SALES & ENGINEERING LTD.

Job Name: Pangnirtung

Job Number: 15-S010792

Date: Aug 25, 2016

O & M Manuals

Gen Tanasie, P. Eng
Sr. Project Manager

Phone: 905-738-2355 x 236
E-mail:

metcon SALES & ENGINEERING LTD.

genovevt@metconeng.com

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2.6 Chlorination System

System Description
Two identical dual pump, redundant piping, Viton elastomers for components, control box for power and signal with 3-way selector switch for duty selection. Each system is pre-mounted, pre-piped, pre-wired and pressure tested on HDPE board, as supplied by Metcon Sales & Engineering Ltd.

Bill of Materials

4 PROMINENT Gala Pumps

(Tag #: CP1, CP2, CP3 & CP4)

- Model: Gala 1005NPB800UD11200
- Max Capacity: 1.1 gph (4.4 l/hr) = 26.4 gpd (105.6 l/d)
- Max. Back Pressure: 145 psi (10 bar)
- Max stroking rate: 180 SPM and 100% stroke length
- Liquid End: Auto-degassing liquid end
- Operational status displayed via three LED lights indicating normal, low flow warning or lack of chemical/operational error
- Direct calibration function and built-in warning indicator
- Feed rate display: LPH or US gal/hour
- Pump Control: Manual + External + Analog Ctrl.
- Relay Contact: 2 A @ 250 Vac
- Power requirements: 0.7 A 115 / 1 / 60
- Suc./disch. connectors: 1/2” x 3/8”
- Control cable (2m): 1001300

Material of Construction
Liquid end type – Acrylic
Suction/Discharge Connectors – PVC
Seals – Viton
Valve Balls - Ceramic
Diaphragm – PTFE

Pumps Panel Accessories:

4 PROMINENT Flow Monitors Type II

- Model: 1009338
- Type: New Style
- Material: PVDF
- Seals: Viton B

8 CHEMLINE Back Pressure / Pressure Relief Valves

- Model: SB12A005VU
- Material: PVC
- Seals: Viton
- Size: ½” (12 mm)
- Ends: Union

28 CHEMLINE Ball Valves

- Model: 21A005VS
- Material: PVC
- Seals: Viton
- Size: ½” (12 mm)
- Ends: Socket

4 CHEMLINE Pressure Gauge and Isolator

- Model: SGA005-002PG
- Material: PVC
- Seals: Teflon
- Size: ½” (12 mm) - ¼” (6 mm)
- Pressure Range: 0-200 psi
- Filled: Glycerin

4 BLACOH Pulsation Dampener

- Model: RC-10PVC-E50
- Capacity: 10 cu.in (0.16 L)
- Body Material: PVC
- Ends: ½” FNPT
- Max. Pressure: 150 psi

4 PRIMARY FLUID Calibration Column

- Model: PV#2 – 500
- Capacity: 500 mL
- Body Material: Clear PVC
- Ends: Threaded

4 CHEMLINE Y Strainer

- Model: YSA005VS
- Size: ½” (12 mm)
- Material: PVC/Viton
- Screen Mesh: 24 (standard(

Note: Please advise if mesh 35 or 55 is required.

4 CHEMLINE Check Valves

- Model: BTA005VS
- Size: ½” x 3/8”
- Material: PP/Viton

2 PROMINENT Injection Valve

- Model: N/A (comes with pump)
- Size: ½” x 3/8”
- Material: PP/Viton

2 CHEMLINE Corp Stop, Chemlance Series (ship loose)

- Model: CL-005-VF
- Material: PVC
- Valve Material: Brasss
- Size: ½” (12 mm)
- Seals: Viton
- Ends: Threaded

2 Metcon Control Panel

- Model: 121006
- Size: 12”H x 10”W x 6”D
- Protection Rating: NEMA-4X
- Power Requirements: 3A @ 115 / 1 / 60
- Approvals: CSA
- Panel Components: As per drawing # 2

2.6.10.1 Magnetic Flow Meter

2 BADGER Magnetic Flow Meter

(Tag #: FM-1 & FM-2)

- Model: M2000 / 6”/ HR / GR / Intergral
- Element Size: 6” (150 mm)
- Flow Range: 30-11890 L/min (7.85-3141 gpm)
- Connections: 150# Flanged
- Amplifier: Mounted on meter
- Electrodes: Alloy-C
- Liner: Hard Rubber
- Body Material: Carbon Steel
- Power Requirements: 20 W @ 85….265 Vac
- Enclosure: NEMA-4X (IP66)
- Comes with: 316SS Grounding Rings

2.6.10.4 Hypochlorite Feeding System

2 ARCH CHEMICAL Calcium Hypo Feeding System

(Tag #: MC 4-50-#1 & MC 4-50-#2)

- Model: MC 4-50
- Dry Chemical Capacity: 62 lbs (28 kg)
- Nominal Operating Conc.: 1.7% AvCL
- Chlorine Delivery Rate: 1-50 lbs AvCI/Day @ 70°F
- Water Requirements: 1.0 gpm @ 50-150 psi
- Power Requirements: 15 A @ 120 Vac
- Comes with: 2 Pails (100 lbs) of Chlor Plus Dry Chlorinator Briquettes per Feeder

2.6.10.5 STS Chlorine Controller

2 STS Chlorine Controller, MicroChem2

- Model: T17M D 4 3 D 1 3 4 D E XX
- Input Channels: 3 (free chlorine, pH & temperature)
- Flow Cell: Panel Mount with pressure regulator
- Power Requirements: 120 Vac
- Installation: Wall Mounted
- Communication: RS-232
- Approval: CE / CSA

2.6.10.6 STS Chlorine Probe

2 STS Chlorine Controller, MicroChem2

- Model: 23184
- Measuring Range: 0-5 ppm
- Tolerable: 4 – 9.5 pH
- Comes with: 12 ft of cable

2.6.10.7 STS pH Probe

2 STS Chlorine Controller, MicroChem2

- Model: 01-4068
- Temperature Sensor: Built-In
- Probe Diameter: 12 mm (1/2 “)
- Comes with: 10 ft of cable

2.6.11 NANODAC Recorder / Controller

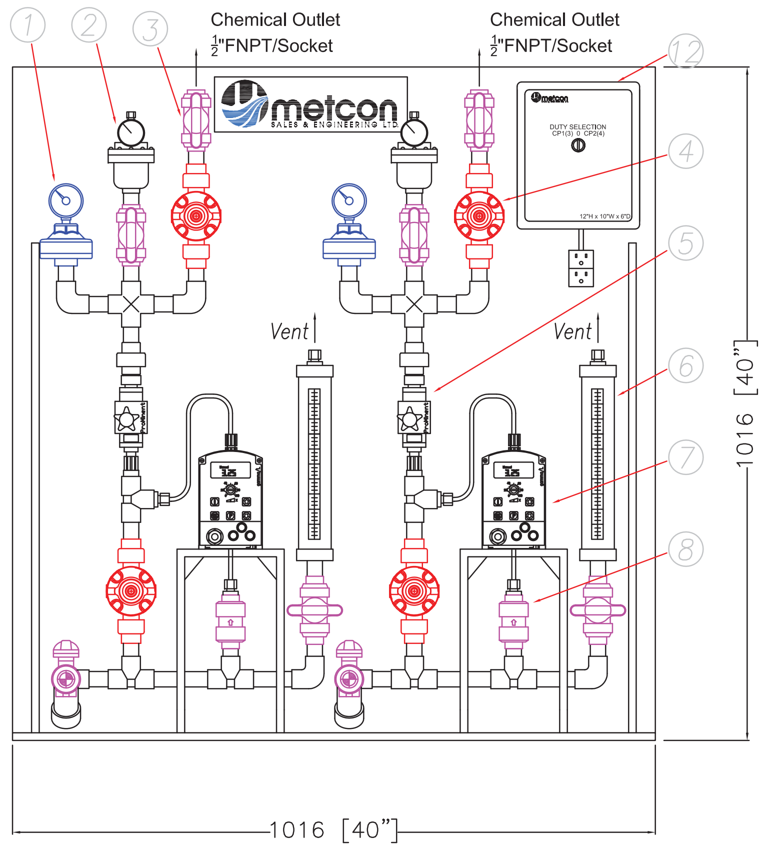
1 NANODAC Recorder / Controller

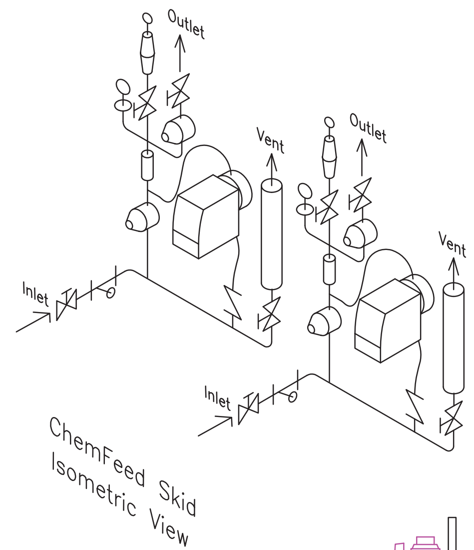
- Model: VH C P LRR XX TS SV XXXX ENG
- Power Requirements: 2 A @ 120 Vac
- Input Ports: 4
- Virtual Inputs 30
- Flash Memory: 50 Mb
- Communication Port: USB
- Communications: Modbus TCP/IP slave
- Screen: ¼ VGA color
- Keyboard with: 4 keys

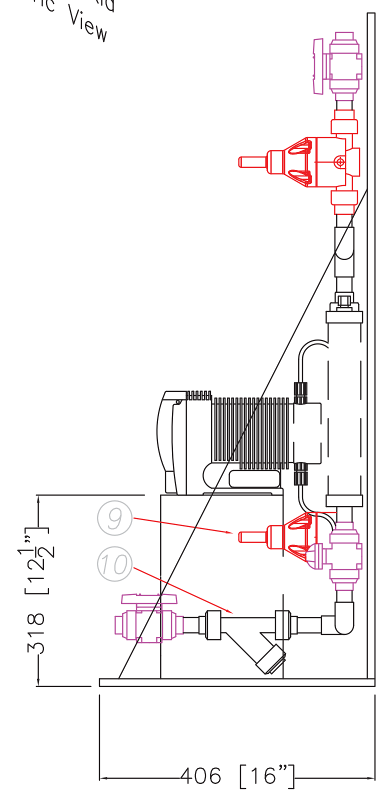
Note: Images are for illustration purposes only and may not reflect the actual product described.

NOTES:

1. Two identical dual pump syetems.
2. Control panel for power signals and automating switchover, if required.
3. Selector switch for selection of duty pump.







REVISIONS:

No	Date	By	Description
1.			
2.			

BILL OF MATERIALS

#	Part #	Make	Description	Pcs
1.	SGA005002PG	Chemline	Pressure Gauge	4
2.	RC-10PVC-E50	Blacoh	Pulsation Dampener	4
3.	21A005VS	Chemline	Ball Valve	28
4.	SB12A005VU	Chemline	Back Pressure Valve	4
5.	1009338	Prominent	Flow Monitor	4
6.	PV#2 - 500	Primary Fluid	Calibration Column	4
7.	Gala 1005NPB 900UD11300	Prominent	Chemical Feeding Pump	4
8.	BTA005VS	Chemline	Foot Valve	4
9.	SB12A005VU	Chemline	Pressure Relief Valve	4
10	YSA005VS	Chemline	Strainer	4
11	CL-005-VF	Chemline	Corp Stop (shipped loose)	2
12	121006	Metcon	Control Panel	2

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☒ FOR APPROVAL
☐ FOR CONSTRUCTION
☐ AS BUILT

metcon SALES & ENGINEERING LTD.

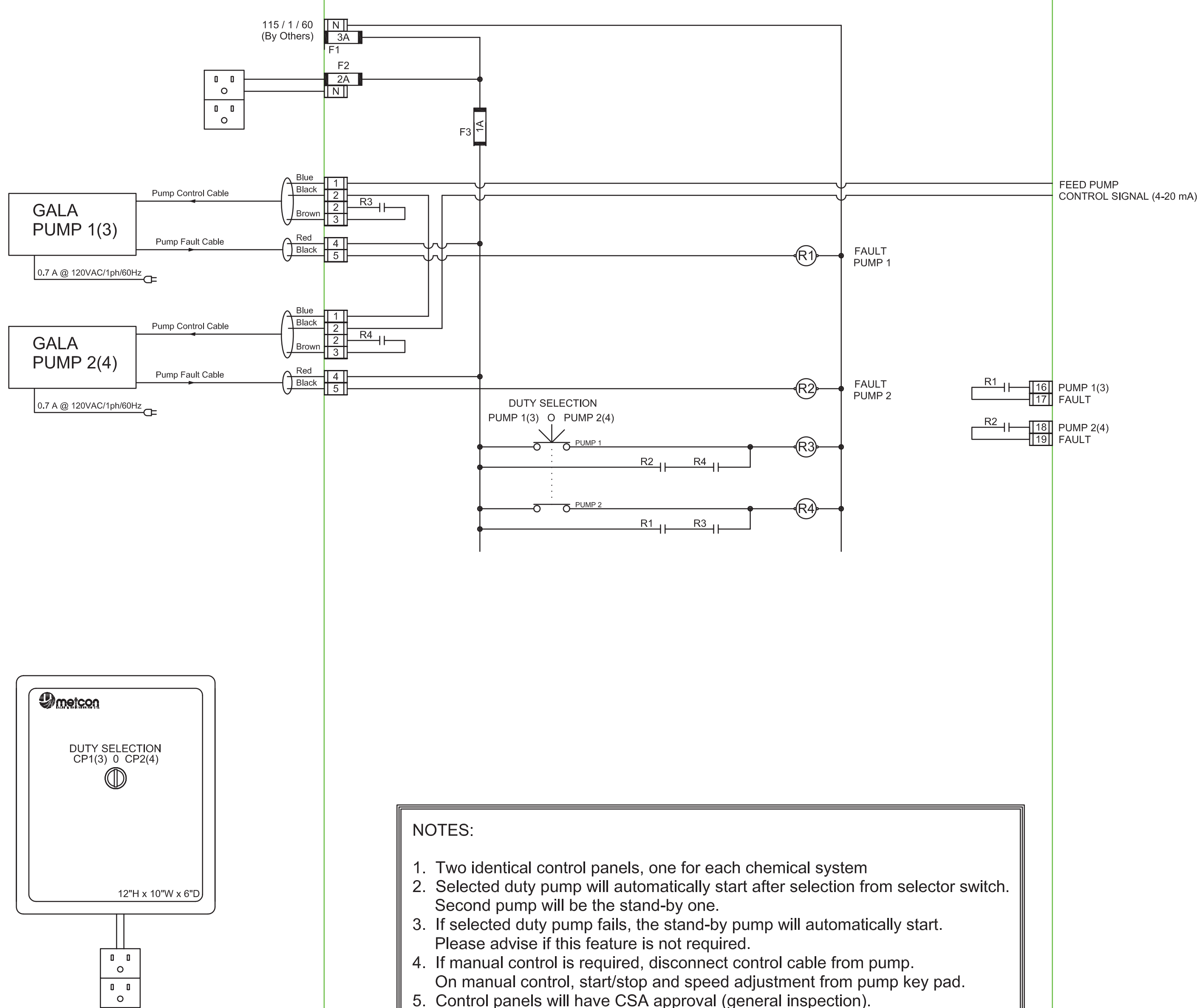
Dual Pump System

Layout & Dimensions

Date:	Mar 05, 2015
Job Number:	15-S010792
Job Name:	Pangnirtung
Dwg. #:	1
Approved by:	GM
Drawn by:	GT

Notes:
1. [●] Indicates supplied by others.
2. Unit: Inches (mm). Do not scale this drawing. All dimmensions, sizing, orientation of piping, wiring and equipment, are estimations and approximations and are not to be used in other related design.
3. The information contained on this drawing is of confidential nature and shall not be used or reproduced without written consent from Metcon Sales and Engineering Limited.

CHEMICAL PUMPS CONTRL PANEL



NOTES:

1. Two identical control panels, one for each chemical system
2. Selected duty pump will automatically start after selection from selector switch. Second pump will be the stand-by one.
3. If selected duty pump fails, the stand-by pump will automatically start. Please advise if this feature is not required.
4. If manual control is required, disconnect control cable from pump. On manual control, start/stop and speed adjustment from pump key pad.
5. Control panels will have CSA approval (general inspection).

REVISIONS:

No	Date	By	Description
1.			
2.			

BILL OF MATERIALS

#	Part #	Make	Description	Pcs
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

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Control Panel

Wiring and Layout

Date:	Mar 05, 2015
Job Number:	15-S010792
Job Name:	Pangnirtung
Dwg. #:	2
Approved by:	GM
Drawn by:	GT

Notes:
1. [•] Indicates supplied by others.
2. Unit: Inches (mm). Do not scale this drawing. All dimmensions, sizing, orientation of piping, wiring and equipment, are estimations and approximations and are not to be used in other related design.
3. The information contained on this drawing is of confidential nature and shall not be used or reproduced without written consent from Metcon Sales and Engineering Limited.

3. Equipment O&M
3.1 - Metering Pump

ProMinent®

Operating Instructions Manual
ProMinent® gamma/ L
Solenoid Metering Pump

TÜV SÜD ISO 9001

GALA ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Please enter ident code of the device here

Please read the operating instructions through completely before commissioning this equipment! Do not discard!
Any part which has been subject to misuse is excluded from the warranty!

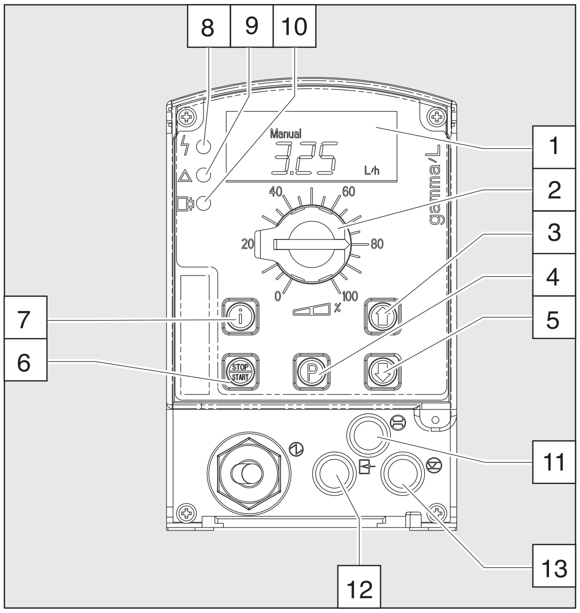
Part No. 987604 **ProMinent Dosiertechnik GmbH · 69123 Heidelberg · Germany** BA G 027 05/06 GB

Printing:
Operating Instructions ProMinent® gamma/ L

Address:
ProMinent Dosiertechnik GmbH
Im Schuhmachergewann 5-11
69123 Heidelberg
Germany
info@prominent.com
www.prominent.com

Please fold out this page!

Control elements: overview



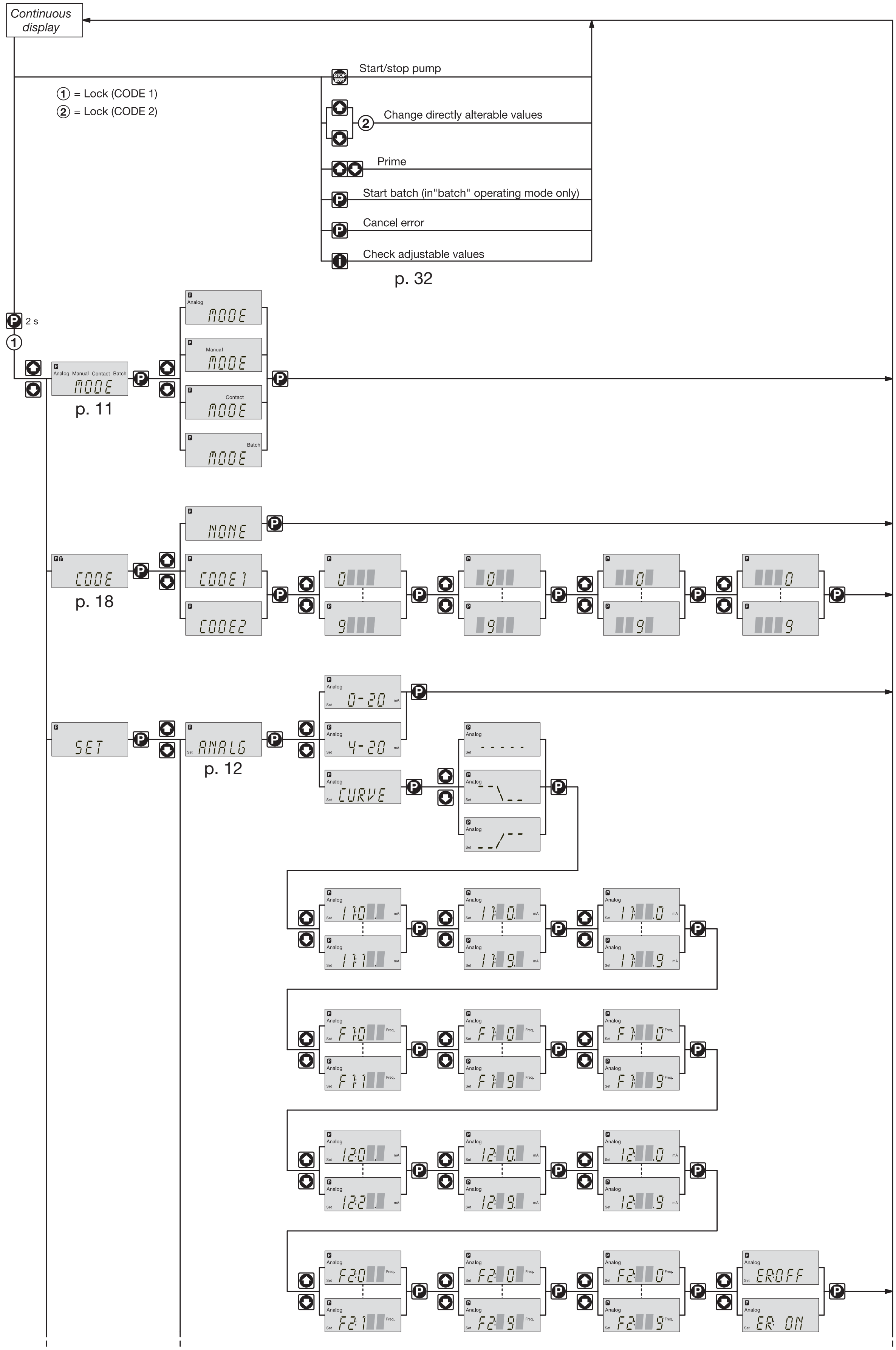
1 LCD display
2 Stroke length adjusting knob
3 UP key
4 P key
5 DOWN key
6 STOP/START key
7 i key
8 Fault indicator (red)
9 Warning indicator (yellow)
10 Operating indicator (green)

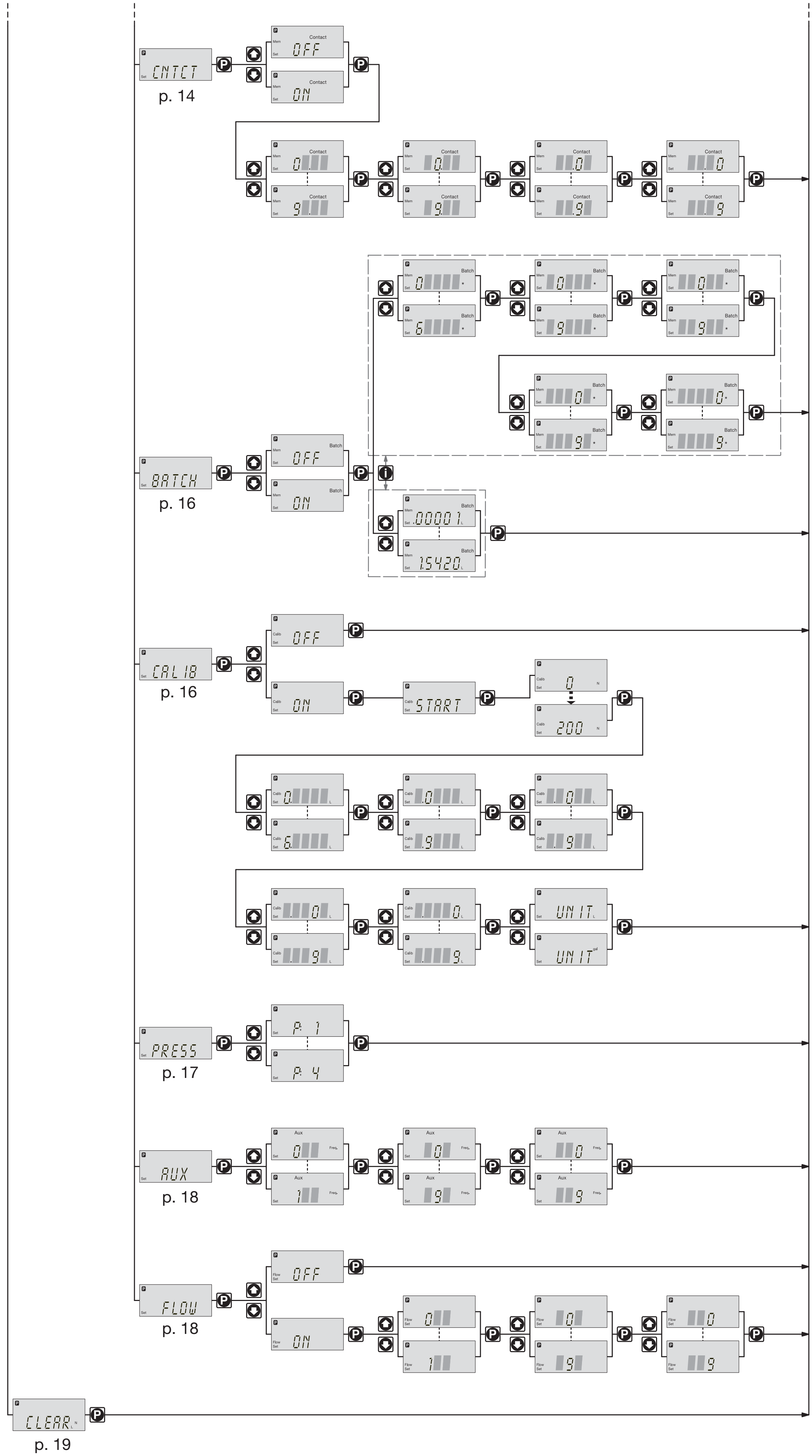
11 “Dosing monitor” terminal
12 “External control” terminal
13 “Float switch” terminal

Key functions

	In continuous display mode (operating)	**In settings mode (settings)**
STOP/START key		
Press briefly	Stop pump, start pump	Stop pump, start pump
P key		
Press briefly	Start batch (in “batch” operating mode only), Cancel error	Confirm entry- jump to next menu option or continuous display
Press for 2 s	Change to settings mode	---
Press for 3 s	---	Jump to continuous display
Press for 10 s	Display software version	---
Press for 15 s	Load factory settings (calibration)	---
Touche i		
Press x1	Toggle between continuous displays	Toggle between “change individual digits” and change a figure”
Press x2	---	For “change individual digits”: jumps to first digit
Arrow keys UP and DOWN		
Press x1 (until “Set” appears)	Change directly alterable values	Select other settings, change individual digit or figure
Press simultaneously	Prime	---

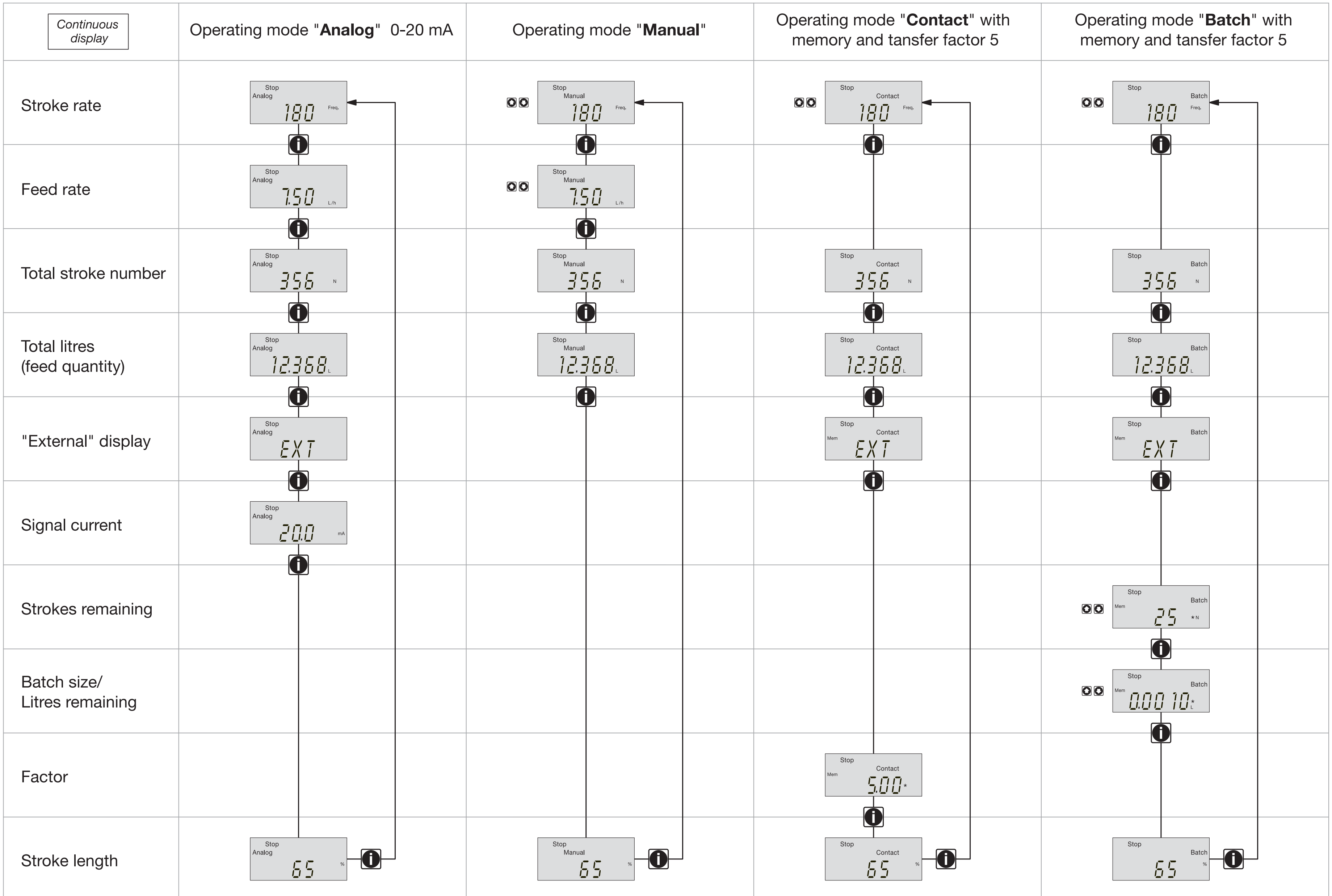
Operating-/Settings Diagram





CNTCT
p. 14
Contact
OFF
ON
BATCH
p. 16
Batch
.00001
15420
CALIB
p. 16
Calib
START
0
200
UNIT
PRESS
p. 17
P. 1
P. 4
AUX
p. 18
Aux
Freq
FLOW
p. 18
Flow
CLEAR
p. 19
Mem
Set

Continuous display



= UP and/or DOWN arrow keys, directly alterable values

"Mem" appears only when "memory" function activated

Table of Contents

Identcode

Please enter the identity code on the device label into the grey box below

GALA — GALA Series gamma/ L, version a

Type	Capacity bar	l/h	
1000	10	0.74	Solenoid Ø 70/M70
1601	16	1,1	
1602	16	2.1	
1005	10	4.4	
0708	7	7.1	
0413	4	12.3	
0220	2	19.0	
1605	16	4.1	Solenoid Ø 85/M85
1008	10	6.8	
0713	7	11.0	
0420	4	17.1	
0232	2	32.0	

Material version:
- PPE Polypropylene/EPDM
- PPB Polypropylene/FPM
- NPE Acrylic glass/EPDM
- NPB Acrylic glass/FPM
- PVT PVDF/PTFE
- TTT PTFE/PTFE
- SST Stainless steel 1.4571/PTFE

Liquid end version:
- 0 Non-bleed, no valve spring, for NP, TT and SS only
- 1 Non-bleed, with valve spring, for NP, TT and SS only
- 2 Bleed function, no valve spring for PP, NP, PV, not type 0232
- 3 Bleed function, no valve spring for PP, NP, PV, not type 0232
- 4 No-vent with valve springs for highly viscous media
- 9 Self bleed function, for PP, NP, not for type 1000 and 0232

Hydraulic connection:
- 0 Standard connector as indicated in technical data
- 5 12/6 hose connector, pressure side only
- 9 10/4 hose connector, pressure side only

Version:
- 0 With ProMinent® logo

Power supply:
- U 100 - 230 V, ±10 %, 50/60 Hz
- M 12...24 V DC (only M 70)
- N 24 V DC (only M 85)
- P 24 V AC

Cable and plug:
- A 2 m Euro
- B 2 m Swiss
- C 2 m Australian
- D 2 m USA
- 1 2 m open end

Relay:
- 0 No relay
- 1 Fault indicating relay, (N/C) changeover relay
- 3 Fault indicating relay, (N/O) changeover relay
- 4 As 1 + pacing relay, (1 input each)
- 5 As 3 + pacing relay, (1 input each)

Accessories:
- 0 No accessories
- 1 Foot and dosing valve,, 2 m PVC suction tube, 5 m PE discharge tubing, PP, PC, and NP only
- 2 As 0 + calibrating cylinder
- 3 As 1 + calibrating cylinder

Control variants:
- 0 Manual + external 1:1
- 1 Manual + external with pulse control
- 2 Manual + external 1:1 with analogue current
- 3 Manual + external with pulse control + analogue current
- 4 as 0 + timer
- 5 as 3 + timer
- P as 3 + Profibus®

Access code:
- 0 No access code
- 1 Access code

Dosing monitoring:
- 0 Pulse input
- 1 Input for continuous contact

Pause/level:
- 0 Pause N/C level N/C

FPM = Fluorkautschuk

GALA ___ _ _ _ _ _ _ _ _ _ _ _ _

General User Guidelines

Please read through the following user Guidelines. Familiarity with these points ensures optimum use of the operating instructions.

On the fold-out page after the title page you will find the overviews “control elements and key functions” and “operating/settings diagrams”.
You will find it useful to open out the “control elements and key functions” overview as you read this instruction manual.

Key points in the text are indicated as follows:

- Enumerated points

▶ Hints

Working Guidelines:

NOTE

Guidelines are intended to make your work easier.

Safety Guidelines:

WARNING

Describes a potentially dangerous situation.
Could result in loss of life or serious injury if preventative measures are not taken.

CAUTION

Describes a potentially dangerous situation.
Could result in lesser injuries or damage to property if preventative measures are not taken.

IMPORTANT

Describes a potentially threatening situation.
Could result in damage to property if preventative measures are not taken.

The name plate affixed to the title page is identical to that on the gamma/ L pump supplied.
This facilitates matching the correct operating instructions manual to the correct pump.

Please quote the identity code and the serial number, which you will find on the name plate, in any subsequent correspondence or when ordering spare parts. This will ensure accurate identification of the pump type and material version.

1 About This Pump

The pumps in the ProMinent® gamma/ L pump series are microprocessor controlled solenoid dosing pumps with the following special features:

- The feed rate can be displayed in l/h and/or gal/h (calibrated), or in strokes/min.
- The stroke rate is continuously adjustable and is displayed in the LCD display.
- Stroke rate adjustment is digitally accurate and is displayed in the LCD display.
- The rated pressure of the gamma/ L can be adapted to individual systems.
- Two pumps can be controlled in different ways via the same standard signal.
- Large, illuminated LCD display

The hydraulic parts of the gamma/ L are identical to those of the Beta®.

2 Safety

Correct use

The gamma/ L must be used for liquids only!
The gamma/ L may be used only in compliance with the technical data and specifications given in the operating instructions!
It is forbidden to use the gamma/ L for any other purpose, or to modify it in any way!
The gamma/ L is not suitable for dosing gases or solids!
The gamma/ L must be used by trained and authorised personnel only!
You must take notice of the information in the operating instructions concerning the various stages in the lifecycle of the device.

Safety Guidelines

WARNING

- **As soon as the gamma/ L is connected to the electricity supply it may commence pumping!**
  Avoid leakage of hazardous chemicals in this case!
  If this should occur, then press the STOP/START key or disconnect the gamma/ L from the power supply immediately!
- **The gamma/ L cannot be switched to a current-free status! In the event of an electrical accident, disconnect cable from the mains power supply!**
- **Disconnect cable from the mains power supply before commencing work on the gamma/ L!**
- **Always depressurise liquid end before commencing work on the gamma/ L!**
- **Empty and rinse out the liquid end before commencing work on the gamma/ L after use with hazardous or unknown chemicals!**
- **Pumps for radioactive materials may not be returned to ProMinent after use!**

CAUTION

- **It is not permitted to assemble and install ProMinent® dosing pumps with non-original parts unless these have been checked and recommended by ProMinent. It can result in harm to persons and property for which no liability will be accepted!**
- **When dosing aggressive materials, check the resistance of the pump materials (see ProMinent® resistance list in the product catalogue!)**
- **If another liquid end size is installed the pump must be reprogrammed on factory premises!**
- **Observe applicable national directives during installation!**

Sound intensity level

The sound intensity level is < 70 dB (A) at maximum stroke, maximum stroke rate, maximum back pressure (water) in accordance with:
DIN EN 12639 (Metering Pump Noise Measurement)

3 Storage, Transport and Unpacking

Transport and store the gamma/ L in the original packaging!

Protect the packed gamma/ L from moisture and the effects of chemicals!
Environmental conditions for storage and transport:
Storage and transport temperature: -10 bis +50 °C
Humidity: < 92 % relative humidity

Check that the delivery is complete:

Delivery range

- Dosing pump with mains lead
- Operating instructions manual with EU conformity declaration
- Accessories if applicablesecteur

4 Device Overview and Control elements

When reading this section it is helpful to fold out the overview “Control elements and key functions”!

4.1 Device overview

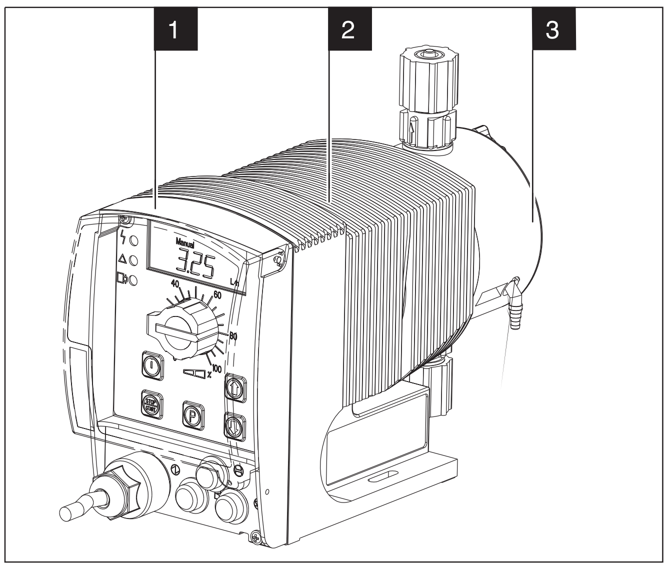


Fig. 01

1 Control unit
2 Power end
3 Liquid end

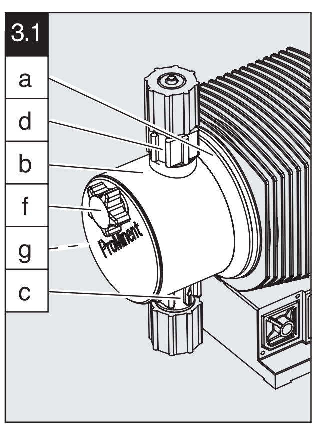


Fig. 02

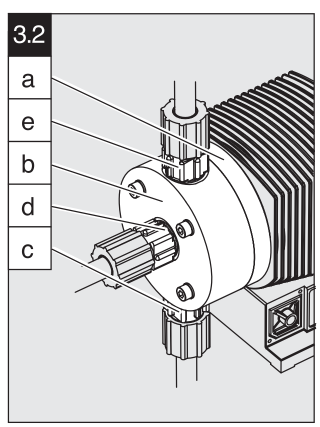


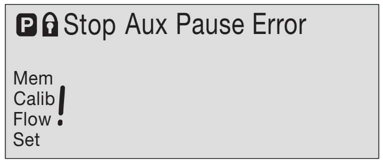
Fig. 03

a Backplate
b Liquid end
c Suction valve
d Discharge valve
e Bleed valve
f Coarse/fine bleed valve
g Bypass hose nozzle

4.2 Control elements

Please acquaint yourself with the gamma/ L control elements with the help of the “control elements and key functions” overview!

Indicators The LCD display supports the operation and setting of the gamma/ L with a range of indicators:



The indicators are interpreted as follows:

Symbol for P key:	The gamma/ L is in settings mode.
Close symbol:	In a continuous display: lock (if code has been set). In settings mode: indicates access to code menu.
Stop:	The gamma/ L has been stopped using the STOP/START key.
Aux:	The gamma/ L is pumping at the auxiliary frequency. In AUX menu: the gamma/ L is in the AUX menu.
Pause:	The gamma/ L has been stopped using the “pause” function (external).
Error:	A fault has occurred and the pump has been stopped.
Auto:	The gamma/ L is in “Auto” operating mode. Depending on the Identcode this means that the gamma/ L can be controlled using PROFIBUS® or the timer (as a comparison see the relevant supplementary instructions).
Mem:	An additional “memory” function has been set in the “contact” and “batch” operating modes. In CNTCT or BATCH menus (“mem” flashes): the memory function can be set
Calib:	The gamma/ L is in the CALIB menu. In a continuous display (“calib” flashes”): Deviation in stroke length of more than 10 degrees (e.g. a stroke length of 40 % when set at less than 30 % or greater than 50 %) from the value at the time of calibration.
Flow:	The gamma/ L is in the FLOW menu.
Set:	The gamma/ L is in the SET menu.
Command symbol:	The number of strokes reached is above the maximum value (99999) that can be shown in the LCD display

NOTE

The pump gamma/ L only displays the metering output in l or l/h or in gal or gal/h when calibrated.

5 Function Description

Function principle Dosing takes place as follows: the dosing diaphragm is forced into the liquid end; the pressure in the liquid end causes the suction valve to close and the chemical flows out of the liquid end through the discharge valve. The dosing diaphragm is then forced back out of the liquid end. The vacuum in the liquid end causes the discharge valve to close and fresh chemical flows into the suction valve in the liquid end. This concludes one operating cycle.

The dosing diaphragm is driven by an electronically controlled electrical solenoid.

Feed rate The feed rate is determined by the stroke length and the stroke rate.
The stroke length is set between 0 - 100 % using the stroke length adjusting knob.
Optimum dosing reproducibility is achieved by setting the stroke length to between 30 - 100 % (SEK type: 50 - 100 %)!
The stroke rate is set using the arrow keys (not in “analogue” operating mode) to between 0 - 180 strokes/min.

Self-bleed function Pumps with self-bleed function (= SEK types) can operate a prime action even when the discharge tubing is closed, discharging existing air through a bypass valve. These pumps can release gas even during operation, irrespective of the actual operating pressure.
An in-built pressure maintenance valve allows accurate dosing even in depressurised states.

Operating modes Operating modes are selected using the MODE menu (depending upon identity code, some operating modes may be absent).

"Analog" operating mode: (Identity code, control variant: analogue current)

The stroke rate is controlled via an analogue electrical signal via the "external control" terminal. Signal processing is pre-selected at the controller.

"Manual" operating mode: (Identity code, control variant: manual, standard function)

The stroke rate is controlled manually via the controller.

"Contact" operating mode:
(Identity code, control variant: external 1:1 / external with pulse control)

This operating mode offers the opportunity to make fine adjustments with small increase/ decrease factors. Dosing can be activated by a pulse via the "external control" terminal or by a semiconductor element. With the "pulse control" option it is possible to pre-set a feed quantity (batch) or number of strokes (factor 0.01 to 99.99) via the control unit.

"Batch" operating function:
(Identity code, control variant, external 1:1 / external with pulse control)

This operating mode offers the option of working with larger transfer factors (up to 65535). Metering can be triggered by pressing the P key or a pulse from the "external control" terminal via a contact or semiconductor element.
A batching quantity or number of strokes can be pre-selected via the control unit.

Operating mode "PROFIBUS®": (Identcode, control variant: profibus®)

This operating mode offers the possibility to control the pump via PROFIBUS® (see "supplemental instructions for ProMinent gamma/ L and ProMinent Sigma versions with "PROFIBUS®").

Functions The following functions can be selected using the SET menu:

"Calibrate" function:
The gamma/ L can be operated in all operating modes including in calibrating mode.
The corresponding continuous displays can show the actual feed quantity or the feed rate.
Calibration is maintained within the stroke frequency range 0 - 180 strokes/min.
Calibration is also maintained when a stroke frequency is altered up to ±10 %.

"Pressure level" function:
It is possible to set different pressure levels.

"Auxiliary frequency" function:
It is possible to set a stroke rate in the SET menu, which may be activated via the "external control" terminal. This auxiliary frequency overrides all other pre-set stroke rate frequencies.

"Flow" function:
Stops the gamma/ L when the flow is insufficient.
In the SET menu, the number of failed strokes is entered after which the pump will be turned off.

The following functions are available as standard:

"Float switch" function:
Information on the liquid level in the feed chemical container is transmitted to the gamma/ L. This option requires the installation of a 2-stage float switch. This is connected to the "float switch" terminal.

"Pause" function:
The gamma/ L can be stopped by remote control via the "external control" terminal.
The "pause" function operates only via the "external control" terminal.

The following functions are activated by keystrokes:

"Stop" function:
The gamma/ L can be stopped by pressing the STOP/START key without disconnecting from the mains power supply.

"Prime" function:
Priming (short term feed at maximum frequency) is activated by pressing both arrow keys at the same time (in "Stroke rate" permanent display).

Optional relay The gamma/ L has two connection options.de deux options :

“Fault indicating relay” option:
In the event of fault signals, warning signals or float switch activation signals, connects an electrical circuit to trigger alarm sirens etc. The relay is retrofitted via an aperture in the power end.

“Fault indicating and pacing relay” option:
Along with the fault indicating relay, the pacing relay produces a contact for every stroke.
The relay is retrofitted via an aperture in the power end.

Function and error indicators The operating and error status is shown via the three LEDs and the “error” indicator on the LCD (see also section 11):

LCD indicator If a fault occurs “error” will appear along with an additional fault warning.

LED indicator **Operating indicator (green)**
This indicator is lit as long as the gamma/ L is operating correctly.
It stops briefly with each stroke.

Warning indicator (yellow)
This warning light appears if the gamma/ L electronics detect a situation that could lead to a fault, e.g. “liquid levels low 1st stage”.

Warning indicator (red)
This warning light appears if a fault occurs, e.g. “liquid levels low 2nd stage”.

Hierarchy of operating modes, functions and fault statuses

The different operating modes, functions and fault statuses each have a differing effect on whether and how the gamma/ L functions. These effects are given below:

1. **Prime**
2. **Fault, stop, pause**
3. **Auxiliary frequency**
4. **Manual, analogue, contact, batch**

to:

1. “Prime” can take place in the permanent “Stoke rate” display in any pump mode (as long as it is operational).
2. “Fault”, “stop” and “pause” stop all system parts up to “prime”.
3. The stroke frequency of the “auxiliary frequency” always has precedence over the stroke frequency, which is set by an operating mode listed under 4.

6 Assembly and Installation

WARNING

- **Installation must be carried out by a trained engineer!**
- **Disconnect gamma/ L from mains power supply during installation!**
- **Risk of electric shock – This pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electric shock, be certain that it is connected only to a properly grounding-type receptacle.**
- **Observe applicable national directives when installing the dosing pumps!**
- **When connecting with parallel inductive power consumers a switch contact must be fitted, e.g. relay or contactor!**

IMPORTANT

The universal signal cable, the external/connecting cable and the liquid level monitoring cable should never be shortened to less than 1.20 m, otherwise the cable identification system will fail.

Connection to mains power supply

Connect the gamma/ L to the mains power supply using the mains lead

Parallel connection to inductive power consumers

If the gamma/ L is connected to the mains in parallel with inductive power consumers (e.g. solenoid valve, motor) they must be electrically isolated. This will avoid damage caused by induction and voltage surges when switching off.

▶ Fit individual contacts for the gamma/ L and supply power via auxiliary contactor or relay.

If this is not possible, then:

▶ Connect a varistor in parallel (order number 710912) or an RC circuit, 0.22 µF/220 Ω (order number 710802).

Power element (in base of pump)

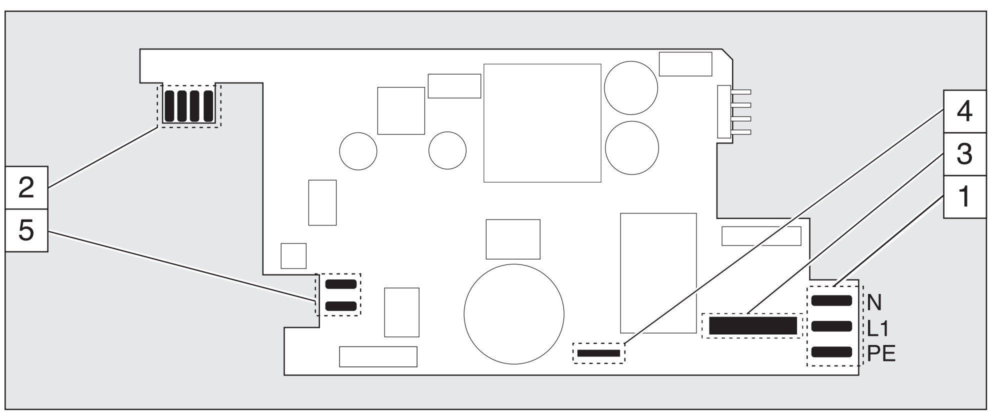


Fig. 04

1 Mains terminal
2 Relay circuit terminal
3 Fuse
4 Solenoid earth lead terminal
5 Solenoid terminal

"External control" terminal

The "external control" terminal is a five pin in-built terminal. It is compatible with the two and four core cables used previously.
The "auxiliary frequency" function is only available with a five core cable.

gamma/ L configuration

Electrical interface for “external contact” - “pause” - “auxiliary frequency”:

- tension contacts ouverts : env. 5 V
- Voltage when contacts open: approx. 5 V
- Input resistance: 10 kΩ
- Control: voltage free contact (load: 0.5 mA at 5 V),
  or: Semiconductor switch (residual voltage < 0.7 V)
- Maximum pulse frequency: 25 pulses/s
- Required pulse duration: ≥ 20 ms

Electrical interface for “external analogue”:

- Input load resistance: approx. 120 Ω
- Maximum current at input: 50 mA

gamma/ L configuration

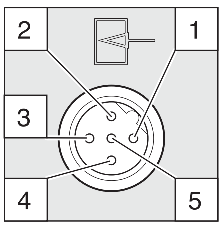


Fig. 05

Pin	Function	2 core cable	4 core cable	5 core cable
Pin 1	Pause	Jumped at pin 4	Brown	Brown
Pin 2	External contact	Brown	White	White
Pin 3	External analogue	–	Blue	Blue
Pin 4	Earth	White	Black	Black
Pin 5	Auxiliary frequency	–	–	Grey

Plug configuration

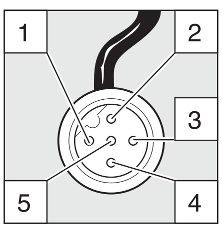


Fig. 06

“Pause” function

The gamma/ L is not operating when

- The cable is connected and pins 1 and 4 are free.

The gamma/ L is operating when

- The cable is connected and pins 1 and 4 are connected.
- There is no cable connected (pin 1 is free).

“Contact” and “Batch” operating modes

One or more discharge strokes are triggered when pin 2 and pin 4 are connected to one another for at least 20 ms.
Otherwise, pin 1 and pin 4 must be connected.

“Analogue” operating mode

The stroke frequency of the gamma/ L is controlled via an electrical signal. The electrical signal is applied between pins 3 and 4.
Otherwise, pin 1 and pin 4 must be connected.

“Auxiliary frequency” function

The gamma/ L runs at a pre-set stroke rate when pin 5 and pin 4 are connected to one another.
Otherwise, pin 1 and pin 4 must be connected.

The factory setting for this function is 180 strokes.

NOTE

For function and operating mode hierarchy, see section 5!

Connecting two gamma/ L pumps in series

Connect two gamma/ L pumps in series as follows if you wish to control both via **one** electrical signal in the “analog” operating mode (see section 7.4.2):

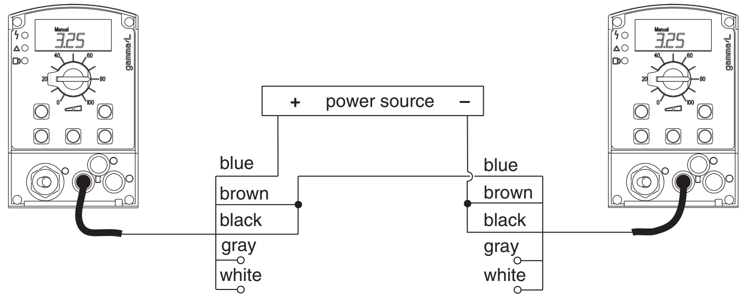


Fig. 07

“Float switch” terminal

Optional fitting of a 2-stage float switch with prior warning and limit switch capacity.

gamma/ L configuration

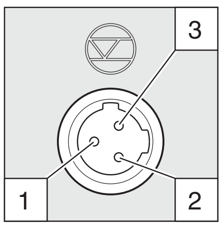


Fig. 08

Electrical interface:

- Voltage when contacts open: approx. +5 V
- Input resistance: 10 kΩ
- Controller: voltage free contact (load: 0.5 mA at + 5V),
  or: semiconductor switch (residual voltage < 0.7 V)

Plug configuration

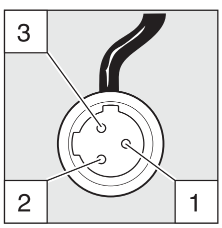


Fig. 09

Function		**3 core cable**
Pin 1	Earth	black
Pin 2	Minimum prior warning	blue
Pin 3	Minimum limit switch	brown

“Dosing monitor” terminal

Optional connection of dosing monitor.

gamma/ L configuration

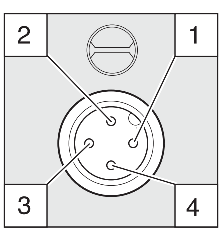


Fig. 10

Electrical interface:

- Voltage when contacts open: approx. +5 V
- Input resistance: 10 kΩ
- Controller: voltage free contact (load: 0.5 mA at +5 V)

Plug configuration

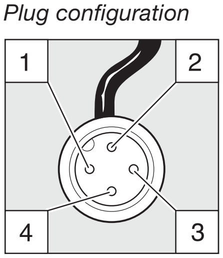


Fig. 11

Function		**4 core cable**
Pin 1	Power supply (5V)	brown
Pin 2	Encoding	white
Pin 3	Response	blue
Pin 4	Earth	black

Relay

"Fault indicating relay" output

A fault indicating relay may be ordered optionally. It is used as the signal output when a pump fault has been detected and to indicate the prior warning signal "liquid level low, stage 1" and the fault signal "liquid level low, stage 2".
Allocation of signal types to "N/O" and "N/C" relay states is selected on the basis of the identity code descriptors.
The relay can be retrofitted and is ready to operate after inserting the relay component (see section 6.2).

The gamma/ L is delivered ex works with default settings for a N/C relay. If an alternative switch function is required the gamma/ L can be reprogrammed at ProMinent.

Electrical interface

- Contact load: 250 V/2 A 50/60 Hz
- Operating life: > 200.000 switch cycles

"Fault indicating relay and pacing relay" output

A fault indicating relay and pacing relay output may be ordered optionally. The pacing relay output is electrically isolated via an optical coupler with a semiconductor switch. The second switch is a relay as for the "fault indicating relay" variant.
The fault indicating / pacing relay can be retrofitted (see section 6.2).

The gamma/ L is delivered ex works with default settings for a N/C fault indicating relay and a N/O pacing relay. If an alternative switch function is required the gamma/ L can be reprogrammed at ProMinent.

Electrical interface

For semiconductor switch

- Residual voltage: < 0,4 Volt at I_C = 1 mA
- Maximum voltage: < 100 mA
- Maximum current: 24 V/DC
- Pacing relay pulse duration: approx. 100 ms

For relay output

- Contact load:
  24 V/100 mA 50/60 Hz
- Operating life:
  > 200.000 switch cycles

Relay cable contact configuration

"Fault indicating relay" option

VDE cable	CSA cable	Contact
white	white	NO (normally open)
green	red	NC (normally closed)
brown	black	C (common)

"Fault indicating relay and pacing relay" option

VDE cable	Contact	Relay
yellow NO (normally open)	Fault indicating relay	
green C (common)	Fault indicating relay	
white NO (normally open)	Pacing relay	
brown C (common)	Pacing relay	

6.1 Retrofitting relays

Delivery range:

1 relay circuit set with 2 screw fasteners
1 relay cable set with socket
1 seal

Press-out relay opening

WARNING

Disconnect gamma/ L from the mains power supply and rinse liquid end before commencing work (see section 12)!

IMPORTANT

When preparing the opening, ensure that the punch is not forced through the entire pump base!
Pump circuits may become damaged.

- ▶ Place the gamma/ L on a firm surface with the relay opening press-out section at the top (see fig. 12:a)
- ▶ Place a punch (dia. 8-15 mm) in the centre of the relay opening press-out section, and strike briefly and sharply with a hammer (approx. 250 g)
- ▶ If necessary clean up the edges of the opening
- ▶ Remove the pressed out section from the gamma/ L

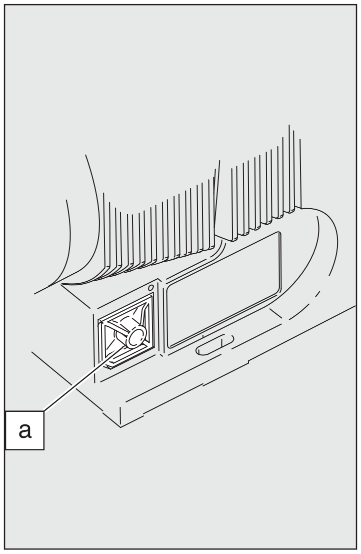


Fig. 12

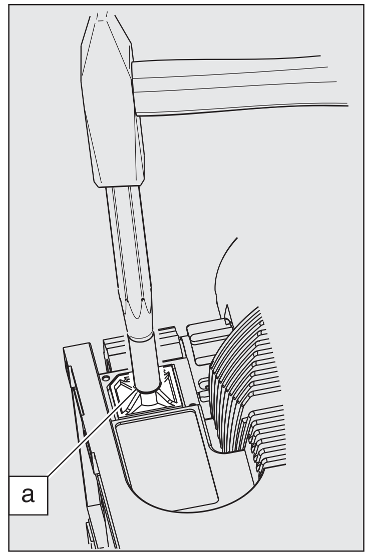


Fig. 13

Inserting the relay component

- ▶ Hold the relay component with your right hand gripping the left and right hand edges of the relay cover, and tilt the front end slightly to the left (see fig. 14)
- ▶ Push the relay component through the relay opening, holding the upper corner of the lower edge against the guide rail on the pump base, until the contact of the relay component has reached the controller contact. (See fig. 15: test: can you still move the end of the circuit back and forth?)
- ▶ Gently push the relay component right into the opening.
- ▶ Screw the relay cover firmly onto the housing using the screws provided.
- ▶ Insert the relay cable plug seal into the relay cover and screw on the plug (see fig. 16)

The gamma/ L is delivered ex works with default settings for a N/C fault indicating relay and a N/O pacing relay. If an alternative switch function is required the gamma/ L can be reprogrammed at ProMinent.

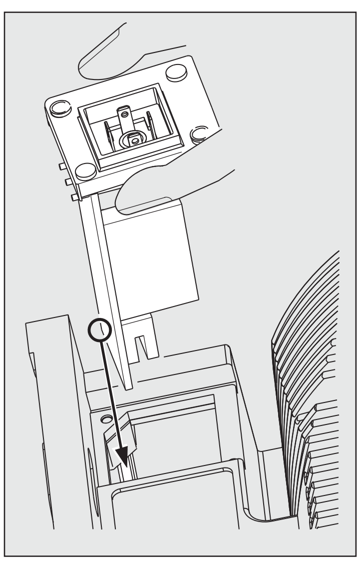


Fig. 14

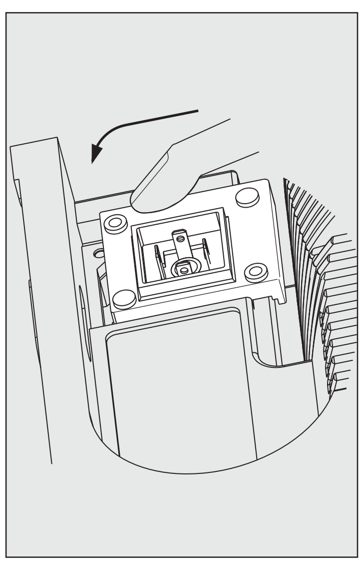


Fig. 15

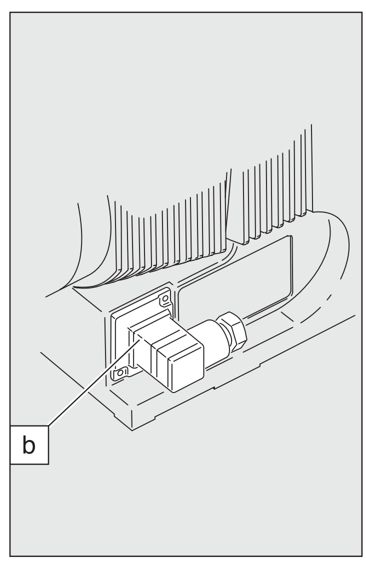


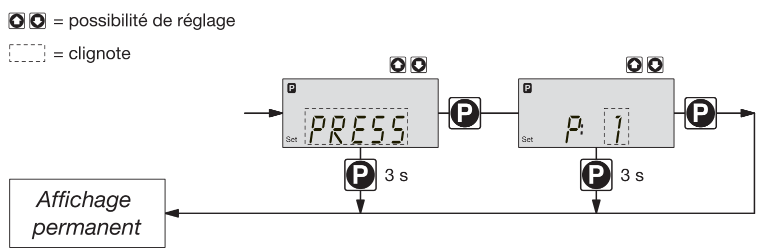
Fig. 16

7 Settings

NOTE

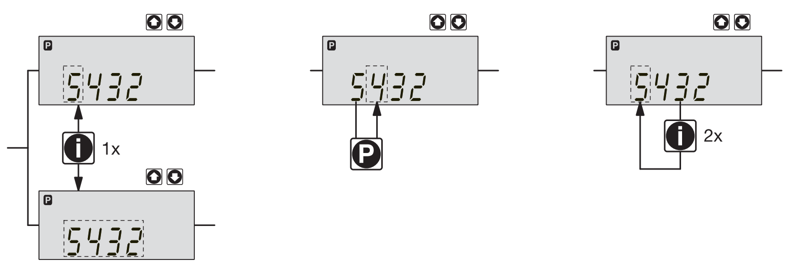
- **Open out the fold-out page following the title page fully! There you will find the overviews “control elements and key functions” and “operating/settings diagram”.**
- **If no keys are pressed within a period of 1 minute, the gamma/ L will return to a continuous display.**

Basic information for setting up the gamma/ L



Confirm entries Press the P key briefly;
you will automatically move to the next menu option or to a continuous display.

Exit menu option without confirming Press the P key for 3 s:
The entry is cancelled and you will return to a continuous display.



Incremental change Iof a value Press the i key 1x;
you can toggle between altering the digits of a value (“change individual digits” = standard) or incremental alteration of a value (“change a figure”).

Change adjustable values Press UP or DOWN arrow key;
The flashing digit or figure will start to increase or decrease incrementally.

Confirm adjustable values For “change individual digits”: confirm each digit using the P key. When the last digit has been confirmed you will automatically move to the next menu option or to a continuous display.

For “change a figure”; press the P key 1x; you will simultaneously move to the next menu option or to a continuous display.

Correct wrongly set digits Press the i key 2x;
you will go back to the first digit.

7.1 Check adjustable values

Before setting up the gamma/ L you can check the current settings of adjustable values.

Press the i key (“i” as in “info”) when the gamma/ L is in continuous display mode
(There is no P key symbol in the LCD display):

Each time you press the i key you will see a different continuous display. The number of continuous displays depends upon the identcode, the selected operating mode and the connected accessories (see overview “continuous displays”).

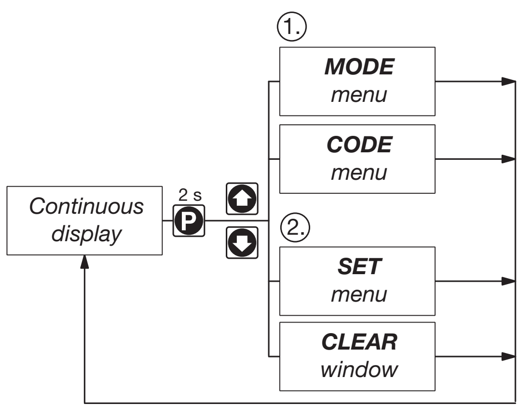
7.2 Change to settings mode

If you hold down the P key for 2 seconds in any continuous display, the gamma/ L will change to the settings mode.
If CODE 1 is set, the code must be entered after pressing the P key.

The following menu options appear first in the settings mode (see also overview “operating/ settings diagram”):

- MODE menu
- CODE menu (optional)
- SET menu
- CLEAR window

In order to adapt the gamma/ L to your process requirements you must:

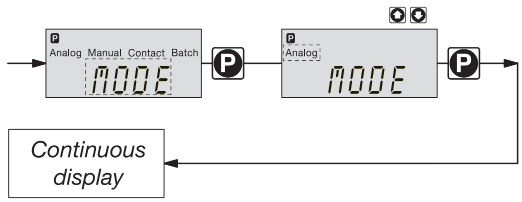


1. Select the operating mode in the MODE menu
2. Adjust settings to this operating mode in the SET menu

7.3 Select operating mode (MODE menu)

The following operating modes are selected via the MODE menu (depending upon identcode, some operating modes may be absent):

- Manual: for operation by hand
  (Identcode, control variant: manual, standard option)
- Analogue: for electronic control
  (Identcode, control variant: analogue current)
- Contact: for contact operation
  (Identcode, control variant: external 1:1 / external with pulse control)
- Batch: for batch operation
  (Identcode, control variant: external with pulse control)



7.4 Settings for operating mode (SET menu)

In the SET menu you can adjust various settings depending upon the selected operating mode.

The following programmable function settings menus appear in all operating modes:

- Calibrate (CALIB menu)
- Pressure levels (PRESS menu)
- Auxiliary frequency (AUX menu)
- Flow (FLOW menu, available only if flow monitor is connected)

See also section 7.5!

Further settings menus depend upon the selected operating mode.

7.4.1 Settings for “manual” operating mode

There are no other settings menus in the overall SET menu for the “manual” operating mode apart from those described in 7.5.

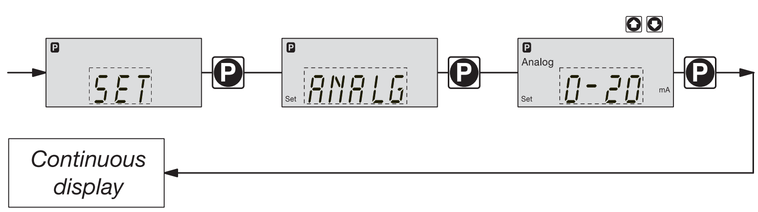
7.4.2 Settings for “analogue” operating mode (ANALG menu)

In addition to those settings menus described in 7.5, there is an additional ANALG menu in the overall SET menu for the “analogue” operating mode.

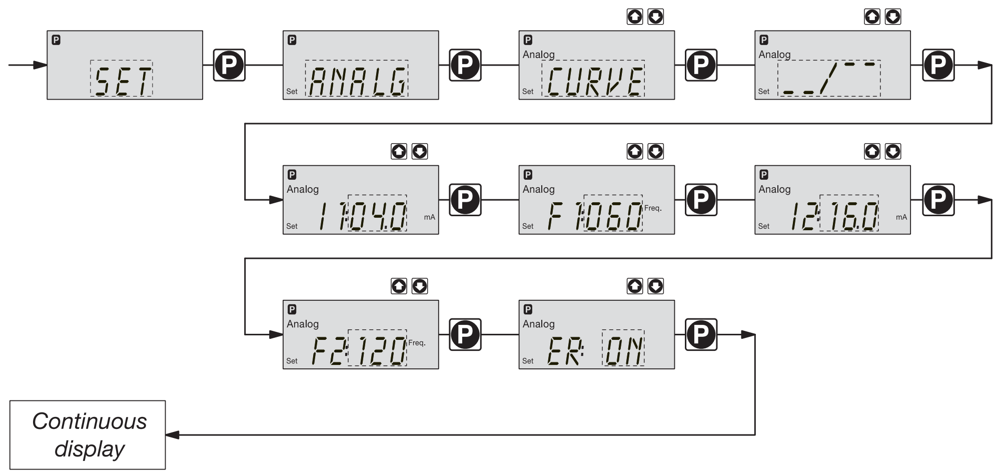
The stroke rate is controlled by an analogue electrical signal via the “external control” terminal.

You can select three signal-processing methods:

- 0 - 20 mA: at 0 mA the gamma/ L does not operate
  at 20 mA the gamma/ L operates at max. stroke rate
  Between these two extremes the stroke rate is proportional to the electrical signal.



- 4 - 20 mA: at 4 mA the gamma/ L does not operate
  at 20 mA the gamma/ L operates at max. stroke rate
  Between these two extremes the stroke rate is proportional to the electrical signal.
  For signals of below 3.8 mA a fault will be detected and the gamma/ L will stop (e.g. cable break).
- Curve: In the “curve” processing mode you can programme the gamma/ L ratios.
  There are 3 options available:
  - - - - - - = straight line
  - --__ = lower band
  - __/-- = upper band



Straight line:

The following symbol appears in the LCD display: - - - - - .
You can enter any stroke frequency ratio for the gamma/ L in proportion to the electrical signal. You must enter two points P1 (I1, F1) and P2 (I2, F2). F1 is the stroke rate at which the pump should operate at current I1: the straight line and the ratio are fixed accordingly:

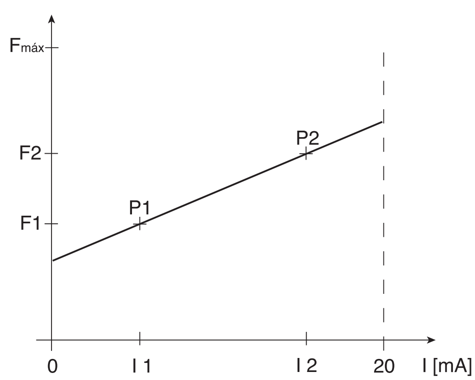


Fig. 17

NOTE

Draw a diagram like the one above - with values for (I1, F1) and (I2, F2) - in order to set the gamma/ L to your required stroke rate!

Lower/upper band:

This processing mode allows you to control a pump via an electrical signal as shown in the diagrams below.

You may also control two pumps for different feed chemicals from a single signal (e.g. one acid pump and one alkali pump from a pH sensor signal). The pumps must be connected electrically in series (see wiring plan in section 6.1).

Lower band

e.g. Alkali pump

Upper band

e.g. acid pump

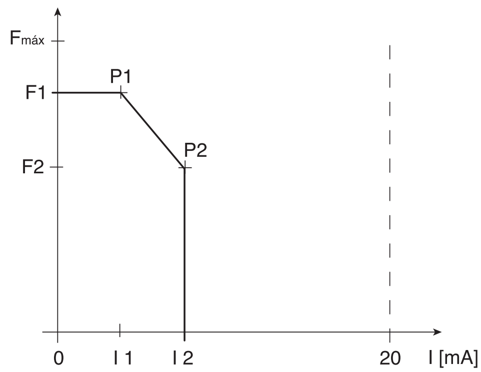


Fig. 18

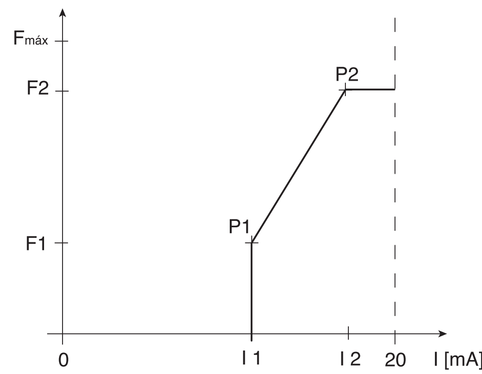


Fig. 19

Lower band:

The symbol ¯¯_ _ appears in the LCD display. The gamma/ L will operate below I1 at F1. Above I2, the gamma/ L ceases to operate. Between I1 and I2 the stroke rate is between F1 and F2, proportional to the signal current.

Upper band:

The signal _ _/¯¯ appears in the LCD display. The gamma/ L will cease to operate below I1. Above I2, the gamma/ L will operate at F2. Between I1 and I2 the stroke rate between is F1 and F2, proportional to the signal current.

The smallest processable difference between I1 and I2 is 4 mA.

Error processing In the “ER” (error) menu option you can activate an error processing function for the “curve” mode. An error message appears for signals below 3.8 mA and the gamma/ L stops.

7.4.3 Settings for “contact” operating mode (CONTCT menu)

In addition to those settings menus described in 7.5, there is an additional CONTCT in the overall SET menu for the “contact” operating mode.

The operating mode “contact” allows you to activate a single stroke or a series of strokes.
The strokes can be activated by a pulse or via the “external control” terminal. This operating mode is intended to transfer input pulses into a reduction (break) or small increase in strokes.

IMPORTANT

- **When switching to another operating mode the factor is reset to “1”.**
- **When switching from “Manual” to “Contact” operating mode, the gamma/ L maintains the stroke frequency.**
  The stroke frequency can also be adjusted in the “Contact” operating mode. It should normally be set at 180 strokes/min.

The following versions are available:

- Contact - identcode: external 1:1
- Contact - identcode: external with pulse control

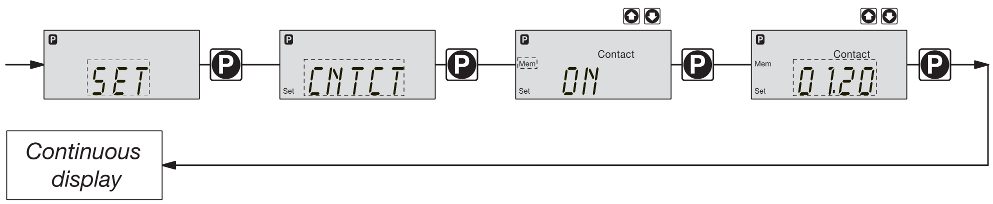
Contact – identcode: external 1:1

In the “contact - identcode: external 1:1” version the gamma/ L makes precisely 1 stroke per pulse (identcode: external 1:1).

No entry possible.

Contact – identcode: external with pulse control

In the “contact - identcode: external with external pulse control” you can enter the number of pulses after which a stroke should be carried out. “Contact - identcode: external with external pulse control” is intended for small dosing quantities.



The number of strokes per pulse depends upon the factor, which you can enter. This allows you to vary to a certain extent the input pulses by a factor of 1.01 to 99.99 and/or reduce by a factor of 0.01 to 0.99:
“Number of strokes activated = factor x number of input pulses”

Examples

	Factor	Pulse (sequential)	Stroke number (sequential)
Increase	1	1	1
	2	1	2
	25	1	25
	99.99	1	99.99
	1.50	1	1.5 (1 / 2)
	1.25	1	1.25 (1 / 1 / 1 / 2)
Reduction	1	1	1
	0.50	2	1
	0.10	10	1
	0.01	100	1
	0.25	4	1
	0.40	2.5 (3 / 2)	(1 / 1)
	0.75	1.33 (2 / 1 / 1)	(1 / 1 / 1)

Explanation of increase

At a factor of 1 — For every 1 pulse, 1 stroke is activated
At a factor of 2 — For every 1 pulse, 2 strokes are activated
At a factor of 25 — For every 1 pulse, 25 strokes are activated

Explanation of decrease

At a factor of 1 — After 1 pulse, 1 stroke is activated
At a factor of 0.5 — After 2 pulses, 1 stroke is activated
At a factor of 0.1 — After 10 pulses, 1 stroke is activated
At a factor of 0.75 — After 2 pulses, 1 stroke is activated, then after 1 pulse, 1 stroke is activated, then after 2 pulses, 1 stroke is activated etc.

NOTE

If a remainder occurs when the factor is processed, the gamma/ L counts up the remainder values. When the sum reaches or exceeds “1” the gamma/ L will activate a stroke. This ensures that the stroke number corresponds exactly to the factor throughout the dosing operation.

The number of input pulses which have not been processed are stored by the gamma/ L in the stroke memory. When the STOP/START key is pressed or the “pause” function is activated, the stroke memory is deleted (this can be avoided using the “memory” extension function, see below).

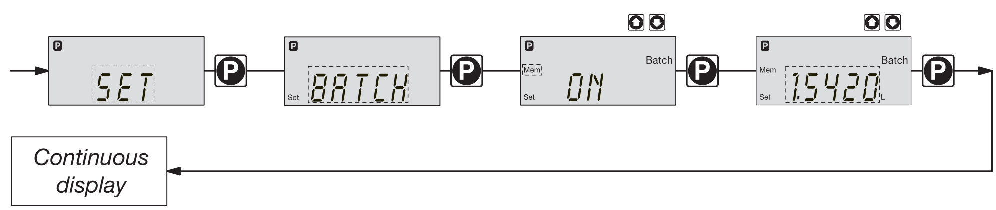
The “contact - identcode: external with pulse control” version allows optimum adaptation of the gamma/ L, in conjunction with e.g. water contact meters, to any process.

“Memory” extension function

The “memory” extension function can be optionally activated (“mem” appears in the LCD display). When “Memory“ is activated, the gamma/ L adds up the unused excess strokes, up to the stroke memory’s maximum capacity of 65535 strokes. If the maximum capacity is exceeded the pump will malfunction.

7.4.4 Settings for “batch” operating mode (BATCH menu)

In addition to those settings menus described in 7.5, there is an additional BATCH menu in the overall SET menu for the “batch” operating mode.



The “batch” operating mode is a variant of the “contact” operating mode (see 7.4.3).
You can pre-select a stroke number (no breaks, whole numbers only from 1 to 65535) as well as a feed quantity (batch). To switch between entries for “stroke number” and “feed quantity” press the i key 1x in the corresponding menu option (see also overview “operating/settings diagram”, fold-out page).
The “batch” operating mode is intended for large dosing quantities.

Metering is activated by pressing the P key or via a pulse from the "external control" terminal.

The number of input pulses which have not been processed are stored by the gamma/ L in the stroke memory. The stroke memory is limited to the batch size if “Memory“ is not activated (with “Memory“ this is 65535 strokes). You can clear it by changing to a different operating mode.

CAUTION

- **When switching from “Manual” to “Batch” operating mode, the gamma/ L maintains the stroke frequency.**
  The stroke frequency can also be adjusted in the “Batch” operating mode. It should normally be set at 180 strokes/min.

“Memory” extension function

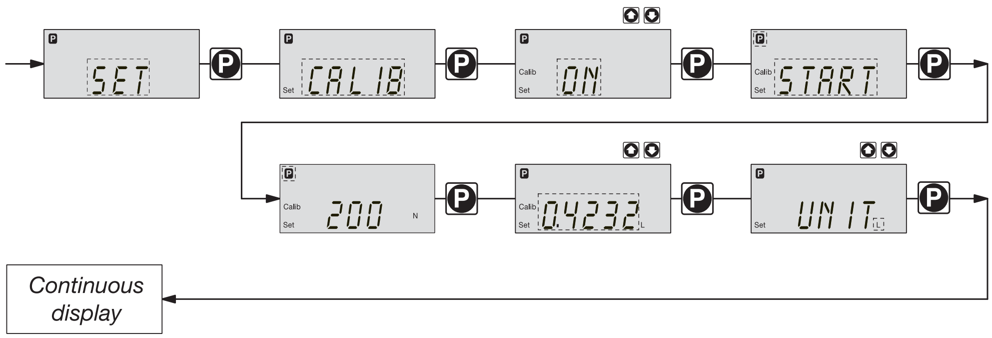
The “memory” extension function can be optionally activated (“mem” appears in the LCD display). When “Memory“ is activated, the gamma/ L adds up the unused excess strokes, up to the stroke memory’s maximum capacity of 65535 strokes. If the maximum capacity is exceeded the pump will malfunction.

7.5 Settings for programmable functions (SET menu)

The following programmable function settings menus appear in all operating modes:

- Calibrate (CALIB menu)
- Pressure levels (PRESS menu)
- Auxiliary frequency (AUX menu)
- Flow (FLOW menu, available only if flow monitor is connected)

7.5.1 Settings for “calibration” function (CALIB menu)



The gamma/ L can also run in calibration mode. The corresponding continuous displays show the current dosing quantities or the feed rate.

Calibration is maintained when a stroke rate is altered up to ±10 degrees (where the stroke length is set at 40 %, the range is 30-50 %). If the stroke rate is altered more than ±10 degrees the yellow warning light is lit, the continuous display flashes and the flashing message “calib” appears.

NOTE

- **Do not go below 30 % stroke length (SEK type: 50 %).**
  This will significantly affect accuracy of calibration.
- **Calibration becomes increasingly accurate the more strokes made by the gamma/ L during calibration (recommended: at least 200 strokes).**

WARNING

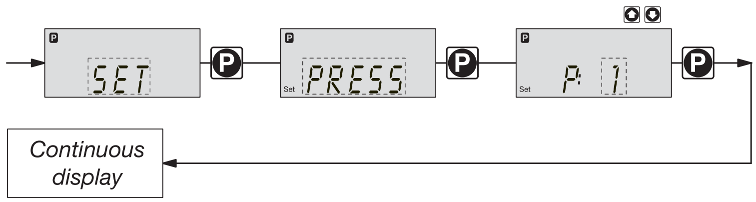
If using a hazardous feed chemical, the following setting instructions ensure adequate safety precautions have been taken!

Calibration

▶ Insert the suction tube into a measuring cylinder containing the feed chemical - the discharge tubing must also be correctly installed (operating pressure, …!)
▶ Suck up the feed chemical (press both arrow keys at the same time) when the suction tube is empty
▶ Note the liquid level in the measuring cylinder and the stroke length
▶ Select the CALIB menu and go to the first menu option using the P key
▶ Select “ON” using an arrow key and change to the next menu option using the P key
▶ To commence calibration, press the P key. The gamma/ L starts to pump and displays the number of strokes (“STOP” appears at regular intervals) (the gamma/ L works at the stroke frequency set under “MANUAL“).
▶ After a sufficient number of strokes, stop the gamma/ L with the P key
▶ Calculate the dosed quantity (difference between the original quantity and the quantity remaining)
▶ Enter this quantity in the next menu and then go to the next menu option using the P key
▶ Select the unit (“L” or “gal”) in the “UNIT” menu with an arrow key

The gamma/ L is calibrated.
The corresponding continuous displays show the calibrated values.
The total stroke number and total litres are set during calibration to “0”.
The gamma/ L is in the STOP state.

7.5.2 Settings for the “pressure levels” function (PRESS menu)



The programmable function “pressure levels” is used to reduce the rated pressure of the gamma/ L.

CAUTION

- **The rated pressure can be considerably exceeded at stroke lengths of below 100 %! The rated pressure relates to a stroke length of 100 %.**
- **If another liquid end size is installed the pump must be reprogrammed on factory premises!**
- **Select as large a rated pressure as required and as small as possible! This will increase system safety (reduces the risk of the tubing bursting when blocked)! This also protects the diaphragm and saves electricity.**

NOTE

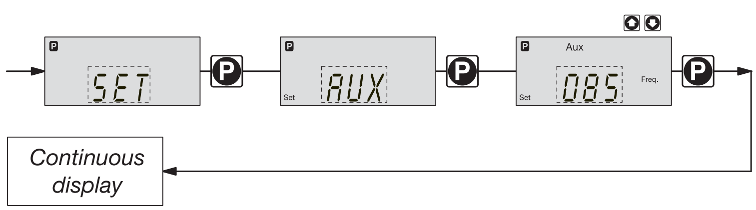
If installing another liquid end size the pump must be reprogrammed on factory premises.

The following rated pressures can be selected for these liquid end sizes (rated pressure in bar):

Liquid end size	Pressure level 1	Pressure level 2	Pressure level 3	Pressure level 4
1601, 1602, 1605	4	7	10	16
1000, 1005, 1008	4	7	10	
0708, 0713	4	7		

No adjustments can be made for pump types 0413, 0420, 0220, 0232.

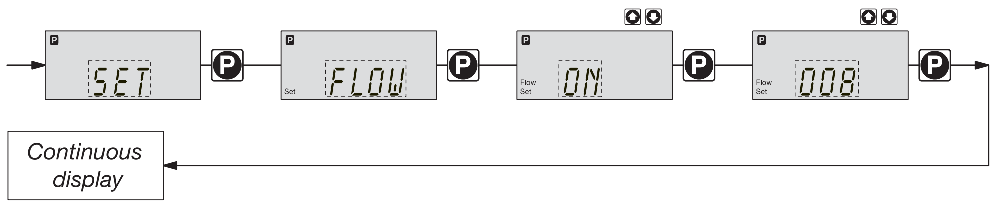
7.5.3 Settings for “auxiliary frequency” function (AUX menu)



The programmable function “auxiliary frequency” allows switching to a different stroke frequency, which can be set in the AUX menu. It can be activated via the “external control” terminal. When the auxiliary frequency is activated, “aux” appears in the LCD display.

This auxiliary frequency overrides the current stroke frequency set for the selected operating mode.

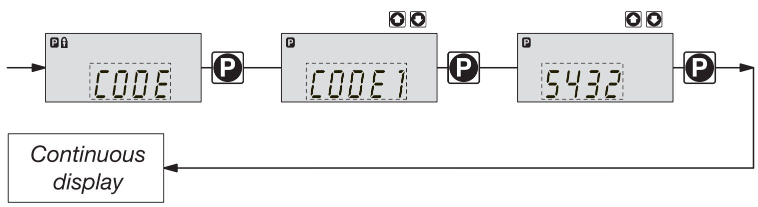
7.5.4 Settings for the “flow” function (FLOW menu)



The flow menu only appears when a dosing monitor is connected to the “dosing monitor” terminal. This dosing monitor registers each discharge stroke of the gamma/ L at the discharge connector and transmits it back to the gamma/ L. If this response transmission is serially omitted for a period set in the FLOW menu (due to failure or below-minimum dosing) the gamma/ L stops.

7.6 Setting code (CODE menu)

The code menu is used to select whether you want to prevent access to parts of the settings options.



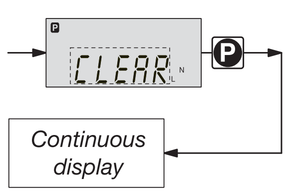
In the first menu option you can choose CODE 1 or CODE 2 (both use the same number).

- Select CODE 1 to prevent access to the settings mode (① in the overview “operating/ settings diagram”, fold-out page). In the next menu option, enter the number you wish to use as the code.
- Select CODE 2 to prevent access to the settings options for directly alterable values in the continuous displays (② in the overview “operating/settings diagram”, fold-out page). In the next menu option, enter the number you wish to use as the code.
- Select NONE to remove a pre-set security lock.

7.7 Cancel total stroke number or total litres (CLEAR window)

In the CLEAR window you can delete the stored total stroke number and simultaneously the total litres (= set to “0”). You may then press the P key briefly to exit this window.

The values displayed are counted incrementally from the point of commissioning the pump, or from the last delete action.



8 Operating

This section describes all operating options available to you when the gamma/ L is in continuous display mode (no P key symbol in the LCD display).

NOTE

- **Open out the fold-out page following the title page fully! There you will find the overviews “control elements and key functions” and “operating/settings diagram”.**
- **Look at the overview “continuous displays”. This page shows you which displays are available in which operating mode, and which values are directly alterable in the corresponding continuous displays.**

8.1 Manual operation

Set stroke length Stroke length is continually adjustable within a range of 0 - 100 %.
The recommended stroke length range, which will practically guarantee technical reproducibility, is 30 - 100 % (SEK type: 50 - 100 %).

The following operating options are available via the different keys (see also figure on the next page):

Stop/Start gamma/ L To stop gamma/ L: press STOP/START key.
To start gamma/ L: press STOP/START key.

Start batch Press the P key briefly in “batch” operating mode.

Load factory settings Press the P key for 15 s only if you wish to load factory calibration settings!
Current settings will be deleted.

Change to settings mode When you press the P key for 2 s in any continuous display the gamma/ L will change to settings mode (see section 7).
If CODE 1 is set, the code must be entered after pressing the P key.

Check adjustable values Each time you press the i key you will see a different continuous display.
The number of continuous displays depends upon the identity code, the selected operating mode and the connected accessories.

Change directly alterable values To change a value (see below) directly in the corresponding continuous display, press one of the arrow keys until “set” appears in the LCD display. The delay has been programmed in to prevent inadvertent changing of values.
If CODE 2 has been set, this code must be entered after pressing the arrow key.

Directly alterable values are as follows:

Stroke rate In “manual”, “contact” and “batch” operating modes:
The stroke rate can be altered in the “stroke rate” display.

Feed rate In “manual” operating mode
The feed rate can be altered in the “feed rate” display.

Factor The factor is the number of strokes activated by an external pulse or a press of the P key (in “batch” mode only).

In “batch” operating mode:

You can alter the factor from the “remaining strokes” display.

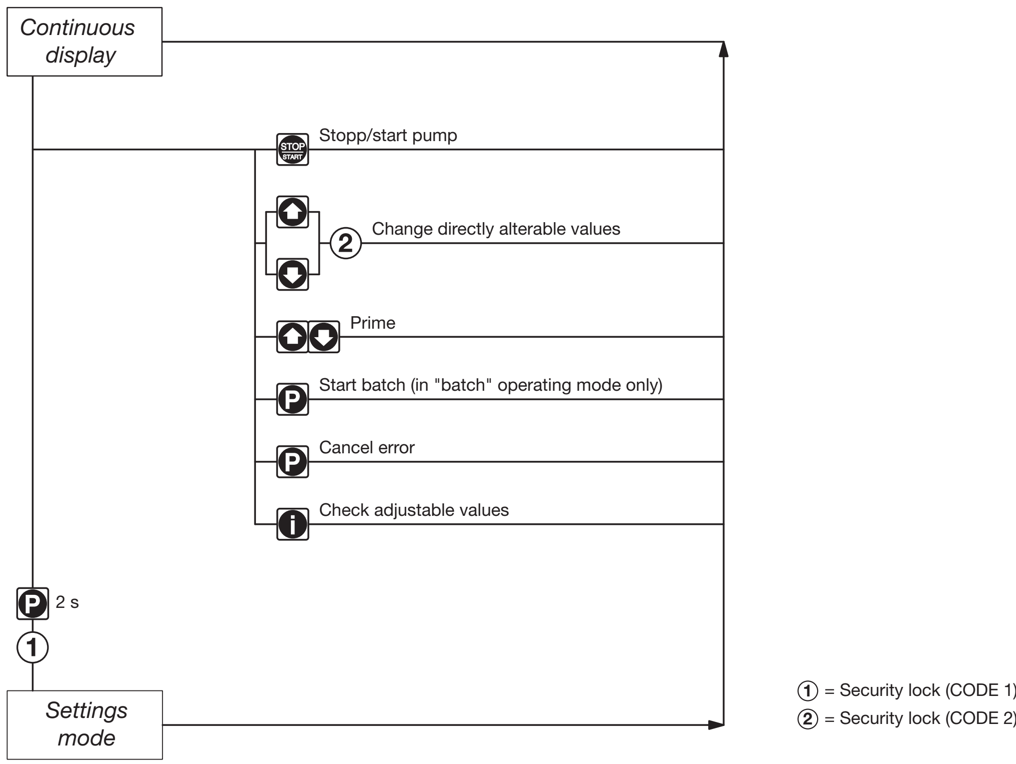
The gamma/ L returns to the original continuous display a few seconds after the factor has been reset.

Batch size In “batch” operating mode:
The batch size can by changed from the “batch size/remaining litres” display.
The gamma/ L returns to the original continuous display a few seconds after the batch size has been reset.

Priming The “priming” function is activated by pressing both arrow keys at the same time in “Stroke rate” permanent display.

Cancel error Error messages are cancelled by pressing the P key briefly.

Display programme versions Press on the P key for 10 seconds to display the programme versions.
Example: “V 1052“ + X 1010“.
Release the key on “LOAD 3“ immediately.



8.2 Remote control

It is possible to control the gamma/ L remotely via a signal cable or Profibus® (see section 6.1 and section 7, “Supplementary Instructions for ProMinent® gamma/ L and ProMinent® Sigma versions with Profibus®” and plant documentation).

9 Maintenance

Maintenance intervals

- Every quarter, when subject to normal usage (continuous operation - approx. 30 %)
- Shorter intervals when subject to heavier usage (e.g. continuous operation)

Maintenance actions

Standard liquid ends:

▶ Check the diaphragm for damage (see section 10)

▶ Check chemical seepage at vent hole

▶ Check that the discharge tubing is connected firmly to the liquid end

▶ Check that discharge and suction valves are firmly fixed

▶ Check that the liquid end is generally watertight (especially vent hole! See fig. 20)

▶ Check for correct feed: run the gamma/ L run for a short period (press both arrow keys together)

▶ Check electrical connections for wear

▶ Check that liquid end screws are fastened tightly (on coarse/fine bleeding versions, first remove knob and cover)

Screw fastening torque: 4,5 to 5 Nm

NOTE

- **For PP liquid end, check fastening torque every quarter!**

Additionally, for liquid ends with coarse/fine bleed function and SEK type:

- **Check that the bypass tubing is connected firmly to the liquid end**
- **Check that the bleed valve is firmly fixed in place**
- **Examine the discharge and bypass tubing for kinks**
- **Check that the coarse/fine bleed function is working correctly**

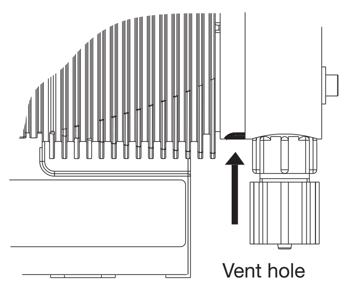


Fig. 20

10 Repairs

NOTE

Repair work may be carried out by authorised personnel only, or on factory premises:

- **Replacement of damaged mains cables**
- **Replacement of fuses and electronic controller.**

Only send the equipment for repair or maintenance in a cleaned condition and with the liquid end flushed. However, should any safety precautions be necessary even after careful draining and cleaning of the equipment, the required information must be listed in the Safety Declaration!

The Safety Declaration forms part of the inspection/repair contract.

Maintenance or repair work will only be carried out if a Safety Declaration - correctly and fully completed by an authorised and qualified member of the Operator's staff - is available.

A copy of the form is included in the "General operating instructions ProMinent solenoid metering pumps" or can be downloaded at www.prominent.com.

WARNING

Pumps used for radioactive materials cannot be returned to ProMinent after use!
They will not be accepted by ProMinent!

Repairs: These should only be carried out by qualified personnel (in accordance with Safety section):

- Cleaning the valve
- Changing the diaphragm

WARNING

- **Always take suitable precautions when using hazardous chemicals!**
- **Ensure equipment is de-pressurised**

NOTE

Take the explosion drawings annexed t the help.

Cleaning the discharge valve (PP, NP, PV) for types 1000, 1005, 1605, 1601, 1602

NOTE

- **Discharge and suction valves are different! Dismantle one after the other to avoid confusion.**
- **Only use new parts, which fit your valve (in shape and chemical resistance)!**
- **The pump must be reset after replacing a valve.**
- **Insert an Allen key or similar into the smaller hole of the pressure connector and push out the valve inserts.**

Cleaning the sucction valve (PP, NP, PV) for types 1000, 1005, 1605, 1601, 1602

Dismantling, cleaning and reassembly of the suction valve is practically the same as for a discharge valve.

Notice however that:

- both valve inserts are actually identical
- an additional spacer is found under the valve inserts
- in the liquid end a shaped seal is used instead of an O-ring
- the flow direction of the suction connection is reversed as for the pressure connector.

Cleaning the discharge valve (PP, NP, PV) for types 0708, 1008, 0220, 0420, 0413, 0713, 0232

NOTE

- **Discharge and suction valves are different! Dismantle one after the other to avoid confusion!**
- **Only use new parts, which fit your valve (in shape and chemical resistance)!**
- **The pump must be reset after replacing a valve.**
- **Insert an Allen key or similar into the smaller hole of the pressure connector and push out the valve inserts.**

Cleaning the suction valve (PP, NP, PV) for types 0708, 1008, 0220, 0420, 0413, 0713, 0232

Dismantling, cleaning and reassembly of the suction valve is practically the same as for a discharge valve.

Notice however that:

- an additional spacer is found under the valve inserts
- in the liquid end the O-ring is used, not the shaped seal
- the flow direction of the suction connection is reversed as for the pressure connector.

Change diaphragm

WARNING

- **Always take suitable precautions when using hazardous chemicals!**
- **Ensure that the equipment is de-pressurised!**

▶ Empty the liquid end (turn the unit upside down and let the feed chemical run out, rinse with a suitable material: rinse the liquid end thoroughly after use with hazardous materials!).

▶ When gamma/ L is running set the stroke length to 0 % (the drive axis is then set).

▶ Switch off the gamma/ L.

▶ Unscrew the hydraulic connectors from the discharge and suction side.

▶ For versions with coarse/fine bleed function: firstly pull out the coarse/fine bleed (knob), then lift off the cover from the liquid end using a screwdriver.

▶ Remove the screws (1).

For pump types 0220, 0232 and 0420 see the following page (4 holes on the diaphragm rim)!

Supply unit types, except 0220, 0232 and 0420

▶ Loosen the liquid end (2) and the top plate (4) from the pump housing (6) (loosen only!).

▶ Hold the housing (6) in one hand and with the other, clamp the diaphragm (3) between the liquid end (2) and the top plate (4); release the diaphragm (3) from the drive spindle with a light anticlockwise turn of the liquid end (2) and top plate (4).

▶ Unscrew the diaphragm (3) completely from the drive spindle.

▶ Remove the top plate (4) from the housing (6).

▶ Check the condition of the safety diaphragm (5) and replace if necessary.

▶ Push the safety diaphragm (5) only as far onto the drive axis until it lies flat on the pump housing (6) – no further!

▶ Screw the new diaphragm (3) carefully up to the stop on the drive axis – this must be exact to ensure correct metering!

▶ Screw the diaphragm (3) tight once more.

▶ Position the top plate (4) on the pump housing (6).

IMPORTANT

- **The leakage hole must point downwards when the pump is fully assembled (see fig. 20).**
- **Position the top plate (4) correctly on the pump housing (6). Do not distort the top plate on the pump housing, otherwise the safety diaphragm (5) will not fit.**

▶ Lay the diaphragm (3) into the top plate (4).

▶ Hold the top plate (4) and screw the diaphragm (3) in a clockwise direction until it is firmly in position (you will feel the resistance of the return spring).

IMPORTANT

- **Do not overtighten the diaphragm (3) (particularly on type 1601).**
- **The top plate (4) must remain in position to prevent the safety diaphragm (5) from distorting.**

▶ Place the liquid end (2) with the screws (1) on the diaphragm (3) and the top plate (4) (the priming connector must point downwards once the pump is fully assembled).

▶ Screw on screws (1) lightly and tighten (starting torque, see below).

▶ For versions with coarse/fine bleed function, ensure that the liquid end cover engages in the liquid end, then push the coarse/fine bleed vent (knob) into the liquid end.

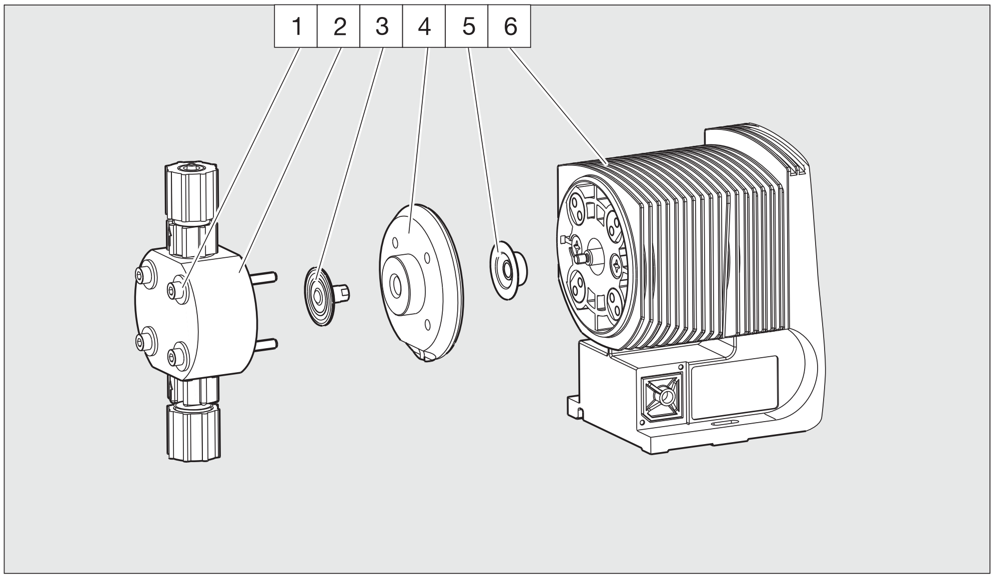


Fig. 21

1 Screws
2 Liquid end
3 Diaphragm
4 Top plate
5 Safety diaphragm
6 Pump housing

NOTE

- **Check the screw torques after 24 hours in operation**
- **For PP liquid ends check the screw torques again after three months.**

Screw torques: 4,5 to 5 Nm

Liquid ends - types 0220, 0232 and 0420

▶ Remove the metering head (2) with the screw (1) from the pump (see fig. 22).

▶ Only type 0232: Remove the screws of the set disk (4) below the diaphragm (3).

▶ The screws (1) should fit in the holes of the diaphragm (3), but not on the set disk.

▶ Hold the housing (6) in one hand and with the other hand, clamp the diaphragm (3) between the liquid end (2) and the top plate (4); release the diaphragm (3) from the drive spindle with a light anti-clockwise turn of the liquid end (2) and top plate (4).

▶ Remove the liquid end (2) with screws (1) from of the diaphragm and unscrew completely from the drive spindle.

▶ Remove the top plate (4) from the housing (6).

▶ Check the condition of the safety diaphragm (5) and replace it necessary.

▶ Push the safety diaphragm (5) only as far onto the drive axis until it lies flat on the pump housing (6) – no further!

▶ Screw the new diaphragm (3) carefully up to the stop on the drive axis – this must be exact to ensure correct metering!

▶ Check that the holes in the diaphragm are aligned with those in the pump housing.

▶ If not, start the pump and set the stroke length to 100 %.

▶ When the pump is running, turn the diaphragm (3) slowly in a clockwise direction until the four holes in the diaphragm are flush with those on the pump housing (6).

▶ Hold the diaphragm (3) in this position, set the stroke length to 0 % and stop the pump.

▶ Screw the diaphragm (3) tight once more.

▶ Position the top plate (4) on the pump housing (6).

▶ Only type 0232: Mount the set disk (4) with the screws.

IMPORTANT

- **The leakage hole must point downwards when the pump is fully assembled (see fig. 20).**
- **Position the top plate (4) correctly on the pump housing (6). Do not distort the top plate on the pump housing, otherwise the safety diaphragm (5) will not fit.**

▶ Lay the diaphragm (3) into the top plate (4).

▶ Hold the top plate and screw the diaphragm (3) in a clockwise direction until it is firmly in position (you will feel the resistance of the return spring).

IMPORTANT

- **Do not overtighten the diaphragm (3).**
- **The top plate (4) must remain in position to prevent the safety diaphragm (5) from distorting.**

▶ Position the liquid end (2) with the screws (1) on the diaphragm (3) and the top plate (4) (the priming connector must point downwards once the pump is fully assembled).

▶ Screw on screws (1) lightly and tighten (starting torque, see above).

▶ For coarse/fine bleed versions: ensure the liquid end cover engages in the liquid end, then push the coarse/fine bleed (knob) into the liquid end.

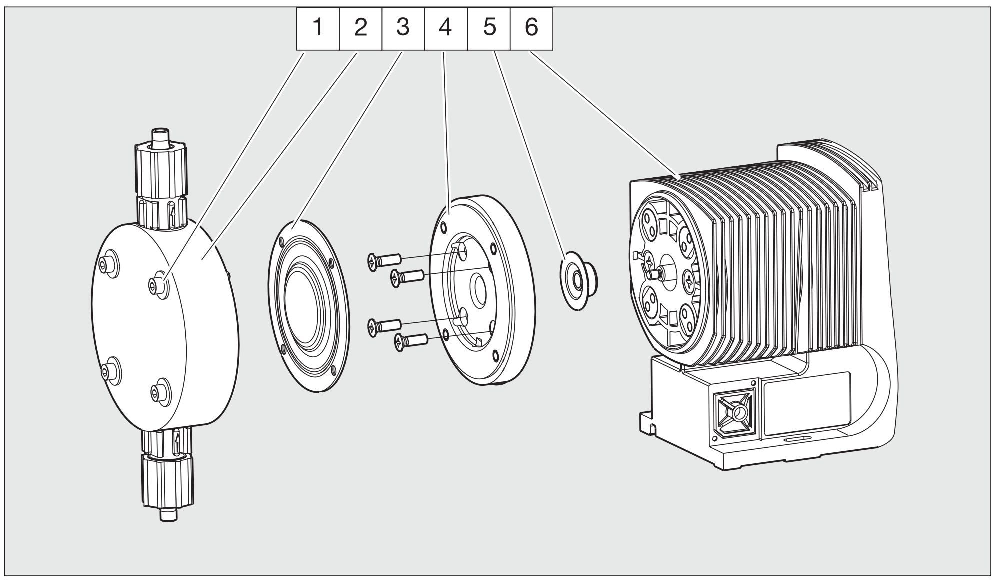


Fig. 22

1 Screws
2 Liquid end
3 Diaphragm
4 Top plate
5 Safety diaphragm
6 Pump housing

NOTE

- **Check the screw torque after 24 hours in operation!**
- **For PP liquid ends recheck the screw torque after three months!**

11 Troubleshooting

WARNING
- **Always take suitable precautions when using hazardous chemicals!**
- **Ensure the equipment is de-pressurised before working on the pump!**

gamma/ L does not prime despite full stroke and bleed function

Cause Crystalline deposits on the ball seat because valves have dried out

Remedy
- ▶ Remove the suction sleeve from the chemical supply container and rinse out the liquid end thoroughly
- ▶ If still unsuccessful, dismantle valves and clean (see section 9)

Fluid is seeping from the top plate

Cause The liquid end is not sealed against the pump diaphragm

Remedy
- ▶ Tighten screws in the liquid end (see section 9)
- ▶ If unsuccessful, replace the diaphragm (see section 10)

Green LED indicator (operating display) is not lit

Cause Incorrect or no mains voltage

Remedy
- ▶ Use the recommended mains voltage as given in the voltage specification on the nameplate

Error Messages

Red LED display is lit, “Error” appears and “MINIM” flashes in the display

Cause Fluid level in the chemical storage tank has reached “liquid level low, stage 2”

Remedy
- ▶ Fill the chemical supply container

Red LED display is lit, “Error” appears and “ANALG” flashes in the display

Cause gamma/ L is in “analogue” operating mode, a fault routine has been programmed in the ANALG menu and the operating current has fallen below 3.8 mA

Remedy
- ▶ Remedy low operating current
- ▶ Switch fault routine “OFF” (see Section 7.4.2.)

Red LED display is lit, “Error” appears and “CNTCT” flashes in the display

Cause gamma/ L is in “contact” or “batch” operating mode and the extended function “memory” has been set.
In addition a very large factor has been entered, too many contacts have been input or the P-key has been pressed too often, resulting in an overflow of the stroke memory.

Remedy
- ▶ Press the P-key, saved data will be deleted
- ▶ Change gamma/ L set up

Red LED display is lit, “Error” appears and “FLOW” flashes in the display

Cause Dosing monitor not properly connected

Remedy
- ▶ Connect dosing monitor properly
- ▶ Press P-key

Cause Dosing monitor has reported more defective strokes than have been set in the FLOW menu

Remedy
- ▶ Press P-key
- ▶ Investigate the cause and remedy

Red LED display is lit, “Error” appears and “Mem” flashes in the display

Cause Stroke memory full

Remedy
- ▶ Remove cause
- ▶ Press P-key (Consider the consequences this will have on your process)

Fault Signals

Yellow LED display is lit

Cause Liquid level in chemical storage tank has reached “liquid level low, stage 1”

Remedy ▶ Fill chemical storage tank

Yellow LED Display is lit and “calib” flashes

Cause The pump is calibrated and the stroke length deviates by more than ±10 % from the value at the time of calibration.

Remedy ▶ Reset the stroke length or calibrate the pump again to the desired stroke length

All other Errors

Please contact your ProMinent branch or representative!

12 Decommissioning and Disposal

Decommissioning

WARNING

- **When decommissioning the gamma/ L the housing and, in particular, the liquid end must be thoroughly cleaned to remove chemicals and dirt!**
- **Always take suitable precautions when using hazardous chemicals!**
- **Ensure that the equipment is de-pressurised!**

▶ Disconnect the gamma/ L from the power supply

▶ Empty the liquid end by turning the gamma/ L upside down and allow the feed chemical to pour out

▶ Rinse the liquid end with a suitable material, thoroughly rinse the liquid end after use with hazardous materials!

If decommissioning is only temporary, maintain the correct storage conditions:

Storage temperature:	-10 to +50 °C
Air humidity:	< 92 % relative humidity

Disposal

IMPORTANT

Electronic waste is classified as special waste!

Please observe all locally applicable directives!

13 Technical Data

13.1 Performance data and weights

gamma/ L at 180 strokes/minute and 100 % stroke length

Liquid end type	Max. feed rate at maximum operating pressure			max. feed rate at medium operating pressure			Connector size outer Ø x inner Ø	Suction-lift*	Priming-lift**	Admmis. priming pressure	Ship. Wt[1]
	bar	l/h	ml/str.	bar	l/h	ml/str.	mm	m Wg	m Wg	bar	approx. kg
1000	10	0.74	0.09	5	0.82	0.076	6x4	6	1.8	8	2.9 / 3.6
1601	16	1.1	0.10	8	1.4	0.13	6x4	6	2	8	2.9 / 3.6
1602	16	2.1	0.19	8	2.5	0.24	6x4	6	2	5.5	2.9 / 3.6
1005	10	4.4	0.41	5	5.0	0.46	8x5****	5	3	3	3.1 / 4.5
0708	7	7.1	0.66	3.5	8.4	0.78	8x5	6	2	2	3.1 / 4.5
0413	4	12.3	1.14	2	14.2	1.31	8x5	3	2	1.5	3.1 / 4.5
0220	2	19.0	1.76	1	20.9	1.94	12x9	2	2	1	3.1 / 4.5
1605	16	4.1	0.38	8	4.9	0.45	8x5****	4	3	3	4.5 / 5.9
1008	10	6.8	0.63	5	8.3	0.76	8x5	3	3	2	4.5 / 5.9
0713	7	11.0	1.02	3.5	13.1	1.21	8x5	3	3	1.5	4.5 / 5.9
0420	4	17.1	1.58	2	19.1	1.77	12x9	3	3	1	5.5 / 8.6
0232	2	32.0	2.96	1	36.2	3.35	12x9	2	2	0.8	5.5 / 8.6

gamma/ L with self-degassing liquid end *** at 180 strokes/minute and 100 % stroke length

Liquid end type	Max. feed rate at maximum operating pressure			max. feed rate at medium operating pressure			Connector size outer Ø x inner Ø	Suction-lift*	Priming-lift**	Admmis. priming pressure	Ship. Wt[1]
	bar	l/h	ml/str.	bar	l/h	ml/str.	mm	m Wg	m Wg	bar	approx. kg
1601	16	0.59	0.055	8	0.78	0.072	6x4	–	1.8	0.5	2.9
1602	16	1.4	0.13	8	1.74	0.16	6x4	–	2.1	0.5	2.9
1005	10	3.6	0.33	5	4.0	0.37	8x5	–	2.7	0.5	3.1
0708	7	6.6	0.61	3.5	7.5	0.69	8x5	–	2	0.5	3.1
0413	4	10.8	1.00	2	12.6	1.17	8x5	–	2.5	0.5	3.1
0220	2	16.3	0.31	8	3.8	0.35	8x5	–	3.0	0.5	4.5
1008	10	6.3	0.58	5	7.5	0.69	8x5	–	3.0	0.5	4.5
0713	7	10.5	0.97	3.5	12.3	1.14	8x5	–	2.5	0.5	4.5
0420	4	15.6	1.44	2	17.4	1.61	12x9	–	2.5	0.5	4.5

* Lift when suction line and liquid end are full
** Priming lift with clean and wetted valves, priming lift at 100% stroke length and free flow or opened bleed valve
*** The feed rate values are for minimum feed rates, based on water at 20° C
**** For material versions SST : 6 x 4 mm
[1] For material versions PPE, PPB, NPE, NPB, PVT, TTT/SST
[2] For material versions PPE, PPB, NPE, NPB

13.2 Dosing reproducibility

Standard Liquid ends

Dosing precision -5 to +10 % at max. stroke length and max. operating pressure for all materials.

Reproducibility ±2 % at constant conditions and minimum 30 % stroke length.

Self-degassing liquid ends

Since self-degassing liquid ends are filled with air bubbles when in contact with gaseous chemicals and when in operation, no dosing reproducibility values can be given.
The recommended minimum stroke length with self-degassing liquid ends is 50 %.

13.3 Viscosity

The liquid ends are designed for liquids up to a maximum viscosity of

- 200 mPas for standard liquid ends
- 500 mPas for valves with springs
- 50 mPas for self-degassing liquid ends

13.4 Materials Data Liquid ends

Version	Liquid end	Valves	Seals	Balls
PPE	PP	PP	EPDM	Ceramic
PPB	PP	PP	FPM	Ceramic
NPE	Acrylic glass	PVC	EPDM	Ceramic
NPE	Acrylic glass	PVC	FPM	Ceramic
PVT	PVDF	PTFE with carbon	PTFE	Ceramic
TTT	PTFE with carbon	PTFE with carbon	PTFE	Ceramic
SST	Stainless steel 1.4571	Stainless steel 1.4571	PTFE	Ceramic

FPM = Fluorine Rubber

Pump

Housing	Polyphenylene ether (PPE with glass fibre)
Cover	Polycarbonate
Electronics	Electronic components

13.5 Electrical Data

Version: 100 - 230 V ±10 %, 50/60 Hz

Varants 100 - 230 V/AC	gamma/ L M70	gamma/ L M85
Power rating	17 W	22 W
Rated current	0.7 A	1 A
Switch on peak current	15 A (for approx. 1 ms)	15 A (for approx. 1 ms)
Fuse	0.8 AT	0.8 AT

Note Fuses must display VDE, UL and CSA certification, e.g. type 19195 from Wickmann in accordance with IEC publication 127 - 2/3

13.6 Ambient conditions

Temperatures

Storage and transport temperatures: -10 to +50 °C
Feed chemical temperature: -10 to +35 °C
Ambient temperature when in operation: -10 to +45 °C (drive and control)

Maximum ambient temperatures for liquid ends depending on material type:

max. ambient temperature	PPE, PPB	NPE, NPB	PVT	TTT	SST
Long-term at max. operating pressure	50 °C	45 °C	50 °C	50 °C	50 °C
Short term (max. 15 min) at max. 2 bar	100 °C	60 °C	120 °C	120 °C	120 °C

* Under extreme conditions such as maximum dosing temperatures, maximum stroke frequency and maximum operating pressure, leakage can occur on the liquid end at an ambient temperature of 35 °C.

Climate

Permissible air humidity: 92 % relative humidity, not condensing
Moist and fluctuating air conditions: FW 24 in accordance with DIN 50016

13.7 Enclosure rating and safety class

Enclosure Rating

Contact and moisture enclosure rating:
IP 65 in accordance with IEC 529, EN 60529, DIN VDE 0470 Part 1

Safety Requirements

Safety Class 1 - Mains connection with earth lead

13.8 Compatibility

The hydraulic parts of the gamma/ L are identical to those of the Beta®.
The following components and accessories for pumps from the product ranges Beta®, CONCEPT, gamma-Classic and gamma are all compatible:

- gamma/Vario signal cable; 2-, 4- and 5 core for “external” function
- 2 stage float switch (gamma/Vario)
- Discharge tubing diameters
- Standard gamma connector set
- gamma wall bracket
- Chemical feed containers and mounting plates
- Total height (distance between suction and discharge connector)
- Distance between the connectors and locating holes on the pumps
- Accessories such as pressure back pressure valve, multifunctional valve, dosing monitor and rinsing equipment

PPE, PPB material versions

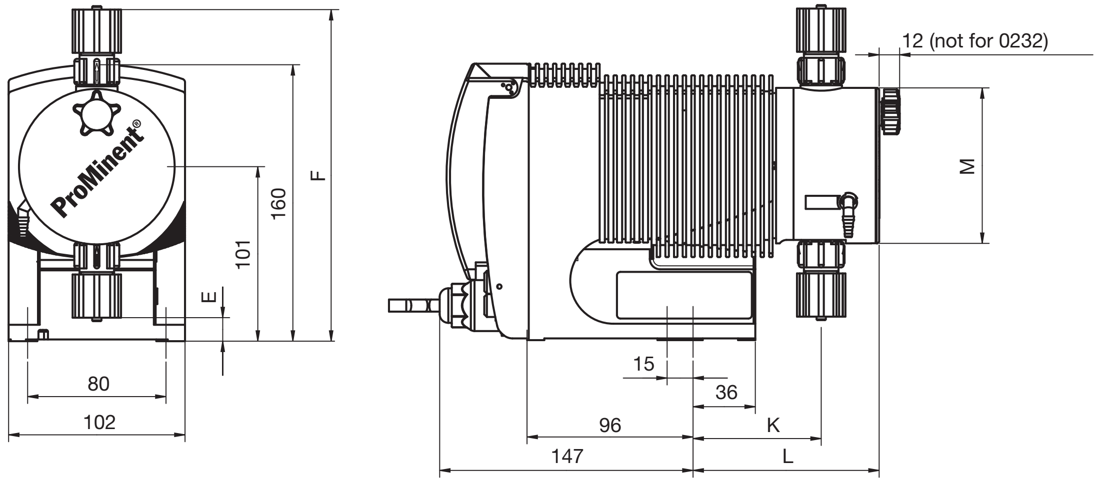


Fig. 23

Dimensions in mm

	gamma/ L M70 1000 - 1602	1005	0708 - 0413	0220	gamma/ L M85 1605	1008 - 0713	0420	0232
E	23	13	15	15	13	15	15	5
F	186	193	191	191	193	191	191	197
K	71	71	74	76	71	74	76	76
L	106	105	108	110	105	108	110	91
M	Ø 70	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 110

NPE, NPB material versions (non bleed)

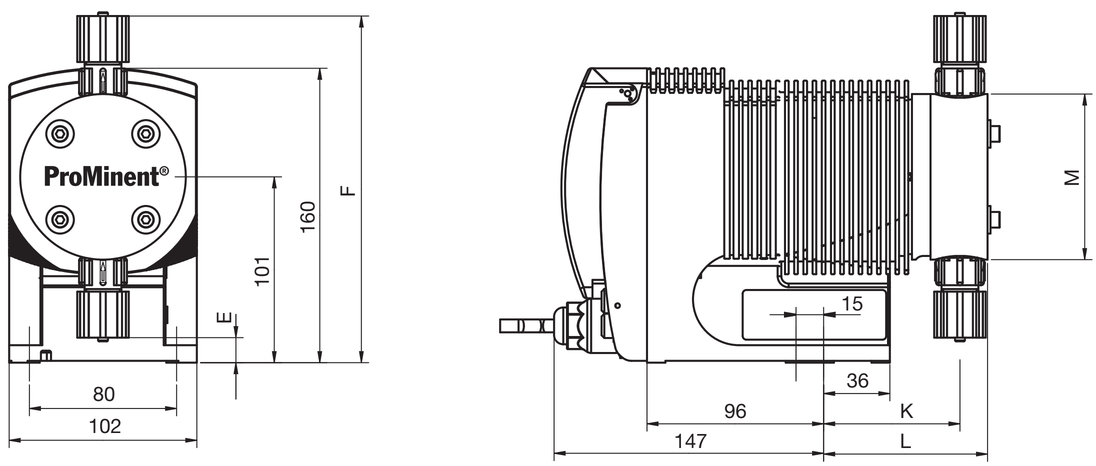


Fig. 24

Dimensions in mm

	gamma/ L M70 1000 - 1601	1602	1005	0708	0413 - 0220	gamma/ L M85 1605	1008 - 0713	0420	0232
E	25	23	16	15	15	16	15	15	5
F	177	179	188	189	189	188	189	189	199
K	77	77	74	74	76	74	74	76	76
L	92	92	89	89	91	89	89	91	91
M	62 (Ø 70)	66 (Ø 70)	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 110

NPE, NPB material versions (with bleed function)

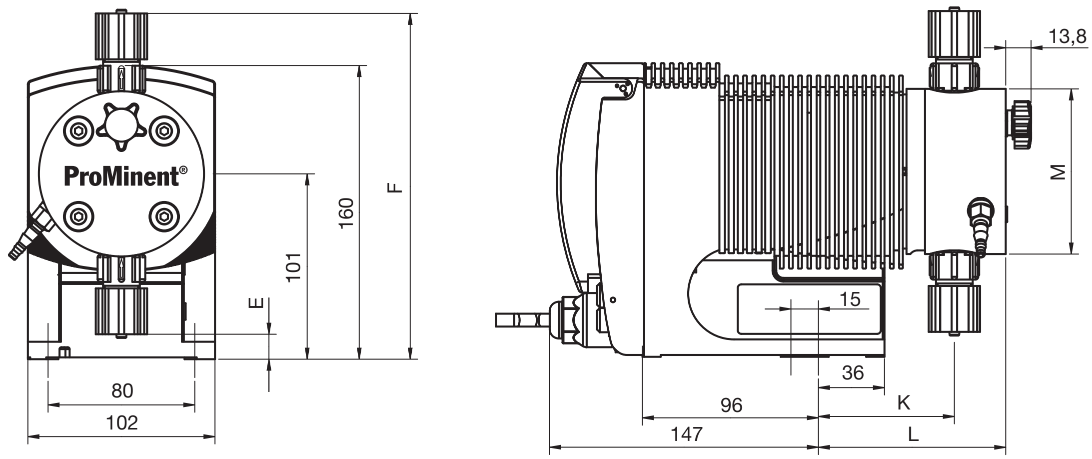


Fig. 25

Dimensions in mm

	gamma/ L M70 1000 - 1601	1602	1005	0708	0413 - 0220	gamma/ L M85 1605	1008	0713 - 0420	0232
E	25	23	16	13	15	16	13	15	5
F	177	179	188	189	189	188	189	189	199
K	77	77	74	74	76	74	74	76	76
L	105	105	102	102	104	102	102	104	105
M	62 (Ø 70)	66 (Ø 70)	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 110

PPE, PPB, NPE, NPB, SEK material versions

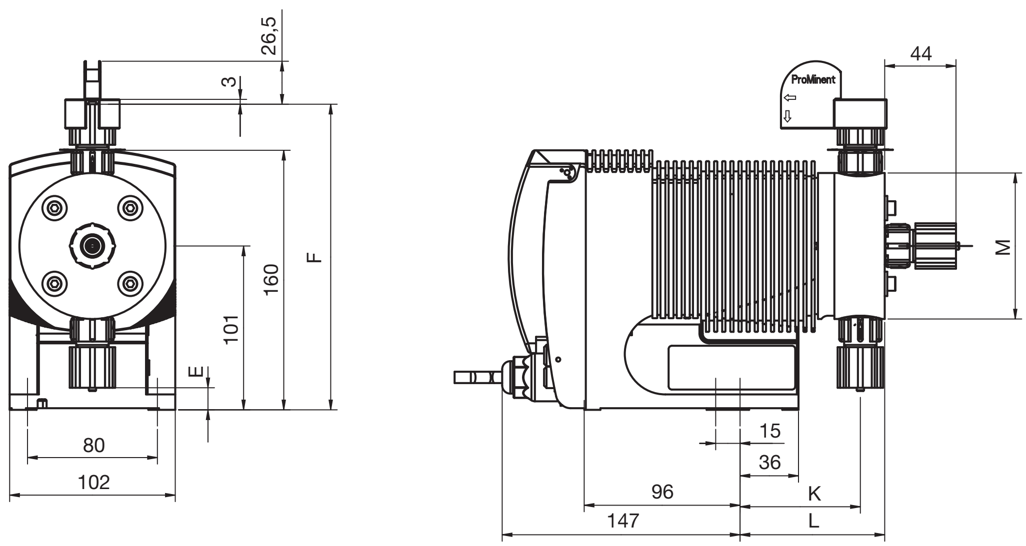


Fig. 26

Dimensions in mm

	gamma/ L M70 1601	1602	1005	0708	0413 - 0220	gamma/ L M85 1605	1008 - 0713	0420
E	25	23	16	15	15	16	15	15
F	177	179	188	189	189	188	189	189
K	77	77	74	74	76	74	74	76
L	92	92	89	89	91	89	89	91
M	62 (Ø 60)	66 (Ø 70)	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90

PVDF material version

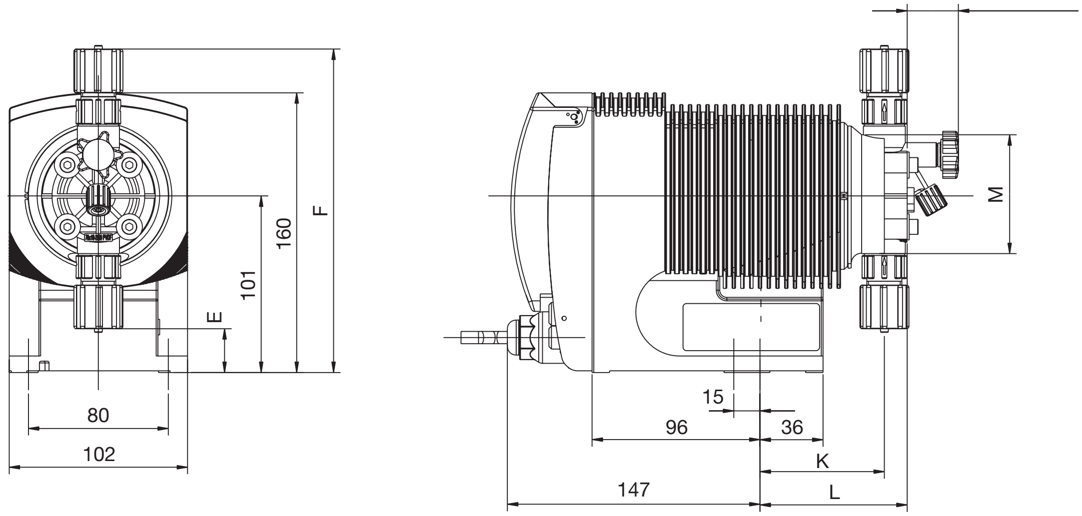


Fig. 27

Dimensions in mm

	gamma/ L M70 1000-1602	1005	0708-0413	0220	gamma/ L M85 1605	0408-0713	0420	0232
E	25	14	14	14	14	14	14	4
F	185	191	191	191	191	191	191	198
K	71	71	73	75	71	73	75	76
L	84	88	90	92	88	90	92	93
M	Ø 70	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 90	Ø 110

TTT material version

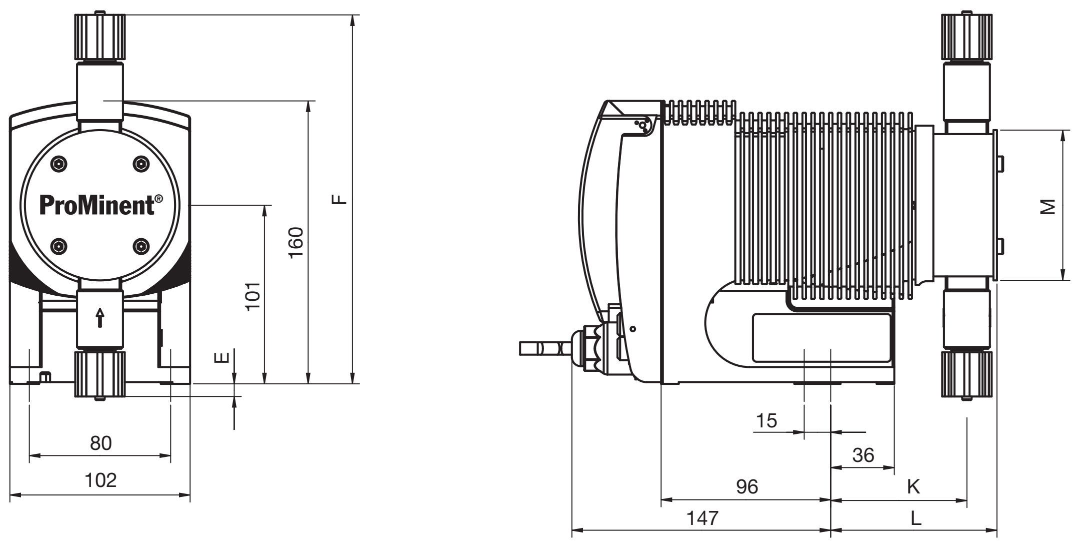


Fig. 28

Dimensions in mm

	gamma/ L M70 1000 - 1601	1602	1005	0708 - 0220	gamma/ L M85 1605	1008 - 0420	0232
E	32	25	23	-7	23	-7	-15
F	170	178	179	209	179	209	217
K	78	72	75	77	75	77	78
L	91	87	90	95	90	95	97
M	51 (Ø 60)	66 (Ø 70)	68 (Ø 80)	81 (Ø 85)	68 (Ø 80)	81 (Ø 85)	96 (Ø 100)

SST material version

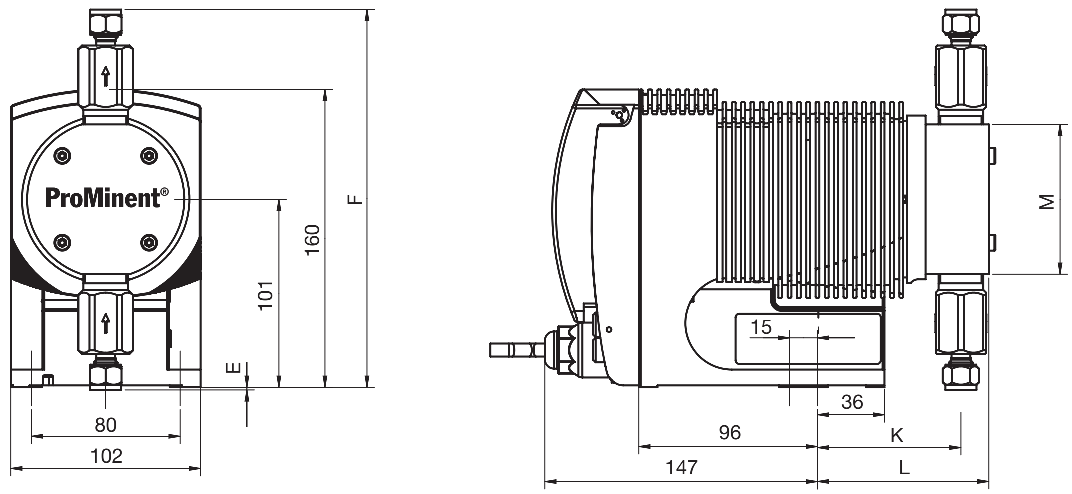
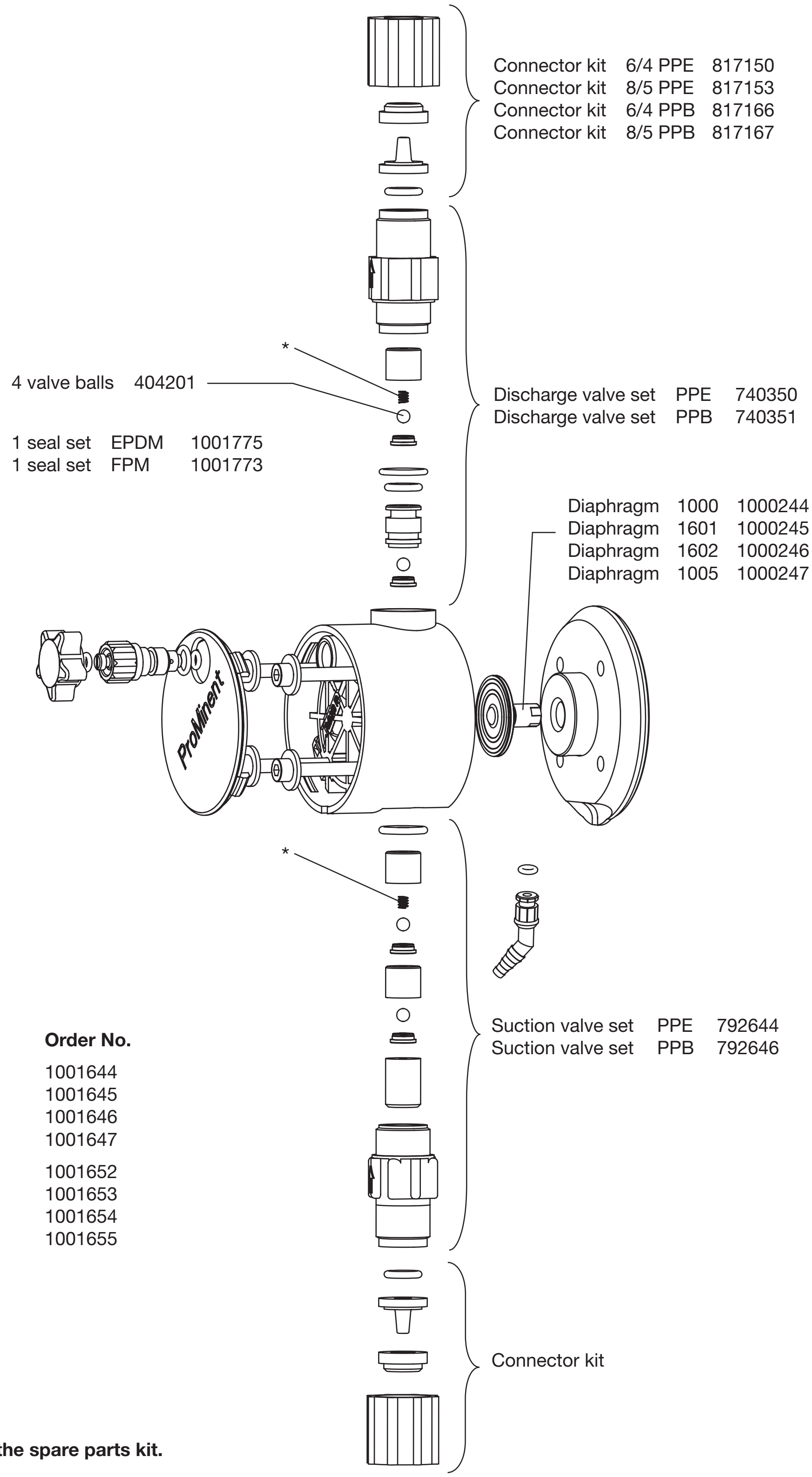


Fig. 29

Dimensions in mm

	gamma/ L M70 1000 - 1601	1602	1005	0708 - 0413	0220	gamma/ L M85 1605	1008 - 0713	0420	0232
E	40	33	31	-2	-3	31	-2	-3	-10
F	162	170	171	203	204	171	203	204	212
K	78	72	75	77	77	75	77	77	78
L	89	85	88	93	93	88	93	93	95
M	51 (Ø 60)	66 (Ø 70)	68 (Ø 80)	81 (Ø 85)	81 (Ø 85)	81 (Ø 80)	81 (Ø 85)	81 (Ø 85)	96 (Ø 100

Liquid end 1000 - 1005 (1605)
PP with coarse/fine bleed



Spare parts kits for:

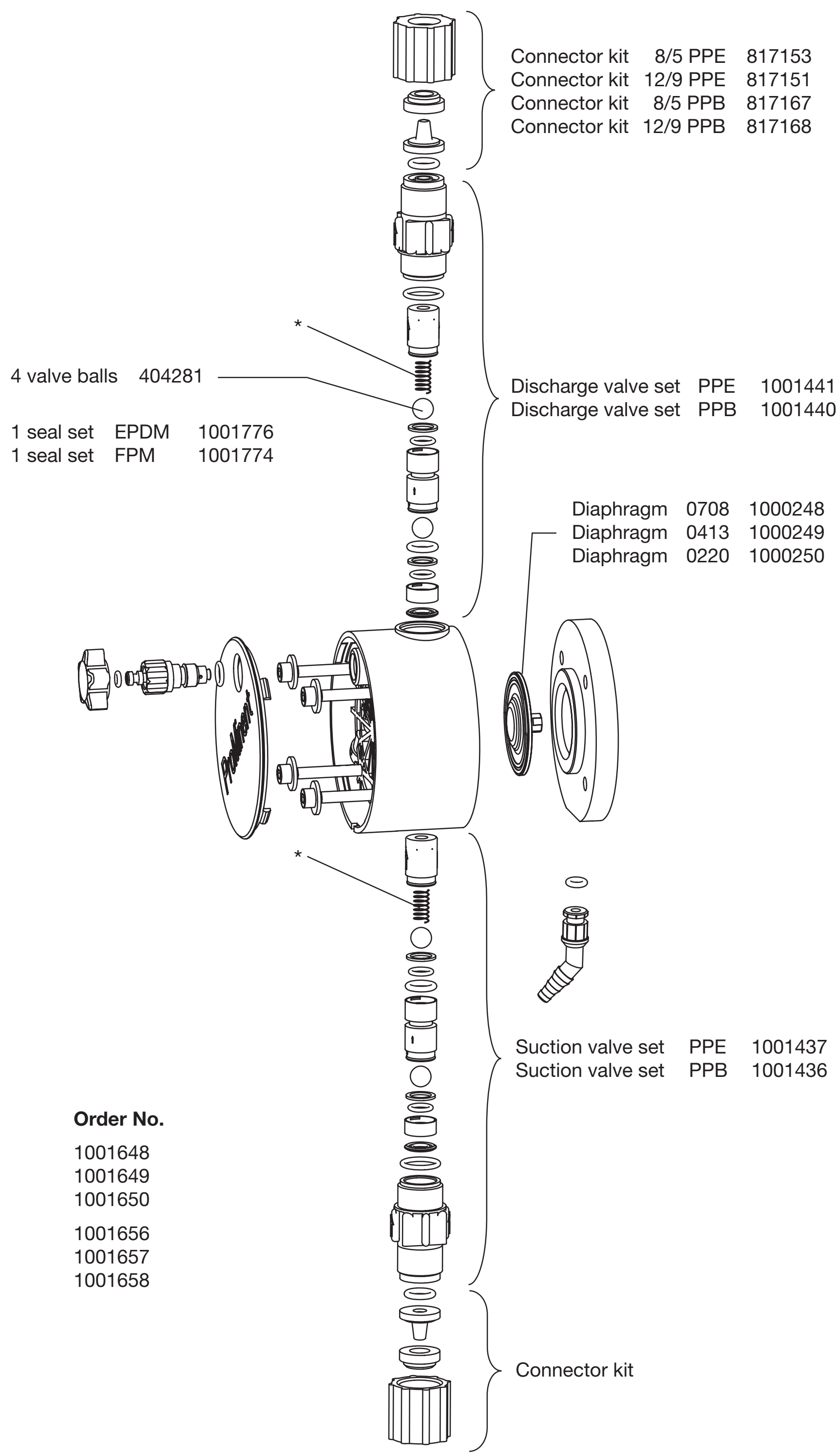
Type	**Material**	**Order No.**
1000	PPE	1001644
1601	PPE	1001645
1602	PPE	1001646
1005 (1605)	PPE	1001647
1000	PPB	1001652
1601	PPB	1001653
1602	PPB	1001654
1005 (1605)	PPB	1001655

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_18-04_2

Liquid end 0708 (1008) - 0220 (0420)
PP with coarse/fine bleed



Spare parts kits for:

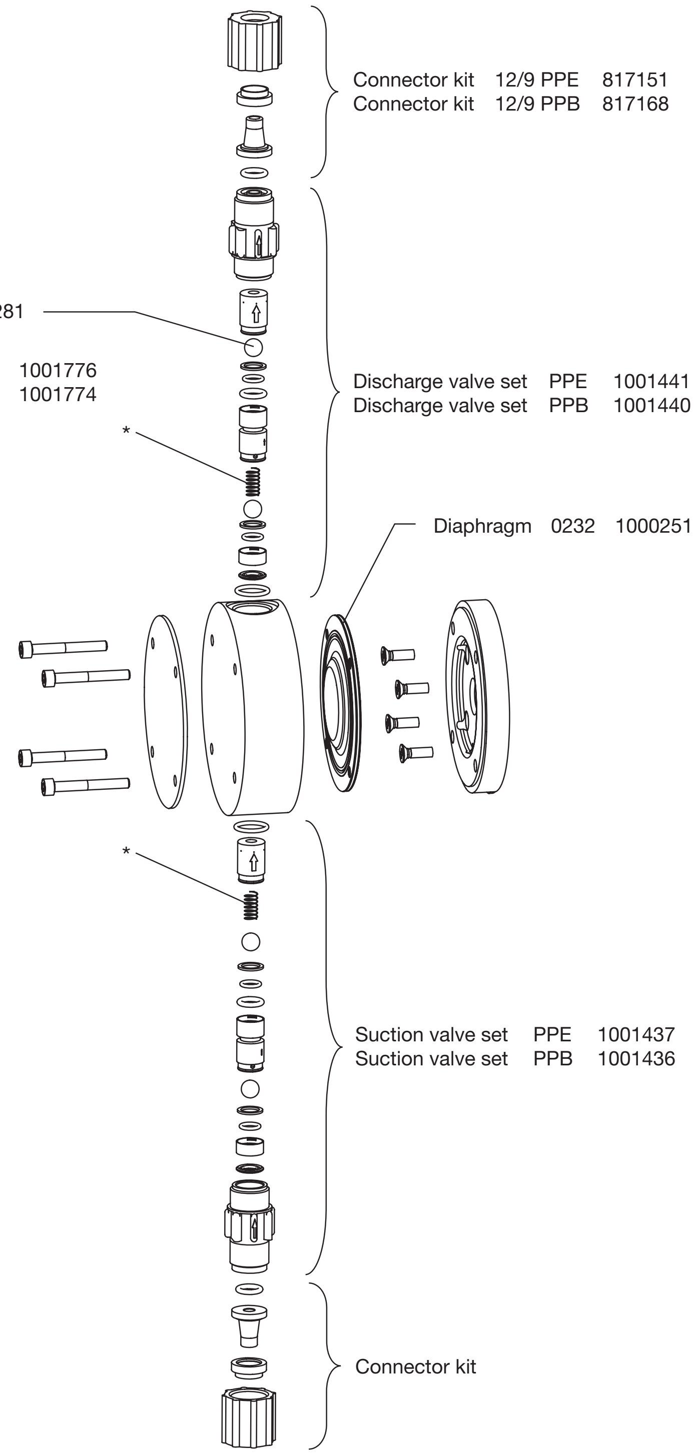
Type	Material	Order No.
0708 (1008)	PPE	1001648
0413 (0713)	PPE	1001649
0220 (0420)	PPE	1001650
0708 (1008)	PPB	1001656
0413 (0713)	PPB	1001657
0220 (0420)	PPB	1001658

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_19-04_2

Liquid end 0232
PP without coarse/fine bleed



Spare parts kits for:

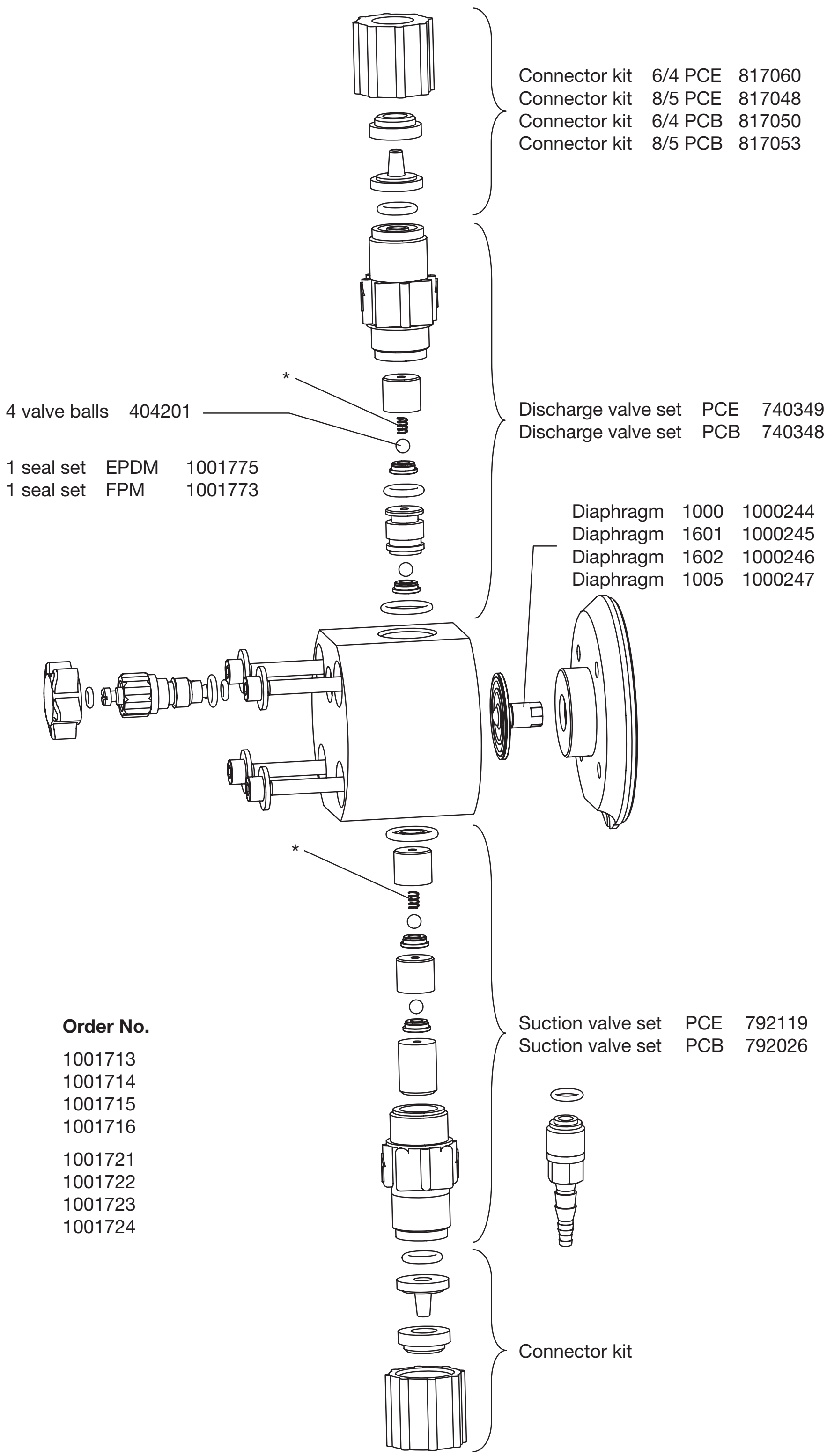
Type	**Material**	**Order No.**
0232	PPE	1001651
0232	PPB	1001659

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_40-04_2

Liquid end 1000 - 1005 (1605)
NP with coarse/fine bleed



Spare parts kits for:

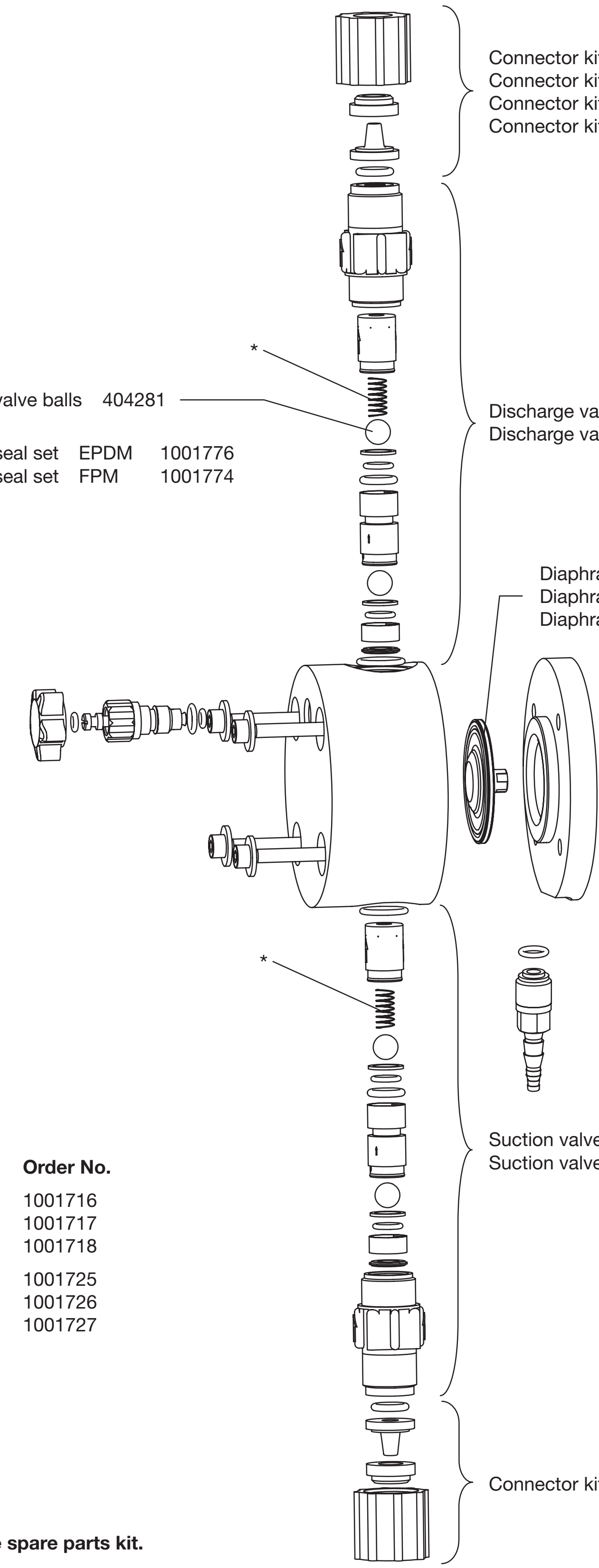
Type	**Material**	**Order No.**
1000	NPE	1001713
1601	NPE	1001714
1602	NPE	1001715
1005 (1605)	NPE	1001716
1000	NPB	1001721
1601	NPB	1001722
1602	NPB	1001723
1005 (1605)	NPB	1001724

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_23-04_2

Liquid end 0708 (1008) - 0220 (0420)
NP with coarse/fine bleed



Spare parts kits for:

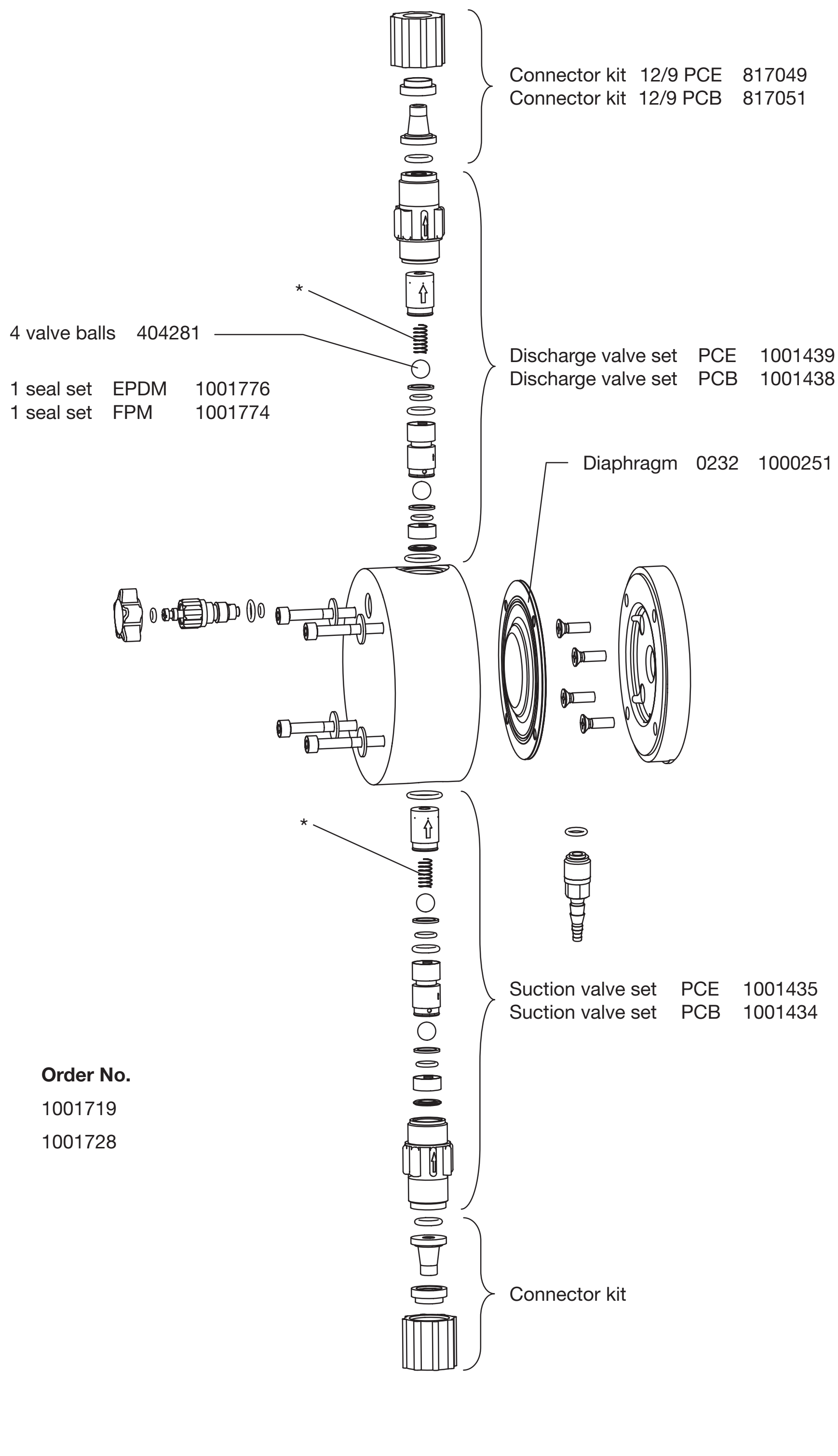
Type	**Material**	**Order No.**
0708 (1008)	NPE	1001716
0413 (0713)	NPE	1001717
0220 (0420)	NPE	1001718
0708 (1008)	NPB	1001725
0413 (0713)	NPB	1001726
0220 (0420)	NPB	1001727

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_24-04_2

Liquid end 0232
NP with coarse/fine bleed



Spare parts kits for:

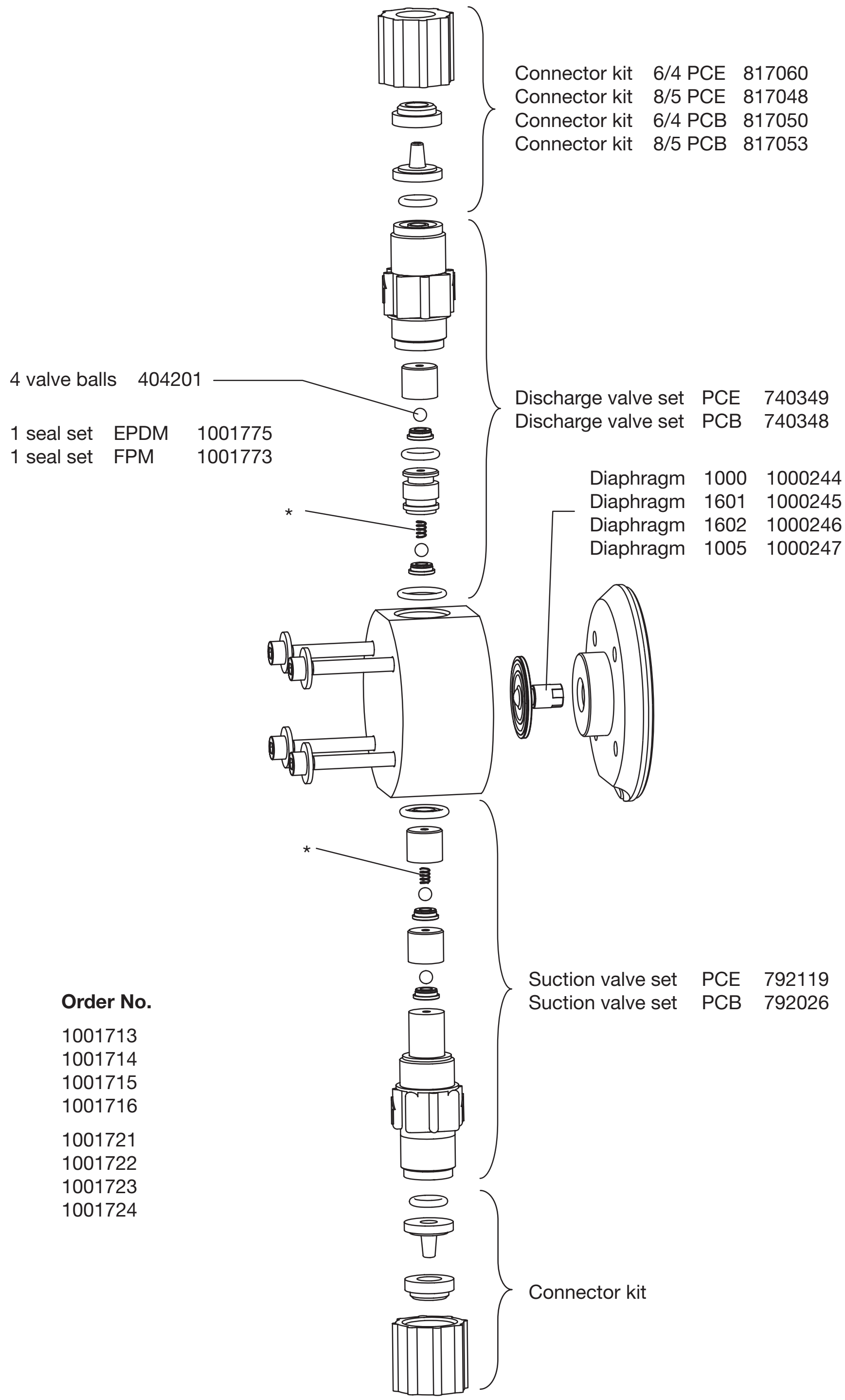
Type	Material	Order No.
0232	NPE	1001719
0232	NPB	1001728

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_34-04_2

Liquid end 1000 - 1005 (1605)
NP without coarse/fine bleed



Spare parts kits for:

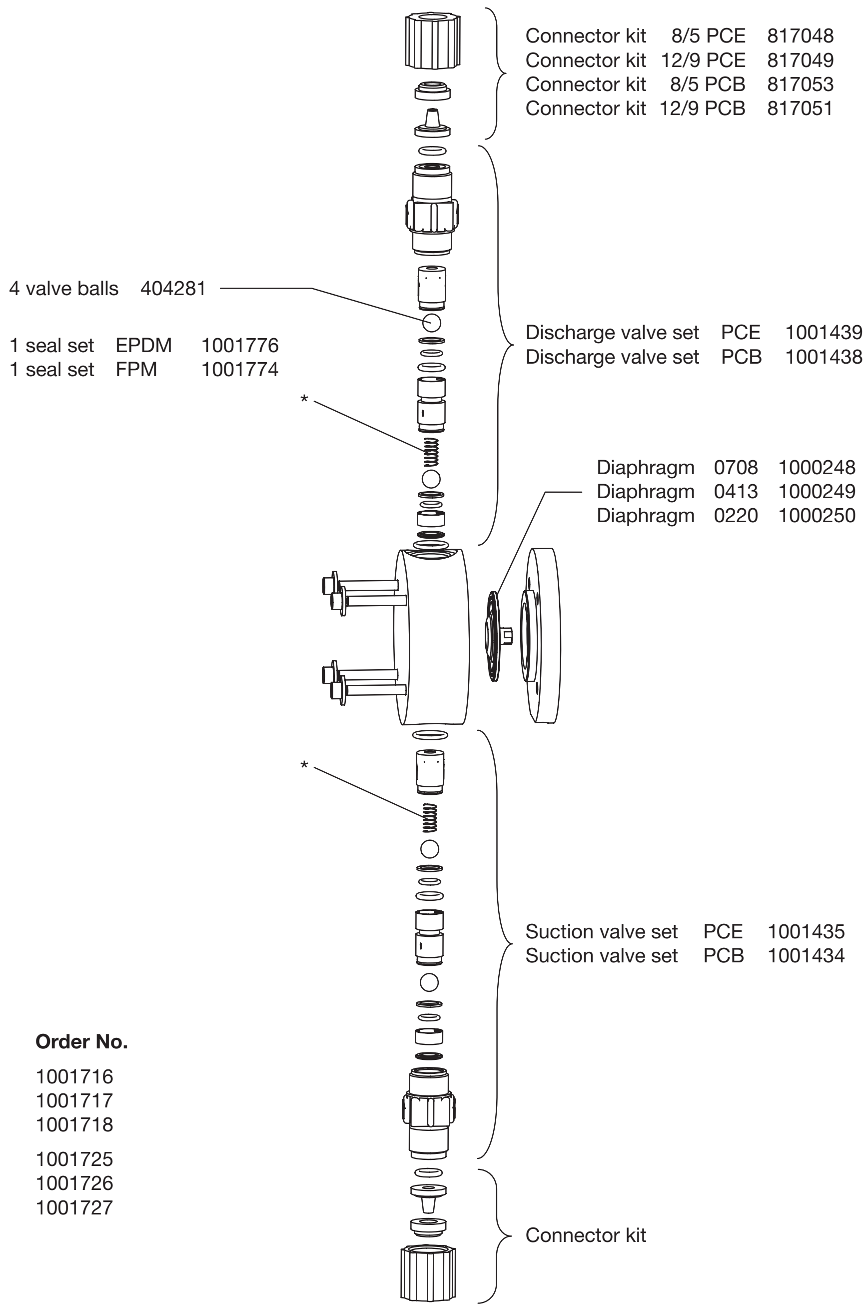
Type	Material	Order No.
1000	PCE / NPE	1001713
1601	PCE / NPE	1001714
1602	PCE / NPE	1001715
1005 (1605)	PCE / NPE	1001716
1000	PCB / NPB	1001721
1601	PCB / NPB	1001722
1602	PCB / NPB	1001723
1005 (1605)	PCB / NPB	1001724

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_21-04_2

Liquid end 0708 (1008) - 0220 (0420)
NP without coarse/fine bleed



Spare parts kits for:

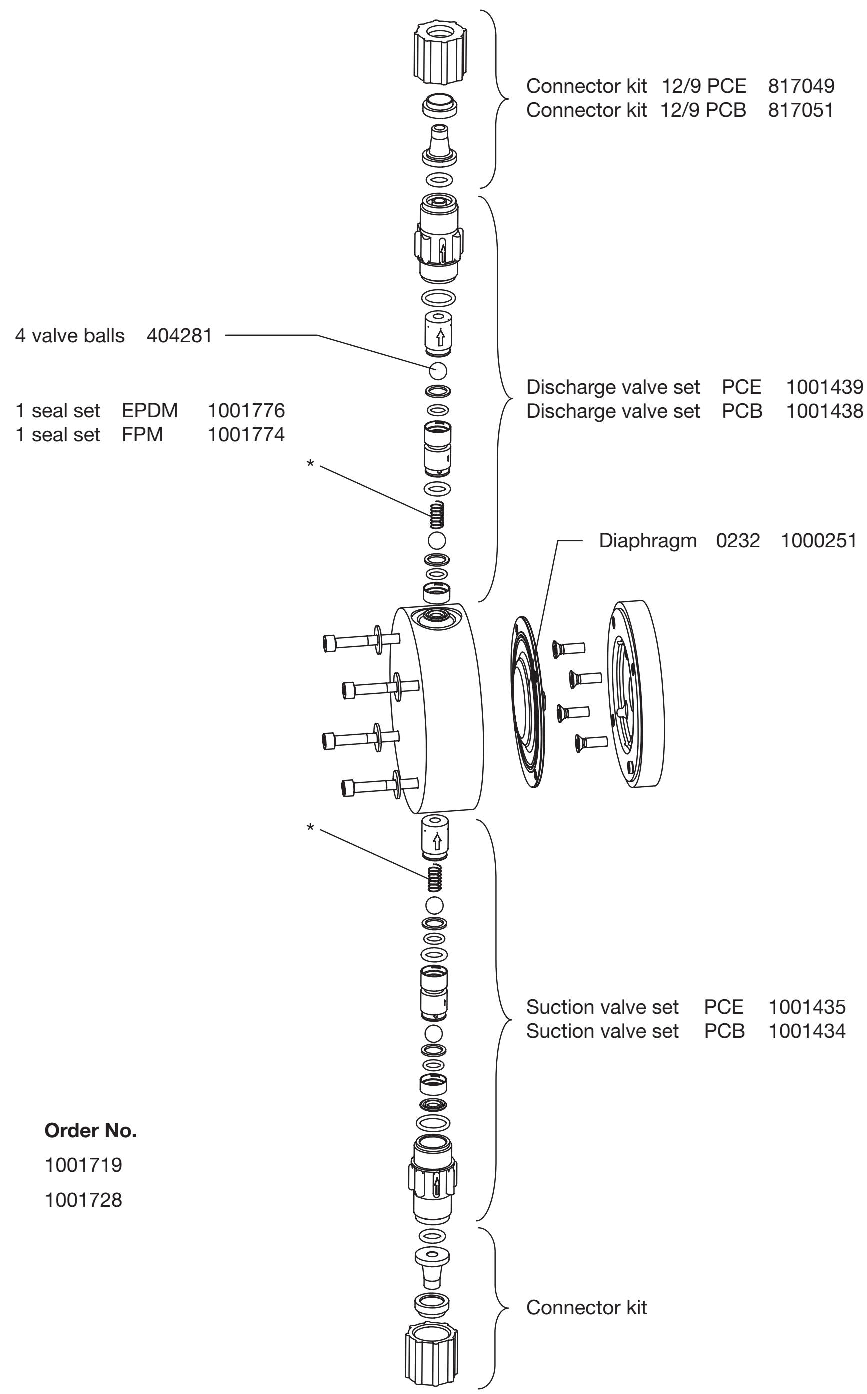
Type	**Material**	**Order No.**
0708 (1008)	NPE	1001716
0413 (0713)	NPE	1001717
0220 (0420)	NPE	1001718
0708 (1008)	NPB	1001725
0413 (0713)	NPB	1001726
0220 (0420)	NPB	1001727

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_22-04_2

Liquid end 0232
NP without coarse/fine bleed



Spare parts kits for:

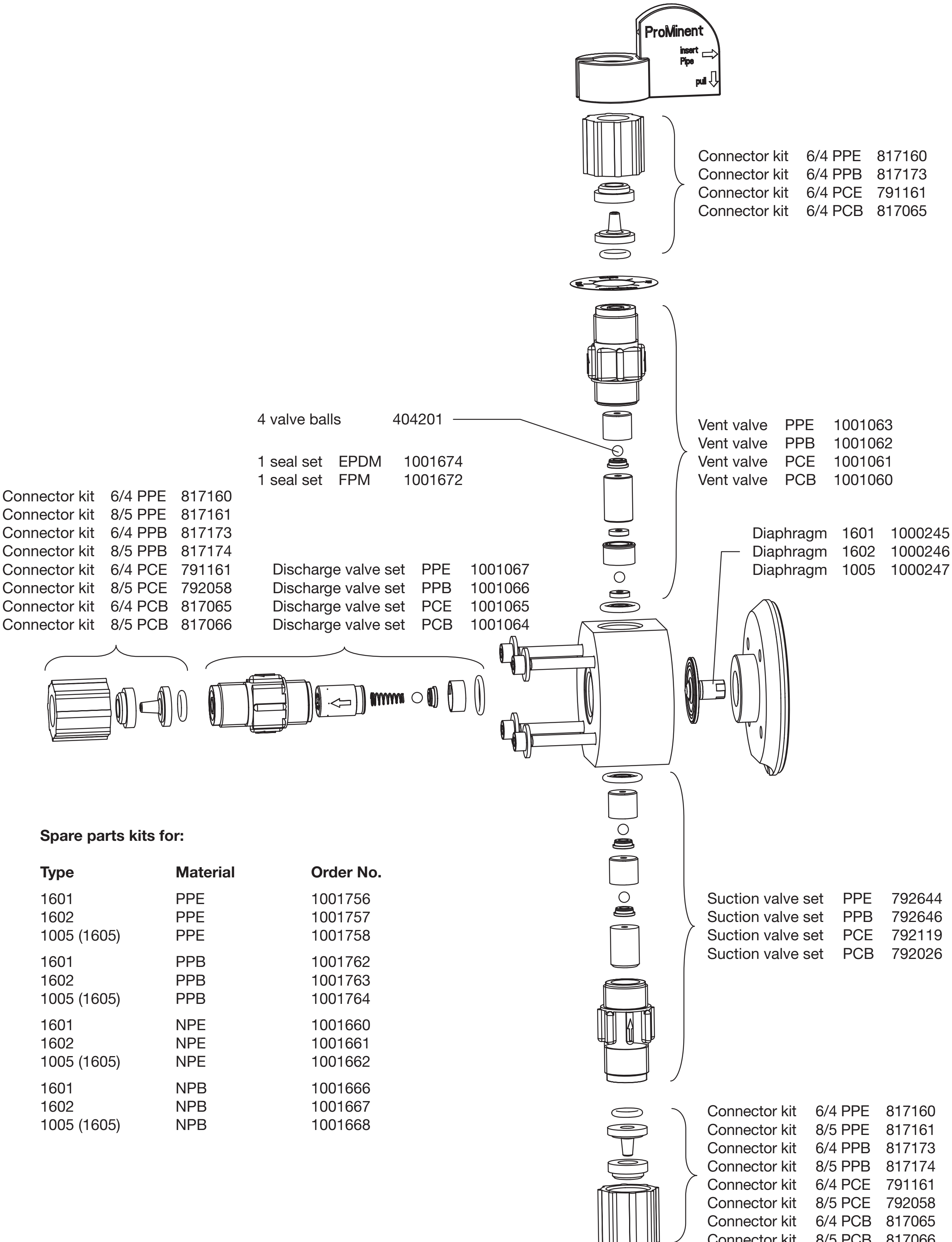
Type	Material	Order No.
0232	NPE	1001719
0232	NPB	1001728

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_20-04_2

Liquid end 1601 - 1005 (1605)
PP / NP self-degassing



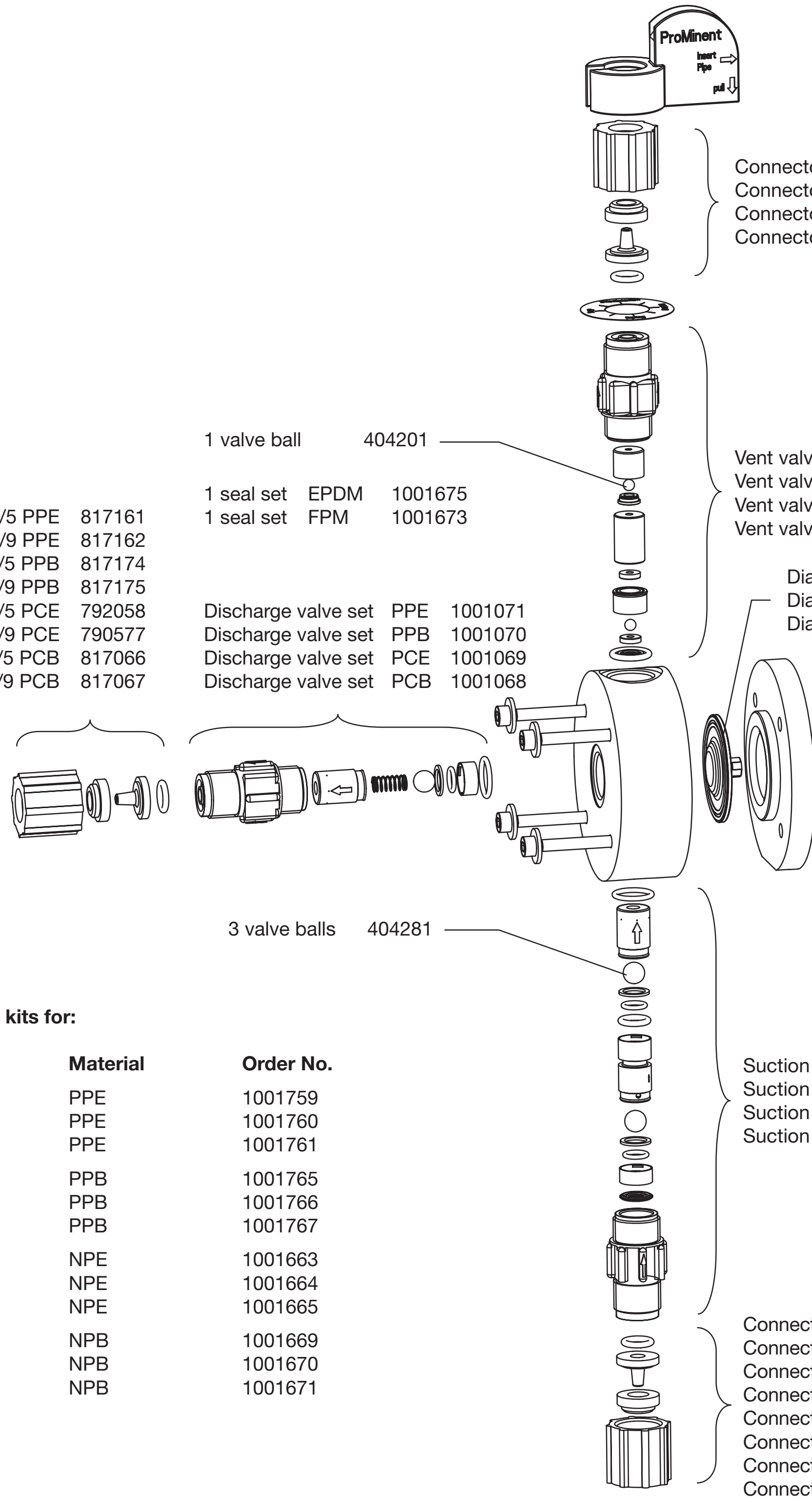
Spare parts kits for:

Type	**Material**	**Order No.**
1601	PPE	1001756
1602	PPE	1001757
1005 (1605)	PPE	1001758
1601	PPB	1001762
1602	PPB	1001763
1005 (1605)	PPB	1001764
1601	NPE	1001660
1602	NPE	1001661
1005 (1605)	NPE	1001662
1601	NPB	1001666
1602	NPB	1001667
1005 (1605)	NPB	1001668

The listed items are included in the spare parts kit.

Subject to technical alterations.

Liquid end 0708 (1008) - 0220 (0420)
PP / NP self-degassing



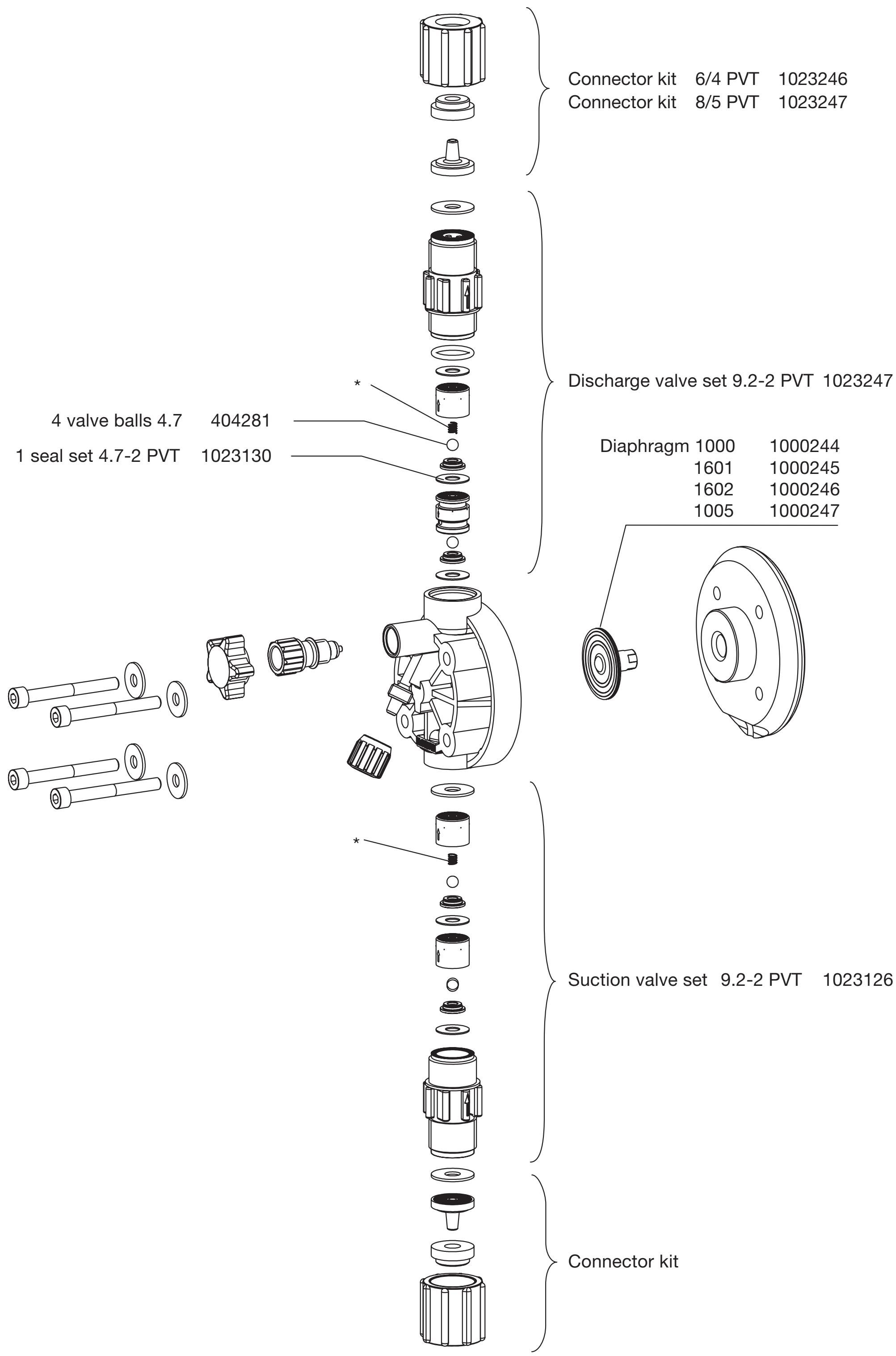
Spare parts kits for:

Type	**Material**	**Order No.**
0708 (1008)	PPE	1001759
0413 (0713)	PPE	1001760
0220 (0420)	PPE	1001761
0708 (1008)	PPB	1001765
0413 (0713)	PPB	1001766
0220 (0420)	PPB	1001767
0708 (1008)	NPE	1001663
0413 (0713)	NPE	1001664
0220 (0420)	NPE	1001665
0708 (1008)	NPB	1001669
0413 (0713)	NPB	1001670
0220 (0420)	NPB	1001671

The listed items are included in the spare parts kit.

Subject to technical alterations.

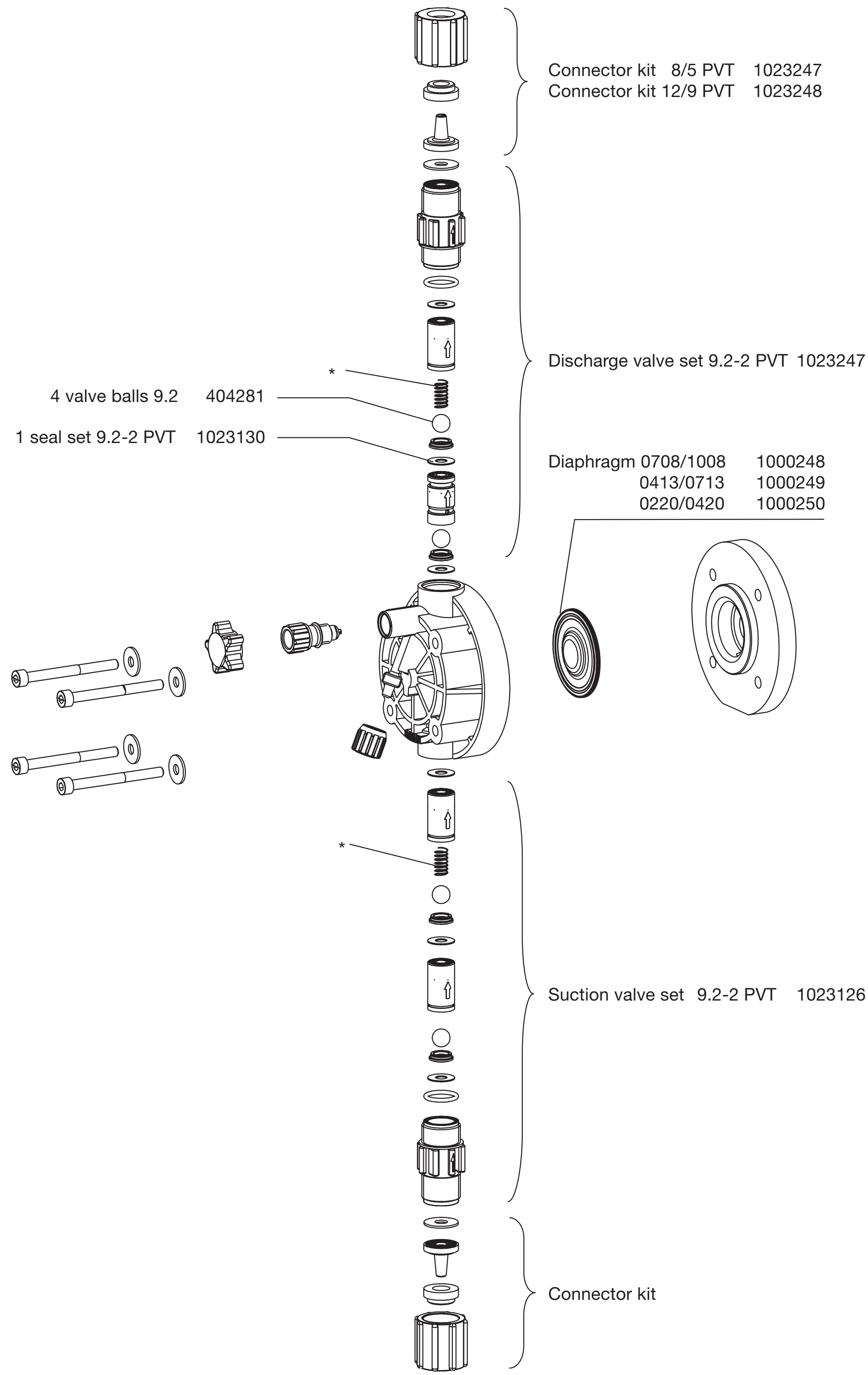
Liquid end 1000-1005 (1605)
PVT with bleed



The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

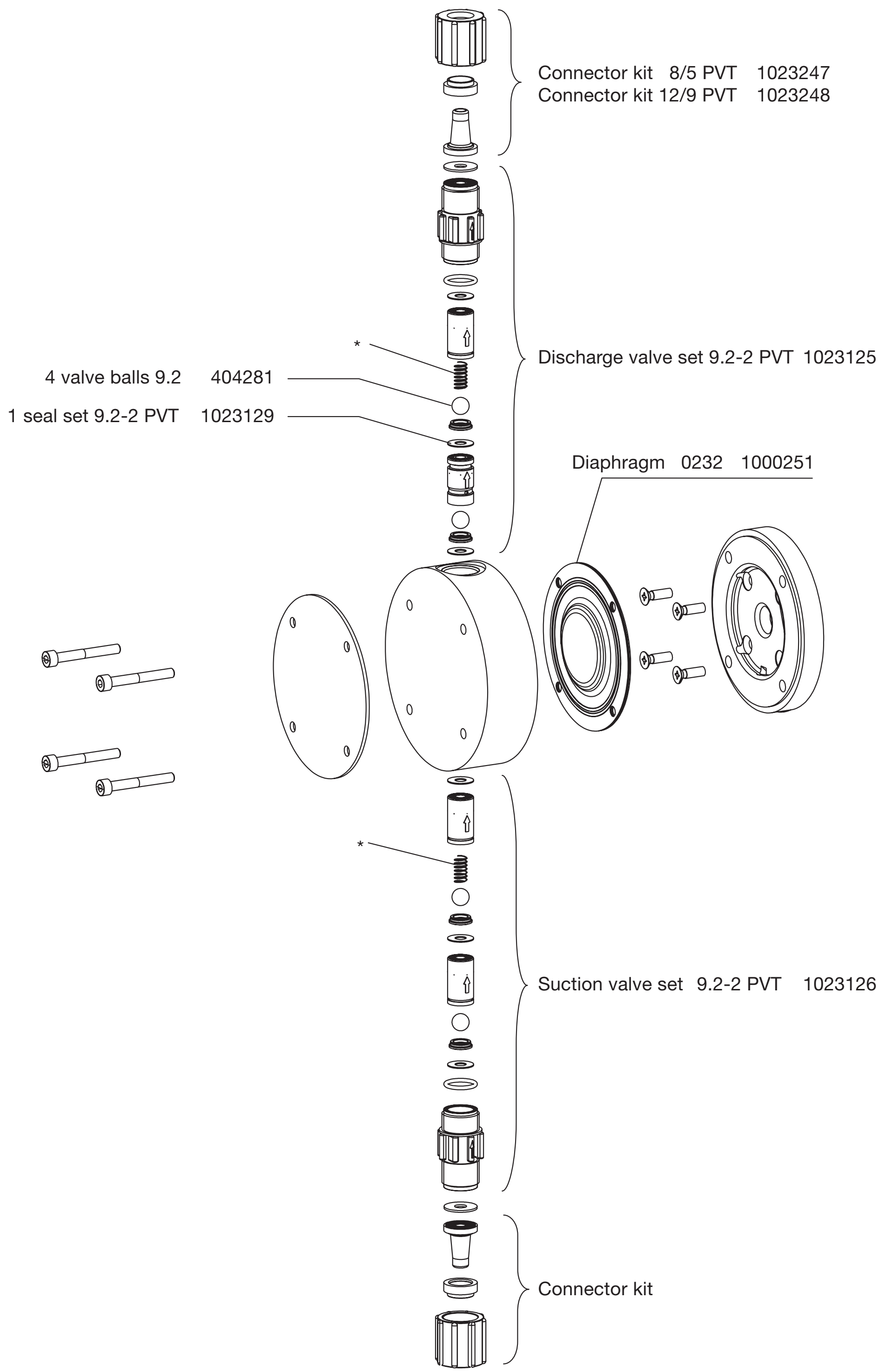
Liquid end 0708 (1008) - 0220 (0420)
PVT with bleed



The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

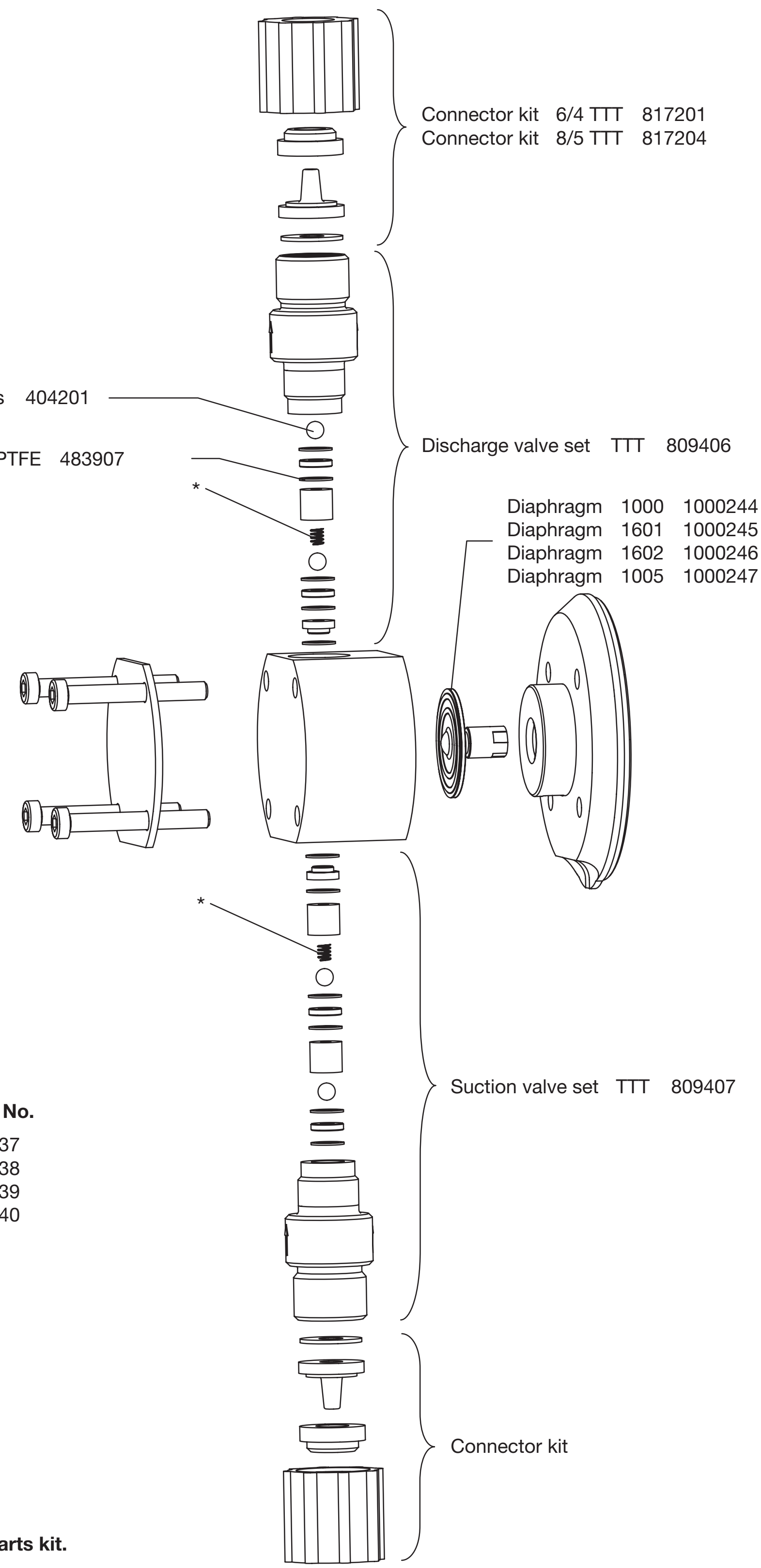
Liquid end 0232
PVT without bleed



The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

Liquid end 1000 - 1005 (1605)
TT



Spare parts kits for:

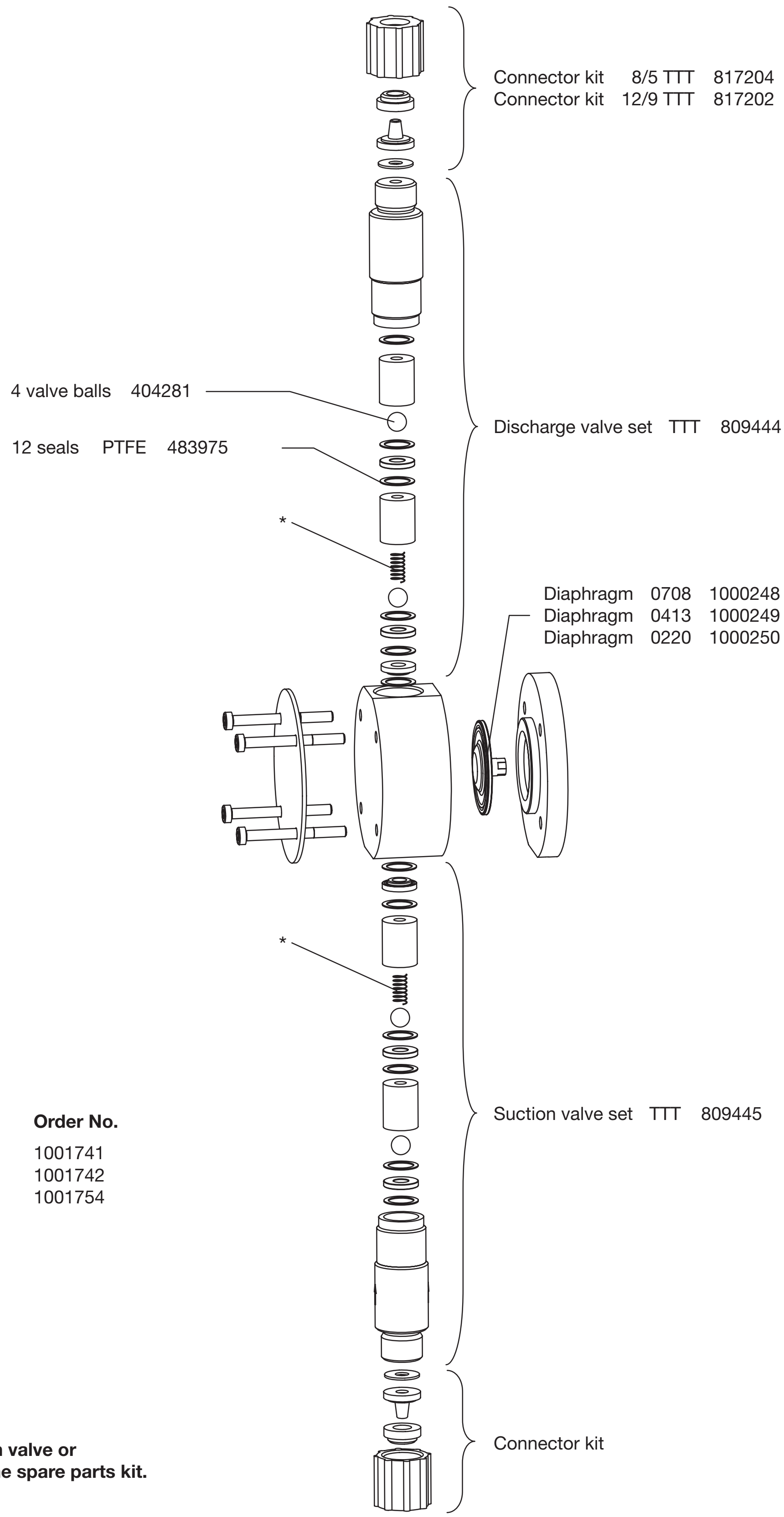
Type	Material	Order No.
1000	TTT	1001737
1601	TTT	1001738
1602	TTT	1001739
1005 (1605)	TTT	1001740

The listed items are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_29-04_2

Liquid end 0708 (1008) - 0220 (0420)
TT



Spare parts kits for:

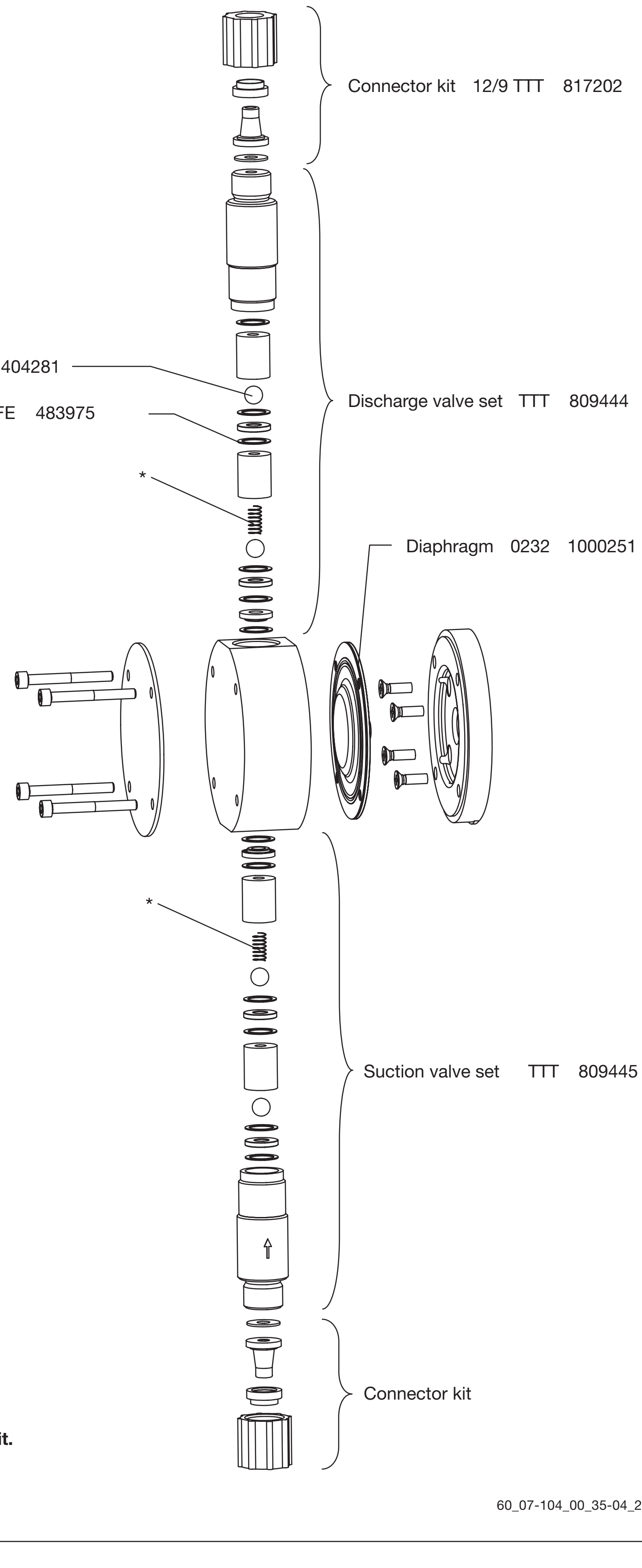
Type	Material	Order No.
0708 (1008)	TTT	1001741
0413 (0713)	TTT	1001742
0220 (0420)	TTT	1001754

The listed items without a suction valve or discharge valve are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_30-04_2

Liquid end 0232
TT



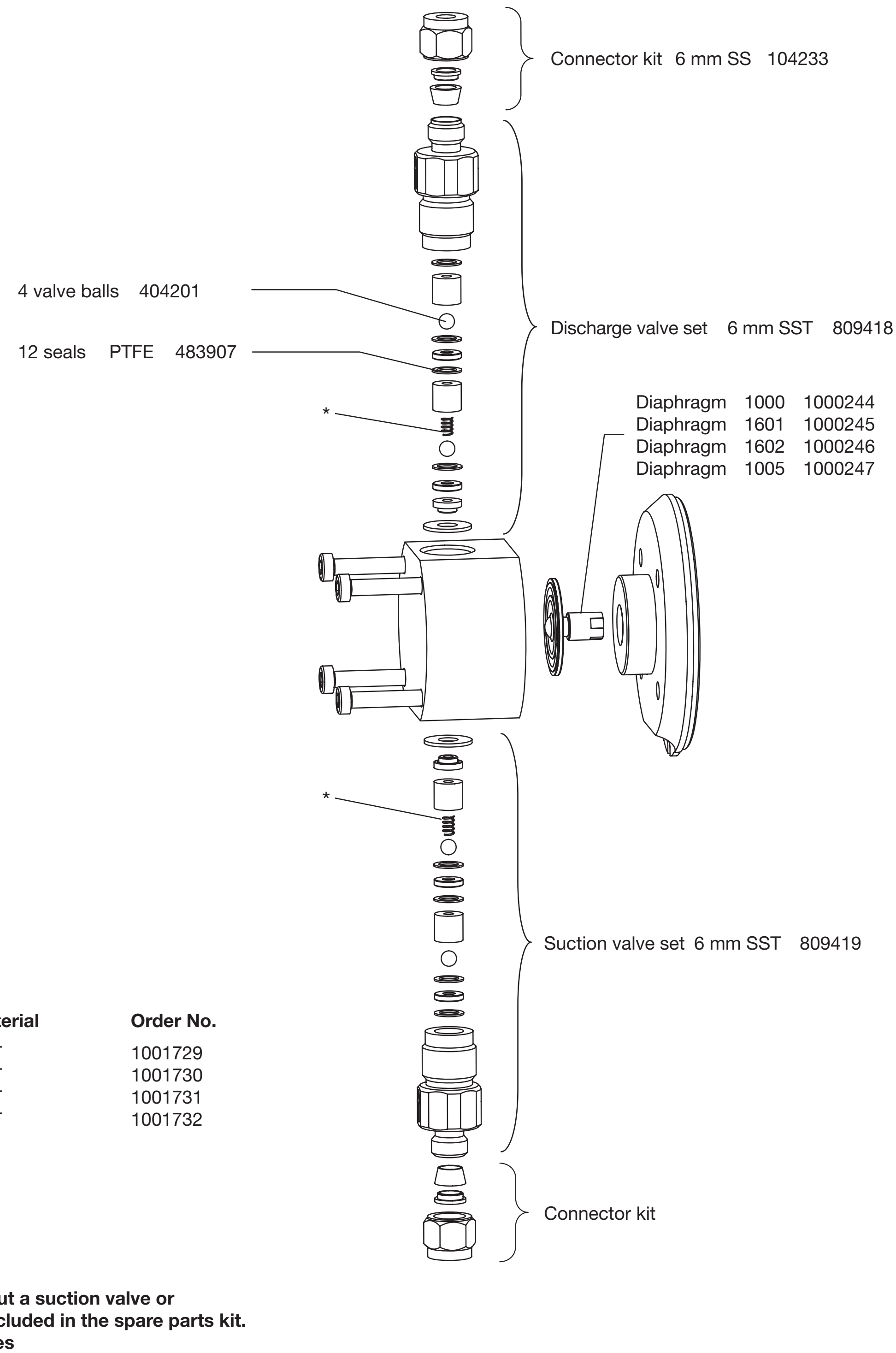
Spare parts kits for:

Type	Material	Order No.
0232	TTT	1001755

The listed items without a suction valve or discharge valve are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

Liquid end 1000 - 1005 (1605)
SS



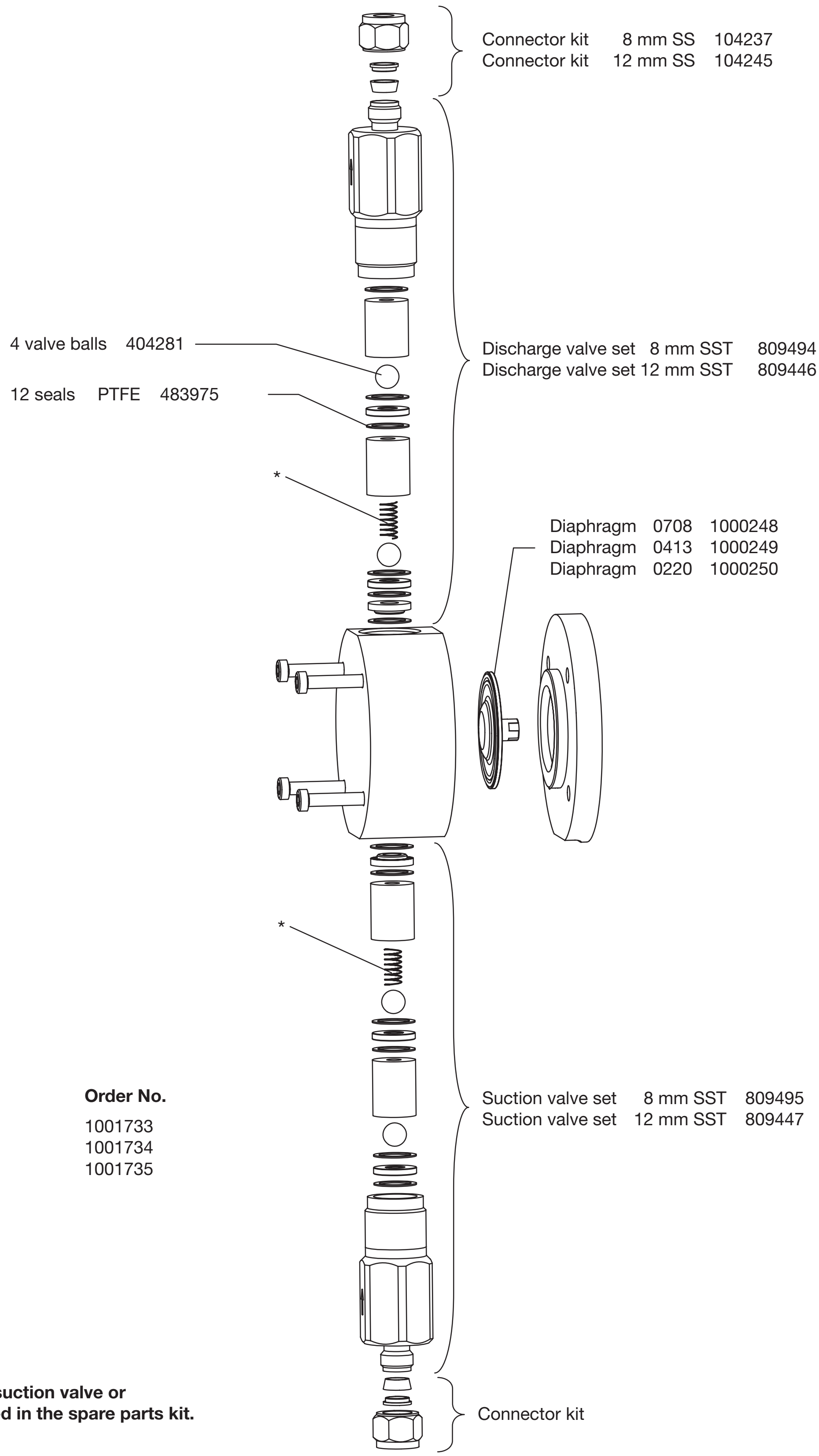
Spare parts kits for:

Type	Material	Order No.
1000	SST	1001729
1601	SST	1001730
1602	SST	1001731
1005 (1605)	SST	1001732

The listed items without a suction valve or discharge valve are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

Liquid end 0708 (1008) - 0220 (0420)
SS



Spare parts kits for:

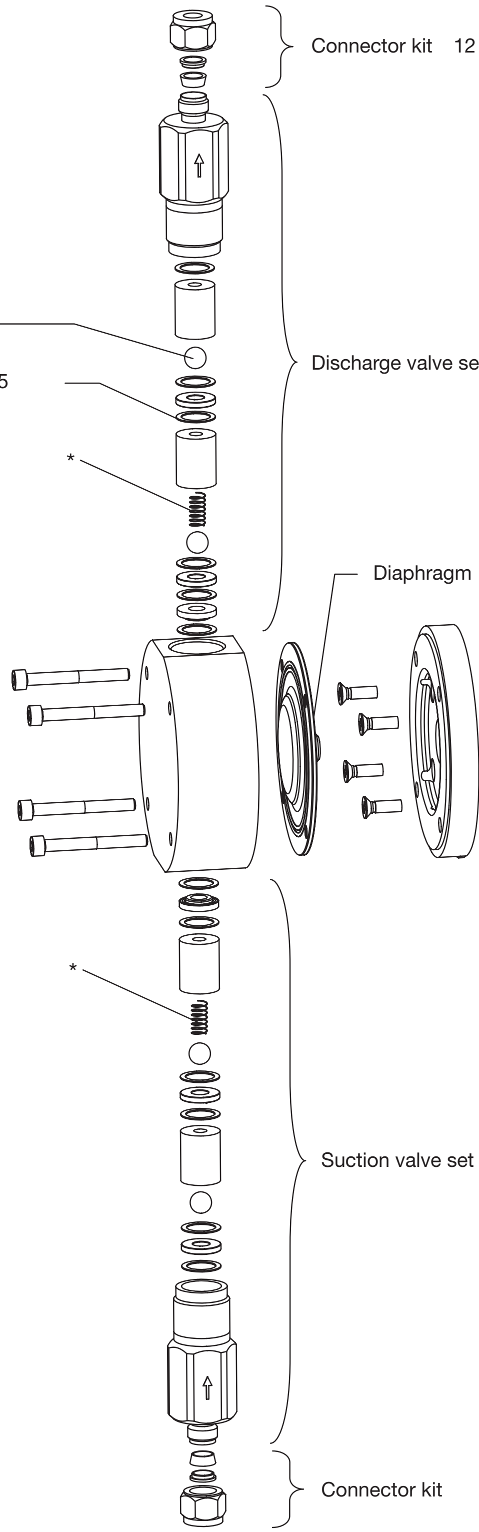
Type	**Material**	**Order No.**
0708 (1008)	SST	1001733
0413 (0713)	SST	1001734
0220 (0420)	SST	1001735

The listed items without a suction valve or discharge valve are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_26-04_2

Liquid end 0232
SS



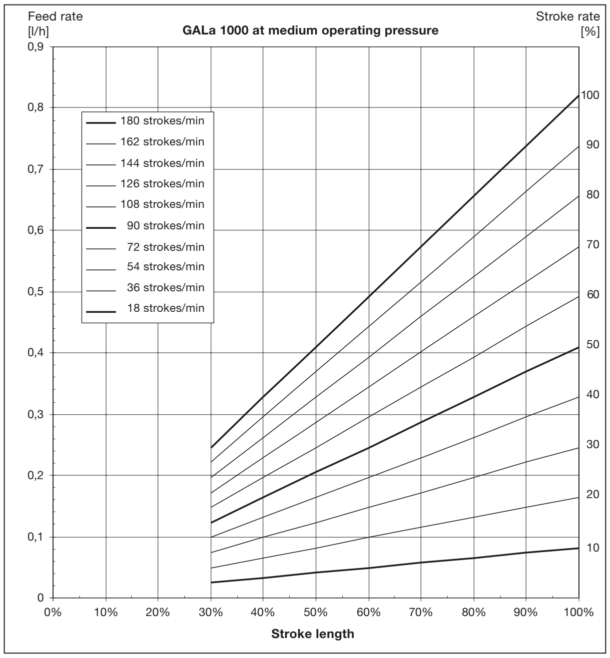
Spare parts kits for:

Type	**Material**	**Order No.**
0232	SST	1001736

The listed items without a suction valve or discharge valve are included in the spare parts kit.
*** Customer accessories**

Subject to technical alterations.

60_07-104_00_36-04_2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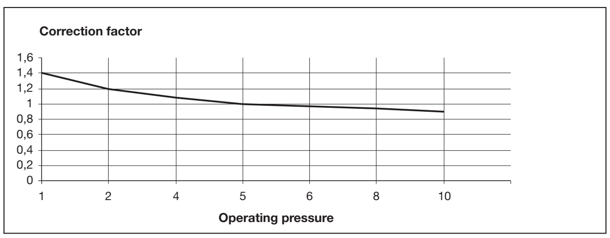
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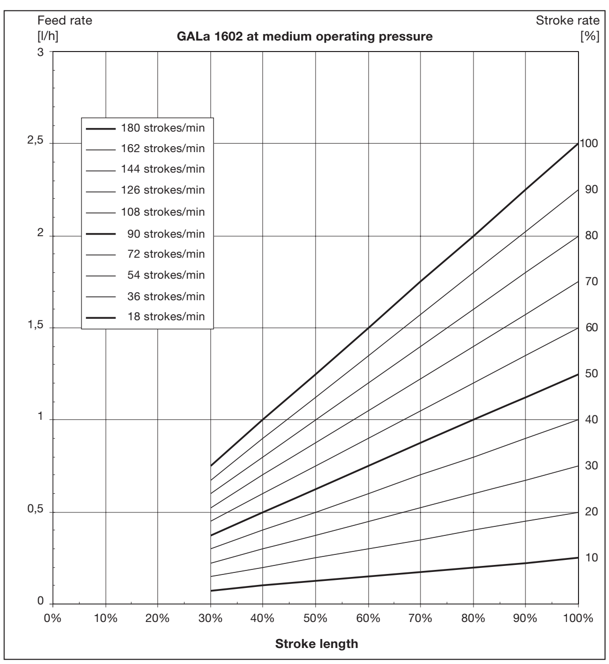
Operating pressure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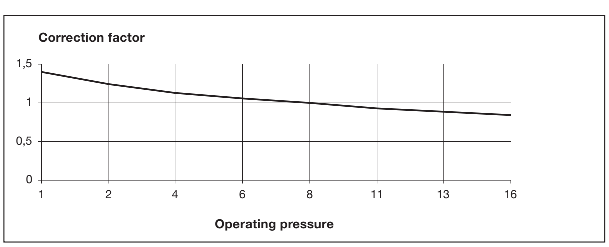
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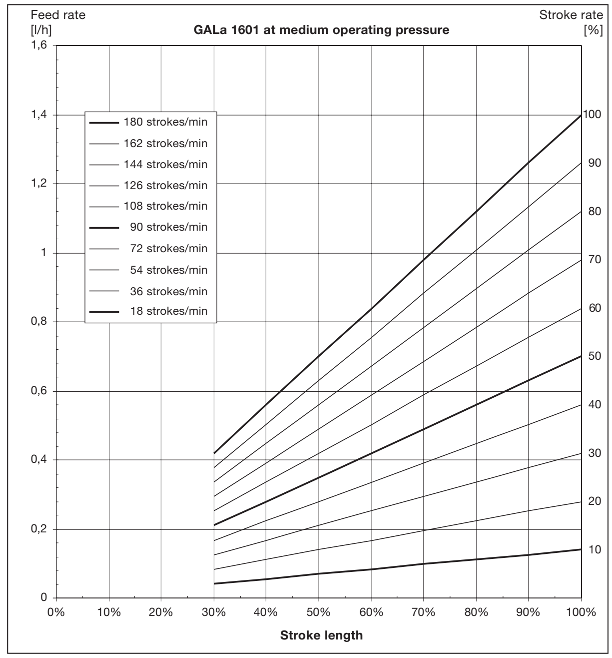
Operating pressure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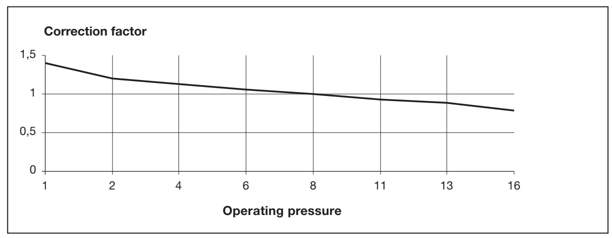
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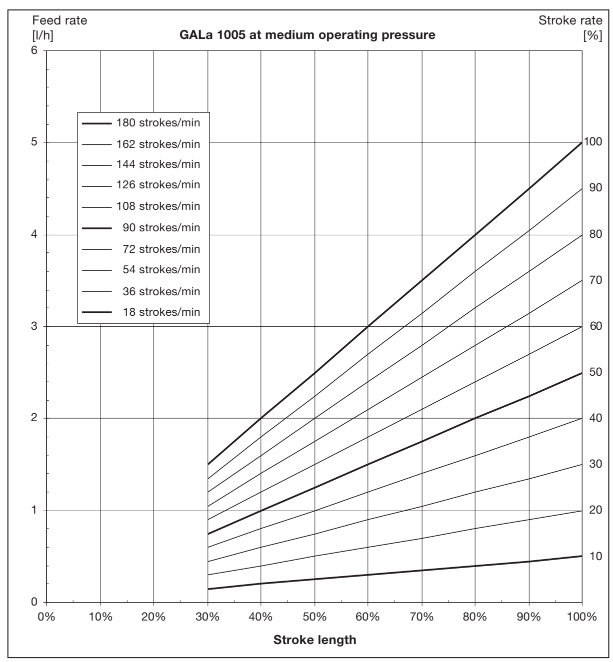
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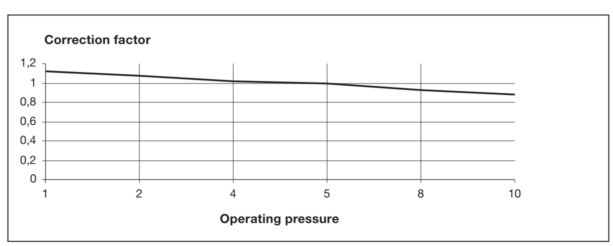
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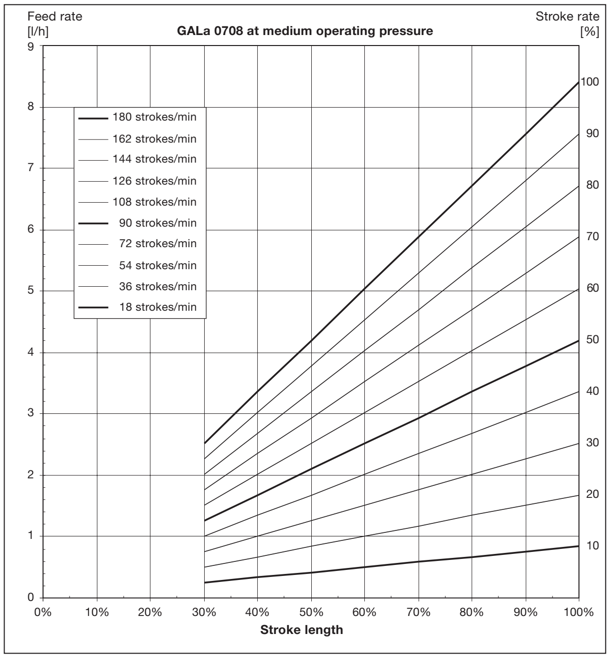
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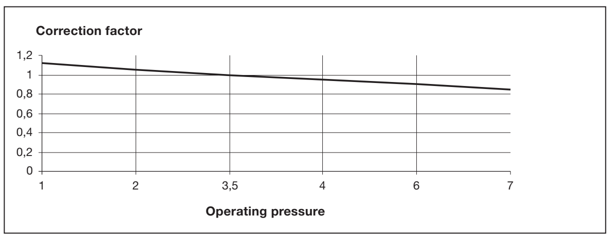
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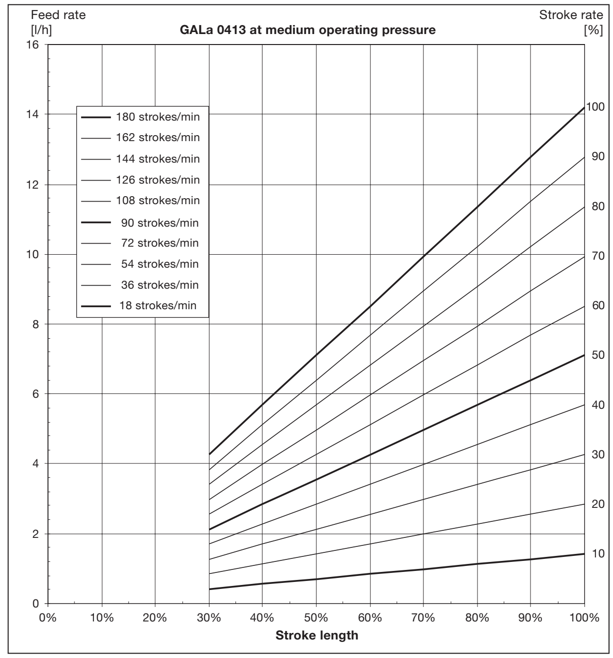
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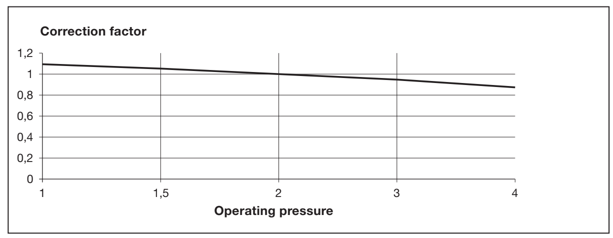
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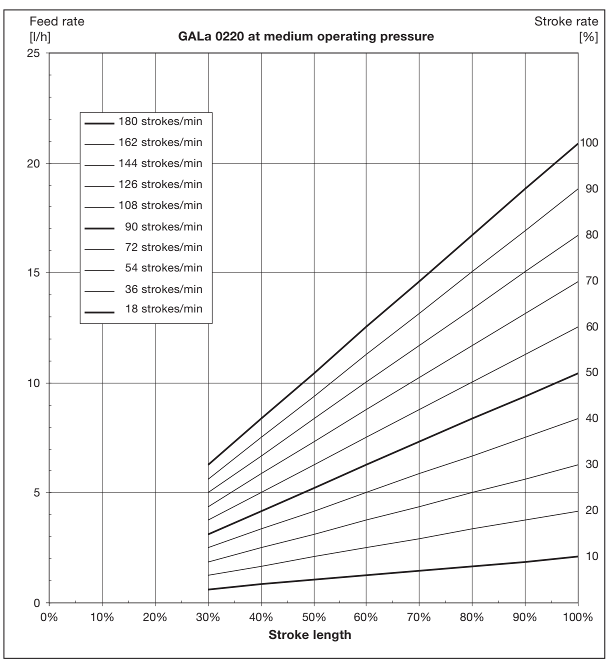
Operating pressure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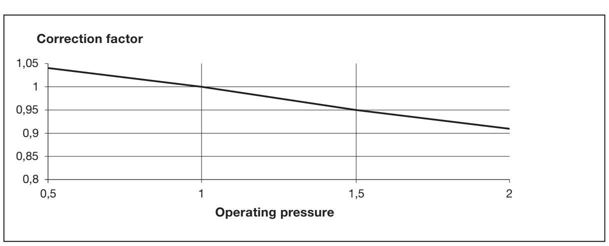
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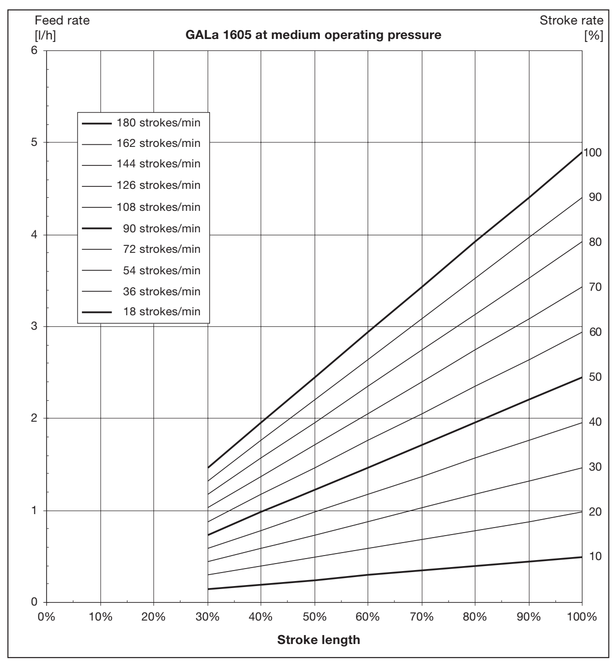
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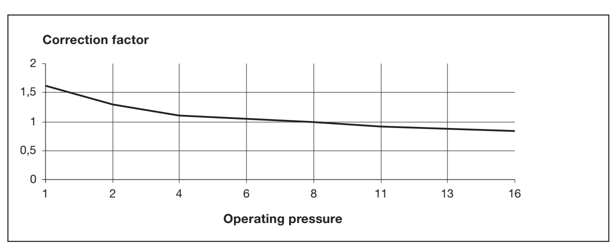
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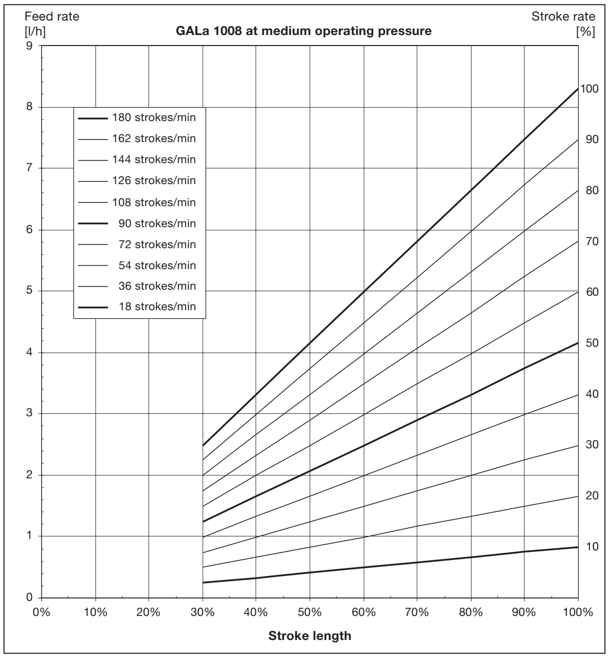
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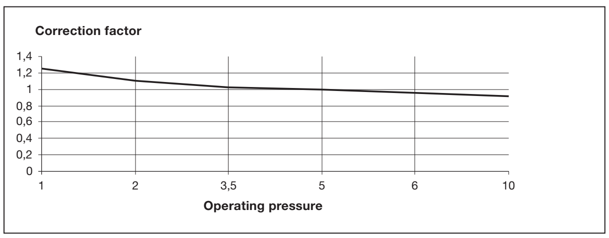
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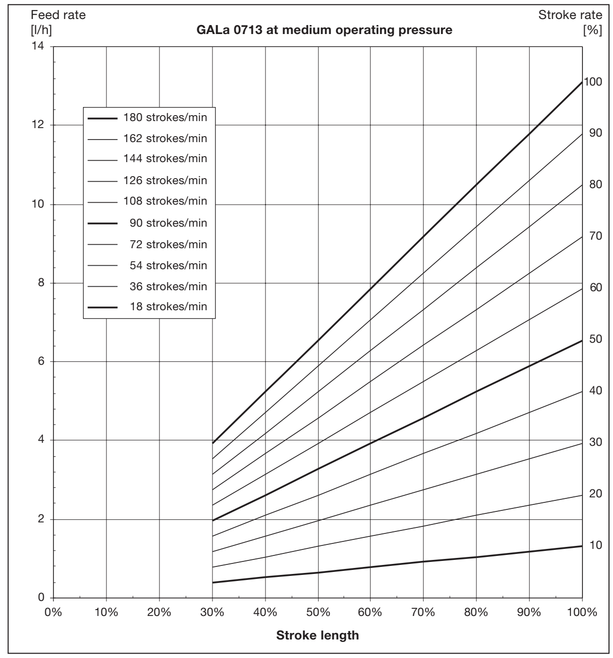
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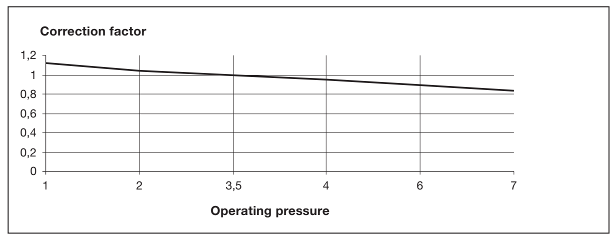
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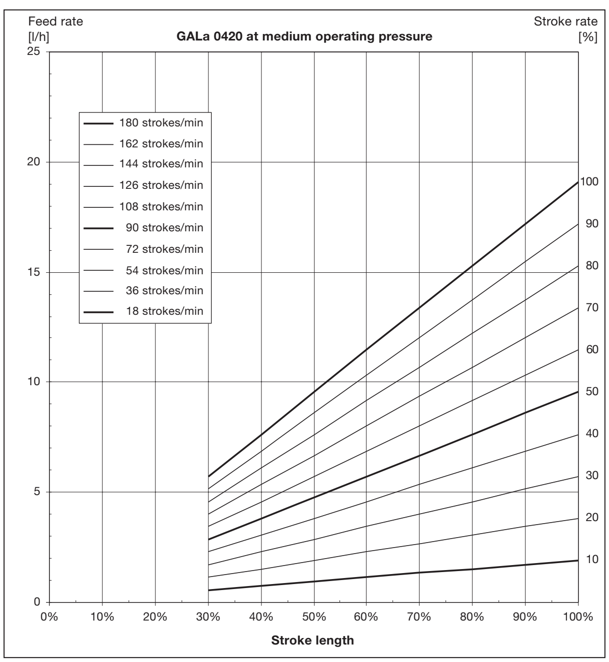
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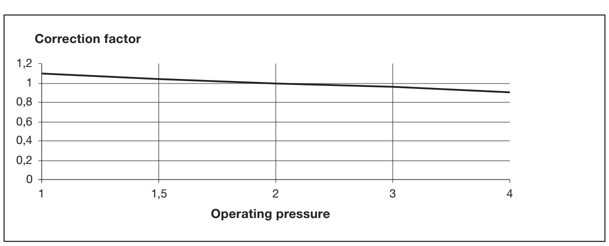
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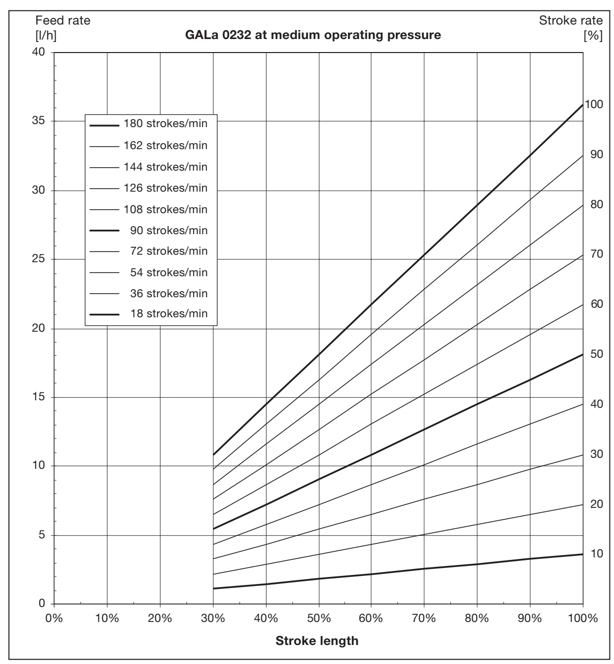
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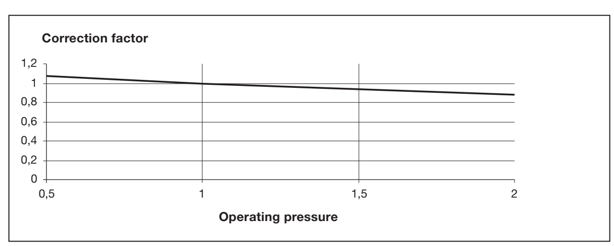
Correction factor
Operating pressure

EC Declaration of Conformity

We, **ProMinent Dosiertechnik GmbH**
Im Schuhmachergewann 5 - 11
D - 69123 Heidelberg

hereby declare that, on the basis of its functional concept and design and in the version brought into circulation by us, the product specified in the following complies with the relevant, fundamental safety and health stipulations laid down by EC regulations.
Any modification to the product not approved by us will invalidate this declaration.

Product description :	***Metering pump, series Gamma L***
Product type :	***GALa***
Serial number :	***see type identification plate on device***
Relevant EC directives :	***EC - machine directive 98/37/EC*** ***EC - low voltage directive 73/23/EEC*** ***EC - EMC - directive (89/336/EEC) subsequently 92/31 EEC***
Harmonised standards used, in particular :	***DIN EN 292-1, DIN EN 292-2, DIN EN 809*** ***DIN EN 60335-1, DIN EN 60335-2-41, DIN EN 50106*** ***DIN EN 50081-1/2, DIN EN 55011, DIN EN 61000-3-3*** ***DIN EN 50082-1/2, DIN EN 61000-4-2/3/4/5/6/11***
National standards and other technical specifications used, in particular :	***DIN VDE 0700 T1*** ***DIN VDE 0700 T41*** ***DIN VDE 0700 T500*** ***IEC 1000-3-3, IEC 1000-4-2/3/4/5/6/11***
Date/manufacturer´s signature :	***02. Nov 99***
The undersigned :	*Dr. Rainer V. Dulger, Executive Vice President R&D and Production*

Die ProMinent Firmengruppe / The ProMinent Group

Stammhaus / Head office

ProMinent Dosiertechnik GmbH · Im Schuhmachergewann 5-11 · 69123 Heidelberg · Germany
info@prominent.com · www.prominent.com
Tel.: +49 6221 842-0 · Fax: +49 6221 842-617 Chemical Fluid Handling · Fax -431 Water Treatment Solutions

Niederlassungen weltweit / Affiliated Companies Worldwide

ProMinent Fluid Controls Pty. Ltd.
Unit 4, Narabang Way
Belrose, NSW 2085 (Australia)
Tel.: +61 2 94500995, Fax: 94500996
sales@prominentfluid.com.au

ProMinent Dosiertechnik Ges. mbH
Gewerbepark-Rosenau/Sonntagberg
3332 Rosenau (Austria)
Tel.: +43 7448 30400, Fax: 4205
office@prominent.at

ProMinent Fluid Controls (Bangladesh) Ltd.
House No. 9, Road No. 17
Block D, Banani Model Town
Dhaka-1213 (Bangladesh)
Tel.: +8802 8818713, Fax: 9889071
info@prominent-bd.com

ProMinent Belgium S.A., N.V.
Parc Industriel de Saintes
Avenue Landas 11
1480 Tubize (Belgium)
Tel.: +32 2 3914280, Fax: 3914290
info@prominent.be

ProMinent Brasil Ltda.
Rua Alfredo Dumont Villares 115
09672-070 Sao Bernardo do Campo-SP (Brazil)
Tel.: +55 11 43610722, Fax: 43632292
prominent@prominent.com.br

ProMinent Fluid Controls BG
8 Kr. Sarafov
1164 Sofia (Bulgaria)
Tel.: +359 2 9631921, Fax: 8660447
prominent@abv.bg

ProMinent Fluid Controls Ltd.
490, Southgate Drive
Guelph, Ontario N1G 4P5 (Canada)
Tel.: +1 519 8365692, Fax: 8365226
info@prominent.ca

ProMinent Fluid Controls China Co. Ltd.
No. 14, Road Liaohe Xisan
Dalian Economic & Techn. Development Zone
116600 Dalian (P.R. of China)
Tel.: +86 411 87315738, Fax: 87315730
dr.r.hou@prominent.com.cn

ProMinent Dosiertechnik CS s.r.o.
Sobieského 1, P.O. Box 53
77010 Olomouc (Czech Republ.)
Tel.: +420 585 757011, Fax: 757023
info@prominent.cz

ProMinent Finland OY
Orapihlajatie 39
00320 Helsinki (Finland)
Tel.: +35 89 4777890, Fax: 47778947
prominent@prominentfinland.fi

ProMinent France S.A.
8, rue des Frères Lumière
B.P. 39, Eckbolsheim
67038 Strasbourg Cedex 2 (France)
Tel.: +33 3 88101510, Fax: 88101520
contact@prominent.fr

ProMinent Fluid Controls (UK) Ltd.
Resolution Road, Ashby de la Zouch
Leicestershire LE65 1DW (Great Britain)
Tel.: +44 1530 560555, Fax: 560777
sales@prominent.co.uk

ProMinent Hellas Ltd.
24, Mitrodorou Str. + Athinon Ave.
10441 Athens (Greece)
Tel.: +30 210 5134621, Fax: 5134500
promin@hol.gr

ProMinent Magyarország Kft.
Íves u. 2
9027 Győr (Hungary)
Tel.: +36 96 511400, Fax: 329981
prominent@prominent.hu

Heidelberg ProMinent Fluid Controls India Pvt. Ltd.
#2/2, MES Road, Yeshwanthpur
Bangalore 560 022 (India)
Tel.: +91 80 23578872, Fax: 23477984
prominent@hpfcindia.com

ProMinent Fluid Controls Ltd.
Finisklin Industrial Estate
Sligo, Co. Sligo (Ireland)
Tel.: +353 71 9151222, Fax: 9151225
sconvay@prominent.ie

ProMinent Italiana S.R.L.
Via Albrecht Dürer, 29
39100 Bolzano (Italy)
Tel.: +39 0471 920000, Fax: 920099
info@prominent.it

ProMinent Japan Ltd.
Toyu Bldg., 528 Wasedatsurumaki-cho
Shinjuku-Ku
Tokyo 162-0041 (Japan)
Tel.: +81 3 32073470, Fax: 32073119
info@prominent.co.jp

ProMinent Korea Co., Ltd.
Sungnam P.O. Box 72
Kyoungki-Do 461-600 (Republic of Korea)
Tel.: +82 31 7018353, Fax: 7072621
info@prominent.co.kr

ProMinent Office Kazakhstan
ul. Timiryaseva 42, „Atakent“
Building 15/1, Office 13
480057 Almaty (Kazakhstan)
Tel.: +7 3272 504130, Fax: 695466
prominent@ducatmail.kz

ProMinent Office Kaunas
Gedimino st. 47
3000 Kaunas (Lithuania)
Tel.: +370 37 325115, Fax: 325116
prominent1@takas.lt

ProMinent Fluid Controls (M) Sdn. Bhd.
92-1 Jalan Radin Anum Satu
Seri Petaling
57000 Kuala Lumpur (Malaysia)
Tel: +60 3-905 77 224, Fax: 3-905 77 219
info@pfc-prominent.com.my

ProMinent Fluid Controls Ltd.
BT 7 - 12, Bulebel Industrial Estate
Bulebel (Malta)
Tel.: +356 21693677, Fax: 21693547
info@pfc.com.mt

ProMinent Fluid Controls de Mexico S.A. de C.V.
Centro Aleman, Av. Santa Fé No. 170 Ofic. 0-4-12
Col. Lornas de Santa Fé
C.P. 01210 Mexico D.F. (Mexico)
Tel.: +52 55 917 29300-302, Fax: 29303
pfc-mexico@prominent.com.mx

ProMinent Verder B.V.
Utrechtseweg 4a
3451 GG Vleuten (Netherlands)
Tel.: +31 30 6779280, Fax: 6779288
info@prominent.nl

ProMinent Dozotechnika Sp. z o.o.
Ul. Jagiellonska 2B
55-095 Mirkow k/Wroclawia (Poland)
Tel.: +48 71 3980600, Fax: 3980629
prominent@prominent.pl

ProMinent Portugal Controlo de Fluídos, Lda.
Estrada de Barrosa, Elospark 16
Algueirao
2725-193 Mem Martins (Portugal)
Tel.: +35 121 9267040, Fax: 9267049
geral@prominent.pt

ProMinent Dositechnika OOO
Lyusinovskaya ul. 36, str. 1
115093 Moskow (Russia)
Tel.: +7 095 7874501, Fax: 7874502
evg.bogatykh@prominent.ru

Proshield Ltd.
Unit 2, 18 Albert Street
Motherwell ML1 1 PR (Scotland)
Tel.: +44 1698 260260, Fax: 260441
pcp@proshield.co.uk

ProMinent Fluid Controls (Far East) Pte. Ltd.
50 Kallang Pudding Road
#08-01 Golden Wheel Industrial Building
Singapore 349326 (Singapore)
Tel.: +65 67474935, Fax: 67452240
pfc@prominent.com.sg

ProMinent Slovensko s.r.o.
Rol’nícka 21
83107 Bratislava-Vajnory (Slovak. Republ.)
Tel.: +421 2 48200111, Fax: 43711030
prominent@prominentsk.sk

ProMinent Fluid Controls Pty. Ltd.
Unit E7, Cnr. Jack + Refinery Roads
Germiston
P.O. Box 15413
Lambton ZA-1414 (South Africa)
Tel.: +27 11 8254142, Fax: 8254132
promsa@mweb.co.za

ProMinent Gugal S.A.
Polígono Industrial, s/n
17853 Argelaguer/Girona (Spain)
Tel.: +34 972 287011/12, Fax: 287107
prominent@prominentspain.com

ProMinent Doserteknik AB
S.a. Hildedalsgatan 10, Box 8933
40273 Göteborg (Sweden)
Tel.: +46 31 656600, Fax: 508960
info@prominent.se

ProMinent Dosiertechnik AG
Trockenloostrasse 85
8105 Regensdorf (Switzerland)
Tel.: +41 44 8706111, Fax: 8706161
info@prominent.ch

ProMinent Fluid Controls (Taiwan) Ltd.
8 F 2, No. 288-9 Hsinya Road
Kaohsiung (Taiwan)
Tel.: +886 7 8135122, Fax: 8135121
richard@prominent.com.tw

ProMinent Fluid Controls (Thailand) Co. Ltd.
2991/7 Visuthanee Office Park
Ladprao Road, Klongchan, Bangkapi
Bangkok 10240 (Thailand)
Tel.: +66 2 3760008, Fax: 37600130
pfc@prominent.co.th

ProMinent Office Kiev
ul. Schorsa 31, office 403
01133 Kiev-133 (Ukraine)
Tel.: +380 44 2696933, Fax: 5311438
prominent@i.com.ua

ProMinent Fluid Controls, Inc.
R.I.D.C. Park West, 136 Industry Drive
Pittsburgh, PA, 15275 (USA)
Tel.: +1 412 7872484, Fax: 7870704
sales@prominent.cc

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12/05

$\frac{1}{10000}$, 0.0001

$\boxed{0.00011}$

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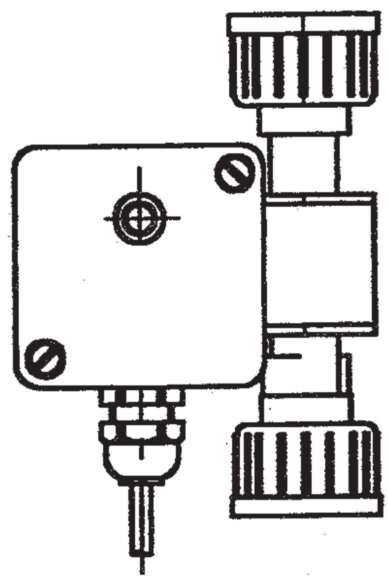
$\frac{1}{10^4} = 0,00011$

ProMinent® Dosierüberwachung ProMinent Flow Control

Betriebsanleitung
Instruction Manual



2407/4

T.Nr./P.No. 981409   ProMinent Dosiertechnik GmbH · D-69123 Heidelberg · Germany   BA MAZ 007 1/97 G/GB

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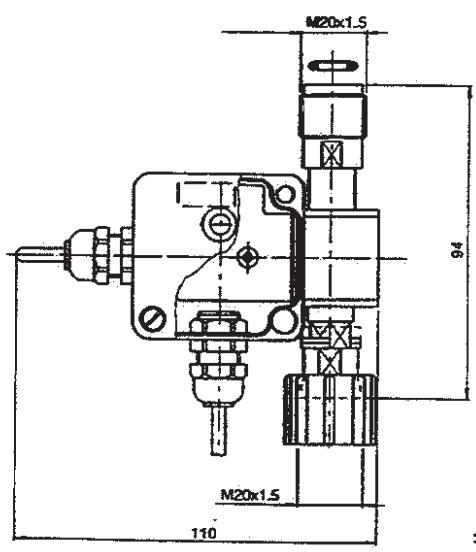

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1. Description of the metering monitor "flow control"

The "flow control" type metering monitor is a turn-key monitor with a switching amplifier and connection cable with four-pin circular connector to be directly connected to the solenoid-driven gamma/ 4 and gamma/ 5 metering pumps and the motor-driven Vario type metering pump. It is used for monitoring the stroke volume of the individual stroke according to the floating body principle.

The materials in contact with the media are PVC/Viton or PP/EPDM. Please consult the table with the technical data for information regarding the respective pumps for the individual sizes.

1.1 Functional description

With every discharge stroke, the float in the pipe is raised upwards and in doing so dips into the ring initiator, whereby the electronics send on a pulse to the pump and the red LED illuminates for the period the float is submerged.

The height of the ring initiator can be adjusted and so it can be adapted to different stroke volumes within the limits specified.

If the capacity drops by a certain degree (approx. 20-30 % of the set displacement volume) no more pulses are sent to the pump by the flow monitor. The pump recognises this as a metering error and after 8 missing acknowledged pulses, a fault annuciation is emitted.

For pump g/4-1601, the metering monitor can only function at a stroke length of ≥ 50% under an operating pressure of 16 bar due to the low flow rate. A stroke length of ≥ 30% is achieved at an operating pressure of 3 bar. For pumps g/4-1201, g/4-1002 and g/5-1602 the minimum stroke length is 45% at the respective maximum operating pressure.

When pumping highly viscous media, the electronic control system can be set in such a way that with the float submerged, pulses at a rate of 3 Hz are constantly issued (outsmart switching), as with highly viscous media there is no guarantee that the float will sink after each stroke, i.e. the float possibly remains submerged over a longer period.

Please note:
The pressure loss, in particular arising in the case of the gamma/ 5 pump due to the characteristic stroke curve (for media with a similar viscosity to water), can amount up to 2 bar for the largest gamma and Vario models, in the case of highly viscous media this figure can of course be higher.

This is to be taken into consideration when selecting the pump and the layout of the discharge lines with additional pressure losses.

Caution: The metering monitor is not a substitute for the float switch. Depending on the set stroke quantity and backpressure there may be no fault indication during air delivery. For this reason, a minimum operating pressure of approx. 1 bar is recommended. Install a level switch if low level is signalled. Magnetic or magnetisable components in the metered medium can cause faults.

2. Installation

2.1 Safety instructions

- The maximum permissible operating pressure for the pumps used may not be exceeded in any operating condition.
- The unions of the flow monitor as well as the connections to the discharge line must be free of leaks when operating under maximum operating pressure.

2.2 Installation

2.2.1 Metering monitor with M 20 x 1.5 connection

- The metering monitor may only be installed in a vertical position.
- Usually the metering monitor is assembled directly onto the delivery connection of the metering pump.
- Before assembly, check by shaking whether the float is moving freely and if necessary blow air through the flow monitor in order to release the float.
- Unscrew the connection set from the delivery connection.
- Mount flow monitor on the delivery connection and screw on connection set.
- Plug in the plug into the socket marked ⊜.

2.2.2 Metering monitor with R 5/8'' connection

- A set of adapters is necessary to connect a metering monitor with R 5/8" internal thread.

Connection size of pump	Appropriate set of adapters PP	PVC
M 20 x 1.5 (6-12 mm)	81.71.54.8	81.70.54.0
R 3/4'' (DN 10)	80.52.80.5	80.52.78.9

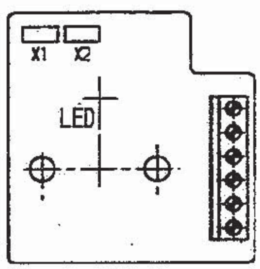
3. Initial operation

3.1 Safety instructions

- The maximum permissible operating pressure for the pumps used may not be exceeded in any operating condition.
- The unions of the flow monitor as well as the connections to the discharge line must be free of leaks when operating under maximum operating pressure.

3.2 Initial operation

- Deactivate the metering monitor on pump, see information in the operating manual of the corresponding pump.
- Start the metering pump.
- Supply the discharge line with the appropriate operating pressure.
- Set the capacity desired via the stroking rate or stroke on the pump.
- Bring the ring initiator into the upper most position until the stop; if no signal is issued in this setting with the pump operating, slowly push the ring initiator downwards until the red LED illuminates for a short time in pace with the metering strokes.
- Press the ring initiator a further 1 mm downwards.
- Reduce the stroke length as a test.
- At approx. 20–50 % reduced stroke length with max. flow and approx. 5–20 % reduced stroke length with min. flow the ring initiator should not issue any more pulses.
- Reset the stroke length to the setting desired. the ring initiator must once again issue pulses.
- If at high metering capacities double pulses should arise (LED illuminates several times in succession per metering stroke) this is not of any importance technically.
- Reactivate the metering monitor on pump.



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For media with a viscosity similar to water, both coding bridges X1 and X2 must be plugged in. For highly viscous media, X2 must be plugged in, not however X1, so that the outsmart switching is active.

4. Maintenance

The metering monitor is made from reliable and tried and proven components. The maintenance is thus essentially limited to observing that the metering monitor is operating correctly.

If it should be necessary to open the flow monitor, the inserts are to be unscrewed using pressure by hand. If it is not possible to unscrew them by hand, the flow monitor can be opened using two fork spanners (size 13 and 17).

When assembling the flow monitor, twist the insert parts by hand on the pipe and tighten about one quarter of a revolution with the fork spanners.

5. Technical data

5.1 Type overview

Operating range for pump type PP/NP/TT, minimum backpressure approx. 1 bar

Metering monitor		Part no.	For use for pump type		
flow Control Typ I, M 20 x 1.5	PP	792076.2	g/4 1601-1003	g/5 1602	
flow Control Typ II, M 20 x 1.5	PP	792077.0	g/4 0308, 0313	g/5 1605-1310	
flow Control Typ III, M 20 x 1.5	PP	792078.8	g/4 0215, 0223	g/5 0613-0423	Vario DN 10
flow Control Typ I, M 20 x 1.5	PVC	792073.9	g/4 1601-1003	g/5 1602	
flow Control Typ II, M 20 x 1.5	PVC	792074.7	g/4 0308, 0313	g/5 1605-1310	
flow Control Typ III, M 20 x 1.5	PVC	792075.4	g/4 0215, 0223	g/5 0613-0423	Vario DN 10
flow Control Typ I, R 5/8"	PP	807117.7	g/4 1601-1003	g/5 1602	
flow Control Typ II, R 5/8"	PP	807118.5	g/4 0308, 0313	g/5 1605-1310	
flow Control Typ III, R 5/8"	PP	807119.3	g/4 0215, 0223	g/5 0613-0423	Vario DN 10
flow Control Typ I, R 5/8"	PVC	807054.2	g/4 1601-1003	g/5 1602	
flow Control Typ II, R 5/8"	PVC	807058.3	g/4 0308, 0313	g/5 1605-1310	
flow Control Typ III, R 5/8"	PVC	807059.1	g/4 0215, 0223	g/5 0613-0423	Vario DN 10

5.2 Material specifications

The materials of the media-contaced parts are PVC/Viton or PP/EPDM

5.3 Dimensions and weights

Installed length R 5/8"
connection approx. 84 mm
Installed length M 20 x 1.5
connection approx. 94 mm
weight: approx. 200 gr

5.4 Electrical data

Supply voltage:	5V +/–5 %
Power drain (max.):	10 mA
Duration of periods with outsmart switching activated:	300 ms +/–150 ms
Pulse extension time:	80 ms +/–30 ms

5.5 Temperature specifications

- permis. storage temperature: –10 °C bis +50 °C
- permis. ambient temperature: –10 °C bis +45 °C
- permis. medium temperature under max. operating pressure: –10 °C bis +35 °C (acc. to IEC 335-2-41)

6. Enclosure ratings maintained

IP 65 acc. to DIN VDE 0470 part 1, corresponds EN 60529 and IEC 529

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Plastics Limited

Your Pipeline To Quality Valves, Strainers, Flowmeters and Controls

55 Guardsman Road
Thornhill, Ontario
L3T 6L2
Canada
Tel: 905-889-7890
Fax: 905-889-8553

MAINTENANCE & INSTALLATION INSTRUCTIONS
For Chemline Type 21 True Union Ball Valve Size 1/2"- 4"

Installation:

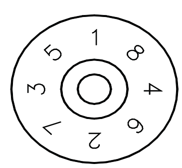
1. Make sure all surfaces are clear and free of debris prior to installing valve in pipeline. Pipeline should be empty at connection site.

2. Valve should be set to the closed position.

3. When installing valves with socket connections, ensure that only PVC solvent cement is used. Excessive use of cement can cause sticking in the valve interior, therefore use caution when applying cement, especially on vertical piping.

4. For threaded connections we recommend the use of sealing tape and, with the use of a strap wrench, to tighten no more than 2 full turns past finger-tight. Use of a pipe wrench can deform the pipe or union nut and cause damage to the valve and/or connection(s).

5. Flanged connections should be torqued evenly and in a symmetrical pattern with a torque wrench and as per the figure and chart below:



RECOMMENDED FLANGE BOLT TORQUES

VALVE SIZE	FLANGE	BOLT TORQUE	IN FT-LB	AXIAL MISALIGNMENT	PARALLELISM (INCH)
	PSI - 50	PSI - 100	PSI – 150		
1½	11	13	14	0.04	0.03
2	13	14	16	0.04	0.03
2½	13	14	16	0.04	0.03
3	18	20	22	0.04	0.03
4	20	20	22	0.04	0.04
5	22	15	29	0.04	0.04
6	25	15	32	0.04	0.04
8	25	32	40	0.06	0.04
10	25	32	40	0.06	0.04
12	29	36	43	0.06	0.04
14	32	36	43	0.06	0.04
16	36	[58-85 PSI]	58	0.06	0.04
18	36	[58-85 PSI]	-		
20	72	-	-		
24	72	-	-		

Maintenance Instructions Type 21 Ball Valve cont.

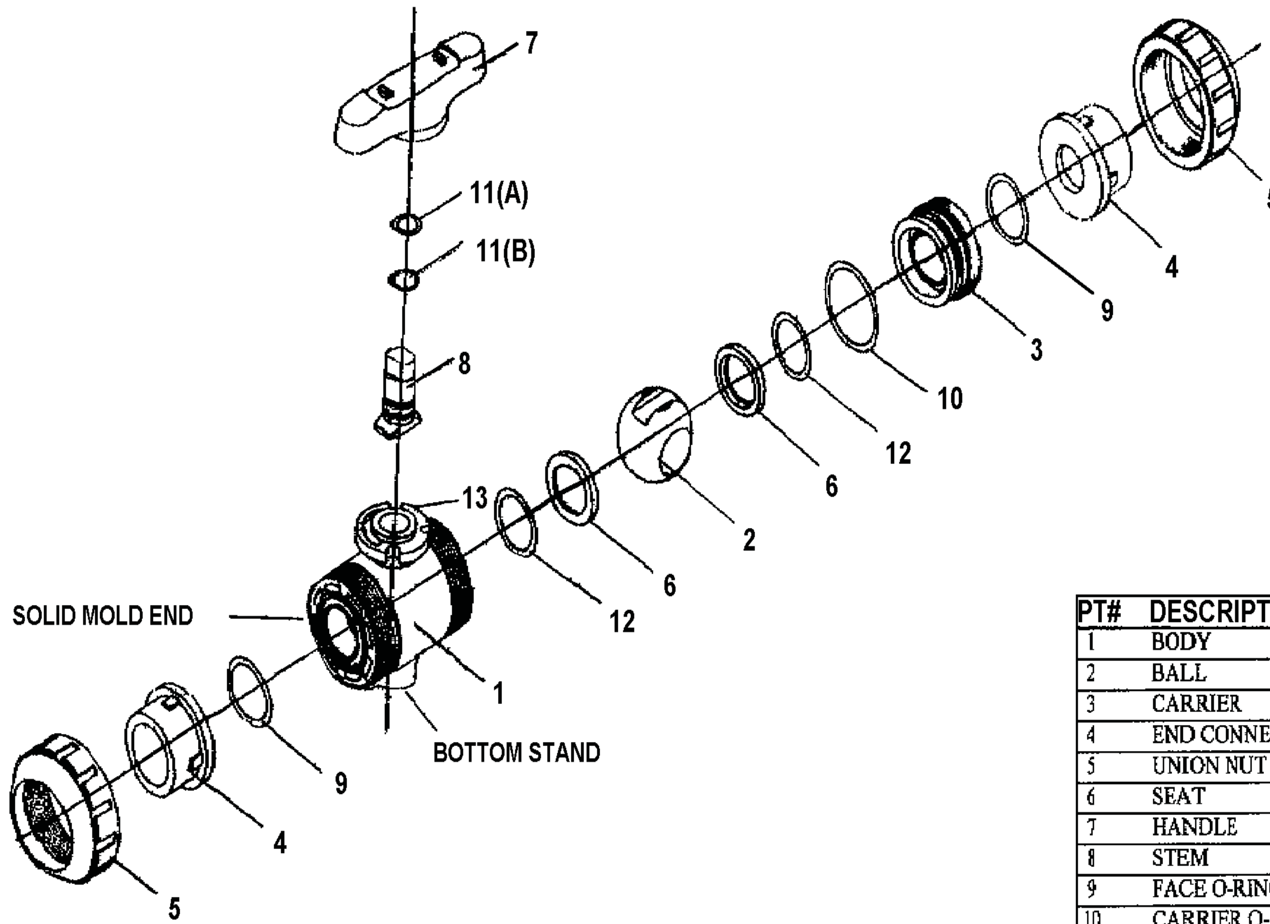
Maintenance:

Refer to **ASSEMBLY DRAWING T21V Rev. 0.** And proceed as follows:

1. Turn valve to the closed position.
2. Unscrew union nut (5) from both ends of valve.
3. Remove end connectors (4).
4. On solid mold end, remove face o-ring (9). This completely disassembles this end of valve.
5. Pull upward on handle (7) to remove.
6. On opposite end of valve, remove face o-ring (9) and use handle (7) as a spanner wrench to remove carrier (3).
7. Remove carrier o-ring (10).
8. Remove seat (6) and seat cushion (12) to expose ball (2).
9. Remove ball (2) by pushing from solid molded end of body.
10. Remove stem (6) by pushing it down into body (1).
11. Remove stem o-rings 11(A) and 11(B) from groves in stem.
12. Remove other seat (6) and seat cushion (12).
13. Inspect all parts for wear and replace as necessary.
14. Before re-assembling valve, lubricate all o-rings with Dow Corning III silicone compound or equivalent.
15. To re-assemble valve follow steps 1 through 10 in reverse order.

NOTE: If mounting actuator on mounting flange (13), make sure handle (7) is removed and stem (6) and actuator are aligned.

After replacing carrier (3), the face of the carrier should remain slightly projected from the end of the body. Make sure the ball rotates smoothly with only a touch of resistance.



PT#	DESCRIPTION	QTY	MATERIALS
1	BODY	1	PVC/PP/PVDF/CPVC
2	BALL	1	PVC/PP/PVDF/CPVC
3	CARRIER	1	CPE/EPDM/VITON/HYP.
4	END CONNECTOR	2	PVC/PP/PVDF/CPVC
5	UNION NUT	2	PVC/PP/PVDF/CPVC
6	SEAT	1	CPE/EPDM/CITON/HYP.
7	HANDLE	1	PVC/PP/PVDF/CPVC
8	STEM	1	PVC/PP/PVDF/CPVC
9	FACE O-RING	2	CPE/EPDM/VITON/HYP.
10	CARRIER O-RING	1	CPE/EPDM/VITON/HYP.
11(A)	STEM O-RING (Upper)	1	CPE/EPDM/VITON/HYP.
11(B)	STEM O-RING (Lower)	1	CPE/EPDM/VITON/HYP.
12	SEAT CUSHION	2	CPE/EPDM/VITON/HYP
13	MOUNTING FLANGE	1	PVC/PP/PVDF/CPVC

TITLE CHEMLINE TYPE 21 TRUE UNION BALL VALVE	SCALE		DATE	CHEMLINE PLASTICS
	DR. BY			
REFERENCE SIZES 1/2" - 4"	CHKD BY			DWG. NO. T21V
	APP. BY			REV. 0

CHEMLINE Plastics Limited

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55 Guardsman Road
Thornhill, Ontario
L3T 6L2
Canada
Tel: 905-889-7890
Fax: 905-889-8553

MAINTENANCE INSTRUCTIONS
For Chemline 3/8” - 1-1/2” SB Series Pressure Relief Valves

Installation:

1. Always mount a filter or strainer in the line immediately before the valve to avoid damage to the valve from dirt or particles. Valve is spring operated, therefore can be installed in any orientation.

2. **To adjust pressure use the adjustment screw (8) and a pressure gauge**.
   - the valve will be closed at the set pressure and will start to open when the operating pressure rises above the set pressure.
   - connect the compressed air supply to the inlet of the valve. Adjust the flow of the air to the desired set pressure by turning clockwise to increase the set pressure, counterclockwise to decrease it.
   - with the valve being closed, adjust the screw (8) until the valve starts to open. Fix the adjusting screw in place with the locking nut (9).

3. For installation in an application where the temperature is 0^{o} C or less. Check with Chemline Engineering
Technical staff prior to installation.

Maintenance

Refer to **ASSEMBLY DRAWING SB10/11 rev 0.** And proceed as follows.

1. Loosen and remove cap (10).

2. Loosen counter nut (9) and remove adjustment screw (8).

3. Remove body cap (12a), body bolt (12b), body nut (12c) and washer (12d).

4. Lift up and remove bonnet (2).

5. Remove pressure plate (7a) and ball bearing (7b) to reach relief spring (3).

6. Loosen piston screw (11), remove spring plate (6) and draw piston assembly (5) downward and out of body (1).
   Note: Piston assembly (5) is all parts (5a) outer piston assembly
   (5b) inner piston assembly
   (5c) seat
   (5d) piston o-ring

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Thornhill, Ontario
L3T 6L2
Canada
Tel: 905-889-7890
Fax: 905-889-8553

MAINTENANCE & INSTALLATION INSTRUCTIONS
For Chemline 2” – 4” SB Series Pressure Relief Valves

Installation:

1. Always mount a filter or strainer in the line immediately before the valve to avoid damage to the valve from dirt or particles. Valve is spring operated, therefore can be installed in any orientation.

2. **To adjust pressure use the adjustment screw (8) and a pressure gauge**.
   - the valve will be closed at the set pressure and will start to open when the operating pressure rises above the set pressure.
   - connect the compressed air supply to the inlet of the valve. Adjust the flow of the air to the desired set pressure by turning clockwise to increase the set pressure, counterclockwise to decrease it.
   - with the valve being closed, adjust the screw (8) until the valve starts to open. Fix the adjusting screw in place with the locking nut (9).

3. For installation in an application where the temperature is 0^{o} C or less. Check with Chemline Engineering
Technical staff prior to installation.

Maintenance:

Refer to **ASEMBLY DRAWING SB1201 rev 0.** And proceed as follows:

1. Loosen and remove cap (10).

2. Loosen counter nut (9) and remove adjustment screw (8).

3. Remove body cap (12c), body nut and bolt (12a) and washer (12b).

4. Lift up and remove bonnet (2).

5. Remove pressure plate (7a) and ball bearing (7b) to reach relief spring (3).

6. Draw piston assembly (5) downward and out of body (1).
   Note: Piston assembly (5) is all parts (5a) outer piston assembly
   (5b) plug
   (5c) seat
   Piston assembly is removed from the body as a unit. It can then be further disassembled into the component parts listed above.

7. Remove diaphragm (4).

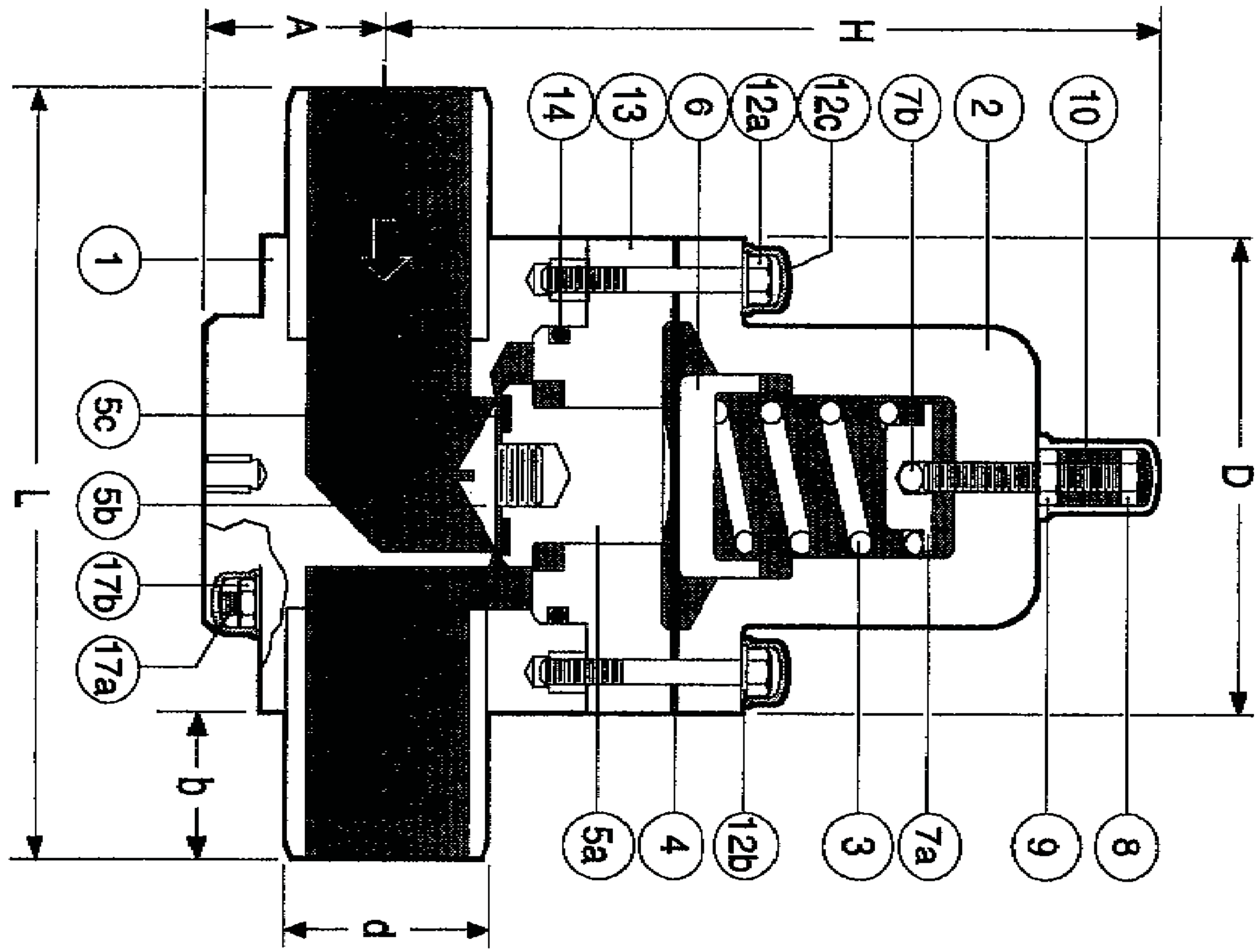
8. Remove seal (14) at intermediate flange (13).

9. Inspect all parts for wear and abrasion, replace seals, diaphragms etc. if necessary.

10. To re-assemble valve follow steps 1 through 10 in reverse order.

TROUBLESHOOTING

FAILURE		REASON	REPAIR
VALVE LEAKS AT DIAPHGRAM (4)		CLAMPING PRESSURE FOR DIAPHRAGM (4) TOO LOW.	TIGHTEN SCREWS (12)
PRESSURE RISES ABOVE SET PRESSURE	{A) (B) (C)	VALVE SEAT (5c) & SEALS (14) ARE DEFECTIVE DIAPHRAGM (4) LEAKING PISTON (5) BORE AT BODY (1) DIRTY	CHECK SEALS OF PISTON (5) BODY (14) - REPLACE REPLACE. DISMANTLE PISTON (5) AND CLEAN BORE
VALVE CLOSED (DOES NOT OPEN)		VALVE MOUNTED IN WRONG DIRECTION.	TURN VALVE IN DIRECTION OF ARROWS
FLUIDS PENETRATE ADJUSTING SCREW (8)		DIAPHRAGM (4) DEFECTIVE.	REPLACE DIAPHRAGM (4)
LEAKING AT PLUG AT VALVE BODY		O-RING SEAL LEAKING	DISMANTLE PLUG AND REPLACE SEAL



PART	DESCRIPTION	PCS
1	BODY	1
2	BONNET	1
3	RELIEF SPRING	1
4	DIAPHRAGM	1
5 (a)	OUTER PISTON	1
5 (b)	PLUG	1
5 (c)	SEAT	2
6	SPRING PLATE	1
7 (a)	PRESSURE PLATE	1
7 (b)	BALL BEARING	1
8	ADJUSTING SCREW	1
9	COUNTER NUT	1
10	CAP	1
12 (a)	BODY NUT & BOLT	4/6
12 (b)	BODY WASHER	4/6
12 (c)	BODY CAP	4/6
13	INTERMED. FLANGE	2
14	SEAL	2

TITLE CHEMLINE SB/12 SERIES	SCALE		DATE	CHEMLINE PLASTICS	
	DR. BY				
REFERENCE PRESSURE RELIEF VALVES 2-4"	CHKD. BY			DWG. NO.	REV.
	APP. BY			SB1201	0

Piston assembly is removed from body as a unit. It can then be further disassembled into the component parts listed above.

7 Remove diaphragm (4).

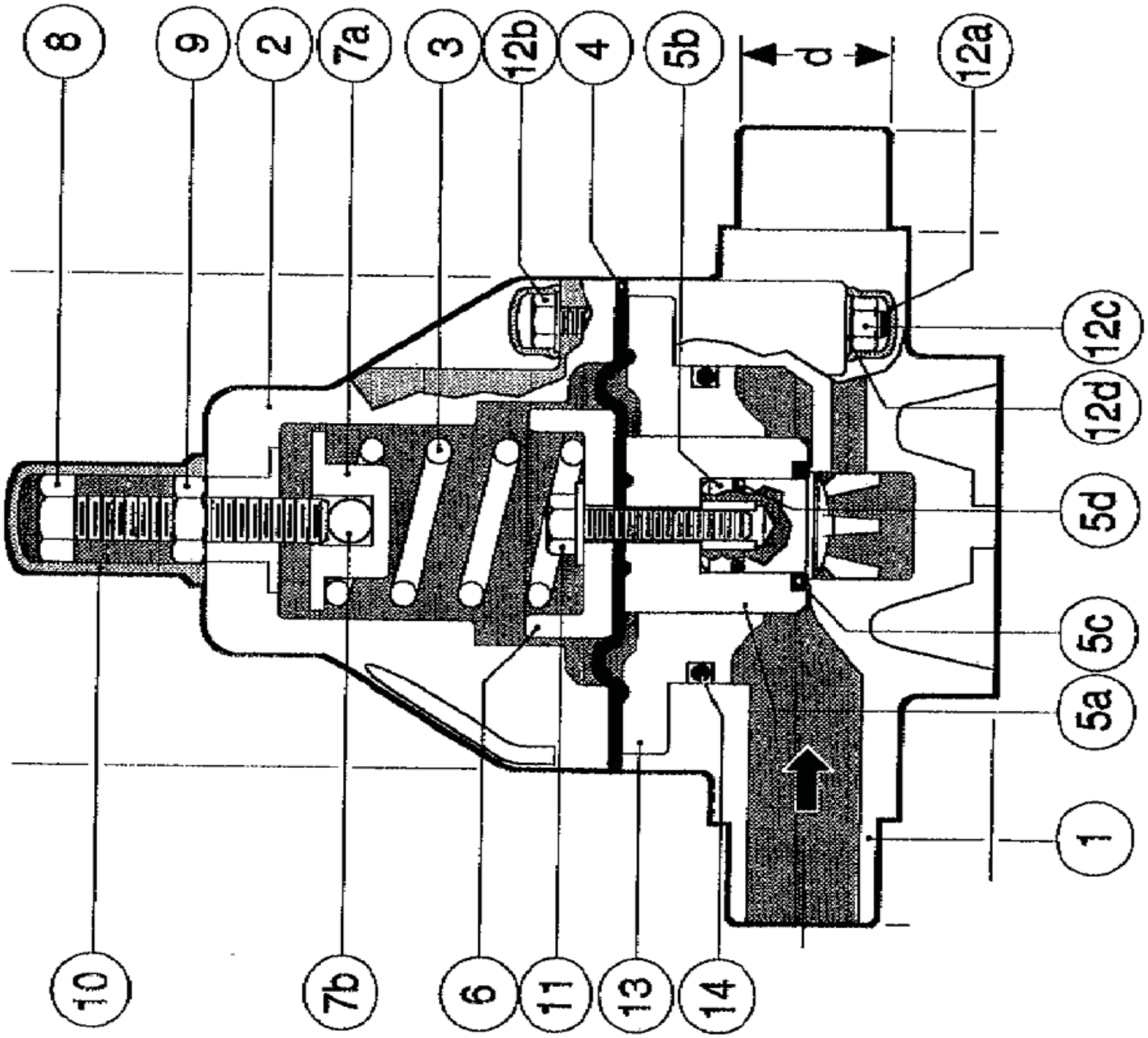
8. Remove seal (14) at intermediate flange (13).

9. Inspect all parts for wear and abrasion, replace seals, diaphragm etc. if necessary.

10. To re-assemble valve follow steps 1 through 9 in reverse order.

TROUBLESHOOTING

FAILURE		REASON	REPAIR
VALVE LEAKS AT DIAPHGRAM (4)		CLAMPING PRESSURE FOR DIAPHRAGM (4) TOO LOW.	TIGHTEN SCREWS (12)
PRESSURE RISES ABOVE SET PRESSURE	{A)	VALVE SEAT (5c) & SEALS (14) & (5d) ARE DEFECTIVE	CHECK SEALS OF PISTON (5) BODY (14) - REPLACE
	(B)	DIAPHRAGM (4) LEAKING	REPLACE.
	(C)	PISTON (5) BORE AT BODY (1) DIRTY	DISMANTLE PISTON (5) AND CLEAN BORE
VALVE CLOSED (DOES NOT OPEN)		VALVE MOUNTED IN WRONG DIRECTION.	TURN VALVE IN DIRECTION OF ARROWS
FLUIDS PENETRATE ADJUSTING SCREW (8)		DIAPHRAGM (4) DEFECTIVE.	REPLACE DIAPHRAGM (4)
LEAKING AT PLUG AT VALVE BODY		O-RING SEAL LEAKING	DISMANTLE PLUG AND REPLACE SEAL



Part	Description	Pcs
1	BODY	1
2	BONNET	1
3	RELIEF SPRING	1
4	DIAPHRAGM	1
5(a)	OUTER PISTON	1
	(PART OF ASSY)	
5(b)	INNER PISTON	1
	(PART OF ASSY)	
5(c)	SEAT	2
	(PART OF ASSY)	
5(d)	PISTON O-RING	2
	(PART OF ASSY)	
6	SPRING PLATE	1
7(a)	PRESS. PLATE	1
7(b)	BALL BEARING	1
8	ADJ. SCREW	1
9	COUNTER NUT	1
10	CAP	1
11	PISTON SCREW	1
12 (a)	BODY CAP	4/6
12 (b)	BODY BOLT	4/6
12 (c)	BODY NUT	4/6
12 (d)	BODY WASHER	4/6
13	INT. FLANGE	2
14	SEAL	2

TITLE CHEMLINE SB PRESSURE RELIEF VALVES	SCALE		DATE	CHEMLINE PLASTICS
	DR. BY			
REFERENCE 3/8" - 1-1/2"	CHKD. BY			DWG. NO. SB1011 — REV. 0
	APP. BY			

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55 Guardsman Road
Thornhill, Ontario
L3T 6L2
Canada
Tel: 905-889-7890
Fax: 905-889-8553

MAINTENANCE INSTRUCTIONS
For Chemline S.I. Series Gauge Isolator 1/4" - 1/2"

Maintenance:

Refer to **ASSEMBLY DRAWING GISI Rev 0.** And proceed as follows:

1. Gauge isolators can be mounted and mounted and filled with glycerine at Chemline prior to delivery, or isolators can be mounted and filled on site.
2. Remove isolator from valve.
3. To disassemble isolator remove gauge (4) from upper chamber (3).
4. Remove bolts, nuts and washers (5) and separate upper chamber (3) from lower chamber (1).
5. Drain glycerin (or other fluid) from both chambers (1 & 3), prior to removing diaphragm (2).
6. Check PTFE diaphragm (2) for wear and replace if necessary.
7. Refill upper chamber (3) and replace diaphragm (2).
8. To reassemble diaphragm follow steps 1 through 4 in reverse, to hand-tight plus ¼ turn.

DIMENSIONS (Inches)

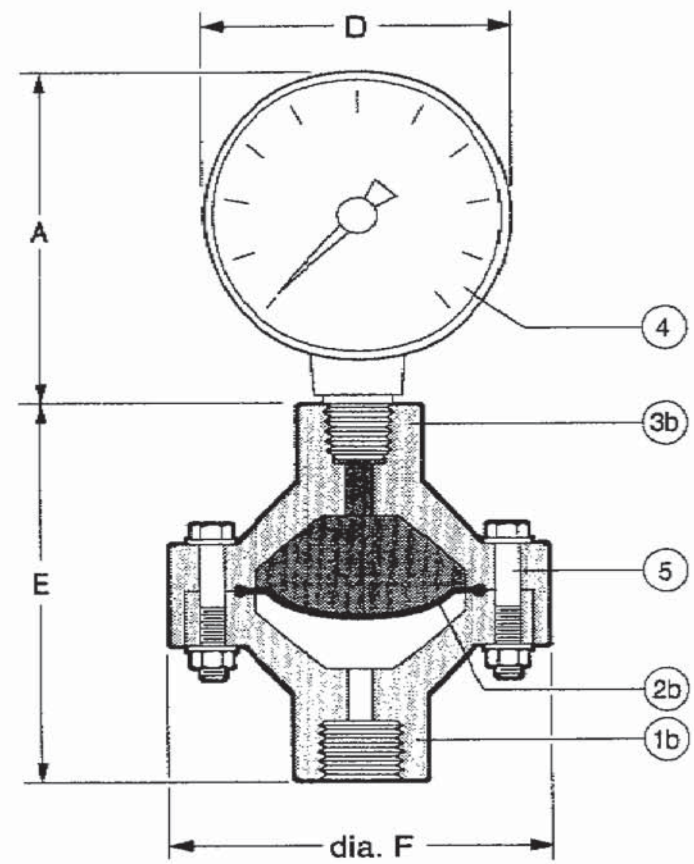
Inlet Size		1/2			
Instrument Connection		1/4			
A	B	C	D	E	F
3.0	4.10	2.64	2.50	3.43	3.19

Gauge Isolators S.I. Series cont.

WORKING PRESSURES

TEMPERATURE				
F	**C**	**PVC**	**PP**	**PVDF**
0	-17	40	-	200
25	-4	130	70	200
50	10	180	130	200
75	24	185	150	200
100	38	160	140	200
125	51	110	120	180
150	66	-	90	160
175	79	-	60	130
200	93	-	-	100
250	120	-	-	60

PART	DESCRIPTION	QTY	MATERIAL
1	LOWER CHAMBER	1	PVC/PP/PVDF
2	DIAPHRAGM	1	TEFLON/PTFE
3	UPPER CHAMBER	1	PVC/PP/PVDF
4	OPTIONAL GAUGE	1	S.S. CASE
5	HEX BOLT/NUT/WASHERS	9	304 SS/M5x30



TITLE CHEMLINE GAUGE ISOLATOR	SCALE		DATE	CHEMLINE PLASTICS	
	DR. BY				
REFERENCE S.I. SERIES 1/4 AND 1/2	CHKD. BY			DWG. NO. GISI	REV. 0
	APP. BY				

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Thornhill, Ontario
L3T 6L2
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MAINTENANCE INSTRUCTIONS
For Chemline Ball Check Valves and Ball Foot Valves Sizes 1/2” to 4”

Maintenance

Refer to dwg. **APR-050** or **ASSEMBLY DRAWING BC-003 rev.0** and proceed as follows:

1. Loosen union nut (5) and remove valve from line.
(Note: make sure there is no pressure in line prior to removing valve.)

2. **Important** Hold seat/seal (3) in place while removing valve, as the seat, stop ring (6) and ball (2) may fall out.

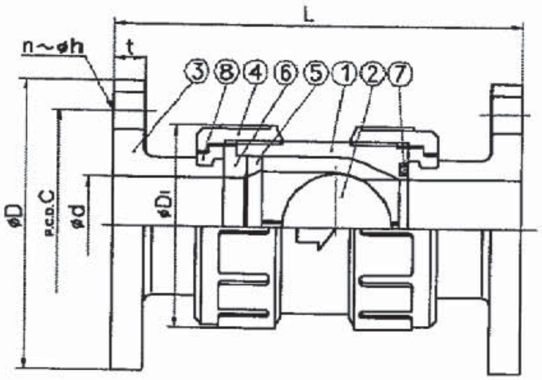
3. Remove seat (3), stop ring (6) and ball (2). Inspect for excessive wear. The ball should not show signs of wear or deformation.

4. When re-installing ball (2), stop ring (6) and seat (3), check inside body for any foreign debris that may have become lodged in the valve.

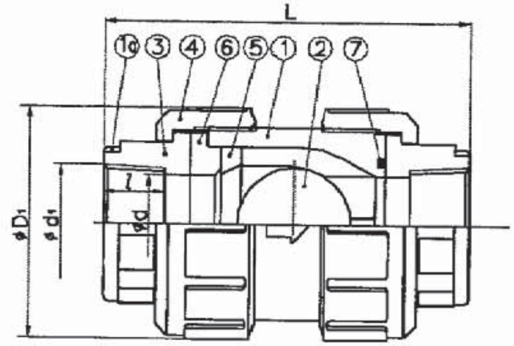
5. Replace union nut (5) and tighten.

6. For Foot Valves with strainer baskets, remove basket (7) and clean thoroughly.

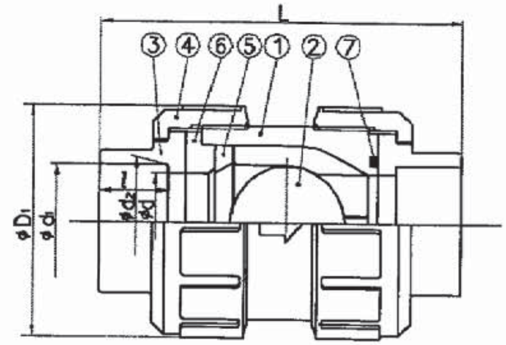
FLANGE END



THREAD CONNECTION



SOCKET CONNECTION



DIMENSIONS TABLE

NOMINAL SIZE		FLANGE □ ANSI 150LBS □ ANSI 125LBS D	C	n	h	L	t	□ THREAD d_1	l	L	d	D_1
½"	15	3.50	2.38	4	0.63	5.12	0.47	½– 14 NPT	0.59	3.39	0.59	1.89
¾	20	3.86	2.76	4	0.63	6.10	0.55	¾– 14 NPT	0.67	4.06	0.79	2.36
1	25	4.25	3.13	4	0.63	6.50	0.55	1 – 11½NPT	0.79	4.45	0.98	2.76
1¼	30	—	—	—	—	—	—	1¼– 11½NPT	0.87	5.00	1.22	3.78
1½	40	5.00	3.88	4	0.63	7.56	0.63	1½– 11½NPT	0.98	5.94	1.57	3.78
2	50	5.98	4.74	4	0.75	8.43	0.63	2 – 11½NPT	1.10	6.97	2.01	4.17

UNIT ; inch

NOMINAL SIZE		SOCKET PVC . C-PVC □ ANSI SCH 40				PVC . C-PVC □ ANSI SCH 80				PVDF □ ANSI				PVDF,PP □ IPS			
		d_1	d_2	l	L	d_1	d_2	l	L	d_1	d_2	l	L	d_1	d_2	l	L
½"	15	0.848	0.836	0.688	3.43	0.848	0.836	0.875	3.80	0.825	—	0.890	3.83	0.831	—	0.625	3.31
¾	20	1.058	1.046	0.719	3.86	1.058	1.046	1.000	4.41	1.030	—	1.015	4.49	1.041	—	1.000	4.43
1	25	1.325	1.310	0.875	4.37	1.325	1.310	1.125	4.88	1.300	—	1.140	4.98	1.305	—	0.815	4.35
1¼	30	1.670	1.655	0.938	4.92	1.670	1.655	1.250	5.55	1.650	—	1.265	5.58	—	—	—	—
1½	40	1.912	1.894	1.094	5.94	1.912	1.894	1.375	6.50	1.890	—	1.390	6.57	1.889	—	1.250	5.57
2	50	2.387	2.369	1.156	6.77	2.387	2.369	1.500	7.44	2.360	—	1.515	7.57	2.364	—	1.250	6.49

NOTE. The shape and appearance of assembly differ a little with nominal size compared to this drawing.

Customer ______________
Customer PO# ______________
Chemline PS# ______________

Part No. ______________
Body Material ______________
Elastomer Material ______________
End Connection ______________

No.	DESCRIPTION	No.REQ'D	MATERIAL	REMARKS
1a	RING	2	STAINLESS STEEL (SUS304)	C-PVC body,thread connection : used for ½"~1"
8	STOP RING (B)	2	PVDF	used for Flange end
7	O-RING	1	□EPDM, □FPM □others( )	
6	SEAT RING	1		
5	STOP RING (A)	1	□ PVC □ C-PVC □ PP □ PVDF	
4	UNION NUT	2		
3	END CONNECTOR	2		
2	BALL	1		
1	BODY	1		

TRUE UNION BALL CHECK VALVE ASS'LY
□FLANGE END, □SOCKET CONNECTION, □THREAD CONNECTION
ANSI : ½ ~ 2"

DRAWN	LC	DATE	SCALE
CHECKED		09/28/99	~
APPROVED		DRAWING No APR-050	△

CHEMLINE PLASTICS LTD.

ACCU-PULSE Installation and Operation Instructions

Chargeable Models

ACCU-PULSE Unit Information

Serial Number: ______________________ **Model Number:** ____________

Material of Construction: **Body:** _________________________

Bladder: _________________________

Pump Area & Number: ________________________________

Date of Purchase: ________________________________

Supplier: Company: ________________________________

Contact: ________________________________

Phone: ________________________________

Notes:

- Primary Fluid Systems Inc. recommends installing a pressure relief valve such as TOP VALVE in all pump systems to ensure compliance with pressure limits on system equipment
- Mount ACCU-PULSE as close to pump discharge, inlet and/or quick closing valve as possible
- Temperature and pressure affect the strength and chemical resistancy of plastic and rubber; Consult Primary Fluid Systems Inc. for assistance
- Remove all pressure from ACCU-PULSE unit and pump system before attempting maintenance
- Do not exceed 150 PSI for standard models; 300 PSI for metallic units
- If a system pressure test is to be performed, ACCU-PULSE must be charged with 80% of the system test pressure, prior to test. This will avoid possible bladder damage.

Limited Warranty:

Primary Fluid Systems Inc. (Primary) warrants its products against defects in workmanship or materials for one (1) year under normal use.Primary's obligations and liabilities under this warranty shall be limited to replacement of the product, or a refund of an amount not to exceed the purchase price of the product(s) to which such warranty claim is made. Repairs or replacements are made subject to our inspection of the returned product(s). Primary's decision of one of these alternatives shall be the buyer's exclusive remedy.

This warranty does not extend to damage by corrosion or other decomposition by chemical action. Primary does not warrant damages caused by (a) improper use of the product, (b) unauthorized modification or attachment to product, (c) misuse, abuse, accident or negligent handling or installation of product, or (e) alterations or repairs made by purchaser.The materials of construction offered are recommendations subject in all cases to acceptance by purchaser. These recommendations do not constitute guarantee against corrosion or decomposition, but are based on previous experience and best available information of the industry.

Statements and instructions set forth herein are based on the best information and practices known to Primary, but it should not be assumed that every acceptable safety procedure is contained herein. Of necessity Primary cannot guarantee that actions in accordance with such statements and instructions will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

Except as specifically provided herein, Primary makes no warranty, representations, promise or guarantee, either express or implied, statutory or otherwise, with respect to the product and technical information including their quality, performance, merchantability, or fitness for a particular purpose.In no event will Primary be liable for indirect, special, incidental, economic, covert or consequential damages arising out of the use or inability to use the product, including without limitation, damages or costs relating to the loss of profits, business and goodwill even if advised of the possibility of such damages. In no event shall Primary's liability exceed the amount paid by you for the product.

The warranty and remedies set forth herein are exclusive and in lieu of all others, oral or written, express or implied. No Primary dealer, distributor, agent or employee is authorized to make any modification or addition to this warranty. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

PRIMARY FLUID SYSTEMS INC.
Call Toll Free 1-800-776-6580
Tel (905) 333-8743 Fax (905) 333-8746
E-Mail: primary@primary fluid.com
http: www.primaryfluid.com

Pump Discharge Installation: Chargeable Models

Step 1: Mounting Position

Mount ACCU-PULSE as close to the pump discharge as possible to absorb the pulse at its source. The pulsation dampener will optimally perform if mounted at the first 90 ° turn in the discharge piping. If using a flexible connector from the pump to your point of discharge, ACCU-PULSE should be hard piped to the pump discharge manifold, then continue with flexible tubing from dampener. Since pressure is equal in all directions, ACCU-PULSE can be installed in any position - vertically, horizontally, upside down. Primary Fluid Systems Inc. does recommend a vertical position for better draining of the unit.
Limitations for horizontal and upside down mounting include high specific gravity, high viscosity, settling of heavy material or possible air entrapment.

Step 2: Air Line Connection

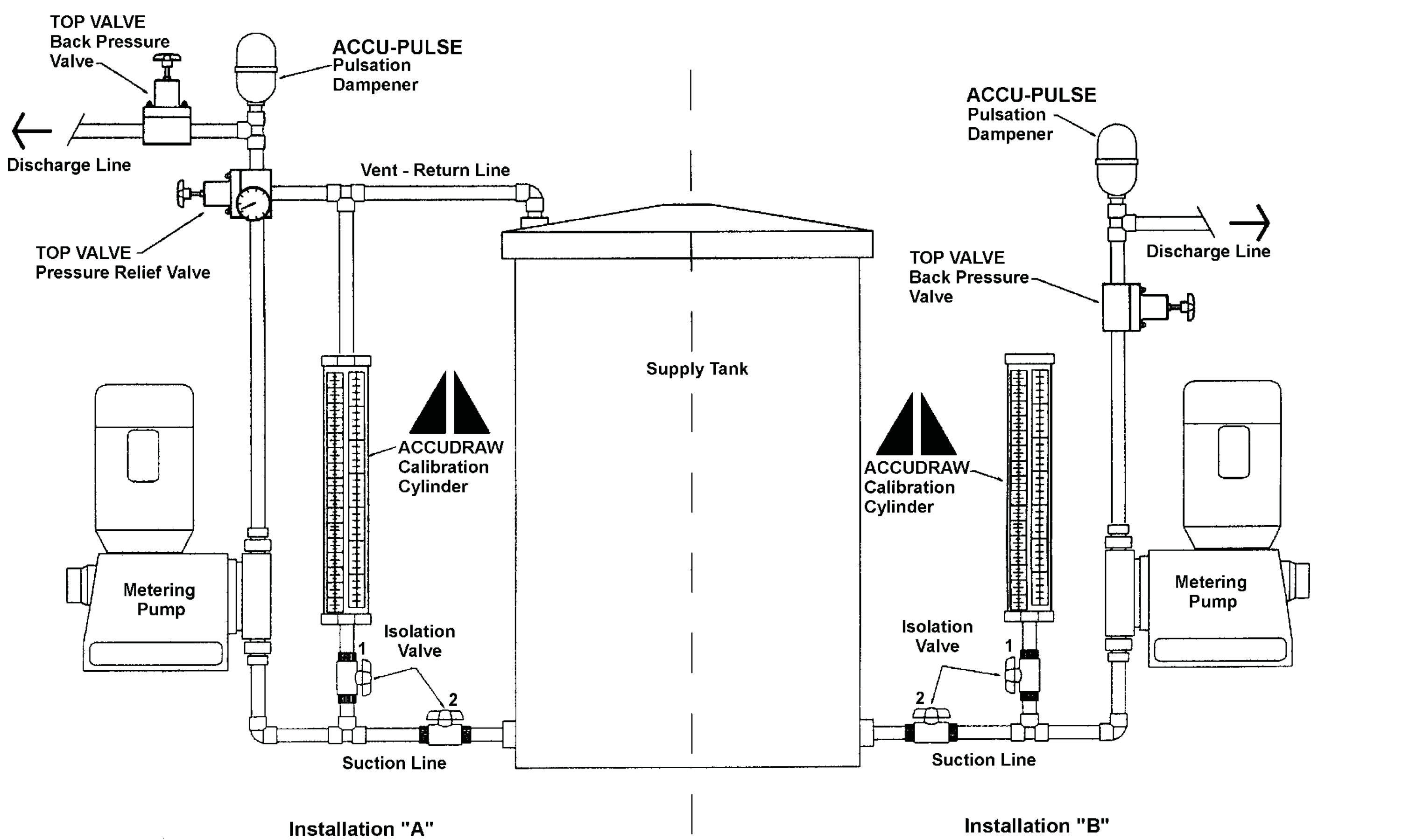
Chargeable models do not require an air line connection, the units must be charged with compressed air or nitrogen, using a hand pump, tank or compressor.

Step 3: Charging and Start Up

Prior to starting the pump, charge ACCU-PULSE with compressed air or nitrogen to approximately 70 to 85% of expected system pressure, to a maximum of 150 PSI for standard models; 300 PSI for metallic models. Start the pump to generate working or system pressure. Once working pressure is achieved, adjustment may be necessary; gradually increase or decrease the gas charge in the dampener by bleeding or filling through the gas valve. Allow the system to respond to each adjustment (this may take a minute or two) before continuing any further adjustments. Generally, pulsation is most effectively minimized when the gas charge is 80 to 85 % of system/pump discharge pressure. Pressure should be checked periodically. Recharge when necessary.

Typical Installations

The installations below are typical installation examples only. Consult your engineering department for the appropriate installation of your application or call the factory for advice.



ACCU-PULSE Safety Warnings

This dampener should only be installed and used by experienced and trained professional mechanics. Observe all safety warnings. Read all safety warnings and operating manuals before using or repairing this Pulsation Dampener (hereafter referred to as “dampener”).

General Safety

This dampener is not intended to be used as a stand alone machine. EU member states must note: Do not use this dampener before it is combined into another machine or assembly that complies with all relevant EU safety directives and that the assembler’s CE mark is affixed on completion.

The internal dampener pressure will equal the maximum fluid pressure of the system in which it is installed.

Do not exceed maximum pressure as stated on dampener tag. If tag is missing, do not use this dampener without consulting distributor or factory for maximum pressure rating.

Always make sure safety shut off valves, regulators, pressure relief valves, gauges etc. are working properly before starting system or assembly.

Always wear protective gloves, safety glasses, etc. when working on or near this dampener.

Before starting a system or assembly, make certain the discharge point of the piping system is clear and safe, and all persons have been warned to stand clear.

Always wear safety glasses when installing, charging or repairing this dampener.

Do not put your face or body near dampener when the system assembly is operating or dampener is pressurized.

Do not operate a dampener that is leaking, damaged, corroded or otherwise unable to contain internal fluid, air or gas pressure.

Do not pump incompatible fluids through the dampener. Consult your distributor or the factory if you are not sure of the compatibility of the fluids with the dampener materials.

Dampeners are designed to operate with compressed air or nitrogen. Other compressed gases have not been tested and may be unsafe to use in dampeners.

Bleed all pressure from system and dampener before removing equipment from the system.

Always shut off air supply, bleed internal dampener pressure and shut isolation valve before performing maintenance or repair on dampener.

Static spark can cause an explosion resulting in severe injury or death. Ground dampeners and pumping system when pumping flammable fluids.

Equipment Misuse Hazard

General Safety:

Any misuse of this equipment such as over pressurization, modifying parts, incompatible chemicals, using worn or damage parts or using gases other than air or nitrogen to charge dampener is not recommended. Any of these circumstances could result in serious bodily injury, death, fire, explosion or property damage.

Over-Pressurization:

Never exceed the maximum operating pressure recommended for the dampener model being used. Maximum operating pressure is stated on tag. Pressure limits are stated at 20°C / 70°F.

Temperature Limits

Do not exceed the recommended operating temperatures for the shell and elastomer materials, independently. Excessive temperature will result in dampener failure.
Temperature limits are stated at zero psig / bar.

Installation and Start Up Hazards:

Install dampener before charging or pressurizing.

Do not start system or assembly without first charging or pressurizing dampener. Failure to charge may result in damage to the elastomeric bladder.

Temperature & Pressure Hazard:

Temperature and pressure reduce the strength and chemical resistance of plastic, metal and rubber.

Charging / Pressurization:

Charge or pressurize the dampener with compressed air or nitrogen only. **Do NOT use oxygen.**

Dampener Bladder Failure:

Dampeners utilize an elastomeric membrane to separate system fluid from the air supply or gas charge. When this membrane ruptures, system fluid may be expelled from the air valve. Always perform preventive maintenance and replace elastomers before excessive wear occurs.

Maintenance Hazards:

Never over-tighten clamp bands. This may cause leakage of system fluid and damage to dampener shell.

3.3 Electromagnetic Flowmeter

ModMAG®
M-Series® | B-MAG Electromagnetic Flow Meters

M-Series® M2000

Electromagnetic Flow Meter

Badger Meter

MAG-UM-01272-EN-05 (February 2015)

User Manual

CONTENTS

SAFETY PRECAUTIONS AND INSTRUCTIONS

Some procedures in this manual require special safety considerations. In such cases, the text is emphasized with the following symbols:

Symbol	Explanation
⚠WARNING	Warning indicates the potential for severe personal injury, death or substantial property damage. Comply with the instructions and proceed with care.
⚠CAUTION	Caution indicates the potential for minor personal injury or property damage. Comply with the instructions and proceed with care.

SYSTEM DESCRIPTION

The Badger Meter M-Series® model M2000 electromagnetic flow meter is intended for fluid metering in most industries including water, wastewater, food and beverage, pharmaceutical and chemical.

The basic components of an electromagnetic flow meter are:

- The **detector**, which includes the flow tube, isolating liner and measuring electrodes.
- The **amplifier**, which is the electronic device responsible for the signal processing, flow calculation, display and output signals.

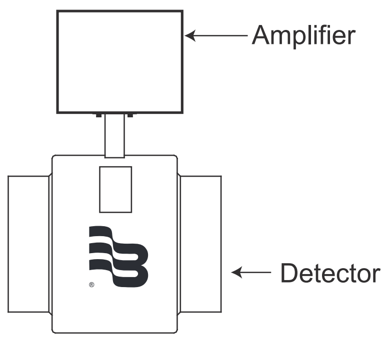


Figure 1: Amplifier and detector

The construction materials of the wetted parts (liner and electrodes) should be appropriate for the specifications on the intended type of service. We recommend that you review all of the compatibilities consistent with the specifications.

Each meter is factory tested and calibrated. A calibration certificate is included with each meter.

UNPACKING AND INSPECTION

Follow these guidelines when unpacking the M-Series equipment.

- If a shipping container shows any sign of damage, have the shipper present when you unpack the meter.
- Follow all unpacking, lifting and moving instructions associated with the shipping container.
- Open the container and remove all packing materials. Store the shipping container and packing materials in the event the unit needs to be shipped for service.
- Verify that the shipment matches the packing list and your order form.
- Inspect the meter for any signs of shipping damage, scratches, or loose or broken parts.

NOTE: If the unit was damaged in transit, it is your responsibility to request an inspection report from the carrier within 48 hours. You must then file a claim with the carrier and contact Badger Meter for appropriate repairs or replacement.

- All detectors with polytetrafluoroethylene (PTFE) liners are shipped with a liner protector on each end to maintain proper form of the PTFE material during shipping and storage.

NOTE: Do not remove the liner protectors until you are ready to install.

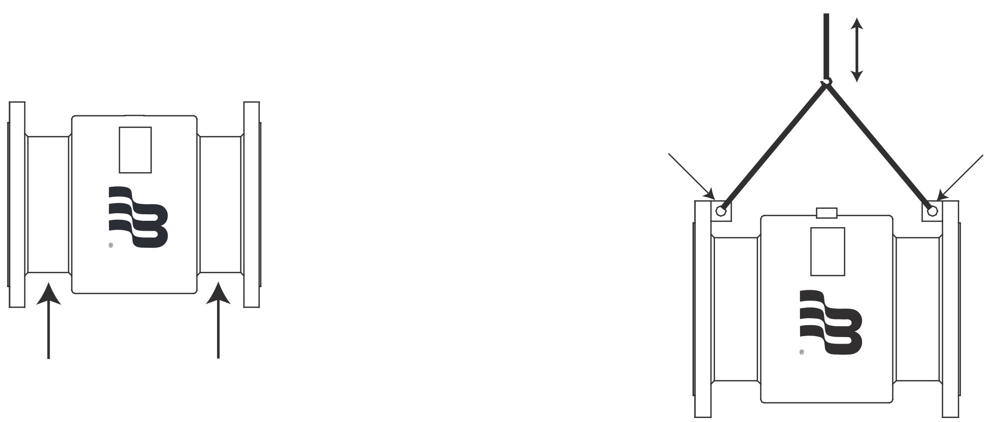
- Storage: If the meter is to be stored, place it in its original container in a dry, sheltered location. Storage temperature ranges are: –40…160° F (–40…70° C).

Rigging, Lifting and Moving Large Units

⚠CAUTION

When rigging, lifting or moving large units, follow these guidelines:

- DO NOT lift or move a meter by its amplifier, junction box or cables.
- Use a crane rigged with soft straps to lift and move meters with flow tubes that are between two inches and eight inches (50 mm and 200 mm). Place the straps around the detector body, between the flanges, on each side of the detector.
- Use the lifting lugs when lifting meter flow tubes that are 10 inches (250 mm) in diameter or larger.



Place straps between flanges.

Use lifting lugs with 10-inch or larger meters.

Figure 2: Rigging large units

- Use the sling-rigged method to lift large detectors into a vertical position while they are still crated. Use this method to position while they are still crated. Use this method to position large detectors vertically into pipelines.

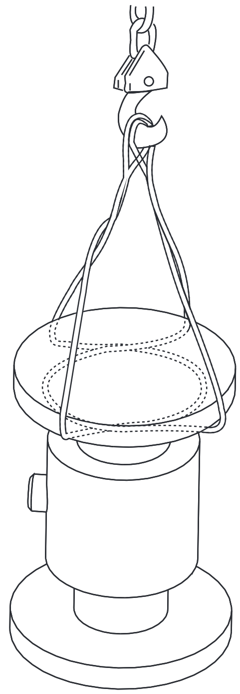
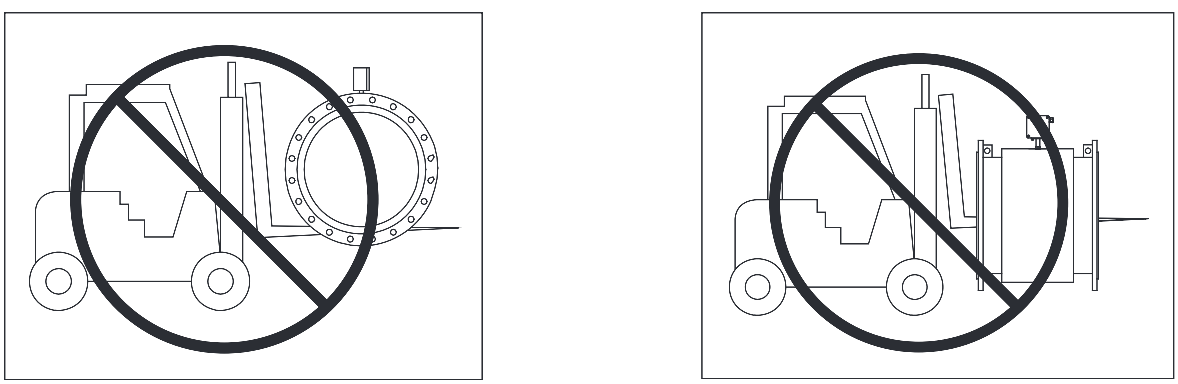


Figure 3: Sling-Rigged lifting methods

- Do not lift a detector with a forklift by positioning the detector body on the forks, with the flanges extending beyond the lift. This could dent the housing or damage the internal coil assemblies.
- Never place forklift forks, rigging chains, straps, slings, hooks or other lifting devices inside or through the detector's flow tube to hoist the unit. This could damage the isolating liner.

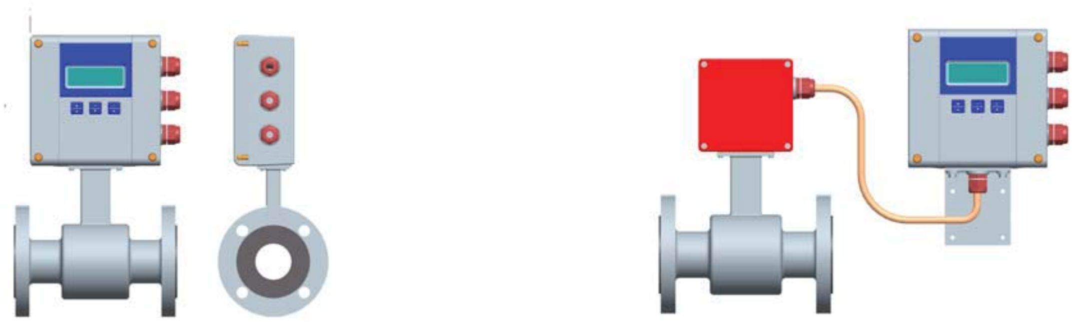


Do not lift detector with forklift. Do not lift or rig lifting devices through detector.

Figure 4: Lifting and rigging cautions

METER LOCATION, ORIENTATION AND APPLICATIONS

The M2000 provides two amplifier mounting options: a meter mount option and a remote mount option.



Meter mount *Remote mount*

Figure 5: Amplifier mounting options

Remote Amplifier Outdoor Location

The amplifier can be installed and operated outdoors. However, it must be protected from the elements, as follows:

- The ambient environment/temperature rating for the unit is –4…140° F (–20…60° C).
- If an indoor location is within 500 feet (152 meters) of the detector, consider increasing the cable length and mounting the amplifier indoors.
- At minimum, fabricate a roof or shield over and/or around the amplifier to protect the LCD display screen from direct sunlight.

Pipelines and Fluid Flow

Take the following precautions during installation:

- Do not install the meter on pipes with extreme pipe vibrations. If pipes are vibrating, secure the piping with appropriate pipe supports in front of and behind the meter. If vibrations cannot be restrained, mount the amplifier in a remote location.
- Do not install the detector close to pipeline valves, fittings or impediments that can cause flow disturbances.
- For detectors with PTFE liners, do not install the detector on suction sides of pumps.
- Do not install the detector on outlet sides of piston or diaphragm pumps. Pulsating flow can affect meter performance.
- Avoid installing the detector near equipment that produces electrical interference such as electric motors, transformers, variable frequency, and power cables.
- Verify that both ends of the signal cables are securely fastened.
- Place power cables and signal cables in separate conduits.
- Place the meter where there is enough access for installation and maintenance tasks.

Meter Orientation

Mag meters can operate accurately in any pipeline orientation and can measure volumetric flow in forward and reverse directions as long as the pipe is completely full.

NOTE: A "Forward Flow" direction arrow is printed on the detector label.

Vertical Placement

Mag meters perform best when placed vertically, with liquid flowing upward and meter electrodes in a closed, full pipe.

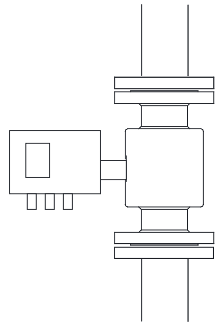


Figure 6: Vertical placement

Vertical placement allows the pipe to remain completely full, even in low flow, low pressure applications, and it prevents solids build-up, sediment deposit and accumulation on the liner and electrodes.

NOTE: Carefully observe the "Forward Flow" label on the meter body and install the meter accordingly. When installed vertically, rotate amplifier so that cable glands are facing down.

Horizontal Placement

M2000 meters are equipped with an *Empty Pipe Detection* feature. If an electrode mounted in the pipe is not covered by fluid for five seconds, the meter will display an Empty Pipe Detection condition. The meter will send out an error message and stop measuring flow. When the electrode is again covered with fluid, the error message disappears and the meter will begin measuring.

When installing the meter on a horizontal pipe, mount the detector to the pipe with the flow-measuring electrode axis in a horizontal plane (three and nine o'clock). This placement helps prevent solids build-up, sediment deposit and accumulation on the electrodes.

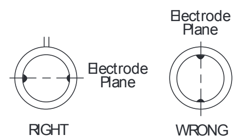


Figure 7: Horizontal placement

Straight Pipe Requirements

Sufficient straight-pipe runs are required at the detector inlet and outlet for optimum meter accuracy and performance. An equivalent of three diameters of straight pipe is required on the inlet (upstream) side. Two diameters are required on the outlet (downstream) side.

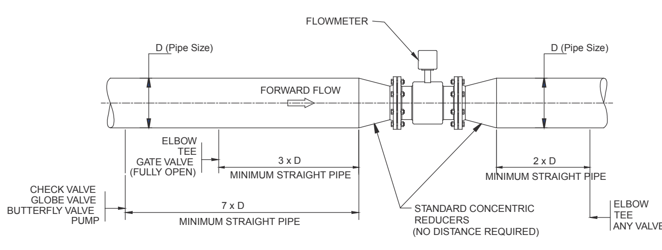


Figure 8: Straight pipe requirements

Pipe Reducer Requirements

With pipe reducers, a smaller meter can be mounted in larger pipelines. This arrangement may increase low-flow accuracy.

There are no special requirements for standard, concentric, pipe reducers.

Custom fabricated pipe reducers must have an approximate slope angle of 15 degrees to minimize flow disturbances and excessive loss of head. If this is not possible, install the custom pipe reducers as if they were fittings and install the required amount of straight pipe.

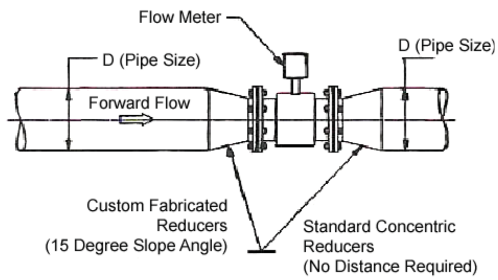


Figure 9: Pipe reducer requirements

Chemical Injection Applications

For water line applications with a chemical injection point, install the meter upstream of the injection point. This eliminates any meter performance issues.

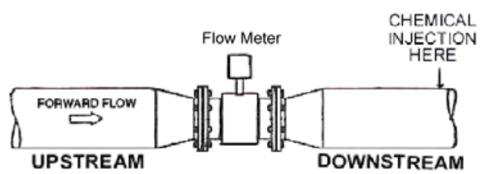


Figure 10: Chemical injection point upstream of meter

If a meter must be installed downstream of a chemical injection connection, the distance between the meter and the injection point should be between 50 and 100 feet (15 and 30 meters). The distance must be long enough to allow the water/chemical solution to reach the meter in a complete, homogeneous mixture. If the injection point is too close, the meter senses the two different conductivities for each liquid. This will likely result in inaccurate measurements. The injection method – spaced bursts, continuous stream of drips or liquid or gas – can also affect downstream readings by the meter.

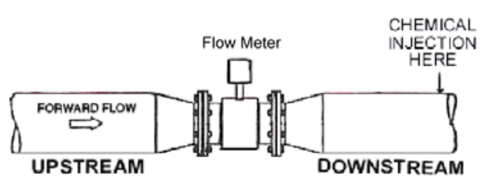


Figure 11: Chemical injection point downstream of meter

Sometimes, due to circumstances, it is difficult to specify the exact downstream placement distances. Contact Badger Meter Technical Support to review your application if necessary.

Partially-Filled Pipe Situations

In some locations, the process pipe may be momentarily only partially filled. Examples include: lack of back pressure, insufficient line pressure and gravity flow applications.

To eliminate these situations:

- Do not install the meter at the highest point of the pipeline.
- Do not install the meter in a vertical, downward flow section of pipe.
- Always position the ON/OFF valves on the downstream side of the meter.

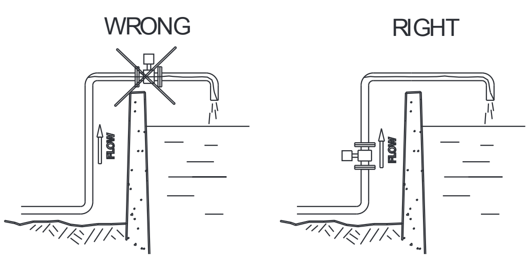
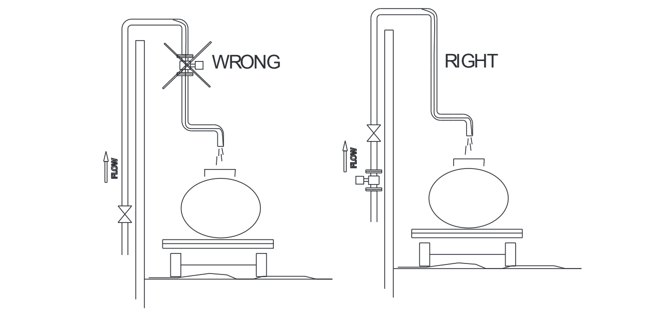


Figure 12: Incorrect meter placement



Do not install in a vertical, downward position.

Position "On/Off" valves on downstream side.

Figure 13: Position valves on downstream side

To minimize the possibility of partially-full pipe flows in horizontal, gravity or low pressure applications, create a pipe arrangement that ensures the detector remains full of liquid at all times.

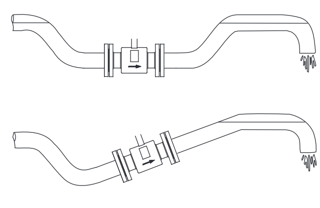


Figure 14: Pipe positioned to keep water in detector

METER GASKETS AND GROUNDING

Gasket and grounding requirements must be considered when determining the meter location, orientation and application.

Meter/Pipeline Connection Gaskets

You must install gaskets (not provided) between the detector's isolating liner and the pipeline flange to ensure a proper and secure hydraulic seal. Use gaskets that are compatible with the fluid. Center each gasket on the flange to avoid flow restrictions or turbulence in the line.

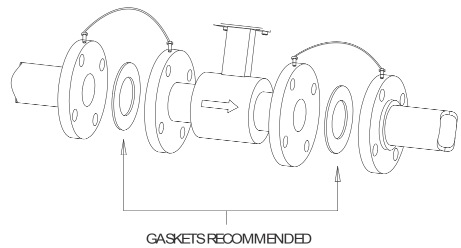


Figure 15: Meter/pipeline connection gaskets

During installation, do not use graphite or any electrically conductive sealing compound to hold the gaskets. This could compromise the accuracy of the measuring signal.

If you are using a grounding ring in the detector/pipeline connection, place the ring between two gaskets. (See *"Non-Conductive Pipe Grounding" on page 13*.)

Meter Grounding

Process pipeline material can be either electrically conductive (metal) or not electrically conductive (made of or lined with PVC, fiberglass or concrete).

IMPORTANT

It is essential that the mag meter amplifier's input ground (zero voltage reference) be electrically connected to the liquid media and to a good, solid earth ground reference.

Conductive Pipe Grounding

To achieve an adequate ground, the meter body MUST be electrically connected to the liquid media. The mag meter flanges are provided with grounding bolts for this purpose.

If the pipe material is electrically conductive, simply install grounding straps between these grounding bolts and the mating flanges.

To ensure a good electrical connection at the mating flanges, we recommend that you drill and tap the flanges and install a grounding screw (not provided).

These grounding straps must be copper wire, at least 12 AWG size. They must be connected on both sides (inlet and outlet) of the detector and to a local, earth ground.

Non-Conductive Pipe Grounding

IMPORTANT

If the process pipe is not electrically conductive (PVC, fiberglass, cement-lined pipes or any other non-conductive material) and the meter was not originally ordered with an optional grounding electrode, you must install a pair of grounding rings between the mating flanges at both ends of the meter. See the following illustration.

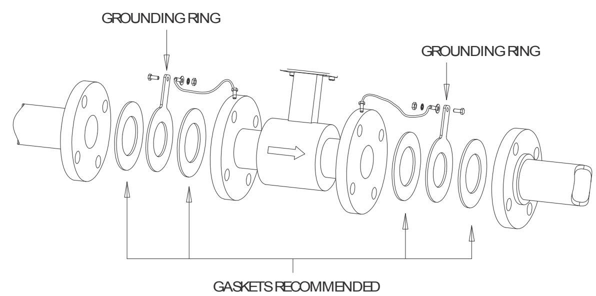


Figure 16: Non-conductive pipe grounding

In this case, the grounding straps should be connected to both of the grounding rings and to a good, solid earth ground. Grounding rings are available in stainless steel. If your fluid is too aggressive for stainless steel, order a meter with the optional grounding electrode in a material compatible with the fluid.

AMPLIFIER MOUNTING CONFIGURATION OPTIONS

There are two configuration options for mounting the amplifier. There are many options to accommodate a variety of meter-placement and environmental conditions.

Meter Mount Configuration

The meter mount configuration has the amplifier mounted directly on the detector. This compact, self-contained configuration minimizes installation wiring.

Remote Mount Configuration

The remote mount configuration places the amplifier at a location away from the fluid flow and detector. This is necessary in situations where process fluid temperature or the environment exceeds amplifier ratings.

The detector and amplifier are connected by wires, run through conduit, between junction boxes on the detector and the amplifier. The distance between the detector junction box and amplifier junction box can be up to 500 feet (152 meters). A remote mounting bracket is supplied.

Submersible Option

If you are installing the meter in a vault, you should order the remote amplifier option. You must not install the amplifier inside a vault. We also recommend ordering the remote meter package with the submersible option (NEMA 6P). This will eliminate any potential problems resulting from humidity or temporary flooding in the vault.

NOTE: The National Electronics Manufacturer's Association (NEMA) 6P enclosures are constructed for indoor or outdoor use to provide protection against access to hazardous parts; to provide a degree of protection against ingress of solid foreign objects and water (hose directed water and the entry of water during prolonged submersion at a limited depth); that provide an additional level of protection against corrosion and that will be undamaged by the external formation of ice on the enclosure.

WIRING

Wiring Safety

⚠WARNING

AT INSTALLATION, BE SURE TO COMPLY WITH THE FOLLOWING REQUIREMENTS:

- Disconnect power to the unit before attempting any connection or service to the unit.
- Do not bundle or route signal lines with power lines.
- Keep all lines as short as possible.
- Use twisted pair shielded wire for all output wiring.
- Observe all applicable, local electrical codes.

Opening the M2000 Cover

The M2000 amplifier's design lets you open the cover without completely removing it.

⚠WARNING

COVER IS ATTACHED WITH DISPLAY RIBBON CABLE.

To open the cover you will need a blade screwdriver.

Follow these steps:

1. Disconnect power to the unit.
2. Completely remove the two screws from either the left or the right side of the amplifier.
3. Loosen each of the remaining screws so that the round head of the screw clears the top edge of the cover.
4. Lift and pivot the cover into the open position.

Power Connections

External Disconnect

⚠CAUTION

- Install an external disconnect switch or circuit breaker that meets local standards.
- Position the M2000 in an accessible location.
- Position and identify the disconnect device so as to provide safe and easy operation.
- Label the disconnect device as being for the mag meter.

AC Power Wiring

For the AC power connections, use three wire-sheathed cable with an overall cable diameter of 0.2…0.45 inch (5…12 mm). For signal output, use 18…22 gauge (0.25…0.75 mm^2) shielded wire. Overall cable diameter between 0.12…0.35 inch (3…9 mm).

⚠CAUTION

TO PREVENT ACCIDENTS, CONNECT MAIN POWER ONLY AFTER ALL OTHER WIRING HAS BEEN COMPLETED.

The amplifier is a microprocessor device. It is important that the power supply be as "clean" as possible. Avoid using power lines that feed heavy loads: pumps, motors, *etc*. If dedicated lines are not available, a filtering or isolation system may be required.

Power wiring is the same for meter mount and remote mount amplifiers.

Remote Mount Installation

If you are installing the M2000 amplifier in a remote location, review the procedures in this section.

Mount Bracket to Amplifier

1. Align bracket-mounting holes with amplifier mounting holes.
2. Attach bracket to amplifier with supplied screws. Torque screws to 80 inch pounds.

Wiring Configuration

Wiring between the detector and the M2000 amplifier comes complete from the factory. If your installation requires the use of conduit, we recommend that you follow these steps when wiring the detector to the amplifier.

1. Remove the junction box lid. Carefully remove the wires connected to the terminal blocks that run to the M2000 amplifier. See the chart below for a reference of wire color to terminal connection.
2. Run cable through the conduit from the amplifier location while retaining the wiring of the cable to the amplifier, as supplied.
3. Complete conduit assembly on both ends and rewire the cable into the junction box as it was previously wired.

Wiring for Remote Configuration

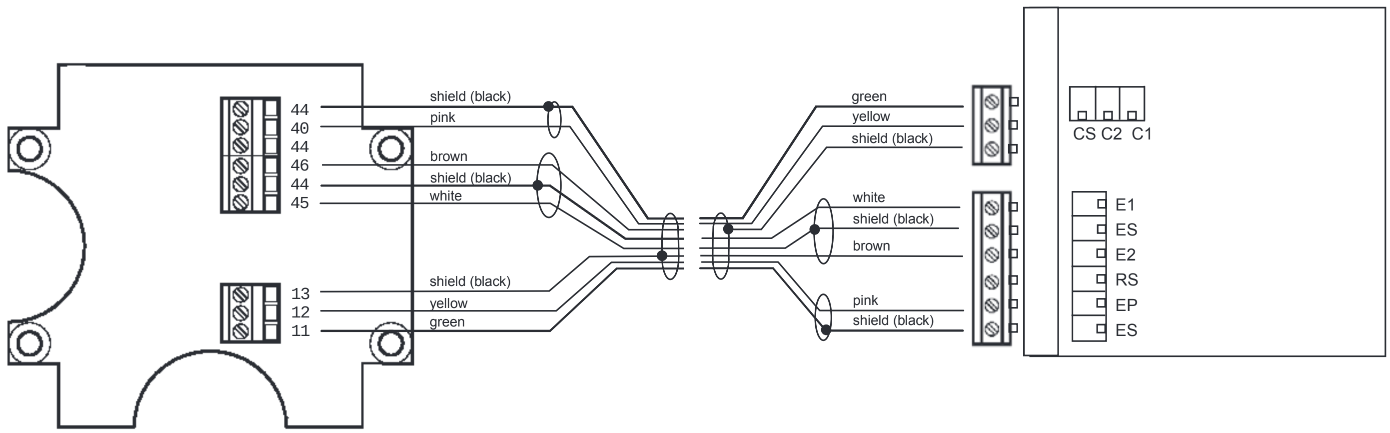


Figure 17: Wiring for remote configuration

Remote style M2000 amplifier models can be ordered with standard cables measuring 15, 30, 50,100 and 150 feet. In addition, cables up to 500 feet are available.

Junction Box			Amplifier
Connection No.	**Description**	**Wire Color**	**Connection**
11	Coil	Green	C1
12	Coil	Yellow	C2
13	Main Shield	Black (Red Ferrule)	CS
45	Electrode	White	E1
44*	Electrode Shield	Black	ES
46	Electrode	Brown	E2
40	**Empty Pipe**	Pink	EP
44*	**Empty Pipe Shield**	Black	ES

*Connections with the No. 44 are lying on the same potential.

Empty Pipe Detection Considerations

Take into account the following cable length and conductivity requirements, if you will be using empty pipe detection.

Cable Length (Feet)	Minimum Conductivity Required (µS/cm)
0*	5
100	20
500	100

*** Meter Mount**

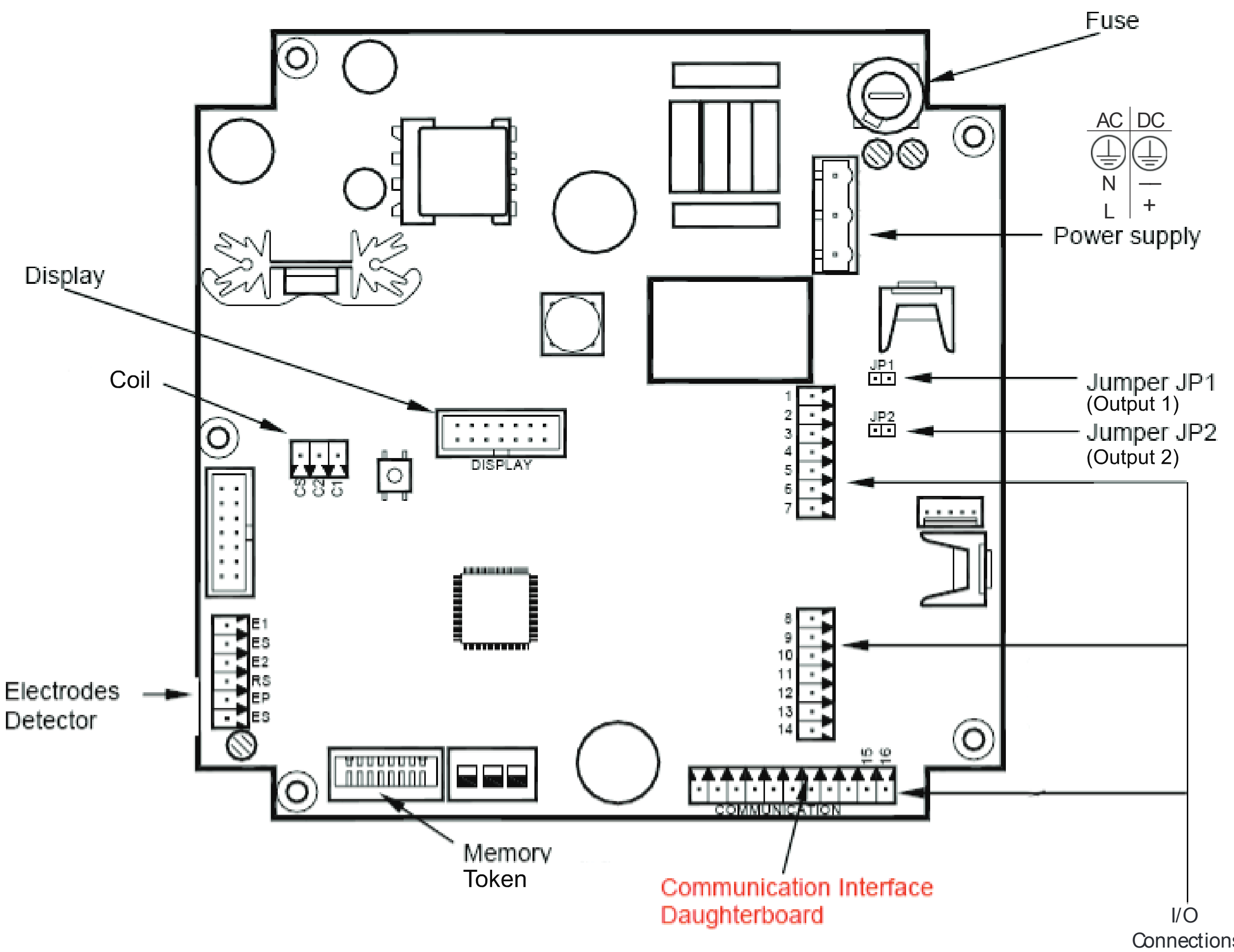
CONFIGURING INPUT/OUTPUT (I/O)

This section describes wiring the following M2000 inputs/outputs:

- Analog output
- Digital input
- Digital outputs
- Communication

Once the sensor and the amplifier have been wired, wire any inputs and outputs to the M2000 amplifier.

Do not connect the main power connection until you have made all other wiring connections. Follow all of the safety precautions and local code to prevent electrical shock and damage to the electronic components.



Supported protocols include:
RS485 MODBUS RTU
PROFIBUS DP
HART

Figure 18: Configuring input/output

Input/Output	Description	Terminal
Analog Output	0…20 mA Resistive Load < 800 ohms 4…20 mA Resistive Load < 800 ohms 0…10 mA Resistive Load < 800 ohms 2…10 mA Resistive Load < 800 ohms	16 (+) 15 (–)
Digital Output 1	Passive max. 30V DC, 100 mA Active 24V DC, 50 mA (set Jumper JP1) Max. Frequency 10 kHz	1 (+) and 2 (–)
Digital Output 2	Passive max. 30V DC, 100 mA Active 24V DC, 50 mA (set Jumper JP2) Max. Frequency 10 kHz	3 (+) and 4 (–)
Digital Output 3	Passive Max 30V DC, 100 mA, 10 kHz Solid State Relay 48V AC, 500 mA, 1 kHz * Software configurable	10 (+) and 9 (–) 10 (+) and 11 (–)
Digital Output 4	Passive Max 30V DC, 100 mA, 10 kHz Solid State Relay 48V AC, 500 mA, 1 kHz * Software configurable	13 (+) and 12 (–) 13 (+) and 14 (–)
Digital Input	5…30V DC	8 (+) and 9 (–)
Communications (Port A)	RS232, configurable, MODBUS RTU, Remote Menu, or Primo 3.1 Emulation.	7 GND 6 Rx 5 Tx

Analog Output Wiring Diagram

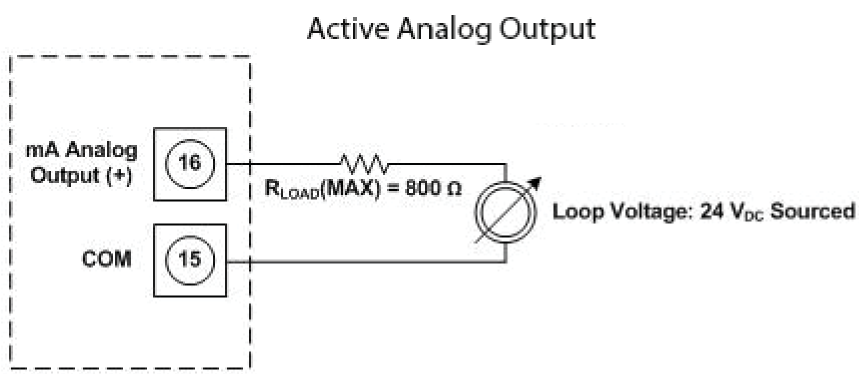
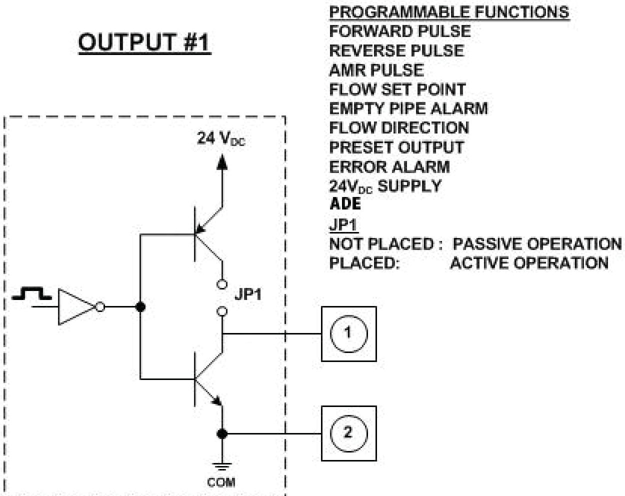
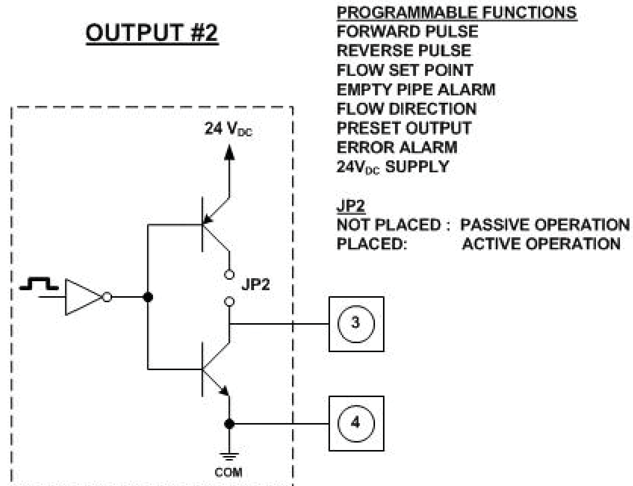
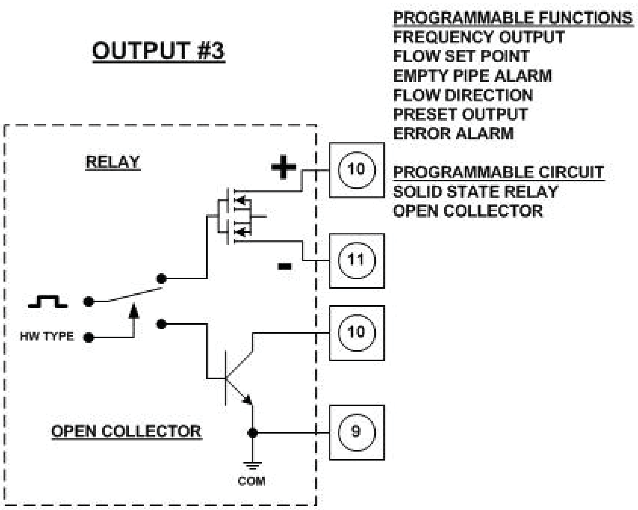


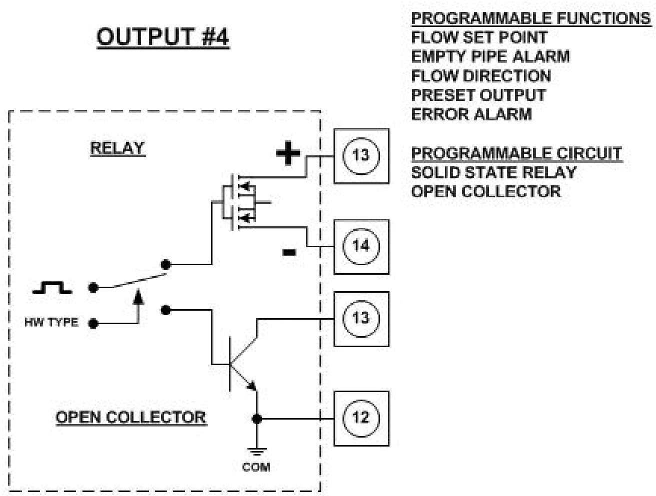
Figure 19: Analog output wiring diagram

Digital Output Wiring Diagrams

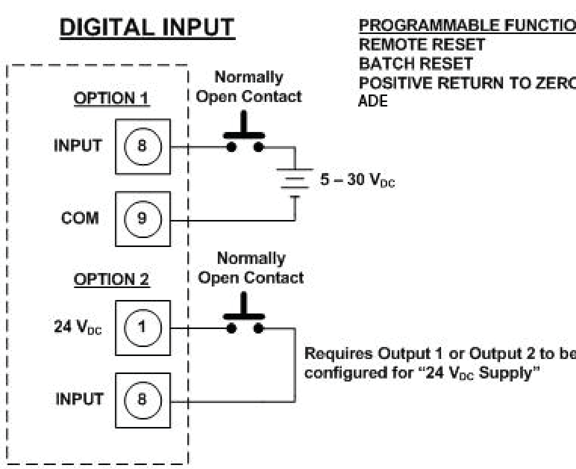








Digital Input Wiring Diagram



PROGRAMMING THE M2000

The M2000 amplifier comes preprogrammed from the factory. Typically, you will not need to do any additional programming. However, to take advantage of special features, you can program the meter for your specific needs. If you will be programming the meter, familiarize yourself with the M2000 Function Buttons and follow the procedures outlined below.

Displays

There are two types of displays on the M2000:

- Menu Selection
- Numeric Entry

Menu Selection Display

Menu selection displays will appear in the following format:

```
DISPLAY TITLE
>Menu Selection 1
 Menu Selection 2
DIRECTIONS LINE
```

Display format

```
START MENU
>Exit this Menu
 Main Menu
MORE: ↑,↓     ENTER:>
```

Example menu

The top line shows the title of the display screen. Below that are two visible menu selections. The bottom line provides directions for user input.

Typically, a menu contains more options than will fit in the two menu selection lines. Press the **[↑]** and **[↓]** buttons to scroll the display text up and down one line at a time. When the arrow is pointed to your desired menu option, press **[E]** to select the item and open its display.

Numeric Entry Display

Numeric entry displays will appear in the following format:

```
DISPLAY TITLE
   Description Line
    Numeric Value
DIRECTIONS LINE
```

Display format

```
LOW FLOW CUTOFF
 % of    300.000 GPM
      2.00%
CHG: +,-      NEXT:E
```

Example numeric entry display

The top line shows the title of the display screen. The second line is a description of the value. The third line shows the current value. The bottom line provides directions for user input.

NOTE: The bottom line of a numeric-value display provides prompts regarding the function of each button. The [+] or [–] button will change the value of the numeral. The [E] button will move the cursor one digit to the right. When the cursor is at the final, right-most digit, pressing [E] will reposition the cursor at the left-most digit. The bottom line display will change to reflect the new function of the [E] button. Press [E] to save the current entry. Press [+] to edit the current entry.

```
LOW FLOW CUTOFF
 % of    300.000 GPM
       3.00%
EDIT:+        SAVE:E
```

Details on how to change and set numeric values are described in the following section.

Function Buttons

All M2000 programming is accomplished using the three function buttons located on the front of the amplifier:

NOTE: Throughout this manual, the buttons will be referred to as: [↑] or [+] and [↓] or [–], depending on the context. The "Enter" button will be referred to as [E].

 Consider the **[+ | ↑]** button as the "next step" or "scroll text up" button. During programming, pressing this button will go to the next menu selection, or increment a numeral.

Example 1: The illustration below shows the M2000 *Main Menu*. The selection arrow is pointing to the Exit this Menu selection.

To scroll up to the menu's next selection, press **[↑]** once. The menu text scrolls up to the next menu selection, *Main Menu*.

```
START MENU
>Exit this Menu
 Main Menu
MORE: ↑,↓      ENTER:>
```

Press [↑]

```
START MENU
> Main Menu
  Quick Setup
MORE: ↑,↓      ENTER:>
```

Example 2: Some procedures require you to enter a numeric value. The [+] button is used to increment the selected numeral. The illustration below shows the *Low Flow Cutoff* parameter display. Notice the cursor under the 2 in the ones' place. In this case, press **[+]** once to increment the numeral to the value of 3.00%.

```
LOW FLOW CUTOFF
 % of    300.000 GPM
       2.00%
CHG: +,-      NEXT:E
```

Press [+]

```
LOW FLOW CUTOFF
 % of    300.000 GPM
       3.00%
CHG: +,-      NEXT:E
```


Consider the Down Arrow [– | ↓] button as the "previous step" button. During a procedure, pressing this button will go to the menu's previous selection or decrement a numeral.

Example 1: The illustration below shows the M2000 *Main Menu*. The selection arrow is pointing to the Meter Setup selection. To scroll the text down to the menu's previous selection, Exit this Menu (which is not visible on the display), press **[↓]** once.

```
MAIN MENU
>Meter Setup
 Measurements
MORE: ↑,↓      ENTER:>
```

Press [↓]

```
MAIN MENU
>Exit this Menu
 Meter Setup
MORE: ↑,↓      ENTER:>
```

Example 2: For procedures that require you to enter a numeric value, the [-] button is used to decrement the selected numeral. The illustration below shows the *Low Flow Cutoff* parameter display. Notice the cursor under the 3 in the ones' place. In this case, press the **[-]** once to decrement the numeral to the value of 2.00 %.

```
LOW FLOW CUTOFF
 % of    300.000 GPM
        3.00%
CHG: +,-       NEXT:E
```

Press [–]

```
LOW FLOW CUTOFF
 % of    300.000 GPM
        2.00%
CHG: +,-       NEXT:E
```


The [E] button functions as an "Enter" button, or "cursor right" button.

Example 1: The illustration below shows the M2000 *Main Menu*. The selection arrow is pointing to the Meter Setup selection. Press **[E]** to select Meter Setup, and open the *Meter Setup* display.

```
MAIN MENU
>Meter Setup
 Measurements
MORE: ↑,↓      ENTER:>
```

Press [E]

```
METER SETUP
>Exit this Menu
 Scale Factor
MORE:↑,↓      ENTER:>
```

In cases where you are entering a numeric value, the [E] button does not function as the "Enter" button, but rather, will move the cursor to the right. When the cursor is at the right-most position, the [E] will now serve as the Enter key.

Example 2: The illustration below shows the *Low Flow Cutoff* display. The cursor is under the 3 in the ones' place. In this case, press **[E]** to move the cursor to the right one digit.

```
LOW FLOW CUTOFF
 % of    300.000 GPM
        3.00%
CHG: +,-       NEXT:E
```

Press [E]

```
LOW FLOW CUTOFF
 % of    300.000 GPM
        3.00%
CHG: +,-       NEXT:E
```

SECURITY

The M2000 security feature gives you the option to restrict access to the meter by way of a five-digit Personal Identification Number (PIN). The system administrator can set up a single PIN for each of the three different levels of access:

- **Administration** – allows access to all M2000 menu configuration screens.
- **Service** – allows access to service-level and user-level menu configuration screens.
- **User** – allows access only to user-level menu configuration screens.

Not all levels of access need to be set. If no PINs are set up, any M2000 user will have access to all functions.

NOTE: The security settings will also apply to remote access. All remote writes to the meter will be blocked unless the user is remotely logged in.

Setting the Administration PIN

Users logged in with the Administration PIN have access to all M2000 menu configuration screens.

To set the administrator's PIN, follow these steps from the *Advanced* menu:

1. Select **Security** to view the *Security* menu.
2. Select **Set Admin PIN** to view the *Admin PIN* display.
3. Set the five-digit PIN number to the desired value.
4. Press **[E]** to save the PIN and to return to the *Security* menu.

Setting the Service PIN

Users logged in with the Service PIN have access to service level menu configuration screens. Service users will not have access to administrative screens.

NOTE: In order to set a service-level PIN, you must first set up an administration PIN.

To set the service PIN, follow these steps from the *Advanced* menu:

1. Select **Security** to view the *Security* menu.
2. Select **Set Service PIN** to view the *Service PIN* display.
3. Set the five-digit PIN number to the desired value.
4. Press **[E]** to save the PIN and to return to the *Security* menu.

Setting the User PIN

Users logged in with this User PIN have access to user-level procedures. Users will not have access to administrative or service screens.

NOTE: In order to set a user-level PIN, you must first set up an administration PIN and a service PIN.

To set the user's PIN, follow these steps from the *Advanced* menu:

1. Select **Security** to view the *Security* menu.
2. Select **Set User PIN** to view the *User PIN* display.
3. Set the five-digit PIN number to the desired value.
4. Press **[E]** to save the PIN and to return to the *Security* menu.

Entering Your Personal Identification Number (PIN)

If your system has been set up with PIN security, you will need to enter a PIN to access programming functions. There are three possible access levels, each with its own unique PIN: User, Service and Administration. Your system administrator will provide you with the appropriate PIN.

NOTE: All PINs are factory set to 00000. At this setting, you will not be required to enter a PIN. If the system administrator has not set the PIN, pressing [E] from the *Start Screen* opens the *Main Menu*.
If you forget or misplace your PIN, call Badger Meter Customer Service to get a master password. When you call, have the security code that appears in the upper right corner of the *PIN Request* display.

Follow these steps to enter your PIN in the M2000:

1. At the *Main Menu*, press **[E]**. The *PIN Request* display opens.

```
PIN REQUEST    12345
 Please enter
    pin #:  00000
CHG:+,-       NEXT:E
```

Security Code

2. Press **[+]** to increment the numeral.
3. Press **[E]** to move the cursor to the next digit.
4. Repeat the steps to set each of the five digits to match your PIN.
5. Press **[E].** If you entered a valid PIN, the *Main Menu* opens indicating your level of access.

   If you entered the wrong PIN, you will see the following display:

```
    MENU ACCESS
      DENIED
```

- Press **[E]** to return to the *PIN Request* display.
- Repeat Steps 1 through 5.

NOTE: Be sure to log off when you have completed work with the M2000. Otherwise, there will be a five-minute delay between your last activity and the time when the M2000 will automatically log you off.

SETTING UP THE M2000 WITH QUICK SETUP

The M2000 provides you with a Quick Setup utility that allows you to set or change your Flow Units, Totalizer Units, Full Scale Flow and Low Flow Cutoff settings. To open the Quick Setup, select **Quick Setup** from the *Start Menu*.

Quick Setup

Flow Unit
[GPM]

Flow Unit lets you set the unit of measure for the flow rate and full scale flow.

To change the Flow Unit value, follow these steps from the *Quick Setup* menu.

1. Select **Flow Unit** to view the *Flow Unit* display.
2. Press **[↑]** or **[↓]** to position the arrow next to one of the following Flow Units:

Code	Flow Unit	Code	Flow Unit
LPS	Liters/Second	GPM	Gallons/Minute
LPM	Liters/Minute	GPH	Gallons/Hour
LPH	Liters/Hour	MGD	Mega Gallons/Day
M^3S	Cubic Meters/Second	IGS	UKG/Second
M^3M	Cubic Meters/Minute	IGM	UKG/Minute
M^3H	Cubic Meters/Hour	IGH	UKG/Hour
F^3S	Cubic Feet/Second	LbM	Pounds/Minute
F^3M	Cubic Feet/Minute	OPM	Ounces/Minute
F^3H	Cubic Feet/Hour	BPM	Barrels/Minute
GPS	Gallons/Second		

3. Press **[E]** to save the Flow Units setting.

Totalizer Unit
[USG]

Totalizer Unit establishes the units of measure for the totalizers.

To change the Totalizer Unit value, follow these steps from the *Totalizer Unit* display.

1. Press **[↑]** or **[↓]** to position the arrow next to one of the following Totalizer Units:

Code	Totalizer Unit	Code	Totalizer Unit
L	Liter	UKG	Imperial Gallon
HL	Hectoliter	Lb	Pound
M^3	Cubic Meter	Oz	Fluid Ounce
CFt	Cubic Feet	Aft	Acre Feet
USG	U.S. Gallon	BBL	Barrel
MG	Mega Gallon		

2. Press **[E]** to save the Totalizer Units setting.

<table>
<tr><th colspan="2">Quick Setup</th></tr>
<tr><td>Full Scale Flow</td><td>Full Scale Flow sets the maximum flow the system is expected to measure. This parameter has influence on other system parameters. These parameters include:
• Frequency Output – Full scale frequency is observed at full scale flow
• Low Flow Cutoff – Changes to full scale flow affect the measuring cut-off threshold of the meter
• Alarm Outputs – Changes to full scale flow adjusts the thresholds for generating set point alarms
• Pulse Outputs – Changes to full scale flow adjusts the pulse frequency and duty cycle
• Analog Outputs – Changes to full scale flow adjusts the interpretation of the analog output signal
Change the full scale flow based on the meter size and the application's requirements. Verify that the full scale flow falls within the meter's suggested flow range limits. In terms of flow velocity, the meter's limits are from 0.1 to 39.4 feet/second.
The full scale flow is valid for both flow directions.
NOTE: If the flow rate exceeds the full scale setting, an error message indicates that the configured full scale range has been exceeded. However, the meter will continue to measure. This will affect the latency of the pulse outputs and possibly cause overflow. Furthermore, the analog output may also be placed in alarm mode.
To set or change the Full Scale Flow, follow these steps from the Quick Setup menu:
1. Select Full Scale Flow to view the Full Scale Flow display.
2. Set the full scale flow value to the desired setting.
3. Press [E] to save the full scale flow value and return to the Measurements menu.</td></tr>
<tr><td>Low Flow Cutoff</td><td>Low Flow Cutoff defines the threshold at which flow measurement will be forced to zero. The cutoff value can be set from 0% to 10% of the full scale flow. Increasing this threshold will help prevent false readings during "no flow" conditions possibly caused by pipe vibration or inherent system noise.
To change Low Flow Cutoff, follow these steps from the Low Flow Cutoff display.
1. Set the Low Flow Cutoff value to the desired setting, between 0% and 10%.
2. Press [E] to save the value.</td></tr>
</table>

QUICK REFERENCE

- Main Menu
  - Meter Setup
    - Scale Factor
    - Empty Pipe Detect
    - Power Line Freq
    - Excitation Freq
    - Pipe Diameter
    - Detector Factor
    - Detector Offset
  - Measurements
    - Velocity Unit
    - Flow Unit
    - Totalizer Unit
    - Full Scale Flow
    - Low Flow Cutoff
    - Flow Direction
    - Damping Factor
  - Inputs/Outputs
    - Analog Output
    - Digital Input 1
    - Digital Output 1
    - Digital Output 2
    - Digital Output 3
    - Digital Output 4
    - Flow Simulation
  - Clear Totals
    - T1
    - T2
    - T+
    - T–
    - TN
    - PS
    - Tpwroff
  - Communications
    - Port A Settings
    - Port B Settings
    - Diagnostics
  - Advanced
    - Data Logger
    - Token Copy
    - ADE
    - Unit Multiplier
    - Backlight Control
    - Analog Calibrate
    - Software Filter
    - Empty Pipe Cal.
    - Security
  - Info/Help
    - Error Counts
    - Rollover Counts
    - Power Up Counter
    - Power Off Totalizer
    - Version Info
    - Serial Number
    - Meter Tag Name
    - Daughterboard Info
    - Polarization Volt
    - Restore Defaults
  - Language Select
    - English
    - Espanol

USING THE M2000 MAIN MENU PROGRAMMING OPTIONS

The following M2000 programming options are available from the *Main Menu*:

- *Meter Setup*
- *Measurements*
- *Inputs/Outputs*
- *Clear Totals*
- *Communications*
- *Advanced*
- *Info/Help*
- *Language Select*

In the section that follows, the applicable security level for each menu option is indicated as follows:

A	S	U
Administrative	Service	User

Options that can be set at *Quick Setup* are indicated with:

The factory default values are shown, enclosed in brackets.

NOTE: Options that are listed [Factory Set] should not be changed without specific directions from authorized Badger Meter personnel.

Meter Setup	
Scale Factor [0.0%] S	Changing the scale factor lets you adjust the meter's accuracy without disturbing factory-set parameters. You can tune the meter to meet changing application requirements. For example, if the meter is under registering by 0.5 percent then set the scale factor to +0.5%. If the meter is over registering by 0.5 percent then set the scale factor to –0.5%. To set the Scale Factor, follow these steps from the *Meter Setup* menu: 1. Select **Scale Factor**, to open the *Scale Factor* display. 2. Set the Scale Factor value to the desired setting. 3. Press **[E]**, to save the new value and return to the *Meter Setup* menu.
Empty Pipe Detect [Off] S	When set to On, Empty Pipe Detect indicates to the outputs and the display that the meter is not completely filled. When set to Off, empty pipe detect is disabled. Enabling empty pipe detect requires a one-time calibration. Calibration is described in the *Advanced* menu section under Empty Pipe Cal. To set Empty Pipe Detect, follow these steps from the *Meter Setup* menu: 1. Select **Empty Pipe Detect** to view the *Empty Pipe Detect* display. 2. Position the arrow next to **On** or **Off**. 3. Press **[E]** to save the Empty Pipe Detect On or Off and return to the *Meter Setup* menu.

<table>
<tr><th colspan="2">Meter Setup</th></tr>
<tr><td>Power Line Freq
[60 Hz]</td><td>Power Line Freq provides measuring immunity to industrial noise from a power supply feed.
To set Power Line Frequency, follow these steps from the Meter Setup menu:
1. Select Power Line Freq to view the Power Line Frequency display.
2. Position the arrow next to 50 Hz or 60 Hz.
3. Press [E] to save the power line frequency and return to the Meter Setup menu.</td></tr>
<tr><td>Excitation Freq
[Factory Set]</td><td>The Excitation Freq parameter is set at the factory. You can change Excitation Freq to configure the DC excitation of the coils. Supported frequencies are dependent on the configured power line frequency:
<table><tr><th>50 Hz</th><th>60 Hz</th></tr><tr><td>1 Hz</td><td>1 Hz</td></tr><tr><td>3.125 Hz</td><td>3.75 Hz</td></tr><tr><td>6.25 Hz</td><td>7.5 Hz</td></tr><tr><td>12.5 Hz</td><td>15 Hz</td></tr></table>To change Excitation Frequency, follow these steps from the Meter Setup menu:
1. Select Excitation Freq to view the Excitation Frequency display.
2. Position the arrow next the desired frequency.
3. Press [E] to save the excitation frequency and return to the Meter Setup menu.</td></tr>
<tr><td>Pipe Diameter
[Factory Set]</td><td>The Pipe Diameter parameter is set at the factory. In the event the amplifier is replaced, verify that the pipe diameter matches the installed pipe size.
To change Pipe Diameter, follow these steps from the Meter Setup menu:
1. Select Pipe Diameter to open the Pipe Diameter display.
2. Position the arrow next to one of the pipe diameters.
3. Press [E] to save the pipe diameter and return to the Meter Setup menu.</td></tr>
<tr><td>Detector Factor
[Factory Set]</td><td>The Detector Factor parameter is set at the factory. This factor compensates for accuracy error as a result of the installed detector. If accuracy adjustment of the meter is required, please refer to the scale factor.
In the event the amplifier is replaced, this parameter must be reprogrammed with the original detector factor.</td></tr>
<tr><td>Detector Offset
[Factory Set]</td><td>The Detector Offset parameter is set at the factory. This parameter compensates for accuracy error as a result of the installed detector. If accuracy adjustment of the meter is required, please refer to the scale factor.</td></tr>
</table>

<table>
<tr><th colspan="2">Measurements</th></tr>
<tr><td>Velocity Units
[???]</td><td>Velocity Units lets you set the …</td></tr>
<tr><td>Flow Units
[GPM]</td><td>Flow Units lets you set the unit of measure for the flow rate and full scale flow. Changing the flow units parameter readjusts the full scale flow parameter. For example, changing from gpm to gps would change the full scale flow from 60 gpm to 1 gps.
To change the Flow Unit, follow these steps from the Measurements menu:
1. Select Flow Units to view the Flow Units display.
2. Position the arrow next to one of the following flow unit options:
<table>
<tr><td>Code</td><td>Flow Unit</td><td>Code</td><td>Flow Unit</td></tr>
<tr><td>LPS</td><td>Liters/Second</td><td>GPM</td><td>Gallons/Minute</td></tr>
<tr><td>LPM</td><td>Liters/Minute</td><td>GPH</td><td>Gallons/Hour</td></tr>
<tr><td>LPH</td><td>Liters/Hour</td><td>MGD</td><td>Mega Gallons/Day</td></tr>
<tr><td>M^3S</td><td>Cubic Meters/Second</td><td>IGS</td><td>UKG/Second</td></tr>
<tr><td>M^3M</td><td>Cubic Meters/Minute</td><td>IGM</td><td>UKG/Minute</td></tr>
<tr><td>M^3H</td><td>Cubic Meters/Hour</td><td>IGH</td><td>UKG/Hour</td></tr>
<tr><td>F^3S</td><td>Cubic Feet/Second</td><td>LbM</td><td>Pounds/Minute</td></tr>
<tr><td>F^3M</td><td>Cubic Feet/Minute</td><td>OPM</td><td>Ounces/Minute</td></tr>
<tr><td>F^3H</td><td>Cubic Feet/Hour</td><td>BPM</td><td>Barrels/Minute</td></tr>
<tr><td>GPS</td><td>Gallons/Second</td><td></td><td></td></tr>
</table>
3. Press [E] to save the flow units and return to the Measurements menu.</td></tr>
</table>

<table>
<tr><th colspan="2">Measurements</th></tr>
<tr><td>Totalizer Unit
[USG]</td><td>
The Totalizer Unit parameter establishes the units of measure for the totalizers.
To change the Totalizer Unit value, follow these steps from the Measurements menu:

Select Totalizer Unit to view the Totalizer Unit display.
Position the arrow next to one of the following totalizer units:

<table>
<tr><td>Code</td><td>Totalizer Unit</td></tr>
<tr><td>L</td><td>Liters</td></tr>
<tr><td>HL</td><td>Hectoliters</td></tr>
<tr><td>M^3</td><td>Cubic Meters</td></tr>
<tr><td>CFt</td><td>Cubic Feet</td></tr>
<tr><td>USG</td><td>U.S. Gallons</td></tr>
<tr><td>MG</td><td>Mega Gallons</td></tr>
</table>
<table>
<tr><td>Code</td><td>Totalizer Unit</td></tr>
<tr><td>UKG</td><td>Imperial Gallons</td></tr>
<tr><td>Lb</td><td>Pounds</td></tr>
<tr><td>Oz</td><td>Fluid Ounces</td></tr>
<tr><td>Aft</td><td>Acre Feet</td></tr>
<tr><td>BBL</td><td>Barrels</td></tr>
</table>
<ol start="3">
Press [E] to save the totalizer unit and return to the Measurements menu.

</td></tr>
<tr><td>Full Scale Flow
[Factory Set]</td><td>
The Full Scale Flow parameter sets the maximum flow the system is expected to measure. This parameter has influence on other system parameters. These parameters include:

Frequency Output – Full scale frequency is observed at full scale flow
Low Flow Cutoff – Changes to full scale flow affect the measuring cut-off threshold of the meter
Alarm Outputs – Changes to full scale flow adjusts the thresholds for generating set point alarms
Pulse Outputs – Changes to full scale flow adjusts the pulse frequency and duty cycle
Analog Outputs – Changes to full scale flow adjusts the interpretation of the analog output signal

Change the full scale flow based on the meter size and the application's requirements. Verify that the full scale flow falls within the meter's suggested flow range limits. In terms of flow velocity, the meter's limits are from 0.1…39.4 feet/second.
The full scale flow is valid for both flow directions.
NOTE: If the flow rate exceeds the full scale setting, an error message indicates that the configured full scale range has been exceeded. However, the meter will continue to measure. This will affect the latency of the pulse outputs and possibly cause overflow. Furthermore, the analog output may also be placed in alarm mode.
To change the Full Scale Flow, follow these steps from the Measurements menu:

Select Full Scale Flow to view the Full Scale Flow display.
Set the full scale flow value to the desired setting.
Press [E] to save the full scale flow value and return to the Measurements menu.

</td></tr>
</table>

Measurements	
Low Flow Cutoff [0.2%]	Low flow cutoff defines the threshold at which flow measurement will be forced to zero. The cutoff value can be set from 0% to 10% of the full scale flow. Increasing this threshold will help prevent false readings during “no flow” conditions possibly caused by pipe vibration or inherent system noise. To change the Low Flow Cutoff value, follow these steps from the *Measurements* menu: 1. Select **Low Flow Cutoff** to view the *Low Flow Cutoff* display. 2. Set the low flow cutoff value to the desired setting. 3. Press **[E]** to save the new low flow cutoff value.
Flow Direction [Bi-Directional]	Flow Direction lets you set the meter to measure forward flow only (uni-directional) or both forward and reverse flow (bi-directional). **Uni-Directional** Flow is totalized in only one direction. The flow direction is indicated by the arrow printed on the detector label. Uni-directional measurements on the main display screen include: • T1: Registers forward flow, resettable by menu or MODBUS RTU • T2: Registers forward flow, resettable by menu, MODBUS RTU, or digital input configured for Remote Reset **Bi-Directional** Flow is totalized in both directions. Bi-directional measurements on the main display screen include: • T+: Registers forward flow, resettable by menu or MODBUS RTU • T–: Registers reverse flow, resettable by menu or MODBUS RTU • TN: Registers total flow, T+ – T–, resettable by menu or MODBUS RTU To change the flow direction follow these steps from the *Measurements* menu. 1. Select **Flow Direction** to view the *Flow Direction* display. 2. Select **Uni-Directional** or **Bi-Directional**. 3. Press **[E]** to save the flow direction and return to the *Measurements* menu.
Damping Factor [No Damping]	The damping factor establishes the stability of the measured flow rate. If back and forth oscillations of the flow rate are observed during normal flow conditions, increase this value incrementally until the flow rate stabilizes. This parameter has no affect on the totalizers. To change the Damping Factor value, follow these steps from the *Measurements* menu. 1. Select **Damping Factor** to view the *Damping Factor* display. 2. Select one of the following damping factors: 1 Second — 10 Seconds 2 Seconds — 20 Seconds 3 Seconds — 30 Seconds 4 Seconds — No Dampening 5 Seconds 3. Press **[E]** to save the damping factor and return to the *Measurements* menu.

<table>
<tr><th colspan="3">Inputs/Outputs</th></tr>
<tr><td rowspan="2">Analog Output</td><td>Range
[4 to 20 mA]</td><td>The Analog Output parameter establishes the range of the analog output signal. To change Analog Output range, follow these steps from the Inputs/Outputs menu:
1. Select Analog Output to view the Analog Output display.
2. Select one of the following options:
• 4 to 20 mA
• 0 to 20 mA
• 2 to 10 mA
• 0 to 10 mA
3. Press [E] to save the analog output and return to the Inputs/Outputs menu:</td></tr>
<tr><td>Alarm Mode
[OFF]</td><td>This parameter configures the behavior of the analog output during alarm conditions. Three options exist for this parameter: OFF, LOW, and HIGH.
OFF: Analog signal is based on flow rate and always within the configured range
LOW: During alarm conditions, the analog signal will be 2 mA less than the configured lower range
HIGH: During alarm conditions, the analog signal will be 2 mA more than the configured upper range
For example, if the analog range is 4 to 20 mA and the alarm mode is set to HIGH, then during a full scale flow alarm condition, the analog output current will be 22 mA.
To change the analog output alarm mode, follow these steps from the Inputs/Outputs menu:
1. Select Alarm Mode to view the Alarm Mode display.
2. Select one of the following options:
• OFF
• LOW
• HIGH
3. Press [E] to save the alarm mode and return to the Inputs/Outputs menu.</td></tr>
<tr><td>Digital Input</td><td colspan="2">Digital Input lets you configure the functional operation of the digital input. The following functions are supported:
• Remote Reset – Clears totalizer T2 (uni-directional)
• Batch Reset – Resets batch totalizer PS to preset amount and clears T2 (uni-directional)
• Pos Zero Return – Forces flow rate to zero (does not totalize)
• ADE – Input configured for ADE operation. See "ADE Interface" on page 50.
To change Digital Input, follow these steps from the Inputs/Outputs menu:
1. Select Digital Input to view the Digital Input display.
2. Select the desired function.
3. Press [E] to save the digital input and return to the Inputs/Outputs menu.</td></tr>
</table>

Inputs/Outputs		
Digital Output	Pulses/Unit [1]	The Pulses/Unit parameter lets you set how many pulses per unit of measure will be transmitted to remote applications. For example, assuming the unit of measure is gallons: • Setting the Pulses/Unit to 1 will transmit 1 pulse every gallon • Setting the Pulses/Unit to 0.01 will transmit 1 pulse every 100 gallons You must configure pulses/unit if the function of the selected output is to be forward, reverse or AMR pulse. This parameter must be considered with the Pulse Width and Full Scale Flow parameters. The maximum pulse frequency is 10 kHz. The frequency is correlated with the flow rate. Violation of output frequency limits will generate a configuration error. To change the pulses/unit, follow these steps from the *Inputs/Outputs* menu: 1. Select **Digital Output 1** or **2** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu select **Pulses/Unit**, and press **[E]** to open the *Pulses/Unit* display. 3. Enter the pulses/unit value. Press **[E]** to save the new parameter and return to the *Digital Output* menu.
	Pulse Width [0 ms]	The Pulse Width parameter establishes the On duration of the transmitted pulse. The configurable range is from 0 to 1000 ms. • Non-zero pulse width configuration – the Off duration of the transmitted pulse is dependent on flow rate. The Off duration is to be at least the configured On duration. At full scale flow, the On duration equals the Off duration. The maximum configurable output frequency is limited to 500 Hz. • 0 ms pulse width configuration – the duty cycle of the transmitted pulse is at 50 percent allowing for a maximum configurable output frequency of 10 kHz. This parameter must be considered with the Pulses/Unit and Full Scale Flow parameters. The maximum pulse frequency is 10 kHz. The frequency is correlated with the flow rate. Violation of output frequency limits will generate a configuration error. To change the pulse width, follow these steps from the *Inputs/Outputs* menu: 1. Select **Digital Output 1** or **2** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu select **Pulse Width**, and press **[E]** to open the *Pulse Width* display. 3. Enter the pulse width value. Press **[E]** to save the new parameter and return to the *Digital Output* menu.

Inputs/Outputs		
Digital Output	Preset Amount [0.0]	Preset amount lets you set the reset value for the associated PS totalizer when the digital input is set to Batch Reset. To change the preset amount, follow these steps from the *Inputs/Outputs* menu: 1. Select **Digital Output 1**, **2, 3 or 4** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu select **Preset Amount**, and press **[E]** to open the *Preset Amount* display. 3. Enter the preset amount value. Press **[E]** to save the new parameter and return to the *Digital Output* menu. **NOTE:** You can only set one Preset Amount. If you set the Preset Amount for Digital Output 1, it will be the same for 2, 3 and 4.
	Set Point Min. [0%]	This parameter establishes, as a percentage of full scale flow, the threshold at which the output alarm will be activated. Flow rates below the threshold will activate the output alarm. To change the set point minimum, follow these steps from the *Inputs/Outputs* menu: 1. Select **Digital Output 1**, **2, 3 or 4** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu select **Set Point Min.**, and press **[E]** to open the *Set Point Min.* display. 3. Enter the set point minimum value. Press **[E]** to save the new parameter and return to the *Digital Output* menu.
	Set Point Max. [100%]	This parameter establishes, as a percentage of full scale flow, the threshold at which the output alarm will be activated. Flow rates above the threshold will activate the output alarm. To change the maximum set point, follow these steps from the *Inputs/Outputs* menu: 1. Select **Digital Output 1**, **2, 3 or 4** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu select **Set Point Max.** and press **[E]** to open the *Set Point Max.* display. 3. Enter the set point maximum value and press **[E]** to save the new parameter and return to the *Digital Output* menu.

Inputs/Outputs		
Digital Output	Output Type [1: Normally Open] [2: Normally Open] [3: Normally Open] [4: Normally Closed]	The Output Type parameter lets you set the output switch to normally open or normally closed. If normally open is selected, the output switch is open (no current) when the output is inactive, and closed (current flows) when the output is active. If normally closed is selected, the output switch is closed (current flows) when the output is inactive, and open (no current) when the output is active. To change the Output Type, follow these steps from the *Inputs/Outputs* main menu: 1. Select **Digital Output 1**, **2, 3 or 4** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu**,** select **Output Type** and press **[E]** to open the *Output Type* display. 3. Select **Normally Open** or **Normally Closed**. 4. Press **[E]** to save the new parameter and return to the *Digital Output* menu.
	Hardware Type [3: Open Collector] [4: Open Collector]	The Hardware Type parameter lets you select the type of hardware used to drive the output signal: either open collector or solid-state relay. To change the Hardware Type, follow these steps from the *Inputs/Outputs* main menu: 1. Select **Digital Output 3 or 4** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu select **Hardware Type**, and press **[E]** to open the *Hardware Type* display. 3. Select **Open Collector** or **Relay**. 4. Press **[E]** to save the new parameter and return to the *Digital Output* menu.
	Full Scale Frequency [3: 1000 Hz]	The Full Scale Frequency parameter establishes the full scale flow output frequency when the flow rate equals the configured full scale flow. To change the Full Scale Frequency, follow these steps from the *Inputs/Outputs* main menu: 1. Select **Digital Output 3** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu select **Full Scale Frequency**, and press **[E]** to open the *Full Scale Frequency* display. 3. Set the full scale frequency value to the desired setting. 4. Press **[E]** to save the new parameter and return to the *Digital Output* menu.

Inputs/Outputs		
Digital Output	Select Function [1: Forward Pulse] [2: Reverse Pulse] [3: Frequency Pulse] [4: Error Alarm]	Digital Output lets you configure the functional operation of the associated output. The following operations are supported: • Reverse Pulse – Generates pulses during reverse flow conditions. • Forward Pulse – Generates pulses during forward flow conditions. • Frequency Output – Generates pulses correlated to the absolute value of the flow rate. • Preset Output – Provides indication when preset batch amount has been realized. • Flow Set Point – Provides indication when flow rate exceeds thresholds defined by flow set points. • 24V DC Supply – Provides constant 24 volts on output (forces output type to normally open). • Error Alarm – Provides indication when meter has error condition. Error conditions include, empty pipe error, full scale flow error, and detector error. • Flow Direction – Provides indication on current flow direction (Inactive = Reverse or No Flow, Active = Forward). • Empty Pipe Alarm – Provides indication when pipe is empty. • ADE – Provides meter information in digital format. See *"ADE Interface" on page 50*. To change the Function Select, follow these steps from the *Inputs/Outputs* main menu: 1. Select **Digital Output 1**, **2, 3** or **4** and press **[E]** to open the *Digital Output* menu. 2. From the *Digital Output* menu choose **Select Function**, and press **[E]** to open the *Select Function* display. 3. Select the desired function. 4. Press **[E]** to save and return to the *Digital Output* menu.
Flow Simulation [Off]	Flow Simulation provides output simulation based on a percentage of the full scale flow. Simulation will not accumulate the totalizers. The range of simulation includes –100% to 100% of the full scale flow. The Flow Simulation Parameter lets you set the range of simulation in 10% increments. To change the Flow Simulation, follow these steps from the *Inputs/Outputs* menu: 1. Select **Flow Simulation** to view the *Flow Simulation* display. 2. Click **[+]** to increment the percentage by 10, or click **[–]** to decrement the percentage by 10. 3. Press **[E]** to save the displayed setting and return to the *Inputs/Outputs* menu.	

Clear Totals	
T1 	The uni-directional totalizer is reset within the menu manager or through remote communications. Clearing T1 also clears the associated rollover counter.
T2 	The uni-directional totalizer is reset within the menu manager, through remote communications or with properly-configured digital input (function = remote reset). Clearing T2 also clears the associated rollover counter.
T+ 	The bi-directional forward flow totalizer is reset within the menu manager or through remote communications. Clearing T+ also clears the associated rollover counter.
T– 	The bi-directional reverse flow totalizer is reset within the menu manager or through remote communications. Clearing T– also clears the associated rollover counter.
TN 	The bi-directional net totalizer, when reset, clears both the forward and the reverse flow totalizers (T+ and T–). This is reset within the menu manager or through remote communications. Clearing TN also clears the associated rollover counter.
PS 	The batch totalizer is reset to the configured preset amount value. It is reset within the menu manager, remote communications or through a properly-configured digital input (function = batch reset).
Tpwroff 	The totalizer accumulating meter time without external power is reset with the menu manager or through remote communications.

Communication		
Port A Settings	Interface [MODBUS RTU] 	The Interface parameter lets you configure how the RS232 communication port will be used. • MODBUS RTU • Remote menu (RDI – Remote Display Interface) • Primo 3.x • Disable port The remote menu interface will check for display updates once a second. If a change is detected, the display contents will be transmitted in ASCII format over the RS232 communication port. The remote menu interface also allows for menu navigation and control of the meter as if using the external push buttons. Keyboard control characters such as <UP>,<DWN>, and <ENTER> are supported to navigate the menus. The Primo 3.x interface will emulate the legacy Primo 3.x Protocol. This protocol will transmit an ASCII string in the following format every 500 ms: "RATE;0.0000; GPM; TOT1;150.0000; USG ; TOT2;150.0000; USG ;" – For Unidirectional Mode "RATE;0.0000; GPM; TOT+;10.0000; USG ; TOT-;50.0000; USG ;" – For Bidirectional Mode To change the Interface follow these steps from the *Port A Settings* menu: 1. Select **Interface** to view the *Interface* display. 2. Select the desired interface. 3. Press **[E]** to save and return to the *Port A Settings* menu.

<table>
<tr><th colspan="3">Communication</th></tr>
<tr><td rowspan="4">Port A Settings</td><td>Port Address
[1]</td><td>This parameter establishes the MODBUS RTU address. MODBUS RTU requests will only be processed if the configured port address of the meter matches the request address found in the MODBUS RTU packet. The range of addresses supported by MODBUS RTU is 1…247. MODBUS RTU request packets with an address of 0 imply the packet is to be treated as a broadcast packet.
To change the port address, follow these steps from the Port A Settings menu:
1. Select Port Address to view the Port Address display.
2. Select the desired port address (1…247).
3. Press [E] to save the option and to return to the Port A Settings menu.</td></tr>
<tr><td>External
Port Address
[1]</td><td>For PROFIBUS® use only. This parameter allows configuration of the PROFIBUS DP daughterboard address.</td></tr>
<tr><td>Baud Rate
[9600]</td><td>The following Baud Rates are supported
• 9600
• 19200
• 38400
To change the baud rate, follow these steps from the Port A Settings menu:
1. Select Baud Rate to view the Baud Rate display.
2. Select one of the following baud rates: 9600, 19200 or 38400.
3. Press [E] to save the option and to return to the Port A Settings menu.</td></tr>
<tr><td>Data Bits
[8 bits]</td><td>The Data Bits parameter configures the port data bits. The following data bits are supported:
• 8 bits
• 7 bits
• 5 bits
To change the data bits, follow these steps from the Port A Settings menu:
1. Select Data Bits to view the Data Bits display.
2. Select one of the following: 8 Bits, 7 Bits or 5 Bits.
3. Press [E] to save the option and to return to the Port A Settings menu.</td></tr>
</table>

<table>
<tr><th colspan="3">Communication</th></tr>
<tr><td rowspan="2">Port A Settings</td><td>Parity
[Even]</td><td>The following Parities are supported
Even
Odd
None
To change the parity, follow these steps from the Port A Settings menu:
Select Parity to view the Parity display.
Select one of the following: None, Even or Odd.
Press [E] to save the option and to return to the Port A Settings menu.</td></tr>
<tr><td>Stop Bits
[1 Stop Bit]</td><td>The Stop Bits parameter configures the port stop bits. The following stop bits are supported:
1 Stop Bit
2 Stop Bits
To change the stop bits, follow these steps from the Port A Settings menu:
Select Stop Bits to view the Stop Bits display.
Select one of the following: 1 Stop Bit, or 2 Stop Bits.
Press [E] to save the option and to return to the Port A Settings menu.</td></tr>
<tr><td>Port B Settings</td><td>Port Address
[1]</td><td>An additional communication port, known as Port B, is used to offer enhanced communications with the meter. This port is located on the 11-pin terminal of the PCB. Enhanced protocols like Hart, Profibus DP or Modbus RTU over RS485 are available. In addition, this communication port has similar configurable properties as port A. Refer to the following user manuals for additional information regarding the enhanced communication capabilities of the M2000.
HART® communication protocol.
PROFIBUS DP communication protocol.
MODBUS RTU communication protocol.</td></tr>
<tr><td>Diagnostics</td><td>Port Counters
[0]</td><td>Port counters are used for diagnostics when configured for MODBUS RTU. These counters are only cleared on power up.
<table>
<tr><th>Counter</th><th>Description</th></tr>
<tr><td>Pkts Processed</td><td>Number of packets processed by meter.</td></tr>
<tr><td>Broadcast Pkts</td><td>Number of broadcast packets (address = 0) processed by meter.</td></tr>
<tr><td>CRC Errors</td><td>Number of received packets with CRC error; packet is discarded.</td></tr>
<tr><td>Pkts Rcvd</td><td>Number of packets received with an address of the configured port address.</td></tr>
<tr><td>Pkts Sent</td><td>Number of packets transmitted in response to a received packet.</td></tr>
<tr><td>Parity Errors</td><td>Number of characters with parity errors (i.e., received character has a mismatch between the number of 1s and its parity bit); packet is discarded.</td></tr>
<tr><td>Framing Errors</td><td>Number of characters with framing errors (i.e. missing stop bit is not found – indicates that synchronization with the start bit has been lost and that the character is improperly framed); packet is discarded.</td></tr>
<tr><td>Overrun Errors</td><td>Number of characters received that were not processed due to degradation of system performance.</td></tr>
<tr><td>Break Detects</td><td>Number of detections that transmission line is locked (i.e., receive line is low for 10-bit transmissions following a missing stop bit).</td></tr>
</table></td></tr>
</table>

<table>
<tr><th colspan="3">Advanced Features</th></tr>
<tr><td>Unit Multiplier
[Off]</td><td colspan="2">The Unit Multiplier establishes the number of units of measure that have to accumulate before the display totalizers are updated. This is also known as setting the number of “dead” zeroes in the display totalizer. For example:
<table>
<tr><th colspan="6">Unit Multiplier less than 1</th></tr>
<tr><td>Unit Multiplier</td><td colspan="5">Example</td></tr>
<tr><td>OFF</td><td>0.00000 USG</td><td>0.00012 USG</td><td>0.00123 USG</td><td>0.01234 USG</td><td>0.12345 USG</td></tr>
<tr><td>0.0001</td><td>0.0000 USG</td><td>0.0001 USG</td><td>0.0012 USG</td><td>0.0123 USG</td><td>0.1234 USG</td></tr>
<tr><td>0.001</td><td>0.000 USG</td><td>0.000 USG</td><td>0.001 USG</td><td>0.012 USG</td><td>0.123 USG</td></tr>
<tr><td>0.01</td><td>0.00 USG</td><td>0.00 USG</td><td>0.00 USG</td><td>0.01 USG</td><td>0.12 USG</td></tr>
<tr><td>0.1</td><td>0.0 USG</td><td>0.0 USG</td><td>0.0 USG</td><td>0.0 USG</td><td>0.1 USG</td></tr>
</table>
<table>
<tr><th colspan="6">Unit Multiplier greater than or equal to 1</th></tr>
<tr><td>Unit Multiplier</td><td colspan="5">Example</td></tr>
<tr><td>OFF</td><td>0.00000 USG</td><td>1.23456 USG</td><td>12.34567 USG</td><td>123.4567 USG</td><td>1234.456 USG</td></tr>
<tr><td>1</td><td>0 USG</td><td>1 USG</td><td>12 USG</td><td>123 USG</td><td>1234 USG</td></tr>
<tr><td>10</td><td>0 USG</td><td>0 USG</td><td>10 USG</td><td>120 USG</td><td>1230 USG</td></tr>
<tr><td>100</td><td>0 USG</td><td>0 USG</td><td>0 USG</td><td>100 USG</td><td>1200 USG</td></tr>
<tr><td>1000</td><td>0 USG</td><td>0 USG</td><td>0 USG</td><td>0 USG</td><td>1000 USG</td></tr>
</table>
To change the Unit Multiplier, follow these steps from the Advanced menu:
Select Unit Multiplier to view the Unit Multiplier display.
Select the desired unit multiplier.
Press [E] to save the option and to return to the Advanced menu.</td></tr>
<tr><td>Backlight Control
[Timed Off]</td><td colspan="2">You can set the meter's backlight to: Always On, Always Off and Timed Off.
When set to Timed Off, the backlight will automatically turn off after one minute of inactivity (no buttons pressed). Pressing any button will turn the backlight on, but will not immediately navigate the menu.
To change the backlight control, follow these steps from the Advanced menu:
Select Backlight Control to view the Backlight Control display.
Select the desired option.
Press [E] to save the option and to return to the Advanced menu.</td></tr>
<tr><td rowspan="3">Token Copy</td><td>Configuration</td><td rowspan="3">See the M2000 Store/Restore user manual for details on using the Token Copy features.</td></tr>
<tr><td>Store to Token</td></tr>
<tr><td>Restore from Token</td></tr>
<tr><td rowspan="2">ADE</td><td>Protocol Type</td><td>The protocol type enables the ADE interface. Selecting S1 or S2 will automatically configure the Digital Input and Digital Output #1 for ADE operation. Manually configuring the input and output for ADE operation is not allowed and will result in a on-screen error.
See "ADE Interface" on page 50 for further details.
S1 – Standard ADE protocol
S2 – Enhanced ADE protocol, provides additional digital information
Disabled – disables and removed ADE configuration</td></tr>
<tr><td>Dial Type</td><td>4 – 8 dials</td></tr>
</table>

Analog Calibrate	Custom Settings [Zero Scale: 0mA] [Full Scale: 0mA]	To set the analog calibration custom settings, follow these steps from the *Advanced* menu: 1. Select **Analog Calibrate** to view the *Analog Calibrate* menu. 2. Select **Custom Settings** to view the *Custom Settings* display. 3. Select one of the following: • **Offset 4 mA** • **Offset 20 mA** 4. Configure desired offset. 5. Press **[E]** to save the option and to return to the *Custom Settings* menu. 6. Press **[E]** to return to the *Analog Calibrate* menu.
	Factory Settings [Factory Set]	To change the analog calibration factory settings, follow these steps from the *Advanced* menu: 1. Select **Analog Calibrate** to view the *Analog Calibrate* menu. 2. Select **Factory Settings** to view the *Factory Settings* display. 3. Select one of the following: • **Calibration Point A** • **Calibration Point B** 4. Set the calibration point to the measured output current. 5. Press **[E]** to save the option and to return to the *Factory Settings* menu. 6. Press **[E]** to return to the *Analog Calibrate* menu.

Advanced Features		
Software Filter	Description	The software filter operates as an acceleration filter. This filter when configured properly allows for filtering of fast changes in fluid flow. Generally, this filter is used in applications having highly conductive fluids. This filter is intended to help provide smoothing of the analog output and display fluctuations.
	Activation [Off] 	The Activation parameter setting enables or disables the software acceleration filter. To change the Activation setting, follow these steps from the *Advanced* menu: 1. Select **Activation** from the *Advanced* menu. 2. Select the desired setting. 3. Press **[E]** to save the option and to return to the *Advanced* menu.
	Filter Delay [1] 	The Filter Delay parameter lets you set the amount of time that the flow will be held constant once the filter is activated. The filter is activated by an acceleration component of the fluid exceeding the configured limit. To change the Filter Delay follow these steps from the *Advanced* menu: 1. Select **Filter Delay,** from the *Advanced* menu. 2. Select the desired setting. 3. Press **[E]** to save the option and to return to the *Advanced* menu.
	Acceleration Factor [1] 	The Acceleration Factor parameter lets you set the maximum acceleration for a given pipe diameter and is dependent on the excitation frequency. The maximum fluid velocity is 12 m/s. The following equation defines the maximum fluid acceleration: Acceleration(MAX) = Acceleration Factor * 12 m/s * Pipe Area * Excitation Frequency / 1.5 If the realized fluid acceleration exceeds the configured maximum acceleration, fluid flow will be held constant for the time set at the Filter Delay parameter. To change the Acceleration Factor setting, follow these steps from the *Advanced* menu: 1. Select **Acceleration Factor** from the *Advanced* menu. 2. Select the desired setting. 3. Press **[E]** to save the option and to return to the *Advanced* menu.

Advanced Features		
Software Filter	Constant Flow [150 M^3/Sec^2] 	During normal flow conditions, there is always a non-zero acceleration component. For example, if acceleration of the flow activates the filter, the meter will assume constant flow for the duration of the filter delay time unless the flow returns within limits. Properly configured, this parameter will help offset excessive impacts of the filter delay. The Constant Flow parameter lets you set the acceleration limit for constant flow. To change the Constant Flow setting, follow these steps from the *Advanced* menu: 1. Select **Constant Flow** from the *Advanced* menu. 2. Select the desired setting. 3. Press **[E]** to save the option and to return to the *Advanced* menu.
	Peak Detect [0 M^3/Sec^2] 	Peak Detect offers a diagnostic view of the acceleration components observed during flow conditions. This parameter records the "high water mark" of the measured accelerations component. This value will help to properly configure the Acceleration Factor parameter. Generally, you will set the acceleration factor at about 75% of the Peak Detect measurement. To reset the Peak Detect setting, follow these steps from the *Advanced* menu: 1. Select **Peak Detect** from the *Advanced* menu. 2. Press **[+]** to reset. 3. Press **[E]** to return to the *Advanced* menu.
MDN Filter	Description	This software filter operates as a Median filter. This filter is very responsive and can be used to help stabilize flow measurements. This filer is enabled by selecting a non-zero filter size. Supported filter sizes are: • S5 - Size 5 • S7 - Size 7 • S9 - Size 9 The filter technique will use the median value of the last Sx samples used for determining flow measurement.:

Advanced Features	

Empty Pipe Cal.
[Default]
	Fluid conductivity impacts the performance of empty pipe measurements. If you require empty pipe detection, you should perform this empty pipe calibration procedure.
	Before starting the empty pipe calibration, verify that empty pipe detection is enabled. Also, run both the empty pipe and the full pipe calibration procedures.
	Calibrating an Empty Pipe
	Before calibrating an empty pipe, verify that the pipe is empty.
	To calibrate with an empty pipe, follow these steps from the *Advanced* menu:
	1. Select **Empty Pipe Cal** to view the *Calibration* menus.
	2. Select **Cal. Empty Pipe** to view the *Empty Pipe Calibrate* menu.
	3. To enable calibration, place the cursor on the calibration enable line and press **[E]**.
	`EMPTY PIPE CALIBRATE`
	` Volts = 3.00`
	`>Cal [ON]     E=OFF`
	` Exit with Save`
	4. Wait 30 seconds for voltage measurement to stabilize.
	5. To save the setting, place the cursor on **Exit with Save** and press **[E]**.
	Calibrating a Full Pipe
	Before calibrating a full pipe, verify that the pipe is full.
	To calibrate with a full pipe, follow these steps from the *Advanced* menu:
	1. Select **Empty Pipe Cal** to view the *Calibration* menus.
	2. Select **Cal. Full Pipe** to view the *Full Pipe Calibrate* menu.
	3. Enable calibration by placing the cursor on the calibration enable line and press **[E]**.
	`FULL PIPE CALIBRATE`
	` Volts = 1.515`
	`>Cal [OFF]     E=ON`
	` Exit with Save`
	4. Wait 30 seconds for voltage measurement to stabilize.
	5. To save the setting, place the cursor on **Exit with Save** and press **[E]**.

Advanced Features		
Security	Set Admin PIN [00000]	Users logged in with this PIN will have access to all M2000 procedures. To set the administrator's PIN, follow these steps from the *Advanced* Menu: 1. Select **Security** to view the *Security* menu. 2. Select **Set Admin PIN** to view the *Admin PIN* display. 3. Set the five-digit PIN number to the desired value. 4. Press **[E]** to save the PIN and to return to the *Security* menu.
	Set Service PIN [00000]	Users logged in with this PIN will have access to all service level and user-level procedures. Service users will not have access to administrative procedures. To set the service PIN, follow these steps from the *Advanced* Menu: 1. Select **Security** to view the *Security* menu. 2. Select **Set Service PIN** to view the *Service PIN* display. 3. Set the five-digit PIN number to the desired value. 4. Press **[E]** to save the PIN and to return to the *Security* menu.
	Set User PIN [00000]	Users logged in with this PIN will have access to user-level procedures. User at this level will not have access to administrative or service procedures. To set the user's PIN, follow these steps from the *Advanced* Menu: 1. Select **Security** to view the *Security* menu. 2. Select **Set User PIN** to view the *User PIN* display. 3. Set the five-digit PIN number to the desired value. 4. Press **[E]** to save the PIN and to return to the *Security* menu.

Info/Help		
Error Counts [0]	Description	This menu provides a diagnostic view of the meter's performance. Below are several system diagnostic counters and their definitions. Use discretion when interpreting these counters. These values could be altered during system setup or when using the verification device. We suggest that you reset these counters before you start monitoring your system and look for conditions possibly affecting performance.
	Detector	The number of times an invalid detector condition has been observed.
	Empty Pipe	The number of times an empty pipe condition has been observed by the meter.
	Full Scale	The number of times the flow has exceeded the full scale flow setting.
	Totalizer	The number of times the totalizers have exceeded limits of the meter.
	Pulse Sync.	The number of times the pulse outputs have fallen out of synchronization.
	ADC Interrupt	The number of times an analog input measurement has been missed.
	ADC Range	The number of times the analog input measurement range has been exceeded.
	System Error	A diagnostic system message indicating the reason for a system reset.
	System Resets	The number of times the meter has been reset.
	System Reset ID	Diagnostic information about a system reset as a result of expired internal timers.
	Token Errors	Indicates the number of parameter copies from a memory token that failed to be copied to the meter.

Info/Help	
Rollover Counts [0]	The number of times the totalizers have rolled over 9,999,999,999 (10 billion). As the meter rolls over, a status indicator appears in the display. When this occurs, we suggest that you record the totalizers and rollover counter and reset the totalizers. Resetting totalizers will also clear the rollover counter. For a meter configured in bidirectional mode, rollover is represented by the net totalizer (TN) as "*********". During this condition, the net totalizer (TN) can be calculated using the following equation: $T(FWD) = [(ROLLOVER_{T+} \times 10{,}000{,}000{,}000) + T+]$ $T(REV) = [(ROLLOVER_{T-} \times 10{,}000{,}000{,}000) + T-]$ $TN = T(FWD) - T(REV)$ *Where $ROLLOVER_{Tx}$ is the rollover count for the appropriate totalizer* For a meter configured in unidirectional mode, the totalizer can be calculated using the following equation: $T1 = [(ROLLOVER_{T1} \times 10{,}000{,}000{,}000) + T1]$ $T2 = [(ROLLOVER_{T2} \times 10{,}000{,}000{,}000) + T2]$ *Where $ROLLOVER_{Tx}$ is the rollover count for the appropriate totalizer*
PowerUp Counter [Not applicable]	The number of times that the unit has been powered on.
Power Off Totalizer [Not applicable]	The length of time that the unit has been without power.
Version Info [Not applicable]	The current software version.
Serial Number [Not applicable]	The manufacturing serial number in the format YYMM####. Where YYMM indicates year and month of manufacturing and #### indicates the sequence number.

Info/Help	
Meter Tag Name	For PROFIBUS – This parameter is only programmable over external PROFIBUS communications.
Daughterboard Information	Describes current version of attached daughterboard. **NOTE:** RS485 daughterboard is not recognized because it is a pass-through device rather than an intelligent protocol converter like Hart-to-MODBUS.
Polarization Voltage	Diagnostic voltage to help determine if the meter or application is performing optimally.
Restore Defaults [Not applicable] 	Restores all non-calibrated parameters to the factory defaults.

Language Select	
Language Select [English] 	The M2000 supports one alternate language along with English. This alternate language choice is set at the factory. The options are: Spanish, German, Czech or French. To select the language, follow these steps from the **Language Select menu**: 1. Select **English** or the **Alternate Language**. 2. Press **[E]** to save the selection.

ADE INTERFACE

This feature requires firmware version 1.10 or later. Reference Badger Meter P/N 6734-003 to obtain a firmware upgrade kit. Enabling the meter as an ADE register requires three settings, all within the advanced menu, to be configured.

- Unit Multiplier – Selects the resolution of the display totalizer.
- Protocol Type – Selects the type of information to be transmitted to the ADE transmitter.
- Dial Type – Enables ADE and selects the number of significant totalizer digits to transmit.

Changing the dial type from Disabled will automatically configure the necessary digital inputs/outputs. It is not allowed to manually change the digital inputs/outputs within the *Input/Outputs* menu. Below is a wiring diagram for connecting an ADE transmitter to the meter.

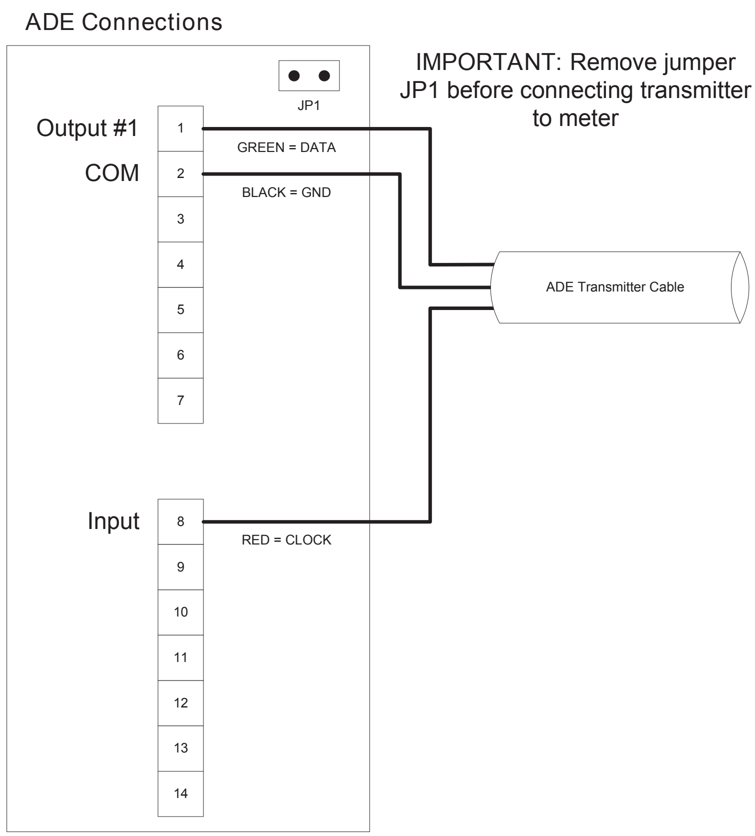


Figure 20: ADE interface

The following table demonstrates how the totalizers are displayed under various configurations of the Unit Multiplier (that is, resolution) and Dial Type. The non-shaded digits are transmitted as defined by the dial type.

For example, if the dial type is 4-dial and the resolution is 10000 then an arbitrary totalizer value of 99999999 is displayed on the meter as 9999**0000** and 9999 is transmitted to the receiving application. In this configuration it will take 10000 units (i.e. USG) before the display totalizer is updated to a new value. For this example the display totalizer will rollover to 0000**0000**.

Dial Type	Unit Multiplier (Resolution)	Display Digits									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**
	10000			1	2	3	4	0	0	0	0
	1000				1	2	3	4	0	0	0
	100					1	2	3	4	0	0
	10						1	2	3	4	0
4 dial	1							1	2	3	4
	0.1						1	2	3	.	4
	0.01						1	2	.	3	4
	0.001						1	.	2	3	4
	0.0001					0	0	1	2	3	4
	10000		1	2	3	4	5	0	0	0	0
	1000			1	2	3	4	5	0	0	0
	100				1	2	3	4	5	0	0
	10					1	2	3	4	5	0
5 dial	1						1	2	3	4	5
	0.1					1	2	3	4	.	5
	0.01					1	2	3	.	4	5
	0.001					1	2	.	3	4	5
	0.0001					1	.	2	3	4	5
	10000	1	2	3	4	5	6	0	0	0	0
	1000		1	2	3	4	5	6	0	0	0
	100			1	2	3	4	5	6	0	0
	10				1	2	3	4	5	6	0
6 dial	1					1	2	3	4	5	6
	0.1				1	2	3	4	5	.	6
	0.01				1	2	3	4	.	5	6
	0.001				1	2	3	.	4	5	6
	0.0001				1	2	.	3	4	5	6
	10000	Not Applicable – Not enough display digits									
	1000	1	2	3	4	5	6	7	0	0	0
	100		1	2	3	4	5	6	7	0	0
	10			1	2	3	4	5	6	7	0
7 dial	1				1	2	3	4	5	6	7
	0.1			1	2	3	4	5	6	.	7
	0.01			1	2	3	4	5	.	6	7
	0.001			1	2	3	4	.	5	6	7
	0.0001			1	2	3	.	4	5	6	7

Dial Type	Unit Multiplier (Resolution)	Display Digits									
		1	2	3	4	5	6	7	8	9	0
8 dial	10000	Not Applicable – Not enough display digits									
	1000	Not Applicable – Not enough display digits									
	100	1	2	3	4	5	6	7	8	0	0
	10		1	2	3	4	5	6	7	8	0
	1			1	2	3	4	5	6	7	8
	0.1		1	2	3	4	5	6	7	.	8
	0.01		1	2	3	4	5	6	.	7	8
	0.001		1	2	3	4	5	.	6	7	8
	0.0001		1	2	3	4	.	5	6	7	8

It is important to understand that the totalizers will be represented in a manner equivalent to an actual ADE register. For example, 1 USG on a 4 dial will be transmitted/displayed as "0001". If in bidirectional mode, –1 USG will be transmitted/displayed as "9999".

The protocol type has two options:

- V1 – meter provides single totalizer, Tn (bi-directional) or T1 (uni-directional)
- V2 – meter provides extended information (For ORION Cellular, ORION Fixed Network (SE) or ORION Migratable (ME))

The additional information provided by protocol type V2 is only accessible for specific models of the ADE transmitter (i.e. ORION SE or ORION ME). The additional information of protocol type V2 includes, status information of the meter, meter identification, a second totalizer reading (T+ or T2), relative flow rate (0…100%), and flow direction.

STORE / RESTORE FEATURE

The Store/Restore feature is intended to save installation costs and reduce installation time. This feature is also intended to protect meter configuration and assure the operator that the meter is properly configured. Over time and handling of the meter, the meter configuration could change. The Store/Restore feature allows the meter to be quickly set to the operator's original configuration. Refer to the M2000 Store/Restore user manual for details on this feature.

DATA LOGGING FEATURE

The Data Logging feature records three types of events to a memory token:

- Totalizer/error events
- Configuration change events
- Startup events (power up, power down or reset events)

Each type of event is recorded into three separate files stored on the memory token. These files are extracted using the provided flow meter tool software over the RS232 communication link. Refer to the M2000 Data Logging user manual for details on this feature.

MAINTENANCE

Mandatory, routine or scheduled maintenance should not be required for the M2000 Mag Meter electronics or flow tube after proper installation.

However, some instances may require personnel to perform the following:

- Flow tube and electrode cleaning
- Fuse replacement
- Circuit board replacement

WARNING

- DISCONNECT MAIN POWER TO THE UNIT BEFORE ATTEMPTING ANY DEVICE MAINTENANCE OR CLEANING.
- DO NOT CLEAN COMPONENTS INSIDE THE AMPLIFIER OR JUNCTION BOX.

Cleaning the Flow Tube and Electrode

At times flow tube, electrodes, amplifier/junction box housings and the amplifier window may need periodic cleaning, depending on process fluid properties, fluid flow rate and surrounding environment.

Clean the flow tube and electrodes by following the material handling and cleaning procedures documented in Material Safety Data Sheet (MSDS) guidelines for the product(s) that were in contact with the flow tube and electrodes.

Should flow tube and/or electrode cleaning become necessary:

1. Disconnect detector from pipeline.
2. Clean electrodes according to MSDS guidelines.
3. Reconnect detector to pipeline.

Replacing the Fuse

WARNING

DISCONNECT MAIN POWER TO THE UNIT BEFORE ATTEMPTING ANY DEVICE MAINTENANCE. RISK OF ELECTRICAL SHOCK. REPLACE THE FUSE ONLY WITH 250V AC, 2 AMP, SLOW BLOW (5 X 20 MM). AUTHORIZED PERSONNEL MUST REPLACE FUSES.

Replacing the Circuit Board

Refer to the M-Series M2000 Interchangeability Procedure Application Brief for information on replacing circuit boards.

TROUBLESHOOTING

The M2000 mag meter is designed for many years of optimal performance. However, should it malfunction, there are certain things that we recommend you check before contacting our Technical Support department or your local Badger Meter Representative.

NOTE: If the fluid measured has a high concentration of conductive solids, deposits may accumulate on the internal liner walls and electrodes. These deposits will cause a reduction of the measuring output. Thus, Badger Meter recommends that you remove the meter and inspect the liner and electrodes after six months. If deposits are found, remove them with a soft brush. Repeat inspection process every six months or until an appropriate inspection cycle can be established for the specific application.

NOTE: Other general conditions include:

Description	Possible Cause	Recommended Action
Flow is present but display is "0"	Digital input is holding flow. Disconnected signal cable. Detector mounted opposite of the main flow direction (see arrow on the nameplate). Coil or electrode cables exchanged. Improper low flow cutoff or full scale flow.	Check signal cable. Turn detector by 180° or switch terminal E1 and E2 or reprogram to bidirectional mode. Check cable connections for cross wiring. Verify digital input configuration. Replace configuration defaults.
Inaccurate measuring	Improper calibration. Wrong calibration parameter. Pipe not fully filled, or air in pipe. Invalid fluid conductivity. Invalid fluid mixture.	Restore calibration defaults. Check the parameters (detector factor and size) according to supplied data sheet. Check if meter is completely filled with fluid. Purge line to eliminate air bubbles.
No display	No power. Incorrect power. Bad wiring connections. Blown fuse.	Apply power. Check power value. Replace fuse (2 amp, 250V AC, slow blow 5 x 20 mm). Check display ribbon cable.
Flow rate value known to be wrong	Detector factor. Deposits on electrodes and/or liner. Incorrect pipe size programmed.	Check value on label. Check and remove deposits. Check size if necessary.
Flow rate indication unstable	Cable issue. Grounding issue. Partially full pipe. Air in pipe. Amplifier location – outside electrical. Invalid fluid conductivity.	Make sure cable is shielded and not vibrating. Make sure meter is properly grounded to a good earth ground. Make sure pipe is full of fluid. Make sure fluid does not contain air bubbles. Make sure amplifier is not too close to sources of electrical interference.

Menu Manager Configuration Errors		
Error	**Description**	**Recommended Action**
100	**ADE: Configuration of the ADE interface is invalid.**	This error is displayed when an invalid modification to either of the following menu parameters is detected: Protocol Type, Dial Type, Unit Multiplier, Digital Input Function Type or Digital Output Function Type. 1. Configuring the M2000 as an ADE interface has the following limitations, Protocol Type V1 is only allowed if number of dials is less than 8. 2. The resolution of the totalizers (i.e. Unit Multiplier) must be set to something other than OFF. 3. For 8 dial configuration, a resolution of 10000 and 1000 are not supported. There are not enough display digits to accommodate 8 dials and greater than 100 units of resolution. 4. For 7 dial configuration, a resolution of 10000 is not supported. There are not enough display digits to accommodate 7 dials and greater than 1000 units of resolution.
101	**ADE: Enabling/Disabling ADE operation is invalid**	This error is observed when Digital input or output function is manually selected for ADE operation. Enabling or Disabling ADE operation can only be accomplished by setting the ADE protocol type.
110	**Output 1/2: Pulse Output Configuration Error**	This error is observed when improperly configuring either the full scale flow, pulse per unit, pulse width or digital output function type for pulse output operation. Preparing these parameters for pulse output operation (i.e. forward or reverse) has limitations that are monitored by the menu manager. This error can indicate the following configuration violations: 1. Pulse Frequency exceeds limits at full scale flow 2. Pulse duty cycle is less than 50% at full scale flow (i.e. pulse on time > pulse off time) 3. AMR Pulse Frequency exceeds limit at full scale flow The pulse frequency limit is 10 kHz when the pulse width is 0 (i.e. 50% duty cycle). The pulse frequency limit is 1 / (2 * Pulse Width) when the pulse width is non-zero in order to achieve a 50% duty cycle. For AMR operation, the frequency limit is 3 HZ. Follow these steps for configuring meter for pulse output operation: 1. Set PPU to zero for both output 1 and 2 2. If necessary, set full scale flow appropriately for application 3. Set PW as required by equipment receiving pulse transmissions from meter. Observe frequency limits for non-zero pulse widths. 4. Determine the desired pulse frequency at a typical flow rate (i.e. 1000 HZ @250 GPM 5. Calculate ratio of typical flow rate to full scale flow: ratio = typical flow rate / full scale flow (i.e. 250 GPM / 500 GPM = 0.5) 6. Calculate flow rate conversion factor: For GPM, conversion factor = 1/60, for GPH, conversion factor = 1/3600, for GPS, conversion factor = 1 7. Calculate PPU: PPU = (Desired pulse frequency at typical flow rate / ratio) / [Full Scale Flow * (conversion factor)]= (1000 / 0.5) / [500 * (1/60)] = 240 Pulse / Gallon 8. If an error is received consider reducing value of full scale flow and ensuring desired pulse frequency is within limits. Then redo steps 4-7 If not using the pulse outputs, set the pulses per unit to zero to allow for reconfiguration of the full scale flow. If it is required to use the pulse outputs, re-evaluate the pulse output configuration. Consider recording and clearing totalizers following pulse output configuration"
120	**Display: Totalizer Conversion Error – Totalizer cannot be properly converted for display**	This error is observed while trying to change the totalizer units. Limits of display will prevent improper configuration of the volume unit dependent on current totalizer values. Consider recording and cleaning totalizers prior to changing totalizer.
121	**Output 1/2: Pulse Output Configuration Error**	This error is observed when changing the totalizer units of measure. This error implies the pulse configuration exceeds limits (see error 110). Please note the pulses per unit is not automatically updated on volume unit reconfiguration. The pulses per unit should be manually changed to accommodate the desired units of measure. It may be necessary to set the pulses per unit to zero then change to the desired totalizer units.
140	**Output 3: Configuration Error – Full scale frequency exceeds limits of relay (1000 Hz)**	Reduce full scale frequency setting of output when hardware is configured for relay operation.
150	**Output 3: Configuration Error – Full scale frequency exceeds limits (10 kHz)**	Reduce full scale frequency setting of output when hardware is configured for open collector operation.
170	**Output 1/2: Output Type Configuration Error**	This error is observed when the function type is 24V DC and the output type is changed from Normally Open to Normally Closed. It is required for 24V DC output operation that the output type be Normally Open.

Menu Manager Configuration Errors		
Error	**Description**	**Recommended Action**
171	**Output 1/2: Output Type Configuration Error**	This error is observed when the function type is ADE and the output type is changed from Normally Open to Normally Closed. It is required for ADE operation that the output type be Normally Open
190	**Full Scale Flow: Entered Value exceeds limits**	Value entered exceeds the absolute maximum flow the meter supports. Reduce the value for this parameter or consider increasing pipe diameter.

Display Error / Status Messages		
Error Message	**Possible Cause**	**Recommended Action**
Err: Detector	No detector connection with amplifier.	Check detector and cable connections in accordance with this manual.
	Connection between amplifier and detector	Contact Technical Support.
	Supply voltage too low.	Contact Technical Support.
	Grounded coils in meter.	Contact Technical Support.
	Water in detector.	Contact Technical Support.
Err: Empty pipe	Pipe may not be full.	Make sure all trapped air is out of system. If fluid or fluid conductivity recalibrate the parameter.
Err: Full scale	Actual flow rate is exceeding programmed flow.	Reduce flow rate or increase the programmed full scale value by more than 5%.
Err: AD-Range	AD-Converter is exceeding signal limits.	Check the grounding scheme of the meter installation. See grounding section in this manual. Verify pipe is not empty.
Err: AD-INT	Initialization of AD-Converter unsuccessful.	Contact Technical Support.
Err: Rollover	Rollover counters have exceeded limit.	Clear all totalizers.
Err: Rollover Status	Totalizer rollover has occurred.	Reload totalizer then clear all totalizers.
Err: Simulation	I/O simulator is enabled.	Disable simulator in I/O menu.

SPECIFICATIONS

Flow Range	0.10…39.4 ft/s (0.03…12 m/s)
Accuracy	± 0.25 percent of rate for velocities greater than 1.64 ft/s (0.50 m/s) ± 0.004 ft/s (± 1 mm/s) for velocities less than 1.64 ft/s (0.50 m/s)
Repeatability	± 0.1%
Power Supply	**AC Power Supply:** 85…265V AC; Typical Power: 20V A or 15W; Maximum Power: 26V A or 20W **Optional DC Power Supply:** 10…36V DC; Typical Power: 10W; Maximum Power: 14W
Analog Output	4…20 mA, 0…20 mA, 0…10 mA, 2…10 mA (programmable and scalable) Voltage sourced 24V DC isolated. Maximum loop resistance < 800 ohms.
Digital Output	Four total, configurable 24V DC sourcing active output (up to 2),100 mA total, 50 mA each; sinking open collector output (up to four), 30V DC max, 100 mA each; AC solid-state relay (up to 2), 48V AC, 500 mA max
Digital Input	Max 30V DC (programmable – positive zero return, external totalizer reset or preset batch start)
Frequency Output	Scalable up to 10 kHz, open collector up to 1 kHz, solid-state relay
Misc Output	High/low flow alarm (0…100% of flow), error alarm, empty pipe alarm, flow direction, preset batch alarm, 24V DC supply, ADE
Communication	RS232 Modbus RTU; RS485 Modbus RTU, HART, Profibus DP require separate daughterboards
Pulse Width	Scalable up to 10 kHz, passive open collector up to 10 kHz, active switched 24V DC. Up to two outputs (forward and reverse). Pulse width programmable from 1…1000 ms or 50% duty cycle.
Processing	32-bit DSP
Empty Pipe Detection	Field tunable for optimum performance based on specific application
Excitation Frequency	1 Hz, 3.75 Hz, 7.5 Hz or 15 Hz (factory optimized to pipe diameter)
Noise Dampening	Programmable 0…30 seconds
Low Flow Cut-Off	Programmable 0…10% of maximum flow
Galvanic Separation	250V
Fluid Conductivity	Minimum 5.0 micromhos/cm
Fluid Temperature	**With Remote Amplifier:** PFA, PTFE & Halar 302° F (150° C) **With Meter-Mounted Amplifier:** Rubber 178° F, (80° C), PFA, PTFE & Halar 212° F (100° C)
Ambient Temperature	– 4…140° F (–20…60° C)
Relative Humidity	Up to 90 percent non-condensing
Flow Direction	Unidirectional or bidirectional two separate totalizers (programmable)
Totalization	Programmable/resettable
Units of Measure	Ounce, pound, liter, US gallon, imperial gallon, barrel, hectoliter, mega gallon, cubic meter, cubic feet, acre feet
Display	4 x 20 character display with backlight
Programming	Three-button, external manual or remote
Amplifier Housing	Cast aluminum, powder-coated paint
Detector Housing	Carbon steel welded
Pipe Spool Material	316 stainless steel
Flanges	**Standard**: ANSI B16.5 Class 150 RF cast steel; **Optional:** 300 lb cast steel, 316 stainless steel
Liner Material	PFA up to 3/8", PTFE 1/2…24", soft and hard rubber from 1…54", Halar® from 14…40"
Electrode Materials	**Standard:** Alloy C; **Optional:** 316 stainless steel, gold/platinum plated, tantalum, platinum/rhodium
Mounting	Meter mount or remote wall mount (bracket supplied)
Locations	Indoor and outdoor
Meter Enclosure Classification	NEMA 4X (IP66); **Optional:** Submersible NEMA 6P (IP67), remote amplifier required
Junction Box Enclosure Protection	For remote amplifier option: powder-coated die-cast aluminum, NEMA 4 (IP66)
Cable Entries	1/2" NPT cord grip (3)
Optional Stainless Steel Grounding Rings	**Meter Size** — **Thickness (of one ring)** Up through 10" — 0.135" 12…54" — 0.187"
NSF Listed	Models with hard rubber liner, 4" size and up; PTFE liner, all sizes
Token Features	Data Logging (Blue token); Store/Restore (Red token); Firmware Upgrade (Black token)

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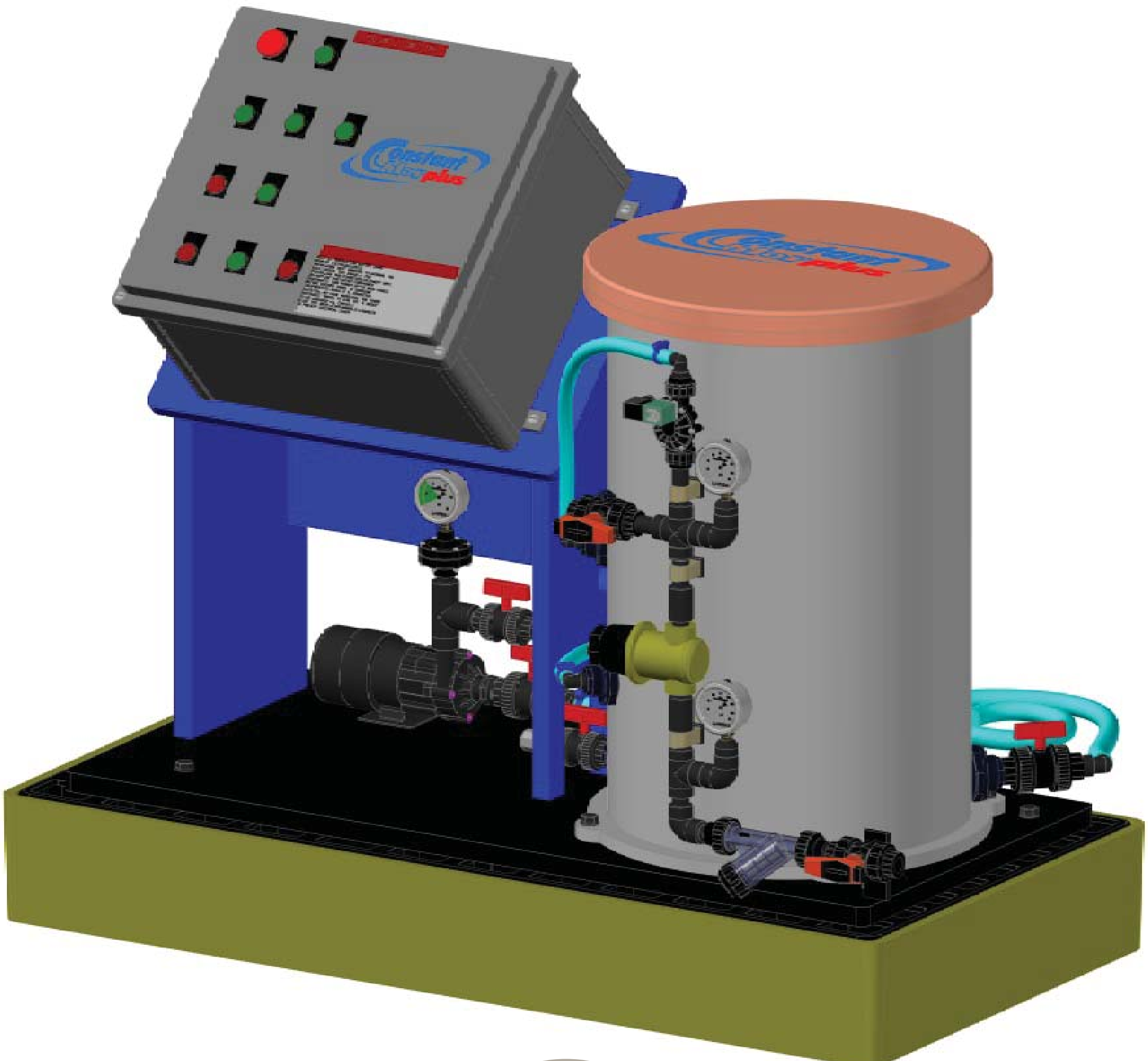
3.4 Hypo Feeding System

Briquette Chlorinator

Operator's Manual

Constant Chlor® Plus Model MC4-50



rev.3 (12/4/13)

ARCH is now a part of Lonza
www.lonza.com

Arch Chemicals, Inc.
1200 Lower River Road, P.O. Box 800
Charleston, TN 37310-0800

Product Stewardship

MAKING THE WORLD A BETTER PLACE

Arch is committed to maintaining and improving our leadership in Product Stewardship. Our goal is to make health, safety, and environmental protection an integral part of a product's life cycle – from manufacture, marketing, and distribution to use, recycling, and disposal.

Successful implementation is therefore, a shared responsibility. Everyone involved with the product has responsibilities to address society's interest in a healthy environment and in products that can be used safely. We are each responsible for providing a safe workplace, and all who use and handle products must follow safe and environmentally sound practices.

For more information about our Product Stewardship Program, contact your Arch Representative.

Dealer Contact:

Table of Contents

Safety Precautions

The Constant Chlor® Plus Briquette Chlorinator is designed to pump calcium hypochlorite solution into pressurized systems. By nature, this application may present circumstances under which personal hazards can exist. All personnel who may have occasionally to install, operate or maintain these chlorination units should be provided with the opportunity to read this owner's manual or be advised of its contents. Awareness of potential hazards can prevent accidents and injury.

Danger from Handling Calcium Hypochlorite

Calcium hypochlorite in briquette or liquid form is hazardous. Suitable personal protective equipment should be used at all times to protect from liquid or vapor. Consult your employer. Refer to the Material Safety Data Sheet found at the back of this manual for additional information and precautions regarding the proper handling of calcium hypochlorite.

Damage from Pressurized Liquid

This system contains liquid and/or air under pressure. This presents the potential for unexpected discharge of liquid in a violent manner. In operation and servicing of the chlorination unit, all components and attached piping which contain liquid should be treated cautiously until it is known with certainty that they have been depressurized and drained.

Danger from Electrical Hazard

Since this unit includes electric components, the hazard of electrical shock can exist. Installation and wiring of electrical components should be in accordance with the applicable codes.

Operational Hazards

To avoid personal injury, the following guidelines should be adhered to:

1. Do not operate any system components with safety guards removed.
2. Always operate system with electrical component enclosures in place.
3. When venting pump heads or piping during start up, air and calcium hypochlorite will be discharged under pressure. Suitable caution should be taken to avoid contact with the liquid and to avoid spillage or spraying of liquid.
4. Any leakage or spillage of calcium hypochlorite should be cleaned up with out delay. See Material Safety Data Sheet found at the back of this manual.

Safety

1. Before operating this unit or attempting to service it, become familiar with the contents of this operator's Manual.
2. Observe all precautions established by plant safety procedures.
3. Observe all regulations and instructions provided at the end of this manual.
4. Do not paint over or remove name plates, labels or tags.
5. In disassembly of dosing pump, precautions should be taken for the possibility that a diaphragm rupture may have allowed calcium hypochlorite solution to enter the lubrication oil system.
6. If motor replacement is required, be certain that motor name plate is the same as the original motor.
7. Establishment of and adherence to a regular maintenance program (pg.16) can prevent problems by early detection of unusual conditions (e.g. unusual noise).

SECTION I. Introduction

Before You Begin Operation, be sure to read this entire manual over carefully.

NOTE: Please refer to the Material Safety Data Sheet at the back of this manual before proceeding. They outline safety measures that must be followed when handling Constant Chlor® Plus Briquettes. If any part of this profile is unclear to you, please contact Arch Chemicals at **(800) 478-5727.**

The Constant Chlor® MC4-50 utilizes patented spray technology to make a consistent solution of calcium hypochlorite that is used for disinfection process. The system uses a constant supply of pressurized water to spray a suspended bed of calcium hypochlorite. The calcium hypochlorite readily dissolves into a reservoir at a 1.5% available chlorine solution, which is ready to be pumped out for disinfection.

The system components of the Constant Chlor® MC4-50 are:

Inlet Supply Manifold

The water supply is controlled by a solenoid valve and a pressure regulator to ensure a constant water pressure of 45 psi *[3.10 bar]* supplied to the spray-tree. It is important to note that the water supply flow rate through the manifold is 1.0 gpm *[3.8 lpm]*. This is a constant flow rate at 45 psi *[3.10 bar]*. The feeder is sized so that the maximum solution output from Constant Chlor® is ~20 gph *[75.7 lph]*, or ~0.30 gpm *[1.1 lpm]*. This means that the Constant Chlor® produces fresh solution at a rate of about 2 times the maximum design withdrawal rate.

Dry Chemical Hopper

The chemical hopper is suspended above the spray-tree within the tank and is easily removed for preventive maintenance and system troubleshooting. The hopper has two handles that allow it to be removed without any hardware or tools required. A custom grid support holds the calcium hypochlorite briquettes above the spray–tree and allows the product to properly dissolve into the reservoir below.

Solution Reservoir

The solution levels are maintained by 3 Ultrasonic level switches. The LOWER switch is only deactivated during startup or if there is a system failure. Normally this switch valve will always be in the CLOSED/ON position while solution is in the tank. The MIDDLE switch is used to control in the supply water via opening and closing the solenoid on the Inlet Supply Manifold. As this solution lowers, it opens the solenoid and allows pressurized water into the spray manifold, which replenishes the solution and closes the MIDDLE switch. This represents a "TANK FULL" condition. The upper or HIGH Switch is an emergency overflow switch that is activated only in the event of a failure condition where the tank continues to fall. In the event of an overflow, the HIGH Switch will activate.

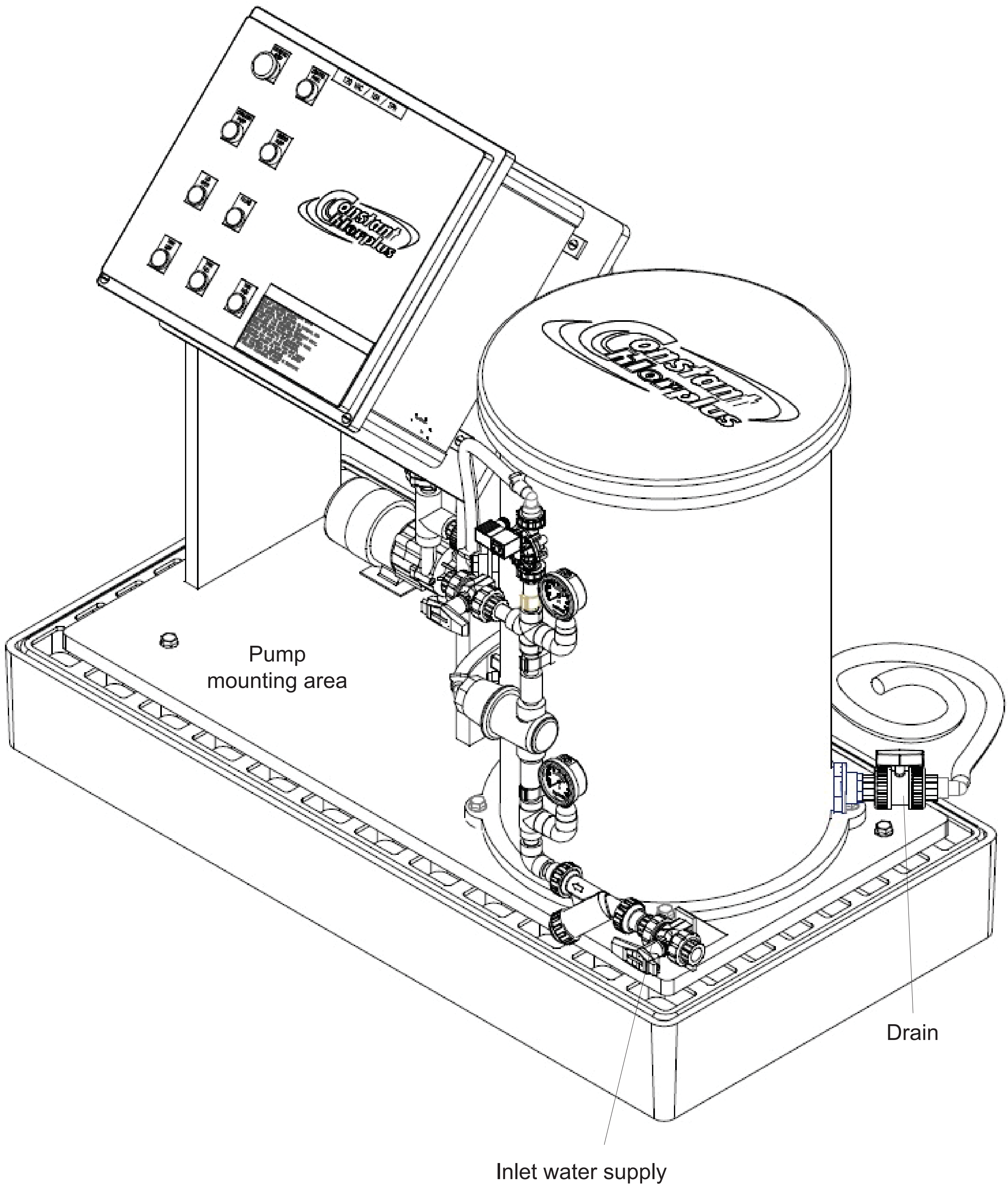
Control Panel

The Constant Chlor® MC4-50 has a UL 508A rated, NEMA 4x control panel with PLC. The standard inputs and outputs are listed in Section V. The control panel has 8 buttons, which have a range of system diagnostics and control features.

SECTION II. Specifications

Model MC4-50 - Chemical Injection Discharge System	
Operational	
Pressure Range	50 to 150 psig *[3.45-10.34 bar]*
Dry Chemical Capacity	75 lbs. *[34.02kg]*
Tank Size (Solution volume)	13 gallons *[49.2 liters]*
Available Working Solution	3 gallons *[11.4 liters]*
Water Inlet Size	1/2″ *[12.7mm]* inch FNPT
Solution Outlet (Injector) Size	1/2″ *[12.7mm]* inch MNPT
Operating Weight	240 lbs. *[108.86kg]*
Operating Temperature	40° to 105° F *[4.4° to 40.6° C]*
Feed Rates	
Chlorine Delivery Rate *(Note: Delivery rate is dependant on the Dosing Pump size.)*	1.0 - 50.0 lb. *[.45kg - 22.68kg]* AvCl/day with 70°F *[21.1° C]* inlet water temperature. 10% decrease for every 10°F *[5.5° C]* drop in inlet water temperature.
Pump Discharge Rate	0-25 gph *[0-94.6 lph]*
Shipping Data	
Shipping Weight	175 lbs. *[79.38kg]*
Shipping Dimensions	52″L x 27″W x 38″H *[132.1cm x 68.6cm x 96.5cm]*
Site Requirements	
Water Inlet	1.0 gpm @ 50-150 psig *[3.8 lpm @ 3.45-10.34 bar]*
Electrical	120V / 1ph / 60Hz - *(20 amp circuit)* 220-240V / 1ph / 60Hz - *(10 amp circuit)* 220-240V / 1ph / 50Hz - *(10 amp circuit)*
Recommended Space Requirements	
Recommended Clearance	84″ L x 48″ W x 60″ H *[213.4cm x 121.9cm x 152.4cm]*
Minimum Clearance	60″ L x 36″ W x 48″ H *[152.4cm x 91.4cm x 121.9cm]*

NOTE: We reserve the right to modify and improve our specifications at any time without notice



Pump
mounting area
Drain
Inlet water supply

figure 1B: System Layout - Front View

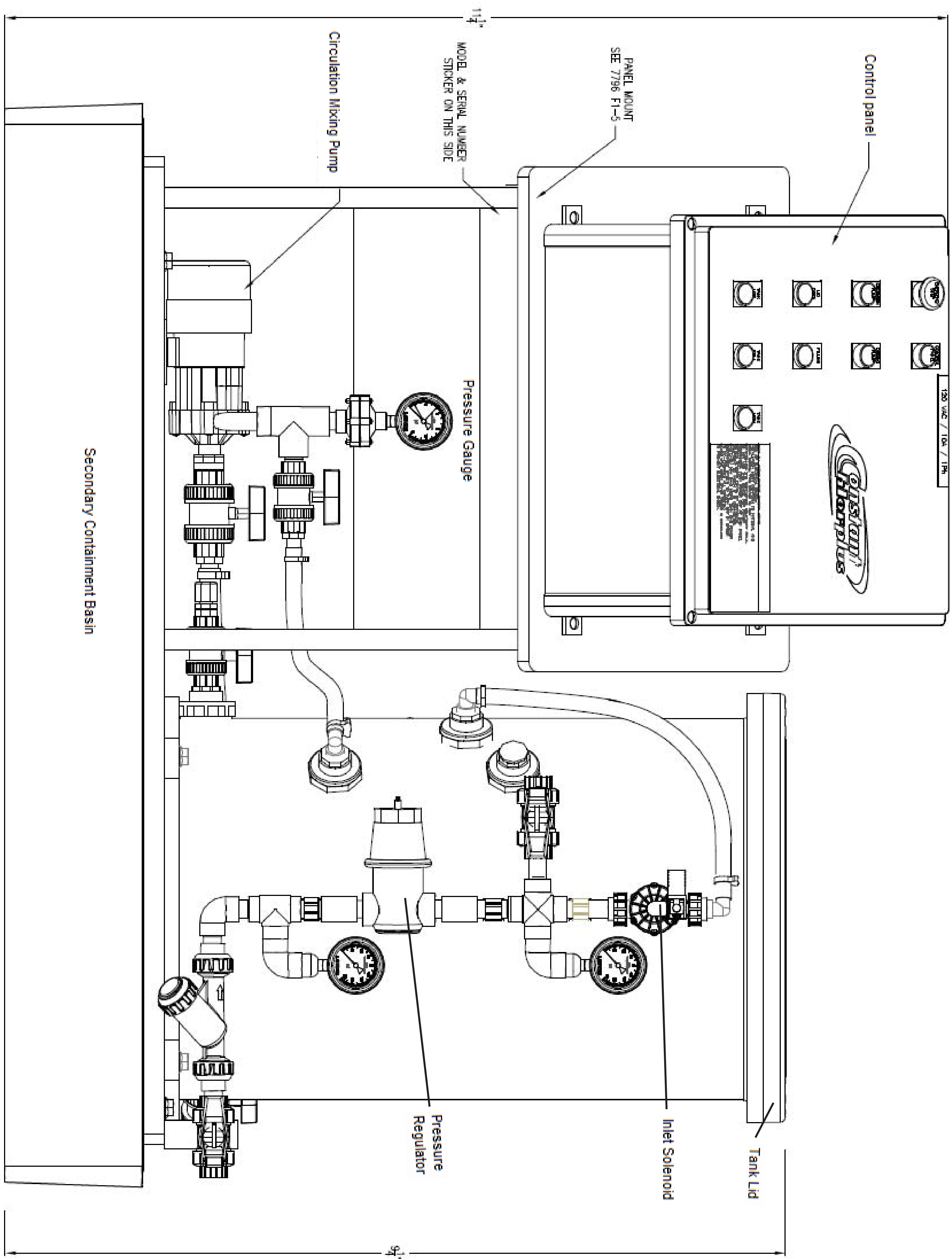
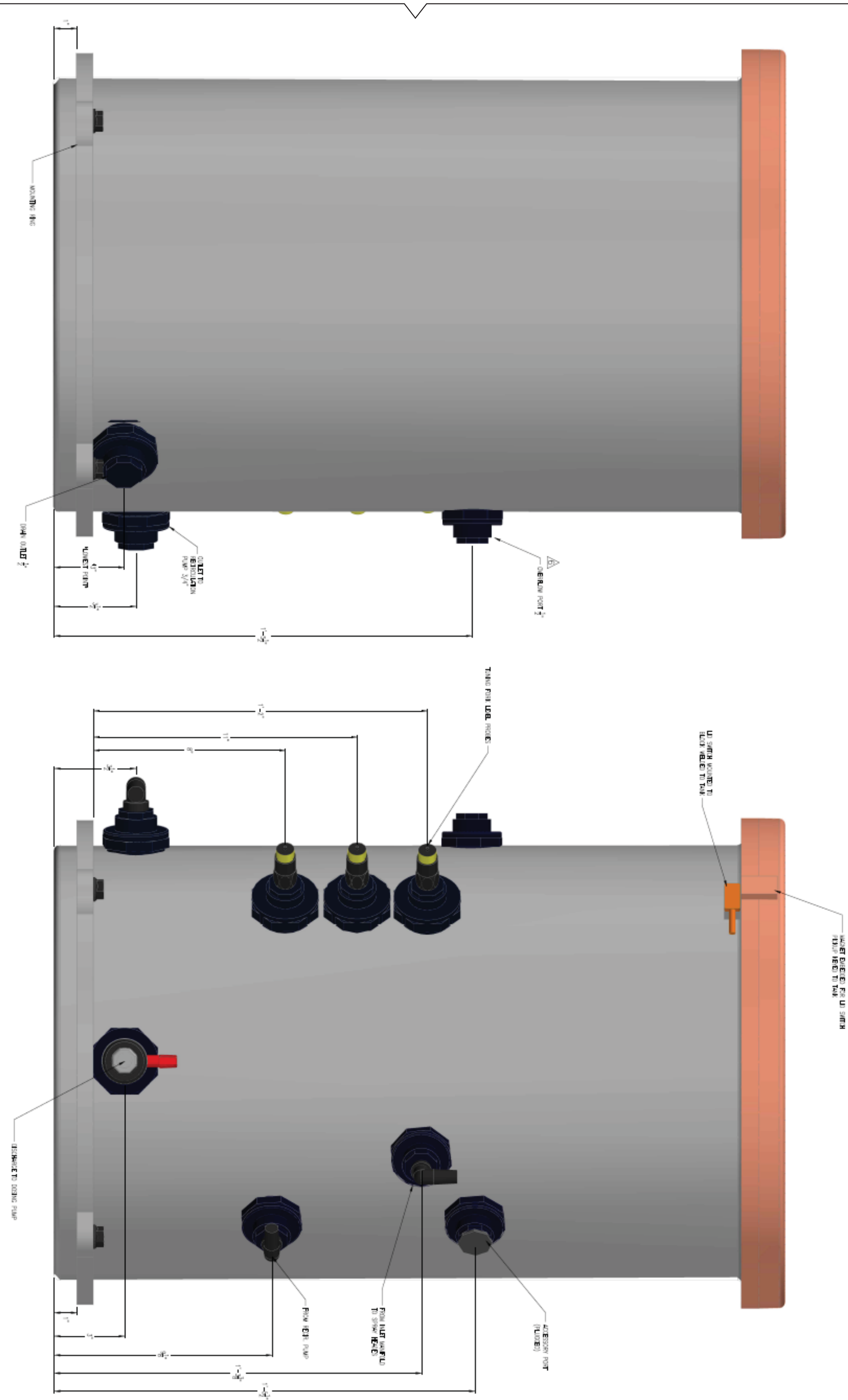


figure 2: Calcium Hypochlorite Tank



SECTION III. Preparation

A. Major System Components:

Please reference Figures 1A, 1B and 2 (pages 8) for layout drawings

a. Control Panel - Figure 1B (pg 8)

b. Pressure Gauge - Figure 1B (pg 8)

c. Circulation Mixing Pump - Figure 1B (pg 8)

d. Secondary Containment Basin - Figure 1B (pg 8)

e. Tank Lid - Figure 1B (pg 8)

f. Inlet Solenoid - Figure 1B (pg 8)

g. Pressure Regulator - Figure 1B (pg 8)

B. Equipment Supplied by Others

a. Metering Pump

b. Chemical injector

c. Tubing and fittings. 1/2″ *[12.7mm]* OD 3/8″ *[9.5mm]* ID polyethylene tubing is acceptable. 1.2″ *[12.7mm]* OD 1/4″ *[6.4mm]* ID braided plastic tubing is preferred. **DO NOT EXCEED 3/8" ID”** *[9.5mm]* **TUBING ON CHEMICAL INDUCTION LINE.**

d. Plastic check-valve at injection point

NOTE: Do not install a strainer of any type on the chemical injection line.

C. Arch Chemicals Technical Support

Arch Chemicals can provide startup support and training as well as troubleshooting for in-field applications. Please contact your Constant Chlor® distributor for more information on pricing and availability.

SECTION IV. Operation and Maintenance

A. Startup and Commissioning Checklist

No.	Items	Initials	Date	Comments
Job Name:				
Equipment Type and Serial Number:				
Pre-Install Checklist (Room)				
1	The installation has been checked by level or plumb bob or other method specified by installation drawings			
2	Is there a drain within ~10′ *[304.8cm]* of equipment			
3	Room has proper ventilation			
4	If required, Cl2 monitor is working correctly			
5	Room is climate controlled			
6	Enough space surrounding equipment for easy and safe access			
7	All accessories for the job have been installed on the vessel openings per the manufacturer's recommendations and engineering specifications			
Startup Checklist				
8	Spray tree installed and Spray Nozzles inside equipment are oriented directly upward and are not turned in any way			
9	No residual debris (plastic shavings, screws, etc) inside vessel			
10	All tubing and unions inside reservoir are installed correctly and not hindered in standard range of motion			
11	Flow directional arrows are pointed in the correct direction of flow on solenoid, inlet water supply, check valves, relief valves, ball valves			
Inlet Water Supply Line Checklist				
12	Is water Pressure constant? Any fluctuations in water pressure?			
13	Are the supply lines properly identified and tagged?			
14	Is supply line secure and not a tripping hazard?			
15	Inlet pressure gauge(s) are working correctly and inlet water pressure is operating at optimal 45 psi			

A. Startup and Commissioning Checklist (continued)

Job Name:				
Equipment Type and Serial Number:				
No.	**Items**	**Initials**	**Date**	**Comments**
Electrical and instrument Checklist				
16	All electrical wire (power supply, instrumental, etc) is secure and free from being a trip hazard			
17	All level sensors, lid switches, alarms have been tested and are operating correctly			
18	Lid Sensor shut-off is working			
19	Instruments are mounted and installed per specification			
20	All exposed electrical and instrument lines are protected and meet field conditions			
21	Components meet area electrical classification			
22	All electrical work performed by licensed electrician			
23	All field components have identification tags and all wire ends are labeled			
24	Correct measures have been taken to ensure electrical requirements are being met			
Chemical Dosing Pump Checklist				
25	The dosing pump is securely mounted to skid, floor, or wall			
26	Tubing is secure and length of the tubing is minimized (minimize peaks and valleys to prevent solids from settling). Tubing is free from kinks			
27	Tubing specifications are in accordance with manufacturer's recommendations			
28	Tubing is installed so that it is not liable to be damaged or cut			
29	If tubing is installed outdoors, it is insulated to preventing freezing			
30	No metal fittings used for connections and fittings are sealed and not leaking			
31	Discharge tubing is equipped with a back-flow prev. valve			
32	No inline/Y-Strainer used on feeder discharge			
33	Pressure-relief assembly installed and operating correctly			
34	Chemical injector – all plastic components and not leaking			
35	Dosing pump has been sized correctly (Maximum head capacity, discharge pressure, flow rate, electrical rating)			

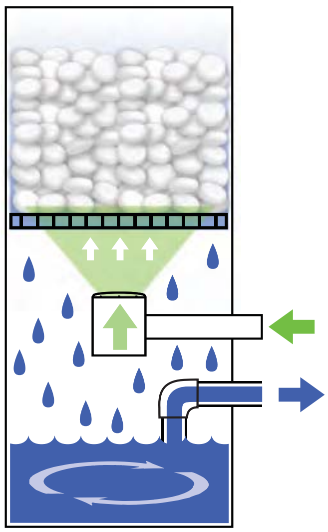
A. Startup and Commissioning Checklist (continued)

Job Name:				
Equipment Type and Serial Number:				
No.	**Items**	**Initials**	**Date**	**Comments**
Agitation Checklist				
36	Eductor nozzles are oriented downward and are not turned			
37	Recirculation pump is installed and mounted correctly below water level (flooded environment)			
38	When solution tank is full, tank is circulating correctly and pump is not airlocked			
39	All intake and return lines for recirculation setup are installed in the correct ports on the tank			
Equipment is ready for service when above complete				

B. Theory of Operation

Method of Operation

The Constant Chlor® Calcium Hypochlorite Briquette Chlorinator is a vertical spray technology and integrated solid suspension technology. The equipment utilizes patented spray technology to spray and saturate a well packed bed of briquettes to generate a solution of calcium hypochlorite in the reservoir, which ranges from 1.5-1.8% available chlorine, depending on temperature. This solution is then metered out via a chemical dosing pump for distribution into the system.



The patent spray technology utilizes a "spray-tree" or manifold which has specific nozzles attached to spray upwards into the suspended bed. The nozzles are vane-less, full cone and all plastic and the pattern of the spray is dependent on inlet water pressure. The height of the nozzle manifold from the bottom of the suspended bed is a critical parameter, as the spray pattern generated at 45 psi *[3.10 bar]* inlet water pressure penetrates the bed of calcium hypochlorite briquettes to a specified and acceptable depth. If the water pressure is not sufficient (<40 psi *[2.76 bar]*), the full-cone spray is not developed and not enough water contacts the briquette bed, which creates un-dissolved product and poor product performance. The unit is equipped with an inlet water pressure regulator to reduce water pressure in excess of 50 psi *[3.45 bar]* to the specified 45 psi *[3.10 bar]*.

All of the Constant Chlor® feeders are equipped with sensor actuated 24VDC solenoid to control the water flow into the feeder. Level sensors on the side of the tank provide alarms and feedback as to the solution level inside the reservoir. These level sensors maintain sufficient water levels inside the tank at all times. For Constant Chlor® feeders that are rated to deliver more than 50 lbs *[22.7kg]* available chlorine per day, the system is programmed with a timer that sprays the bed for 30 seconds and is off for 20 seconds. This timing mechanism allows the water contacting the bed of briquettes to saturate a boundary layer of the calcium hypochlorite product while the spray is off, and when the spray is turned back on, the saturated layer is easily washed away. This produces a consistent and concentrated solution of available chlorine.

The hopper containing the solid calcium hypochlorite briquettes is angled at 60º. The 60º angle allows the product to easily feed downwards as the product below is dissolved. The grid that supports the briquettes is a perforated sheet of PVC with 3/8" *[9.5mm]* holes. The pattern and thickness are critical and are integral to the spray technology. The lid for the hopper is equipped with an automatic shut-off switch that will terminate the spray cycle if the lid is opened.

Because the Constant Chlor® feeder generates a concentrated solution of calcium hypochlorite, a mixing mechanism is equipped inside the solution reservoir. This patent-pending technology enables the solution to be homogeneously mixed and prevents build-up of solids inside the equipment. The solution reservoir is equipped with a high-head capacity centrifugal pump that circulates and returns the solution through a mixing eductor nozzle designed to enhance mixing and particle suspension.

Because the Constant Chlor® feeders generate a concentrated solution of available chlorine, with high solid peristaltic pumps are generally used to dose the solution into the point of application. Typical feed rates are 10-40 gph *[37.9-151.4 lph]*, but some applications can deliver in excess of 200 gph *[757.1 lph]*. The low flow rates and high concentration enable precise control and constant chlorine residual. The chemical feed pumps are generally equipped with a pressure relief valve that can be routed back into the Constant Chlor® feeder if there is a problem with injection downstream. Correct chemical injectors and tubing size are critical in the application of the Constant Chlor® system. All plastic injectors, non-fouling tips, and 1/2" *[12.7mm]* OD (maximum) are all recommended, but not supplied with the equipment.

Overview of Operation

- Inlet raw water supply 1.0 gpm *[3.8 lpm]* at 45 psi *[3.10 bar]* or greater enters water supply manifold
- Solenoid valve opens, allowing pressurized water to spray bed of calcium hypochlorite briquettes, which are suspended over solution reservoir
- Calcium hypochlorite briquettes are dissolved, making a solution of available chlorine in the reservoir
- Level sensors turn on or turn off inlet solenoid valve
- Pump circulation system constantly mixes the solution in the reservoir
- Chemical dosing pump withdraws solution from the reservoir tank to point of application

C. Step-By-Step Start-Up

1. Before starting up, be sure to complete the Startup Commissioning Checklist in section A.
2. Inlet ball valve on the water supply line should be in the closed position.
3. For startup, it is best to fill the hopper approximately half full with Constant Chlor® Briquettes. (The first batch of solution will be ~0.10-0.50% weaker than the normal 1.50% available chlorine solution and will increase steadily as the bed conditions and the solution turns over).
4. Replace lid on unit.
5. Turn Power ON.
6. Slowly open the inlet ball valve to allow water to flow through the manifold. You will hear an audible clicking of the solenoid valve opening.
7. Check to make sure that pressure gauges are operating, indicating flow. The gauge on the left should read 45 psi *[3.10 bar]*.
8. The circulation pump should be OFF and as the tank begins to fill, the TANK LOW light will go off and the circulation pump will turn on
9. As the circulation pump develops head pressure to >5 psi *[0.34 bar]*
10. The tank will continue to fill until the TANK FULL light is ON.
11. Turn ON the chemical dosing (metering) pump on the control panel.

D. Recommended Maintenance Schedule

Parts to be Inspected and Cleaned	Alkalinity (ppm)	Frequency	Estimated Time
1. Support Grid and Level sensors	50	Quarterly	2 hours
2. Spray Nozzle			
3. Supply and Discharge Lines and Pump Head of Chemical Dosing Pump	100	Monthly	
4. Chemical Injector	150	Bi-weekly	
5. Plastic Eductor on Circulation Line			
6. Supply and Discharge Line and Pump Head of Circulation Pump	200+	Weekly	
7. E-stop operation			

Important Note about Silica: Silica in excess of 25 ppm can contribute to scaling. Calcium silicate can form solid deposits in addition to calcium carbonate scale and can increase cleaning frequency even if alkalinity levels are low. There are a variety of methods to pre-treat and remove both carbonate alkalinity and silica, thereby reducing maintenance significantly. Please contact your Constant Chlor® distributor about pre-treatment options.

E. Preventative Maintenance Schedule

Item	Instruction	Check	Maintenance
Hopper Basket	Daily		Check briquette level and verify there is enough chemical to be fed until the next visit, if the outer bound briquette are moist, move the briquette to the center of the basket
Recirculation Pump	Daily		Check for leaks on line, verify pressure is above 3 psi as indicated on te pressure gauge, consider rebuild pump Wet end if pressure drops below 3psi
Dosing Pump Lines	Daily		Check all connections for leaks and part degradation.
Inlet Supply Solenoid Valve	Daily		Ensure solenoid coil is not hot to the touch and that valve does not make a rattling noise when energized.
Lid Sensor Shut-Off	Daily		Remove lid and make sure that "Lid Open" alarm is activated. When replaced, make sure that alarm is cleared.
Bulk-Head Fittings	Daily		Verify that there are no leaks at any of the bulkhead fittings.
Inlet Manifold	Daily		Verify that there are no leaks at any of the fittings.
Cal-Hypo Support Grid	See pg 17		Inspect grid for cleaning. Follow maintenance procedures for cleaning the grid if holes are fouled.
Chemical Injection point	See pg 17		Remove injector and inspect for solid build-up and scale. Follow maintenance procedure if fouled.
Tank Mixing Eductor	See pg 17		Visually inspect the 3/8" *[9.5mm]* mixing eductor in solution reservoir. Look to see if there are calcium deposits and follow maintenance procedures to clean.
Level Switches	See pg 17		When tank is empty, verify "Low Solution Level" light is ON. When tank is full, verify "Low Solution Level" is OFF and "Tank Full" is ON.
Spray Nozzles	See pg 17		With lid open and hopper removed, visually inspect spray nozzles for fouling. Make sure they are point upwards and level towards the grid.
Dosing Pump Lines	See pg 17		Verify that lines are free of solids and not fouled.
E-Stop Operation	See pg 17		Depress button and ensure that all functions on the unit STOP.
Inlet Supply Solenoid Valve	Quarterly		Check for an audible clicking when before going into "Filling" or "High Level" modes. Ensure solenoid coil is not hot to the touch and that valve does not make a rattling noise when energized.
Y-Strainer Inspection	Bi-Annual		Close water supply valve. Remove strainer and inspect for debris.
Recirculation Pump	Annually		Rebuild pump wetend
Inlet Supply Solenoid Valve	Every 2 years		Replace solenoid valve

F. Recommeded Cleaning Procedures

SAFETY NOTE: Please use Personal Protective Equipment (PPE) per the MSDS sheet when handling the Briquettes.

CAUTION! Make sure spray is turned off before opening the Hopper Lid.

DO NOT USE CONCENTRATED ACID TO CLEAN THE HOPPER OR GRID. Instructions for a dilute acid solution are provided below.

NOTE: It is recommended to let the briquette level drop as low as possible prior to cleaning the Hopper and grid.

Supplies needed:

- PPE – Gloves, Goggles, and Apron
- Clean 5 gallon plastic bucket
- Hose
- Drain line from base of feeder (routed to the drain)
- Muriatic Acid (Hydrochloric Acid), 20° Baume (32%)

Tank Cleaning

1. Allow hopper to empty as much as possible prior to cleaning.
2. Ensure that the point of application for the chlorine is turned off and not requiring chlorination.
3. Shut-off inlet ball valve on supply manifold.
4. Remove lid and hopper.
5. Disconnect the union for the spray manifold and remove the spray-tree and.
6. Connect tubing to drain line and route to drain.
7. Open drain ball valve and allow the solution to drain.
8. Rinse the feeder 2-3 times by using the hose to fill the tank and at the same time draining. Allow the feeder to completely drain. Remove as much residual solids and calcium hypochlorite residue as possible with the hose.
9. Prepare in the 5 gallon bucket a solution of weak acid by making a 3:1 solution of water to muriatic acid.

   CAUTION: ALWAYS ADD ACID TO WATER
10. Gently pour the solution of weak acid into the feeder tank. Add at least enough solution to SHUT-OFF the TANK LOW alarm. This will activate the circulation pump and mix the acid solution through the system. Allow to mix for 20 minutes and drain the system. Rinse one more time.

Chemical Dosing Pump and Injector Cleaning

11. Remove injector and disconnect tubing from injector.
12. Soak injector and suction and discharge tubing for chemical dosing pump in 3:1 solution of water to muriatic acid.

    CAUTION: ALWAYS ADD ACID TO WATER

Chemical Hopper Cleaning

13. Rinse the hopper prior to cleaning. In a cleaning pan, add a 3:1 water to acid solution to clean the grid and the spray-tree.

    CAUTION: ALWAYS ADD ACID TO WATER
14. Place the hopper in the pan so that the grid is submerged. Place spray-tree in pan too. Allow to sit for 20 minutes.
15. Rinse all components with fresh water and replace spray-tree, deflector shield, and hopper. Close drain and add briquettes.
16. Replace lid and open inlet ball valve.
17. Discharge according to local sewer discharge requirements.

G. Step-By-Step Shut-Down and Storage

When the chlorinator is going to be shut-down for extended periods of time (>3 weeks) the unit should be drained prior to shut-down. Allow the product in the hopper to empty. Follow the above section for rinsing and cleaning the hopper. The solution tank should also be drained and cleaned prior to shut-down.

1. Turn OFF the chemical dosing (metering) pump on the control panel. Follow manufacturer's recommended storage procedure for the chemical dosing (metering) pump. The dosing pump lines should be flushed prior to storage.
2. Close inlet water supply ball valve.
3. Drain the tank via the drain ball valve.
4. The TANK FULL light will turn off.
5. The TANK LOW light will turn on and the circulation pump will turn off.
6. Rinse and drain the feeder to ensure that the circulation lines and the circulation pump head do not contain residual calcium hypochlorite, as these can solidify over time.
7. If the unit is going to be stored or shipped in freezing conditions, make sure that the inlet manifold and solenoid do not contain water. This is best accomplished by disconnecting the tubing from the solenoid discharge (to the tank) and allowing it to drain. **DO NOT STORE UNIT WITH ANY RESIDUAL WATER INSIDE THE SYSTEM.**

SECTION V. Technical Data

A. Water Quality

Water chemistry changes from site to site and even season to season. It is important to understand how water chemistry effects the Constant Chlor® MC4-50. There are options for pre-treatment to remove impurities that can react inside the Constant Chlor® MC4-50. The main parameters that need to be identified are: carbonate alkalinity (hardness as CaCO-3), silica, iron, and manganese. Alkalinity and silica can react inside the Constant Chlor® MC4-50 and produce scale on the grid and the dosing lines. It is important to know the iron and manganese levels if pre-treatment such as reverse osmosis is used because these species can harm the RO membrane.

B. Operating Specifications

The system operates under the following conditions:

- Water supply at 45 psi *[3.10 bar]* and 1.0 gpm *[3.8 lpm]*
- Solution reservoir is non-pressurized
- 50 lbs *[22.7 kg]* available chlorine per day (75 lbs *[34.0 kg]* cal-hypo per day)
- 0-25 gph *[0-94.6 lph]* delivery of 1.5% available solution
- Solution is mixed using a centrifugal pump at 6 gpm *[22.7 lpm]* at 7 psi *[0.48 bar]*
- The solution reservoir contains 13 gallons *[49.2 liters]* of solution
- The working volume of solution is 3 gallons *[11.4 liters]*

C. Electronics Panel and PLC Information

- 120/240VAC, 60/50Hz, 15/10A, 1Phase
- 4 Normally Open Contact relays for Remote Interface. 1 Dry Contact for Remote Start of Dosing Pump
- 24VDC Control Power
- 8 Buttons / Indicators:
  - OFF/ON Indicator: Push-Button to turn the unit ON or OFF
  - LID OPEN: Prevents the unit from operating if lid is opened
  - TANK LOW: Solution inside tank is low, alarm condition
  - CIRCULATION PUMP: Circulation pump is interlocked with TANK LOW AND will not operate if TANK LOW alarm is activated. Push-Button to turn ON or OFF
  - DOSING PUMP: Chemical dosing pump is interlocked to the system. Will not pump if LOW CHLORINE SOLUTION alarm is activated. Remote or manual start capability. Push-Button to turn ON or OFF
  - FILLING: Indicates that the solenoid is energized and the unit is making solution
  - TANK FULL: The level sensor is engaged and the tank is full of chlorinated solution
  - E-STOP: Push-Button emergency stop for the unit. Turns OFF every function

SECTION VI. Troubleshooting

A. Guide

Trouble	Probable Cause	Remedy
Calcium Hypochlorite solution tank is empty and/or TANK LOW light is on.	Drain port may be open or leaking.	Check ensure fitting and connections are tight and not leaking.
	Inlet supply ball-valve may be closed.	Ensure valve is open.
	Inlet y-strainer may be plugged.	Perform preventive maintenance on y-strainer.
	High and low solution level switches may be inoperable.	Remove hopper, drain solution, and verify on control panel that both Tank Low is ON when down and OFF when in the up position. Check Tank full is OFF when down and ON when in up position.
	Lid switch may be malfunctioning or misaligned causing supply water to shut off.	Ensure lid is secure and in place.
	Bulkhead fitting may be leaking.	Check ensure fitting and connections are tight and not leaking.
Low Chlorine Residual Downstream (and solution level inside tank is at least half full).	Demand increase at point of application or increased flow.	Check to see if water flows or demand has increased.
	Water temperature has changed (colder).	Check records and sample water.
	Ensure pressure relief valve isn't partially open.	Verify that solution is not being returned to the feeder via the PRV.
	Is dosing pump rated to pump against system head pressure?	Check with dosing pump representative or literature.
	Clogged Injector.	Clean injector (see injector fouling remedy).
	Clogged dosing pump tubing.	Clean or replace tubing.
	Siphoning.	Ensure injection point is above feeder's height.

Trouble	Probable Cause	Remedy
Injector is fouling quickly.	Injector with metal fittings used - failing.	Replace injector with compatible material.
	High alkalinity in source water causing scale formation.	Setup a predictable PM Schedule.
	"Injector" is not setup with spring-gate or "duck-bill" type closed tips.	Standard tubing connected to the point of injection is insufficient. A chemical injector that prevents constant mixing at the tip is required.
	Low solution dosing velocity.	Decrease tubing size to increase solution velocity.
Dosing pump tubing is clogging up with white solids.	Extremely high alkalinity or silicates.	Install pre-treatment such as reverse osmosis, water softener, deionizer, etc.
	ID of tubing is too large, reduce diameter tubing.	Consult Installation Manual regarding proper tubing sizing.
	Agitation inside feeder is not working. Solids are forming and being pulled into the tubing.	Ensure circulation pump is working and providing >5 psi. Clean circulation system.
	Too many "peaks and valleys" in tubing run.	Avoid long vertical runs at pump discharge.
	Solids building up in base.	Remove solids by cleaning the unit.
Strong chlorine smell in utility room.	Feeder is overfilled and product is sitting too long in hopper.	Reduce amount of product in hopper by 50%. Install vent line in "Accessory port" and vent to outdoors (see Section B of this section).
	Hot, humid environment in utility room.	Ensure that storage and ventilation recommendations are being met. Follow above instructions as well.

B. Installing a Vent Line

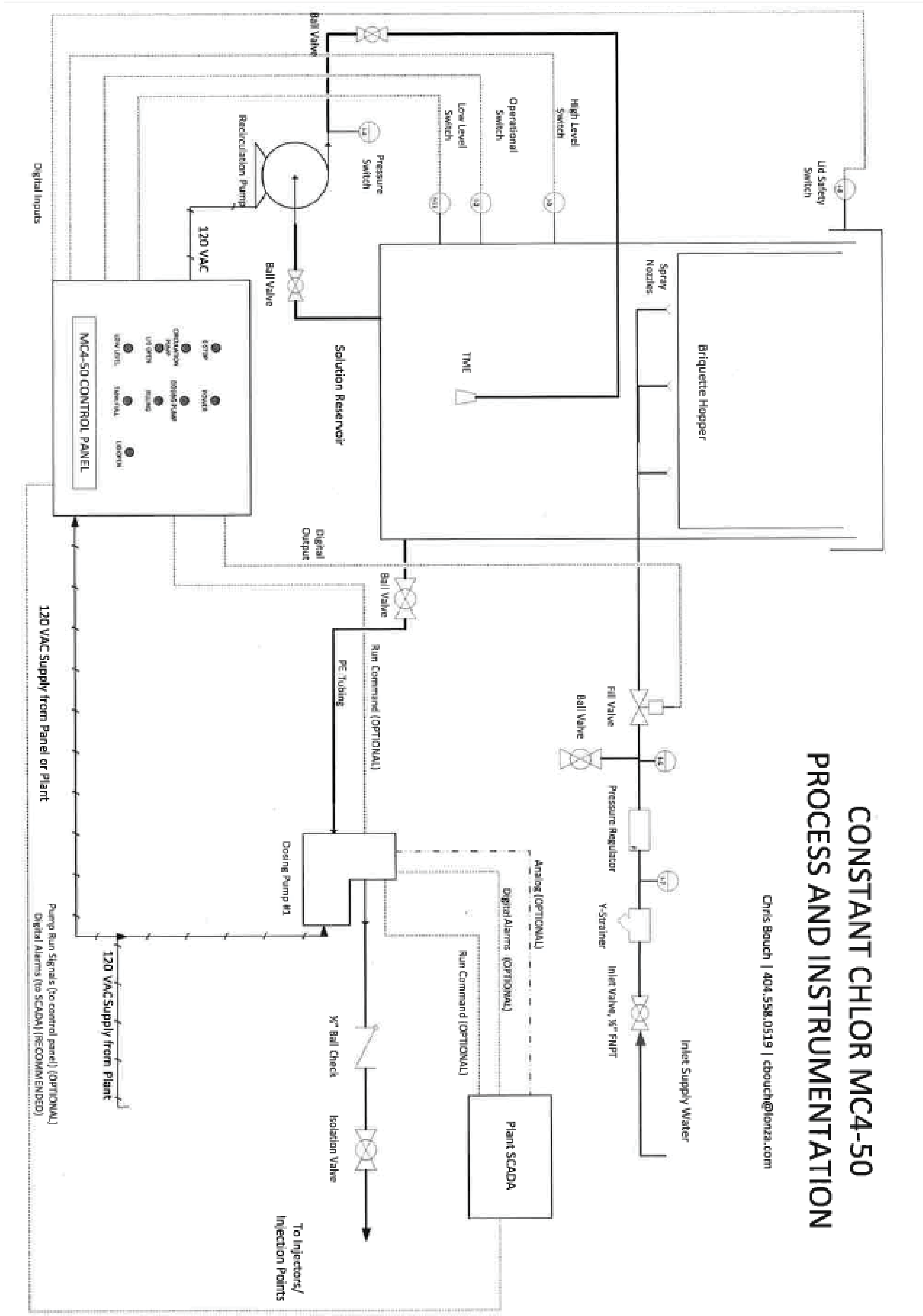
There are circumstances that require a vent line to be installed. Scenarios can vary from hot environments, to low feed rates. There is a 1/2" *[12.7mm]* FNPT bulkhead fitting labeled "Accessory Port" that can be seen in Figure 2. This can either be used as pressure relief return or a vent line. To install a vent line, you will need the following:

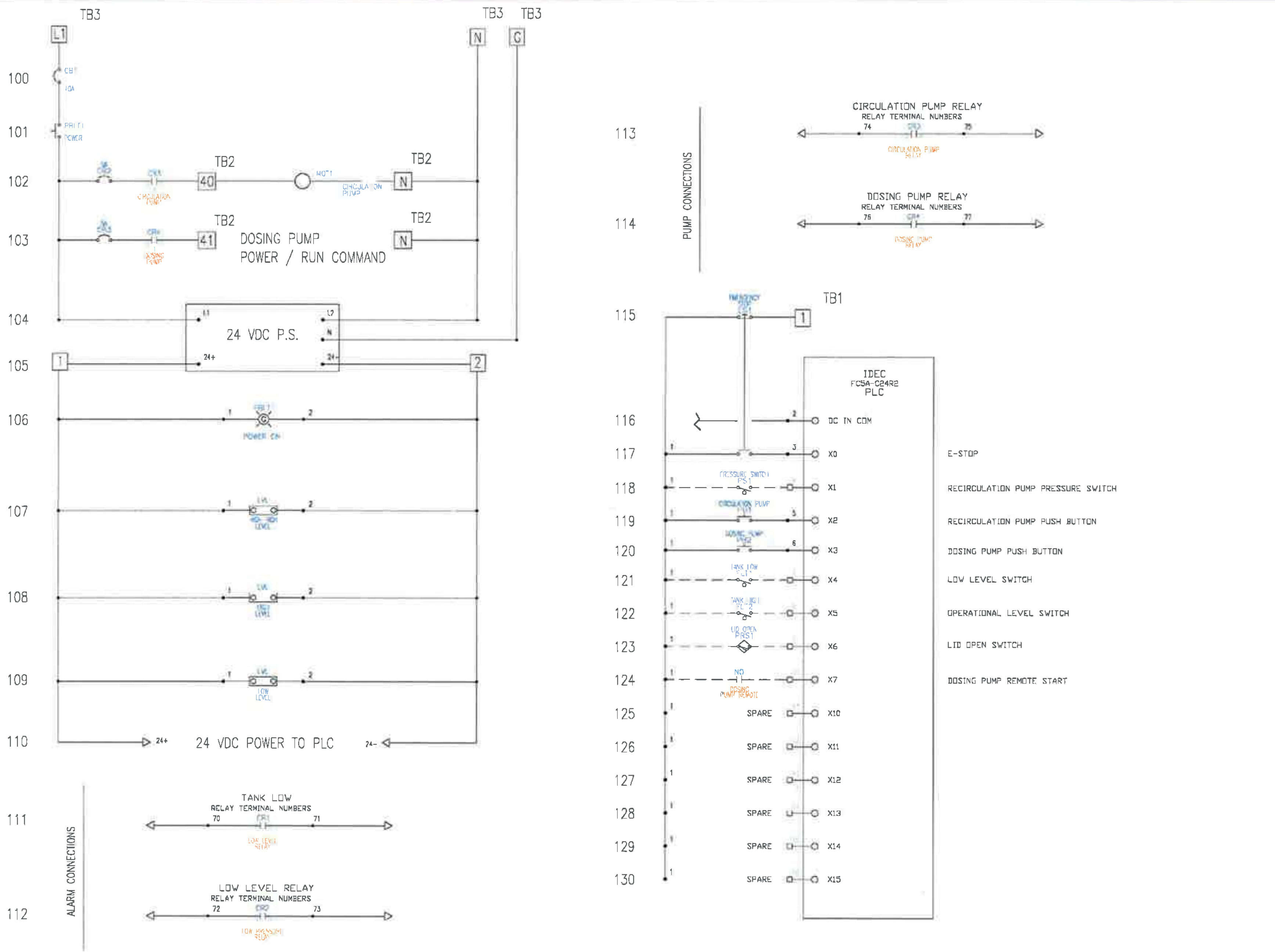
- 1/2" *[12.7mm]* MNPT barbed fitting
- 3/4" *[19.1mm]* OD tubing (preferably clear tygon)
- Teflon tape

Install tubing connector, and tubing. Run the tubing straight down towards the ground and preferably to a louver or vent to the outdoors. Ensure that tubing run stays flat on the ground and is not obstructed. The chlorine vapors are heavier than air and will gravity flow through the tubing as long as it is close to the ground.

SECTION VII. Engineering Drawings

A. P & ID



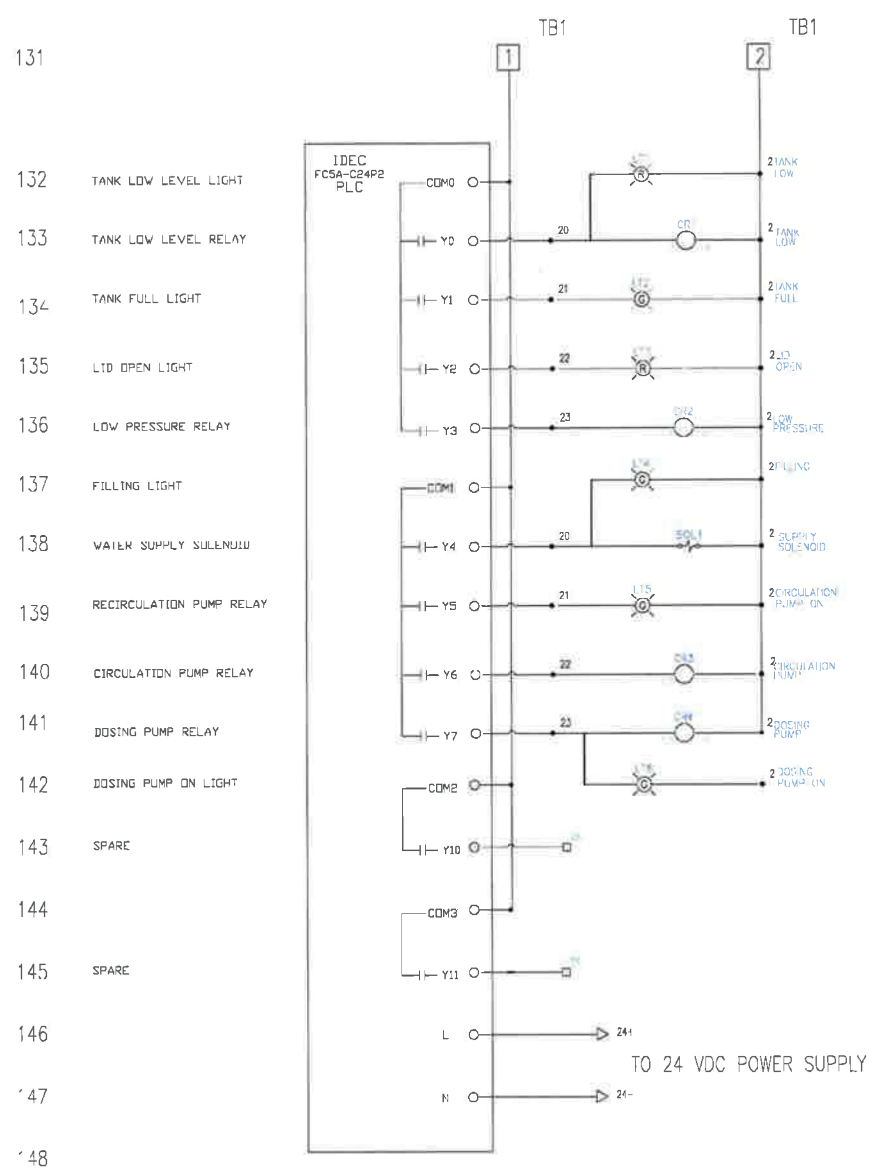


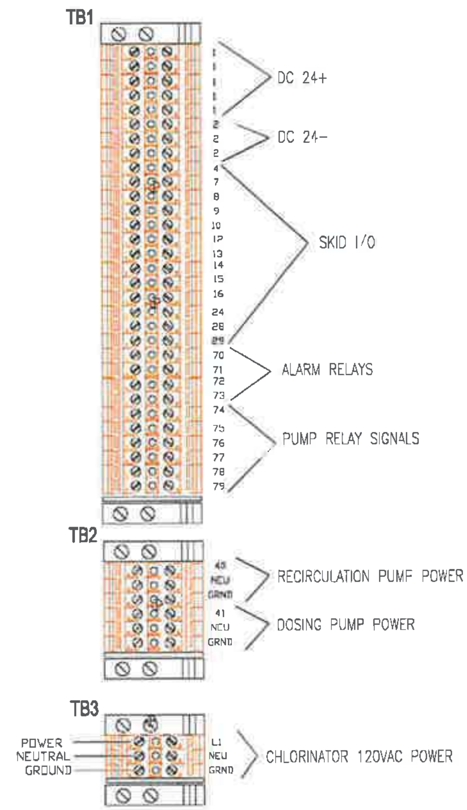
NO.	REVISION	DATE	BY
1		4/8/13	CAI
2			
3			
4			
5			
6			

ARCH

CRIMPL FEEDER ELECTRICAL CONTROL PANEL WIRING MC4-50

DRAWN BY: C.BOUCH
CHECKED BY:
SCALE: NONE
DWG. NO. E-MC4-50-2





TAG	QTY	DESCRIPTION
	1	Non-metallic enclosure, NEMA 4X, top-hinge with locking screws, 18"x16"x10"
	1	w/coated steel back plane and DIN mounting rails.
PLC	1	Idec Microsmart PLC, FC5A-C24R2
	1	Power supply, Idec PS5R-SB24
CB1	1	Circuit protector, Idec NC1V11, 10 A
CB2	1	Circuit protector, Idec NC1V11, 5 A
CB3	1	Circuit protector, Idec NC1V11, 5 A
CR1,2	2	Power Relay, DPDT, Idec RH1BU-DC24V
CR3,4	2	Relay Socket, Idec SH1B-05
PB#	2	Illuminated push buttons, Idec HW1L-A1F10QD, w/momentary and latching blocks
ES1	1	E-stop mushroom push button, Idec HW1B-A4F11-R, w/latching block

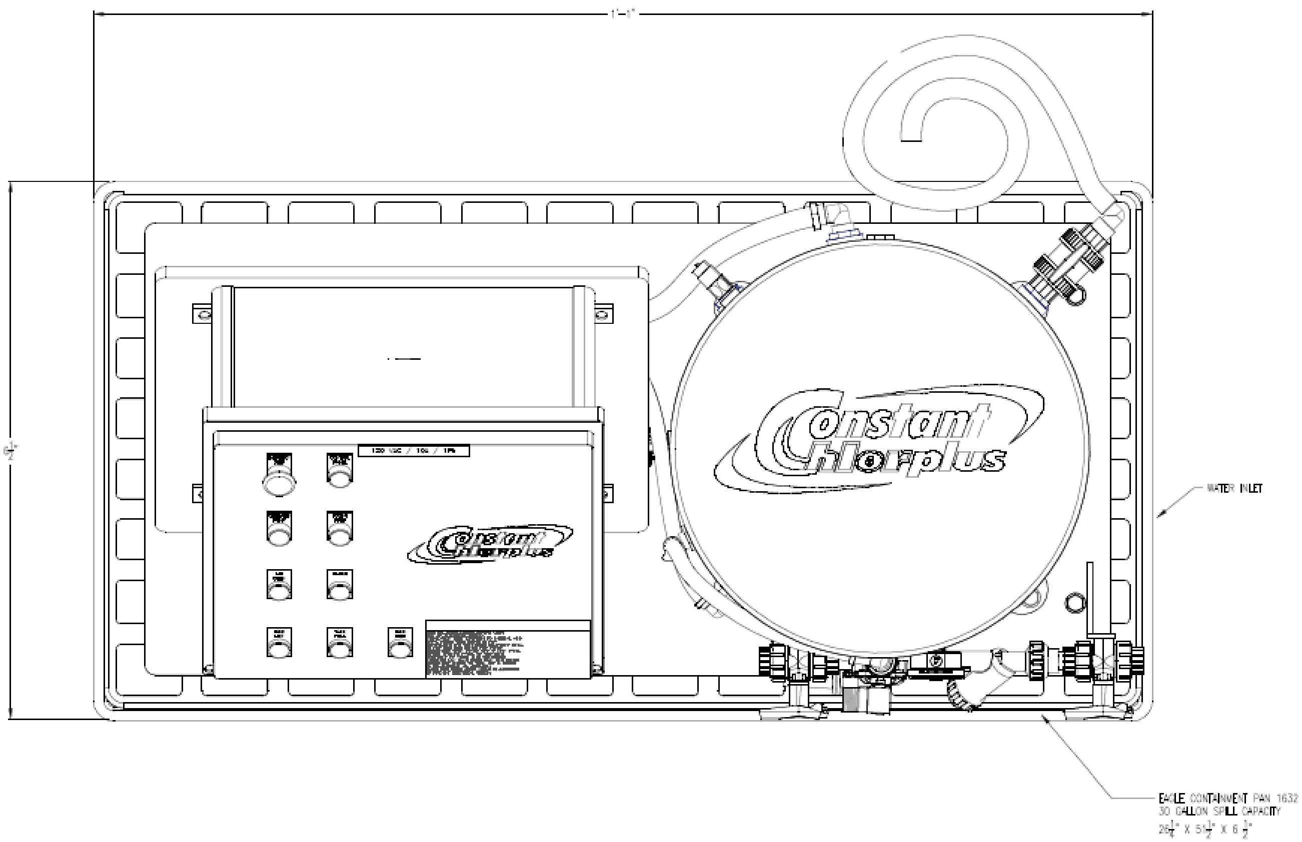
NO.	REVISION	DATE	BY

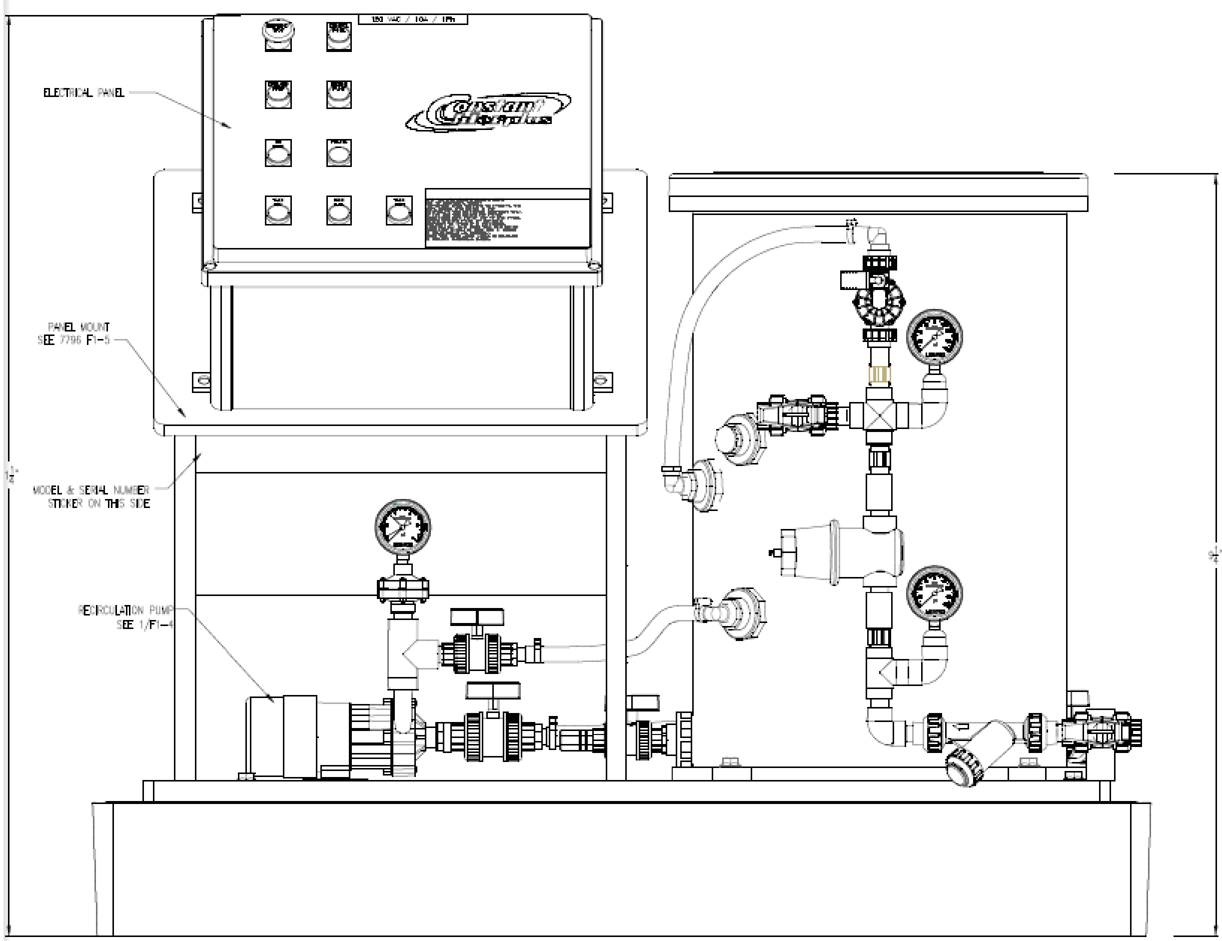
ARCH

CRIMPL FEEDER ELECTRICAL CONTROL WIRING MC4-50

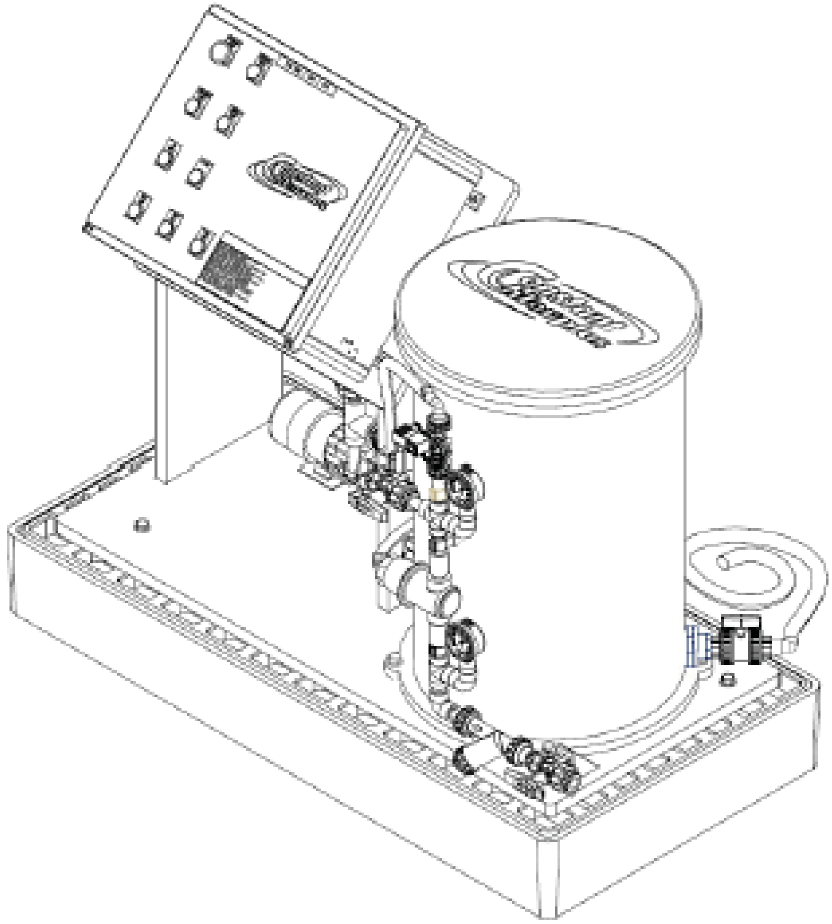
DRAWN BY: C.BOUCH
CHECKED BY:
SCALE: NONE
DWG. NO. E-MC4-50-3

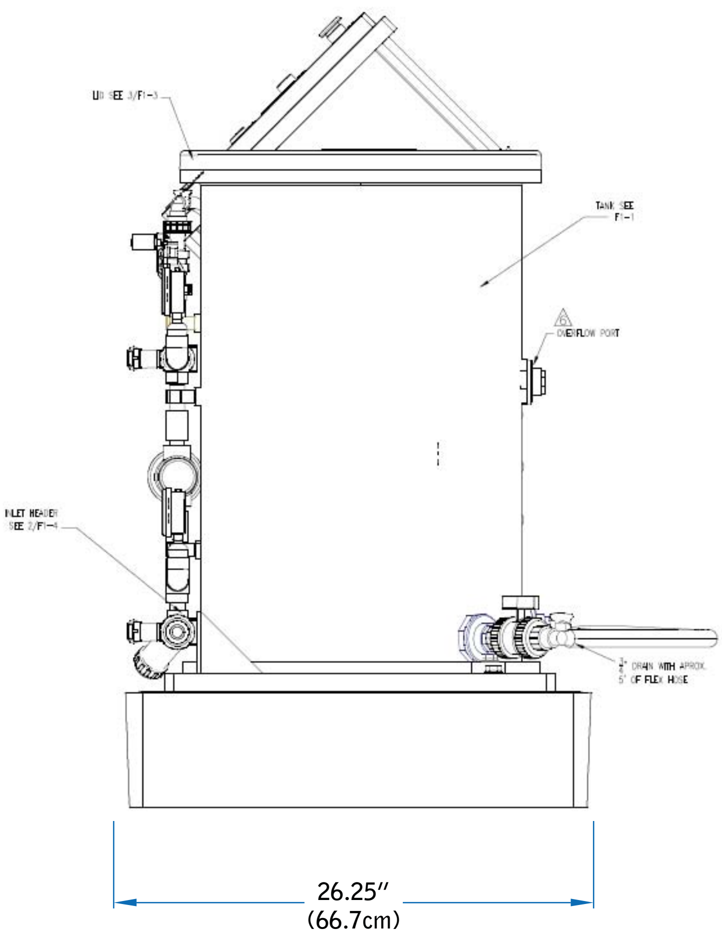
C. 2D Drawings





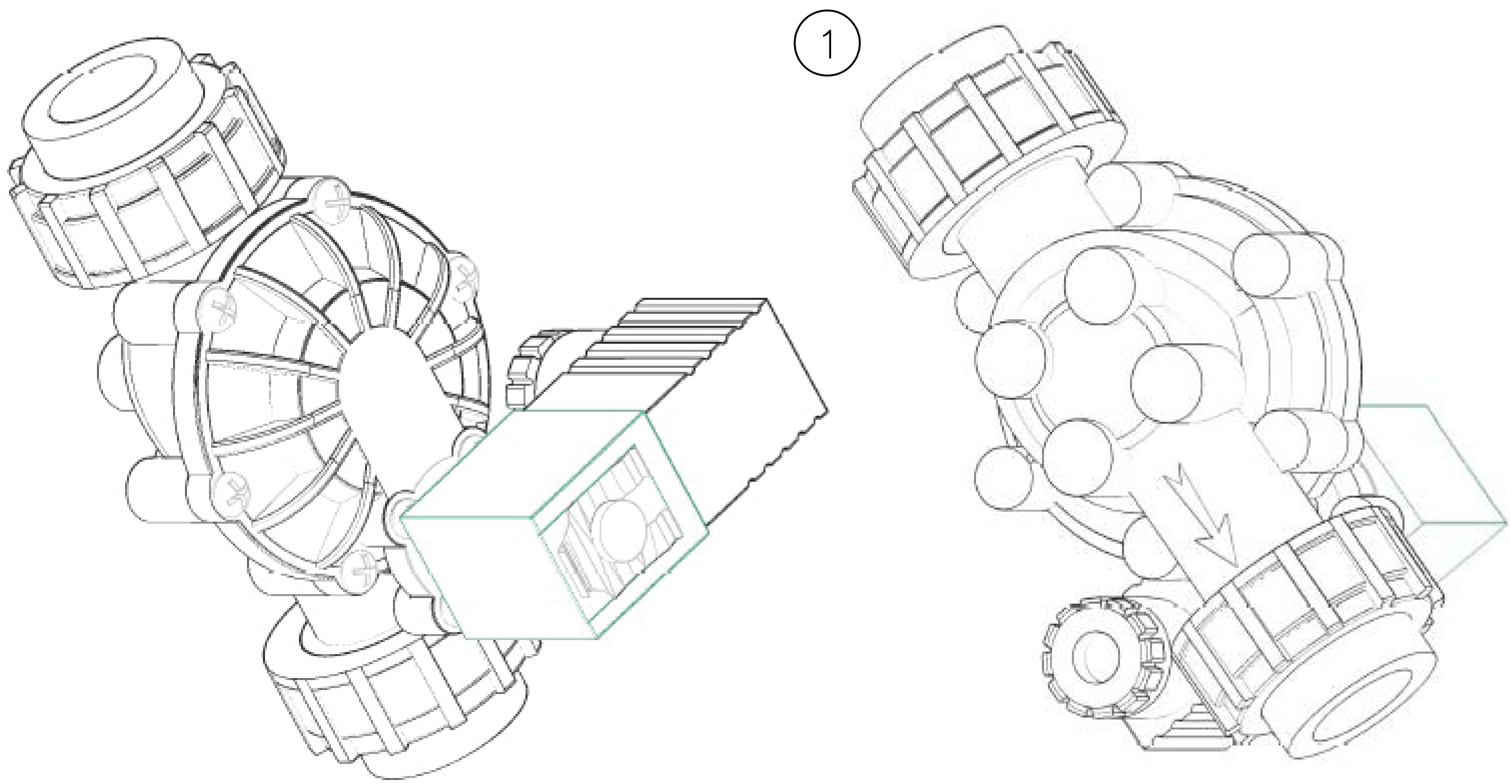
C. 2D Drawings (continued)

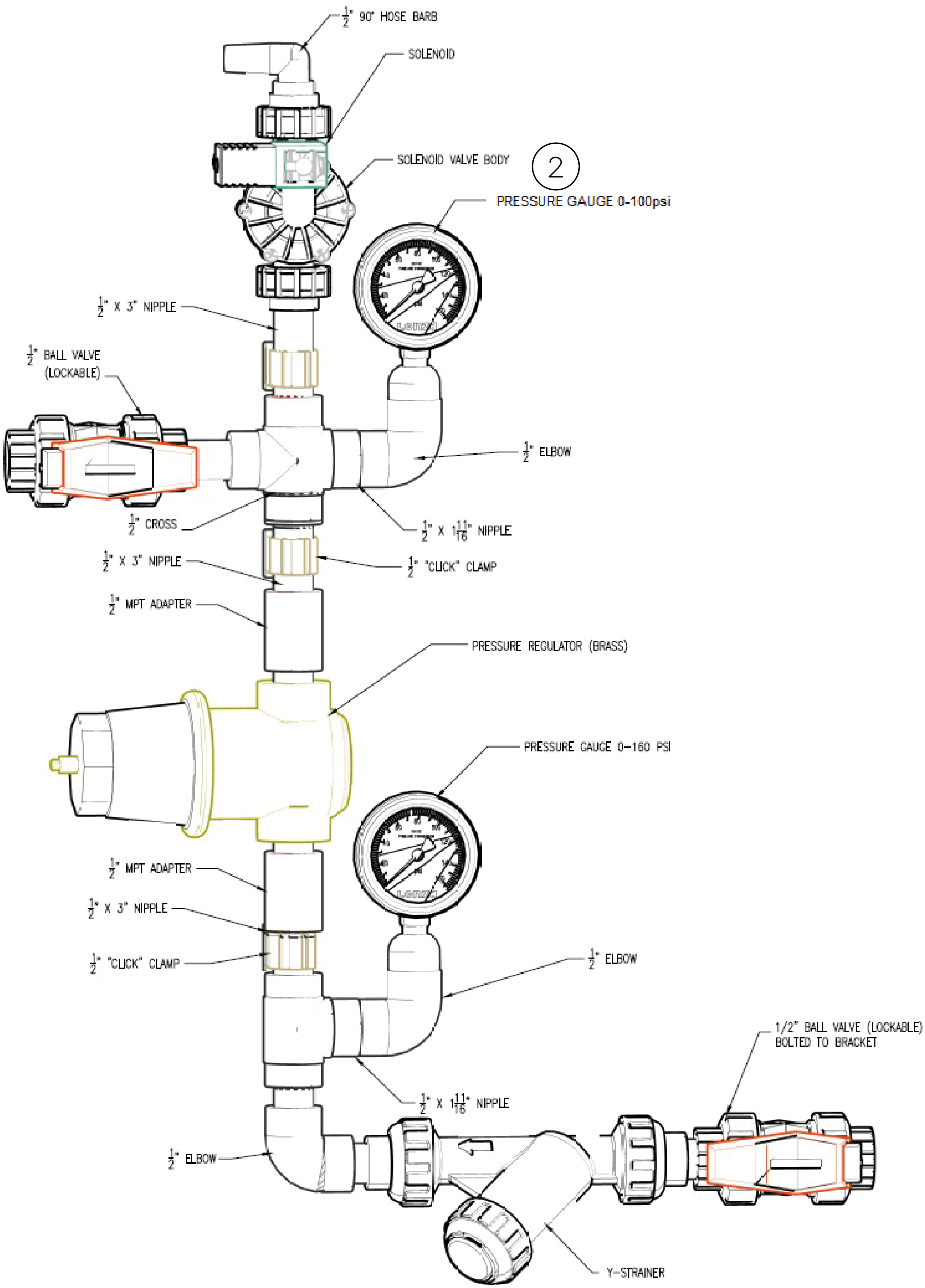




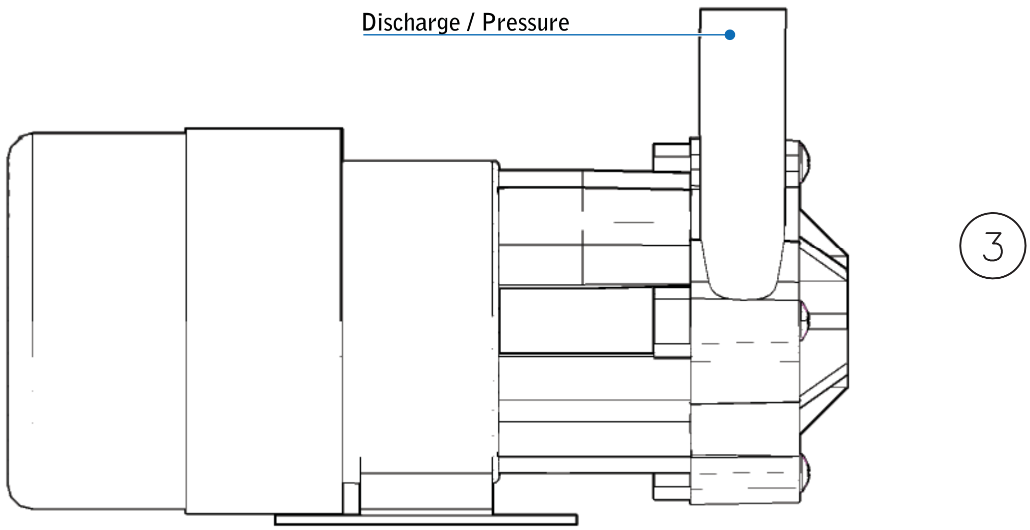
SECTION VIII. Exploded View and Parts List

No.	Description	Part Number
1	24V DC Solenoid valve (Recommended Spare)	79664
2	Inlet Manifold w/out solenoid	79519
3	Magnetic Drive Recirculation Pump	79520
4	Magnetic-drive Pump Wet End (Recommended Spare)	79521
5	Recirculation Re-build (No Pump) (Recommended Spare)	79522
6	Ultrasonic level Switch (switch-tek model: LU10-1405)	Non-SKU item
7	Spray Nozzle (1)	71617
8	Tank Mixing Eductor	79008
9	Basket with Grid (MC4-50 and MC4-50L)	79524
10	Lid with Contact	79564
11	Pre-Programmed PLC (Picture not shown)	79526
12	24VDC power supply, 120 watts, 5 amp (Picture not shown)	79527
13	Spray Tree Assembly (MC4-50 and MC4-50L) (Picture not shown)	79558
14	Lid Switch (Picture not shown)	79580



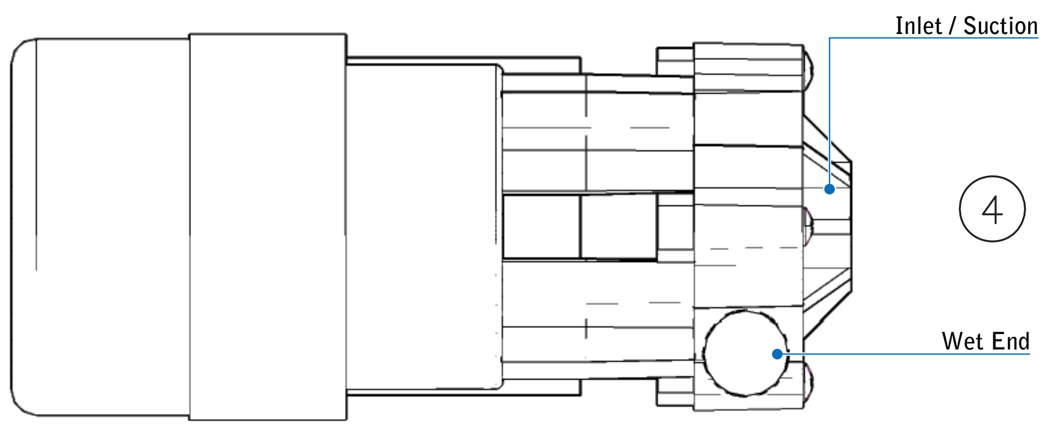


1/2" 90° HOSE BARB
SOLENOID
SOLENOID VALVE BODY
2
PRESSURE GAUGE 0-100psi
1/2" X 3" NIPPLE
1/2" BALL VALVE (LOCKABLE)
1/2" ELBOW
1/2" CROSS
1/2" X 1 11/16" NIPPLE
1/2" X 3" NIPPLE
1/2" "CLICK" CLAMP
1/2" MPT ADAPTER
PRESSURE REGULATOR (BRASS)
PRESSURE GAUGE 0-160 PSI
1/2" MPT ADAPTER
1/2" X 3" NIPPLE
1/2" "CLICK" CLAMP
1/2" ELBOW
1/2" BALL VALVE (LOCKABLE) BOLTED TO BRACKET
1/2" X 1 11/16" NIPPLE
1/2" ELBOW
Y-STRAINER



Front View

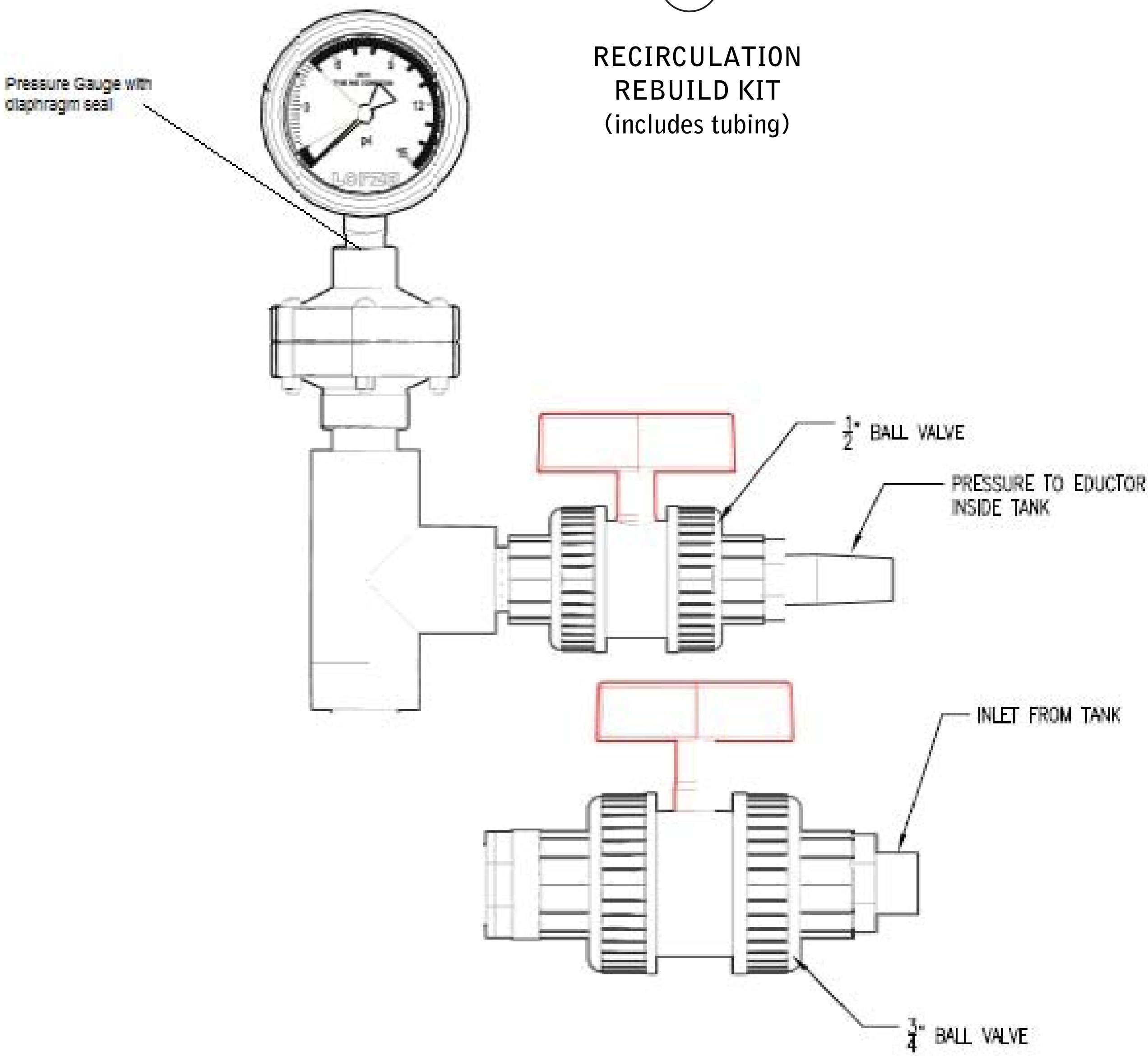
RECIRCULATION PUMP



Top View

5

RECIRCULATION
REBUILD KIT
(includes tubing)



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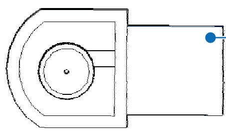

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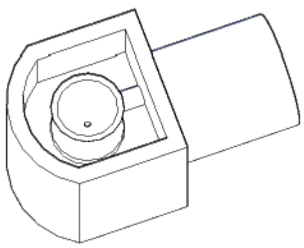

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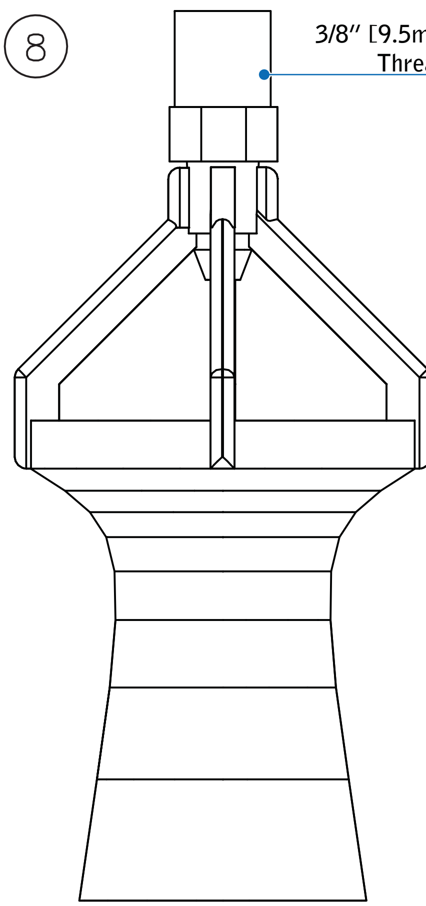

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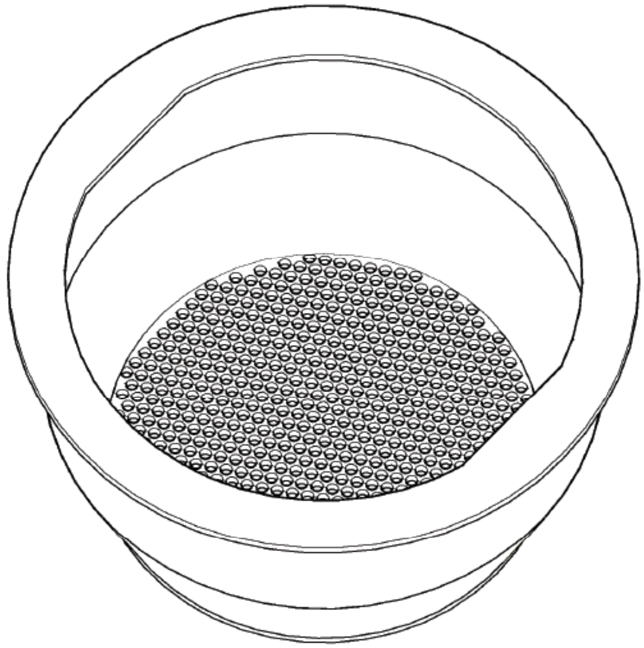

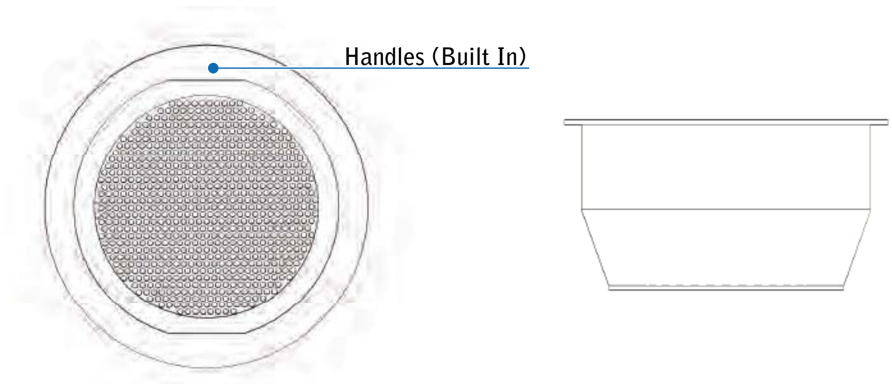

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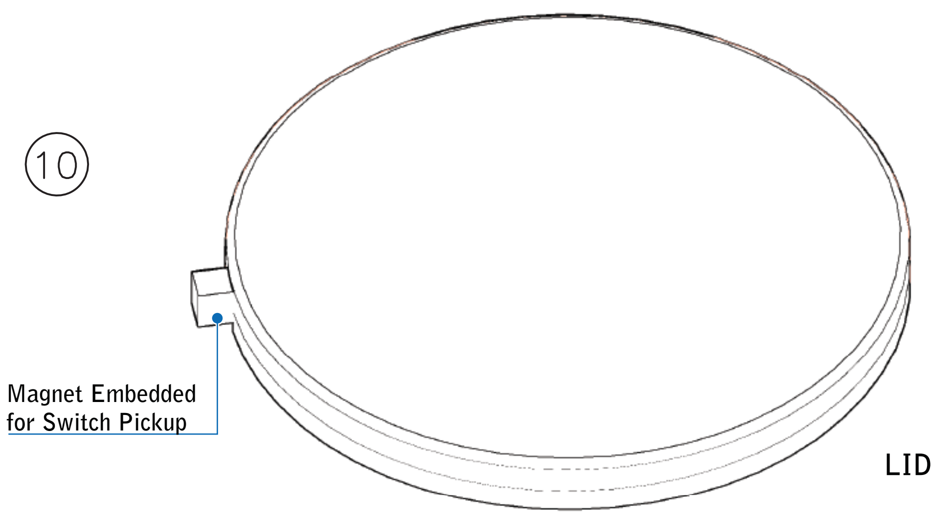


Arch Chemicals, Inc.

MATERIAL SAFETY DATA SHEET

FOR ANY EMERGENCY, 24 HOURS / 7 DAYS, CALL:	1-800-654-6911 (OUTSIDE USA: 1-423-780-2970)
FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC®:	1-800-424-9300 (OUTSIDE USA: 1-703-527-3887)
FOR ALL MSDS QUESTIONS & REQUESTS, CALL:	1-800-511-MSDS (OUTSIDE USA: 1-423-780-2347)

PRODUCT NAME: **CONSTANT CHLOR® PLUS BRIQUETTES**
EPA Registration Number: 1258-1179

1. PRODUCT AND COMPANY IDENTIFICATION

Arch Chemicals, Inc.
501 Merritt 7 PO Box 5204
Norwalk, CT 06856-5204

REVISION DATE:	09/12/2011
SUPERCEDES:	04/29/2010
MSDS Number:	000000000844
SYNONYMS:	None
CHEMICAL FAMILY:	Hypochlorite
DESCRIPTION / USE	Sanitizer and Oxidizer
FORMULA:	Not Applicable/Mixture

2. HAZARDS IDENTIFICATION

OSHA Hazard Classification:	**Toxic by inhalation., Corrosive to eyes and skin, Lung toxin, Oxidizer**

Routes of Entry:	Inhalation, skin, eyes, ingestion
Chemical Interactions:	No known or reported interactions.
Medical Conditions Aggravated:	Asthma, respiratory and cardiovascular disease

Human Threshold Response Data

Odor Threshold	Approximately 1.4 mg/m3 (based on odor threshold of chlorine)
Irritation Threshold	Approximately 13-22 mg/m3 (based on irritation threshold of chlorine)

Hazardous Materials Identification System / National Fire Protection Association Classifications

Hazard Ratings :	Health	Flammability	Physical / Instability	PPI / Special hazard.
HMIS	3	0	1	
NFPA	3	0	1	OX

Immediate (Acute) Health Effects

Inhalation Toxicity:	HARMFUL IF PRODUCT IS INHALED IN HIGH CONCENTRATIONS. CAUSES BURNS TO RESPIRATORY TRACT. Inhalation of dust or vapor from this product can be irritating to the nose, mouth, throat and lungs. In confined areas, mechanical agitation can result in high levels of dust, and reaction with incompatible materials (as listed in Section 10) can result in high concentrations of chlorine vapor, either of which may result in burns to the respiratory tract, producing lung edema, shortness of breath, wheezing, choking, chest pains, impairment of lung function and possible permanent lung damage.
Skin Toxicity:	DRY MATERIAL CAUSES MODERATE SKIN IRRITATION. WET MATERIAL CAUSES SKIN BURNS. Dermal exposure to dry material causes moderate skin irritation characterized by redness and swelling. Dermal exposure to wet material can cause severe irritation and/or burns characterized by redness, swelling and scab formation. Prolonged skin exposure may cause permanent damage.
Eye Toxicity:	CAUSES BURNS TO EYES. Severe irritation and/or burns can occur following eye exposure. Direct contact may cause impairment of vision and corneal damage.
Ingestion Toxicity:	MODERATELY TOXIC IF SWALLOWED. CAUSES BURNS TO DIGESTIVE TRACT. Irritation and/or burns can occur to the entire gastrointestinal tract, including the stomach and intestines, characterized by nausea, vomiting, diarrhea, abdominal pain, bleeding, and/or tissue ulceration or perforation. Significant exposure to this material can lead to serious health effects and/or death.
Acute Target Organ Toxicity:	This product is corrosive to all tissues contacted and upon inhalation, may cause irritation to mucous membranes and respiratory tract., The dry material is irritating to the skin. However when wet, it will produce burns to the skin.

Prolonged (Chronic) Health Effects

Carcinogenicity:	This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA.
Reproductive and Developmental Toxicity:	No reproductive or developmental risk to humans is expected from exposure to this product.
Inhalation:	Repeated inhalation exposure may cause impairment of lung function and permanent lung damage.

Skin Contact:	Effects similar to those from acute exposure. In addition, chronic exposure to wet material may cause effects secondary to tissue destruction.
Ingestion:	There are no known or reported effects from chronic ingestion except for effects similar to those experienced from single exposure. The acute corrosivity of this product, makes chronic ingestion of significant amounts unlikely.
Sensitization:	This material is not known or reported to be a skin or respiratory sensitizer.
Chronic Target Organ Toxicity:	There are no known or reported effects from repeated exposure except those secondary to burns.
Supplemental Health Hazard Information :	No additional health information available.

3. COMPOSITION / INFORMATION ON INGREDIENTS

CAS OR CHEMICAL NAME	CAS #	% RANGE
CALCIUM HYPOCHLORITE	7778-54-3	60 - 80
SODIUM CHLORIDE	7647-14-5	10 - 20
CALCIUM CHLORATE	10137-74-3	0 - 5
CALCIUM CHLORIDE	10043-52-4	0 - 5
CALCIUM HYDROXIDE	1305-62-0	0 - 4
CALCIUM CARBONATE	471-34-1	0 - 4
1,2,4-BUTANETRICARBOXYLIC ACID, 2-PHOSPHONO-, SODIUM SALT	40372-66-5	0.2 - 0.8

Water	7732-18-5	4.0 - 8.5

4. FIRST AID MEASURES

General Advice:	Call a poison control center or doctor for treatment advice. For 24-hour emergency medical assistance, call Arch Chemical Emergency Action Network at 1-800-654-6911. Have the product container or label with you when calling a poison control center or doctor, or going for treatment.
Inhalation:	IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.
Skin Contact:	IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
Eye Contact:	IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
Ingestion:	IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.
Notes to Physician:	Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA): This product is chemically reactive with many substances. Any contamination of the product with other substances by spill or otherwise may result in a chemical reaction and fire., This product is a strong oxidizer which is capable of intensifying a fire once started., Product is not known to be flammable, combustible or pyrophoric.

<u>Flammable Properties</u>

Flash Point:	Not applicable
Autoignition Temperature:	Not applicable
Extinguishing Media:	Water only. Do not use dry extinguishers containing ammonium compounds.
Fire Fighting Instructions:	Use water to cool containers exposed to fire. See Section 6 for protective equipment for fire fighting.
Upper Flammable / Explosive Limit, % in air:	Not applicable
Lower Flammable / Explosive Limit, % in air:	Not applicable

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Emergency Situations:	Response to a large quantity spill (100 pounds or greater) or when dusting or decomposition gas exposure could occur requires the use of a positive pressure full face supplied air repirator or self contained breathing apparatus (SCBA), chemical resistant gloves, coveralls and boots. In case of fire, this personal protective equipment should be used in addition to normal fire fighter equipment.

<u>Spill Mitigation Procedures</u>

Air Release:	Vapors may be suppressed by the use of water fog. All water utilized to assist in fume suppression, decontamination or fire suppression may be contaminated and must be contained before disposal and/or treatment.
Water Release:	This product is heavier than water. This material is soluble in water. Monitor all exit water for available chlorine and pH. Advise local authorities of any contaminated water release.
Land Release:	Contact 1-800-654-6911 immediately. DANGER: All spills of this product should be treated as contaminated. Contaminated product may initiate a chemical reaction that may spontaneously ignite any combustible material present, resulting in a fire of great intensity. In case of a spill, separate all spilled product from packaging, debris and other material. Using a clean broom or shovel, place all spilled product into plastic bags, and place those bags into a clean, dry disposal container, properly marked and labeled. Disposal containers made of plastic or metal are recommended. Do not seal disposal containers tightly. Immediately remove all product in disposal containers to an isolated area outdoors. Place all damaged packaging material in a disposal container of water to assure decontamination (i.e. removal of all product) before disposal. Place all undamaged packaging in a clean, dry container properly marked and labeled. Call for disposal procedures.
Additional Spill Information :	Hazardous concentrations in air may be found in local spill area and immediately downwind. Remove all sources of ignition. Stop source of spill as soon as possible and notify appropriate personnel. Dispose of spill residues per guidelines under Section 13, Disposal Consideration. This material may be neutralized for disposal; you are requested to contact Arch Chemicals at 1-800-654-6911 before beginning any such procedure. FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC: 1-800-424-9300 REPORTABLE QUANTITY: 10 lbs. (as calcium hypochlorite) per 40 CFR 302.4.

7. HANDLING AND STORAGE

Handling:	Avoid inhalation of dust and fumes. Do not take internally. Avoid contact with skin, eyes and clothing. Upon contact with skin or eyes, wash off with water. Remove contaminated clothing and wash before reuse.
Storage:	Keep product tightly sealed in original containers. Store product in a cool, dry, well-ventilated area. Store away from combustible or flammable products. Keep product packaging clean and free of all contamination, including, e.g. other pool treatment products, acids, organic materials, nitrogen-containing compounds, dry powder fire extinguishers (containing mono-ammonium phosphate), oxidizers, all corrosive liquids, flammable or combustible materials, etc.
Shelf Life Limitations:	Do not store product where the average daily temperature exceeds 95° F. Storage above this temperature may result in rapid decomposition, evolution of chlorine gas and heat sufficient to ignite combustible products. Shelf life (that is, the period of time before the product goes below stated label strength) is determined by storage time and temperatures. Store in a cool, dry and well ventilated area. Prolonged storage at elevated temperatures will significantly shorten the shelf life. Storage in a climate controlled storage area or building is recommended in those areas where extremes of high temperature occur.
Incompatible Materials for Storage:	Do not allow product to come in contact with other materials, including e.g. other pool treatment products, acids, organic materials, nitrogen-containing compounds, dry powder fire extinguishers (containing mono-ammonium phosphate), oxidizers, all corrosive liquids, flammable or combustible materials, etc. A chemical reaction with such substances can cause a fire of great intensity.
Do Not Store At temperatures Above:	Average daily temperature of 35° C / 95° F. Storage above this temperature may result in rapid decomposition, evolution of chlorine gas and heat sufficient to ignite combustible products.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation:	Local exhaust ventilation or other engineering controls are normally required when handling or using this product to keep airborne exposures below the TLV, PEL or other recommended exposure limit.

<u>Protective Equipment for Routine Use of Product</u>

Respiratory Protection :	Wear a NIOSH approved respirator if levels above the exposure limits are possible.
Respirator Type :	A NIOSH approved full-face air purifying respirator equipped with combination chlorine/P100 cartridges. Air purifying respirators should not be used in oxygen deficient or IDLH atmospheres or if exposure concentrations exceed ten (10) times the published limit.
Skin Protection :	Wear impervious gloves to avoid skin contact. A full impervious suit is recommended if exposure is possible to a large portion of the body. A safety shower should be provided in the immediate work area.
Eye Protection:	Use chemical goggles. Emergency eyewash should be provided in the immediate work area.
Protective Clothing Type:	Neoprene, Nitrile, Natural rubber (This includes: gloves, boots, apron, protective suit)

Exposure Limit Data

CHEMICAL NAME	CAS #	Name of Limit	Exposure
CALCIUM HYPOCHLORITE	7778-54-3	ARCH-ROEG*	1 mg/m3 TWA
CALCIUM HYPOCHLORITE	7778-54-3	NIOSH-IDLH	37 - 48 mg/m3 based on IDLH concentration of chlorine
CALCIUM HYDROXIDE	1305-62-0	ACGIH	5 mg/m3 TWA
CALCIUM HYDROXIDE	1305-62-0	OSHA Z1	15 mg/m3 TWA total dust
CALCIUM HYDROXIDE	1305-62-0	OSHA Z1	5 mg/m3 TWA respirable fraction
CALCIUM CARBONATE	471-34-1	OSHA Z1	15 mg/m3 TWA Total dust
CALCIUM CARBONATE	471-34-1	OSHA Z1	5 mg/m3 TWA respirable dust fraction

*ARCH-ROEG: Arch Recommended Occupational Exposure Guideline.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	solid
Form	Tablet
Color:	white
Odor:	Chlorine-like
Molecular Weight:	143.00
Specific Gravity :	Not applicable
pH :	10.4 - 10.8 (1% solution in neutral, distilled water) (@ 25 Deg. C)
Boiling Point:	Not applicable

Freezing Point:	Not applicable
Melting Point:	Not applicable
Density:	1.9g/cc
Vapor Pressure:	(@ 25 Deg. C) Not applicable
Vapor Density:	Not applicable
Viscosity:	Not applicable
Fat Solubility:	No data
Solubility in Water:	18 % (@ 25 Deg. C) Product also contains calcium hydroxide and calcium carbonate which will leave a residue.
Partition coefficient n-octanol/water:	Not applicable
Evaporation Rate:	Not applicable
Oxidizing:	Oxidizer
Volatiles, % by vol.:	Not applicable
VOC Content	Not applicable
HAP Content	Not applicable

10. STABILITY AND REACTIVITY

Stability and Reactivity Summary:	Product is not sensitive to mechanical shock or impact. Product is not sensitive to electrical static discharge. Product will not undergo hazardous polymerization. Product is an NFPA Class 3 oxidizer which can cause a severe increase in fire intensity. Not pyrophoric. Not an organic peroxide. If subjected to excessive temperatures, the product may undergo rapid decomposition, evolution of chlorine gas, and heat sufficient to ignite combustible substances. If product is exposed to small amounts of water, it can react violently to produce heat and toxic gases and spatter. Use copious amounts of water for fires involving this product.
Conditions to Avoid:	Do not store next to heat source, in direct sunlight, or elevated storage temperature. Do not store where the daily average temperature exceeds 95 °F. Prevent ingress of humidity and moisture into container or package. Always close the lid.
Chemical Incompatibility:	This product is chemically reactive with many substances, including, e.g., other pool treatment products, acids, organics, nitrogen-containing compounds, dry powder fire extinguishers (containing mono-ammonium phosphate), oxidizers, corrosive ,flammable or combustible materials. Do not allow product to contact any foreign matter, including other water treatment products. Contamination or improper use may cause a fire of great intensity, explosion or the release of toxic gases. If product is exposed to small amounts of water, it can react violently to produce heat and toxic gases and spatter.
Hazardous Decomposition Products:	Chlorine
Decomposition Temperature:	170 - 180 DEG°C - , 338 - 356 DEG°F-

11. TOXICOLOGICAL INFORMATION

Component Animal Toxicology
Oral LD50 value:

CALCIUM HYPOCHLORITE	LD50 (65% calcium hypochlorite) 850 mg/kg Rat
SODIUM CHLORIDE	LD50 = 3,000 mg/kg Rat
CALCIUM CHLORIDE	LD50 = 1,000 mg/kg Rat
CALCIUM HYDROXIDE	LD50 = 7,340 mg/kg Rat

Component Animal Toxicology
Dermal LD50 value:

CALCIUM HYPOCHLORITE	LD50 (65% calcium hypochlorite) > 2,000 mg/kg Rabbit
SODIUM CHLORIDE	LD50 > 10,000 mg/kg Rabbit
CALCIUM CHLORIDE	LD50 = 2,630 mg/kg Rat
CALCIUM HYDROXIDE	No data

Component Animal Toxicology
Inhalation LC50 value:

CALCIUM HYPOCHLORITE	Inhalation LC50 1 h (65% calcium hypochlorite), (Nose Only) = 2.04 MG/L Rat
CALCIUM HYPOCHLORITE	Inhalation LC50 4 h (65% calcium hypochlorite), (Nose Only) = 0.51 MG/L Rat
SODIUM CHLORIDE	Inhalation LC50 1 h > 42 MG/L Rat
CALCIUM CHLORIDE	No data
CALCIUM HYDROXIDE	No data

Product Animal Toxicity

Oral LD50 value:	LD50 Approximately 800 mg/kg Rat
Dermal LD50 value:	LD50 > 2,000 mg/kg Rabbit
Inhalation LC50 value:	Inhalation LC50 1.00 h (Nose Only) > 2.04 MG/L Rat Inhalation LC50 4 h (Nose Only) > 0.51 MG/L Rat

Skin Irritation: DRY MATERIAL CAUSES MODERATE SKIN IRRITATION., WET MATERIAL CAUSES SKIN BURNS.
Eye Irritation: Corrosive to eyes.
Skin Sensitization: This material is not known or reported to be a skin or respiratory sensitizer.

Acute Toxicity: This product is corrosive to all tissues contacted and upon inhalation, may cause

	irritation to mucous membranes and respiratory tract.The dry material is irritating to the skin. However when wet, it will produce burns to the skin.
Subchronic / Chronic Toxicity:	There are no known or reported effects from repeated exposure except those secondary to burns.

Reproductive and Developmental Toxicity:	Calcium hypochlorite has been tested for teratogenicity in laboratory animals. Results of this study have shown that calcium hypochlorite is not a teratogen.	
CALCIUM CHLORIDE		Not known or reported to cause reproductive or developmental toxicity.
Mutagenicity:	Calcium hypochlorite has been tested in the Dominant lethal assay in male mice, and it did not induce a dominant lethal response. Calcium hypochlorite has been reported to produce mutagenic activity in two in vitro assays. It has, however, been shown to lack the capability to produce mutations in animals based on results from the micronucleus assay. In vitro assays frequently are inappropriate to judge the mutagenic potential of bactericidal chemicals due to a high degree of cellular toxicity. The concentration which produces mutations in these in vitro assays is significantly greater than the concentrations used for disinfection. Based on high cellular toxicity in in vitro assays and the lack of mutagenicity in animals, the risk of genetic damage to humans is judged not significant.	
CALCIUM CHLORIDE		This product was determined to be non-mutagenic in the Ames assay. It was also shown to be non-clastogenic in the chromosomal aberration test.
Carcinogenicity:	This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA. One hundred mice were exposed dermally 3 times a week for 18 months to a solution of calcium hypochlorite. Histopathological examination failed to show an increased incidence of tumors. IARC (International Agency for Research on Cancer) reviewed studies conducted with several hypochlorite salts. IARC has classified hypochlorite salts as having inadequate evidence for carcinogenicity to humans and animals. IARC therefore considers hypochlorite salts to be not classifiable as to their carcinogenicity to humans (Group 3 Substance).	
CALCIUM CHLORIDE		This chemical is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP, or EPA.

12. ECOLOGICAL INFORMATION

Overview:	Highly toxic to fish and other aquatic organisms.

Ecological Toxicity Values for: **CALCIUM HYPOCHLORITE**

Bluegill	-	(nominal, static). 96 h LC50 0.088 mg/l
Rainbow trout (Salmo gairdneri),	-	(nominal, static). 96 h LC50 0.16 mg/l
Daphnia magna,	-	(nominal, static). 48 h LC50 0.11 mg/l
Bobwhite quail	-	Dietary LC50 > 5,000 ppm
Mallard ducklings	-	Dietary LC50 > 5,000 ppm
Bobwhite quail	-	Oral LD50 3,474 mg/kg

Ecological Toxicity Values for: **CALCIUM CHLORIDE**

Bluegill	-	(nominal, static). 96 h LC50 = 10,650 mg/l
Mosquito fish	-	(nominal, static). 96 h LC50 = 13,400 mg/l
Fathead minnow (Pimephales promelas),	-	(nominal, static). 96 h LC50 = 4,630 mg/l
Daphnia magna,	-	(nominal, static). 48 h LC50= 2,770 mg/l
Ceriodaphnia dubia	-	(nominal, static). 48 h LC50= 1,830 mg/l
Nitzschia linearis (diatom)	-	(nominal, static). 5 day LC50 = 3,130 mg/l

13. DISPOSAL CONSIDERATIONS

CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THE MATERIAL. THE USER OF THE MATERIAL HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NONHAZARDOUS WASTES.

Waste Disposal Summary :	If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following EPA hazardous waste number: D001.If this product becomes a waste, it will be a hazardous waste which is subject to the Land Disposal restrictions under 40 CFR 268 and must be managed accordingly.
Disposal Methods :	As a hazardous solid waste it should be disposed of in accordance with local, state and federal regulations.
Potential US EPA Waste Codes :	D001

14. TRANSPORT INFORMATION

Land (US DOT):	UN1748 CALCIUM HYPOCHLORITE, DRY MIXTURE 5.1 III
Water (IMDG):	UN1748 CALCIUM HYPOCHLORITE, DRY MIXTURE, 5.1 III MARINE POLLUTANT
	Flash Point: Not applicable
Air (IATA):	UN1748 CALCIUM HYPOCHLORITE, DRY MIXTURE, 5.1 III
Emergency Response Guide Number:	ERG # 140
Transportation Notes:	Under specific circumstances, this product can ship under two transport exceptions, Limited Quantity or Consumer Commodity. See Bill of Lading for proper shipping description. REPORTABLE QUANTITY: 10 lbs. (Per 49 CFR 172.101, Appendix) Material is not regulated as a marine pollutant for ground transportation within the US if shipped in non-bulk packages.
EMS:	F-H, S-Q

15. REGULATORY INFORMATION

UNITED STATES:

Toxic Substances Control Act (TSCA):	This is an EPA registered pesticide.
EPA Pesticide Registration Number:	1258-1179
FIFRA Listing of Pesticide Chemicals (40 CFR 180):	This product is regulated under the Federal Insecticide, Fungicide and Rodenticide Act. It must be used for purposes consistent with its labeling.

Superfund Amendments and Reauthorization Act (SARA) Title III:

Hazard Categories Sections 311 / 312 (40 CFR 370.2):

Health	Immediate (Acute) Health Hazard
Physical	Fire Hazard

Emergency Planning & Community Right to Know (40 CFR 355, App. A):

Extremely Hazardous Substance Section 302 - Threshold Planning Quantity:

ZUS_SAR302	TPQ (threshold planning quantity)	None established

Reportable Quantity (49 CFR 172.101, Appendix):

ZUS_CERCLA	Reportable quantity	Calcium hypochlorite Value: 10lbs

ZUS_SAR302 Reportable quantity None established

Supplier Notification Requirements (40 CFR 372.45), 313 Reportable Components

ZUS_SAR313 De minimis concentration None established

Clean Air Act Toxic ARP Section 112r:
CAA 112R None established

Clean Air Act Socmi:
HON SOC None established

Clean Air Act VOC Section 111:
CAA 111 None established

Clean Air Act Haz. Air Pollutants Section 112:
ZUS_CAAHAP None established

ZUS_CAAHRP None established

CAA AP None established

State Right-to-Know Regulations Status of Ingredients

Pennsylvania:

CAS #	COMPONENT NAME
10137-74-3	CALCIUM CHLORATE
1305-62-0	CALCIUM HYDROXIDE
7778-54-3	CALCIUM HYPOCHLORITE

ZUSPA_RTK

Pennsylvania: Hazardous substance list
1989-08-11
CHLORIC ACID, CALCIUM SALT

Pennsylvania: Hazardous substance list
1989-08-11
CALCIUM HYDROXIDE

Pennsylvania: Hazardous substance list
1989-08-11
HYPOCHLOROUS ACID, CALCIUM SALT
Environmental hazard

New Jersey:

CAS #	COMPONENT NAME
10137-74-3	CALCIUM CHLORATE
1305-62-0	CALCIUM HYDROXIDE
7778-54-3	CALCIUM HYPOCHLORITE

ZUSNJ_RTK

New Jersey Right to Know Hazardous Substance List (RTK-HSL)
2007-03-01
CALCIUM CHLORATE   CHLORIC ACID, CALCIUM SALT

New Jersey Right to Know Hazardous Substance List (RTK-HSL)
2007-03-01
CALCIUM HYDROXIDE   CALCIUM HYDROXIDE (Ca(OH)2)   HYDRATED LIME

New Jersey Right to Know Hazardous Substance List (RTK-HSL)
2007-03-01
CALCIUM HYPOCHLORITE   HYPOCHLOROUS ACID, CALCIUM SALT   BLEACHING POWDER

Massachusetts:

CAS #	COMPONENT NAME
10137-74-3	CALCIUM CHLORATE
1305-62-0	CALCIUM HYDROXIDE
7778-54-3	CALCIUM HYPOCHLORITE

ZUSMA_RTK

Massachusetts Right to Know List of Chemicals and Hazard Classifications
1993-04-24
CALCIUM CHLORATE

Massachusetts Right to Know List of Chemicals and Hazard Classifications
1994-04-01
CALCIUM HYDROXIDE

Massachusetts Right to Know List of Chemicals and Hazard Classifications
1993-04-24
CALCIUM HYPOCHLORITE

California Proposition 65:

CAS #	COMPONENT NAME
ZUSCA_P65	None established

WHMIS Hazard Classification:

Ingredient Disclosure List (WHMIS)
2007-08-24
Threshold limits: 1 Weight percent
991
Calcium hydroxide

16. OTHER INFORMATION

MSDS REVISION STATUS :
SECTIONS REVISED: 1
Major References : Available upon request.

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. THIS INFORMATION HAS BEEN PREPARED FOR THE GUIDANCE OF PLANT ENGINEERING, OPERATIONS AND MANAGEMENT AND FOR PERSONS WORKING WITH OR HANDLING THIS PRODUCT. ARCH CHEMICALS BELIEVES THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF THE DATE OF PUBLICATION BUT, MAKES NO WARRANTY THAT IT IS. ADDITIONALLY, IF THIS MSDS IS MORE THAN THREE YEARS OLD, YOU SHOULD CONTACT ARCH CHEMICALS MSDS CONTROL AT THE PHONE NUMBER ON THE FRONT PAGE TO MAKE CERTAIN THAT THIS DOCUMENT IS CURRENT. .

Limited Warranty

Limited Warranty

The Constant Chlor® Plus Briquette Chlorinator is warranted against any manufacturing defects in material or workmanship for a period of 12 months after installation or 18 months after shipping from Arch, whichever is earlier. This warranty applies only to the original end-user.

Service

For warranty service, contact the authorized Constant Chlor® Dealer in your area. Any defective part(s) covered by this warranty will be repaired or replaced, at Arch's discretion. Replacement may be with either new or reconditioned parts.

Exclusions

This warranty does not cover damage or failure due to accidents, fire, flood, or other acts of God. Nor does it cover damage or failure due to abuse, misuse, abnormal or improper use, neglect, improper maintenance, alterations or modifications by anyone other than Arch (unless specifically approved in writing by Arch), repairs by anyone other than an authorized Dealer, or ordinary wear and tear. Use of any Briquettes or other chemicals other than the Constant Chlor® Plus Briquettes designed for use with this chlorinator shall void this warranty.

Any transportation to and from an authorized Constant Chlor® Dealer is your responsibility.

Neither Arch nor its Dealers are responsible or liable for indirect, special, or consequential damages arising out of or in connection with the use or performance of the product or other damages with respect to loss of property, loss of revenues or profit by the owner. EXCEPT AS PROVIDED ABOVE, ARCH MAKES NO WARRANTIES. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE IS SPECIFICALLY EXCLUDED.

NOTE: No modifications may be made to the chlorinator without prior written approval from Arch. Unauthorized modifications void any warranty. This Constant Chlor® Briquette Chlorinator is subject to one or more patents owned by Arch, and all rights in any modifications or improvements, including but not limited to any patents, copyrights, trademarks or trade secrets, belong exclusively to Arch.

For information, contact Arch Sales Office at 800-432-7223.

Lonza.
HTH® Water Products
1200 Bluegrass lakes Parkway
Alpharetta GA, 30004

www.archwaterworks.com/municipal

NOTES

NOTES

Lonza

Lonza Emergency Action Network (LEAN)

The Lonza Emergency Action Network ("LEAN") is Lonza's emergency action system. Call the LEAN system at 1-800-654-6911) in North America, and at (Country Code for the United States) 423-780-2970 elsewhere in the world. The LEAN system is available 24 hours a day, 7 days a week for assistance with spills, injuries and emergencies of any kind. It uses computers and other systems to make Lonza's environmental, technical transportation, toxicological and other expertise about its products readily available to anyone needing assistance. The LEAN system also includes emergency response teams capable of providing on-site support throughout North America.

(800) 654-6911

(From outside North America, call after the country code for the US, 423-780-2970)

Additionally, in the event of an emergency, CHEMTREC (Chemical Transportation Emergency Center) should be contacted. CHEMTREC is a national center established by the Chemical Manufacturers Association (CMA) in Washington, DC, to relay pertinent emergency information concerning specific chemicals on request.

CHEMTREC has a 24-hour toll-free telephone number (800) 424-9300, intended primarily for use by those who respond to chemical transportation emergencies. CHEMTREC may also be accessed through the CMA website at www.cmahq.com.

Material Safety Data Sheets (MSDS) can be obtained by contacting (800)-511-MSDS.

Instruction Manual -
MicroChem®2 Transmitter and Controller
Series 4000

These instructions describe the installation, operation and maintenance of the subject equipment. Failure to strictly follow these instructions can lead to an equipment rupture that may cause significant property damage, severe personal injury and even death. If you do not understand these instructions, please call Severn Trent Water Purification (STWP), Inc. for clarification before commencing any work at +1 215 997 4000 and ask for a Field Service Manager. Severn Trent Water Purification, Inc. reserves the rights to make engineering refinements that may not be described herein. It is the responsibility of the installer to contact STWP Inc. for information that cannot be answered specifically by these instructions.

Any customer request to alter or reduce the design safeguards incorporated into STWP Inc. equipment is conditioned on the customer absolving STWP Inc. from any consequences of such a decision.

STWP Inc. has developed the recommended installation, operating and maintenance procedures with careful attention to safety. In addition to instruction/operating manuals, all instructions given on labels or attached tags should be followed. Regardless of these efforts, it is not possible to eliminate all hazards from the equipment or foresee every possible hazard that may occur. It is the responsibility of the installer to ensure that the recommended installation instructions are followed. It is the responsibility of the user to ensure that the recommended operating and maintenance instructions are followed. Severn Trent Water Purification, Inc. cannot be responsible for deviations from the recommended instructions that may result in a hazardous or unsafe condition.

STWP Inc. cannot be responsible for the overall system design of which our equipment may be an integral part of or any unauthorized modifications to the equipment made by any party other that STWP Inc.

STWP Inc. takes all reasonable precautions in packaging the equipment to prevent shipping damage. Carefully inspect each item and report damages immediately to the shipping agent involved for equipment shipped “F.O.B. Colmar” or to STWP Inc. for equipment shipped “F.O.B Jobsite”. Do not install damaged equipment.

SEVERN TRENT SERVICES - COLMAR OPERATIONS
COLMAR, PENNSYLVANIA, USA
ISO 9001: 2008 CERTIFIED

It is mandatory to carefully read the present manual before operating any action of the instrument.

Do not install any equipment if damage is such that faulty operation is likely to result.
Carefully inspect all packing material before discarding it, to prevent loss of mounting hardware, accessories, spare parts or instructions.

All instructions given on any attached tag should be followed.

WARNING

To ensure safe operation of MicroChem®2 equipment carefully follow use and installation instructions and recommendations illustrated in this manual. Improper use of the equipment may damage the equipment and endanger the safety of the operating personnel.

WARNING

All MicroChem®2 electronics are shipped with voltage selection jumper set to the 220 Vac position. Set the voltage selection jumper to match the local power source.

WARNING

If the equipment is used in a manner NOT specified by Severn Trent or NOT included in the present document, the protection provided by the equipment may be impaired.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 MODEL NUMBER BREAKDOWN

MicroChem®2 — -- 4 -- D 2 1 --
T17M

Type of Instrument
Transmitter (NOTE 1) — B
Controller (NOTE 2) — D
Swimming Pool Controller (NOTE 3) — E

Series of Production - fixed code — 4

Channels
1 Channel — 1
2 Channel — 2
3 Channel — 3

Design Level - Fixed Mode — D

Voltage
110/220 + 10%, 50/60 Hz, Field selectable, shipped set for 220 Vac — 2

Mounting
Wall Mounting — 1

Serial Communication
RS 485 — 2
RS 422 (default when not specified) — 3
RS232 — 4

NOTES

1. Transmitter with the cleaning sequence enabled: alarm relays are possible only for Channels 1 and 2.
2. PID standard has 1 Channel; PID with Feed Forward requires two Channels installed: Channel 1 for the controlled variable, Channel 2 for the analog input 4-20 mA signal from the flow rate meter. A Third measurement-only sensor can be installed on Channel 3. A 2 channel instrument is also required if a PID output signal is configured on channel 1 and a retransmission of the measured value from the input signal on channel 1 is also required.

   The controller option D includes software for the instrument to average the input signals from 2 or 3 of the same type of sensor such as DO. The controller will then provide an output signal to control the blowers in an aeration basin based on the averaged signal. Any parameter the instrument is capable of receiving may be used with the averaging feature.
3. Swimming pool Controller is available in three different versions: pH and mV (ORP); pH and Cl; and pH, Cl and ORP. (In the latter case the controlled parameters are to be installed in Channels 1 and 3).

MODEL NUMBER BREAKDOWN (UK ORDERS ONLY)

MicroChem®2 Transmitter[1]

Description	Part Number
MicroChem®2 Transmitter – 1 Channel	01-4045
MicroChem®2 Transmitter – 2 Channel	01-4050
MicroChem®2 Transmitter – 3 Channel	01-4024

MicroChem®2 Controller[2]

Description	Part Number
MicroChem®2 Controller – 1 Channel	01-4013
MicroChem®2 Controller – 2 Channel	01-4015
MicroChem®2 Controller – 3 Channel	01-4018

MicroChem®2 Specific Controllers

Description	Part Number
MicroChem®2 Swimming Poop Controller[3] – Supplied as 2 Channel	01-4051
MicroChem®2 Aeration Basin Controller[4] – Supplied as 2 Channel	01-4052

MicroChem®2 Accessories

Description	Part Number
Sunshade Assembly – for wall mounting – 1T624B037U01	01-4055
Sunshade Assembly – for 2” Pipe mounting – 1T624B037U03	01-4056
S4000 Analog Board	71-4000

NOTE:

1 Supplied with software to initiate a sensor cleaning sequence activated by a relay.
Available with 1, 2 or 3 channels. When cleaning sequence is selected, alarm transmission is limited to channel 1 and channel 2 only. Relays are available for alarm transmission for channel 3 only if a cleaning sequence is not activated.

2 Combines a PID algorithm utilizing the sensor input signal or PID with Feed Forward control utilizing a 4-20mA input signal from a flow transmitter (channel 2). Control is achieved through a 4-20mA output or time proportional relay. Available with 2 or 3 channels (only Channel 1 is for control).

3 Combines 2 PID control algorithms to control a swimming pool. pH is controlled on channel 1, ORP or Chlorine is controlled on a second channel. A third channel, in this case channel 2, can be used for ORP or chlorine not controlled on a channel 3.
Supplied as standard with 2 channels, a third channel is available if ordered with a S4000 Analog Board P/N 71-4000.

4 Specifically designed for O_2 control. Signals from up to three DO sensors are averaged and computed, and then processed through a PID algorithm. Supplied as standard with 2 channels, a third channel is available if ordered with a S4000 Analog Board P/N 71-4000.

2 INTRODUCTION

2.1 Glossary

Symbol	Meaning
~	ALTERNATING CURRENT SUPPLY ONLY
⎓	DIRECT CURRENT SUPPLY ONLY
	PROTECTIVE EARTH (ground) terminal Both direct and alternating current supply.
	EARTH (ground) terminal
	WARNING – Refer to the manual for instructions
	CAUTION - Risk of electric shock
	WEEE SYMBOL: indicates the separated collection of electric and electronic equipment at the end of life.

PARAMETER	SYMBOL
pH	pH
ORP (oxidation reduction potential)	mV
Dissolved Oxygen	O2
Residual Chlorine	Cl
Chlorine Dioxide	CD
Ozone	O3
Temperature	T
Bromine	Br
Fluoride	F
Ammonia	NH_3
Nitrate	NO_3
Conductivity*	mA

These symbols are also used in displayed indications.

NOTE: Chlorine (CL4000) and conductivity probes are available in units running software version 2.8 or higher.

*Sensors with a 4-20mA output can be fed into the MicroChem®2 and the signal displayed as either mA or, for certain common sensors, converted into actual units e.g. conductivity (µS). A list of the configurable units available is shown below:

Symbol	Unit
mA	Milliamp
%	Percent
ppm	parts per million
mg/l	milligrams per liter
g/h	grams per hour
l/s	liters per second
l/h	liters per hour
m^3/h	cubic meter per hour
°C	degrees centigrade
°F	degrees Fahrenheit
µS	microsiemens
mS	millisiemens
KPa	Kilopascals
MPa	Megapascals
PSI	pounds per square inch
GPM	gallons per minute
GPD	gallons per day
MGD	Megagallons per day
NTU	Nephelometric units
FTU	Formazin turbidity units
m	meters
ft	feet
in	inches

2.2 General Description

MicroChem®2 is a family of microprocessor based transmitters controllers for analytical values used in drinking water plants, and in swimming pools.

MicroChem2, using Severn Trent Water Purification probes, is able to measure simultaneously up to three of the following parameters:

pH, ORP, Dissolved Oxygen, Chlorine, Chlorine Dioxide, Bromine, Ozone, Analog signal 0/4-20 mA, Temperature (Pt100).

The type and number of sensors (max 3) can be freely chosen in any combination. The analytical values are retransmitted with 4-20 mA analog signal. New types of analysis can be added or modified in the field at any time. MicroChem2 automatically detects the number of installed sensors. All the measurements and the sample temperatures are displayed. The transmitter/controller has automatic temperature compensation.

The cleaning sequence time setting allows an easy sensors' maintenance.

The MicroChem2 Family includes 3 Types of instrument:

- **Transmitter** (Instrument Type 1)

A group of transmitters: single channel, dual channel and triple channel.

- **Controller** (Instrument Type 2)

PID controller for the installed Sensor, with specific algorithms for each type of measured parameter. It can accept an optional 4-20 mA signal from a flow-meter on channel 2. This second input can be used as Feed Forward input in the PID algorithm.

- **Swimming Pool Controller** (Instrument Type 3)

Available in three different parameter combinations:

- three channels (pH, mV, Cl parameters)
- two channels (pH and mV)
- two channels (pH and Cl).

It performs PID control of two channels: pH (on channel 1) and the sensor installed on channel 3.

2.3 Technical Specifications

- **Display:** digital LCD display, dot matrix, 16 + 16 characters, with back light.

- **Power supply,** selectable through a jumper on the power supply pc board (see Sect. 3.4.1):
  115 V~ (Vac) ±10%, 50/60 Hz
  230 V~ (Vac) ±10%, 50/60 Hz

- **Power consumption:** 20 VA.

- **Fuses:** T100mAL 250V @ 230 V~ (Vac)
  T200mAL 250V @ 115 V~ (Vac)

- **Electrical classification:** for non hazardous area.

- **Casing:** NEMA 4X, material GREENLAC reinforced with fiberglass (17%), White RAL 9010, Class VØ (in accordance to UL94)

- **IP protection:** IP65 whether power and signal cables respect the indications in the following section 3.4.1.1

- **Mounting:** refer to Section 3.2

- **Isolating level:** Signal inlet isolated at 2224Vrms referring to the power supply.

- **Analog outputs:**
  one for each installed channel (analog I/O pc board); separately selectable for each channel as 0-20 mA or 4-20 mA (to be specified in the order).

- **Galvanically isolated outputs:** Load 0-1000 Ohm, protected against short circuits.

- **Digital outputs:**
  . 7 relay outputs: 24 V ⎓ (Vdc), 115/230 V ~ (Vac), 3A max.
  . Individually settable as Normally Open (NO) or Normally Closed (NC)

- **Digital inputs:** 2 free contacts

- **Serial communication port:** RS232, RS422 and RS485 with RJ11 plug-in sockets. The protocol used is illustrated in a dedicated section (Sect. 11).

- **Alarm setting:** High and Low alarm for channel 1, 2 and 3. Separate levels for each channel are field selectable. Dead band freely selectable for each channel.

- **Measuring ranges:** field selectable for each channel within the limits indicated for each parameter, as follows in the table below:

PARAMETER	MINIMUM SPAN	RANGE	DEFAULT SETTING
pH	1.00 pH	0.00 - 14.00 pH	2.00 - 12.00 pH
mV	100 mV	-1500 - +1500 mV	-500 - +500 mV
O2	2.0 ppm	0.00 - 20.00 ppm	0.00 - 10.00 ppm
O3	0.25 ppm	0.00 - 10.00 ppm	0.00 - 1.00 ppm
Cl	0.25 ppm	0.00 - 10.00 ppm	0.00 - 1.00 ppm
CD	0.25 ppm	0.00 - 10.00 ppm	0.00 - 1.00 ppm
T	5 °C	0 - +100 °C	0 - +100 °C
mA	2 mA	0/4 - 20 mA	4 - 20 mA
Br	0.25 ppm	0 – 10.00 ppm	0 – 1.00 ppm
ORP	100 mV	-1500 to +1500 mV	-500 to +500 mV
µS	+/- 5% of probe range	0 – 10,000 µS	4 – 20 µS

- **Sensors with a 4 to 20 mA output** can be connected to the transmitter, the units range set and then the sensor output can be displayed on the screen.
- **Analog Input:** up to 3 sensors (any of pH, ORP, Dissolved Oxygen, Residual Chlorine, Chlorine Dioxide, Ozone, 0/4-20 mA analog signal and temperature (Pt100)
- **Weight:** 3 kg (6.6 lbs).
- **Outline dimensions:** 220 mm x 250 mm x 120 mm (8.7 x 9.8 x 4.7 in). Refer to picture 6 for details.
- **Stocking temperature limits:** -40 °C - +65 °C (-40 °F - 150 °F).
- **Operative temperature limits:** -10 °C - +50 °C (15 °F - 122 °F)
- **Thermal drift:** within 0.2% of full scale for a 10 °C (50° F) temperature variation.
- **Relative humidity:** 80 % with temperature up to 31 °C (88 °F), with linear decrease down to 50% with temperature 40 °C (104 °F).
- **Accuracy:** within ± 0.2 % of full scale.
- **Repeatability**: 0.05 % of span.
- **Stability:** 0.05% of span.
- **Transmitter response time:** measure is refreshed at each microprocessor scan cycle (100 msec).
- **Microprocessor scan cycle:** 100 msec.
- **Smoothing:** separately set for each channel inside Configuration menu.
- **Languages:** Italian, English, French, German, Spanish.

2.4 Hardware structure of the system

The MicroChem®2 hardware is modularly structured. The different p.c. boards are mounted in four separate layers, according to the following scheme:

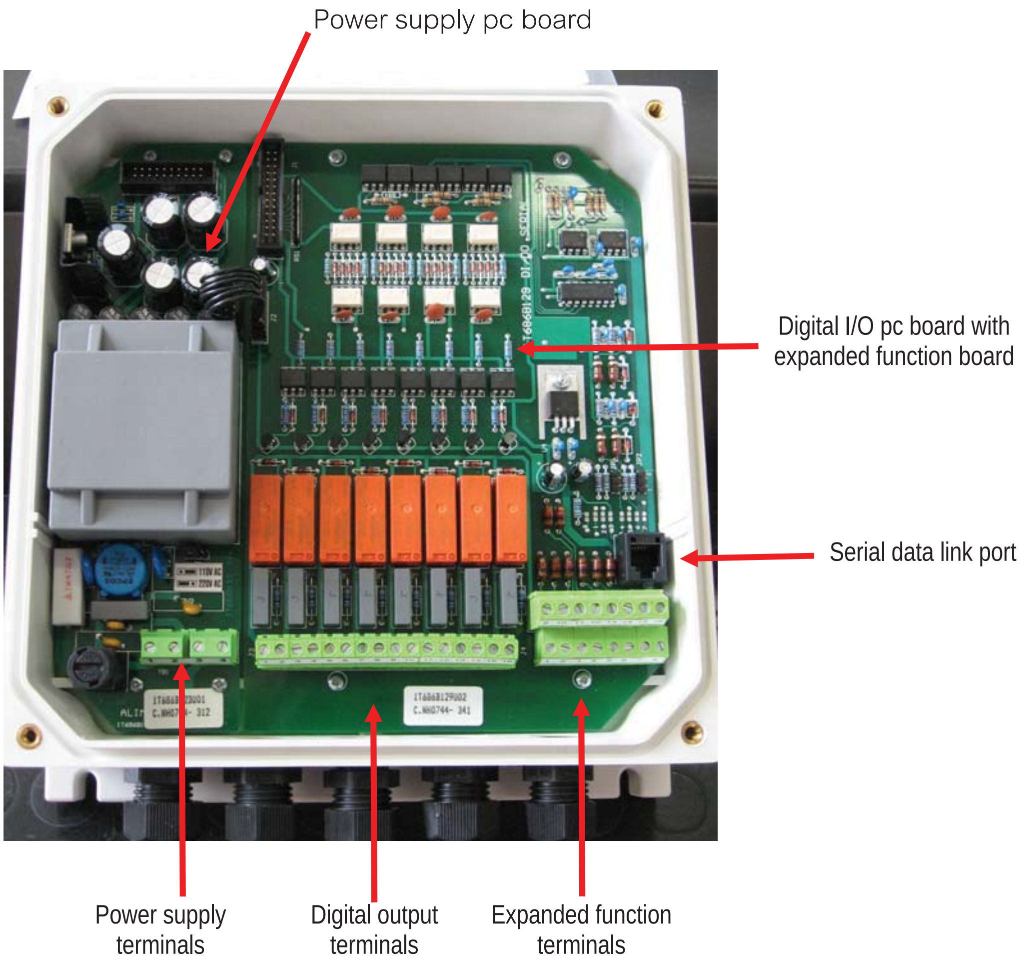


Figure 1 - First layer of p. c. board (bottom)

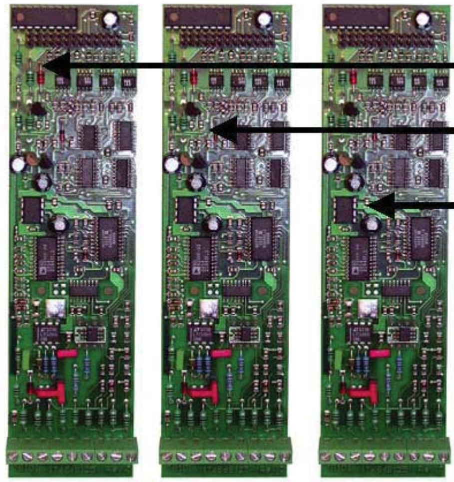


Figure 2 - Second layer of p. c. boards (Analog Input/Output)

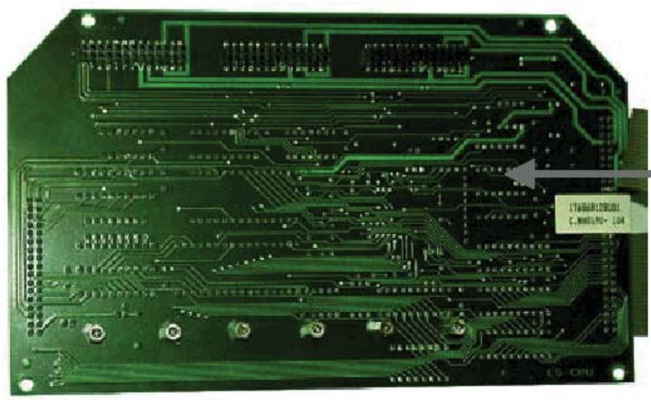


Figure 3 - Third layer of p. c. boards (Main Board)

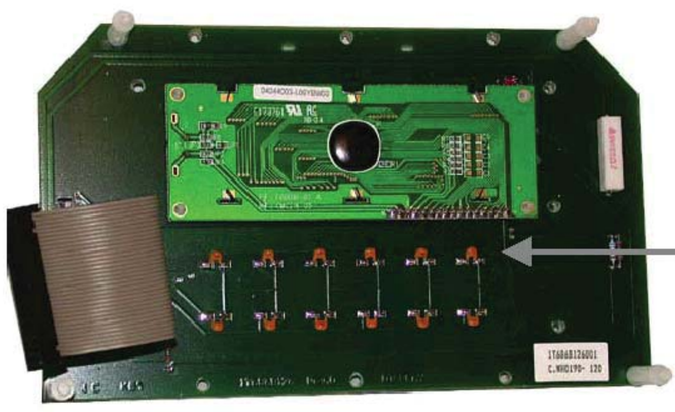


Figure 4 - Fourth layer of p. c. boards (Top)

3 INSTALLATION

3.1 Location

The transmitter location should meet the following requirements:

- the site of installation should be free of vibrations
- atmosphere should be free of corrosive substances
- enough space has to be left around the transmitter to allow easy operation and maintenance
- the transmitter should be mounted at a height of 1.6 m (64 in) from floor level to make normal reading and easier maintenance and calibration operations.
- in outdoors installations use of a sunshade is strongly recommended
- power supply matching the instrument tag should be available

3.2 Mounting

MicroChem®2 is supplied with the hardware for wall mounting.

3.2.1 Wall mounting

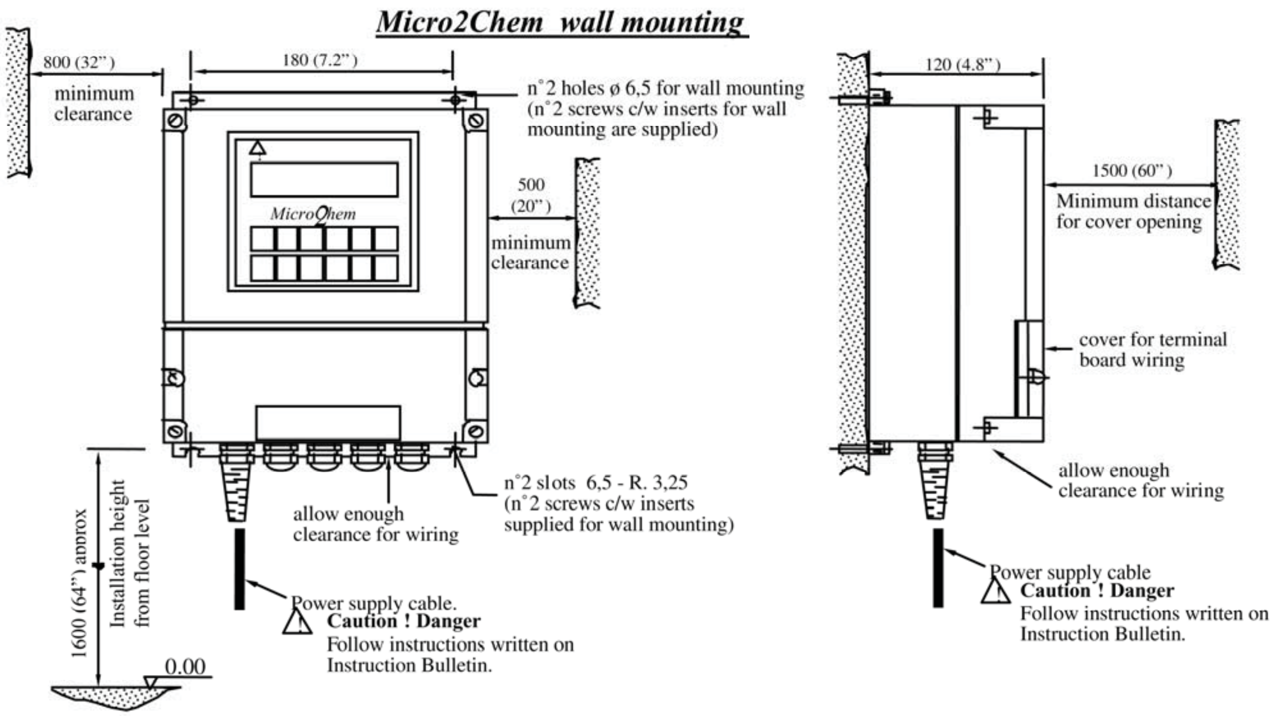


Figure 5 - Typical Wall-mounting Installations of MicroChem®2

3.3 Dimensions and mounting

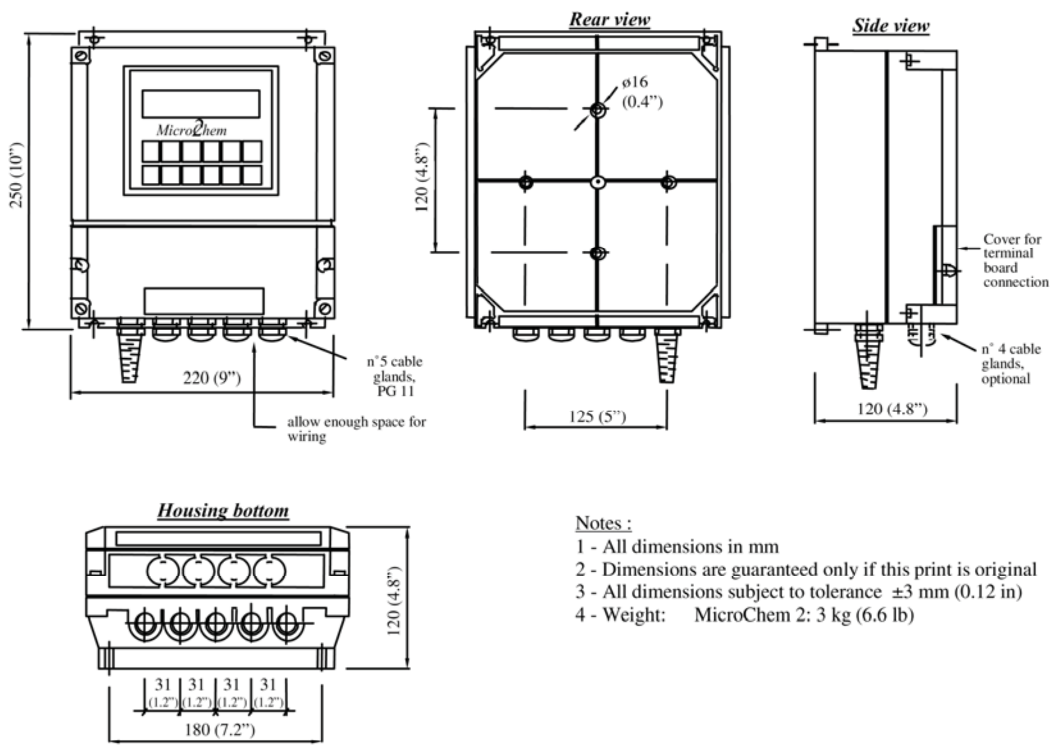


Figure 6 - MicroChem®2 dimensions

3.4 Electrical connections

3.4.1 Power supply p.c. board

Electrical Shock Hazard!

Remove power prior to servicing power supply board.

The power supply is connected to the terminal board TB1 (See Fig. 7).

The selection between the 115 V~ (Vac) or 230 V~ (Vac) power settings can be changed by moving a jumper (in position JP1) on the power supply pc board. Jumpers are represented in Fig. 7. The power supply is shipped with the voltage selector jumper in the 230 V~ (Vac) position. Should any modification be needed, proceed as per the following steps:

1. Always operate on an unpowered instrument.
2. Open the wiring access cover.
3. Locate the JP1 jumper on the power board (Fig. 7).
4. Set the jumper in the correct position using thin tapered pliers according to the input voltage required.
5. Insert the proper fuse F1 in the power supply depending on the voltage selector jumper position. (see below for details)
6. Connect power cable to Terminal board TB1 (Fig. 7). Reference Sections 3.4.1.1 and 3.4.1.2.
7. Close the cover.
8. It is now possible to connect the power to the instrument.

NOTE: Since the power supply is factory set for 230 V~ (Vac) operation, the T100 mA L fuse is installed in the power supply. The T200 mA L fuse has been provided with the instrument should a change of voltage be required during installation.

Fuse Rating: T100 mA L 250V @230V~ (Vac) Part Number: 1T151A003U06
T200mA L 250v @115V~ (Vac) Part Number: 1T151A003U09

Be sure to use the correct fuse rating when power supply setting is modified.

CAUTION

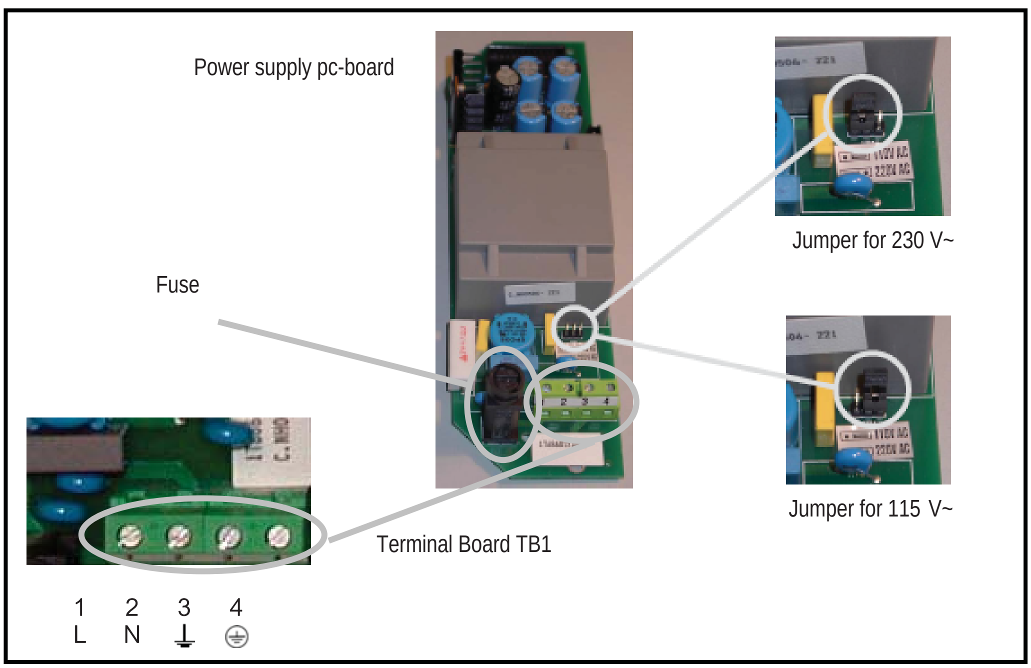


Figure 7 - Power supply selection

3.4.1.1 Power Cable

Power supply cable has to be supplied by the Customer and installed by qualified personnel.

The power supply cable has to satisfy the following requirements:

- Must be certified or approved by an official national/international testing bureau (IMQ, UL, CSA...) and according to the local law.
- Three-cores cable 16 AWG, (each core with section 1 mm^2 or 1.5 mm^2) and with specific colors required by local requirements.
- Must be suitable for ambient temperature up to 75°C (167°F)
- Must have a cross section of 6-10 mm to guarantee the casing IP65 protection.
- Must include ground wire that has to be properly connected.

3.4.1.2 Power cable installation

Electrical Shock hazard!

Power supply cables are connected to 115 V ~ (Vac) or 230 V ~ (Vac)

Power cable inlet

The three-core power supply cable, as described in section 3.4.1.1, has to be wired to the board passing through the specific gland. The gland itself can not be removed as its specific action is to avoid cable abrasions and damages and to guarantee the IP protection.

The external wire sheathed shell should be removed for at least 1.5 inches (3-4 cm) from the termination to allow the three cores separation into the instrument while shell is kept in contact with the gland. Each wire shell is stripped for about .4 inches (1 cm) to allow for insertion into the power terminals.

Cable anchorage (Customer Care)

Cable anchorage must be designed to avoid stresses, included torsion stresses to the conductors at the point where they enter the transmitter. Cable anchorage has to satisfy the following requirements:

- Cable may not be secured by a screw acting directly on the cable itself.
- Never make knots on the cable itself.
- Cable anchoring must be designed to make cable replacement easy and safe.
- Cable has to be protected from any possible mechanical stress that may damage it or making it directly or indirectly dangerous.

Plug (not supplied)

The plug shall be certified and approved (IMQ, UL, CSA...) and have the ground connection.

CIRCUIT BREAKER (Customer care)

The instrument shall be equipped with a specific circuit breaker which have two main functions:

1. Main power supply disconnection
2. Over current protection.

Shall have the following characteristics:

- Shall be easily identifiable, easy to access and operate and shall be installed nearby the instrument.
- Shall be a certified and approved model according to the standard in use in the country where the instrument will be installed.
- Shall clearly indicate if the power is activated and present or not.
- Shall be specific characteristics for protective action (10A curve "C" type)
- When installed outdoor, shall have the appropriate IP protection rating.

3.4.2 Cable gland

MicroChem®2 is capable up to 9 holes that can be opened for electrical wires connection.
As standard 5 cable glands are installed on each unit.
Below, is an example of how to use the different cable glands (see Figure 8)

- 1 cable with three wires for power supply
- Cables from wet-end
- Cable for 4-20mA signal retransmission
- 10 cables for digital output (CCO1-7)
- Cables with two wires for digital input (CCI1-2)
- 1 cable RJ11 type for serial communication option.

RECOMMENDED: Do not put power supply cable alongside other cables.

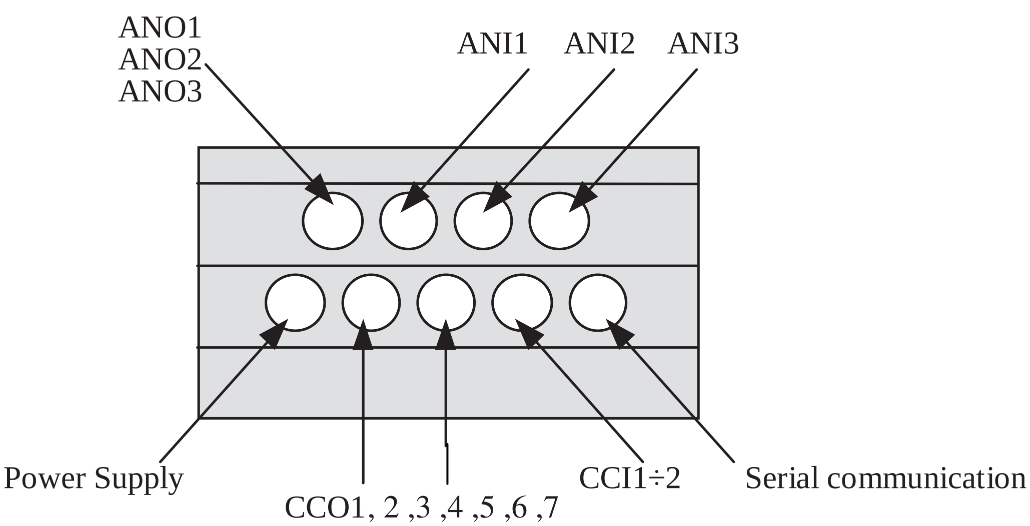


Figure 8 - Recommended use of cable glands

3.4.3 Digital I/O board

Characteristics of the cables for the input and output wiring are:

- Two wires shielded cable
- Two-cores, 18 AWG (0.5 - 1.0 mm^2)
- The shields have to be connected to ground shield terminal strip (⏚) on the MicroChem2 power supply board (see Fig. 7).
- Cables for digital outputs shall have an 80°C (176°F) rating.

3.4.3.1 Digital Outputs

Electrical Shock hazard!
Remove power from external circuits prior
to connection or servicing of digital output terminals.

MicroChem®2 digital outputs are provided by 7 relays (physically 8 relays are installed but only 7 are available).

The function of each output contact depends on the type of instrument selected and its configuration. The different possibilities are detailed in the sections dedicated to each specific type of instrument. Figure 9 shows the terminal number assigned to each CCO on the I/O pc board.

The maximum rating of the relays are:

- Maximum Voltage: 24 V ⎓ (Vdc), 230 V ~ (Vac)
- Maximum Current: 3A

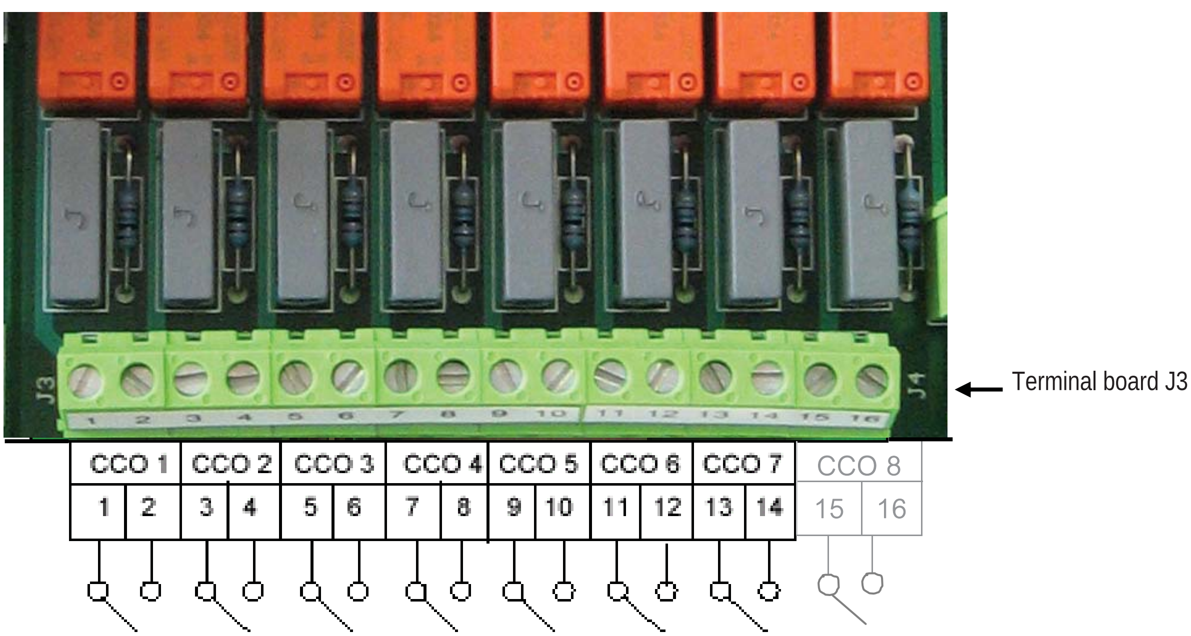


Figure 9 - Relays interconnection terminal barrier

3.4.3.2 Digital input

MicroChem2 digital input (free contacts) are represented in Figure 10.

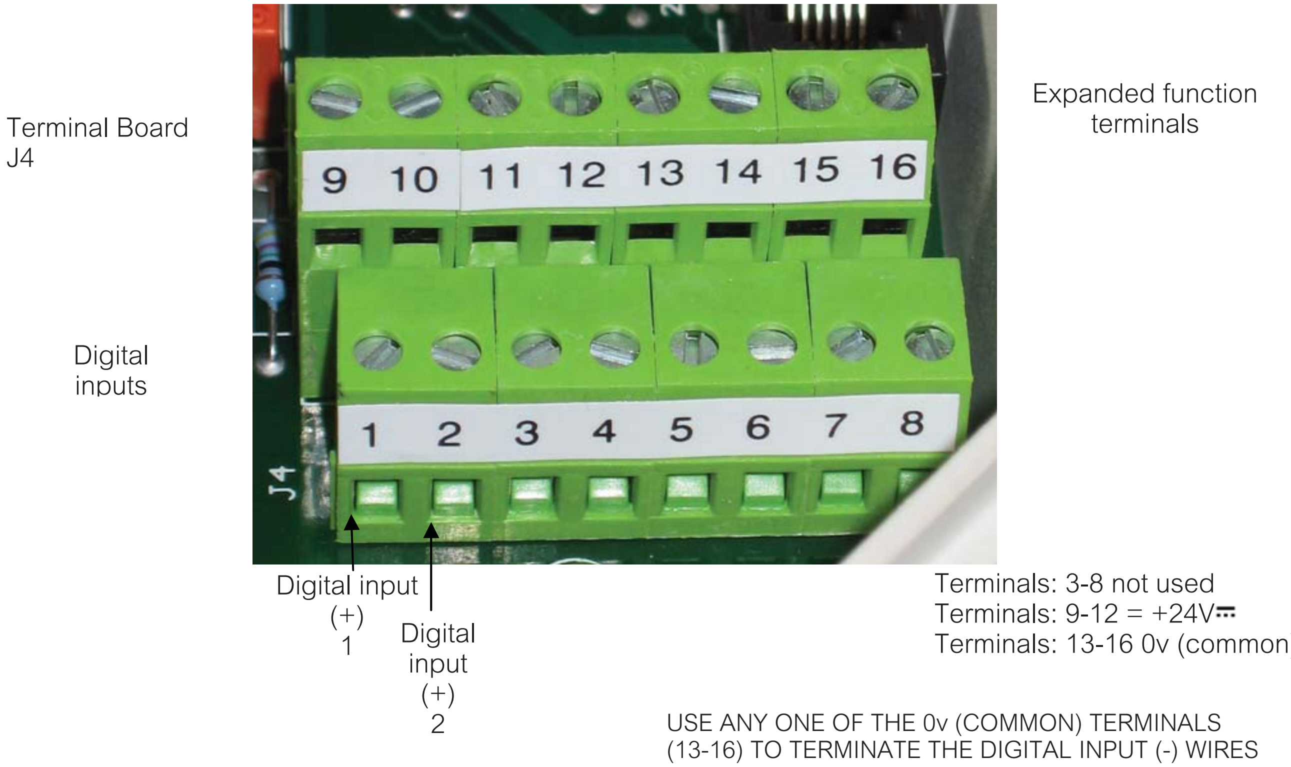


Figure 10 - Digital inputs terminal barrier

3.4.4 Analog input/output board

Refer to each sensor Instruction Bulletin for the color/number codification of the sensors wires. The Pt100 shield and the sensor shield, if present, has to be connected to ground shield terminal ⏚, (see Fig. 7), inside MicroChem®2. Please notice that, for pH, ORP and O2 sensors it is recommended to fix the cable near the sensor so that it doesn't move at the outlet of the cable gland. The wear of the cable at that point is thus prevented.

The 0-20 mA or 4-20 mA signal INPUT is on terminals 5 and 6: when these terminals are used for the 0/4-20 mA INPUT, install a 100 Ω resistor (0.1 % accuracy) across terminals 5 and 6.
The units and range can be set within the channel configuration software and then the sensor output can be displayed on the screen – see section 2.2 for the range of units that can be selected.

NOTE: The CL4000 and conductivity probe cables 78-4001, 2 and 3 have a resistor built in to the lead so do not require a further resistor.

Use two cores shielded cables for 4-20 mA output signals, section of each conductor 18 AWG (0.5 - 1.0 mm^2); connect shields to the shield ground terminal ⏚ , (see Fig. 7) inside MicroChem®2.

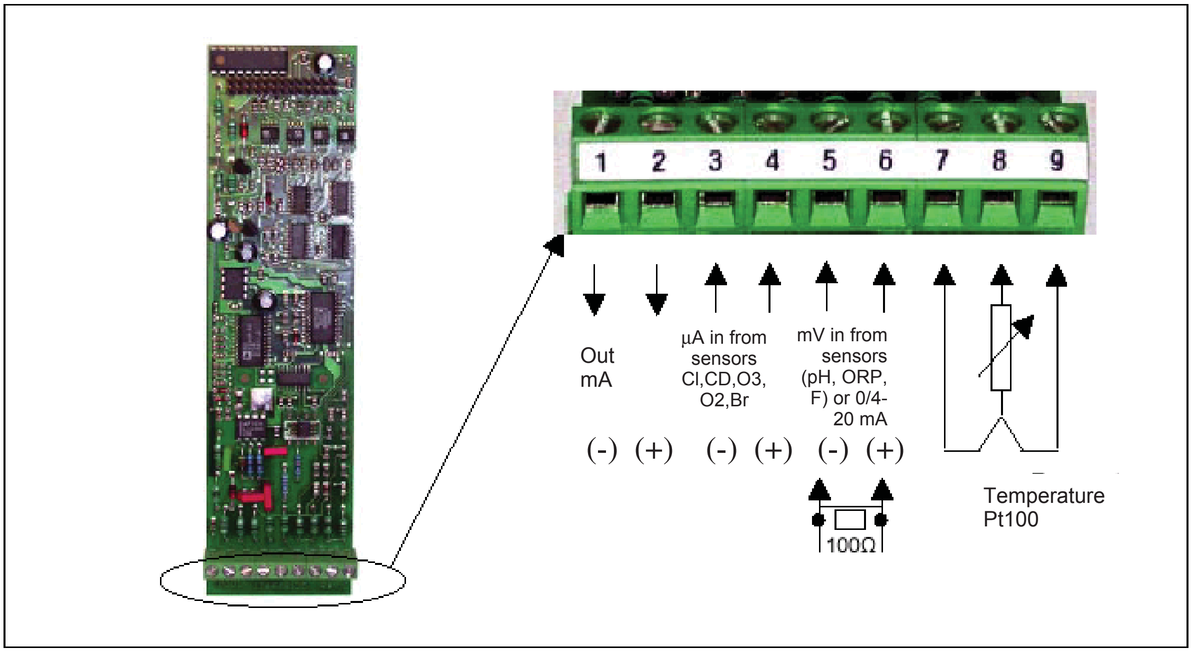


Figure 11 - Analog Input /Output terminal barrier

3.4.4.1 Temperature compensation

The temperature compensation Pt100 is not necessarily present in each sensor, in fact in some installations the different sensors are installed in the same cell, and therefore the reference temperature can be read from one input only, namely from the sensor connected to channel 1.

In the channel definition menu, when configuring channel 2 and 3, after the choice of the type of sensor, it is requested to specify if the reference temperature is to be "equal to first channel" or "independent". In the first case the reference temperature for that channel is taken from channel 1, in the second case it is read from its own PT100 thermistor which in this case must be present.

This option is not applicable for mA, ORP or Chlorine in CL4000 mode inputs measurements, as these parameters are not influenced by operating temperature or already compensated.

3.4.5 Serial communication board

MicroChem®2 supports serial communication standards RS232 and RS422/485 by connection of a modular telephone jack RJ11.

The 6 poles terminal board supports all three standards.

The pin-out of the RJ11 connectors and 6-pin terminal board is illustrated in Section 11.3 in this manual, dealing with the serial communication option.

4 SET-UP AND CONFIGURATION

4.1 Keyboard functionality

All the keys have dual functionality, except the ENTER key. Blue background keys are the ones whose second function is only used in Controllers options (instrument Type D, Type E). The selection between numbers and functions is automatically recognised by the instrument.

KEY	PRIMARY FUNCTION	SECONDARY FUNCTION
	MANUAL SELECTOR Selects manual mode in Controllers (instruments Type D, E).	0: digit zero when allowed
	DECREASE OUTPUT Decreases output in Controller (instruments Type D, E) when in manual mode.	1: digit 1 when allowed
	INCREASE OUTPUT Increases output in Controller (instruments Type D, E) when in manual mode.	2: digit 2 when allowed
	LIGHT Light up / down the display.	3: digit 3 when allowed
	MENU Calls for the menu and, inside a menu, cycles the parameters.	4: digit 4 when allowed
	ENTER: decimal point is not used; any parameter needing it already includes the decimal point in the correct position. Enter function: allows to enter the displayed menu or parameter; once entered the parameter, allows to modify it. A parameter can be changed (set) when the cursor appears on the display. Once the cursor has appeared, whether or not the parameter has been changed, the Enter key confirms the displayed value. In display mode Enter key allows to call the Warnings & Messages page.	None
	AUTOMATIC SELECTOR Selects Automatic operation mode in Controllers (instruments Type D, E).	5: digit 5 when allowed

	DECREASE SETPOINT Decreases Set Point in Controllers (instruments Type D, E).	6: digit 6 when allowed
	INCREASE SETPOINT Increases Set Point in Controllers (instruments Type D, E)	7: digit 7 when allowed
	WASH Starts a cleaning sequence when this option is activated and allowed (timers set at any value different from zero).	8: digit 8 when allowed
	CANCEL Cancel is used to modify a parameter wrongly written: when a parameter can be modified the cursor appears on the display; when the cursor is in the last right position pressing the Cancel key will delete the newly introduced value and allow to re-write a new one. Cancel is also used to load default parameters (Super-Reset, See Section 9.4).	9: digit 9 when allowed
	END End key in Display Mode allows to scroll different pages if present. In Menu Mode allows to step up menu.	-: negative sign when allowed

Table 1 - Keyboard functionality

Use of MENU, ENTER and END keys to move inside menus and change parameters:

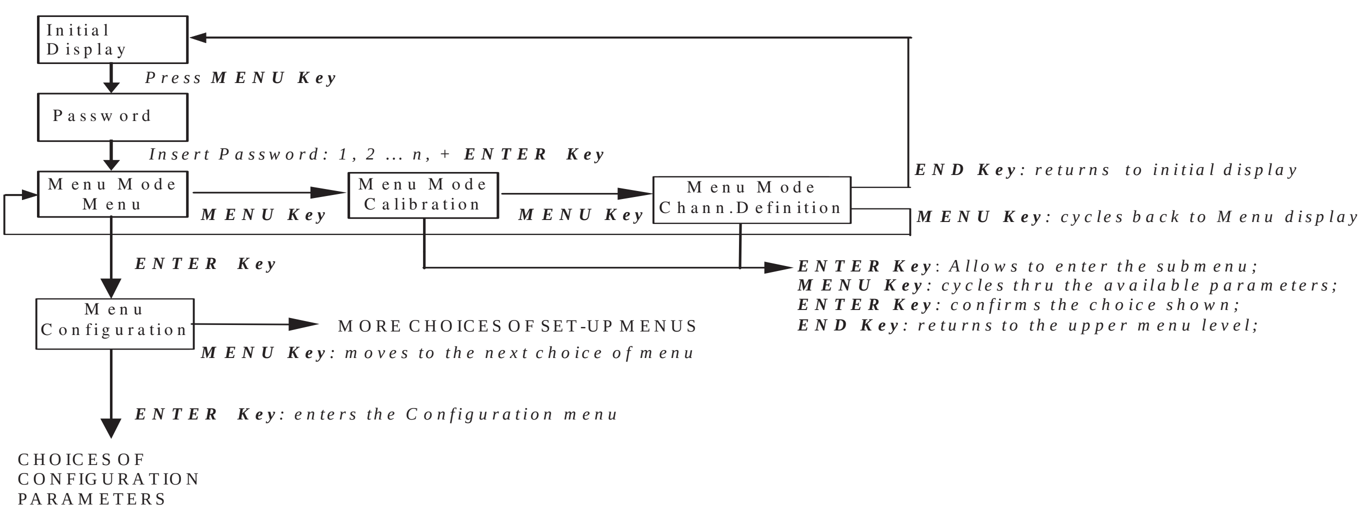


Figure 12 - Example of menus navigation

4.2 Display

The MicroChem®2 display shows the instantaneous value of the parameter measured, its identification symbol and the temperature of the sampled liquid. Here is an example of the standard one-channel display:

1	2	.	5	2		p	H		1	5	.	5		°	C

If the instrument is configured to support two sensors, the display shows on the top line the metered value and the temperature of parameter installed on Channel 1, and on the bottom line the metered value and the temperature of parameter installed on Channel 2. When three sensors are installed, the process values are displayed on two different pages. Press END key to toggle form one page to the other.

Channel 1 Measure	1	2	.	5	2		p	H		1	5	.	5		°	C	**Channel 1 Temperature**
Channel 2 Measure		0	.	1	1	4	O	3		0	.	1	5	8	C	l	**Channel 3 measure**

On the second page appears:

Channel 1 Measure	1	2	.	5	2		p	H		1	5	.	5		°	C	**Channel 1 Temperature**
Channel 2 Temperature		1	6	.	4		°	C		1	1	.	2		°	C	**Channel 3 Temperature**

When MicroChem2 is configured as a Controller, the process information is displayed on a dedicated page, as per following example:

Channel 1 measure (Process variable)	1	0	.	1	2		p	H		1	0	.	4		°	C	**Channel 1 Temperature**
Setpoint	1	2	.	0	0		S	P		1	6	%	O	U	T	A	**Output (%)- Aut./Man.**

4.3 Channel definition

This menu allows to select the type of sensor associated to each channel.

The Channel definition menus are in accordance to the number of the channels installed (e.g. if only Channel 1 is installed, only Channel 1 definition menu appears; if two channels are installed, both Channel 1 definition menu and Channel 2 definition menu will appear. The same principle applies for Channel 3).

Select the type of channel according to the sensor installed (see Section 2.1 for the symbols used).

NOTES:

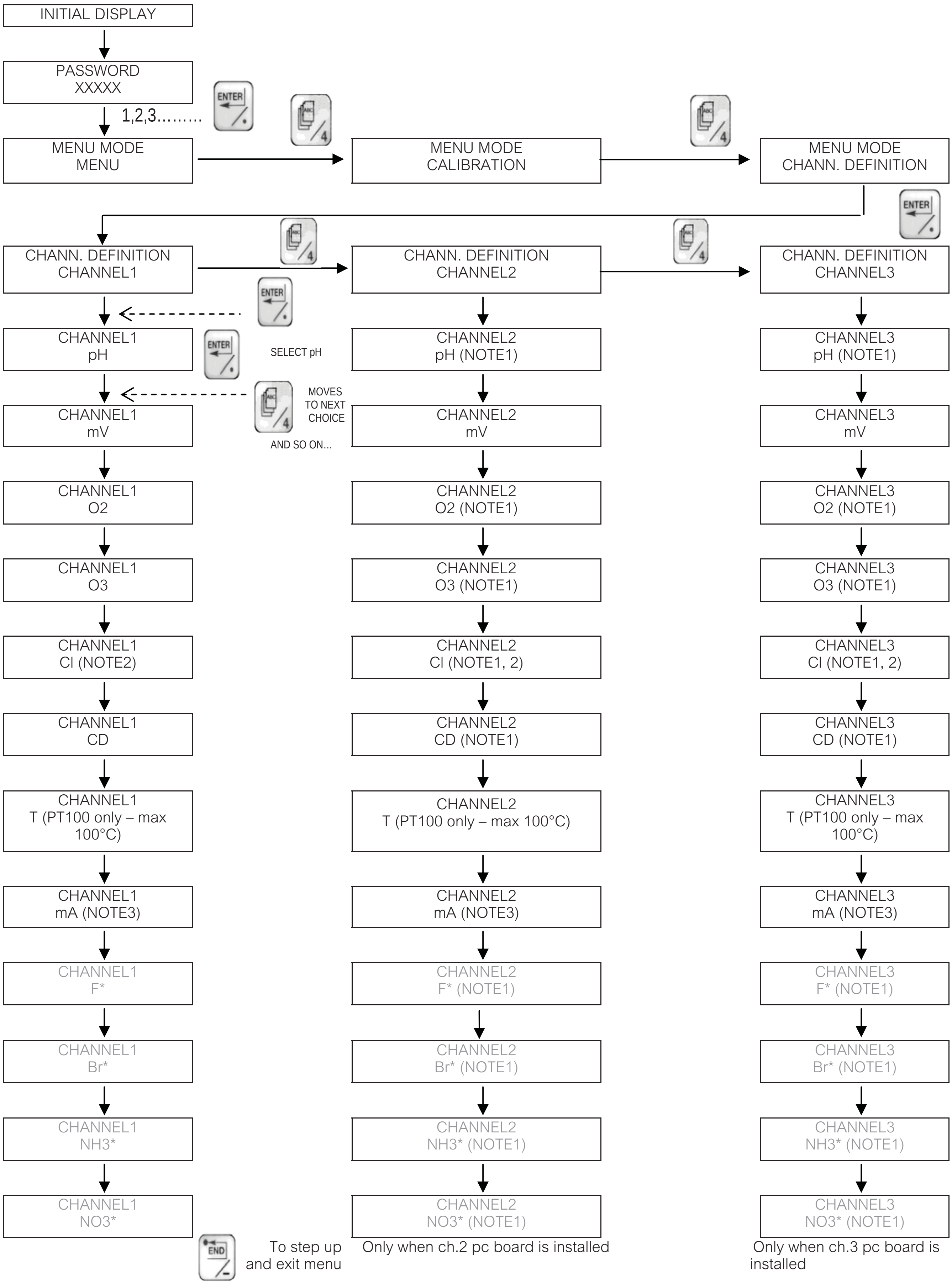
- When changing channel definition from one parameter to another, the MicroChem®2 transmitter/controller will set the alarm outputs and the PID parameters to the default values.
- At power-up, the instrument loads data in memory according to the last channel definition. When the Channel definition is modified, in order to have the new data properly stored, it is necessary to operate the Super-Reset procedure (See Section 9.4).

There are 3 different Channel definition menus depending on the type of instrument operating:
Channel definition – Transmitter: see section 4.3.1
Channel definition – Standard/Average controller: see section 4.3.2
Channel definition – Swimming pool controller: see section 4.3.3

4.3.1 Channel definition -Transmitter

(Please refer also to the menu trees in the appendices for an overview of how to navigate through the software).

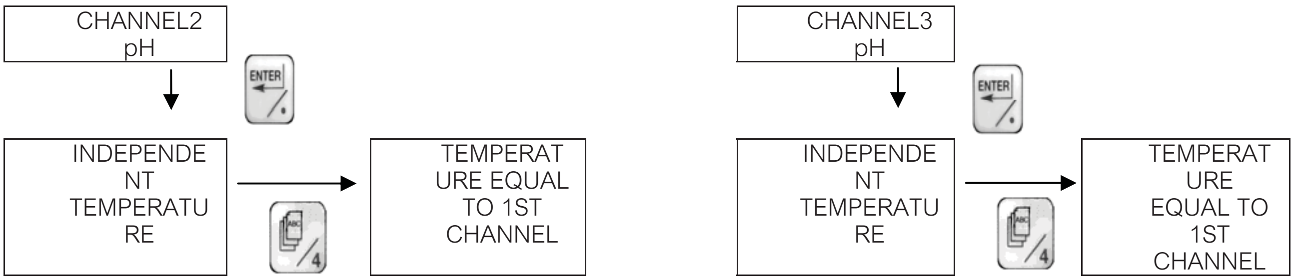
Please refer to step by step programming instructions in the appendix for instrument configuration examples.


INITIAL DISPLAY
PASSWORD
XXXXX
1,2,3………
ENTER
MENU MODE
MENU
MENU MODE
CALIBRATION
MENU MODE
CHANN. DEFINITION
ENTER
CHANN. DEFINITION
CHANNEL1
CHANN. DEFINITION
CHANNEL2
CHANN. DEFINITION
CHANNEL3
ENTER
CHANNEL1
pH
ENTER
SELECT pH
MOVES
TO NEXT
CHOICE
AND SO ON...
CHANNEL1
mV
CHANNEL1
O2
CHANNEL1
O3
CHANNEL1
Cl (NOTE2)
CHANNEL1
CD
CHANNEL1
T (PT100 only – max
100°C)
CHANNEL1
mA (NOTE3)
CHANNEL1
F*
CHANNEL1
Br*
CHANNEL1
NH3*
CHANNEL1
NO3*
CHANNEL2
pH (NOTE1)
CHANNEL2
mV
CHANNEL2
O2 (NOTE1)
CHANNEL2
O3 (NOTE1)
CHANNEL2
Cl (NOTE1, 2)
CHANNEL2
CD (NOTE1)
CHANNEL2
T (PT100 only – max 100°C)
CHANNEL2
mA (NOTE3)
CHANNEL2
F* (NOTE1)
CHANNEL2
Br* (NOTE1)
CHANNEL2
NH3* (NOTE1)
CHANNEL2
NO3* (NOTE1)
CHANNEL3
pH (NOTE1)
CHANNEL3
mV
CHANNEL3
O2 (NOTE1)
CHANNEL3
O3 (NOTE1)
CHANNEL3
Cl (NOTE1, 2)
CHANNEL3
CD (NOTE1)
CHANNEL3
T (PT100 only – max
100°C)
CHANNEL3
mA (NOTE3)
CHANNEL3
F* (NOTE1)
CHANNEL3
Br* (NOTE1)
CHANNEL3
NH3* (NOTE1)
CHANNEL3
NO3* (NOTE1)
END
To step up
and exit menu
Only when ch.2 pc board is installed
Only when ch.3 pc board is
installed

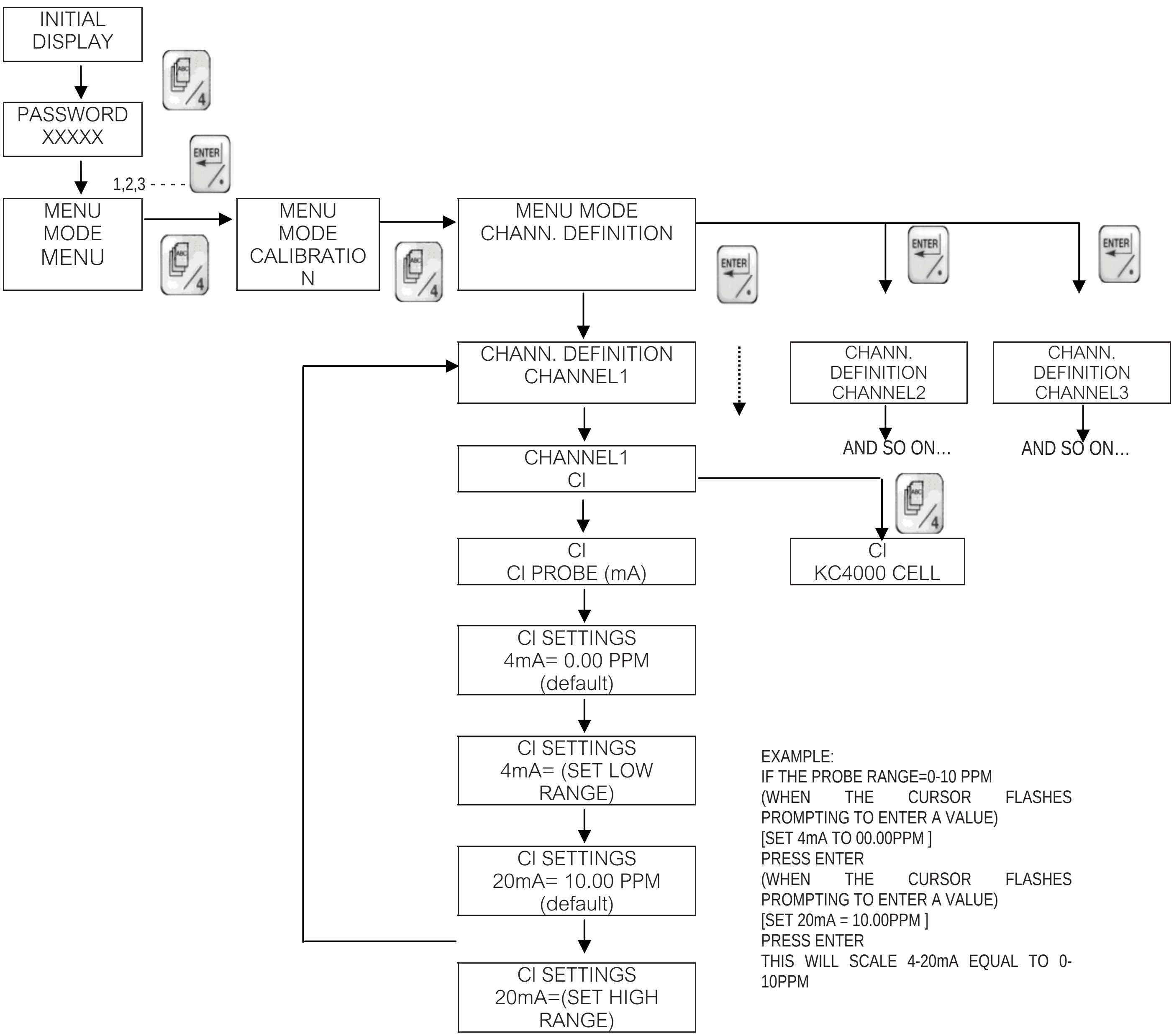
NOTES

* = Not available

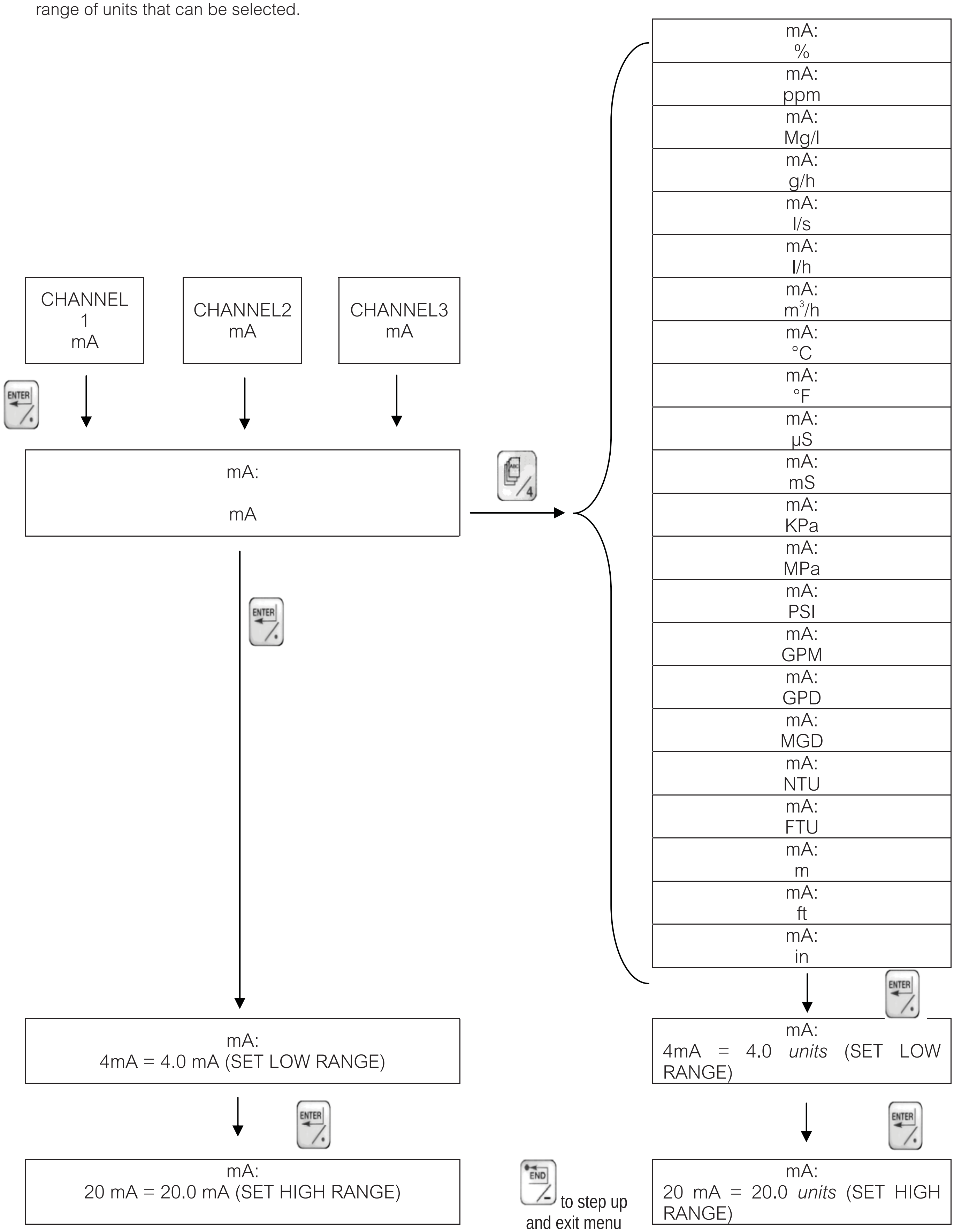
NOTE 1: In 2nd and 3rd channel definition it's possible to choose between "Independent Temperature" or "Temperature equal to 1st channel":



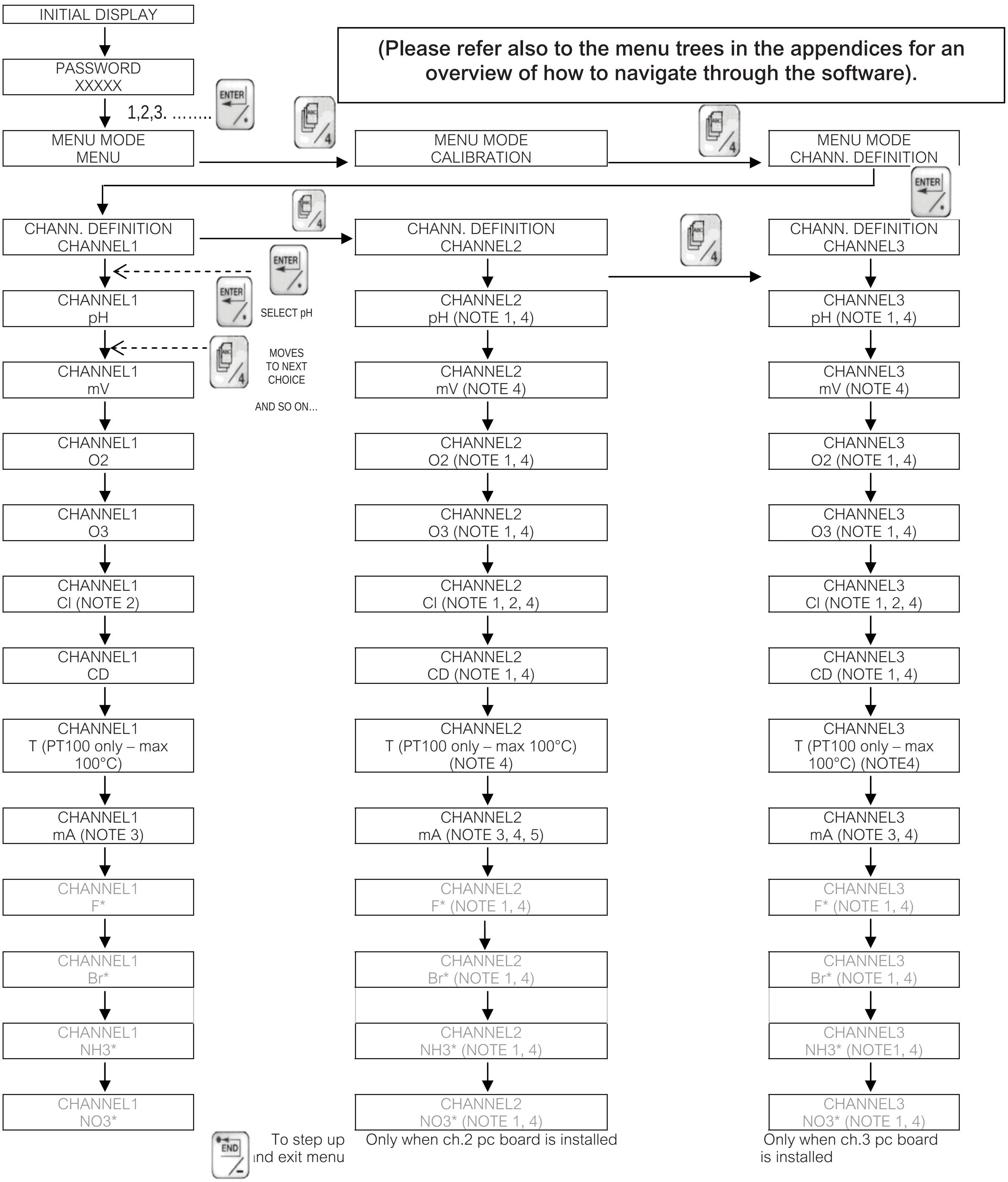
NOTE 2: If chlorine (CL) is selected, the type of CL measurement must be defined as either a cell (KC4000) or a probe (CL4000). When CL4000 probes are selected, you will be prompted to enter the (4mA and 20mA) probe settings to match the range of the probe supplied with the system (i.e. 0-2 or 0-10 ppm):



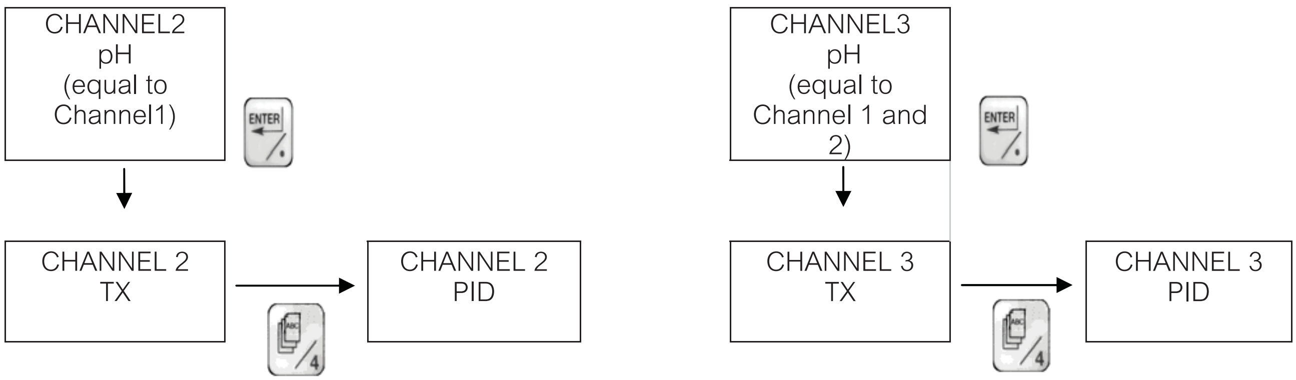
NOTE 3: Sensors with a 4 to 20 mA output can be connected to the transmitter and the units and range can be set within the channel configuration software and then the sensor output can be displayed on the screen – see Section 2.1 for the range of units that can be selected.



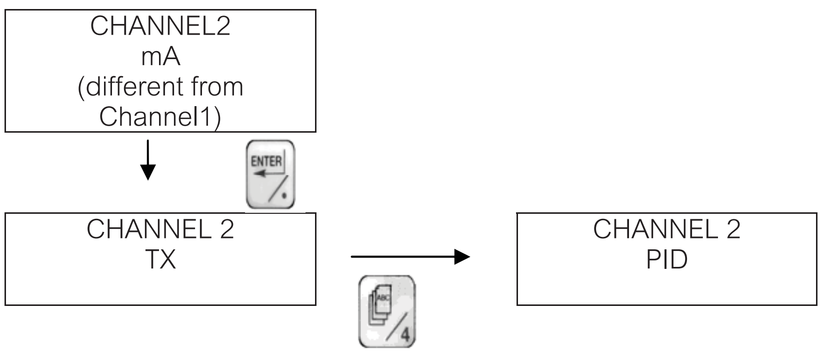
4.3.2 Channel definition-Standard/Average Controller



NOTES
* = Not available
NOTE 1, 2, 3: See NOTE 1, 2, 3 Section 4.3.1
NOTE 4: If channel 2 or channel 3 is selected equal to the first one, choose TX for stand alone channel or PID to include measurement into the computation of average process variable (PV)

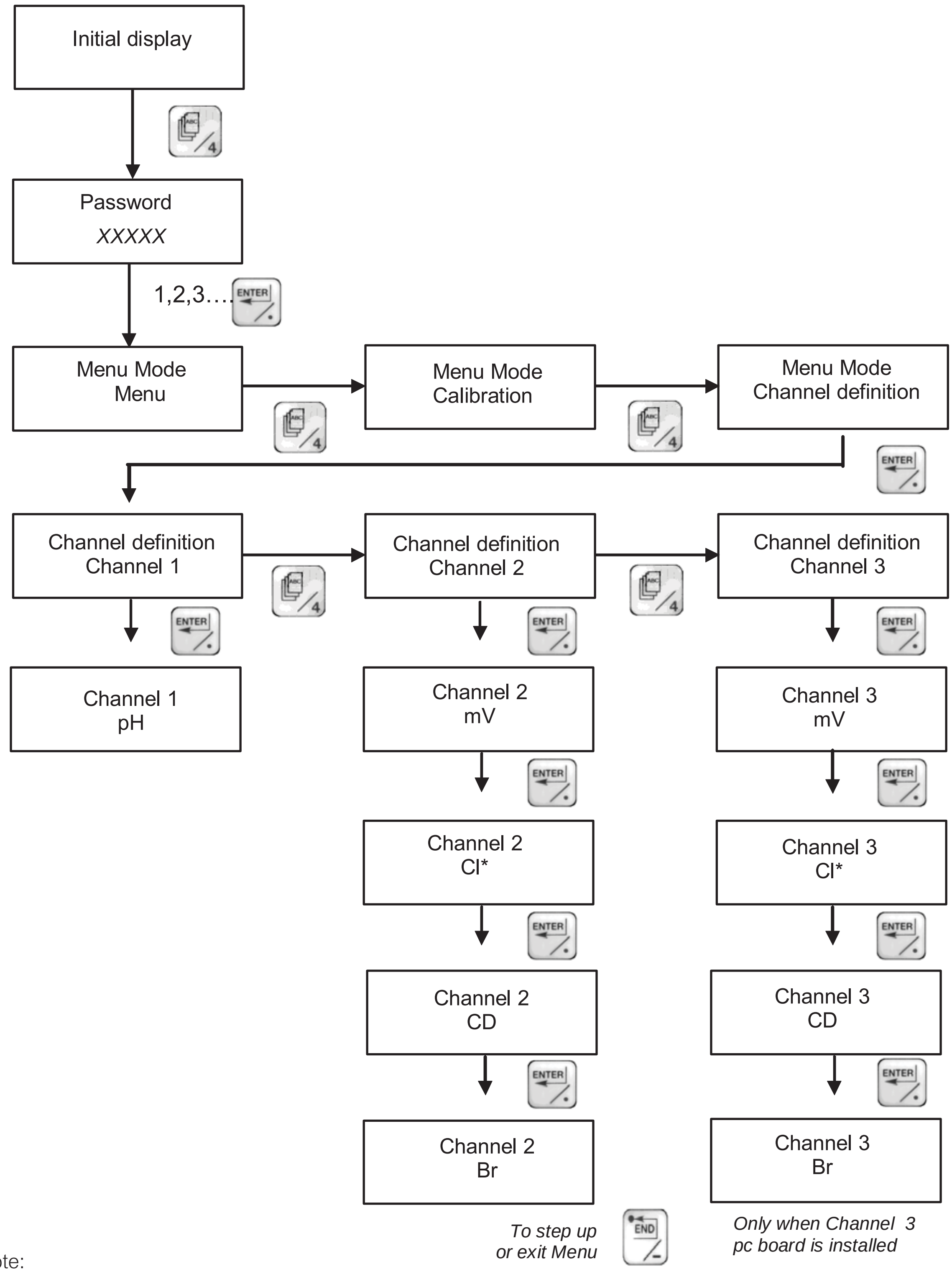


NOTE 5: If channel 2 is set as mA and different from the first channel, choose TX for stand alone channel or PID for feed forward flow rate value.



4.3.3 Channel definition-Swimming pool Controller

(Please refer also to the menu trees in the appendices for an overview of how to navigate through the software).



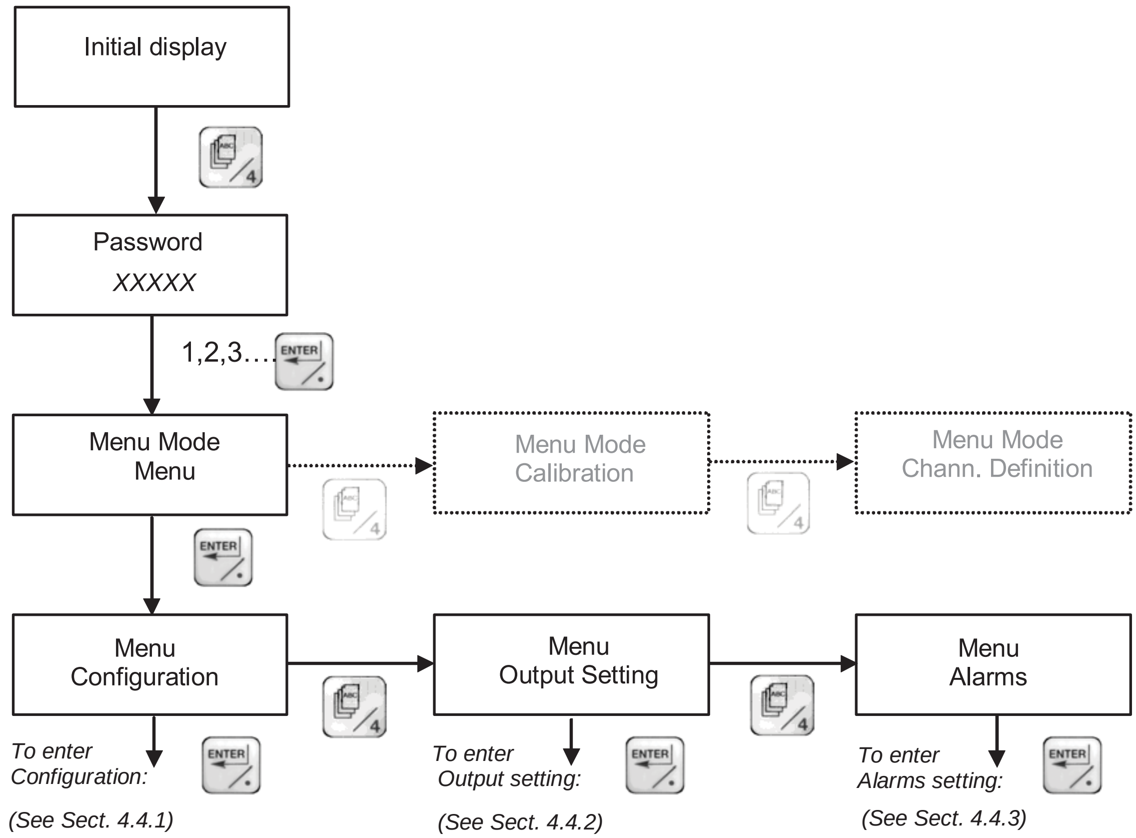
Note:
* = See Note 2 Section 4.3.1

4.4 Set-up menu

The set-up menu is structured in three different submenus and namely:

- Configuration: to set the general operating parameters of the instrument, see Sect. 4.4.1
- Output settings: to select 4-20 mA or 0-20 mA output for each channel, see Sect. 4.4.2
- Alarms: to set alarms level; see Sect. 4.4.3.

Each of them will be discussed in detail in the following pages.



4.4.1 Configuration

The configuration menu consents to set the general parameters of the instrument. Only those parameters which are pertinent to the selection made and to the hardware installed will appear in the menu. When a digital value is requested, pressing the ENTER key will cause a cursor to appear in the display: at this point a digital value may be entered using the second function of the keyboard pushbuttons. When ENTER key is pressed again, the value shown on the display will be confirmed, whether the latter has been modified or not.

Here is a description of the parameters appearing in the menu. A summary of the configuration menu flowchart follows in the next page.

4.4.1.1 Configuration parameters

Language: select the language of the displayed messages. Available languages: Italian, English, French, German, Spanish. Default: Selected language

Password: set the password, that is a numeric code composed of up to 5 characters. Default setting by Factory: 00000

Serial link: optional serial communication link
See Section 11 “Serial Communication” for detailed instructions

Cleaning: logical sequence for periodical cleaning of the sensors
See Section 4.4.1.3 for details

Temperature select: select measuring units for displayed temperature value: °C or °F; default: °C

Temperature set: define temperature at which operate temperature compensation when the thermistor is faulty; default: 20 °C (68°F)

Altitude: it appears when at least one channel is configured as O2. It's the altitude on sea level at which the instrument is installed. It must be set at start up and it does not need to be changed again. It is needed for automatic "in air" calibration procedure. Available units are feet (ft) and meter (m). Default Altitude: 200 m (666.6 ft)

CCI in ‘OR’: When CCI in OR option is chosen, if one or the other or both the CCI is/are closed the MicroChem2 freezes the output signals until CCI returns in the original state. See Section 5.2.3.3

Average: for dual/triple channels transmitters, with identical sensors installed; the transmitter computes the average of the two/three input signals. The choice is Average NO or Average YES; default is NO (the average is not computed)

Delta: for dual/triple channels transmitters, same installed parameter; the transmitter displays an alarm when the difference between the two/three measured values is higher than the set value allowed for the deviation. Default: 0.0 (the delta is not active)

Sigma: for triple channels controller, with identical sensors installed; the controller verifies if one of the three input signals is incorrect in comparison with the others. The choice is Sigma NO or Sigma YES; default is NO (the check is not activated)

K1, K2 selectable numeric thresholds determining if probe maintenance is requested. K1= maximum standard deviation value admitted. Default: 1.00; K2= maximum error value admitted for each probe. Default: 1.00;
Set numeric values in order to verify the following formulas:

$$= \bullet \overline{[\ (Vi - Vm)^2]/2}$$

If >K1 then verify for each probe:
If |Vi – Vsp| - |Vm – Vsp| > K2 then probe requires maintenance.
If not: probe works correctly.
(Vi= measured value; Vm= average value of the 3 measures; Vsp= set point value)
NOTE: the faulty condition message appears only on Alarms page (it is accessed by pressing the ENTER Key in display mode. See Sect. 9.2)

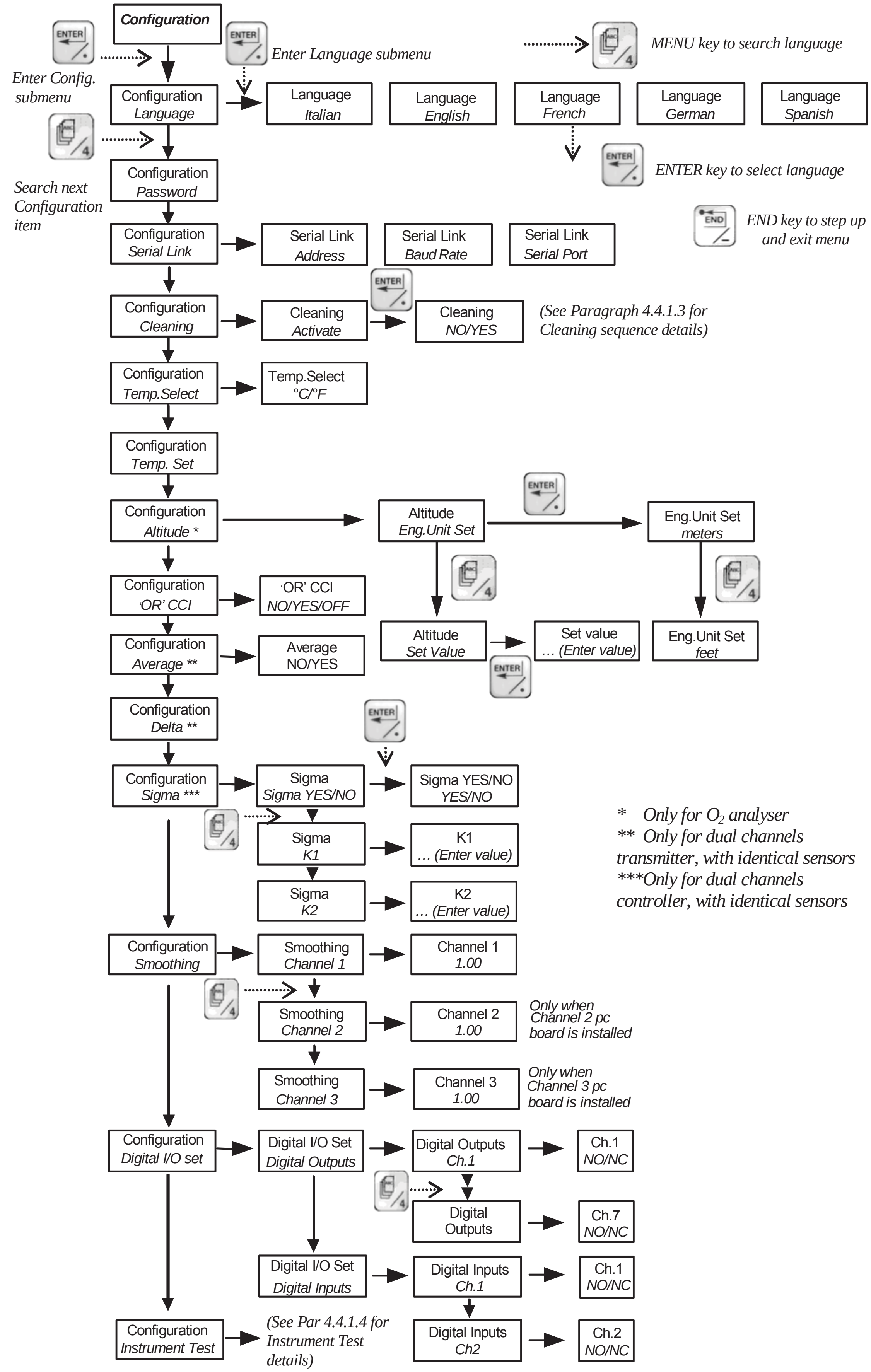
Smoothing: The number is the smoothing in seconds on the input signal. It can be separately set for the three channels. Allowed values are 0.00 - 10.00. Default: 1.0

Digital I/O Setting: allows to set the status of digital input and digital outputs: each CCI and each CCO can be separately set as NC or NO. Default: NO

Instrument test: see Section 4.4.1.4

4.4.1.2 Configuration menu flowchart

(Please refer also to the menu trees in the appendices for an overview of how to navigate through the software).


Configuration
Enter Config. submenu
Enter Language submenu
MENU key to search language
Configuration Language
Language Italian
Language English
Language French
Language German
Language Spanish
ENTER key to select language
Search next Configuration item
Configuration Password
END key to step up and exit menu
Configuration Serial Link
Serial Link Address
Serial Link Baud Rate
Serial Link Serial Port
Configuration Cleaning
Cleaning Activate
Cleaning NO/YES
(See Paragraph 4.4.1.3 for Cleaning sequence details)
Configuration Temp.Select
Temp.Select °C/°F
Configuration Temp. Set
Configuration Altitude *
Altitude Eng.Unit Set
Eng.Unit Set meters
Configuration 'OR' CCI
'OR' CCI NO/YES/OFF
Altitude Set Value
Set value … (Enter value)
Eng.Unit Set feet
Configuration Average **
Average NO/YES
Configuration Delta **
Configuration Sigma ***
Sigma Sigma YES/NO
Sigma YES/NO YES/NO
Sigma K1
K1 … (Enter value)
Sigma K2
K2 … (Enter value)
* Only for O_2 analyser
** Only for dual channels transmitter, with identical sensors
***Only for dual channels controller, with identical sensors
Configuration Smoothing
Smoothing Channel 1
Channel 1 1.00
Smoothing Channel 2
Channel 2 1.00
Only when Channel 2 pc board is installed
Smoothing Channel 3
Channel 3 1.00
Only when Channel 3 pc board is installed
Configuration Digital I/O set
Digital I/O Set Digital Outputs
Digital Outputs Ch.1
Ch.1 NO/NC
Digital Outputs
Ch.7 NO/NC
Digital I/O Set Digital Inputs
Digital Inputs Ch.1
Ch.1 NO/NC
Configuration Instrument Test
(See Par 4.4.1.4 for Instrument Test details)
Digital Inputs Ch2
Ch.2 NO/NC

4.4.1.3 Cleaning functionality

The cleaning functionality implemented in the MicroChem®2 supports a sequence of operations necessary to perform a periodical cleaning of the sensors. This function is always present in the software and can be enabled or disabled by a YES/NO selection in the configuration menu (default setting is NO).

When the selection is set to “YES”, the instruments activates the cleaning sequence and operates the output contact relays associated to CCO5 and CCO6 to drive the solenoid valves for the washing and rinsing lines (see Fig. 15). Each phase of the cleaning sequence requires a different timing, and this can be freely configured in parameters T1, T2, T3 and T4 (see Table 2 below for details). During the cleaning sequence active phases, the measure is frozen to the last valid value, and when instrument is operating as a Controller (T17MD4000, T17ME4000) the latter is automatically forced in manual mode.

The cleaning sequence can be started locally with a manual command by pressing Key 8 / WASHING, or it can be triggered automatically by setting proper values in the timers T1-T4.
There are two cleaning sequences designed to work in conjunction with optional STWP devices: sequence “A” (Water Analytic Unit) and sequence “B” (Sequential Cleaning Unit). Select “B” option and use the output contacts as directed in Figure 15 to drive the solenoid valves.

The cleaning sequence consists of the following four phases:

T1 - Analysis: Normal operation phase of the sensor that is the time period between the end of a cleaning sequence and the start of the next one in automatic mode. Allowed time values are 1 second to 30 hours. Typical value is 23.5 hours.

T2 – Washing: Phase to be used to wash the sensor with chemical detergent. Allowed values are 0-30 minutes. Typical value is 10 min.

T3 – Rinsing: Phase to be used to rinse the sensor with pressurized clean water. Allowed values are 0-30 minutes. Typical value is 10 min.

T4 – Pause: Pause period usually allowed to consent the sensor to recover sensibility before starting a new measure. Allowed values are 0-30 minutes. Typical value is 10 min.

PHASES	TIME	CCO5	CCO6	MESSAGE
T1 Analysis	T1	•	•	
T2 Washing	T2	O	•	WASH!
T3 Rinsing	T3	•	O	WASH!
T4 Pause	T4	•	•	WASH!
T1 Analysis	T1	•	•	

Legend:
O = open
• = closed

Table 2 - Sequence of cleaning phases

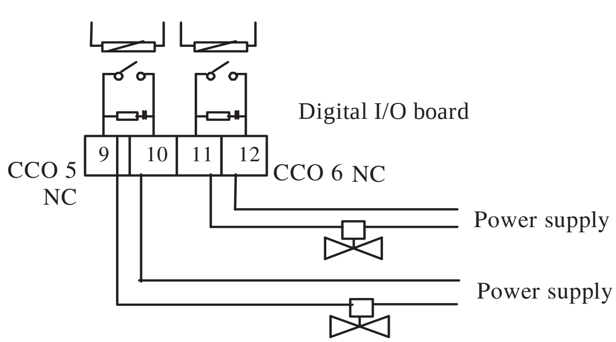
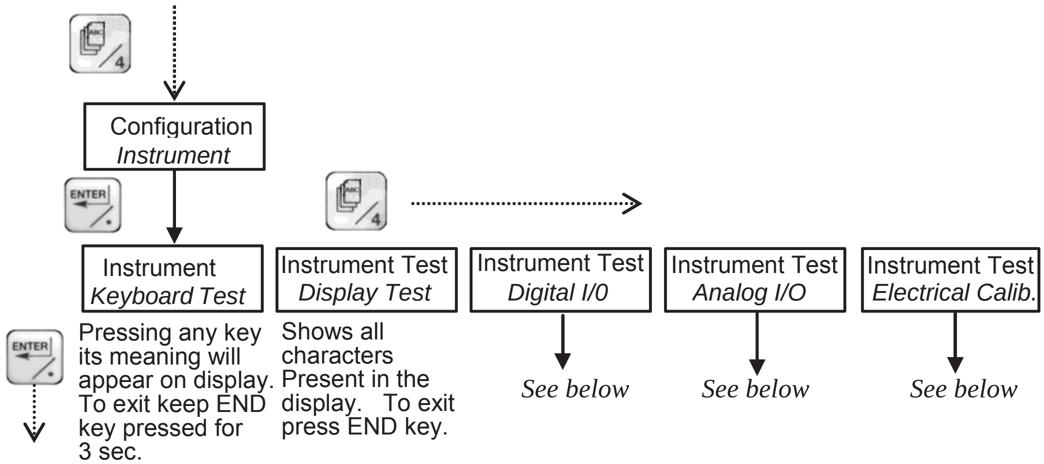


Figure 13 - Connection of solenoid valves

4.4.1.4 Instrument test

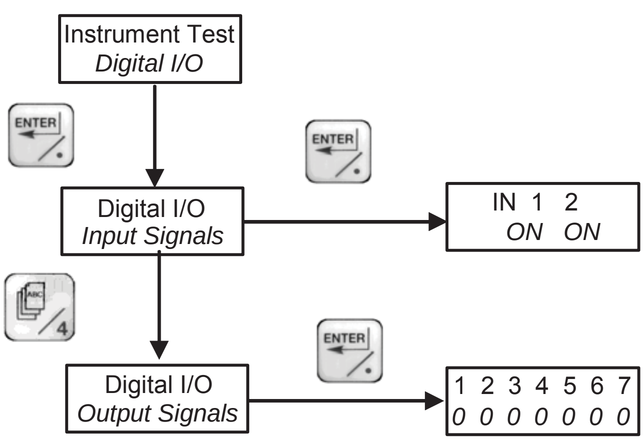
This submenu which is part of the Configuration menu, allows to perform self diagnostic routines on MicroChem®2 basic functions, sensor check and MicroChem2 electrical calibration:



- Keyboard test: pressing any key the display will show the corresponding number (0....9) or function (ENTER, END). To exit this submenu press END key and keep it pressed for 3 seconds, until the display shows - - -.

- Display test: once entered this submenu the display shows cyclically in all the 32 writing locations of the display all the characters present. To exit press END key.

- Digital I/O test: this submenu allows to verify the status and the correct functionality of the digital inputs and outputs:



Digital Input: Input signals submenu the display shows

" 1 2 "
" OFF OFF "

changing the status of one of the CCI by shorting the associated terminals (see Section 3.4.3.2) the display shows ON below the number of the associated CCI.

Digital Output: the display will show the status of the 7 output contacts (relay):

" 1 2 3 4 5 6 7 "
" 0 0 0 0 0 0 0 "

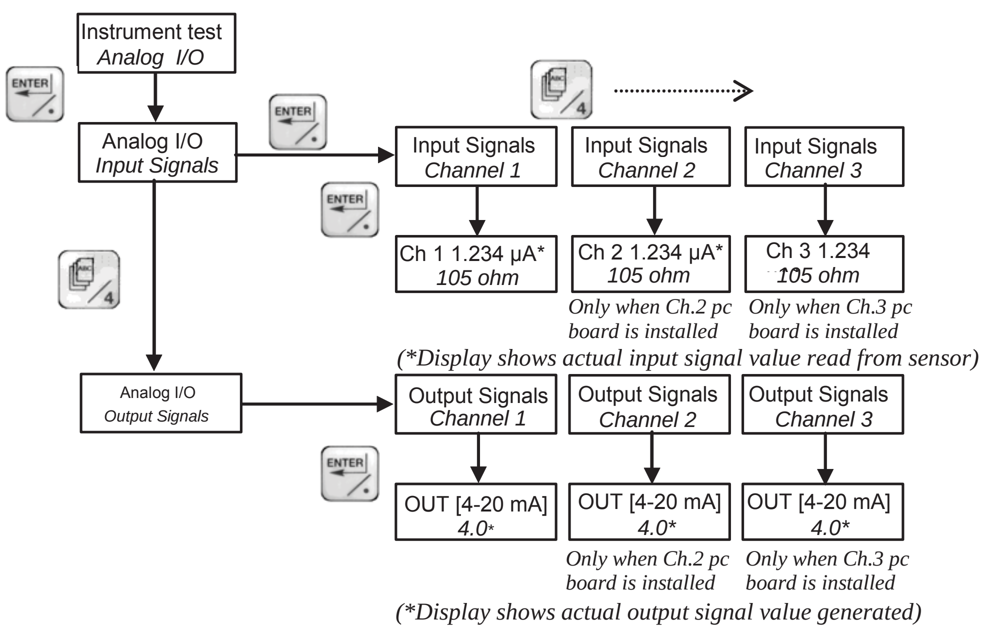
pressing the key corresponding to displayed number (from 1 to 7) the display will change the "0" in "1" or vice versa and the contact output status will change from “OPEN” to “CLOSE”: verify with an ohmmeter the status of the pertinent CCO (see hereafter terminal numbers correspondence).

Contact Number (CCO)	CCO1		CCO2		CCO3		CCO4		CCO5		CCO6		CCO7	
Terminal identification (TB J3)	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Table 3 - CCO Terminal identification

- Analog I/O test: the Analog I/O test allows to verify the correct value of the input and output signals. In the analog “Input” mode, the display shows the value of the signal generated by the sensor and the pertinent Pt100, in order to verify the correct sensor operation in an easy and fast way.

In analog output mode the instrument allows to check correct functionality of the 4-20 mA output: operating the OUT increase and OUT decrease keys the output value indicated on display can be changed and with a multimeter connected to the pertinent channel output [terminals 1(-), 2(+)] it can be verified that the current output changes accordingly.



- Electrical Calibration: The access to this menu is protected by a password that is only known to Severn Trent personnel, because the included parameters must never be tampered with.

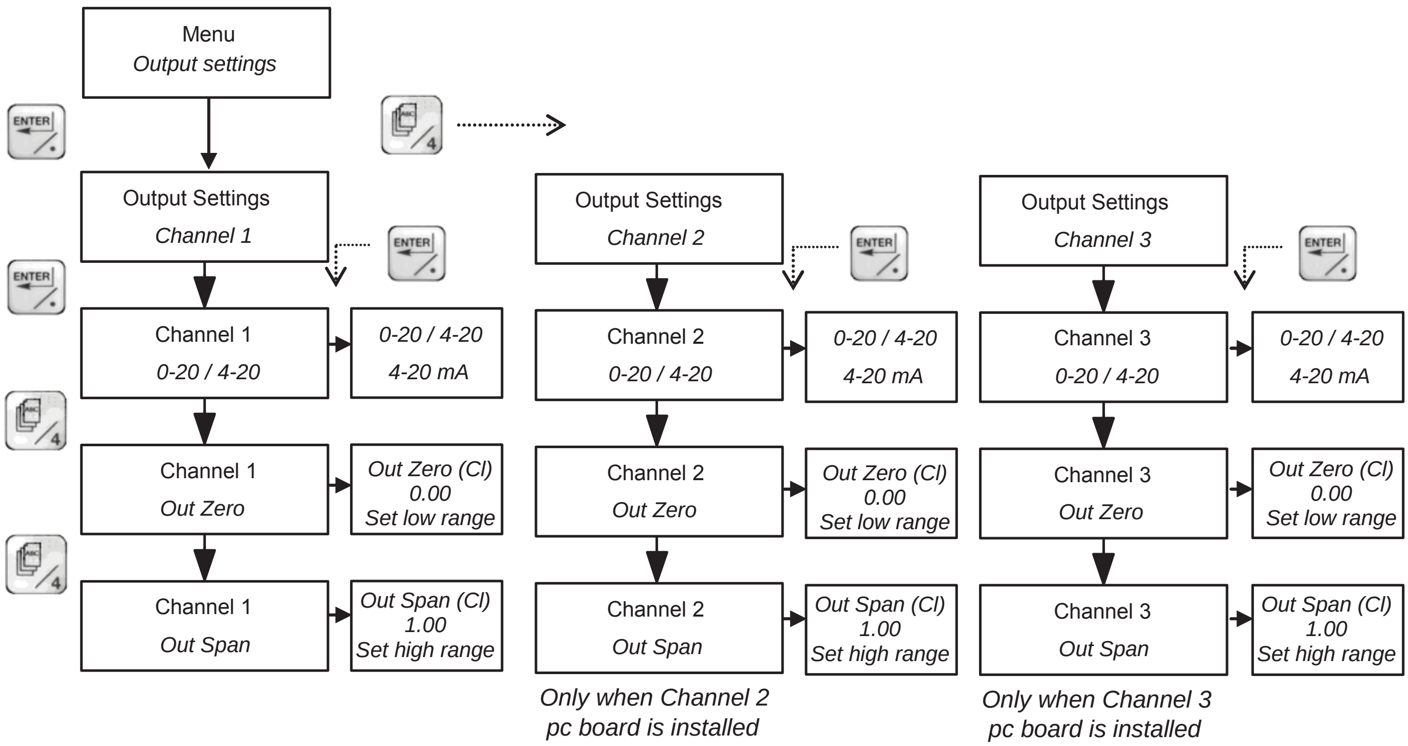
The electrical calibration is only performed in the Factory at the end of manufacturing process.

4.4.2 Output setting

The Output Settings menu allows to set current output (0-20 or 4-20 mA), zero (Out Zero) and full scale (Out Max) values, in engineering units. Out Zero value corresponds to 0 mA or 4 mA (according to the output chosen) and the Out Full Scale value to 20 mA.

WARNING! **The 0 or 4 mA selection is a hardware/software setting made during manufacturing process. Set 0-20 mA or 4-20 mA accordingly. To modify output signal change Jumper JP1-JP2 as shown in Figure 14.**

(See Sect. 4.4 to get here)



In the following table the default values of Out Zero and Out Max are presented. Minimum span and maximum ranges are also presented.

Parameter	Unit	Out Zero	Out Max	Minimum Span	Maximum range
pH	pH	2.00	12.00	1.00	0.00-14.00
mV	mV	-500	+500	100	-1500-+1500
O2	ppm	0.00	10.00	2.0	0-20.00
O3	ppm	0.00	10.00	0. 25	0.00-10.00
Cl	ppm	0.00	10.00	0.25	0.00-10.00
CD	ppm	0.00	10.00	0.25	0.00-10.00
T	°C	0.00	100.0	5	0.00-+100
mA	See Section 2.1	4.00	20.0	2	(0) 4-20.0
Br	ppm	0.00	1.00	1.00	0.00 -10.00

Table 4 – Output max and min range

4.4.2.1 Output signal hardware modification 4-20 to 0-20 mA

To modify output signal from 4-20 to 0-20 mA make following hardware modification on Analog Input/Output board:

- Identify Jumper JP1 and JP2 on board (see figure below);
- Remove JP1 (cut copper, this jumper is factory-made by default);
- Install Jumper in JP2 position.

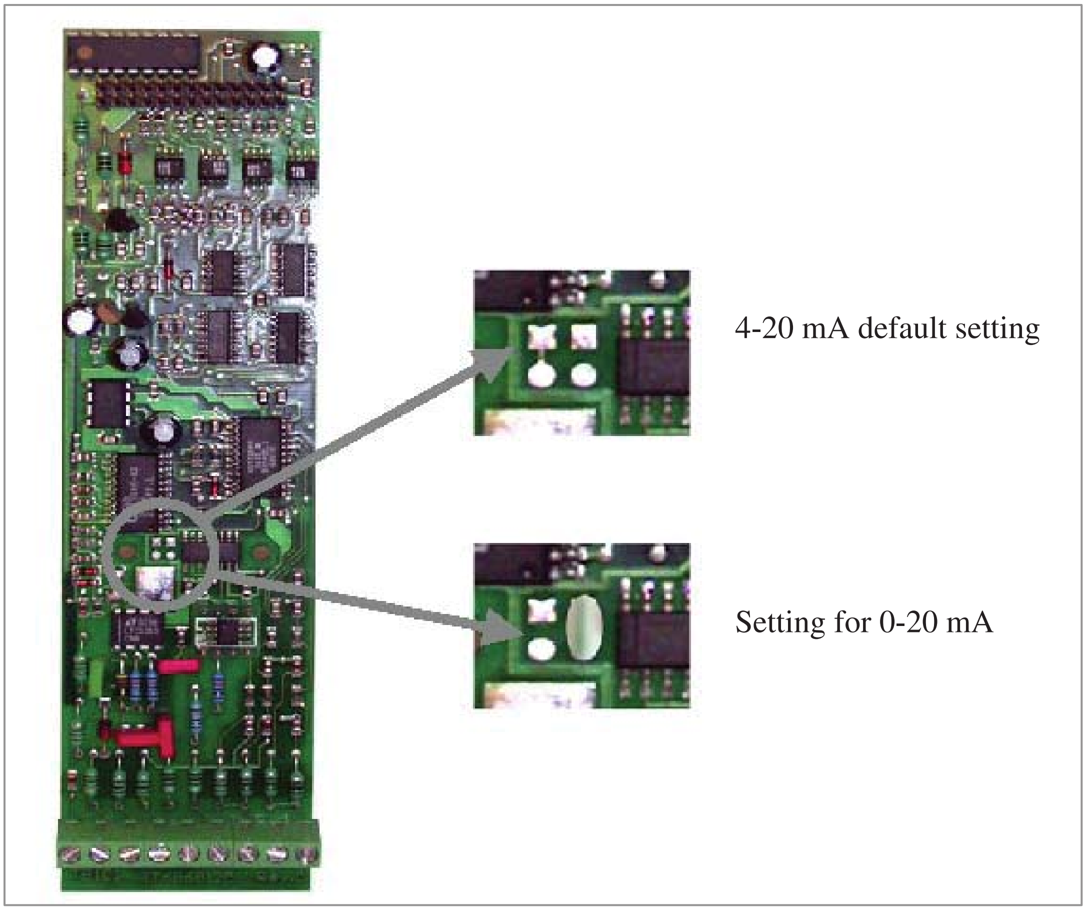


Figure 14 - Jumper position for 4-20 to 0-20 mA output signal modification

4.4.3 Alarms

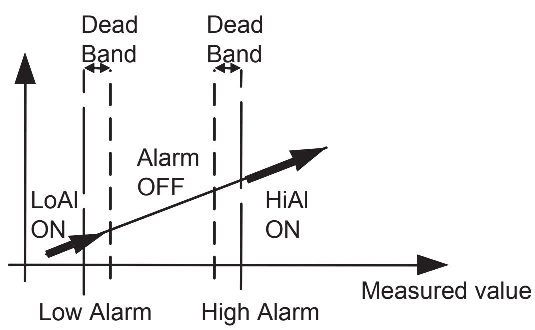
This menu allows to set high and low alarm levels and the dead band. The alarm levels are freely selectable by the user. Select the channel and press Enter to select alarms and dead band. Default levels are automatically related to the set range of output: low alarm is set at 10 % of Out Zero and high alarm is set at 90 % of Out Max (see the following table for default alarm setting values).

Parameter	Unit	Alarm		
		low	***high***	***dead band***
pH	pH	3.00	11.00	0.00
mV	mV	-400	+400	0.00
O2	ppm	1.00	9.00	0.00
O3	ppm	0.10	0.90	0.00
Cl (KC4000)	ppm	0.10	0.90	0.00
Cl (CL4000 0-2 ppm)	ppm	0.20	1.80	0.00
Cl (CL4000 0-10 ppm)	ppm	1.00	9.00	0.00
CD	ppm	0.10	0.90	0.00
T	°C/°F	10.0	90.0	0.00
mA	mA	5.60	18.40	0.00

Table 5 – Default alarm setting

Dead band is useful to avoid a repeated switch on and off of an alarm condition. The operation principle is represented in Figure 15 below: if the measured value reaches the high alarm level, MicroChem®2 generates an alarm message, but a second alarm condition is triggered only after the measure lowers below the set dead band, and then rises again above the HI alarm level. A similar procedure of opposite sign is performed for low alarm.

To identify contacts for alarm retransmission, see the operation description for each instrument type in the following chapters.



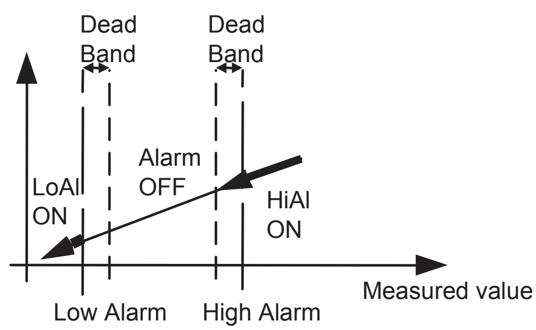


Figure 15 – Hi and LO alarm dead-band

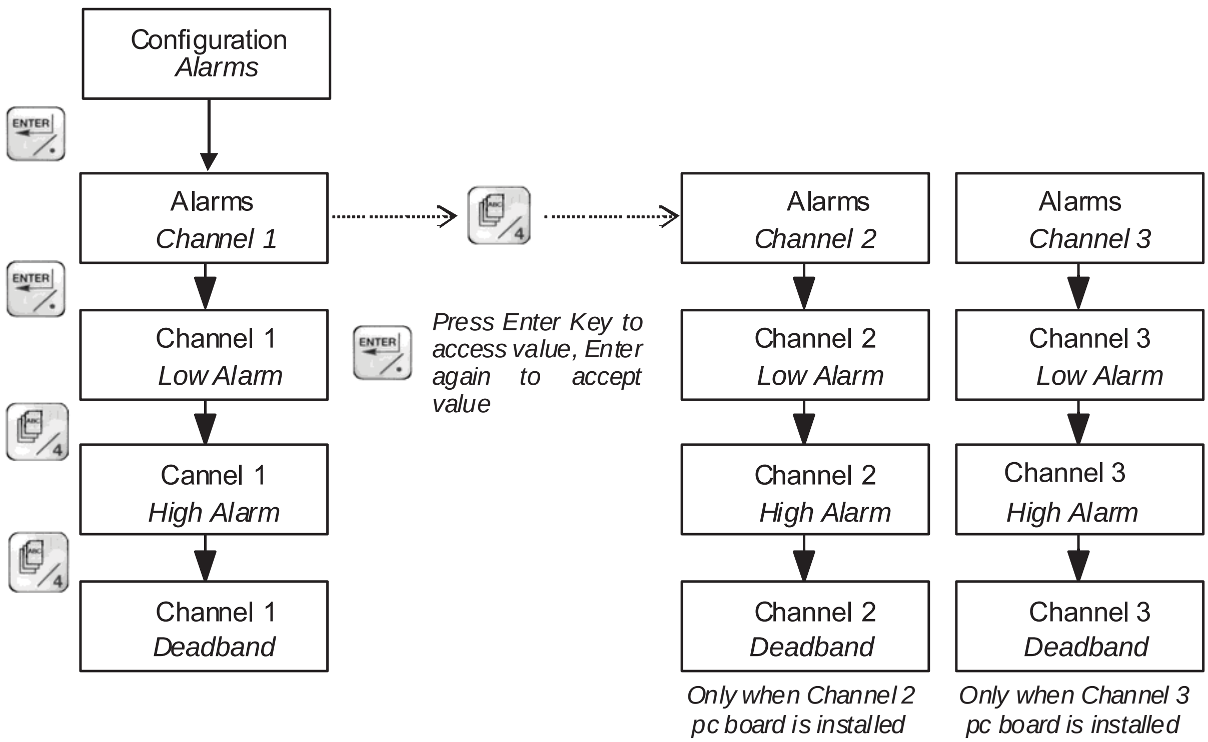
4.4.3.1 Alarm Display

When an alarm occurs, the display indication will flash on and off to signal the alarm condition.

By pressing the ENTER key, the alarm page will be called on display, and it will be possible to identify the channel and the alarm type .
See Sect. 9.2 for details.

4.4.3.2 Alarm setting Menu

(See Sect. 4.4 to get here)



5 FUNCTIONALITY

The different functionality of the instrument depends on the Model Number selected, and it can be classified in two main groups: Analyzer-Indicator-**Transmitter** or Analyzer-Indicator-Transmitter-**Controller.**

5.1 Transmitter

The transmitter can support up to three sensors, and the association of input/output signals depends on the configuration selected as per following tables.

Digital inputs:

CCI in ‘OR’ SELECTION	**CCI1**	**CCI2**
CCI in ‘OR’ = ***NO***	Freezes measured value of Channel 1	Freezes measured value of Channel 2 (Channel 3 alone cannot be frozen)
CCI in ‘OR’ = ***YES***	Freezes measured value of all Channels installed	Freezes measured value of all Channels installed
CCI in ‘OR’ = ***OFF***	CCI 1 inactivated	CCI 2 inactivated

Table 6 - Digital Inputs Functionality for Transmitter

Digital outputs:

Transmitter Type	**CCO1**	**CCO2**	**CCO3**	**CCO4**	**CCO5**	**CCO6**	**CCO7**
Without Cleaning	HI Alarm Ch. 1	LO Alarm Ch. 1	HI Alarm Ch. 2 (1)	LO Alarm Ch. 2 (1)	HI Alarm Ch. 3 (2)	LO Alarm Ch. 3 (2)	Watch dog
With Cleaning	HI Alarm Ch. 1	LO Alarm Ch. 1	HI Alarm Ch. 2 (1)	LO Alarm Ch. 2 (1)	Washing command	Washing command	Watch dog

Table 7 - Digital Outputs Functionality for Transmitter

Analog Signal output 0/4-20 mA:

Instrument	Channel 1	Channel 2	Channel 3
Transmitter	Retransmission of analysis value for Sensor on Ch. 1	Retransmission of analysis value for Sensor on Ch. 2 (1)	Retransmission of analysis value for Sensor on Ch. 3 (2)

Table 8 - Analog Outputs Functionality for Transmitter

(1) – Only when Channel 2 is installed
(2) – Only when Channel 3 is installed

5.2 Controller

The control strategies offered by the MicroChem®2 are basically:

- Standard PID Controller, with Feed Forward option
- Swimming Pool Controller
- Average Controller between 2 or 3 equal probes

These will be discussed in detail in the following paragraphs.

NOTE: MicroChem2 controller type must be specified at time of order. Hardware changes are required to convert from a standard transmitter to a standard PID controller or to a swimming pool controller.

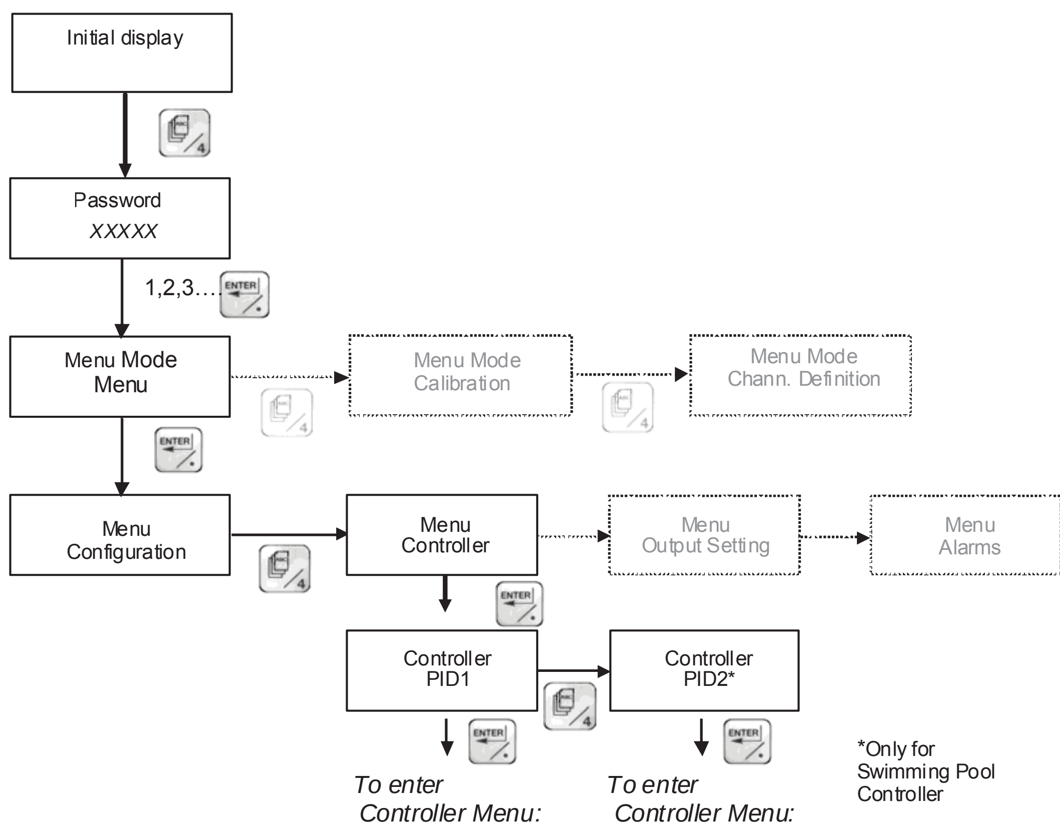
5.2.1 General description

The PID Controller of the MicroChem2 is usable in the majority of process applications. The controller calculates an output based on the difference between the analytic measure (Process Variable, PV), and a Set-point (SP) value, it calculates an Output (OUT), that is applied to a final control element (e. g. dosing pump) to restore actual process value to the set-point demand. The output is calculated with the PID algorithm, which has Proportional, Integral and Derivative actions. The effect these terms have on the calculated output is determined by the PID configuration.

The Controller can work in Automatic or Manual mode, pushing numbers 0 or 5. The Manual mode let the user modify the output manually, whereby the PID calculated output is not used. The output is driven with push-buttons 1 (decrease) and 2 (increase). The Automatic mode is selected pushing button 5. The set-point is modified with the push-buttons 6 (decrease) and 7 (increase). The output signal to drive the control element can be either a 4-20 mA analog signal or two contacts (increase-decrease). The user can choose to control the final element according to the characteristics of the device used.

5.2.2 Controller's Parameters

When the instrument is operating as a controller the following menu becomes accessible:



Entering the Controller Menu the accessible parameters are presented as per the following table:

1 - General Parameters (valid for all control strategies)		
Description	***Symbol***	***Configuration***
4/20 mA / Contacts	-	Selection of controller output as analog 4/20 mA signal or Contact closure (See 5.2.2.5). Default: 4 – 20 mA
Proportional Band	PB	Numeric entry in % (Integer positive) Default: 100% - Range: 0% - 999%
Time Reset or Integral action	TR	Numeric Entry in minutes per repetition Default: 0 min/rep – Range 0 -999.99 min/rep
Manual Reset (Active when TR=0)	MR	Numeric entry in % Default: 50% - Range 0-100%
Derivative	TD	Numeric Entry in minutes Default: 0 min – Range 0 -99.99 min
Process Variable (display only)	PV	Engineering units
Set Point	SP	Engineering units Default: 0.00
Control zone	CZ	Numeric entry in Engineering units Default: 0.00 - Range: 0.0 - 99999.99
Direct/Reverse Action	RSW	D = Direct; R = Reverse. Default = Reverse
Span	SPAN	Controller Span Default = According to channel configuration
(Feed Forward parameters appear here if this option has been selected. - See Section 2 below)		
High limit on controller's output	OH%	Numeric entry in % Default: 100% - Range 0-100%
Low limit on controller's output	OL%	Numeric entry in % Default: 0% - Range 0-100%

2 - Feed Forward action (this function available only when option is activated – See Par. 5.2.2.2)		
Limit output as function of flowrate?	OHLP	Enter No/Yes Default: No
Factor to compute Max output based on Flowrate value	FFH	Numeric entry in %/100 Default: 1.5 - Range: 0 - 999.99
Factor to compute Min output based on Flowrate value	FFL	Numeric entry in %/100 Default: 0.50 - Range: 0 - 999.99
Absolute High limit on output when limits based on flowrate are active	Absolute Max.	Numeric entry in % Default: 100% - Range 0-100%
Gain factor applied on flowrate signal	GAIN	Numeric entry in % Default: 100% - Range 0-999.99%

3 – Time Sampling and/or Flow Pacing Controller (Process with dead time - this menu available only when Chlorine input Channel is selected – See Par. 5.2.2.3)		
Sampling based on flow?	TATP	Enter No/Yes Default: No
Scaling factor for flow	K	Numeric entry in Engineering units Default: 0.0 - Range: 0 - 999999.9
Active time	Att.	Numeric Entry in minutes Default: 0.0 min – Range 0- 99999.99 min

Total Cycle time (or volume)	Cycle	Numeric Entry in minutes (or units sample) Default: 0.0 min - Range: 0 - 99999.99 min
4 - pH/ORP control (this parameter compares when pH/ORP is selected – See Par. 5.2.2.4)		
Squared error control band	Dead Band	Numeric entry in % Default: 100% - Range 0-100%

5 - Contact output controller – (this menu available when option is selected - See Par. 5.2.2.5)		
Frequency / Relay	DIGITAL OUTPUT S	Function not supported at this time, leave always the selection "Relay"
Gain	GAIN	Numeric entry in %/100 Default: 1.00 - Range: 0 - 99.99
Dead Zone	DZ	Numeric entry in Engineering units Default: 0 - Range: 0 - 99999.99
Cycle time	TIME CYCLE SEC	Numeric Entry in seconds Default: 0 sec - Range: 0 - 99999 sec

6 – Swimming Pool Controller / Dual PID – (See Par. 5.2.4)
When this option is implemented, the menu offers a choice of PID2 in addition of PID1. The parameters of PID2 are identical to those of PID1, except for the option not compatible with this configuration, and namely those of items 2-Feed Forward and 4-pH/ORP (which is on PID1).

Table 9 - Controller Parameters

5.2.2.1 PID Parameters

The MicroChem2 is capable of Proportional (P), Proportional Integral (PI) and Proportional Integral Derivative (PID) control. To do so, a chip written with controller software must be inserted in an open slot on the control board. Recall that each of the three channels has the ability to accept a 4-20mA input, a micro-amp input, or a mV input. The instrument also has digital relay contact outputs CCO1 through CCO7, which have different functions depending on how the instrument is configured. Each of the three channels also has a 4-20mA output.

4-20mA/Contacts

4-20mA/Contacts is selected to determine if the instruments will function as a PID controller or as a Relay Contacts controller. As a PID controller, the instrument sends a control signal to the equipment being controlled using its 4-20mA output. Contact relays CCO1 through CCO6 are used to provide Hi and Lo alarms. 4-20 mA output is set by default. Refer to Section 5.2.2.5.

NOTE: If you wish to control a given parameter and want to forward the measured value (via a 4-20 mA output) being controlled, a 2 channel system is required. The analog input on channel 1 will be the measured value. The analog output on channel 1 will be the control signal. The analog output on channel 2 configured as mA will be the retransmitted signal from the channel 1 input. The analog input on channel 2 can be a flow signal coming from a flow meter or not used. If contact closure control output is selected, a second channel is not needed for retransmission.

As a Relay Contacts controller, the control signal is sent via digital relay control contacts outputs, CCO3 and CCO4. CCO5 and CCO6 are used for washing if selected. Hi and Lo alarms are provided by CC01 through CCO6 depending on the configuration and the number of channels. Please refer to 5.2.3.4, Table 12.

<u>Proportional Action (PB)</u>

Percent Proportional Band is the full scale through which the error signal (the difference between the process variable and the setpoint) must vary to cause a full scale output variation due only to proportional control mode response. In Proportional Action there is a comparative relationship between the controller loop output signal magnitude and the calculated error, which is the difference between the process variable and the setpoint.

Proportional Band determines the size of the incremental changes the controller makes. To set PB:

- Fast response to the error — if you want a small change in the process variable to cause a large response, set PB to a small number (a high Gain). If too low of a number is selected, the control action will change rapidly and may cause overshoot of the set point.
- Slow response to error — if you want a large change in the process variable to cause a small response, set PB to a large number (a small Gain). This will cause the control signal output to change in small steps taking longer to eliminate the error. This will lessen the possibility of an overshoot but will take longer to eliminate the error.

When setting PB you are telling the controller what percentage of the difference between the set-point and the process variable you want to use as steps to eliminate the error. Each step is equal to 100% divided by the % of the PB. If for example the PB setting is 200%, you are telling the controller to make incremental changes of 100/200 or 1/2 of the error. As the error decreases, so do the incremental changes

Minimum PB value is 0% (high Gain) and maximum value is 999% (small Gain)

Integral Action (TR)
Integral Action augments proportional action to cause a PID control loop to drive its final control element until the deviation is completely eliminated. In other words, TR produces a corrective signal proportional to the error and length of time the controlled variable is different from the set-point.

As in the last example, if PB is set at 200% the incremental change the controller will make is equal to 1/2 of the error. So if you set your TR to 5 minutes, every 5 minutes the controller will compare the set-point to the process variable and regulate the pump to turn on to eliminate 1/2 of the error. As the error is reduced the incremental change the controller makes is also reduced. This is actually done continuously, not in discrete steps as inferred above. Suggested range of values are 0.02 min/repetition (fastest response) to 30 min/rep (slowest).

To determine the TR value you need to measure the elapsed time between making a change to the process and the MicroChem2 reacting to this change.

For example in the case of a Chlorine Residual Analyzer, the equipment should be installed such that the system lag time is 3 to 5 minutes between chemical injection and residual analyzer detection of a change. Once the system is operational, change the chemical feed rate and start a stopwatch. When the analyzer displays the change in the process variable, stop the watch. Add 5 to 10 seconds to the time and this will now be the TR time to enter into the MicroChem2.

NOTE: Integral action is activated when sampling is not based on flow. TATP (see Section 5.2.2.3) must be set to NO, which is the default. If TATP is set to YES, then sampling is based on flow and TR has no meaning.

Derivative Action (TD)
Derivative action augments proportional action by responding to the rate of change of the process variable. It is used to make each controller PID loop more responsive to sudden process disturbances. The derivative time in minutes is the amount of time by which the proportional action (or proportional plus integral action) is advanced. The minimum value for derivative action is 0.01 minutes for the fastest response, and the maximum value is 8 minutes for the slowest response.

Control Zone (EZ)
This parameter is used to avoid continuous control adjustments for small fluctuation from set-point. If for example set-point is set to 7 and CZ = 1, control action is not active in the range 6.5 -7.5.

Manual Reset (MR)
This parameter represents the integral action set manually. It is activated by setting TR parameter to “0”.

Direct/Reverse Action (RSW)
Direct/Reverse Action is used to have the controller respond directly or oppositely to the change in your process variable. For example if you are adding sulfur dioxide to lower your residual and you are measuring your residual to control the sulfur dioxide, set the RSW to direct. If you are controlling your residual by adding chlorine, set RSW to reverse.

Span
Span is the measuring range used by controller. This value is typically set to the maximum ranger of the sensor connector to Channel 1.

Output High and Low Limits(OH and OL)
Output High and Low Limits represent the absolute high and low limits at which you want the controller to run. If for example, you are using a pump with a higher capacity than your process requires and there is the possibility that you can overdose, you will need to set the OH to prevent this from occurring. Ranges for OH and OL are both 0-100%.

5.2.2.2 Feed Forward (FF) Configuration

The instrument will activate this function only if it detects the presence of a 4-20 mA input signal connected to Channel 2.

Feed Forward is used to modify the controller’s output as a function of the flow rate. If the process flow rate is variable, the software will take the flow rate signal input from channel 2 and the measured value input from channel 1 to compute the PID output. The 4-20mA input flow rate signal is generated by an external flow meter connected to Channel 2.

To use this strategy you will need to do the following: The flowmeter must be connected to channel 2 and defined as mA. mA needs to be further defined as MODE PID, which is the default under the mA Channel Definition to take the flow into consideration.

MODE PID -- When the instrument is defined as MODE PID for flow proportional control, it allows the instrument to adjust the PID control signal depending upon the flow signal and the measured value of the process. MODE PID allows access to the feed forward control parameters OHLP, FFH, FFL and ABS Max. Please refer to the Controller Software Menu Tree Appendix D and the Step by Step instructions to easily navigate through the software.

MODE TX – is used when Channel 2 is not used to retransmit the 4-20 mA output signal from Channel 1 or when feed forward action is not desired. When MODE TX is selected Channel 2 can be used to independently measure another parameter.

NOTE: MODE PID and MODE TX only appear on Channel 2 and only if the instrument is configured as a controller.

Limit Factor as a Function of Flow Rate? (OHLP is set to NO):

A. If OHLP is set to **No** then FFH, FFL, and MAX ABS are off. OHLP controls the limit functions with respect to the flow signal. To mask the flow signal the Gain would also need to be set to 0.

Limit Factor as a Function of Flowrate? (OHLP)

B. If OHLP is set to **Yes** – The MicroChem2 calculates output limits as a function of the instantaneous flow rate. If Feed Forward control is implemented through the automatic detection of the 4-20mA input signal on Channel 2 configured as PID, the standard High(OH) and low(OL) limits on the controllers output are automatically disabled to allow for flow proportional control.

See 5.2.2.1 PID Parameters – Output High and Low Limits. Maximum and Minimum Output Limits as a function of flow rate must be determined to prevent over dosing or under dosing the process.

Maximum Output Limit as a Function of Flow Rate (FFH) – The Maximum output limit is calculated by multiplying the FFH by the Flow Rate. FFH is determined based on plant experience. If for example you have an oversized pump you would consider the overdosing possibility.

Minimum Output Limit as a Function of Flow Rate (FFL) – The Minimum Output Limit is calculated by multiplying the Flow Rate by the Feed Forward Low Factor.

Flow Rate is 20%	Flow Rate is 20%
FFH is 1.5	FFL is 0.5
Output limit is 20% x 1.5 = 30%	Output limit is 20% x 0.5 = 10%

Absolute High Limit on Output when limit based on flow rate is active (ABSOLUTE MAX) – The Max ABS parameter sets the absolute maximum limit on the output when the limits are based on flow. When OHLP is set to Yes, then OH and OL are not engaged and MAX ABS is used instead.

Gain – When using the Feed Forward control strategy, Gain is the factor applied to the flow rate signal contribution to control the coarse dosing and limit the flow action of the PID. In other words, Gain is the ratio of how much to open the valve or turn on the feed pump with respect to the process flow signal.

Example assuming no limits of FFH AND FFL

@100% Gain	@ 50% Gain
FF min in 0% at 4.00mA	FF min in 0% at 4.00mA
FF max is 100% at 20mA	FF max is 50% at 20mA

NOTE: If a 4-20mA input is connected to Channel 2, and FF control is not desired, set OHLP to NO, set GAIN to 0, and the PID output will be based on the residual value only.

5.2.2.3 Time Sampling and/or Flow Pacing Controller

The Time Sampling and/or the Flow Pacing menu is made available automatically when the MicroChem®2 detects that a Chlorine input channel has been selected. When a process has dead time, which is often the case for Chlorine dosage, it can best be controlled with this strategy using either Time Sampling or Volume Pacing. Time Sampling or Flow/Volume Pacing control updates the PID function on a periodic basis for a specific length of time or amount of flow.

Time Sampling (TATP) is enabled by setting the TATP parameter to NO. TATP is an Italian acronym. The TATP parameter asks the question, is sampling based on flow?

When TATP is set to NO, the PID control output is updated based on Time, the Active (Att) and Cycle parameters.

Scaling Factor for Flow (K) Although the K parameter is available in the menu, it has no effect on Time Sampling and should be set to 0.

Active Time (Att) – Active time is defined as the amount of time that the PID is engaged and applied to the control output. Active Time – is a sample and hold control strategy used in a batch system i.e. in a contact tank, with a given volume of water. Set Active Time in whole minutes. The analyzer will not accept fractions of a minute.

Cycle Time (Cycle) Cycle Time sampling is defined as the total amount of Active time plus wait time. A "W" will appear on the bottom right corner of the display to indicate that the system is in wait mode. During the wait time the microprocessor does not update the residual portion of the PID output. For continuous PID control, set the Active time larger than the Cycle time. Set Cycle Time in whole minutes. The analyzer will not accept fractions of a minute.

Cycle Time	
ATT	**Wait "W" Time**

Flow or Volume Pacing is enabled by setting the TATP parameter to YES. When TATP is set to YES, the PID control output is updated based on flow volume. To use Volume Pacing:

1. Channel 1 is configured for the specific parameter being measured and controlled. The 4-20mA output on channel 1 is used to provide the PID control signal.
2. The analog input for Channel 2 must be configured to 4-20mA, which further asks to configure channel 2 to Mode PID or Mode TX. Select Mode PID.

Scaling Factor for Flow (K) – The scaling factor (K) for flow is used by the MicroChem® 2 software to calculate the flow.

- set K factor to the flowmeter's full-scale value expressed in cubic meters (m3/h).
- K factor can be set between 0 and 17000 m3/h.

1 m^3/h=	6340.129 gallon/day
	219.9692 gallon/hr
	3.666153 gallon/minute

Active Time (ATT) – The ATT Parameter is defined as the Period (in m^3) that the PID is updated during the cycle and applied to the control output signal.

Cycle (for Flow) – is defined as the total volume of process flow expressed in cubic meters (m^3) for a complete cycle. A "W" will appear at the bottom right corner of the display to indicate the system is in the wait mode. During the wait time the microprocessor does not update the residual portion of the PID output.

Cycle Volume	
ATT	**Wait "W" Volume**

5.2.2.4 Error Squared Controller (pH and ORP Applications)

When the instrument detects that pH or ORP sensor has been selected for the controller, it enables a special PID algorithm with an "Error Squared" function. The error squared function is applied only within a band defined in the "BAND" parameter of the controller's configuration menu. When the error is outside this band, the effective error is a linear response (see Figure 16).

If "BAND" parameter is set to "0", then the controller operates like a standard PID controller.

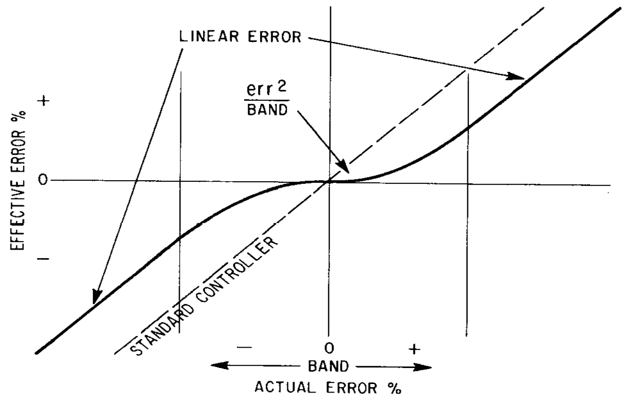


Figure 16 - Error versus control band

5.2.2.5 Contacts Output Controller

Contact output control is particularly suitable when using a dosing pump controlled by contacts (rather than 4-20mA analog signal) or for operation with an electrically motorized control valve.

NOTE: When the contact closure routines are being used the cycle time (Section 5, Table 9 - Control Parameters, number 6 - Contact output controller must be set (i.e. not left at 0).

Gain - For controllers operating in the contacts mode, the PID algorithm is NOT active and the output is calculated using the Gain parameter (similar in function to the proportional term in PID).

NOTE: The main screen still shows the calculated PID output even though it is not used in contact closure mode - ignore this.

The algorithm works by looking at how far away from the setpoint the measurement is and then switching the dosing pump on for a period of time (switched on for longer when the setpoint is a long way away).

1) A small percentage of deviation of the process variable will cause a full scale output if the gain is set to a low number, increasing the possibility of an overshoot.
2) A large percentage of deviation of the process variable will cause a small scale output if the gain is set to a high number decreasing the possibility of an overshoot. This will require the pump to operate more frequently in smaller steps as the instrument attempts to bring the measured value to the set point value.

Dead Zone (DZ) - Dead Zone parameter represents the range around the setpoint where control action has no effect. Similar to Deadband, this function is used when the process variable is near the setpoint when using the Contacts Output Controller. So, when the difference between the process variable and setpoint is lower than this value the contacts are kept open.

Time Cycle - When using contact closures for control, the amount of time the contact closure is closed is the amount of time the pump is on or the valve is open.

% output duty cycle (% time pump is on) = % deviation from setpoint x gain

e.g.: If the setpoint is 3 mg/l and the signal measured is 2 mg/l then the % deviation from the setpoint = (3-2)/3 = 1/3 = 33%

If the time cycle is set to 20 seconds and the gain =1, then in the 20 second period the contact closure will be on for 33% of 20 seconds (6.7 seconds).

If after this 20 seconds period the measurement is now 2.5 mg/l the new % deviation from the setpoint = (3-2.5)/3 = 17%. The contact closure will now be on for 17% of 20 seconds, i.e. 3.5 seconds.

By changing the gain to say 2, then the contact will be on for longer; 3.5 x 2 = 7 seconds, getting to the set point faster but possibly overshooting slightly.

The contacts used by the controller to drive the final element are assigned as per the following table:

PID 1		PID 2 (only for Swimming Pool Controller	
CCO 3	**CCO 4**	**CCO 5**	**CCO6**
Decrease	**Increase**	**Decrease**	**Increase**

Table 10 – Contacts Output Controller Assignment

5.2.3 Standard Controller

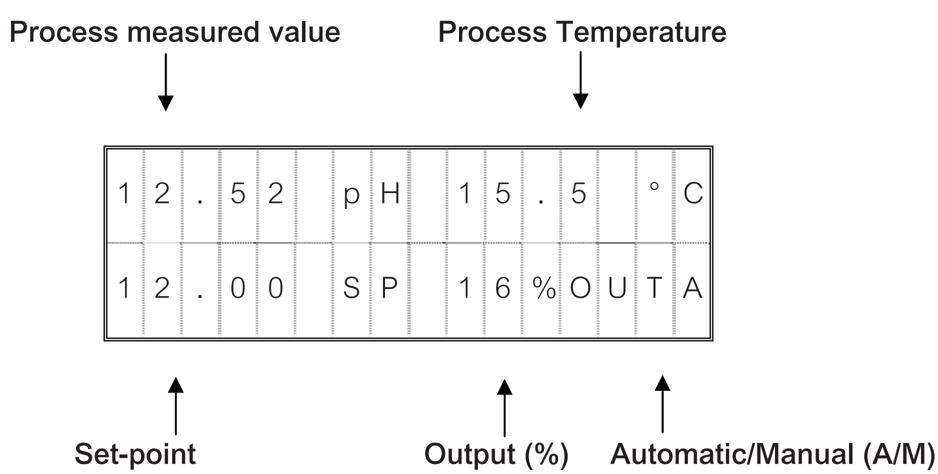
This section deals with the functionality which is specific of the standard controller.

5.2.3.1 Standard Controller Display

The standard controller display shows the following values:

- instantaneous value of process variable measure
- process variable temperature (not present for ORP or CL4000 sensor)
- set-point
- output signal value
- Controller status: A/M (A = Automatic, M = Manual).

Fields of display are configured as in the following draft:



If the instrument is configured to perform additional functions beside operating as a controller, for example to monitor another parameter with a second or third sensor installed on channel 2 or 3, the indication of these values can be called on display by pressing the key END, which will cycle through the different display available, and eventually back to the controller display.

5.2.3.2 Standard Controller Analog Output assignment

The assignment of the analog output signals depends on the number of channels installed and on the type of configuration selected for the controller output, whether it is to operate on a 4-20 analog signal or on contacts closure, as per the following table:

Type of Controller	Output option	4-20 mA Channel 1	4-20 mA Channel 2	4-20 mA Channel 3
Controller with 1 Channel installed	Analog output	PID Control output	---	---
	Contacts output	Measured value retransmission of Channel 1 analysis		
Controller with 2 Channels installed	Analog output	PID Control output	Measured value retransmission of Channel 1 analysis (1)	---
	Contacts output	Measured value retransmission of Channel 1 analysis	Measured value retransmission of Channel 2 analysis (1)	
Controller with 3 Channels installed	Analog output	PID Control output	Measured value retransmission of Channel 1 analysis (1)	Measured value retransmission of Channel 3 analysis
	Contacts output	Measured value retransmission of Channel 1 analysis	Measured value retransmission of Channel 2 analysis (1)	

(1) If the two sensors/channels are identical, and the PID option is selected on Channel 2, the output becomes the average of the two measured values

Table 11 - Std Controller Analog Outputs

5.2.3.3 Standard Controller Digital Input assignment

The Digital Input functionality is identical for all type of instrument selected, as per following table:

CCI in ‘OR’ SELECTION	CCI1	CCI2
CCI in ‘OR’ = ***NO***	Freezes measured value of Channel 1	Freezes measured value of Channel 2 (Channel 3 alone cannot be frozen)
CCI in ‘OR’ = ***YES***	Freezes measured value of all Channels installed	Forces to 0 PID1 output signal
CCI in ‘OR’ = ***OFF***	CCI1 inactivated	CCI2 inactivated

Table 12 - Digital Input Functionality for Controller

5.2.3.4 Standard Controller Digital Output assignment

The assignment of the digital output signals depends on the number of channels installed, on the type of configuration selected, for the controller output, whether it is to operate on a 4-20 analog signal or on contacts closure, and on the cleaning option configuration, as per the following table:

Controller Type	CCO1	CCO2	CCO3	CCO4	CCO5	CCO6	CCO7
Controller without Cleaning Analog output PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	HI Alarm Ch. 2 (2)	LO Alarm Ch. 2 (2)	HI Alarm Ch. 3 *(if Ch. 3 installed)*	LO Alarm Ch. 3 *(if Ch. 3 installed)*	Watch dog
Controller without Cleaning Contacts out PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	PID control output (*decrease*)	PID control output (*increase*)	HI Alarm Ch. 3 *(if Ch. 3 installed)*	LO Alarm Ch. 3 *(if Ch. 3 installed)*	Watch dog
Controller with Cleaning Analog output PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	HI Alarm Ch. 2 (2)	LO Alarm Ch. 2 (2)	Washing command *(See Par. 4.4.1.3)*	Washing command *(See Par. 4.4.1.3)*	Watch dog
Controller with Cleaning Contacts out PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	PID control output (*decrease*)	PID control output (*increase*)	Washing command *(See Par. 4.4.1.3)*	Washing command *(See Par. 4.4.1.3)*	Watch dog

(1) If two/three identical sensors/channels are installed, and PID option is selected on Channel 2/3, the alarm is based on the average of the two/three measured values
(2) If two/three identical sensors/channels are installed, and PID option is selected on Channel 2/3, the alarm is triggered by the first of the two/three measured values that reaches the alarm level configured (first-out functionality).

Table 13 - Std. Controller Digital Output assignments

5.2.4 Swimming Pool Controller

The Controller for swimming pool is a flexible instrument dedicated to the control of the principal parameters in the swimming pool: pH, ORP and Residual Chlorine. It is available in two different versions: two channels (pH + chlorine and pH + ORP) and three channels (pH, chlorine and ORP).

If the instrument has two channels, the dual controllers operate on the two channels installed. If the instrument has three channels, the control is operated on pH (channel 1) and on measure installed on channel 3 (see Section 2.5, for the position of channel 3). If ordered as a three channel instrument, Channel 2 will be available to measure the parameter not controlled via PID on Channel 1 and 3.

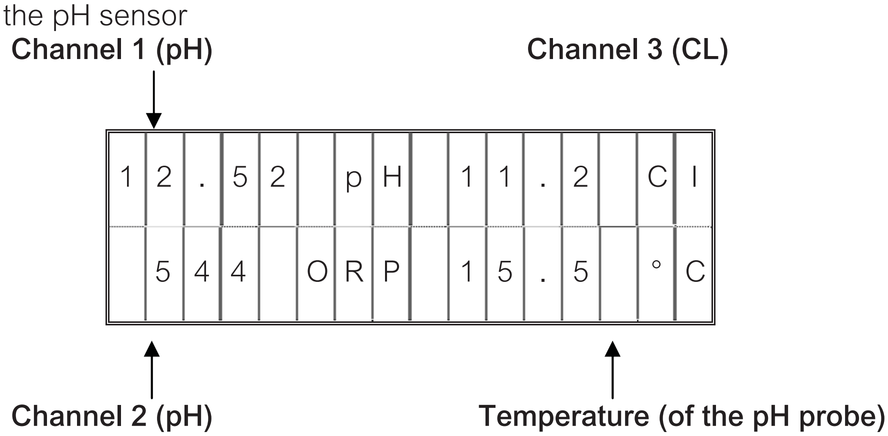
With this option, the Controller menu offers two submenus. PID 1 is associated with the configuration of pH control on channel 1, PID 2 with the configuration of either chlorine or ORP.

5.2.4.1 Swimming Pool Controller Display

MicroChem2 supports three different displays. The main one is meant to monitor the process and it shows the controlled variables measured, pH and ORP/chlorine. The secondary displays let the user modify set-point and output (in Manual mode) of pH and ORP/chlorine. To toggle from one display to the other, press the END key.

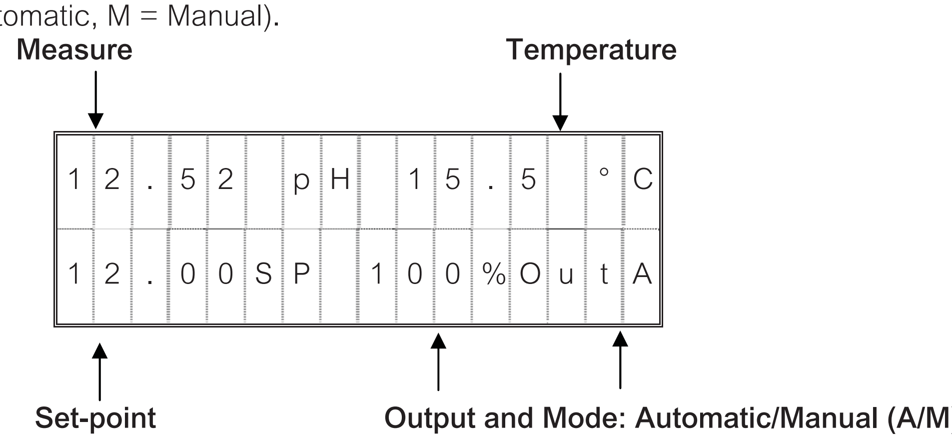
Main display (fields of display are assigned as in the following draft):

- measures of pH/ORP/chlorine
- temperature of the pH sensor



Secondary displays:

- measure of a single sensor (pH/ORP/chlorine)
- sample temperature
- set-point
- Output (%)
- Mode: A/M (A = Automatic, M = Manual).



5.2.4.2 Swimming Pool Controller Analog Output assignment

The assignment of the analog output signals depends on the number of channels installed and on the type of configuration selected for the controller output, whether it is to operate on a 4-20 analog signal or on contacts closure, as per the following table:

<table>
<tr><th>Type of Controller</th><th>Output option</th><th>4-20 mA Channel 1</th><th>4-20 mA Channel 2</th><th>4-20 mA Channel 3</th></tr>
<tr><td rowspan="2">Controller with 2 Channels installed</td><td>Analog output</td><td>PID1 Control output</td><td>PID2 Control output</td><td rowspan="2">---</td></tr>
<tr><td>Contacts output</td><td>Measured value retransmission of Channel 1 analysis (pH)</td><td>Measured value retransmission of Channel 2 analysis</td></tr>
<tr><td rowspan="2">Controller with 3 Channels installed</td><td>Analog output</td><td>PID1 Control output</td><td rowspan="2">Measured value retransmission of Channel 2 analysis</td><td>PID2 Control output</td></tr>
<tr><td>Contacts output</td><td>Measured value retransmission of Channel 1 analysis (pH)</td><td>Measured value retransmission of Channel 3 analysis</td></tr>
</table>

Table 14 - Swimming Pool Controller Analog Outputs

If the 4-20 mA output is used to providing a PID control signal, the 4-20mA output is not available for transmission of the actual measurement value. However, if the control is done by activating the CC03, 04, 05, 06 contact closure (see 5.2.2.5) then the 4-20mA output is available and can transmit the measurement signal

5.2.4.3 Swimming Pool Controller Digital Input Assignment

The Digital Input functionality is identical for all type of instrument selected, as per following table:

CCI in 'OR' SELECTION	CCI1	CCI2
CCI in 'OR' = ***NO***	Freezes measured value of Channel 1[1]	Freezes measured value of Channel 2 [1] (Channel 3 alone cannot be frozen)
CCI in 'OR' = ***YES***	Freezes measured value of all Channels installed[1]	Forces to 0 PID1 & PID 2 output signals[2]
CCI in 'OR' = ***OFF***	CCI1 disabled	CCI2 disabled

Table 15 - Digital Input Functionality for Swimming pool Controller

NOTES:

1 Freezing the channels is typically used when performing maintenance.

2 As a safety precaution, as a swimming pool controller, the measurement is still made and displayed on the swimming pool controller

5.2.4.4 Swimming Pool Controller Digital Output assignment

The assignment of the digital output signals depends on the number of channels installed, on the type of configuration selected for the controller output, and whether it is to operate on a 4-20 mA analog signal or on contacts closure, as per the following table:

Controller Type	CCO1	CCO2	CCO3	CCO4	CCO5	CCO6	CCO7
Controller with 2 Sensors Analog out PID1& 2	HI Alarm Ch. 1	LO Alarm Ch. 1	HI Alarm Ch. 2	LO Alarm Ch. 2	----	----	Watch dog
Controller with 2 Sensors Contact out PID1or 2	HI Alarm First-out Ch. 1/2	LO Alarm First-out Ch. 1/2	PID1 control out (*decrease*)	PID1 control out (*increase*)	PID2 control out (*decrease*)	PID2 control out (*increase*)	Watch dog
Controller with 3 Sensors Analog out PID1& 2	HI Alarm Ch. 1	LO Alarm Ch. 1	HI Alarm Ch. 2	LO Alarm Ch. 2	HI Alarm Ch. 3	LO Alarm Ch. 3	Watch dog
Controller with 3 Sensors Contact out PID1or 2	HI Alarm First-out Ch. 1/2/3	LO Alarm First-out Ch. 1/2/3	PID1 control out (*decrease*)	PID1 control out (*increase*)	PID2 control out (*decrease*)	PID2 control out (*increase*)	Watch dog

Table 16 - Swimming Pool Controller Digital Output assignments

5.2.5 Average Controller

The average controller is dedicated to processes that need high reliability of the analysis values. MicroChem®2 supports two or three identical sensors and the calculated average value is used in the PID algorithm as process variable. In function of the difference between the average value (Process Variable, PV), and a Set-point (SP) value, an Output (OUT) signal is calculated, that is applied to a final control element to restore process analysis to the set-point value. The output is calculated with the PID algorithm, which has Proportional, Integral and Derivative terms. The effect these terms have on the output calculation is determined by the PID configuration selections.

The average value control strategy is activated by selecting "YES" in the *"Average"* parameter appearing in the Channel definition menu when two or three identical channels are configured.

5.2.5.1 Average Controller Display

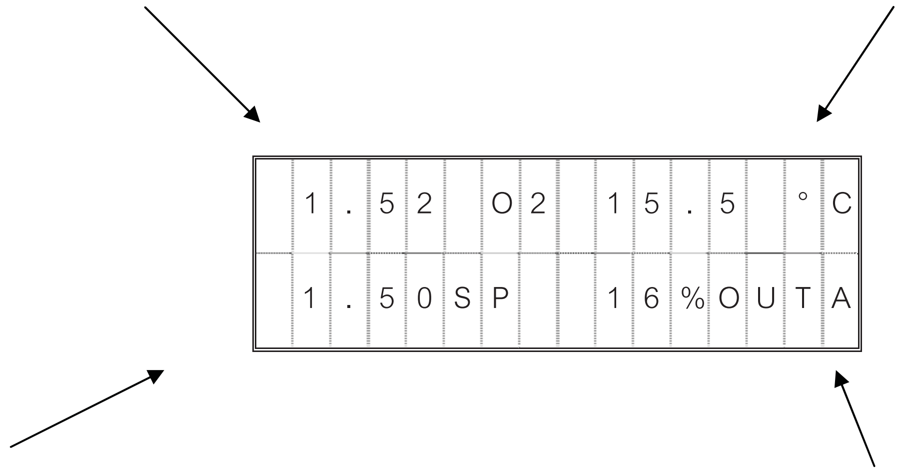
MicroChem2 supports two different displays. The main one shows the values used in the PID algorithm: the average measured value, the average value of the temperature, the set-point and the output. The three secondary displays show the measure and the temperature of each of the three probes. To toggle from a display to another, press the END key.

Main display:

- average measured value, used in the PID algorithm
- average value of temperature
- set-point
- output (%)
- A/M (A = Automatic, M = Manual).

Display fields are illustrated below:

Average value of measure (i.e. O2) **Average Temperature**

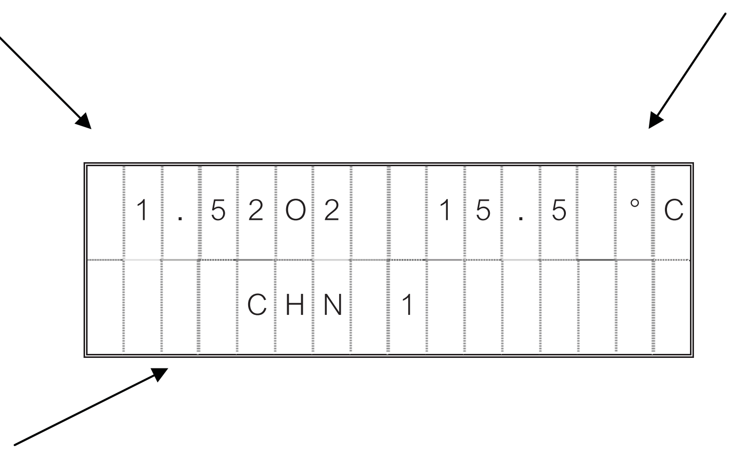


Setpoint **Output (%) and Automatic/Manual (A/M)**

Secondary display:

- measure of each single probe
- temperature
- channel number on display

Instantaneous measure **Temperature**



Channel being displayed

5.2.5.2 Average Controller Digital Input assignment

The Digital Input functionality is identical for all type of instrument selected, as per following table:

CCI in 'OR' SELECTION	CCI1	CCI2
CCI in 'OR' = ***NO***	Freezes measured value of Channel 1	Freezes measured value of Channel 2 (Channel 3 alone cannot be frozen)
CCI in 'OR' = ***YES***	Freezes measured value of all Channels installed	Freezes measured value of all Channels installed
CCI in 'OR' = ***OFF***	CCI1 disabled	CCI2 disabled

Table 17 - Average Controller Digital Inputs assignment

5.2.5.3 Average Controller Analog Output assignment

The assignment of the analog output signals depends on the number of channels installed and on the type of configuration selected for the controller output, whether it is to operate on a 4-20 analog signal or on contacts closure, as per the following:

Type of Controller	Output option	4-20 mA Channel 1	4-20 mA Channel 2	4-20 mA Channel 3
Controller with 2 Channels installed	Analog output	PID Control output	Measured value retransmission of Channel 1 analysis (1)	---
	Contacts output	Measured value retransmission of Channel 1 analysis	Measured value retransmission of Channel 2 analysis (1)	
Controller with 3 Channels installed	Analog output	PID Control output	Measured value retransmission of Channel 1 analysis (1)	Measured value retransmission of Channel 3 analysis
	Contacts output	Measured value retransmission of Channel 1 analysis	Measured value retransmission of Channel 2 analysis (1)	

(1) If the PID option is selected on Channel 2, the output becomes the average of the two measured values

Table 18 - Average Controller Analog Output assignments

5.2.5.4 Average Controller Digital Output assignment

The assignment of the digital output signals depends on the number of channels installed, on the type of configuration selected, for the controller output, whether it is to operate on a 4-20 analog signal or on contacts closure, and on the cleaning option configuration, as per the following table:

Controller Type	CCO1	CCO2	CCO3	CCO4	CCO5	CCO6	CCO7
Controller without Cleaning Analog output PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	HI Alarm Ch. 2 (2)	LO Alarm Ch. 2 (2)	HI Alarm Ch. 3 *(if Ch. 3 installed)*	LO Alarm Ch. 3 *(if Ch. 3 installed)*	Watch dog
Controller without Cleaning Contacts out PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	PID control output (*decrease*)	PID control output (*increase*)	HI Alarm Ch. 3 *(if Ch. 3 installed)*	LO Alarm Ch. 3 *(if Ch. 3 installed)*	Watch dog
Controller with Cleaning Analog output PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	HI Alarm Ch. 2 (2)	LO Alarm Ch. 2 (2)	Washing command *(See Par. 4.4.1.3)*	Washing command *(See Par. 4.4.1.3)*	Watch dog
Controller with Cleaning Contacts out PID	HI Alarm Ch. 1 (1)	LO Alarm Ch. 1 (1)	PID control output (*decrease*)	PID control output (*increase*)	Washing command *(See Par. 4.4.1.3)*	Washing command *(See Par. 4.4.1.3)*	Watch dog

(1) If two/three identical sensors/channels are installed, and PID option is selected on Channel 2/3, the alarm is based on the average of the two/three measured values.
(2) If two/three identical sensors/channels are installed, and PID option is selected on Channel 2/3, the alarm is triggered by the first of the two/three measured values that reaches the alarm level configured (first-out functionality).

Table 19 - Average Controller Digital Output assignments

6 CALIBRATION

Calibration is required to align the sensor sensitivity. This operation is necessary at the start-up of the instrument and at periodical intervals. New sensors have to be let in operation for at least 24 hours, to allow the electrode to recover complete sensitivity, before performing the calibration procedure.

The calibration procedure must be accomplished having the sensor and the MicroChem®2 connected and powered.

WARNING

6.1 Calibration Procedure

When the instrument is powered up or when a channel is changed, the following message is displayed:

-calib-

To access the calibration procedure press the button MENU and insert the password, as shown in the diagram at Paragraph 6.1.2.
If problems are encountered during the calibration procedure, pressing the END key the calibration procedure is aborted and the display returns to the main menu.

If the calibration procedure is aborted, the read out of value may become unreliable.

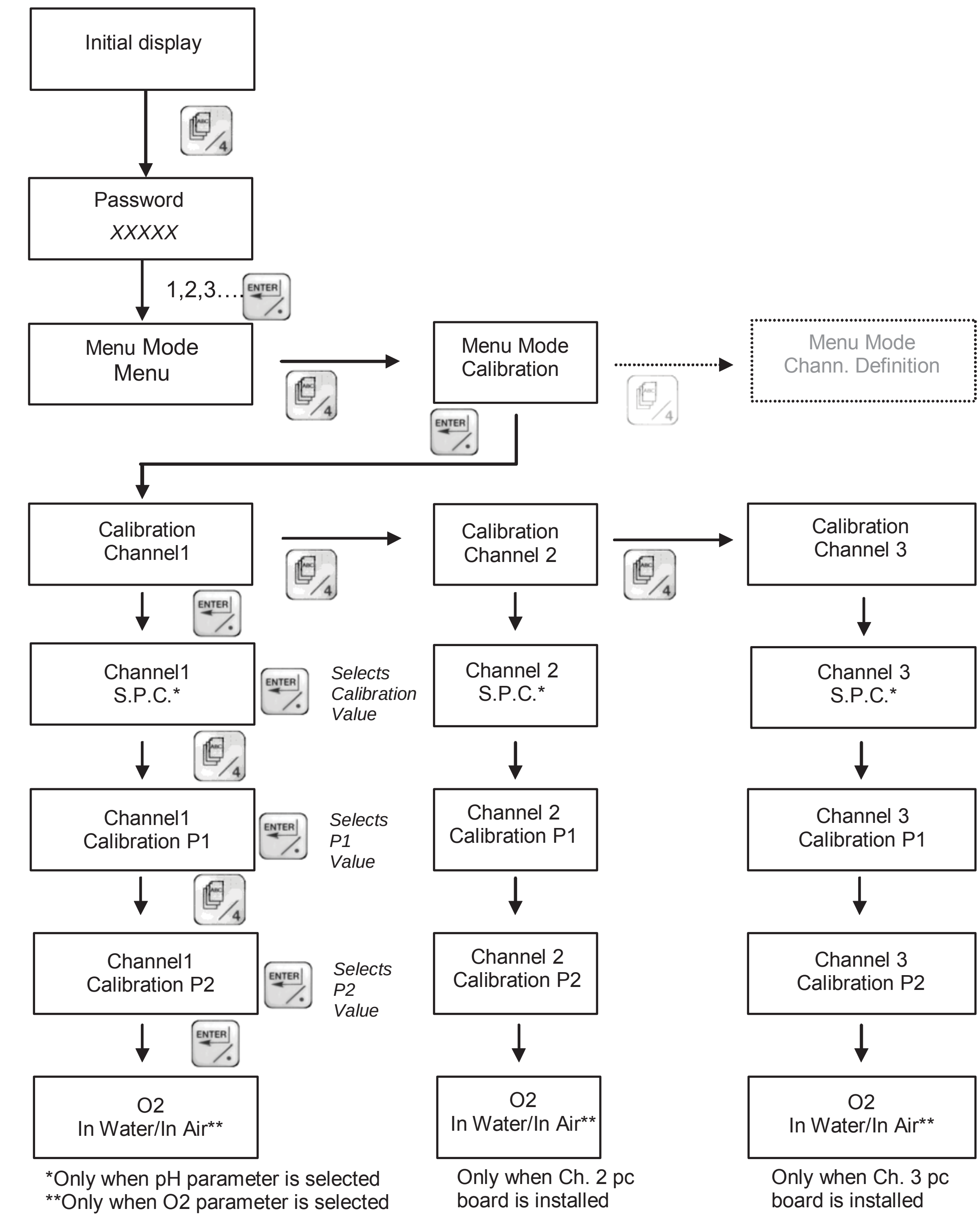
WARNING

6.1.1 Calibration Menu

Calibration menu allows a dual point calibration procedure for the analyzers. In every dual point calibration, the first number (P1) is the lower value point, and the second (P2) is the higher value point. The instrument has P1 and P2 values assigned by default, as shown in the table 18. P1 and P2 values can be changed by the user and have to be distant enough. Single point calibration (S.P.C.) is available for pH analyzer. For O2 analyzer two calibration procedures are available: calibration in air and calibration in water.

Parameter	P1 point value	P2 point value
pH	7.00	4.00
mV	-500	+500
O2	0.00	10.00 (in water)
O3	0.00	1.00
Cl	0.00	1.00
CD	0.00	1.00
T	0.00	100.00
mA	4.00	20.00
Br	0.00	1.00

Table 20 - Default calibration values



6.1.2 pH Sensor Calibration

The calibration procedure is necessary to standardise the sensor sensitivity.
The double point calibration gives the maximum accuracy because it allows to set both the slope and the offset of the curve giving displayed pH value as a function of the mV from the probe (sensitivity), pH = f (mV).

The first point can be calibrated by 7 pH buffer solution and the second point can be calibrated by 4 pH buffer solution. Capsules for buffer solution's preparation can be optionally supplied by STWP; however the operator can use other commercially available buffer solutions.

6.1.2.1 Double point calibration

The calibration procedure involves a series of operation on the pH probe and the transmitter. The following description indicates step by step the calibration procedure, with the buffer solution supplied by STWP.

To operate the calibration the following material is required:
- two plastic or glass beakers
- capsules for buffer solution pH 7 and pH 4
- de-mineralised water

BUFFER SOLUTIONS PREPARATION

Severn Trent Services optionally supplies a calibration kit (P/N 1T141B008U02)

50 capsules of standard buffer solution pH7
50 capsules of standard buffer solution pH4
50 capsules of standard buffer solution pH9

Each of these capsules is suitable to prepare 100 ml of solution.

If the sensor is new and has been dry stored, leave it immersed in water for 24 hours to allow the hydration of the glass sensitive membrane and of the porous diaphragm. If it has been wet stored half an hour is enough for the stabilization.

Prepare the buffer solution in volumetric flasks: for the preparation of each buffer solution put one capsule into the flask. Add about 100 ml of distilled water in the flask and stir carefully till the capsule is completely dissolved. Put the two standard buffer solutions (pH 7 and pH 4) in two beakers in a sufficient amount to cover the sensor. Wash the probe with de-mineralised water, dry it and dip it in the standard pH 7 buffer solution. Stir the probe gently in the solution to decrease the stabilization time.

1. Press the MENU key to enter the Instrument Calibration submenu and enter the CALIBRATION menu and then the channel of the pH probe. The display will show:

X	X	.	X	X		p	H			2	3	.	5	°	C
P	1	:							Y	Y	.	Y			

   P1 indicates the first point of calibration at HIGHER pH (pH 7). XX.XX is not a REAL pH value, but it shows when stability of measure has been reached. YY.Y is a value set at the last calibration and can be freely modified according to the chosen buffer solution.

2. Press ENTER and insert the correct value. Wait 3 minutes after the measure in XX.XX has stabilised (XX.XX is stable).
3. Press ENTER to save the value (press END if you don't want to save the value).

   If the following message appears: **-Bad Input!-**

   It means the buffer solution is bad since the mV generated are too close.
4. Pass on to the second point (P2) of calibration pressing the MENU key. Take the sensor out of the pH 7 standard buffer solution, rinse it thoroughly with de-mineralised water, dry it and immerse it in the pH 4 buffer solution. Stir the probe gently in the solution to decrease the stabilization time.
5. Wait till the value in XX.XX is stabilized (XX.XX is stable) and correct the pH value in YY.Y.
6. Confirm by pressing the ENTER key. Previously stored values are overwritten in non volatile memory.
7. To start the measure press the END key and the display will show the actual measured value.

6.1.2.2 Single point calibration (S.P.C.)

The single point calibration may be performed ONLY IF A DOUBLE POINT CALIBRATION HAS ALREADY BEEN PERFORMED. The single point calibration is a fast procedure to correct the sensitivity of an instrument leaving it working in field; however it's less accurate than the double point calibration and must be performed as near as possible to the pH value of the process liquid. The single point calibration corrects the intercept of the pH = f(mV) curve, but doesn't vary its slope.

To perform the single point calibration:

1. Measure the pH value of the process fluid near the location of the sensor (if it is constant during the time interval needed for the calibration).
2. Insert the pH value in YY.YY. Entering the Calibration menu the following display will appear:

X	X	.	X	X		p	H			2	3	.	5	°	C
p	H		S	P	C	:		Y	Y	.	Y	Y			

When a double point calibration is performed the S.P. C. value is forced to 0.00.

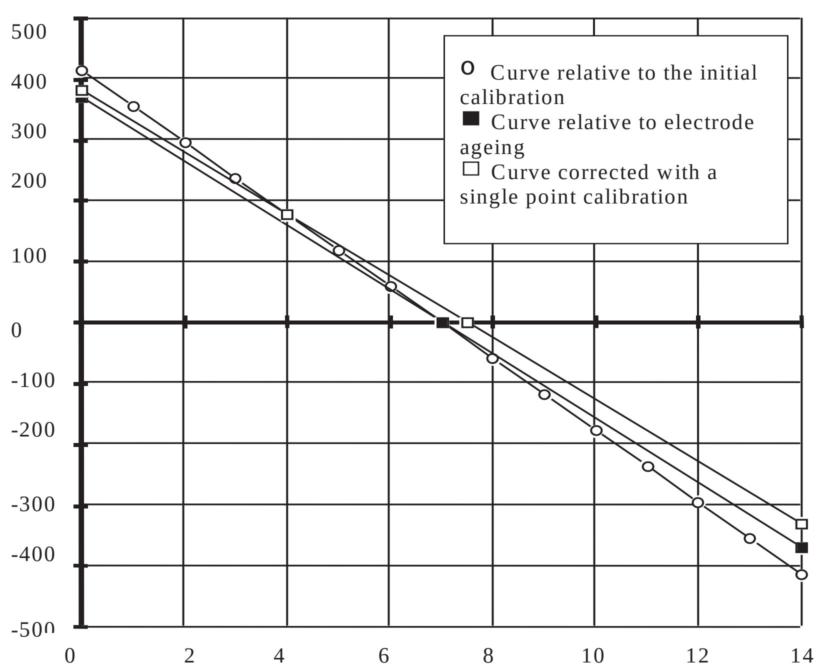


Figure 17 - pH Calibration curves examples

NOTE: Single point calibration corrects the sensitivity in the zone where the correction is made. It is therefore necessary to operate single point calibration as near as possible to the process fluid pH value.

IMPORTANT: THESE CURVES ARE ONLY A THEORETICAL REPRESENTATION, NOT BASED ON EXPERIMENTAL VALUES.

6.1.3 ORP Sensor Calibration

The calibration procedure is necessary to standardize the sensor sensitivity. The double point calibration gives the maximum accuracy because it allows to set both the slope and the offset of the curve giving displayed ORP value as a function of the mV from the probe (sensitivity).

STWP does not supply ORP buffer solution, they are however easily available on the market.
The calibration of ORP analyzer is not usually required, however the two point calibration procedure is foreseen in the transmitter software.

NOTE: Calibration procedures are different if the arrangement “oxidation potential with negative value” or “oxidation potential with positive value“ is used. Both are described in the following pages.

The calibration procedures involve both the electronic transmitter and the sensor. The following description indicates step by step the double point calibration procedure:
To operate the calibration the following material is necessary:

- two plastic or glass beakers
- standard ORP solutions

Put the two standard ORP solutions in two beakers in a sufficient amount to cover the sensor. Wash the probe with de-mineralised water, dry it and dip it in the first buffer solution. Stir the probe gently in the solution to decrease the stabilization time.

6.1.3.1 "OXIDATION potential with NEGATIVE values" arrangement

P1 will be the value of the oxidant standard solution, and P2 the value of the reducing standard solution. In case both the standard solution have the same sign, P1 will be the standard solution with the lower value.

Press the MENU key to enter the Instrument Calibration submenu and enter the CALIBRATION menu and then the channel of the ORP probe. The following display will appear:

X	X	.	X	X		R	X			2	3	.	5	°	C
P	1	:							Y	Y	.	Y			

P1 indicates the first point of calibration. XX.XX is not a REAL value, but it shows when stability of measure has been reached. YY.Y is a value set at the last calibration and can be freely modified according to the chosen buffer solution. Press ENTER and insert the correct value. Wait about 3 minutes after the measure in XX.XX has stabilised (XX.XX is stable), then press ENTER to save the value (press END if you don’t want to save the value).

Pass on to the second point (P2, higher value) of calibration pressing the button MENU. Take the sensor out of the first standard solution rinse it thoroughly with de-mineralised water, dry it and immerse it in the second standard solution. Stir softly but continuously the probe: in this way a shorter stabilization time would be required.

Wait till the measure is stabilized (no more variations of XX.XX shown on the display). If needed, correct the ORP value pressing the ENTER key and inserting the correct value, according to the second buffer solution ORP value. If you want to save these values push the ENTER key. If you don't want to save above mentioned calibration parameters press END. If the ENTER key is pressed new calibration data are overwritten to previously stored values in not volatile memory.

To start the measure press the END key and the display will show the measured value.

NOTE: The calibration procedure can be performed also at two values which are outside from the measuring range selected, depending on the buffer solutions which are available for the calibration.

6.1.3.2 "OXIDATION potential with POSITIVE values" arrangement

Calibration is similar to the previous one but P1 is the value of the reducing standard solution, and P2 the value of the oxidant standard solution. In case both the standard solution have the same sign, P1 will be the standard solution with the lower value.

6.1.4 Chlorine/ Chlorine Dioxide/ Ozone/ Bromine - KC4000 Cell or CL4000 Probes

The calibration procedure is necessary to stabilize the sensor sensitivity. The calibration procedure sets both the slope and the offset of the curve giving the chlorine/chlorine dioxide/ozone/bromine concentration as a function of the µA from the cell/probe (sensitivity).

Severn Trent Services analyzers allow an easy two point calibration and the two points can be freely chosen, provided they are distant enough and inside the selected measuring range. In this way the instrument is given all the parameters it needs to fix the calibration curve. The calibration procedures involve both the transmitter and the sensor.

If the cell is new or recently cleaned, leave it working for 24 hours so that the electrodes can gain the correct sensitivity.

The following description indicates step by step the calibration procedure:

1. **P1 — Low Calibration:** Enter the Instrument Calibration submenu and using the menu key, change the channel for calibration and press ENTER until the following display appears (Refer to Section 6.1.1):

X	X	.	X	X	X	C	L[1]			2	3	.	5	°	C[2]
P	1	:							Y	Y	.	Y			

NOTES:
1 = The name of the sensor chosen in the channel definition will appear where Cl is displayed.
2 = The temperature will appear if a temperature sensor is installed

P1 indicates the first point in calibration (the lower point). XX.XXX is the measured parameter concentration reading. This reading is based upon calibration parameters previously stored. XX.XXX serves as an indication of the stability of the measure. 0.000 is a default ppm value recommended but can be freely changed. YY. Y is a value set at the last calibration and can be freely modified.

NOTE: P1 calibration is only necessary for the initial calibration to set the zero point. When performing a recalibration it is only necessary to RESET the P2.

2. To zero the instrument, supply sample water from a point prior to adding the disinfection agent. In the case of chlorine measurement a dechlorinating filter can be inserted in the sample line to remove chlorine during the calibration procedure. Turn on the supply of zero process water to the measuring cell. Let the system stabilize until XX.XXX is stable (15-20 minutes can be required).
3. Take a water sample and perform an analysis to determine residual concentration.
4. Press enter and input YY.Y value according to the measured sample value (Typically 0.00)
5. Confirm entered data with ABC key

6. **P2 — High Calibration:** Press the ABC button to pass on the second point (P2) calibration:

X	X	.	X	X	X	C	L[1]			2	3	.	5	°	C[2]
P	2	:							Y	Y	.	Y			

NOTES:
1. The name of the sensor chosen in the channel definition will appear where CL is displayed.
2. The temperature will appear if a temperature sensor is installed.

P2 – High Calibration – P2 indicates the second point in the calibration (the higher point)
XX.XXX is the measured parameter concentration reading. This reading is based upon calibration parameters previously stored. XX.XXX serves as an indication of the stability of the measure. YY.Y is a value set at the last calibration and can be freely modified.

7. Allow a sample flow to the cell (with a concentration as near as possible to the chosen full scale) and let it stabilize (stabilization time depends on the plant configuration, 10 – 15 minutes may be required).

8. Take a water sample and perform an analysis to determine residual concentration.

9. Press ENTER and insert the correct high calibration point value (according to the value on step 8).

10. Press ENTER again to confirm. Press END key to return to measure mode.

WARNING

It is advisable to repeat the calibration after 24 hours and after 2/3 days.

6.1.5 Dissolved oxygen calibration

The calibration procedure is necessary to standardize the sensor sensitivity. The calibration procedure allows to set both the slope and the offset of the curve giving the dissolved oxygen concentration as a function of the µA from the cell (sensitivity). This analyzer allows an easy two point calibration and the two points can be freely chosen; usually the calibration is performed at 0 ppm O2 and either at the saturation point of water in the conditions (altitude, temperature) of the process or at the sample dissolved oxygen concentration measured with a O2 meter. In this way the instrument has all the parameters to fix the calibration curve.

The calibration procedures involve both the transmitter and the sensor. The following description indicates step by step the calibration procedure:

Prepare the sensor as described in Instruction Bulletin T17DO4000, then leave it working for approx. 2 hours so that the system can gain the correct sensitivity.

WARNING

When the sensor is disconnected from the transmitter and then reconnected, it polarises and generates a signal that is much higher than normal signal. The transmitter may in this case indicate a fixed value higher than the f.s. value. The reading becomes normal when the input signal returns to normal limits.

WARNING

It is advisable to repeat the calibration after 24 hours and after 2/3 days.

6.1.5.1 Calibration in water

Press the MENU key to enter the Instrument Calibration submenu and enter the CALIBRATION menu and then the channel of the ORP probe. Select “Calibration IN WATER”. The following display will appear:

X	X	.	X	X		O	2			2	3			°	C
P	1	:							Y	Y	.	Y			

P1 indicates the first point in calibration, XX.XX is a dissolved oxygen concentration reading. This reading, is not a REAL value, but it's based upon calibration parameters previously stored. XX.XX serves as an indication of the stability of the measure. 0.00 is a default ppm value and can be freely changed. YY.Y is a value set at the last calibration and can be freely modified.

Fill a beaker with distilled water and add about 1 g of sodium sulphite (Na_2SO_3). Let the salt dissolve and immerse the probe being careful not to damage the membrane and the electrode. Let the measure stabilise and confirm the zero ppm pushing the ENTER key.

If you want to save the value press ENTER. If you don't want to save the above mentioned calibration parameters press END. So forth, previously stored parameters aren't destroyed and they remain still valid for the computation (if the range setting has not been changed).

If **-Bad Input!-** appears, a second calibration attempt should be made. The probe may need additional time to stabilize. If the **-Bad Input!-** continues, check the probe membrane, connections, channel definitions, etc.

Pass on to the second point (P2) of calibration pressing the button MENU. Immerse the probe in the sample and wait till XX.XX is stabilized. Measure the dissolved oxygen concentration in the sample. Correct the displayed ppm value according to the O_2 value found in the sample.

Alternatively perform a calibration in water saturated with air: fill a vessel with distilled water and inject air for at least 10 minutes. Keep the dissolved oxygen probe immersed in the solution (be careful not to damage membrane and electrode). Once the reading has stabilized, read the temperature of the process from the instruments display. Table 21 can be used to determine the concentration of the saturated solution by looking up the current altitude and sample temperature. Once XX.XX is stable, enter the correct value in YY.YY and press the Enter key to save the result.

T °C	T °F	L.M. Sea Level	120m 390ft	240m 779ft	365m 1185ft	490m 1591ft	610m 1980ft	750m 2435ft	850m 2760ft	975m 3166ft	1100m 3571ft
0	32	14,60	14,40	14,10	13,90	13,70	13,50	13,20	12,90	12,70	12,50
1	33,8	14,20	14,00	13,80	13,60	13,30	13,10	12,90	12,60	12,40	12,20
2	35,6	13,90	13,70	13,40	13,20	13,00	12,90	12,60	12,30	12,10	11,80
3	37,4	13,50	13,30	13,10	12,90	12,70	12,40	12,20	12,00	11,80	11,50
4	39,2	13,20	12,90	12,70	12,50	12,30	12,10	11,90	11,70	11,40	11,20
5	41	12,80	12,60	12,40	12,20	12,00	11,80	11,60	11,40	11,10	10,90
6	42,8	12,50	12,30	12,10	11,90	11,70	11,50	11,30	11,10	10,90	10,70
7	44,6	12,20	12,00	11,80	11,60	11,40	11,20	11,00	10,80	10,60	10,40
8	46,4	11,90	11,70	11,50	11,30	11,10	10,90	10,70	10,50	10,30	10,10
9	48,2	11,60	11,40	11,20	11,10	10,90	10,70	10,50	10,30	10,10	9,90
10	50	11,30	11,10	10,90	10,80	10,60	10,40	10,20	10,00	9,90	9,70
11	51,8	11,10	10,80	10,60	10,50	10,30	10,10	9,90	9,70	9,60	9,40
12	53,6	10,80	10,60	10,40	10,30	10,10	9,90	9,70	9,50	9,40	9,20
13	55,4	10,60	10,30	10,20	10,00	9,80	9,70	9,50	9,40	9,20	9,10
14	57,2	10,40	10,10	10,00	9,80	9,70	9,50	9,30	9,20	9,00	8,90
15	59	10,20	9,90	9,80	9,60	9,50	9,30	9,10	9,00	8,80	8,70
16	60,8	10,00	9,70	9,60	9,40	9,30	9,10	8,90	8,70	8,60	8,50
17	62,6	9,70	9,50	9,40	9,20	9,10	8,90	8,70	8,60	8,40	8,40
18	64,4	9,50	9,40	9,20	9,10	8,90	8,80	8,60	8,50	8,30	8,20
19	66,2	9,40	9,20	9,00	8,90	8,70	8,60	8,40	8,30	8,10	8,00
20	68	9,20	9,00	8,80	8,70	8,50	8,40	8,20	8,10	7,90	7,80
21	69,8	9,00	8,80	8,60	8,50	8,30	8,20	8,00	7,90	7,70	7,60
22	71,6	8,80	8,70	8,50	8,40	8,20	8,10	7,90	7,80	7,60	7,50
23	73,4	8,70	8,50	8,30	8,20	8,00	7,90	7,70	7,60	7,40	7,30
24	75,2	8,50	8,30	8,10	8,00	7,80	7,70	7,50	7,40	7,20	7,10
25	77	8,40	8,20	8,00	7,80	7,70	7,60	7,40	7,30	7,10	7,00
26	78,8	8,20	8,00	7,80	7,70	7,50	7,40	7,20	7,10	6,90	6,80
27	80,6	8,10	7,90	7,70	7,60	7,40	7,30	7,10	7,00	6,80	6,70
28	82,4	7,90	7,70	7,60	7,40	7,30	7,20	7,10	6,90	6,80	6,70
29	84,2	7,80	7,60	7,50	7,30	7,20	7,10	7,00	6,80	6,70	6,60
30	86	7,60	7,40	7,10	7,10	7,00	6,90	6,80	6,60	6,50	6,40

Table 21 – DO concentration in air saturated water as function of temperature and altitude

NOTE:

* This table is referred to distilled water with no chlorides
* The atmospheric pressure at sea level is considered at 760mmHg
* The air is considered water saturated
* The error, using dry air, is negligible:

Example: at 25°C at sea level with relative humidity of 50%, the error is 0.15 ppm O_2, and with dry air the error is 0.3 ppm O_2.

6.1.5.2 Calibration in air

From the CALIBRATION menu, choose “Calibration IN AIR”. Calibrate P1 (zero) as described before.

Pass on to the second point (P2) of calibration pressing the button MENU. The following display will appear:

Y	Y	.	Y	Y		O	2			1	4	.	9	°	C
X	X	.	X	X			<	O	2	>					

Where YY.YY is the value of saturation of oxygen in air at the temperature measured by the thermo-resistance and at the set altitude.

Proceed in this way for the calibration IN AIR of P2: lift the O2 sensor and fix it suspend in air, keeping it over a vessel containing water (the sensor must not be in contact with the water). This operation allows to simulate a condition of "air saturated with water". Avoid direct exposition of the sensor to the sunlight that may increase too much the temperature on the point where the temperature compensation element is inserted. Wait 5' that the value in XX.XX is stable, then confirm the value determined via software displayed in YY.YY pressing ENTER. To pass to the display mode press the END key.

6.1.6 Calibration of Sensors with a mA input (e. g. Conductivity)

The calibration procedure is necessary to maximize sensor accuracy. The calibration procedure is very similar to the calibration procedure of any other of the sensors attached to the MicroChem®2.

The calibration procedure sets both the slope and the offset of the curve giving the sensor concentration (in chosen units) as a function of the mA input from the sensor.

Two calibration solutions are required – a low (P1) and a high (P2). The actual calibration procedure depends on the sensor used. Detailed below is a description of a typical calibration sequence for the 4-20mA input conductivity probes supplied by Severn Trent Services.

Prepare the two calibration solutions. If the sensor is new or has been stored dry please leave it immersed in water for 2 hours before calibrating. Another calibration is recommended 24 hours later.

1. Prepare the two calibration solutions and put enough of each in a beaker or bottle (it needs to cover the bottom 50 mm (2 inches) of the probe).

2. Press the MENU key on the transmitter. Enter the password and then press Enter to get to the Calibration submenu. Enter this screen and use the Menu key to scroll to the channel to be calibrated. Use the Enter key to select this channel. The Menu key can be used to scroll to either the measure P1 (low standard) or P2 (the high calibration standard). Enter the P1 screen. The display will show:

X	X	.	X	X		μ	S[1]			2	3	.	5	°	C
P	1	:							Y	Y	.	Y	Y		

1= Units will depend on those set by the customer – see Section 4.3.1

P1 indicates the first point of calibration at the LOWER concentration. XX.XX is the current value. It is useful as it shows when measurement stability has been reached. YY.YY is the value set at the last calibration and can be freely modified.

3. Place the probe in the P1 calibration standard. Press the ENTER key on the transmitter and insert the correct value. Wait 2 minutes or until the reading has stabilized (XX.XX is stable), then confirm by pressing the ENTER key to save the value or reject by pressing the END key.

4. Proceed to the second point (P2) by pressing the MENU key. Take the probe out of the low standard, rinse it with demineralized water, and put it in the high standard ensuring the bottom 50mm (2 inches) of the probe is covered. Wait 2 minutes or until the measured reading (XX.XX) has stabilized and type in the correct standard value in YY.YY. Confirm by pressing Enter or reject by pressing End.

5. To start the measurement press the End key repeatedly until you are in run mode, and put the probe back into the sample stream.
   If at anytime during the calibration procedure the following message appears:

   -Bad Input!-

   It means there was not enough difference in signal seen between standards. This message can be overwritten by pressing the END key. However the standards should be replaced and the probe recalibrated.

7 START UP

WARNING

If the equipment is used in a manner NOT specified by Severn Trent or NOT included in the present document, the protection provided by the equipment may be impaired.

CAUTION

Transmitter casing must be properly closed before being powered up

Before proceeding with the start-up, it is recommended to verify the following points:

- Verify that the installation has been performed according to the section 3.3 of the present manual.
- Verify that the power supply is in accordance with the value indicated in the instrument label.
- Verify that the electrical wiring has been properly completed according to the recommendations mentioned in section 3.4 of the present document.
- Verify that power-up of the instrument will not cause any uncontrolled action related to the items eventually connected to the output signals (i.e. dosing pumps, operating valves, fume extractors).
- Verify that the probes connected to the instrument are properly installed and wired according to the instructions indicated in the specific probe instruction manual.

7.1 Preliminary operations

7.1.1 Getting started

Power the transmitter up and perform the following steps:

1. Turn on power supply;
2. Enter Configuration menu and set the desired language for the display messages;
3. If the displayed measured value is not in agreement with the connected sensor(s) enter the Channel Definition menu, and set, for each installed channel, the correct type of measure (Refer to Sect. 4.3).
4. Verify that the selected measuring ranges correspond to the desired values; if not, modify ranges as needed.
5. If the alarm levels are required at values that are not the 10 % and 90 % of measuring range, enter the Alarms menu and set Low Alarm and High Alarm level as required. (Refer to Sect. 4.4.3).
6. Verify that all Configuration parameters are set as required (See Sect. 4.4 to 4.4.1.3).
7. If a Dissolved Oxygen Sensor (O2) is installed, set the installation altitude value, to allow automatic calibration in air.
8. Once the sensor(s) sensitivity is stabilised the calibration procedure(s) has to be performed to standardize the transmitter together with the connected sensor(s).
9. During the first 4 days of operation, it is suggested to verify every day the reading of the analyzer, and repeat calibration if necessary.
10. Now the analyzer is in operation. It is important to repeat periodically the maintenance procedures detailed in the instruction manual pertinent to each sensor.

7.1.2 Personalization of Parameters

1. If the Input / Output digital contacts are used, enter the Configuration menu and set the NO or NC status of the contact as desired.
2. It is important to remember that any device connected to the digital output must be arranged in order to operate in fail safe condition.
3. If the Serial Communication option has been selected, enter the Configuration menu and set the desired instrument address, baud rate and selected communication port.
4. Select the desired engineering unit for the temperature indication.
5. If it is desired to operate the controller with the average value of 2 or 3 identical sensors, select PID in the Channel installation menu.
6. If it is desired that the transmitter calculates the difference between two identical sensors input values, set a value in the "Delta" parameter.
7. If required, select a dumping value for each channel input.
8. Modify the "Password" in the Configuration menu, if it is desired to set a personalised access code.

7.2 Controller PID tuning

The PB, TR, and TD constants are preset to the default values shown in Table 7. If desired the control action setting can be optimized by using a trial and error method as outlined below.

1. Set process to approximately normal conditions in MANUAL.
2. Preset constants to some acceptable starting point for the process. For example

   PB = 500
   TR = 100
   TD = 0
3. Switch Controller to AUTO mode.
4. Decrease the PB setting to ½ the previous value. Then, alter the set point 2% by pressing one of the set point pushbuttons.
5. Check that the process indication value does not oscillate.
6. Continue to decrease the PB setting by a factor of 2, altering the set point between steps until a point is reached where process cycling is just evident. Then increase the PB setting by a factor of 2.
7. Introduce Automatic Reset slowly by decreasing TR until cycling starts.
8. Increase TR to approximately 1,5 times the value obtained in 7) above.

When PID tuning constants have been selected, the controller is ready for on-stream operation. Optional PID tuning methods may be desired for slow response processes. Consider recording all tuning parameters in the instruction manual for future reference should it become necessary to reprogram the instrument.

8 MAINTENANCE

MicroChem®2 housing can be externally cleaned with a cloth slightly wetted with alcohol and water, paying attention not to damage the keyboard.

Do not use acids or chemicals solvents for MicroChem2 cleaning.

CAUTION

8.1 Periodical operations

All analyzers need cleaning of the sensors at periodical intervals that depend on type of sensor and process characteristics. For further details refer to the specific sensor Instruction Manual. The analyzers also need periodical check of sensitivity and calibration if required.

8.1.1 Automatic sensitivity check during dual point calibration

During dual point calibration, MicroChem2 performs an automatic sensor sensitivity check. If the sensitivity is too low the display will show the message “Bad In”. Refer to the instruction manual. pertinent to each specific sensor for details on how to fix the problem. If the message “Fault” appears the signal generated by the sensor is abnormally high. Refer to the instruction manual pertinent to each specific sensor for details on how to fix the problem.

8.1.2 Sensor signal check

The signal generated by the sensor and by the temperature sensing element can be directly read (in µA or mV and in •) on MicroChem2 display simply by entering the Analog I/O, input signals submenu, under Instrument Test submenu. This is a very easy way to define if the sensor is correctly working just verifying its signal and comparing it to a lab analysis of the measured value. See the pertinent instruction manual for nominal signal to be expected from each type of sensor.

8.1.3 Other checks

Accessing to the menu at section INSTRUMENT TEST, is possible to verify the instrument features. Refer to section 4.4.1.4. for further details.

9 ERROR MESSAGES & TROUBLESHOOTING

Different levels of messages are generated by the instrument at need.

9.1 Messages

At power up, the instrument shows the following sequence of messages:

"MicroChem II"
"S.Rel...."
"Transmitter"

9.1.1 Operation messages

Messages displayed during operation to clarify what MicroChem2 is doing.

"Loading default database"

is shown when a reset has been performed. After few seconds the instrument goes to normal display mode.

"-calib-"

is shown when the instrument is powered up and when a Channel has been changed. After some seconds the instrument goes to normal display mode.

"---wash---"

flashing is displayed when the instrument is performing a cleaning sequence. "---wash---" is alternated to a value that is the last measure before the starting of the cleaning sequence.
Both the displayed measure and the 4-20 mA output signals are frozen at that last value.

"Access denied"

is displayed when the inserted password is not correct.

"password"

is displayed when the menu key is pressed: the correct password must be entered in order to access the menu.

9.1.2 Error messages

These messages are displayed when something is not correct in the unit.

"Error, no analog input"

is displayed when analog I/O pc board are missing (or contact in their connectors is failing).

"Bad In"

is displayed if the input signal generated by the sensor is too low, that is the sensitivity is too low.

"Fault"

is displayed if the signal generated by the sensor is too high.

"RTFault"

is displayed when the Thermo resistance is faulty and the instrument is currently using the default temperature value

"Red LED lit (Watchdog)"

When Red LED watchdog is lit it means the microprocessor circuit is faulty.

9.2 Alarms page

It is accessed by pressing the Enter key in display mode.

If no alarm or no abnormal condition is present the display will show nothing.

The following messages are displayed with the indicated meaning:

A1L = low alarm on channel 1
A2L = low alarm on channel 2
A3L = low alarm on channel 3

A1H = high alarm on channel 1
A2H = high alarm on channel 2
A3H = high alarm on channel 3

AML = low alarm on average value

AMH = high alarm on average value

Ch1 Bad = Bad value on channel 1
Ch2 Bad = Bad value on channel 2
Ch3 Bad = Bad value on channel 3

=•= = the value set for delta has been overcome

AVE = the instrument is computing the average of two measures (same parameter) and the averaged value is indicated on the first line of the display instead of the measure of the first channel

BLK = When CCI in OR parameter is set to YES it means that output(s) is (are) frozen because either CCI1 or CCI2 or both is (are) closed.

RUN = When CCI in OR parameter is set to YES it means that output(s) is (are) working (not frozen) because CCI1 and CCI2 are both open.

9.3 Troubleshooting

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
RT fault	Faulty thermistor or Incorrect connection	Replace thermistor assembly or Make correct connections
Low	Incorrect Calibration	Repeat calibration
Watchdog led lights	General fault	Super-Reset
Menu access denied	Wrong password	Super-Reset
Unstable measure	Incorrect Calibration	Repeat calibration
Erratic or absent analog output	Incorrect pc board or CPU calibration	Super-Reset or Replace pc board
Inaccurate PID regulation	PID parameters erratic configuration	Control PID parameters
Instrument doesn't light up	Boken fuse or erratic electrical connections	Control fuse or electrical connections
Erratic measure reading	Incorrect electrical connection Incorrect calibration CPU fault	Control electrical connections Perform calibration Super-Reset

9.4 Super-Reset

Super-Reset procedure returns MicroChem®2 to the factory default. Alarms, timers, password, digital output settings, engineering units and all other parameters have to be verified or reconfigured and channels calibration must be operated before using it in the process.

Super-Reset has to be operated:

- After an hardware upgrade
- To return password at default "00000"
- When a software problem occurs
- When Watch Dog led lights

How to operate:

- Switch the power supply OFF
- While keeping CANCEL button pressed, switch the power ON
- "Loading default database" will appear on display
- MicroChem2 is reconfigured to the default values

10 PARTS LIST

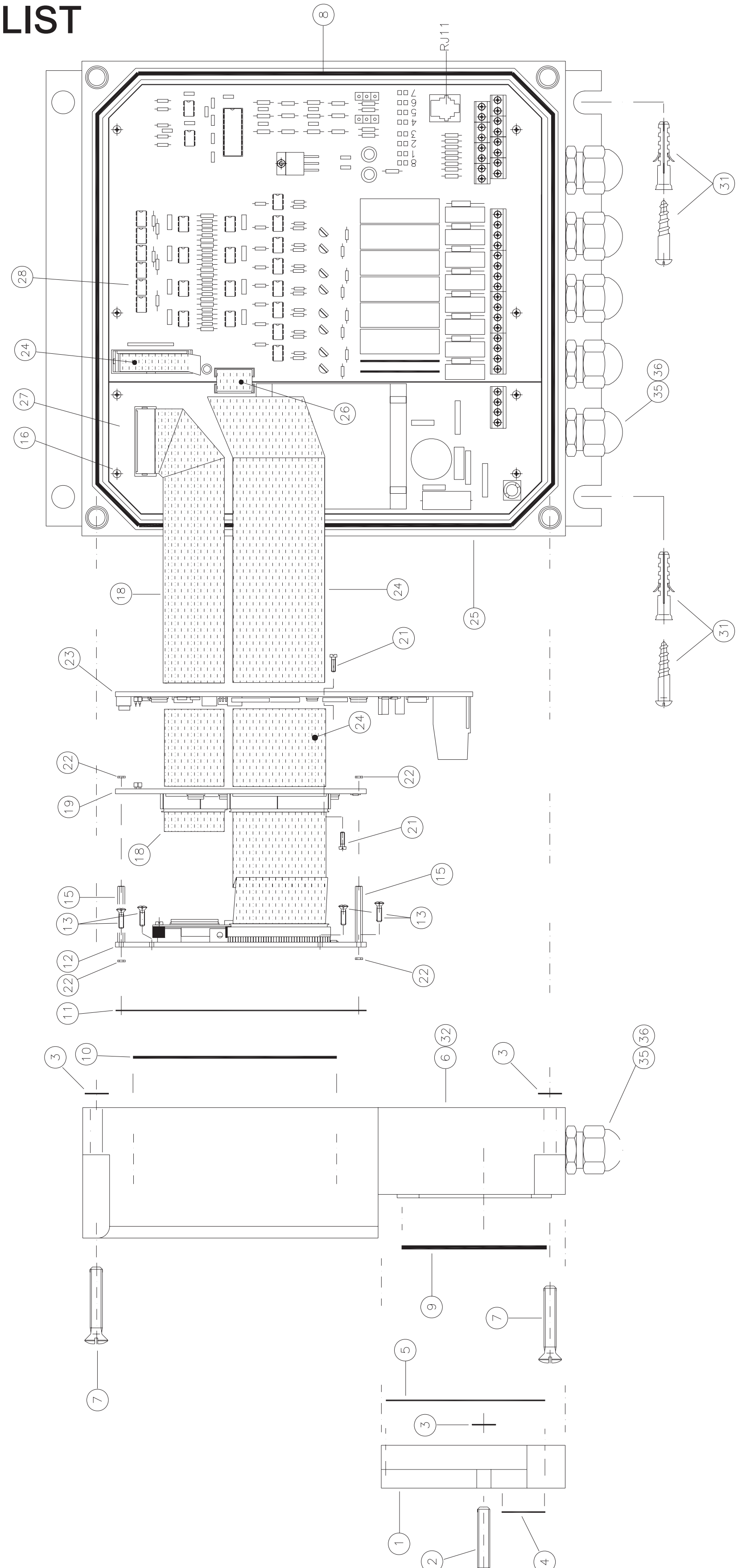


Figure 18 - MicroChem®2 assembly, exploded view

10.1 MicroChem®2 assembly, Parts List

ITEM	DESCRIPTION	PART NUMBER
1	Wire terminal cover	1T324C018U01
2	Screw M5 x 20	1T005L007T60
3	"O" Ring (Buna)	101A702U01
4	Warning label	1T338D152U01
5	Wiring label	1T338D151U02
6	Front cover	1T612B057U01
7	Screw M5 x 25	1T005L008T60
8	"O" Ring (Buna)	1T101A014U01
9	"O" Ring (Buna)	1T101A015U01
10	"O" Ring (Buna)	1T101A016U01
11	Membrane keypad	1T338D153U01
12	Display board	1T686B126U01
13	Screw with auto-thread mod. KB 30x10	1T094L001U06
14	/	/
15	Spacer length 22 mm	1T104D089U01
16	Screw with auto-thread mod. KB 30x8	1T094L001U05
17	/	/
18	Flat cable CPU/ Power supply board	1T677B117U01
19	CPU board	1T686B128U06
20	/	/
21	Screw M3 x 6	1T003E013T60
22	Screw nut M4 nylon	1T082A105N00
23	I/O analog board	1T686B125U01
24	Flat cable I/O CPU	1T677B118U01
25	Bottom enclosure	1T612B058U01
26	Flat cable Power supply I/O analog board	1T677B115U01
27	Power supply board, 115 VAC	1T686B123U11
	Power supply board, 230 VAC	1T686B123U10
28	Digital I/O board + expanded function board RS 232	1T686B129U22
28	Digital I/O board + expanded function board RS 422	1T686B129U24
28	Digital I/O board + expanded function board RS 485	1T686B129U23
29	Cable gland PG11	1T104B018U02
30	PG11 insert disk	1T114C006U03
31	Mounting kit transmitter box	1T614B017U01
	PIC for Mod. T17MD4000, controller	1T699B018U01
	PIC for Mod. T17ME4000, swimming pool controller	1T699B019U01
	Fuse F1 – 230 V~	1T151A003U06
	Fuse F1 – 115V~	1T151A003U09

11 SERIAL COMMUNICATION

NOTE: This section applies only to instruments equipped with the optional Serial Communication P.C. Board.

11.1 Standard of Communications

Two digital communication standards are supported by the serial communication board of MicroChem®2, one port is an RS232 serial interface and the other is an RS 422/485 serial interface. Only one port at a time can be activated, and the selection of the desired standard is made via software at the Configuration Menu.

The Factory default setting is RS 422/485, which allows up to a maximum of 32 instruments to be connected to the same Data-link, where each instrument must have a unique address number ranging from 00 to 31 (Factory setting is 00).

The RS 232 standard can be selected for a peer to peer communication mode.
Transmission speed can be adjusted between 1200 and 28800 baud in the Configuration Menu; default setting is 28800, asynchronous by character.

One character can be defined as either one of the following two modes:

Mode 1 - (Standard PC mode - Default setting by Factory):
 1 Start bit;
 8 Data Bits – the Least Significant Bit (LSB) is transmitted first;
 1 Stop Bit.
Mode 2 - (Optional setting):
 1 Start bit;
 8 Data Bits – the Least Significant Bit (LSB) is transmitted first;
 1 Even Parity bit
 1 Stop Bit.

NOTE: When operating in RS232 mode, the character definition must be set as Mode 1.
Mode 2 is active optionally only when operating in RS485.
To modify this selection, enter the Configuration menu and select the RS485 mode: the menu will ask to select Mode 1 or Mode 2. When Mode 1 is selected and the communication is to work in RS232, remember to set RS232 again in the menu after having selected "Mode 1" from the RS485 menu.

11.1.1 Software characteristics

1. All transactions are initiated by the Host: The MicroChem2 can only work as a ***responder*** to Host commands (Interrogate or Change).
2. All MicroChem2 begin their response within 10 ms after the end of the transmission by the Host, otherwise a faulty transmission may be assumed.
3. The maximum number of data bytes per message is 32 (decimal).
4. Data type are made up of 1 (logical), 2 (integer), 4 (floating point) bytes or string type, with string length bytes, according to Intel Format.

11.1.2 Communication Protocol

The communication protocol requires the Host to initiate all transactions. There are two basic categories of message types: *Interrogate*, which is used to read data from an addressed MicroChem2, and *Change*, which is used to alter a value in an addressed MicroChem2. The addressed instrument decodes the message and provides an appropriate response.

The protocol definitions for the message types are provided in the following table:

Message Field Definition		
Symbol	***Title***	***Definition***
SOH	Start of Header	This character, 7E, denotes the beginning of a message
I.A.	MicroChem®2 Address	The address of the MicroChem2 responding to the transaction. It must be within a range of 00-1F (00-31 decimal).
CMD	Command	Is the operation to be performed or a description of the message that follows the Command-I.A. byte. The Command-I.A. byte has two fields: the Command field (3 bits), and the I.A. field (5 bits). There are the following commands type: Interrogate Change Acknowledge Response The command descriptions are covered in the following section.
NUM	Number	The number of data bytes transferred or requested. The NUM must be in a range of 00-32 decimal.
LO-ADD	Lower Address Bits	The least significant 8 bits of a 16 bit address in the MicroChem2 database (*)
HI-ADD	Higher Address Bits	The most significant 8 bits of a 16 bit address in the MicroChem2 database (*)
DATA		An 8 bit data type
XXXX		Represents a variable number of data bytes
LRC	Longitudinal Redundancy Character	Is a character written at the end of the message that represents the byte content of the message and is checked to ensure data was not lost in transmission. Is the sum of all bytes Modulo 256 of the message not including the SOH character or its own bit setting (LRC)

Table 22 - Message field definition

(*) The addresses of the single variables to be accessed in the MicroChem2 database are listed in the following pages.

11.1.3 Message Types and Commands Description

The types of messages that are sent between the host and the MicroChem2 are formatted as follows:

Host to MicroChem2

1. Interrogate – This message requests up to 20_H consecutively stored bytes, beginning at the specified memory address location of the addressed MicroChem2.
   01111110 E0H + I.A. NUM LO ADD HI ADD LRC

2. Change – This message sends up to 20 bytes of new data to the addressed MicroChem2.
   01111110 A0H + I.A. NUM LO ADD HI ADD Data 1 XXXXXXX Data N LRC

3. Acknowledge – This message signals the addressed MicroChem2 that it's last echoed change message was received correctly; the MicroChem2 performs the change requested.
   01111110 80H + I.A.

MicroChem®2 to Host

1. Response – This message furnishes the data requested by the INTERROGATE command of the Host. It is also used to echo back the previous CHANGE message of the Host.

   01111110 20_H + I.A. NUM LO ADD HI ADD Data 1 XXXXXXX Data N LRC

11.2 Communication Transaction Examples

11.2.1 Transaction A Example

Host requests 9 bytes of data beginning at hexadecimal memory address 1000 from the MicroChem2 at data-link address 03:

1. Host sends **interrogate** message:

01111110	11100011	00001001	00000000	00010000	11111100	
SOH	Command + I.A.	NUM	LO ADD	HI ADD	LRC	

2. MicroChem2 sends **response** message:

01111110	00100011	00001001	00000000	00010000	XXXX XXXX XXXX	LRC
SOH	Command + I.A.	NUM	LO ADD	HI ADD	Data 1 ………..Data 9	

11.2.2 Transaction B Example

Host sends two bytes of new data, to be loaded into the MicroChem2 at data-link address 03 beginning at hexadecimal memory address 1000_H:

1. Host sends **change** message:

01111110	10100011	00000010	00000000	00010000	00001000	00001100	11001001
SOH	Command + I.A.	NUM	LO ADD	HI ADD	Data 1	Data 2	LRC

2. MicroChem2 sends **response** message:

01111110	00100011	00000010	00000000	00010000	00001000	00001100	01001001
SOH	Command + I.A.	NUM	LO ADD	HI ADD	Data 1	Data 2	LRC

3. Host sends **acknowledge** message:

01111110	10000011
SOH	Command + I.A.

4. MicroChem2 performs the change requested at end of the current program scan.

NOTE: Database address table is shown at the end of this section.

11.3 Serial link signal connection

The MicroChem®2 optional serial communication P.C. Board is equipped with modular telephone RJ11 type jack supporting both for RS 232 and RS 422/485 standards:

RJ11 TELEPHONE SIGNAL CONNECTION JACK LAY-OUT:			
Pin N.	**RS 232**	**RS 422**	**RS 485**
1	GND Ground	GND Ground	GND Ground
2	Rx IN Data transmission from PC	Tx + Data transmission to PC, +	-
3	Tx OUT Data transmission to PC	Tx – Data transmission to PC, -	-
4	-	Rx + Data transmission from PC, +	Tx Rx +
5	-	Rx – Data transmission from PC, -	Tx Rx -
6	GND Ground	GND Ground	GND Ground

Table 23 - RJ11 Jack serial Communication connector pin-out

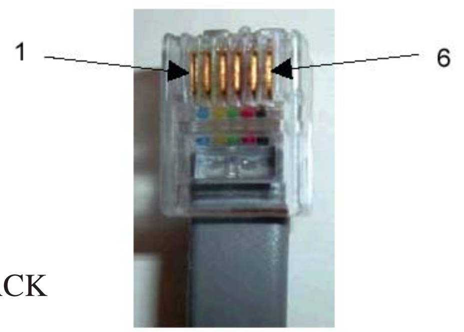


Figure 19 - RJ11 Connector layout

For RS232 and RS485 use shielded cables, two-cores twisted pair wire, section 0.5 ÷ 1.0 mm^2.
For RS422 use shielded cable, 4 cores, twisted pairs wire, section 0.5 ÷ 1.0 mm^2.
Connect shields to the ground shield terminal strip inside MicroChem2.

11.4 Data-link Terminator

The datalink impedance should be 110 Ohm. When the serial communication standard is selected as RS422 or RS485, and more than one MicroChem®2 are installed on the same datalink, it is necessary to activate a terminator resistance, which is available on the serial communication board.

This operation is to be made only on the last MicroChem2 connected on the serial link.
If the host computer serial port is already equipped with a 220 Ohm resistor, then an identical resistor is to be activated in parallel to obtain a 110 Ohm loop impedance. If no such resistor is present on the Host side, then a 110 Ohm resistor is selected on the MicroChem2 serial board.

The terminator resistance selection is made by installing a jumper on JP1 or JP2 for RS422 or RS485 respectively: the 110 Ohm resistor is selected by jumper between pin 1-2, while the 220 Ohm resistor is selected by jumper between pin 2-3.

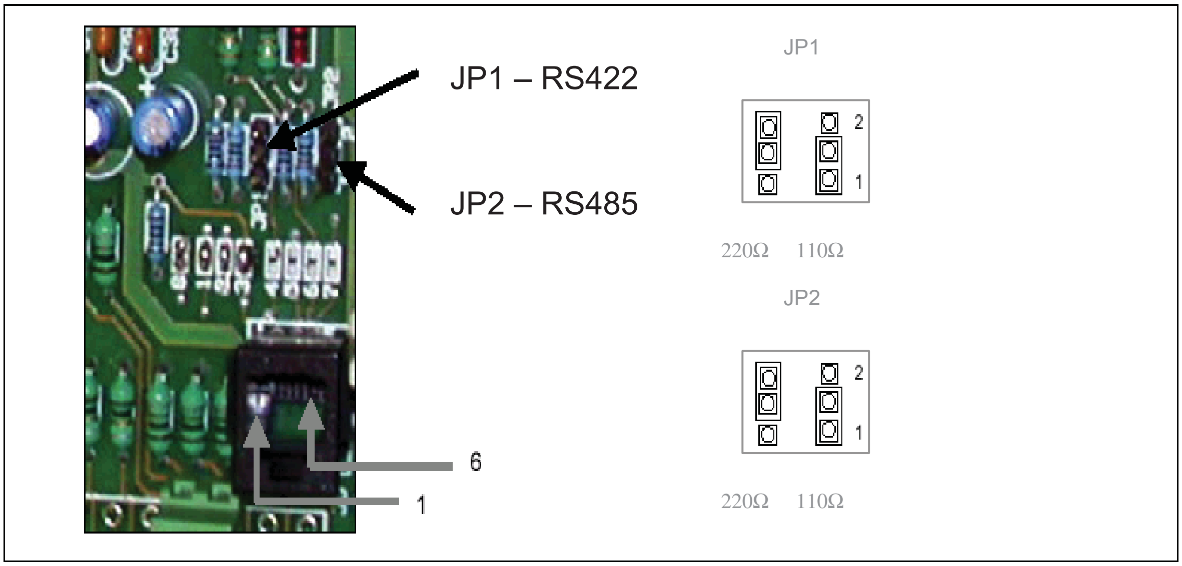


Figure 20 - Data link configuration

Please NOTE:
- to select RS232 weld jumpers onto position 1, 2, 3 and 8.
- to select RS485 weld jumpers onto position 6, 7 and 8.
- to select RS422 weld jumpers onto position 4, 5, 6, 7 and 8.

11.5 MicroChem®2 Memory Map

Increment: (figures between brackets '[x]' indicate the number of similar variables repeated).

Char type:	1 byte
int type:	2 bytes
float type:	4 bytes
string type:	1 byte x string length

Type	Hex addr.	Name	Description
Char	0X0000	PgmMode	Program mode (0-4) Transmitter, Washing, Regulator…
Char	0X0001	Lng	Language in use
String [6]	0X0002	AccCode[6]	MicroChem2 Password
String [4]	0X0008	TermAddr[4]	Serial line address
Char	0X000C	SerSpeed	Serial line speed
Char	0X000D	SerType	Serial line type
Float	0X000E	Altitude	Altitude where MicroChem2 is mounted
Char	0X0012	CCIinOR	Set for CCI in OR mode
Char	0X0013	Average	Set for Average count
Float	0X0014	Delta	Delta limit
Float	0X0018	pH_offset[3]	Offset for PH (SPC), for 3 channels
Float	0X0024	P1[3]	Calibration P1 value for 3 channels
Float	0X0030	P2[3]	Calibration P2 value for 3 channels
Float	0X003C	P1U[3]	User Calibration P1 value for 3 channels
Float	0X0048	P2U[3]	User Calibration P2 value for 3 channels
Char	0X0054	Light	Set when back-light is ON
Char	0X0055	T_Units	Temperature units
Float	0X0056	DefTemp	Default temperature for termo-compensation
Char	0X005A	AltUnits	Altitude Units meters/feet
Char	0X005B	Sigma	Sigma enabled or not
Float	0X005C	sK1	Sigma K1 parameter
Float	0X0060	sK2	Sigma K2 parameter
Float	0X0064	Hyst[3]	Smoothing for each channel
String [9]	0X0070	wT[4]	Wash Wash Timers T1-T4
Float	0X0094	Out_LO[3]	Min. output value for 3 channels
Float	0X00A0	Out_HI[3]	Max. output value for 3 channels
Char	0X00AC	DacType[3]	Type of DAC output
Char	0X00AF	wType	Wash Type T17AU / T17SU
Float	0X00B0	AlLO[3]	Alarms low level
Float	0X00BC	AlHI[3]	Alarms high level
Float	0X00C8	AlBA[3]	Alarms Band
Float	0X00D4	DO_AIR[3]	Set when O2 is in air
String [3]	0X00E0	Res	Reserved
Char	0X00E3	SerMode	Type of RS485/422 serial line
Char	0X00E4	CCIO	0 = No I/O Board, 1 = Yes I/O Board
Char	0X00E5	DoWash	When set, TX has washing
Char	0X00E6	PidType	Determine program PID mode
String [2]	0X00E7	Res	Reserved
Char	0X00E9	UnEng[3]	Engineering unit mA
Char	0X00EC	Type Cl[3]	Chlorine type input
Float	0X00EF	LLmA[3]	mA low limit
Float	0X00FB	LLCl[3]	Chlorine low limit
Float	0X0107	HLCl[3]	Chlorine high limit
Float	0X0113	LLmVCl[3]	mV Chlorine low limit
Float	0X011F	HLmVCl[3]	mV Chlorine high limit
Char	0X012B	EnPID1	enable PID1
Char	0X012C	EnPID2	enable PID2
Int	0X012D	FFPID	Enable FFPID
Int	0X012E	ChInst[3]	Channel installed
Int	0X0134	ChMode[3]	Channel Mode
Float	0X013A	PV[3]	Process value
Float	0X0146	Temp[3]	Temperature value

Table 24 - General Data Memory Map

PID1	Hex addr.	Name	Description
String [2]	0X0152	Reserved	Reserved
Float	0X0154	PB	Proportional Band
Float	0X0158	TR	Reset Time
Float	0X015C	MR	Manual Reset
Float	0X0160	TD	Derivative Action
Float	0X0164	SP	Set Point
Float	0X0168	CZ	Control Zone
Char	0X016C	RSW	Direct/Reverse Action
Char	0X016D	OHLP	Flow dependent limits
Float	0X016E	SPAN	Span
Float	0X0172	FF HIGH	High output limit calculation factor
Float	0X0176	FF LOW	Low output limit calculation factor
Float	0X017A	FF ABS MAX	High output limit
Float	0X017E	FF GAIN	Flow rate gain
Float	0X0182	OH	Output high limit
Float	0X0186	OL	Output low limit
Float	0X018A	K	Scaling factor for flow
Float	0X018E	TATT	Activation time
Float	0X0192	TCYC	Cycle time
Float	0X0196	LH	Reserved
Float	0X019A	LL	Reserved
Float	0X019E	B	Reserved
Int	0X01A2	CT	Reserved
Float	0X01A4	CG	Reserved
Float	0X01A8	DZ	Reserved
Char	0X01AC	TATP	Reserved
Char	0X01AD	CY	Reserved
Char	0X01AE	PA	Reserved
Char	0X01AF	Reserved	Reserved

Table 25 - PID1 Data Memory Map

PID 2	Hex addr.	Name	Description
String [2]	0X01B0	Reserved	Reserved
Float	0X01B2	PB	Proportional Band
Float	0X01B6	TR	Reset Time
Float	0X01BA	MR	Manual Reset
Float	0X01BE	TD	Derivative Action
Float	0X01C2	SP	Set Point
Float	0X01C6	CZ	Control Zone
Float	0X01CA	SPAN	Span
Float	0X01CE	OH	High output limit
Float	0X01D2	OL	Low output limit
Float	0X01D6	TATT	Activation time
Float	0X01DA	TCYC	Cycle time
Float	0X01DF	LH	Reserved
Float	0X01E2	LL	Reserved
int	0X01E6	CT	Reserved
Float	0X01E8	CG	Contact Gain
Float	0X01EC	DZ	Reserved
Char	0X01F0	CY	Reserved
Char	0X01F1	TATP	Reserved
Char	0X01F2	PA	Reserved
Char	0X01F3	RSW	Reserved
Int	0X01F4	Seq_Lav	Actual washing phase
String[10]	0X01F6	T_Lav	Washing time
int	0X0200	CCO[8]	CCO state
int	0X0210	CCI[8]	CCI state
float	0X0220	PID_Dev[2]	PID 1,2 DEV
float	0X0228	PID_Out[2]	PID 1,2 OUT
float	0X0230	PID_FF[2]	PID 1,2 FF
float	0X0238	HiAl [3]	HI Alarm Channel 1-3
float	0X0244	LowAl [3]	LO Alarm Channel 1-3
int	0X0250	PID_ AM[2]	PID1,2 Auto/Manual

Table 26 - PID2 Data Memory Map

12 APPENDIX

12.1 APPENDIX A – WEEE Compliant

Severn Trent Water Purification S:pA., as manufacturer of the electronic instrument described in the present manaul (MicroChem®2 line) is registered at the WEEE register (Waste Electric and Electronic Equipment).

Member registration WEEE number: IT11040000007171

12.2 APPENDIX B – Step by Step Programming Instructions

Please Refer to 4.3 Channel Definition

The keys used to define the channels are:

ABC – moves you laterally through the software

Enter – moves you down into the software holding the Enter key is also used to display an alarm condition.

End – moves you up in the software. End is also used to toggle the process display conditions from channels 1, 2, 3 if they are installed

The following procedure is to configure a transmitter to analyze Chlorine on channel 1 using CL4000 probes:

Press ABC, see Password:/ Flashing Cursor

Type in 00000

Press Enter, see ------ Menu Mode ------/ Menu

Press ABC, see ------ Menu Mode ------/Calibration

Press ABC until you see - Menu Mode/Channel Definition

Press Enter, see Channel Definition/ Channel 1

Press Enter see Channel 1/ CL

Press ABC until you see Channel 1/CL. (Continual pressing of ABC will rotate/move you laterally through the various parameters that the MicroChem2 is capable of measuring CL, CD, T, mA, F, Br, NH_3, NO_3, pH, O_2, mV, and O_3.

NOTE: mA allows you to drill down another level. Then pressing ABC will rotate/move you laterally through mA, %, ppm, mg/l, g/h, L/s, L/h, m^3/h, °C, °F, µS, mS, Kpa, Mpa, PSI, GPM, GPD, MGD, NTU, FTU, m, ft, in.)

Press Enter, see CL/ KC4000 Cell

Press ABC, see CL/CL probe [mA]

Press Enter, see CL Settings/ 4mA = 0.00ppm (This is the low range of your chlorine probe)

Press Enter and Enter 00.00. You will see a flashing cursor.

Press Enter, see CL Settings 20mA = 10.00 ppm

Press Enter, see the flashing cursor, enter the upper limit of the range for the Chlorine probe.

Press Enter, see Channel Definition/ Channel 1

Press End two times and see the display for what is being measured on channel 1

Continual pressing of the End key will toggle through the process measurement screens for the number of channels that are installed and configured.

Please refer to 4.4.1 Set Up/ Instrument Configuration

The keys used to define the channels are:

ABC – moves you laterally through the software

Enter – moves you down into the software. Holding the Enter key is also used to display an alarm condition.

End – moves you up in the software. End is also used to toggle the process display conditions from channels 1, 2, 3 if they are installed.

The following procedure is to set the instruments basic configuration.

Please refer to 4.4.1.1 (Configuration Parameters)

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------ Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press Enter, see English

Continual pressing of the ABC key will rotate you through the languages that are available

When you see English press the End key twice, see Menu/ Configuration

Serial Link — Please refer to 4.4.1.1

The serial communications link to be used by the analyzer. This also requires a hardware change. Please refer to 4.4.2.1, Figure 8

At the process display screen

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Serial Link

Press Enter, see Serial Link/ Address

Press Enter, see Address/ 00 If using RS422 or RS485 you must identify the address of this instrument. RS422 and RS485 are used to link up to 31 instruments. Please refer to section 11 in the instruction manual. If you wish to identify the instrument press the Enter key and you will get a flashing cursor. Enter the numeric value to identify the instrument and press the Enter key.

Cleaning — Please refer to 4.4.1.3

To wash and rinse the sensors

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/Configuration

Press Enter, see Configuration/Language

Press ABC until you see Configuration/Cleaning

Press Enter, see Cleaning/Activate

Press Enter, see Activate/NO

Press ABC, see Activate/Yes

Press Enter, see Cleaning/Activate

Press ABC - see Cleaning/A or B, You must choose B.

Press Enter - see A or B/A

Press ABC - see A or B/A

Press ABC - see A or B/B

Press Enter - see Cleaning A or B

Press ABC - see Cleaning/Cleaning T1. This is the time period between the end of a cleaning sequence and the start time of the next one.

Press Enter - see Cleaning T1/00:00:00. This represents hours, minutes and seconds between cleanings.

Press Enter - see Cleaning T1/flashing cursor

Insert desired time between cleanings

Press Enter - see Cleaning/Cleaning T1

Press ABC - see Cleaning/Cleaning T2

Press Enter - see Cleaning T2/00:00:00. This represents the length of time for washing. Hours have no meaning. You can set cleaning to 30 minute maximum.

Press Enter - see Cleaning T2/flashing cursor

Insert desired time per T2

Follow the same sequence for T3 (Rinse Time) and T4 (Pause Time after cleaning for sensor recovery sensibility) if needed

Continual pressing of the End Key will bring you back to the process measuring display

Temperature Select °C or °F— Please refer to 4.4.1.1

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Temp. Select

Press Enter, see Temp. Select/ °C, another press of the ABC key will toggle you to °F

Press End until you see Menu/ Configuration

Temperature Set — Please refer to 4.4.1.1

This is a safety feature to tell the instrument the temperature to be used if the thermistor is faulty

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Temp. Set

Press Enter, see Temp. Set/ 20.00

Press Enter, see Temp. Set/ with the flashing cursor. Enter the value of the temperature you wish

Press the End Key until you return back to the process measurement display

Altitude (only used for Dissolved Oxygen) — Please refer to 4.4.1.1

This only appears when one of the channels is defined O2

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Altitude

Press Enter, see Altitude/ Eng. Unit Set

Press Enter, see Eng. Unit Set/ Meters by pressing ABC, and Enter you can select altitude in feet rather than meters

Press Enter see Altitude/ Eng. Unit Set

Press ABC, see Altitude/ Set Value

Press Enter, see Set Value/ Ft = 656.20

Press Enter, see Set Value/ Ft = 656.20 with a flashing cursor

Enter the altitude at your plant location and press Enter

Press the End Key until you return back to the process measurement display

CCI in OR — Please refer to 4.4.1.1

This function is used during cleaning to freeze the display.

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ OR CCI

Press Enter, see OR CCI/ NO

Press ABC, see OR CCI/ YES and press Enter to freeze the display of the analyzer.

Press the End key until you return back to the process measurement display

Average — Please refer to 4.4.1.1

This function is used if you have a 2 or a 3 channel instrument and 2 of the channels are configured to test the same parameter.

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Average

Press Enter, see Average/ NO

Pressing the ABC key will let you toggle between Average/ NO and Average/ Yes

Press the End key until you return back to the process measurement display

Delta — Please refer to 4.4.1.1

This function is used with 2 channel transmitters when both channels are configured to test the same parameter. It will cause an alarm if the difference between the two channels is greater than the set value.

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Delta

Press Enter, see Delta/ 0.000

Press Enter to see the flashing cursor and enter the desired Delta value31

Press Enter, see Configuration/ Delta

Press the End key until you return back to the process measurement display

Smoothing — Please refer to 4.4.1.1

This function lessens the degree of measurement fluctuation seen on the display

Press ABC, see Password:/ flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Smoothing

Press Enter, see Smoothing/ Channel 1. Press ABC to toggle between channels

Press Enter, see Channel 1/ 1.00.

Press Enter to see the flashing cursor. Set the smoothing to 30. This is a good place to start.

Press Enter to see Confirm, see Smoothing/Channel 1.

Press the End key until you return back to the process measurement display

Digital Input and Digital Output Settings — Please refer to 4.4.1.1 and 4.4.1.4

Each analyzer has 2 digital inputs CCI 1 and CCI 2. Each analyzer also has 7 digital outputs also referred to as Digital Relay Contact Closures. Each input and output is configured separately as normally opened (NO) or normally closed (NC).

Press ABC, see Password: / flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press Enter, see Configuration/ Language

Press ABC until you see Configuration/ Digital I/O Set

Digital Outputs:

Press Enter, see Digital I/O Set/ Digital Outputs

Press Enter, see Digital Outputs/ Ch. 1

Press ABC to rotate through channels 1 through 7 (CCO1 through CCO7)

Press Enter, see Ch. 1/ NO. Toggle between NO and NC by pressing the ABC key

Digital Inputs:

Press End until you see Digital I/O Set/ Digital Outputs. Press the ABC key to toggle between Digital Inputs and Digital Outputs

Press Enter, see Digital Inputs/ Ch. 1

Press ABC to toggle between channels 1 and 2

Press Enter, see Ch. 1/ NO. Toggle between NO and NC by pressing the ABC key

Output Setting – Please refer to 4.4.2 (Output Setting)

Press ABC, see Password:/flashing cursor and enter 00000

Press Enter, see ------ Menu   Mode------/ Menu

Press Enter, see Menu configuration

Press ABC until you see Menu/Output Settings

Press Enter, see Output Settings/Channel 1

Press Enter, see Channel 1/0-20/4-20

Press Enter, see 0-20/4-20/4-20mA. Press Enter to confirm. The output setting for the instrument is now configured for 4-20mA.

Press ABC, see Channel 1/Out Zero

Press Enter, see Out Zero/0.00

Press Enter, see a flashing cursor. The number entered will correspond to the 4.0 mA output signal.

Press Enter, see Out Zero

Press ABC, see Channel 1/Out Span

Press Enter, see Out Span = 10.00

Press Enter, see the flashing cursor, enter the upper limit of your probe that you wish to correspond to 20.00 mA

Press Enter, see Out Span

Press End once, see Menu/Output Settings

Press End again and see -----Menu Mode-----/Menu

Press End again – will show the process display screen

Setting Alarms - Please refer to 4.4.3

The keys used to set the alarms are:

ABC – moves you laterally through the software

Enter – moves you down into the software. Enter is also used to display an alarm condition.

End – moves you up in the software. End is also used to toggle the process display conditions from channels 1, 2, 3 if they are installed

The Alarms Menu is used to set the alarms for each parameter the instrument is capable of analyzing. Alarms default to the default settings in 4.4.3 Table 4.

Low and High Alarms

To change the alarm settings:

Press ABC, see Password: / flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press ABC key to rotate to Alarms

Press Enter, see Alarms/ Channel 1

Press Enter, see Channel 1/ Low Alarm

Press Enter, see Low Alarm/ 1.000

Press Enter to see the flashing cursor and enter the desired low alarm value

Press the End Key see Menu/ Alarms

Press Enter, see Alarms/ Channel 1

Press Enter, see Channel 1/ Low Alarm

Press ABC, see Channel 1/ High Alarm

Press Enter, see High Alarm/ 9.000

To change the High Alarm press Enter and the flashing cursor will appear. Enter the desired value.

Press the End key until the measuring process display appears

Dead Band – Please refer to 4.4.3

Dead Band is used to avoid the alarms from oscillating around the Lo and Hi alarm set points

Press ABC, see Password: / flashing cursor and enter 00000

Press Enter, see ------Menu Mode ------/ Menu

Press Enter, see Menu/ Configuration

Press ABC until you see Menu/ Alarms

Press Enter, see Alarms/ Channel 1

Press Enter, see Channel 1/ Low Alarm

Press ABC until you rotate to Dead band

Press Enter, see Dead band/ 0.000

Press Enter, see Dead band/0.000 with the flashing cursor. Enter the desired value. Then press the End key until the measuring process display appears

ANALYZER CALIBRATION

The following procedure is to configure the instrument to analyze Chlorine on channel 1

The keys used to calibrate the instrument are

ABC – moves you laterally through the software

Enter – moves you down into the software. Enter is also used to display an alarm condition

End – moves you up in the software. End is also used to toggle the process display conditions from channels 1, 2, 3 if they are installed

Probe Calibration - General - Please refer to 6.1.1 for Calibration Menu

Calibration - Please refer to 6.1.4 for Chlorine Calibration

Press ABC, see Password:/ Flashing Cursor. Insert 00000

Press Enter, see ------Menu Mode ------/ Menu

Press ABC, until you see ------Menu Mode ------/Calibration

Press Enter, see Calibration/ Channel 1

Press Enter, see Channel 1/ Calibration P1

NOTE: P1calibration is only necessary for the initial calibration to set the zero point. When performing recalibration it is only necessary to set the P2; skip to the P2 calibration (4 lines below)

Press Enter, see the low calibration value/ P1: 0.000

Press Enter, see the flashing cursor and enter the calibration value (for your low sample that has been stripped of chlorine using a carbon filter)

Press Enter, see Channel 1/ Calibration P1

Press ABC, see Channel 1/ Calibration P2

Press Enter, see the high chlorine calibration value/ P2: 10.00

Press Enter, see the flashing cursor and enter the P2 value based on testing such as with DPD or titration

Press Enter, see Channel 1/ Calibration P2:

Press End 3 times to take you to the process measurement display

AUTOMATIC CONTROL METHODS: (Available in instruments configured as controllers)

A. RESIDUAL PID CONTROLLER PROPORTIONAL BAND (PB) - Please refer to 5.2.2, Table 9.

1. Press ABC key – see Password with a flashing indicator. Press Zero Key and enter 00000.

2. Press Enter, see ------ Menu Mode ------/ Menu

3. Press Enter, see Menu/Configuration
4. Press ABC and scroll to Menu / Controller
5. Press Enter to Controller / PID 1
6. Press Enter, see PID1 General/ 4-20 / Contacts
7. Press Enter, see 4-20 / Contacts / 4-20 mA. This is the default. In order to use the general PID parameters, the instrument must be set to 4-20.
8. Press Enter, see PID / General 4-20 / Contacts
9. Press ABC, see PID1 General/ PB
10. Press Enter, see PB/100. This is the default for PB.
11. Press Enter again to get the flashing cursor to allow you to change the Proportional Band.
12. Insert 250, press Enter and see PID1 General/ PB

TIME RESET/INTEGRAL ACTION (TR) - Please refer to 5.2.2, Table 9

13. Press ABC, see PID1 General/ TR m/r
14. Press Enter see TR m/r / 0.00
15. Press Enter to show the flashing cursor
16. Enter the previously determined TR value. If a higher number than the range is inserted, the instrument defaults to 30 minutes
17. Press Enter to confirm the value and see PID1 General/ TR m/r

MANUAL RESET (MR) - Please refer to 5.2.2.1, Table 9

18. Press ABC and see PID1 General/ MR %

Skip this function. Manual reset is rarely used. To use Manual Reset you must set TR = 0. It represents the output of the controller when the PV is in the Control Zone; when the PV is almost equal to the Set Point.

DERIVATIVE ACTION (TD) - Please refer to 5.2.2.1, Table 9

19. Press ABC and see PID1 General/ TD m

Skip this function, it is rarely used. It is used to allow for sudden changes in the PV

PROCESS VARIABLE (PV) - Please refer to 5.2.2.1, Table 9

20. Press ABC and see PID1 General/ PV
21. Press Enter and see PID1 PV: the analysis and the current Process Variable will be indicated at the top left of the display
22. Press End and see PID1 General/ PV

SET POINT (SP) - Please refer to 5.2.2.1, Table 9

23. Press ABC and see PID1 General/ SP

SP is the Set Point for the desired PV

24. Press Enter and see SP/ 0.00
25. Press Enter to see the flashing cursor and enter the desired Set Point for the process.
26. Press Enter and see PID1 General/ SP

NOTE: The Set Point can be adjusted manually using the blue buttons.

CONTROL ZONE (CZ) - Please refer to 5.2.2.1, Table 9

27. Press ABC and see PID1 General/ CZ

    Control Zone is used to avoid continuous control adjustments for small fluctuations from Set Point. Please refer to 5.2.2.1 for an explanation of Control Zone

28. Press Enter twice to see the flashing cursor and enter the desired value
29. Press Enter and see PID1 General/ CZ

DIRECT/REVERSE ACTION (RSW) - Please refer to 5.2.2.1 for an explanation of DIRECT/REVERSE ACTION (RSW).

30. Press ABC and see PID1 General/ RSW D/R
31. Press Enter and see RSW D/R/ Reverse
32. Press Enter to confirm and see PID1 General/ RSW D/R

SPAN - Range of Wet End/Probe

33. Press ABC and see PID1 General/ SPAN
34. Press Enter and see SPAN/ X.XX – see the numeric indication of the process variable.
35. Press Enter to see the flashing cursor and enter the desired range for the controller based on (in the case of chlorine using a CL4000 probe) the range of the probe
36. Press Enter to confirm and see PID1 General/ SPAN

HIGH LIMIT OUTPUT (OH)

37. Press ABC and see PID1 Limits/ OH%
38. Press Enter and see OH%/ 100.00
39. Press Enter again and see the flashing cursor, and enter the upper limit of the process
40. Press Enter to confirm and see PID1 Limits/ OH %

LOW LIMIT OUTPUT (OL)

41. Press ABC and see PID1 Limits/ OL %
42. Press Enter and see OL%/ 0.00
43. Press Enter to see the flashing cursor. Insert the desired low limit
44. Press Enter to confirm and see PID1 Limits/ OL%
45. Press End until you return to the process analysis/controller screen

Once the Process Variable is running as desired press the Blue 5 Key to switch to Automatic Mode

A.FEED FORWARD ACTION - Please refer to 5.2.2.2

Limit output as a function of Flowrate (OHLP)

A 2 channel unit is required

Channel 2 must previously have been configured as mA and further defined as mode PID

B.FEED FORWARD CONTROL - Please refer to 5.2.2.2

1. Press ABC, see Password/flashing cursor and enter 00000
2. Press Enter, see ------Menu Mode ------/ Menu
3. Press Enter, see Menu/Configuration

4. Press ABC, see Menu/Controller
5. Press Enter, see Controller/PID1
6. Press Enter, see PID General/4-20/Contacts
7. Press ABC, see PID1 General/PB. Continue to press ABC until PID1 Feed Flow/OHLP   NO/YES appears on the display
8. Press Enter, see OHLP   NO/YES/NO
9. Press ABC, see OHLP   NO/YES/YES. OHLP must be set to Yes to limit the output as a function of the flow rate.

FACTOR TO COMPUTE MAX OUTPUT BASED ON FLOWRATE (FFH) - Please refer to 5.2.2.2

10. Press Enter, see PID1 Feed Forw./OHLP   NO/YES
11. Press ABC, see PID1 Feed Forw./FFH
12. Press Enter, see FFH 1.50. This is the default
13. Press Enter, see FFH/flashing cursor
14. Enter the desired numeric value
15. Press Enter, see PID1 Feed Forward/FFH

FACTOR TO COMPUTE MINIMUM OUTPUT BASED ON FLOWRATE VALUE (FFL) - Please refer to 5.2.2.2

16. Press ABC, see PID1 Feed Forward/FFL
17. Press Enter, see FFL 0.50. This is the default value
18. Press Enter, see FFL/flashing cursor
19. Enter the desired numeric value
20. Press Enter, see PID1 Feed Forward/FFL

ABSOLUTE HIGH LIMIT ON OUTPUT WHEN LIMITS BASED ON FLOWRATE ARE ACTIVE (MAX. ABS) - Please refer to 5.2.2.2

21. Press ABC, see PID1 Feed Forward/Absolute Max
22. Press Enter, see Absolute Max/100.00. This is the default value
23. Press Enter, see Absolute Max/flashing cursor
24. Enter the desired Absolute Max value
25. Press Enter, see PID1 Feed Forward/Absolute Max.

GAIN FACTOR APPLIED ON FLOW RATE SIGNAL (GAIN) - Please refer to 5.2.2.2

26. Press ABC, see PID1 Feed Forward/Gain
27. Press Enter, see Gain/100.00. This is the default value
28. Press Enter, see Gain/flashing cursor
29. Enter the desired value
30. Press Enter, see PID1 Feed Forw./Gain
31. Press End until you return to the process analyzer/controller screen
32. Once the process is running as desired, press the Blue 5 Key to switch to automatic mode.

C. TIME SAMPLING OR FLOW-PACING CONTROLLER (TATP)- Please refer to 5.2.2.3

Define Channel 1 as chlorine or another parameter. The 4-20 mA output provides PID control. The channel definition for Channel 2 must be configured to 4-20 mA and further configured to mode PID.

TIME SAMPLING (TATP) - Please refer to 5.2.2.3

1. Press ABC, see Password:/flashing cursor and Enter 00000.
2. Press Enter, ---Menu Mode---/ Menu
3. Press Enter, see Menu/Configuration
4. Press ABC, see Menu/Controller
5. Press Enter, see Controller/PID1
6. Press Enter, see PID1 General/4-20/Contacts
7. Press ABC until you see PID1 Chlorine/TATP NO/YES
8. Press Enter, see TATP NO/YES/NO
9. Press ABC, see TATP NO/YES/YES
10. Press Enter, see PID1/Chlorine/TATP NO/YES, then OH and OL are not engaged, Absolute Max is used.

SCALING FACTOR FOR FLOW (K) - Please refer to 5.2.2.3

11. Press ABC, see PID1 Chlorine (if configured)/K
12. Press Enter, see K/O.O. This is the default value. K is not used in Time Sampling.
13. Press End and see PID1 Chlorine (if configured as such)/K

ACTIVE TIME (ATT) - Please refer to 5.2.2.3

14. Press ABC, see PID 1 Chlorine/ATT.
15. Press Enter, see ATT/0.00. This is the default value.
16. Press Enter, see ATT/flashing cursor.
17. Enter the desired numeric value
18. Press Enter, see PID1 Chlorine/ATT (if configured as such)

CYCLE (FOR FLOW) - Please refer to 5.2.2.3

19. Press ABC, see PID1 Chlorine/Cycle
20. Press Enter, see Cycle/0.00. This is the default value.
21. Press Enter, see Cycle/flashing cursor.
22. Enter the desired Cycle time.
23. Press Enter, see PID1 Chlorine/Cycle.
24. Press End until you return to the process analyzer/controller screen.
25. Once the process is running as desired, press the Blue 5 key to switch to automatic mode.

TIME CYCLE - Please refer to 5.2.2.3 - PID must be defined as Contacts instead of 4-20mA.

3. Press Enter, see ---Menu Mode---/ Configuration
4. Press ABC, see Menu/Controller
5. Press Enter, see Controller/PID1
6. Press Enter, see PID1 General/4-20/Contacts

7. Press Enter, see 4-20/Contacts/4-20mA
8. Press ABC, see 4-20/Contacts/Contacts
9. Press Enter, see PID1 General/4-20/Contacts
10. Press ABC until you see PID1 Contacts/Time Cycle sec
11. Press Enter, see Time Cycle sec/0. This is the default value
12. Press Enter, see Time Cycle sec/flashing cursor
13. Enter the desired value
14. Press Enter, see PID1 Contacts/Time Cycles sec
15. Press End until you return to the process Analyzer/Controller screen
16. Once the process is running as desired, press the Blue 5 key to switch to the automatic mode.

E. ERROR SQUARED CONTROLLER - Please refer to 5.2.2.4

Channel 1 must be defined for pH or mV

Set Point (SP) and process variable (PV) must have been previously defined

1. Press ABC, enter 00000
2. Press Enter, see ---Menu Mode---/ Menu
3. Press Enter, see Menu/Configuration
4. Press ABC, see Menu/Controller
5. Press Enter, see Controller/PID1
6. Press Enter, see PID1 General/4-20/Contacts
7. Press Enter, see 4-20/Contacts/4-20mA
8. Press End, see PID1 General/4-20/Contacts

DEAD BAND

9. Press ABC until you see PID1 pH/Dead Band
10. Press Enter, see Dead Band/100.00, this is the default value.
11. Press Enter, see Dead Band/flashing cursor
12. Enter the desired value
13. Press Enter, see PID1 pH/Dead Band
14. Press End until you return to the process Analyzer/Controller screen

F. CONTACT OUTPUT CONTROLLER - Please refer to 5.2.2.5

1. Press ABC, see Password:/flashing cursor and enter 00000
2. Press Enter, see ---Menu Mode---/ Menu
3. Press Enter, see Menu/Configuration
4. Press ABC, see Menu/Controller
5. Press Enter, see Controller/PID1
6. Press Enter, see PID1 General/4-20/Contacts
7. Press Enter, see 4-20/Contacts/4-20mA
8. Press ABC, see 4-20/Contacts/Contacts
9. Press Enter, see PID1 General/4-20/Contacts
10. Press End twice, see Menu/Controller

11. Press Enter, see Controller/PID1
12. Press Enter, see PID1 General/4-20/Contacts

GAIN - Please refer to 5.2.2.5

13. Press ABC until you see PID1 Contacts/Gain
14. Press Enter, see Gain 1.00, this is the default value.
15. Press Enter, see Gain/flashing cursor
16. Enter the desired Gain value.
17. Press Enter, see PID1 Contacts/Gain

DEAD ZONE (DZ) - Please refer to 5.2.2.5

18. Press ABC, see PID/Contacts/DZ
19. Press Enter, see DZ/0.00, this is the default value.
20. Press Enter, see DZ/flashing cursor
21. Enter the desired value.
22. Press Enter, see PID1 Contacts/DZ

TIME CYCLE - Please refer to 5.2.2.5

23. Press ABC, see PID1 Contacts/Time Cycle Sec
24. Press Enter, see Time Cycle sec 10, this is the default value.
25. Press Enter, see Time Cycle sec/flashing cursor
26. Enter the desired value
27. Press Enter, see PID1 Contacts/Time Cycle sec
28. Press the End key until you return to the process Analyzer/Controller screen.

12.3 APPENDIX C - Analyzer/Transmitter Software Menu Tree

- **Menu**
  - Configuration
    - Language
      - Italian
      - English
      - French
      - German
      - Spanish
    - Password
      - 00000 (Default)
    - Serial Link
      - Address
      - Baud Rate
      - Serial Port
    - Cleaning (when cleaning software option is installed)
      - Activate
        - No
        - Yes
          - A or B
            - A (not used)
            - B
              - Cleaning T1
              - Cleaning T2
              - Cleaning T3
              - Cleaning T4
    - Temp Select
      - C
      - F
    - Temp Set
      - 20.00
    - OR CCI
      - No
      - Yes
      - Off
    - Average (multichannel units with two or more identical channels)
      - No
      - Yes
    - Delta (multichannel units with two or more identical channels)
      - (enter value)
    - Smoothing
      - Channel
        - 1.00
    - Digital I/O Set
      - Digital Outputs
        - Channel
          - NO
          - NC
      - Digital Inputs
        - Channel
          - NO
          - NC

12.4 APPENDIX C (continued)

- Instrument Test
  - Keyboard Test
  - Display Test
  - Digital I/O
    - Input Signals
    - Output Signals
  - Analog I/O
    - Input Signals
      - Channel
    - Output Signals
      - Channel
  - Electric Calib. (Factory use only)
- Output Settings
  - Channel
    - 0-20/4-20
    - Out Zero
    - Out Span
- Alarms
  - Channel
    - Low Alarm
    - High Alarm
    - Deadband

- **Channel Definition**
  - Channel
    - F
    - Cl
      - KC4000 cell
      - Cl probe (mA)
        - T
          - Independant
          - Equal to 1st channel
        - 4mA
        - 20mA
    - CD
    - T
      - (2 or 3 channel units)
      - Independant
      - Equal to 1st channel
    - Br
    - mA
      - UNITS AVAILABLE: mA, %, ppm, mg/l, gr/h, l/s, l/h, m3/h, °C, °F, µS, mS, Kpa, Mpa, PSI, GPM, GPD, MGD, NTU, FTU, m, ft, in
        - 4mA
        - 20mA
    - pH
    - mV
    - O2
    - O3
- **Calibration**
  - Channel
    - S.P.C. (pH)
    - Calibration P1
    - Calibration P2
      - In Air (Dissolved Oxygen)
      - In Water (Dissolved Oxygen)

12.4 APPENDIX D - Standard/Average Controller Software Menu Tree

- **Menu**
  - Configuration
    - Language
      - Italian
      - English
      - French
      - German
      - Spanish
    - Password
      - 00000 (Default)
    - Serial Link
      - Address
      - Baud Rate
      - Serial Port
    - Cleaning
      - Activate
        - No
        - Yes
          - A or B
            - A (not used)
            - B
              - Cleaning T1
              - Cleaning T2
              - Cleaning T3
              - Cleaning T4
    - Temp Select
      - C
      - F
    - Temp Set
      - 20.00
    - OR CCI
      - No
      - Yes
    - Average (multichannel units with two or more identical channels)
      - No
      - Yes
    - Sigma
      - Yes
      - No
      - K1
      - K2
    - Delta (multichannel units with two or more identical channels)
      - (enter value)
    - Smoothing
      - Channel
        - 15
    - Digital I/O Set
      - Digital Outputs
        - Channel
          - NO
          - NC
      - Digital Inputs
        - Channel
          - NO
          - NC
    - Instrument Test
      - Keyboard Test
      - Display Test
      - Digital I/O
        - Input Signals
        - Output Signals
      - Analog I/O
        - Input Signals
          - Channel
        - Output Signals
          - Channel
      - Electric Calib. (Factory use only)
  - **Controller**
    - PID 1
      - 4-20/Contacts
        - 4-20
          - PB
          - TR m/r
          - MR%
          - TD m
          - PV
          - SP
          - CZ
          - RSW D/R
            - Reverse
            - Direct
          - Span
          - OHLP
          - FFH
          - FFL
          - ABS MAX
          - Gain

            Available when 2nd channel configured as a Feed Forward Controller by defining channel 2 as mA.
          - OH%
          - OL%
          - (if CH1 = CL, CD) if CH1 = pH, mV
          - TATP Deadband
          - K
          - ATT.
          - Cycle

- Output Settings
  - Channel
    - 0-20/4-20
    - Out Zero
    - Out Span
- Alarms
  - Channel
    - Low Alarm
    - High Alarm
    - Deadband

- **Calibration**
  - Channel
    - S.P.C. (pH)
    - Calibration P1
    - Calibration P2
      - In Air (Dissolved Oxygen)
      - In Water (Dissolved Oxygen)

- **Channel Definition**
  - Channel
    - F
    - Cl
      - KC4000 cell
      - Cl probe (mA)
        - CH2
          - MODE PID[1]
          - MODE TX[1]
            - T
              - Independant
              - To 1st channel
          - 4mA
          - 20mA
    - CD
    - T
      - (2 or 3 channel units) Independant
      - Equal to 1st channel
    - Br
    - mA
      - MODE PID[1]
      - MODE TX[1]
        - UNITS AVAILABLE: mA, %, ppm, mg/l, gr/h, l/s, l/h, m3/h, °C, °F, µS, mS, Kpa, Mpa, PSI, GPM, GPD, MGD, NTU, FTU, m, ft, in
          - 4mA
          - 20mA
    - pH
    - mV
    - O2
    - O3

NOTE 1: ONLY APPEARS ON CHANNEL 2.
SEE SECTION 5.2.2.2.

MODE PID ALLOWS INSTRUMENT TO ADJUST CONTROL SIGNAL BASED ON FLOW RATE AND THE MEASURED VALUE OF THE PROCESS.

MODE TX ALLOWS THE MEASUREMENT OF THE OTHER UNITS AVAILABLE WHEN CHANNEL 2 IS DEFINITED AS mA.

12.5 APPENDIX E - Swimming pool Controller –Software Menu Tree-

- **Menu**
  - Configuration
    - Language
      - Italian
      - English
      - French
      - German
      - Spanish
    - Password
      - 00000 (Default)
    - Serial Link
      - Address
      - Baud Rate
      - Serial Port
    - Cleaning
      - Activate
        - No
        - Yes
          - T17AU or T17SU
            - T17SU
            - T17AU
              - Cleaning T1
              - Cleaning T2
              - Cleaning T3
              - Cleaning T4
    - Temp Select
      - C
      - F
    - Temp Set
      - 20.00
    - OR CCI
      - No
        Yes
        Off
    - Smoothing
      - Channel
        - 1.00
    - Digital I/O Set
      - Digital Outputs
        - Channel
          - NO
          - NC
      - Digital Inputs
        - Channel
          - NO
          - NC
    - Instrument Test
      - Keyboard Test
      - Display Test
      - Digital I/O
        - Input Signals
        - Output Signals
      - Analog I/O
        - Input Signals
          - Channel
        - Output Signals
          - Channel
      - Electric Calib. (factory use only)

12.5 APPENDIX E – (continued)

- **Controller**
  - PID 1
    - 4-20/Contacts
      - Contacts
      - 4-20
    - PB
    - TR m/r
    - MR%
    - TD m
    - PV
    - SP
    - CZ
    - RSW D/R
      - Reverse
      - Direct
    - Span
    - OH%
    - OL%
    - Deadband
  - PID 2
    - 4-20/Contacts
      - Contacts
      - 4-20
    - PB
    - TR m/r
    - MR%
    - TD m
    - PV
    - SP
    - CZ
    - RSW D/R
      - Reverse
      - Direct
    - Span
    - OH%
    - OL%
    - PID1 Chlorine
      - TATP
        - yes
        - no
      - K
      - ATT.
      - Cycle
  - PID 1
    - 4-20/Contacts
      - Contacts
      - 4-20
    - PV
    - SP
    - RSW D/R
    - SPAN
    - pH Deadband
    - Digital Ouputs
      - Relays
        - Gain
        - DZ
        - Time Cycle sec
      - Frequency
        - Gain
        - Low Limit
        - Number of Pulses
  - PID 2
    - 4-20/Contacts
      - Contacts
      - 4-20
    - PV
    - SP
    - RSW D/R
    - SPAN
    - pH Deadband
    - Digital Ouputs
      - Relays
        - Gain
        - DZ
        - Time Cycle sec
      - Frequency
        - Gain
        - Low Limit
        - Number of Pulses
- Output Settings
  - 0-20/4-20
  - Out Zero
  - Out Span
- Alarms
  - Channel
    - Low Alarm
    - High Alarm
    - Deadband

- **Channel Definition**
  - Channel 1
    - pH
  - Channel 2
    - Cl
      - KC4000 cell
      - Cl probe (mA)
        - 4mA
        - 20mA
    - mV
    - Temperature (2 or 3 channel units only)
      - Independent
      - Equal to 1st

- **Calibration**
  - Channel
    - S.P.C. (pH)
    - Calibration P1
    - Calibration P2
      - In Air (Dissolved Oxygen)
      - In Water (Dissolved Oxygen)

Design improvements may be made without notice.
Represented By:

Severn Trent Services
3000 Advance Lane Colmar, PA 18915
Tel: +1 215 997 4000 • Fax: +1 215 997 4062
Web: www.severntrentservices.com
E-mail: marketing@severntrentservices.com

3.6 Recorder

invensys
Eurotherm

nanodac™
User Guide

nanodac™ recorder/controller
Versions 5.00 and later

HA030554/8
February 2014

Restriction of Hazardous Substances (RoHS)

Product group nanodac

Table listing restricted substances

Chinese

限制使用材料一览表

产品 nanoDAC	有毒有害物质或元素					
	铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
印刷线路板组件	X	O	O	O	O	O
附属物	O	O	O	O	O	O
显示器	X	O	X	O	O	O
O	表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006标准规定的限量要求以下。					
X	表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。					

English

Restricted Materials Table

Product nanoDAC	Toxic and hazardous substances and elements					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
PCBA	X	O	O	O	O	O
Enclosure	O	O	O	O	O	O
Display	X	O	X	O	O	O
O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.					
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.					

Approval

Name:	Position:	Signature:	Date:
Kevin Shaw	R&D Director	K Shaw	24th July 2013

nanodac Recorder/Controller

User Guide

List of sections

Associated documents

HA028838 Printable version of iTools Help
HA025464 EMC installation guidelines
HA027962 Printable version of 'Review' Help

Application notes

HA030817U001 Archiving data from the nanodac recorder/controller
HA030817U002 Heat/Cool with carbon potential or oxygen level monitoring
HA030817U003 Heat only temperature control and carbon potential control
HA030817U004 Virtual channels using the nanodac recorder/controller.

Software effectivity

This manual refers to instruments fitted with software version 5.0.
Software versions 2.20 onwards are 'backwards compatible' so that it can be used on all hardware versions of the unit.
Previous software versions are not compatible with instruments with hardware status greater than 2.
The status level may be found on the instrument label and consists of a letter indicating software status followed by a numeral indicating the hardware status (e.g. 'B2')

nanodac Recorder/Controller

User Guide

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SAFETY NOTES

WARNINGS

1. Any interruption of the protective conductor inside or outside the apparatus, or disconnection of the protective earth terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.
2. Live sensors: The unit is designed to operate if the temperature sensor is connected directly to an electrical heating element. It must be ensured that service personnel do not touch connections to such inputs whilst the inputs are live. With live sensors, all cables, connections and switches for connecting the sensor must be mains rated for use in 240V Cat II.
3. Grounding the temperature sensor shield: Where it is common practice to replace the temperature sensor whilst the instrument is live, it is recommended that the shield of the temperature sensor be grounded to safety earth, as an additional protection against electric shock.
4. The instrument must not be wired to a three-phase supply with an unearthed star connection, because, under fault conditions, such a supply could rise above 240V RMS with respect to ground, thus rendering the instrument unsafe.

Notes:

1. Safety requirements for permanently connected equipment state:
   a. A switch or circuit breaker shall be included in the building installation.
   b. It shall be in close proximity to the equipment and within easy reach of the operator.
   c. It shall be marked as the disconnecting device for the equipment.
2. Recommended external fuse ratings are: 2A Type T 250V.

1. This instrument is intended for industrial temperature and process control applications within the requirements of the European directives on safety and EMC.
2. Installation may be carried out only by qualified personnel.
3. To prevent hands or metal tools coming into contact with parts that are electrically live the instrument must be installed in an enclosure.
4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the enclosure.
5. The mains supply fuse within the power supply is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.
6. Whenever it is likely that protection has been impaired, the unit shall be made inoperative, and secured against accidental operation. The manufacturer's nearest service centre should be contacted for advice.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
8. The unit must be wired according to the instructions in this manual.
9. Before any other connection is made, the protective earth terminal shall be connected to a protective conductor. The mains (supply voltage) wiring must be terminated in such a way that, should it slip, the Earth wire would be the last wire to become disconnected. The protective earth terminal must remain connected (even if the equipment is isolated from the mains supply), if any of the I/O circuits are connected to hazardous voltages*.
   The protective earth connection must always be the first to be connected and the last to be disconnected.
   Wiring must comply with all local wiring regulations, e.g. in the UK, the latest IEEE wiring regulations (BS7671) and in the USA, NEC class 1 wiring methods.
10. Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring.

* A full definition of 'Hazardous' voltages appears under 'Hazardous live' in BS EN61010. Briefly, under normal operating conditions, hazardous voltages are defined as being > 30V RMS (42.2V peak) or > 60V dc.

SAFETY NOTES (Cont.)

11. The maximum continuous voltage applied between any of the following terminals must not exceed 240Vac.
    1. Relay output to logic, dc or sensor input connections
    2. Any connection to ground.

    The ac supply must not be connected to sensor input or low-level inputs or outputs.
12. Over temperature protection: A separate over-temperature protection unit (with an independent temperature sensor) should be fitted to isolate the process heating circuit should a fault condition arise.

    Alarm relays within the recorder/controller do not give protection under all fault conditions/
13. In order to allow the power supply capacitors to discharge to a safe voltage, the supply must be disconnected at least two minutes before the instrument is removed from its sleeve. The touching of the exposed electronics of an instrument which has been removed from its sleeve should be avoided.
14. Instrument labels may be cleaned using iso-propyl alcohol, or water or water-based products. A mild soap solution may be used to clean other exterior surfaces.

USB DEVICE PRECAUTIONS

Note: the use of U3 USB Flash drives is not recommended.

1. Precautions against electrostatic discharge should be taken when the instrument terminals are being accessed. The USB and Ethernet connections are particularly vulnerable.
2. Ideally, the USB device should be plugged directly into the instrument, as the use of extension leads may compromise the instrument's ESD compliance. Where the instrument is being used in an electrically 'noisy' environment however, it is recommended that the user brings the USB socket to the front of the panel using a short extension lead. This is because the USB may 'lock up' or reset in noisy environments and the only means of recovery is to remove the device, then re-insert it. For memory sticks, EMC-related failure during a write operation might cause corruption of the data held on the stick. For this reason, the data on the memory stick should be backed up before insertion and checked after removal.
3. When using a USB extension cable, a high quality screened cable must be used. The total length of USB cable between the device and the USB port must not exceed 3 metres (10 ft.)
4. Most barcode readers and keyboards are not designed for use in industrial EMC environments, and their operation in such environments may result in impaired performance of the recorder/controller.

32-BIT RESOLUTION

Floating point values are stored in IEEE 32-bit single precision format. Values which require greater resolution than is available in this format are rounded up or down.

SYMBOLS USED ON THE RECORDER LABELLING

One or more of the symbols below may appear as a part of the recorder labelling.

	Refer to manual for instructions		Risk of electric shock
CE	This unit is CE approved		Precautions against static electrical discharge must be taken when handling this unit
	C-Tick mark for Australia (ACA) and New Zealand (RSM)		Ethernet connector
c UL US LISTED	Underwriters laboratories listed mark for Canada and the U.S.A.		USB connector
40	For environmental reasons, this unit must be recycled before its age exceeds the number of years shown in the circle.		Protective conductive terminal (Safety Earth)

1 INTRODUCTION

This document describes the installation, operation and configuration of a paperless graphic recorder/controller. The instrument comes, as standard with four input channels and is equipped, for secure archiving via FTP transfer and/or to USB memory stick.

1.1 UNPACKING THE INSTRUMENT

The instrument is despatched in a special pack, designed to give adequate protection during transit. Should the outer box show signs of damage, it should be opened immediately, and the contents examined. If there is evidence of damage, the instrument should not be operated and the local representative contacted for instructions. After the instrument has been removed from its packing, the packing should be examined to ensure that all accessories and documentation have been removed. The packing should then be stored against future transport requirements.

2 INSTALLATION

CAUTION

Before installation, ensure that the specified instrument supply voltage matches the facility supply.

2.1 MECHANICAL INSTALLATION

Figure 2.1.1 gives installation details.

2.1.1 Installation Procedure

1. If it is not already in place, fit the IP65 sealing gasket behind the front bezel of the instrument.
2. Insert the instrument through the panel cutout, from the front of the panel.
3. Spring the retaining clips into place, and secure the instrument by holding it firmly in place whilst pushing both clips towards the rear face of the panel.
4. The protective membrane can now be removed from the display.

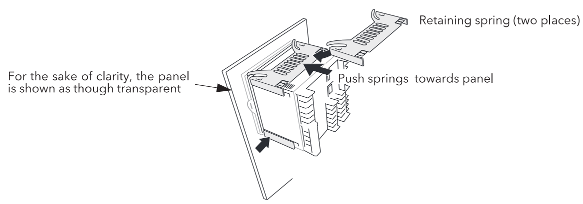


Figure 2.1.1 Securing the Instrument

2.1.2 Demounting

WARNING

Before removing the supply voltage wiring, isolate the supply voltage and secure it against unintended operation.

1. Isolate the mains supply and secure it against accidental operation. Remove all wiring and the USB device and Ethernet cable (if any).
2. Remove the retaining springs by unhooking them from the sides using a small flat-blade screwdriver.
3. Pull the instrument forwards out of the panel.

2.1.3 Removing the Instrument from its Sleeve

The instrument is designed to be removed from its sleeve from the front panel. However, if a USB memory stick or the Ethernet cable is fitted then this must be removed first.

When the instrument is shipped from the factory it is fitted with two small red clips, one in the top side of the sleeve and the other below. These are intended as a safeguard against removal of the instrument from its sleeve when an Ethernet cable is fitted. These clips must also be removed, using a small screwdriver, before the instrument can be taken out of its sleeve.

Ease the latching ears (Figure 2.1) outwards and pull the controller forward.

When plugging back in ensure that the latching ears click into place to maintain the panel sealing.

2 Mechanical Installation (Cont.)

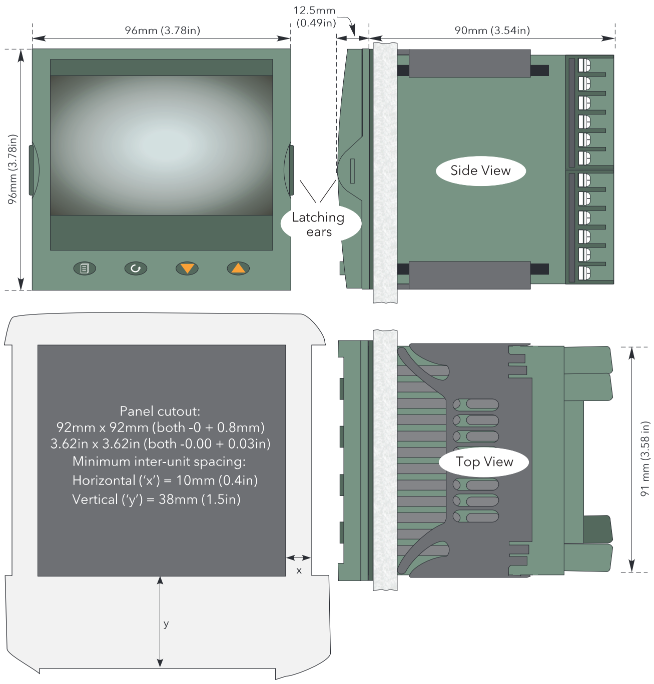


Figure 2.1a Mechanical installation details (standard case)

2 Mechanical Installation (Cont.)

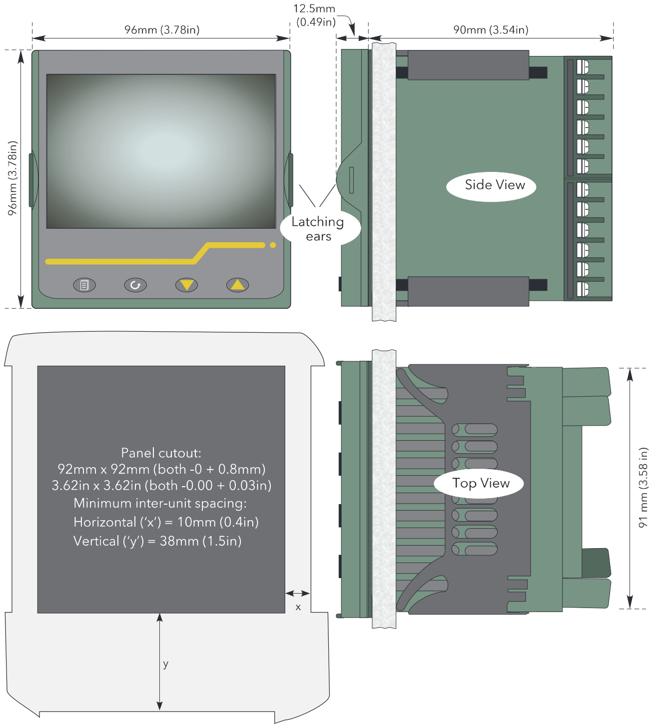


Figure 2.1a Mechanical installation details (wash down case option)

2.2 ELECTRICAL INSTALLATION

Figure 2.2 shows the locations of the various user terminations along with signal and supply wiring pinouts.

2.2.1 Termination details

The screw terminals accept single wires in the range 0.21 to 2.08 mm^2 (24 to 14 AWG) inclusive, or two wires each in the range 0.21 to 1.31 mm^2 (24 to 16 AWG) inclusive.

Screw terminals should be tightened to a torque not exceeding 0.4Nm (3.54 lb in)

2.1 ELECTRICAL INSTALLATION (Cont.)

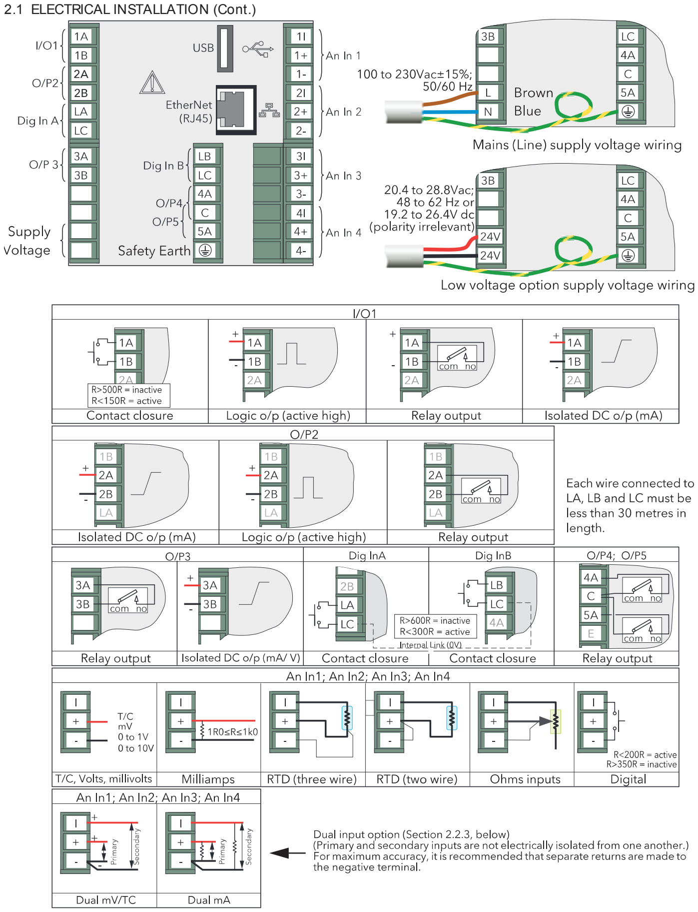


Figure 2.2 Connector locations and pinouts (rear panel)

2.2.2 Low Voltage Option

This option allows the use of a low voltage ac or dc 24 V supply. The specification in Appendix A gives full details. The polarity of the dc supply connection is not important - it may be connected either way round.

2.2.3 Dual Input Option

This is a cost option, enabled on a channel-by-channel basis by means of entering the relevant password in the 'Feature3 Pass' field in Instrument.Security menu described in Section 4.1.6.

For each enabled channel, a pair of thermocouple, mV or mA inputs can be connected to the instrument. These inputs are called 'primary' and 'secondary', and are terminated at the analogue input terminals (An In1 to An In 4) as shown in 'figure 2.2, above. The primary inputs 1 to 4 are assigned to channels 1 to 4, as normal. Each secondary input must be soft wired to a maths channel configured as Operation = 'Copy' if it is to be recorded/displayed/alarmed etc.

> Note: Due to the nature of the input circuit, a large offset may appear for secondary thermocouple inputs. This offset can be removed only by using the input adjust feature described in Section 4.1.9 Because of this offset, the dual thermocouple input option is not suitable for AMS2750D applications

Soft wiring is described in Section 7
Maths channels are described in Section 4.5.1
Channel configuration is described in Section 4.4.1
Input adjust is carried out as described in Section 4.1.9

SAMPLE RATE

For dual input channels, both primary and secondary sample rate is reduced to 4 Hz (250ms) from the normal 8Hz (125ms).

SENSOR BREAK DETECTION

Input sensor break detection is not supported for secondary inputs. The internal circuit acts as a 'pull up' on the secondary input which therefore saturates high in the event of a sensor break.

DUAL MILLIAMP OFFSET CORRECTION

If 'Dual mA' is selected as input type, then an automatic offset correction will be made, according to the shunt value entered in channel configuration.

INPUT RANGE LIMITATION

There is no 10V range associated with the secondary input. Any input greater than +2V or less than -2V is deemed to be 'bad range'.

2.2.4 Modbus Master communications

The master instrument can be connected directly to up to two slaves using standard ethernet network cable either directly (single slave only) or via a hub or switch (one or two slaves). In either case, 'straight through' or 'crossover' cable may be used. The cable is terminated at the RJ45 socket at the rear of the unit.

2.2.5 EtherNet/IP

The Client and Server are connected in the same way as described above for Modbus Master communications, except that there can be only one client and one server.

3 OPERATION

On power up a default or custom splash screen appears and remains visible whilst the unit is initialising. If during this process a network broadcast storm is detected, the unit stops, displaying a network failure icon until the broadcast storm has cleared, after which the initialisation process resumes.

3.1 INTRODUCTION

The operator interface consists of a display screen and four push buttons.

3.1.1 Display Screen

The display screen is used both to display channel information (in one of a number of display modes), and to display the various configuration screens which allow the user to setup the recorder to display the required channels, to set up alarms and so on. Display modes are described in Section 3.4 below; configuration is described in Section 4.

In display mode, the screen is split horizontally into three areas (figure 3.1.1)

1. a faceplate giving channel details.
2. the main display screen showing channel traces etc.
3. the status area, displaying instrument name, the current time and date and any system icons.

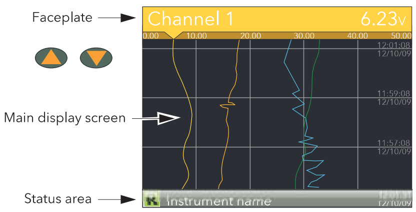


Figure 3.1.1 Display mode screen (vertical trend)

In configuration mode, the entire display screen is devoted to the selected configuration menu.

3.1.2 Navigation Pushbuttons

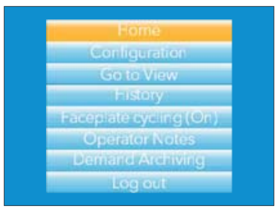


Figure 3.1.2 Top level menu (Engineer level access)

There are four navigation buttons, called 'Page', 'Scroll', 'Lower' and 'Raise' located below the screen. The general properties of these buttons are described in the remainder of this section, but some have additional, context sensitive functions, which, for the sake of clarity are not described here but in the relevant sections (e.g. 'Message summary') of the manual.

3.1.2 Navigation Pushbuttons (Cont.)

PAGE BUTTON

From any non-configuration page, pressing this push button causes the top level menu (figure 3.1.2) to appear. The figure shows the menu for a user logged in with 'Engineer' level access. Other access levels may have fewer menu items.

Within configuration pages, the Scroll button can be used as an enter key to select lower menu levels. In such cases the page button is used to reverse this action, moving the user up one menu level per operation.

SCROLL BUTTON

From trending pages, operation of the scroll push-button scrolls through the channels enabled in the group. The Faceplate cycling 'Off' selection can be used to keep a particular channel permanently displayed, and the scroll pushbuttons can then be used to select channels manually.

In configuration pages, the scroll key operates as an 'enter' key to enter the next menu level associated with the highlighted item. Once the lowest menu level is reached, operation of the scroll key allows the value of the selected item to be edited by the relevant means (for example, the raise/lower keys, or a keyboard entry).

The 'Page' key is used to move the user back up the menu structure, until the top level menu is reached, when the scroll key can be used again to return to the Home page.

The scroll button is also used to initiate user wiring as described in Section 7.

RAISE/LOWER BUTTONS

Within trending displays, the Raise and Lower keys can be used to scroll through the enabled display modes in the sequence: vertical trend, horizontal trend, vertical bargraph, horizontal bargraph, numeric, vertical trend... and so on.

Within configuration pages, these pushbuttons act as cursor keys, allowing, for example, the user to highlight menu items for selection using the scroll button, and in many cases allowing the user to select one from a number of alternative values within menu items. These keys are also used to navigate through the virtual keyboards (Section 3.6) and number pads used to enter text or numeric strings.

3.1.3 On Screen Help

The top level configuration menu includes contextual help text on the right-hand half of the screen. Mostly this text fits within on screen height. Where this is not the case, the text can be moved up or down the screen by holding the Page button operated whilst using the up and down arrows to move the text.

The down arrow moves the text upwards on the screen; the up arrow moves it downwards.

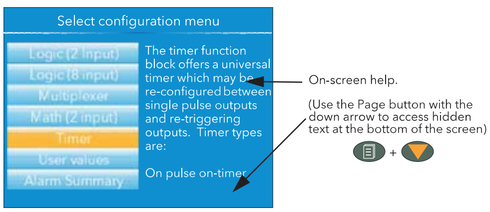


Figure 3.1.3 On-screen help (typical)

3.2 PROCESS VARIABLE DISPLAY

As discussed above, the operator interface consists of a display screen and associated push buttons. The display screen shows process variables in one of a number of formats, or operational details (notes or alarm history for example), or configuration details for use in setting up the recorder to produce the required displays and history formats. The remainder of section three discusses the process variable displays, alarm displays and so on; configuration details are to be found in Section 4.

Note: Some of the items below can be selected for use only by users with a suitable permission level as set up in the 'Instrument' 'Security' menu described in Section 4.1.6.

Figure 3.2 below, depicts a typical trend display and gives details of the various areas of the display page.

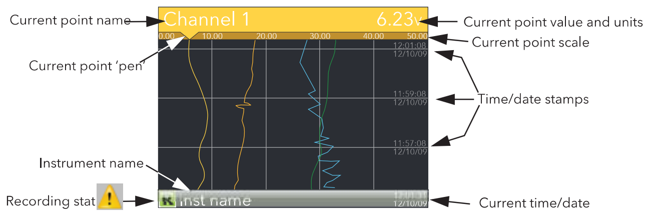


Figure 3.2 Typical display screen (Vertical trend)

Figure 3.2 shows a vertical trend page. Operating the Raise/Lower push-buttons allows the user to scroll through the other display modes: Horizontal trend, Vertical bargraph, horizontal bargraph, numeric, vertical trend... and so on. All these display modes are described in Section 3.4, below.

A display mode can also be selected from the Top level menu 'Go To View' item which appears when the 'Page' key is operated.

The scroll button can be used to scroll through the points in the group, overriding the 'Faceplate Cycling' on or off selection

3.2.1 Alarm Icons

Notes:

1. A full discussion of alarms is given in the Channel Configuration section of this manual (Section 4.4.3)
2. Trigger alarms do not display threshold marks or bars, or faceplate symbols

The alarm icons shown below appear in some display modes. The icons on a channel faceplate show the status of that channel's alarm(s), as follows:

Icon is flashing	alarm is active but unacknowledged or it is an Auto alarm which is no longer active but which has not been acknowledged
Icon steadily illuminated	the alarm is active and has been acknowledged.

Alarm thresholds and deviation alarm bars appear for horizontal and vertical trend modes. For deviation bars, the bar stretches from (Reference - Deviation) to (Reference + Deviation). Vertical and Horizontal bargraph modes display only absolute alarm symbols.

3.2.1 Alarm Icons (Cont.)

Absolute High
Absolute Low
Deviation High
Deviation Low
Deviation Band
Rising Rate of change
Falling Rate of change
Digital High
Digital Low

Table 3.2.1 Alarm icons

3.2.2 Status Bar Icons

The following items can appear in a dedicated window immediately to the left of the time and date, at the bottom right-hand corner of the display. The width of this window expands as the number of icons increases, and the instrument name is truncated, as necessary, to make room.

SYSTEM ALARMS

This indicator appears, flashing, if any one or more of the alarms listed below is active. The System Alarms summary page (accessed from 'Go to View in the top level menu) allows the user to view such system alarms as are active. It is not possible to 'acknowledge' system alarms

Archive Disabled	An unattended archiving strategy has temporarily been disabled.
Archiving Failed	An unattended archiving strategy has failed to complete.
Archiving Timeout	A configured archiving strategy has timed out.
Battery failure	Indicates that the battery is approaching the end of its useful life, or that it is missing or is completely exhausted. Immediate battery replacement is recommended (Appendix C; section C1).
Broadcast Storm detected	Networking is limited until the storm has passed.
Clock failure	The internal clock was found to be corrupt at power up, or that the time has never been set. Time is forced to 00:00 1/1/1900. Can be caused by battery failure, in which case a battery failure message appears. The error is cleared by setting the time and date.
Channel error	Indicates a hardware failure in the channel circuit or in the internal cold junction temperature measurement.
Database failure	Corrupted EEPROM or flash memory.
DHCP Server failure	For units with 'IP Type' set to 'DHCP' (Network.Interface configuration) this alarm occurs if the instrument is unable to obtain an IP address from the server.
FTP Archiving file lost	A file has been deleted that had not yet been archived. Possible causes: Communications with the server could not be established,; archive is disabled; archive rate too slow.
FTP Archiving to slow	The archive rate is too slow to prevent the internal memory from overflowing. The recorder effectively switches to 'Automatic' (Section 4.2.2) to ensure that data is not lost.

(Continued)

3.2.2 Status Bar Icons (Cont.)

FTP Primary Server Failure	This error occurs if the recorder fails to establish connection with the primary server, after two attempts. After the second attempt fails, the recorder attempts to establish connection with the secondary server instead. Primary and secondary server details are entered in the Network. Archiving area of configuration (Section 4.2.2).
FTP Secondary Server Failure	This error occurs if the recorder fails to establish connection with the secondary server, after two attempts. Primary and secondary server details are entered in the Network.Archiving area of configuration (Section 4.2.2).
Maths channel failure	Appears if, for example, the divisor of a divide function is zero.
Media archiving lost	A file has been deleted that had not yet been archived. Possible causes: Memory stick missing, full or write protected; archiving has been disabled; archiving rate too slow.
Media archiving to slow	The archive rate is too slow to prevent the internal memory from overflowing. The recorder effectively switches to 'Automatic' (Section 4.2.2) to ensure that data is not lost.
Media full	Archive storage device is full. The alarm becomes active only when an archive is in progress.
Media missing	No archive storage device present when archive attempted.
Non-volatile memory failure	RAM copy of non-volatile parameters is corrupted.
Non-volatile Write Frequency warning	One or more parameters are being written frequently to non-volatile memory. If this continues, it may lead to 'memory depletion' (i.e. the memory will no longer be able to store values correctly). A common cause of this problem is frequent writes over Modbus comms.
Recording failure (message)	Message explains reason for failure.
USB overcurrent	USB power fault - too much current (i.e. >100mA) is being drawn by a USB device.
Wiring failure	The user wiring has failed to verify, i.e. one or more wires has been detected that does not have both a source and a destination defined. This may be the result, for example, of power loss during a download from iTools.

CHANNEL ALARM

This indicator appears if any channel (including channels not in the display group) is in an alarm state. The symbol is illuminated continuously if all alarms are acknowledged or flashes if any one or more alarms is unacknowledged. Alarms are acknowledged from the Root menu 'Alarm summary' item as described in Section 3.3.3 or in the Channel configuration area (Section 4.4.3) if the user's access permission is appropriate.

USB

This icon appears whenever a memory stick (max. capacity 8GB) or other supported USB device (Section 8) is plugged into the USB port at the rear of the recorder.

When data transfer is in progress between the instrument and the memory stick, the icon changes to a 'busy' version.

CAUTION

The Memory stick must not be removed while archiving (demand or automatic) is in progress, as to do so may irreparably damage the file system of the memory stick, rendering it unusable. It is recommended that all archiving be suspended before the memory stick is removed.

Memory stick fitted

Transfer in progress

FTP ICON

The FTP icon appears whenever transfer activity is taking place.

3.2.2 Status Bar Icons (Cont.)

RECORD ICON

One of four icons appears at the bottom left corner of the display to indicate recording status.

Record

This indicates that the recorder is recording the items selected in the Group Recording area of configuration (Section 4.3).

Stopped

This means that 'Enable' has been set to 'no' in the Group Recording area of configuration (Section 4.3). Trending is not affected.

Paused (Suspended)

This means that recording has been paused by a wire to the Suspend parameter (Group Recording area of configuration (Section 4.3) going true (high). Trending is not affected.

In Configuration

The recorder has been placed in configuration mode either at the user interface, or via iTools. Recording is stopped until the recorder is no longer in configuration mode. For each non-recording state (Stopped, Paused or In Configuration). A new history file is created when the unit comes out of configuration mode.

Note: For recording to be enabled, configuration status must be 'logged out' both at the instrument and at iTools.

MESSAGE ICON

This 'envelope' icon appears when a message is generated and it remains on display until the Message Summary is accessed, when it is removed from the display until the next new message is generated.

AUTOTUNE ICON 

For instruments fitted with the Loop option, this symbol appears during the Autotune process.

3.2.3 Breaks in recording

Breaks in recording can be caused by the unit being powered down, by the user entering configuration mode or when the recorder time is changed manually. In vertical and horizontal trend modes, a line is drawn across the width/height of the chart to indicate that recording has been interrupted.

On power up, a red line is drawn across the chart. In 'History', if messages are enabled the message:

`Date Time System power up`

is printed on the chart, together with the configuration and security revisions.

On exiting configuration mode, a blue line is drawn on the chart and in 'History', if messages are enabled, the messages:

`Date Time Logged out.`

`Date Time Config Revision: N was N-1` (assuming a configuration change was made)

`Date Time Logged in as: Engineer`

appear on the chart.

When the instrument time is changed (manually - not through daylight saving action) a green line is drawn on the chart and in 'History', if messages are enabled, the message:

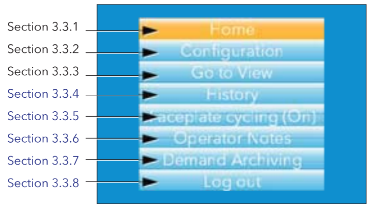
`Date Time Time/Date changed`

appears on the chart.

3.3 TOP LEVEL MENU

This menu appears when the page key is operated from any non-configuration page. The menu items displayed depend on the access permission of the user. One of the menu items is highlighted, and if the scroll key is operated, then it is the highlighted item that is 'entered'.

Figure 3.3 shows the top level menu for Engineer level access.



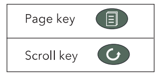


Figure 3.3 Top level menu

3.3.1 Home

Operating the scroll key whilst 'Home' is highlighted causes a return to the 'Home' page. By default, this is the vertical trend mode, but the mode can be changed in 'Instrument. Display' configuration (Section 4.1.3)

3.3.2 Configuration

Operating the down arrow key highlights the 'Configuration' item. Operating the Scroll key enters the configuration submenu described in Section 4of this manual.

Note: 'Configuration' appears only if the user has an appropriate access level.

3.3.3 Go to View

Operating the scroll key whilst the 'Go to view' item is highlighted, calls the Go to view submenu (figure 3.3.3a). This allows the user to view channel alarms, system alarms, messages or to select a different display mode.

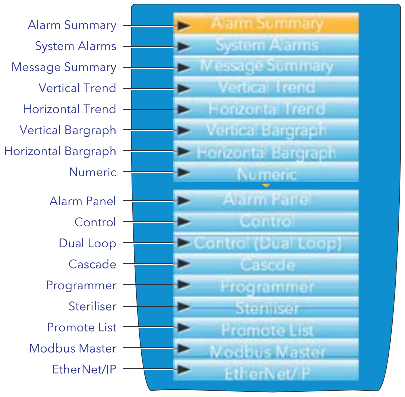


Figure 3.3.3a Go to view submenu

Notes:
1. If an option (e.g. 'Steriliser') is not fitted, its display mode does not appear in the list.
2. Some display modes must be enabled in Instrument. View configuration (Section 4.1.3) before they become available.

3.3.3 Go To View (Cont.)

ALARM SUMMARY

For each active alarm, this page displays the channel identifier with alarm number (e.g. C1(2) = channel 1; alarm 2), the channel descriptor, the alarm threshold the current process value and an alarm type symbol.

To return to the top level menu, operate the Page key.

Notes:
1. The background colour to the channel ID is the same as that chosen for the channel.
2. A prefix 'C' in the channel ID means that this is a measuring channel; A prefix 'V' means that this is a virtual channel (i.e. a totaliser, counter or maths channel)

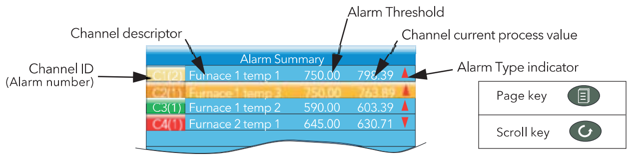
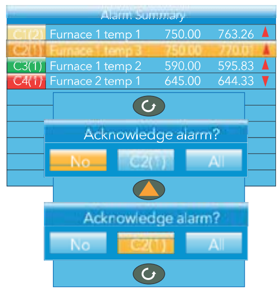


Figure 3.3.3b Alarm summary page with acknowledge confirmation display

ALARM ACKNOWLEDGEMENT

To acknowledge an alarm from this view:

1. Use the up and down arrows to highlight the required alarm
2. Operate the scroll button. The 'Acknowledge alarm' window appears.
3. Use the up arrow to highlight the relevant field (C2(1) in this example), or 'All' if all alarms are to be acknowledged.



4. Operate the scroll key to confirm. If the alarm fails to respond, this may be due to the fact that it has been configured as a 'Manual' alarm, and the trigger has not yet returned to a 'safe' (non-alarm) state, or it could be that the instrument is in a logged out state.

SYSTEM ALARMS

Operating the scroll button whilst the 'System Alarms' field is highlighted displays a list of all currently active system alarms. Section 3.2.2 contains a list of system alarms and their interpretations. To return to the top level menu, operate the Page key.

A further operation of the scroll button displays a 'Help Information' page, giving the reason for the highlighted alarm.

Operate the scroll button again to return to the system alarm display.

3.3.3 Go To View (Cont.)

MESSAGE SUMMARY

Operating the scroll key whilst the 'Message summary' field is highlighted displays the10 most recent messages.

Operating the scroll key whilst a message is highlighted shows the selected message in more detail (and using the up/down keys allows the other messages to be scrolled through). Whilst in this mode, operating the scroll key again, allows the user to choose to jump to the message's location in trend history mode (Section 3.5) or to return to the summary page.

By default, the interface is set up such that:

1. all message types are included
2. the up and down arrow keys cause the highlighted selection to move up or down by one message at a time.

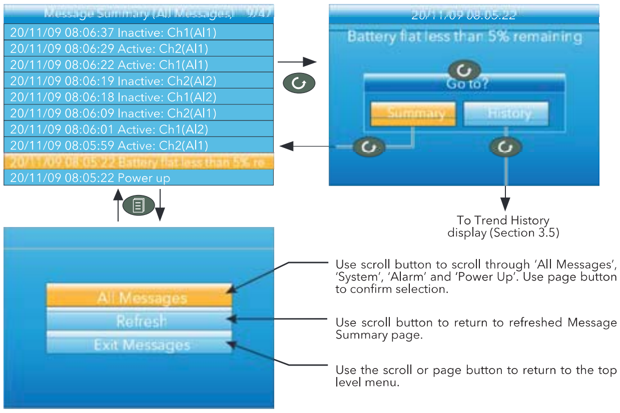


Figure 3.3.3c Message summary features

MESSAGE FILTERS

All Messages	Causes all messages to be displayed on the screen.
System	Shows only system alarms
Alarm	Shows only channel alarms
Power up	Shows only power up messages
Login/out	Limits the display to Log in and Log out events.

3.3.3 Go To View (Cont.)

DISPLAY MODE SELECTION

Use the up/down arrow buttons to highlight the required display mode. Once the required display mode is highlighted, operation of the scroll button causes the recorder to leave the 'Go to View' menu and to display channel values in the selected mode. See Section 3.4 for a description of the various display modes.

Alternatively the up and down arrow buttons can be used from any of the display modes to cycle through the available modes in the order listed in the figure.

Notes:
1. If an option (e.g. 'Steriliser') is not fitted, its display mode is not available for selection.
2. Some display modes must be enabled in Instrument. Display configuration (Section 4.1.3) before they become available.

3.3.4 History

This top level menu item allows the user to switch from real-time trending to review mode, where channel values, messages, alarm triggers etc. can be viewed back as far as the last significant con.figuration change. History mode is fully discussed in Section 3.5.

3.3.5 Faceplate Cycling on/off

For the purposes of this document the channel whose faceplate is currently displayed and whose 'pen' symbol is visible is called the 'Active' channel.

By default, the recorder scrolls through all the channels in the display group, with each channel becoming the active channel in turn. This top level menu 'Faceplate Cycling' item allows the user to inhibit this scrolling action such that the currently active channel remains active permanently, or until a manual scroll is performed using the scroll button (or until Faceplate Cycling is re-enabled).

'Faceplate Cycling' is highlighted by using the up/down arrow buttons. Once highlighted, the status can be changed from 'On' to 'Off' or vice-versa using the scroll button. Operation of the 'Page' button returns the user to the trend display.

3.3.6 Operator Notes

This area allows up to 10 notes to be created when logged in as Engineer, using either the text entry techniques described in Section 3.6, or 'iTools' described in Section 6. Once logged out, operating the scroll button whilst a note is highlighted calls a selection box allowing the user either to send that note to the chart, or to write a Custom Note.

CUSTOM NOTE

The Custom Note is written using the text entry techniques described in Section 3.6. Once the note is complete, operation of the page button calls a confirmation display. The down arrow is used to highlight 'Yes', and when the scroll key is then operated, the message is sent to the chart. This custom message is not retained for further use, so if it is required on a regular basis, it is suggested that one of the Operator Notes 1 to 10 be configured (Engineer access level required) so that it may be used instead.

Note: Each note can contain up to 100 characters.

3.3.7 Demand Archiving

This allows a user, with a high enough access level, to archive a selected portion of the recorder history, either to a 'memory stick' plugged into the USB port at the rear of the recorder (Local Archiving), or to a pc, by means of the FTP protocol (Remote Archiving). The archived data remains in the flash memory of the instrument. When the flash memory is full, new data causes the oldest file(s) to be discarded.

The up and down arrow keys are used to navigate to the required field.

3.3.7 Demand Archiving (Cont.)

ARCHIVE MENU

Figure 3.3.7 Demand Archiving menu (Local Archiving on left; Remote Archiving on right)

Archive To	With this item highlighted, the scroll button and the up/down arrows can be used to select 'USB' or 'FTP Server'. For 'USB', the archive will be made to the rear USB memory stick. For 'FTP Server' the archive will be made to the Primary or Secondary server (configured in the Network.Archive area of configuration described in Section 4.2.2. For more details about remote archiving, see 'Remote archiving', below.
Archive	In a similar way, select the archive period: None: No archiving to take place. (Not editable when logged out) Last Hour: Archives all files created within the last 60 minutes. Last Day: Archive all files created in the last 24 hours. Last Week: Archives all files created in the past seven days. Last Month: Archives all files created in the past 31 days. Archive All: Archives all the files in the recorder's history. Bring To Date: Archives all files created or updated since the 'Last Archive' date and time.
Suspend Schedule	When set to 'Yes', automatic (scheduled) archiving is stopped, once the transfer of the current file is complete. Suspend Schedule must be set to 'No' again, to restart the suspended archive. Suspend can be used to allow the memory stick to be removed and re-fitted safely.
Cancel All	When set to 'Yes', this cancels USB archiving activity immediately, or cancels FTP archiving once transfer of the current file (if any) is complete.
Last Archive	Shows the date and time at which the last archive (demand or automatic) was attempted. If a demand archive is requested, or is in operation when an automatic archive is triggered, the automatic archive takes precedence.
Status	For Archive to USB only 'Complete' means that no archiving is currently taking place. 'Transferring' indicates that an archiving is in progress. Accompanied by an animated circular display. 'Suspended' means that archiving has been suspended as requested.
PriStatus	For Archive to FTP Server only, this shows the transfer status between the instrument and the primary host computer.
SecStatus	For Archive to FTP Server only, this shows the transfer status between the instrument and the secondary host computer.

3.3.7 Demand Archiving (Cont.)

FTP SERVER ARCHIVING

This allows the archiving of recorder files to a remote computer via the RJ45 type connector at the rear of the recorder, either directly or via a network.

In order to carry out a successful transfer:

1. Details of the remote host must be entered in the Network.Archive area of configuration (Section 4.2.2).
2. The remote computer must be set up as an FTP server. Help from the user's IT department may be necessary in order to achieve this. Appendix C, Section C2 to this manual suggests one way, using Filezilla.
3. The remote computer must also be set up to respond to 'pings'. This is because the instrument pings the host whilst establishing connection, and if it does not receive a response the archive attempt fails.

When accessing files using Microsoft® Internet Explorer, the address (URL) field can be in one of two formats:

1. ftp://<instrument IP address>. This allows a user to log in as the anonymous user (if the recorder has any account with the user name set to 'anonymous' with a blank password.
2. ftp://<user name>:<password>@<instrument IP address> to log in as a specific user.

For IE5 users, Microsoft® Internet Explorer displays, by default, history files only. To quit the history folder, either uncheck the Tools/Internet Options/Advanced/Browsing/'Enable folder view for FTP sites' option, or check the Tools/Internet Options/Advanced/Browsing/'Use Web based FTP' option.

REVIEW SOFTWARE

'Review' is a proprietary software package which allows the user to extract 'archive' data from one or more suitable instruments* and to present this data on a host computer, as if on a chart, or as a spreadsheet. The host computer must be set up as an ftp server (see Appendix C section C2 for a description of one way of doing this).

As described in the Review help system, 'Review' allows the user to set up a regular transfer of data (using ftp) from connected instruments into a database on the pc, and then from this database to the chart or spreadsheet. The chart/spreadsheet can be configured to include one or more 'points' from one or all connected instruments (where a 'point' is an umbrella term for channel, totaliser, counter etc.).

It is also possible to archive instrument history files to a memory stick, Compact Flash card etc. (depending on instrument type) and to use this to transfer the data to the pc.

Each type of instrument has its own remote user name and password configuration - for this instrument, the user name and password are both 'history.

*Suitable instruments are connected instruments, the archive files of which have the suffix '.uhh'.

3.3.8 Login

Login allows the user to enter a password in order to gain access to areas of the unit's configuration which are not available when the user is logged out.

LOGGED OUT ACCESS LEVEL

Logged out mode allows the user to select viewing mode, to view history, to view alarms, to toggle faceplate cycling on and off, to send notes, to suspend/resume USB archiving and to access the login process.

OPERATOR ACCESS LEVEL

In addition to the logged out features, Operator access level allows the user to acknowledge alarms, to edit notes and to perform demand archive operations.

By default, no password is required in order to enter Operator level, but a password can be set either at Supervisor level or at Engineer level.

3.3.8 Login (Cont.)

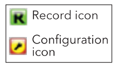
SUPERVISOR ACCESS LEVEL

In addition to the logged out level function, this access level allows the user to view the recorder's configuration, and to edit some values (such as alarm thresholds). By default, there is no password required to enter Supervisor level, but a password can be set in the Instrument area of configuration, either at Supervisor level or at Engineer level.

ENGINEER ACCESS LEVEL

This allows full access to all areas of the recorder configuration. The default password is 100, but this can be edited in the Instrument area of configuration (Section 4.1.5).

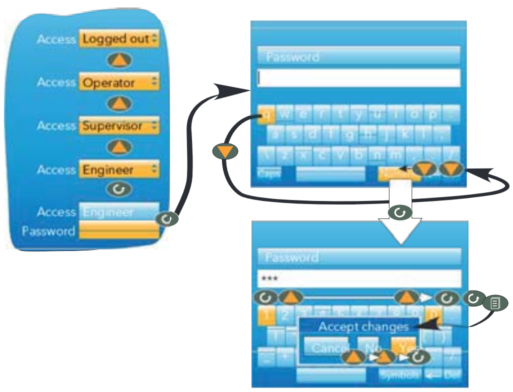
Note: recording is stopped for as long as the user is logged in at Engineer level, even if the recorder is not being configured. This is indicated by the Record icon at the bottom left corner of the process value display screen being replaced by the Configuration (wrench) icon.



LOGIN PROCEDURE

From the top level menu, use the up or down arrow keys as often as necessary in order to highlight 'Login', and then operate the Scroll key to produce the 'Access Logged out' display.

Note: this procedure describes how to login to an access level with a password associated with it. For non-password protected logins, the user needs only to select the required access level, and press the scroll key.



To log in as Engineer (password = 100):

1. Operate the up arrow key three times, to display 'Engineer'.
2. Press the scroll key to call the 'alpha' keyboard, with the letter 'q' highlighted.
3. Use the down arrow key three times to highlight 'Numeric'.
4. Operate the scroll key to display the numeric keyboard (numeral '1' highlighted.)

5. Operate the scroll key to enter '1', then use the up arrow key nine times to highlight numeral '0' and use the scroll key twice to enter '0' 0', completing the password of 100.
6. Use the Page key to call the confirmation display.
7. If the password entry is as required, use the up arrow twice (or the down arrow once) to highlight the word 'Yes' and operate the scroll key to confirm. The top level configuration menu appears. Otherwise, 'Cancel' can be used to clear the entry in order to start again, or 'No' can be used to quit login.

3.4 DISPLAY MODES

The following subsections describe the various display modes available to the user. By default, the 'Home' display mode is 'Vertical Trend', but this can be edited as a part of 'Instrument.Display' configuration. This configuration area also allows the user to disable one or more display modes should they not be required.

The current display mode can be chosen either by using the top level menu 'Go to View' item or, from any display mode, by scrolling through the enabled modes using the up or down arrow button.

Details of the various display modes are to be found in the following subsections:

3.4.1 Vertical Trend

In this mode, channel values are traced as though on a chart rolling downwards (i.e with the latest data at the top). The chart speed, and the number of major divisions are configured in the 'Group.Trend' area of configuration (Section 4.3.1). By default, the chart background is black, but this can be changed to white or grey in the 'Instrument' 'Display' area of configuration (Section 4.1.3).

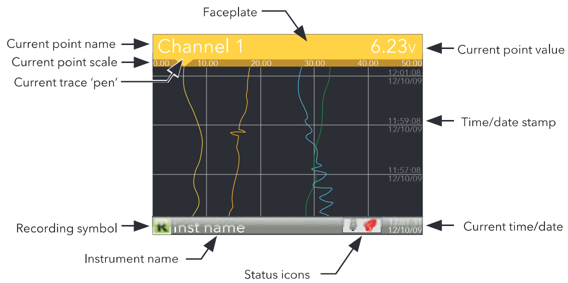


Figure 3.4 Vertical trend mode display elements

One of the channels is said to be the 'current' or 'scale' channel. This channel is identified by its pen icon being displayed, and by the channel descriptor, dynamic value and its scale being displayed on a 'faceplate' across the width of the display, above the chart.

Each channel in the Group becomes the 'current' channel in turn, for approximately five seconds -i.e. the channels are cycled through, starting with the lowest numbered channel. Once the final channel in the Group has ben displayed for five seconds, the first channel is returned-to and the process repeats. This scrolling behaviour can be enabled/disabled from the top level menu 'Faceplate Cycling (Off)' item described in Section 3.3.5.

The scroll button can be used to cycle through the channels manually in both Faceplate cycle on and off modes.

Use of the up arrow button causes the next enabled display mode to be entered (default = horizontal trend).

The page key calls the top level menu.

3.4.2 Horizontal Trend mode

This view is similar to the vertical trend mode described in section 3.4.1 above, except that the traces are produced horizontally rather than vertically. Initially, as each channel appears, its scale appears at the left edge of the display (as shown below), but in order to show the maximum amount of trend data, the scale is overwritten after a few seconds.

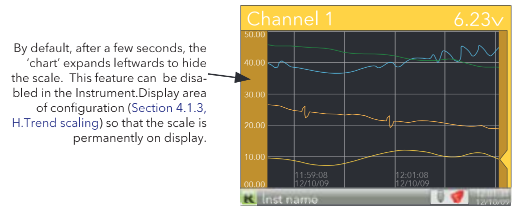


Figure 3.4.2 Horizontal trend display mode

Note: Timestamps appear to the right of the gridline to which they relate

Use of the up arrow button causes the next enabled display mode to be entered (default = vertical bar-graph). Use of the page key calls the top level menu.

3.4.3 Vertical Bargraph mode

This display mode shows the channel values as a histogram. Absolute alarm threshold values appear as lines across the bars, grey if the alarm is not triggered; red if the alarm is triggered. Alarm symbols appear for active alarms.

Bargraph widths for four to six channels divide the width of the display screen equally between them. For one and two channels, the width is fixed, and the bars are centred on the screen. Figure 3.4.3 shows some examples (not to the same scale).

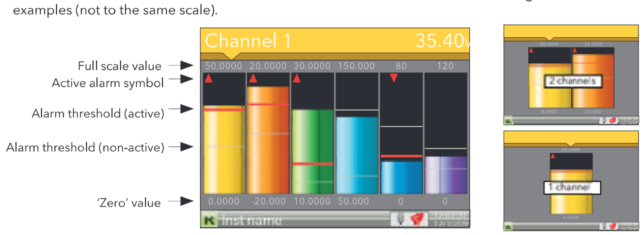


Figure 3.4.3 Vertical bargraph display mode

Use of the up arrow button causes the next enabled display mode to be entered (default = horizontal bar-graph). Use of the page key calls the top level menu.

3.4.4 Horizontal Bargraph mode

Similar to the Vertical bargraph mode described in Section 3.4.3, above, but includes channel descriptors.

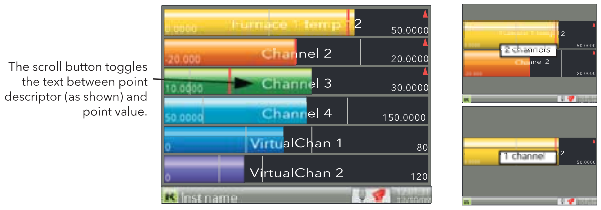


Figure 3.4.4 Horizontal bargraph mode

Use of the up arrow button causes the next enabled display mode to be entered (default = numeric).
Use of the page key calls the top level menu.

3.4.5 Numeric mode

Shows the enabled channels' values along with their descriptors and with indications of the type(s) of alarm configured for each channel.

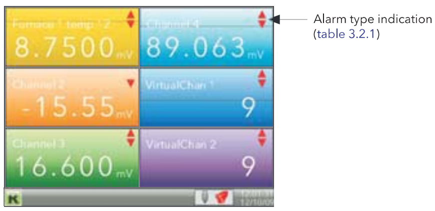


Figure 3.4.5a Numeric display mode (six enabled channels)

The figure above shows an example where the Trend group contains six channels. Figure 3.4.5b shows how the display appears for trend groups with fewer than six channels configured.

Figure 3.4.5b Display layout for different numbers of channels

The up arrow button returns to the vertical trend display mode; the page key calls the top level menu.

3.4.6 Alarm panel

This display appears only if enabled in the Instrument Display configuration (Section 4.1.3) Alarm panel mode shows current value and alarm status for each channel enabled in the Trend Group. The status is shown in two ways, by the colour of the relevant bar, and by the alarm status indicators.

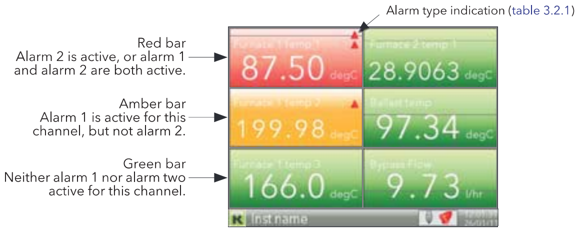


Figure 3.4.6a Alarm panel display (six channels)

The figure above shows an example where the Trend group contains six channels. Figure 3.4.6b shows how the display appears for trend groups with fewer than six channels configured.

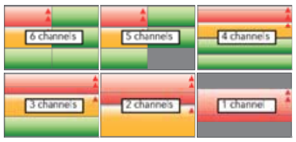


Figure 3.4.6b Alarm panel display layouts for trend groups with fewer than six channels

3.4.7 Control Loop1/Loop2

These displays appear only if the controller option is enabled (Section 4.1.6).

The loop display modes are interactive, in that the setpoint, the Auto/Manual mode and the Manual Output value can be edited from the user interface. Full configuration is carried out in the Loop setup menus (Section 4.6) and a fuller description of control loops is to be found as Appendix B to this manual.

Figure 3.4.7 depicts a single loop display and the dual loop display. The up and down arrow keys are used as normal to scroll through Loop1, Loop2 and Dual loop pages.

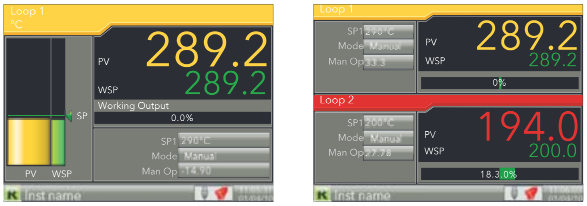


Figure 3.4.7 Loop displays

Note: The colours associated with the loops are those of the channels to which they are wired.

EDITING TECHNIQUES

1. With the loop page on display, operate the Scroll key. This highlights the first editable item (SP1). The scroll order includes both loop1 and loop 2 parameters in the dual loop display.

2. Use the up and down arrow keys to select the required field for editing. When the required field is highlighted, operate the scroll key again, to enter edit mode.

3. Use the up/down arrows to edit the current setting.

4. Operate the scroll key to confirm the edit.

5. Select a further parameter for editing, or operate the page key to return to normal operation.

Note: Edit permissions for Setpoint, Auto/Manual and Manual Output Access are set in the Loop Setup configuration menu (Section 4.6.2).

3.4.8 Cascade Display Mode

This display mode appears only if 'Cascade' has been enabled in the Instrument.Display area of configuration Section 4.1.3). See also Advanced Loop configuration (Section 4.7).

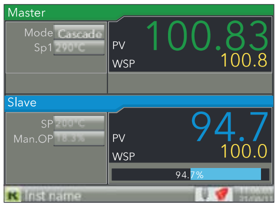


Figure 3.4.8a Cascade display mode

Operating the scroll button highlights the Master 'Mode' field. Operating the scroll button again, enters edit mode allowing the user to use the up/down arrow buttons to scroll through the available modes. Once the required mode appears, a further operation of the scroll button confirms the entry and quits edit mode.

Once out of edit mode, the down arrow key can be used to select Master 'SP1', Slave 'SP' and Slave 'Man OP'. The Mode selected determines how many of these items are editable by the operator.

Mode
: Cascade: The master loop is in auto mode and provides the slave setpoint. Changing modes causes the slave to switch to the local slave setpoint.
Slave: A simple single loop controlling with a local setpoint.
Manual: Provides a single manual % power output.

SP1
: Setpoint 1 is the primary setpoint of the controller. If the controller is in automatic control mode, then the difference between the setpoint and the process variable (PV) is continuously monitored by the control algorithm. The difference between the two is used to produce an output calculated to bring the PV to the setpoint as quickly as possible without causing overshoot.

SP
: The slave setpoint, either local (Manual or Slave mode) in which case it can be edited, or supplied by the master loop (Cascade mode), in which case it is not editable.

Man.OP
: The percentage output power to be applied when in Manual mode (100% = full on; 0% = off).

> Note: The default loop names ('Master' and 'Slave') can be replaced by user-entered strings of up to 10 characters in Advanced Loop Setup configuration (Section 4.7.2).

3.4.9 Programmer Display Mode

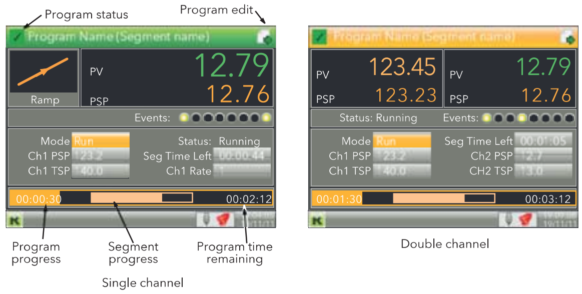


Figure 3.4.9a Programmer displays (typical)

This display mode (if enabled - see Section 4.1.3 allows the user to monitor the progress of a single or dual-channel setpoint program, and if logged-in as 'Operator*', to reset or run the program. The program itself is created in the Program edit page (described below) and in Programmer configuration (Section 4.8 or 'iTools').

*Note: Operator is the default access level - to edit, see ' Prog Mode Access' in Section 4.8.3)

The displays contain the following features:

Program name: This is the name of the loaded program. If the program has been modified since being saved, an asterisk (*) appears after the name. Default background colour shown. This colour changes to that assigned to the input channel when this is configured.

Segment name: This is the name of the current segment. If not named in Segment configuration, then the segment number appears instead.

Program status: At the top right hand corner of the display, this can be any one of the following:
The program is running (or ran last time) without any PV 'Alarm' events or user intervention.
The user has intervened in the running of the program, by placing it in 'hold' or 'reset', or by advancing a segment, or by adjusting a duration, target setpoint, ramp rate or time-to-target value.
A PV 'Alarm' Event has activated. A PV 'Alarm' Event is an absolute high/low or a deviation alarm on the PV input.
There is no program loaded, or if a program is loaded, it has not yet run.

Program edit: This icon appears for users with appropriate access permissions, to indicate that setpoint programs can be configured (as described in Program edit, below).

Segment type: For single channel displays, this indicates the type of segment currently being run:
Dwell. The segment value remains constant for the duration of the dwell period.
End (dwell). Displayed on completion of the program. The segment value remains at the final value until reset
End (reset). Displayed on completion of the program. The program resets.
Ramp. The segment value ramps at a fixed rate or over a fixed period to the Target setpoint. Ramp up icon shown; ramp down is similar but inverted.
Step. The segment value switches immediately to the new Target setpoint. Step down shown; step up similar but inverted.
Wait. The segment value remains constant until the wait criteria are satisfied.

3.4.9 Programmer Display Mode (cont.)

PV	The current process value of the signal wired to Ch1(2) PV Input.
Ch1(2)PSP	This is the output setpoint from the programmer for the channel. In reset this value tracks the configured servo parameter.
Ch1(2)TSP	The channel target setpoint. The target set-point may be edited while the program is in hold (in such cases, for ramp rate segments the time remaining is recalculated.
Events	Up to eight events can be configured in the Program Edit page. Any one or more of these events may be deemed to be active for the duration of each individual segment.
Mode	Shows the current run mode of the program. If the user has the correct access level, the mode can be set to 'hold', reset' etc. by using the scroll key twice (first to highlight the run mode, then again to enter edit mode) and then using the up/down arrow keys to select the required mode. Run, reset, hold etc. can also be selected by inputs from other parameters, switch inputs etc.
Status	Shows the status of the current segment.
Ch1 Rate	The channel 1 rate-of-change of segment value for 'Rate' ramp segments.
Ch1 Time	Shows the channel 1 duration configured for the segment to ramp, dwell etc. for 'Time' ramp segments. For two-channel programs, see the note below.
Seg Time Left	Shows the time that the segment has to run before completion.
Program progress	The numerals show program elapsed time, and the bar gives an indication of progress so far. For two-channel programs, see the note below.
Segment progress	For each segment as it runs, this gives a visual indication of the proportion of total segment time which has elapsed so far. For two-channel programs, see the note below.
Program time remaining	Shows the time remaining until the program completes. For two-channel programs, see the note below.

Note: For two-channel programs, in 'Hold' mode, the 'program progress', 'segment progress' and 'program time remaining' areas of the display are replaced by 'Ch1 Time' and 'Ch2 Time', as shown below.

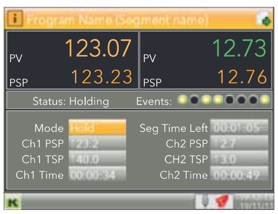


Figure 3.4.9b two channel program in Hold mode

3.4.9 Programmer Display Mode (cont.)

PROGRAM RUN/RESET/HOLD

Programs can be controlled by users with the correct access level (defined in Programmer configuration - Section 4.25). The display page is placed in edit mode by operation of the scroll key ('Mode' highlights). A second operation of the scroll key followed by operation of the up/down arrows allows the user to select 'Run', 'Hold' or 'Reset'. A further operation of the scroll key initiates the selected action.

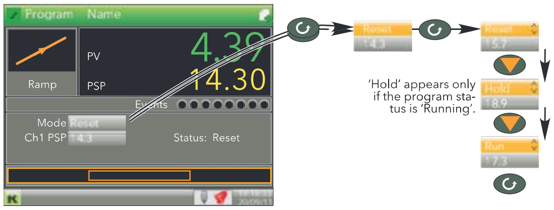


Figure 3.4.9c Setting the Mode

Notes:

1. These functions can also be carried out by wiring relevant inputs to the 'Run', 'Hold' or 'Reset' parameters in Programmer configuration (Section 4.8).
2. The user must have either 'Logged off', 'Operator' or 'Supervisor' level access as defined in 'Prog Mode Access' in the Programmer. Setup menu described in Section 4.8.3 . The program cannot run if the unit is logged into at 'Engineer' level.

3.4.9 Programmer Display Mode (cont.)

PROGRAM EDITING

The program edit page is accessed by operating the scroll button once to highlight the Mode, then using the up arrow key to highlight the page symbol at the top right hand corner of the display and then the scroll button again to enter the program editor.

Figure 3.4.9d Access to the program editor

As can be seen from the figure above, the initial Program Edit page is divided into two areas - the top part contains program details; the lower part (figure 3.4.9f) contains individual segment details. The editable items that appear in the program details area depend on the features enabled in the Programmer Features configuration menu (Section 4.8.1).

Note: Access to some program operations is restricted to users with the correct access level, as defined in the 'Prog Mode Access', the 'Prog Edit Access' and the 'Prog Store Access' parameters in the Programmer. Set Up area of configuration described in Section 4.8.3. Access to some items also depends on whether or not the program is running.

3.4.9 Programmer Display Mode (cont.)

PROGRAM DETAILS

Operation	This allows the user to select one of the following (see also 'Program Store'): Load. Opens the program store and allows the user to select a program to be loaded. The program must have the same number of channels as defined in Programmer.Set Up (Section 4.8.3). Store. Allows the current program to be saved to the internal program drive. This is useful if you wish to snapshot the current program and store this under a different program name. Delete. Allows the selected program to be deleted. Delete All. Deletes all programs. Copy. Copies the selected program for 'pasting' either from the internal drive to the USB device, or vice-versa. This is useful if you wish to transfer a program to other nanodac instruments. Copy All. As above, for 'Copy', but copies all the programs in the selected directory.

Note: If a 'Store', 'Copy' or 'Copy All' operation would result in there being a total of more than 100 program files in the internal drive, the operation fails and an error message is displayed.

Status	Success. Previous operation was successful. Failed. Previous operation failed. Loading. The program is loading. Copying. The program copy process is underway. Deleting. The relevant program is being deleted.
Program	The name of the program currently loaded.
Holdback Style	Appears only if 'Holdback' is enabled in the Programmer Features configuration (Section 4.8.1). See also 'Holdback', below. Program: Holdback applies to all appropriate segments. Per Segment: Holdback enabled on a segment by segment basis as described in 'Segment configuration below.
Ch1 Holdback	Appears only if 'Holdback Style' (above) is set to 'Program'. Off: Holdback is disabled Low: Holdback is entered when PV < (PSP - Holdback Value) High: Holdback is entered when PV > (PSP + Holdback Value) Band: Holdback is entered when PV < (PSP - Holdback Value) or PV > (PSP + Holdback Value)
Ch1 Holdback value	The value to be used in triggering holdback.
Ch2 Holdback	As for Ch1 Holdback, above but for channel 2. Appears only if 'Channels' is set to '2' in Programmer Set Up configuration (Section 4.8.3).
Ch2 Holdback value	As for 'Ch1 Holdback value', above, but for channel 2. Appears only if 'Channels' is set to '2' in Programmer Set Up configuration (Section 4.8.3).
Ramp Style	Ramp style applies to all ramp segments in the program. Ramp Style can be edited only when the program is in Reset mode. Setpoints, rates, times etc. are set in the individual segment configurations Rate. A Ramp Rate segment is specified by a target set-point and the rate at which to ascend/descend to that set-point. Time. A Ramp Time segment is specified by a target set-point and a time in which to achieve that set-point.
Ch1 Ramp Units	Select 'Per Second', 'Per Minute' or 'Per Hour' for ramp timing units. Ramp Units can be edited only when the program is in Reset mode.
Ch2 Ramp Units	As for 'Ch1 Ramp Units' above. Appears only for two channel programs and allows different ramp units to be selected for the two channels, if required. Ramp Units can be edited only when the program is in Reset mode.

3.4.9 Programmer Display Mode (cont.)

PROGRAM DETAILS (Cont.)

HOLDBACK

Holdback pauses the program (freezes the Programmer setpoint (PSP) and the time remaining parameters) if the difference between the Process value (PV) and the PSP exceeds a user-specified amount (Holdback value). The program remains paused until the PV returns to within the specified deviation.
In ramp or step segments, holdback indicates that the PV is lagging the SP by more than the specified amount and that the program is waiting for the process to catch up. In a dwell segment, holdback is used to guarantee that a work piece stays at set-point within a specified tolerance for the specified dwell duration.

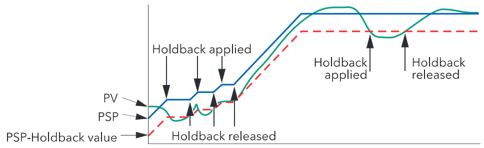


Figure 3.4.9e Holdback

SEGMENT CONFIGURATION

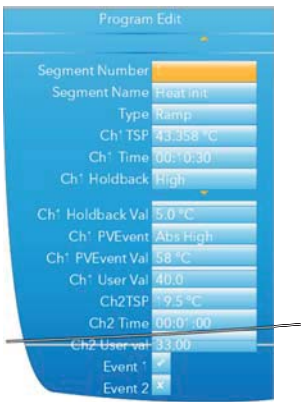


Figure 3.4.9f Segment configuration

Segment Number	Select the relevant segment for configuration.
Segment Name	Enter a segment name of up to 20 characters. This name will be truncated on the display page if it, together with the program name, are too long to fit the width of the display area.

3.4.9 Programmer Display Mode (cont.)

SEGMENT CONFIGURATION (Cont.)

Type	Select a segment type. Default is 'End'. Ramp. For any program, Ramp segments can be either 'Ramp Rate' segments or 'Ramp Time' segments according to the 'Ramp Style' setting described above. See also 'Ch1(2) Time' or 'Ch1(2) Rate', below. Dwell. The setpoint is maintained at its current value for the period defined in 'Duration' (see below). Step. A step segment allows a step change to be entered for the target set-points Ch1 TSP and Ch2 TSP. Wait. A wait segment causes the program to wait for a certain event to occur before continuing. See 'Wait For', below. Go Back. A Go Back segment allows a specifiable number of iterations to be performed of a group of segments. This could be used, for example, to cycle an entire program by having a Go Back segment immediately before the end segment and specifying segment 1 as the 'Go Back To' point. Setting 'Cycles' to 'Continuous' causes the program to loop indefinitely, until interrupted by the user. 'Nested' loops are not permitted i.e. 'Go Back' is not available as a segment type for segments inside an existing GoBack loop. End. The final segment of a program allows the user to select 'Dwell' or 'Reset' as the action to be taken at the end of the program (see 'End Type', below)
Ch1(2) TSP	Target setpoint. The value that Ramp or Step segments seek to attain, for channel 1(2).
Ch1(2) Rate	For Ramp Rate segments, this specifies the speed at which the process value ramps towards the target, for Channel 1(2). The ramp units (per second, per minute, per hour) are set in Ch1(2) ramp units described above.
Ch1(2) Time	For Ramp Time segments, this allows the user to specify the time to be taken by the segment for the process value to reach the target.
Duration	For Dwell segments, this allows the entry of the time for which the segment dwells.
Go Back To	For 'Go Back' segments, this defines the number of the segment to which the program is to return.
Cycles	The number of times the 'Go Back' instruction is to be carried out. If set to 'Continuous', the program continues until the user intervenes to stop it.
End Type	Allows the user to select the action to be taken at the end of the program: Dwell: the set-point is maintained indefinitely and event outputs remain at their configured state. Reset: the set-point reverts to the value used by the control loop before the program was started and the event outputs return to their default states.
Wait For	Digital High: Wait segments can be configured to wait for 'Wait Digital' to go 'high' before allowing the program to continue. Analog 1(2): The segment waits for 'Wait Analog1(2) to meet an Absolute High or Low, or Deviation High or Low condition before allowing the program to continue. Analog Both: As Analog 1(2) above, but waits for both Channels' conditions to be true before continuing.

Note: 'Wait Digital', Wait Analog 1' and 'Wait Analog 2' parameters are configured in the Programmer.Set Up menu described in Section 4.8.3.

Ch1 Wait	Select 'Abs High', 'Abs Low', 'Dev High' or 'Dev Low' as the wait criterion for channel 1. Appears only if 'Wait For' (above) is set to 'Analog 1' or 'Analog Both'.
Ch2 Wait	Select 'Abs High', 'Abs Low', 'Dev High' or 'Dev Low' as the wait criterion for channel 2. Appears only if 'Wait For' (above) is set to 'Analog 2' or 'Analog Both'.
Ch1(2) Wait Val	Enter the trigger value for 'Ch1(2) Wait'
Ch1(2) Holdback	Select 'Off', 'Low', High', or 'Band' (see description in Program details above).
Ch1(2) Holdback Val	The value to be used in triggering holdback.

3.4.9 Programmer Display Mode (cont.)

SEGMENT CONFIGURATION (Cont.)

Ch1(2) PV Event	Appear only if 'PV Events' have been enabled in the Programmer Features menu (Section 4.8.1). A PV Event (an analogue alarm on the channel PV) is available for each channel in every segment (excluding Wait and Go Back segment types). The following PV Events are supported: Off: The PV Event is disabled Abs High: The event is triggered when the channel PV exceeds PVEvent Val for the relevant channel. Abs Low: Triggered when the channel PV becomes less than PVEvent Val for the relevant channel. Dev High: This event is triggered when the channel PV exceeds (PSP + PVEvent Val) for the relevant channel Dev Low: Triggered when the channel PV becomes less than (PSP - PVEvent Val) for the relevant channel. Dev Band - This event is triggered when the channel PV differs from the PSP by more than the configured deviation value (either above or below) In the following example, in segment 1 Ch1 PV Event has been configured as Dev Band and in segment 2 it has been configured as an Abs low:

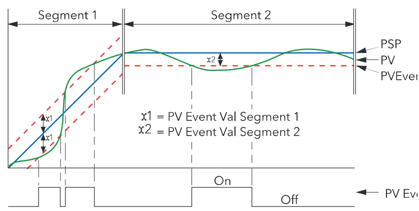


Figure 3.4.9g PV Events

Ch1 PVEvent Val	Appears only if 'Ch1 PVEvent' is not 'Off'. Sets the level at which Ch1 PV Event becomes active.
Ch2 PVEvent Val	Appears only if 'Ch2 PVEvent' is not 'Off' and if 'Channels' is set to '2' in Programmer Set Up configuration (Section 4.8.3). Sets the level at which Ch2 PV Event becomes active.
Ch1 (2) Event Use	When PV events become active, they can be used either to Trigger a secondary process or as a simple analogue alarm on the PV input. Appears only if the relevant PV Event parameter is not set to 'Off'.
Ch1 (2) User Val	Specifies the User Value for this segment, for channel 1(2). Appears only if 'User Value' has been enabled in the Programmer Features menu (Section 4.8.1). The example below (from iTools) shows this parameter wired to the trigger 1 input of the Custom Messages block, so that, if a User value >0 is entered, then every time the segment runs, Custom message 1 is generated.
Event 1 to 8	The number of Events available (Max Events) is defined in Programmer Set Up configuration (Section 4.8.3). Enabling an event causes the relevant indicator on the display page to be illuminated for the duration of the segment. As with 'User Val', above, Events can be wired to the inputs of other parameters if required.

3.4.9 Programmer Display Mode (cont.)

SEGMENT CONFIGURATION (Cont.)

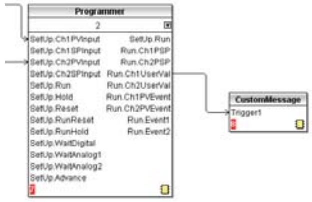


Figure 3.4.9h iTools example showing Ch1 UserVal being used to trigger custom message 1.

FUTURE TREND DISPLAY MODE

If enabled in Instrument.Display configuration (Section 4.1.3), this allows the user to view the actual value of the PSP alongside the expected value, so the two can be compared to see how the process is performing.

Future trend is an enhancement of the horizontal trend mode, with the display being divided into two parts, with the instantaneous current value located at the divide, with past trends to the left and the next few program segments to come, to the right.

Notes:
1. For the future trend mode to appear, the programmer must be wired to the loop or advanced loop feature.
2. Both historic and future trends move from right to left with the present anchored at the screen centre.
3. The amount of history and of future trending displayed on the screen depends on the trend interval set in Group.Trend configuration (Section 4.3.1)

Figure 3.4.9i shows a typical future trend display

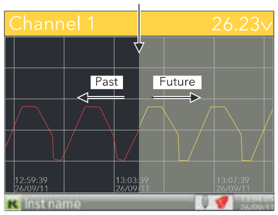


Figure 3.4.9i Future trend display

3.4.9 Programmer Display Mode (cont.)

PROGRAM STORE

Note: The access levels required for the operations described below are configured in the Programmer Set Up menu 'Prog Edit Access' and 'Prog Store Access' parameters, described in Section 4.8.3.

The program store allows access to the instrument's local program storage area and to programs stored on a USB memory stick (if any) and to those stored in a pc (if any), via FTP. Programs may be saved to (Stored) or retrieved from (Loaded) from the program store, or they can be copied or deleted.

Selecting any of the program operations (except 'Delete All'), from the Program Edit page (Engineer access level required) opens the file explorer page. Figure 3.4.9j depicts this page, with just a couple of example entries after a 'Load' operation has been requested.

On entry, use the up/down arrow button to select 'User', 'USB' or 'FTP' (selection highlights yellow), then use the scroll button to confirm. Use the up/down arrow buttons to select the required file, and then use the scroll button again to confirm. Other operations are similar.

The file explorer supports 100 entries, which may be directories or files.

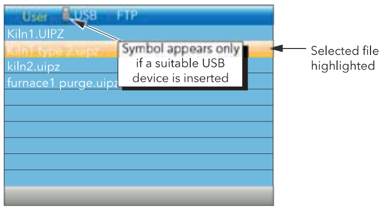


Figure 3.4.9j Program store display

Note: A 'busy' icon (rotating green flash) appears whilst directory listings are being accessed.

PROGRAM LOAD - QUICK ACCESS

From firmware version V5.00 and above a quick selection of an internally stored program may be made directly from the Program Summary page. The programmer must be in Reset. Press and hold the scroll key for 2 seconds. The page will go immediately to the file explorer page with the 'User' drive selected and the 'Operation' parameter set to 'Load'. The first program file will be selected (assuming different programs have been configured). Use the Up/Down keys to select the required program followed by the scroll key to load it.

If the selected file cannot be loaded (for example, the programmer file is for a different number of channels) then an error message is shown on the file explorer.

The Quick Access to load mode adheres to the access security settings set in configuration mode - Programmer set up (Figure 4.8.3).

Note: Quick load is disabled when in Edit mode. This is indicated by the highlighted parameter showing the raise/lower symbol to the right of its value.

Figure 3.4.9k Program load display

PROGRAM LOAD VIA A PROGRAM NUMBER

This feature has been added to firmware versions V5.00 and above.

To allow a program (stored as a file) to be loaded, either via a BCD switch, wired to a set of digital inputs, or via a single comms transaction, it is necessary to prefix the progam name with a program number in the range 01 to 99. For example, 01kiln1.uipz, 01furnace.uipz, 02kiln2.uipz, 03kiln3.uipz etc. The program name can consist of up to 18 characters. Note that program numbers 1 to 9 must be entered as 01 to 09 otherwise they will not be recognised by the switch or via comms.

On value change of the program number, the first program file with the prefixed number in the instrument's internal User drive (listed lexographically) will be loaded. In the above example if program 01 is selected, 01furnace.uipz will be loaded, 01kiln1.uipz will not be loaded using the BCD switch or through comms. It can, of course, be loaded manually.

If no program number is prefixed it is not possible to load the program via the BCD switch or via comms. It is, however, still possible to load the program by selecting the file as described in the previous section.

Note: When a BCD switch is turned from its current value to another value, intermediate switch positions may be seen on the inputs of the BCD function block and could potentially be used by subsequent blocks wired from the BCD input. A Settle Time parameter has been introduced which will in effect filter out these intermediate values by applying a time in which the inputs can settle before their converted decimal value is seen on the output parameters of the block. The Settle Time can be set from 0-10seconds with a default of 0s i.e. no filtering as in previous firmware versions. The BCD block is described in Section 4.19.

EXAMPLE BCD SWITCH WIRING

Figure 3.4.9l below shows an example of using digital input channels soft wired to the BCD function block using iTools.

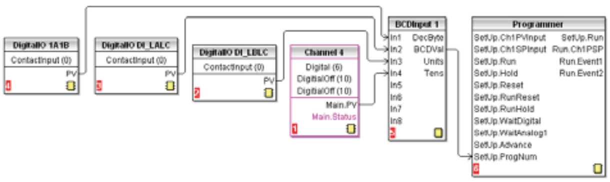


Figure 3.4.9l BCD Switch Wiring

Figure 3.4.9m below shows the corresponding hard wiring of a BCD switch.

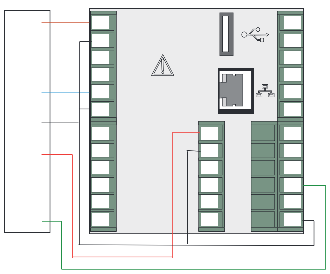
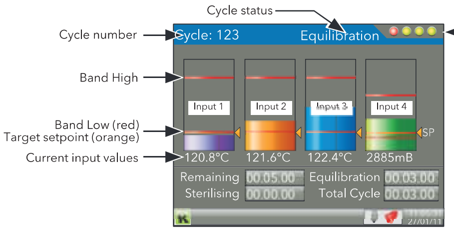


Figure 3.4.9m BCD Switch Physical Wiring

3.4.10 Steriliser display mode

This display mode appears only if the Steriliser option is fitted and if the display mode has been enabled in the Instrument Display configuration (Section 4.1.3). Steriliser configuration parameters are to be found in Section 4.17.



Note:
If any input is configured 'Off' (in Steriliser configuration), it does not appear in the display, and the other inputs occupy the screen width equally.

Input status beacons are black for inputs configured 'Off'

Figure 3.4.10a Steriliser display mode (typical) (four inputs)

OPERATION

A sterilising cycle cannot be initiated whilst the unit is in Configuration (Engineer) mode.

A steriliser cycle is started by setting its relevant 'Start' input to 'Yes' for the duration of the cycle. The cycle waits (status 'Waiting') until input 1 reaches its setpoint, at which point the cycle enters the equilibration period (status 'Equilibration'), and remains there until all the configured inputs are valid. The cycle then enters the sterilising period and stays in this mode until the sterilising period has expired (status 'Passed') or until one of the inputs becomes invalid (status 'Failed') for longer than its configured 'Failure Dwell' time.

Note: The cycle stops (status 'Failed') if the trigger source is removed.

TERMINOLOGY

Holding time	Most operating cycles have a stage in which the load must be exposed to sterilisation conditions for a specified length of time, known as the 'Holding time'.
Equilibration time	The holding time (above) is preceded by a period during which, although the sterilising condition is present in the chamber, the load has not yet attained that temperature due to its thermal inertia. 'Equilibration time' is defined as the time between the attainment of sterilisation temperature in the chamber, and the attainment of that temperature in all parts of the load.
Bands	For steam and dry heat sterilisers, sterilisation conditions are specified by a sterilisation temperature band, defined by a minimum acceptable temperature (known as the sterilisation temperature) and a maximum allowable temperature. A sterilisation band is normally quoted for each steriliser type.

BEACONS

There are four input status beacons near the top right hand corner of the display, one for each input.

During equilibration, the beacons are flashing red for inputs that have not attained the Target setpoint, and go green when the target setpoint is reached, remaining green even if the input value rises above the Band High value The beacons revert to red if input falls below* the target setpoint.

During sterilisation, the beacons go red for any input whose value rises above Band High or falls below* setpoint for a duration exceeding the configured 'Failure Dwell' period.

Beacons are black for inputs that are configured as 'Off'.

* 'rises above' for input types 'Falling Pressure' or 'Fall Air Detect'

3.4.10 Steriliser Display Mode (Cont.)

DISPLAYED INFORMATION

Cycle	A five-digit counter to indicate the total number of cycles started.
Status	Wait start: The initial state at power up. This status remains until the first cycle is initiated Waiting: Waiting for input 1 to reach its target setpoint. The cycle then enters Equilibration. Equilibration: Currently in the equilibration period, during which the cycle waits until all inputs have reached sterilisation conditions. Sterilising: Currently in the decontamination phase Passed: The cycle has completed successfully Failed: The cycle has failed either through one or more inputs becoming invalid, or because the 'Start' signal was removed. Test cycle: A test cycle is in progress
Remaining	The sterilising time remaining for the current cycle. Display field is replaced by 'Target Time' (below) when the cycle is not running.
Target time	The intended sterilisation time. This can be configured by operating the scroll button twice (once to highlight the field, and again to enter edit mode), and then using the up and/or down arrows to edit the time. Use the Scroll button again to quit edit mode, and the page key to 'unhighlight' the field. Replaced by 'Remaining' (above) when the cycle is running.
Equilibration	The equilibration time period for the current cycle
Sterilising	The time for which the load has currently been at sterilisation conditions
Total Cycle	The elapsed time since the initiation of the current cycle. This time increments from the time the cycle is triggered until the time the trigger is removed.
Input values	Temperature are required in °C; pressure inputs in mBar. If necessary, maths channels and user values can be used to convert from other units (see 'Note' overleaf).

STERILISING CYCLE DIAGRAM

Figure 3.4.10b, below, shows a steriliser cycle in diagrammatic form.

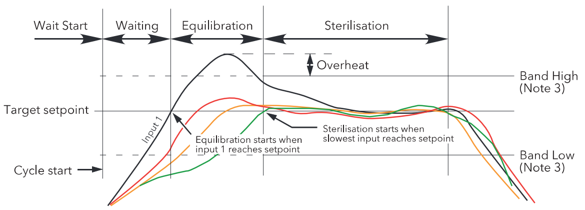


Figure 3.4.10b Steriliser cycle

Notes:

1. For temperature inputs in most applications, the Setpoint value is the same as the Band Low value For the sake of clarity, this is not as shown in the figure above.
2. For the sake of clarity all four inputs in the figure above are shown with the same Band High, Band Low and Setpoint value. This would not be unusual for temperature units, but the pressure input would normally have a different set of values from temperature inputs.
3. Band High and Band Low are effective only during Sterilisation phase.

3.4.10 Steriliser Display Mode (Cont.)

APPLICATION DETAILS

Figure 3.4.10c shows a typical steriliser application, with temperature and pressure signals from the sterilisation chamber being applied directly to the rear terminals of the controller/recorder, and control signals connected from the controller to both the chamber and the controller/recorder.

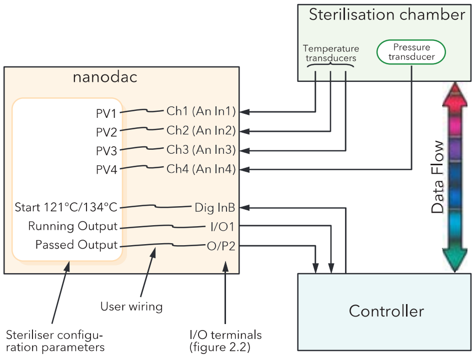


Figure 3.4.10c Typical steriliser application

Analogue inputs 1 to 3 receive signals from temperature transducers (typically thermocouples) within the chamber. These inputs are internally connected to channels 1 to 3 respectively, allowing transducer type, ranges, alarms etc. to be configured (Section 4.4). Inputs are assumed to be degrees Celsius*.

The pressure transducer is connected to channel 4 and can be configured in the same way. The input is assumed to be in milliBar. Other pressure inputs should be converted using virtual channels*.

PV1 to PV4 in the Steriliser configuration is software wired (Section 7) to Ch 1 to Ch4.

Start cycle input and the 'Running Output' and 'Passed Output' signals are software wired to suitable DIO terminals, for connection to the Controller.

*Note: For Fahrenheit inputs, use one virtual channel to subtract 32, and a second to divide the result by 1.8 (where 32 and 1.8 can be configured as user values). Similar techniques should be used to convert pressure input units if necessary.

TEST CYCLES

A 'Test' cycle is initiated by initiating a 121°C cycle and a 134°C cycle simultaneously. A test cycle allows the user to check actual performance against expected performance.

3.4.10 Steriliser Display Mode (Cont.)

F_0

F_0 is a means of calculating 'equivalent time at sterilising temperature' for temperatures below, at and above sterilizing temperature, using the equation below.

$$F_0 = \text{Sterilisation time} \times 10^{\frac{Temp - Ts}{Z}}$$

Where:

Sterilisation time	Depends on the application, typically 15 minutes at Ts = 121°C
Temp	The value of the temperature measuring input.
Ts	Desired Sterilising temperature
Z	Temperature interval representing a factor-of-10 reduction in killing efficiency. Z = 10 for steam sterilising (F_0), or Z=20 for dry heat sterilising (FH). Z = 10 for thermal disinfection (A_0).

To ensure that steriliser loads which contain materials with different thermal inertias are thoroughly sterilised, a number of sensors are located withing the load. The F value should be calculated using the sensor closest to that part of the load which has the highest thermal inertia. For maximum accuracy, the temperature sensor should be calibrated and the input adjust function used to compensate for any inaccuracy found.

F0 calculation examples

For all the examples following, the following are assumed: Sterilisation time = 15 minutes; Sterilisation target temperature =121°C and Z = 10.

1. For an actual sterilising temperature of 111°C

$$Fval = 15 \times 10^{\frac{111-121}{10}} = 15 \times 10^{\frac{-10}{10}} = 1.5\,\text{minutes}$$

Which means that 15 minutes at 111°C is equivalent to 1.5 minutes at 121°C

2. For a sterilising temperature of 121°C

$$Fval = 15 \times 10^{\frac{121-121}{10}} = 15 \times 10^{\frac{0}{10}} = 15\,\text{minutes}$$

Which means that the sterilising temperature is ideal (by definition)

3. For a sterilising temperature of 124°C

$$Fval = 15 \times 10^{\frac{124-121}{10}} = 15 \times 10^{\frac{3}{10}} = 15 \times 1.995 = 29.925\,\text{minutes}$$

Which means that 15 minutes at 124°C is equivalent to nearly 30 minutes at 121°C.

Normally sterilising temperatures would not remain constant at temperatures below or above the target value, so the above equations are illustrative only of the facts:

1 Temperatures below the target have some killing efficacy
2 Temperatures above the target value have a greater killing efficiency, so that the sterilising time can be reduced.

In order to calculate the value dynamically, the instrument uses the equation:

$$Fval_t = Fval_{t-1} + T \times 10^{\frac{ma_t - \text{Target temp}}{Z}}$$

where

$Fval_t$	= F value this iteration
$Fval_{t-1}$	= F value last time
T	= Iteration period (minutes)
ma_t	= input temperature value this iteration
Target Temp	= 121°C for F_0, 170°C for F_H, 80°C for A_0
Z	= 10°C for F_0, 20C for F_H, 10°C for A_0

3.4.11 Promote list

This display page allows the user to display up to 10 of the parameters that appear anywhere in the operator interface. The parameters can be selected only by using iTools, as described below.

Notes:
1. 'Promote List' must be enabled (in 'Instrument.Display' configuration), before it appears in the 'Go to View' list.
2. There are more parameters visible in iTools than appear at the operator interface. If non-operator interface parameters are selected for inclusion in the promote list, they do not appear.
3. If parameters which appear only in certain circumstances are selected, then they appear in the promote list only when they appear in the Operator interface. For example, a channel PV is not visible unless that channel is enabled (i.e. it is not 'Off').

PARAMETER SELECTION
1. Open iTools and scan for the instrument, (see Section 6).
2. Once the instrument has been found, stop the scan. When the instrument has synchronised, click on the 'Access' button near the top of the display to set the unit into configuration mode (a password may be required).
3. Click on the '+' sign to the left of the Instrument folder in the tree list (left-most pane) to expand the folder. Double-click on 'Promote List', to display the Promote list in the main pane. The list contains 20 entries, 1 to 10 being for parameters, 11 to 20 being available to the user to add descriptors for parameters 1 to 10 respectively.
4. Expand further folders, as necessary, to access the required parameters, and click-drag these parameters into the promote list. Enter a descriptor for the parameter if the default is not as required. As each parameter is dragged into the list, it appears in the Promote list.
5. If the parameters are modified at the operator interface, the changes are reflected in iTools, and vice-versa.
6. Once all the parameters have been added, it is recommended that the Access button be used to quit configuration mode, as otherwise it will not subsequently be possible to quit from the operator interface.

Figure 3.4.11 shows typical displays.

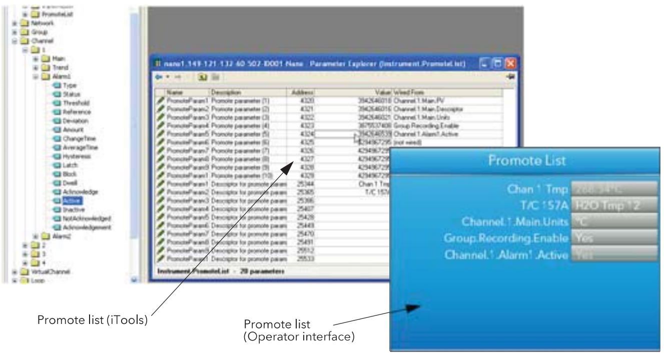
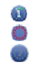


Figure 3.4.11 Promote list displays.

3.4.12 Modbus Master display mode

This display mode consists of two pages, as shown below.

Page one opens by default and shows the first eight parameters being read from (left pointing arrow) or written to (right pointing arrow) the relevant slave. These items are configured in the Modbus Master configuration described in Section 4.9. Hidden parameters may be viewed by operating the scroll key, then using the arrow keys to scroll through the list. A green arrow means that the item may be edited by the user when logged in.

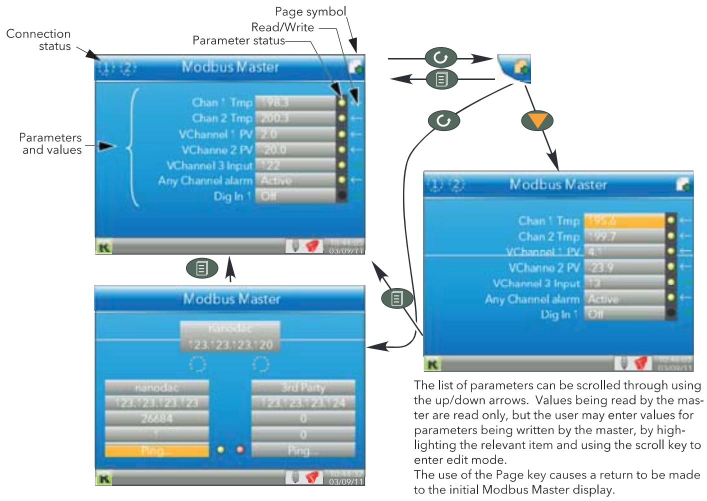


A pair of animated indicators in the top left-hand corner of the screen show the connection status of the two possible slaves. A green moving 'streak' indicates that successful communications are being carried out. A red flashing circle indicates that there is a break in the transmission line or that the slave is switched off. A grey, non-animated display indicates that that slave has not yet been configured as a part of the communications link (i.e it is 'off line').

A 'traffic light' indicator appears to the right of each parameter. Green indicates that the parameter is being read from or written to successfully. Orange indicates that a write of the value is pending. Red indicates that there is an error and that no value is currently being read or written; the value displayed is the last good value read or written depending on whether the data item is a read or write. If the indicator is black, the parameter is 'off'.

Operation of the scroll key highlights the page symbol in the top right-hand corner of the screen, and a further operation of the scroll key calls page two to the screen.

Page two contains the IP address of the Modbus master and of any slaves connected to it, together with some diagnostic information, as described in 'PING DETAILS' below.



The list of parameters can be scrolled through using the up/down arrows. Values being read by the master are read only, but the user may enter values for parameters being written by the master, by highlighting the relevant item and using the scroll key to enter edit mode.
The use of the Page key causes a return to be made to the initial Modbus Master display.

Figure 3.4.12a Modbus Master display pages

3.4.12 Modbus Master Display Mode (Cont.)

PING DETAILS

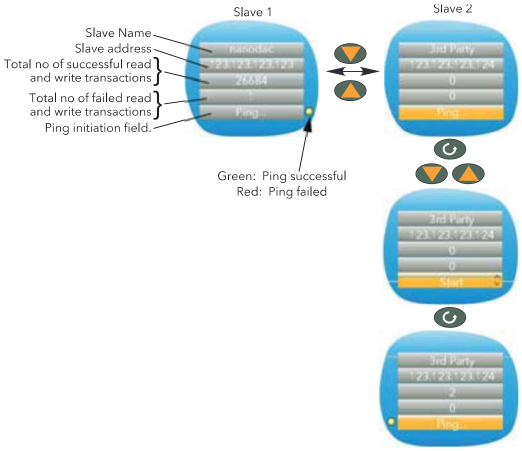


Figure 3.4.12b Slave 2 ping initiation (Slave 1 similar)

The 'Ping...' field of the first slave is highlighted by default. As shown above, the down (or up) arrow can be used to highlight the 'Ping...' field of the other slave instead.

Once the relevant 'Ping...' field is highlighted, the scroll key can be used to enter edit mode and the up/down arrow key used to select 'Start'. A further operation of the scroll key initiates the 'Ping' and if this is successful, a green indicator appears alongside the field (and the text returns to 'Ping...'). If the Ping is unsuccessful, then the indicator is coloured red.

The up or down arrow can now be used to return to slave 1, or the page key can be used to return to the previous parameter display page.

As shown in the figure above, some diagnostic information is given. This includes the total number of successful attempts that the master has made to communicate with the relevant slave, and the total number of failed attempts. Fuller diagnostic details are to be found in the Modbus Master Communications configuration description (Section 4.9)

3.4.13 EtherNet/IP display mode

This display mode appears only if enabled in Instrument.Display configuration (Section 4.1.3) and is used to display the input and output parameters assigned to the Client and Server input and output tables. Parameters which have been configured with descriptors are identified by these descriptors instead of their 'opc' names (shown below).

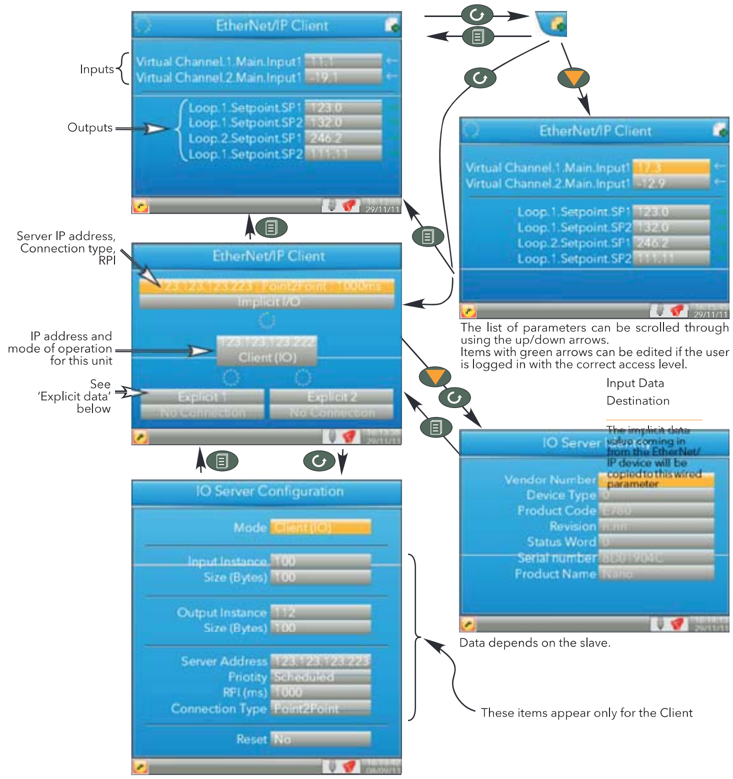


Figure 3.4.13a Typical EtherNet/IP display

3.4.13 Ethernet/IP Display Mode (Cont.)

If the EtherNet/IP option has been ordered and enabled, the nanodac can be configured as either a client (master) or a server (slave) (see Section 4.10). The client and server displays are identical except that the configuration area of the client display is more extensive than that of the server display.

Figure 3.4.13a, above shows a typical set of display pages for an EtherNet/IP client.

CONFIGURATION OF IMPLICIT INPUT/OUTPUT TABLES

Configuration of the input and output tables is carried out via iTools drag and drop only by:

a. Entering the parameters to be read by the client into the server output table.
b Entering the destination parameter into the equivalent location in the client input table.
c. Entering the parameters to be written by the client into the client output table.
d Entering the destination parameter into the equivalent location in the server input table.

The example in figure 3.4.13b attempts to show this (using the nanodac as the client) in graphical form, using just a few parameters (there can be up to 50 in each table)

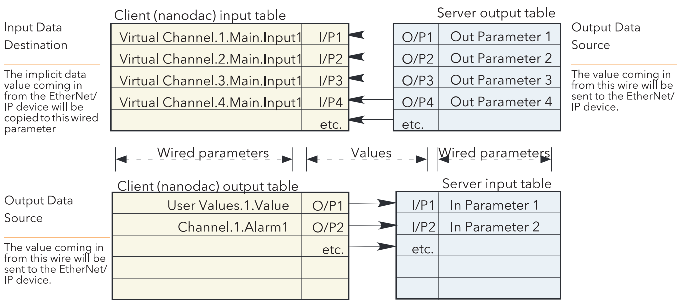


Figure 3.4.13b Input/Output table entries

Notes:
1. Channel values from the Server can be 'wired' into nanodac Virtual channel inputs (as shown above) so that they can be traced and/or recorded. In such cases the virtual channel 'Operation' must be set to 'Copy' (see Section 4.5.1).
2. Inputs and outputs would normally be given suitable descriptors (e.g. 'Reset timer' instead of 'Channel.1.Alarm1').

CONNECTION STATUS INDICATOR

A circular status indicator appears in a number of the EtherNet/IP display pages. This indicator can indicate the following states:

Green rotating 'flash': the instrument is on line and at least one CIP connection is established.
Green flashing circle: the instrument is on line but no CIP connections have been established.
Red flashing circle: there is a break in the physical connection between the client and the server, or the remote unit is switched off or is initialising.

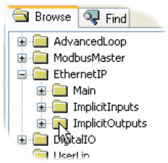
3.4.13 Ethernet/IP Display Mode (Cont.)

Adding parameters to the input and output tables can be achieved only through the proprietary software package 'iTools', running on a pc. It cannot be configured through the user interface. The following description assumes that the user is familiar with 'iTools'. Section 6 of this manual shows how to set up an iTools link to the unit and the iTools on-line help system and its pdf version (HA028838) should be referred-to as necessary.

Note: the client/server and the pc must all be on the same network.

Once iTools has started up and the 'Scan' process has 'found' the relevant instrument, the scan process should be stopped and the instrument (s) allowed to synchronise. (The scan may be left to run its course, but the speed at which iTools operates is reduced for the duration of the scan process.)

EXAMPLE



To add Loop 2 Setpoint 2 to Output 4 of the Client Output table.

In the example shown below, the instruments have both synchronised, and the 'Access' tool button clicked-on for both instruments to set them into configuration mode.

With the client selected, expand the EtherNet/IP folder in the Browse list, then double-click on the 'ImplicitOutputs' folder.

Locate and expand the Loop 2 SP folder in the Browse window, and click-drag SP2 to 'Output 4' and release.

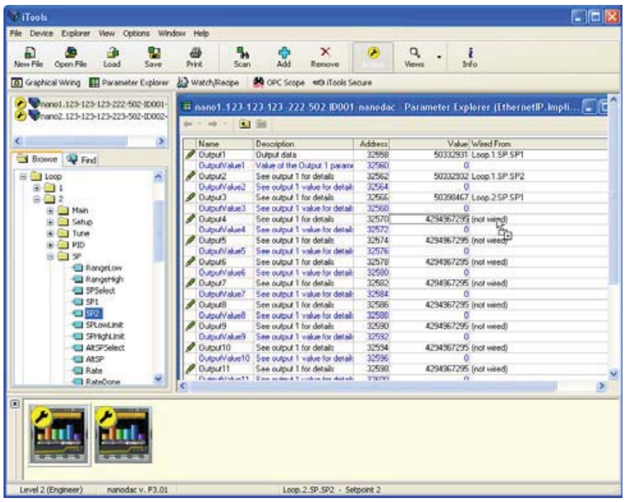


Figure 3.14.3c Dragging a parameter to the Output table

3.4.13 Ethernet/IP Display Mode (Cont.)

An alternative to the click-drag technique is to right click on the required output (five in the example below), and select 'Edit Wire...' from the context menu that appears. A browse window pops up, allowing the user to navigate to the required parameter. This technique can be used both on previously empty inputs or outputs and on those previously filled.

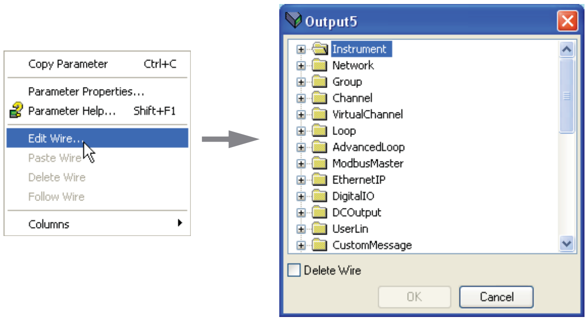


Figure 3.4.13d Context menu details

EXPLICIT DATA

As shown in table 3.4.13, when configured as a server, there is only one explicit application object, and that has the class ID= A2 (162 decimal). The instance ID is the Modbus address of the parameter and the Attribute is always = 1. Explicit service codes hex10 (decimal 16) and 0E (14) are both supported, for writing and reading single attributes respectively.

Service code		Class ID		Instance ID	Attribute
Hex	Dec	Hex	Dec	Decimal	
0010	16	A2	162	1-65535	1
000E	14	A2	162	1-65535	1

Table 3.4.13 Explicit data specification

When configured as a client, two separate connections are available allowing the user to produce two independent explicit read or write messages to different server devices.

Figure 3.4.13e below, shows an example of how to configure an explicit message request. The instance ID and the data type are taken from the server manufacturer's data. In this example a read request is configured to determine the Group recording status of a nanodac server, and it can be seen from table 5.3 that the decimal modbus address for this parameter is 4150 and the data type is int16. It is this address which is used as the instance ID.

Once all the information has been entered, the read is requested by setting 'Send' to 'Yes'. The Data field changes to '3' for this example and from table 5.3 it can be seen that the recording status is 'Recording enabled'.

Note: The nanodac supports only 16 bit data types for reading and writing of explicit messages.

3.4.13 Ethernet/IP Display Mode (Cont.)

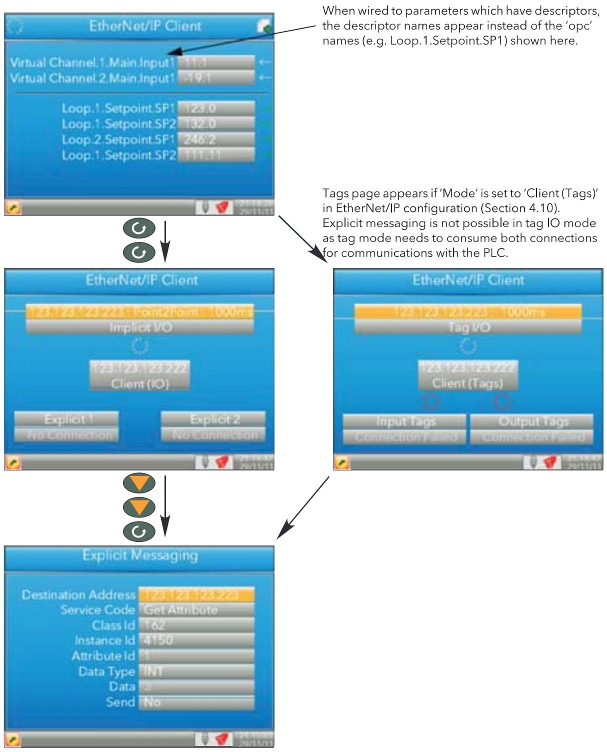


Figure 3.4.13e explicit messaging example

3.4.13 Ethernet/IP Display Mode (Cont.)

USING TAGS

When acting as servers, many PLCs present their data in a tag format instead of implicit data format. For this reason, when the client is configured as 'Client (Tags)', (Section 4.10) 30 input and 30 output tags become available to the user via iTools (figure 3.4.13f).

This allows tag names to be typed in, input tags 1 to 30 being associated with implicit inputs 1to 30 respectively and output tags 1 to 30 being associated with implicit outputs 1to 30 respectively.

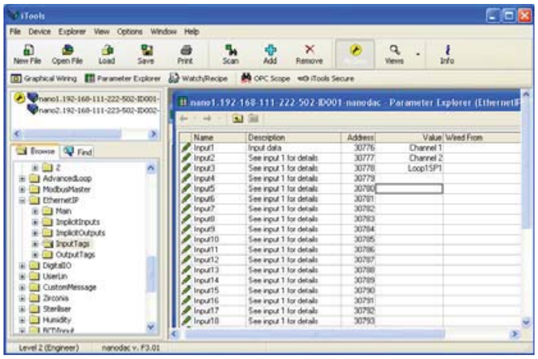


Figure 3.4.13f iTools display showing input tags.

In the example above, the value of the parameter with the tag 'Channel 1' will be written to implicit input 1.

Notes:

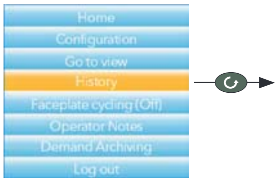
1. Most PLCs have a data buffer limit of 500 Bytes. The total number of bytes being used is given by the equation: Total number of data bytes = (tag length + 10) × the number of requested tags.
2. Input data direction is always to the nanodac:
   in server mode input data is written to the nanodac from the client
   in client mode, input data is read by the nanodac from the server device.
3. Output data direction is always from the nanodac:
   in server mode output data is written to the client from the nanodac
   in client mode, output data is read by the server from the nanodac.

3.5 TREND HISTORY

Entered from the top level menu (Section 3.1), this allows vertical and horizontal traces to be reviewed for Trend group channels. The amount of data displayed in one screen depends on the 'Zoom In/Out' setting in the History menu (Section 3.5.2) and on the recording interval selected in Group Recording configuration (Section 4.3.2). It is also possible to enter a time and date to which the history then jumps.

The history display is identical in appearance with the trend display except:

1. History displays can include messages if so configured in the History menu.
2. For horizontal trends, the scale is displayed permanently at the left edge of the display.



Enter trend history mode

Figure 3.5a Top level menu

3.5.1 Navigation

The down arrow button moves the display backwards in time by $^1/_3$ screen-full per operation (assuming that the current display is not the earliest). See also 'SEARCH FOR', below.

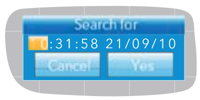
The up arrow button moves the display forwards in time by $^1/_3$ screen-full per operation (assuming that the current display is not the latest). See also 'SEARCH FOR', below

The scroll key scrolls through the trend group channels, emphasizing each channel (and displaying its face-plate) as it is selected.

The page key calls the History Menu, described in Section 3.5.2, below.

SEARCH FOR

In the history display, holding the up or down arrow key operated for approximately two seconds produces a 'Search for' display which allows the user to enter a time and date. Once a time and date have been entered, 'Yes' then causes the history display to jump to that time and date (if such history exists).



To enter a time and date:

1. Use the up/down arrows to highlight the item to be edited.
2. When highlighted (orange background), operate the scroll button. The highlighted text turns black.
3. Use the up and down arrow keys to scroll to the required value for the field, then operate the scroll button again. The text goes white.
4. Repeat the above editing process for all the remaining items which are to be edited.
5. Use the up/down keys to select 'Yes'. The 'Search for' window closes, and the history display jumps to the selected time and date.

Notes:
1. If no history exists for the selected time and/or date 'No History Available' is displayed.
2. The time and date format and Daylight Savings Time (DST) effects are as set in the 'Locale' area of Instrument configuration. See Section 4.1.2 for further details.

3.5.2 History Options Menu

Operating the page key from within a history display, causes the History Options menu to appear.

Figure 3.5.2 History Options menu

PARAMETERS

Zoom In/out	Allows the user to select the amount of history displayed on the screen.
Trend	Select either 'All Points' or 'Each Point'. 'All points' displays all channels in the trend group, with the first channel emphasized on the screen and its faceplate displayed. The Scroll button is used to select the next channel in the group. 'Each Point' initially displays only the first point in the trace group. The scroll key is used to cycle through individual group channels in turn.
Show Messages	'Off' disable the inclusion of messages in history display. 'On' causes messages to appear, superimposed upon the point traces (vertical trend mode only).
Exit History	Selecting 'Yes' for this item causes a return to the top level menu or to the message summary page.

Note: Operating the page key from the History menu causes a return to the history display.

3.6 TEXT ENTRY

The user is often required to enter text characters or numbers (when editing operator notes, for example). This is done using the pop-up keyboards which are displayed when required. When only numerals are required a special keyboard is presented which contains only numerals.

Figure 3.6 shows the three standard keyboards, along with a 'scan' direction for operations of both up arrow and down arrow keys. To change keyboards, use the arrow pushbuttons to highlight the keyboard name ('Numeric', 'Symbols' or 'Alpha'), and then operate the scroll button.

Generally, to enter text, the required character is highlighted using the up and down arrows and the scroll button is used as an 'Enter' key. Once text entry is complete, the Page button is used to confirm the edit (use the down arrow to select 'Yes' then operate the scroll button).

Pressing and holding the scroll button and then immediately operating the up or down arrow, causes the character insertion point to move to the left (down arrow) or to the right (up arrow).

The user can press and hold the scroll key to display variations on certain characters (the letter 'e' in the figure). Once displayed, the up and down arrows can again be used to scroll through auxiliary list, allowing capital letters, and characters with diacriticals (e.g. accents, umlauts, tildes, cedillas) to be selected and entered using the scroll button.

The backarrow key is used as a back space key - i.e. it deletes the character to the left of the cursor position. The 'Del' key deletes the character to the right of the cursor.

Note: Leading and trailing space characters are automatically removed from text strings.

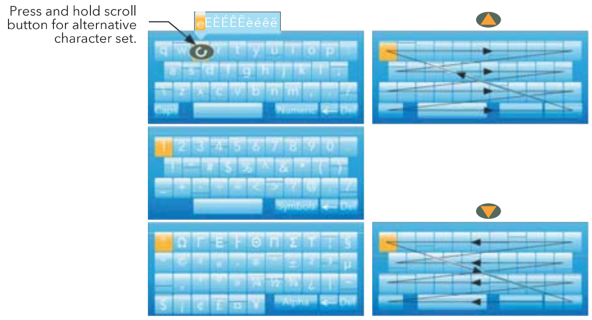


Figure 3.6 Standard Keyboards

3.6.1 Numeric keyboard

As mentioned previously, for functions which can take only numerals, a special numeric keyboard appears, as depicted in figure 3.6.1.

Figure 3.6.1 Numeric keyboard

3.6.2 USB keyboard

Text and numeric entry can also be carried out using a USB keyboard as described in Section 8.3.

4 CONFIGURATION

Entered from the top level menu (Section 3.1) this allows the recorder configuration to be accessed and edited ('Engineer' access level required for full editing).

CAUTION

Recording is stopped for as long as the recorder login is at Engineer level. This means that Input/output circuits are switched off during configuration.

As shown in figure 4, below, the recorder configuration is arranged in a number of 'areas', each of which is allocated its own sub-section within section 4.

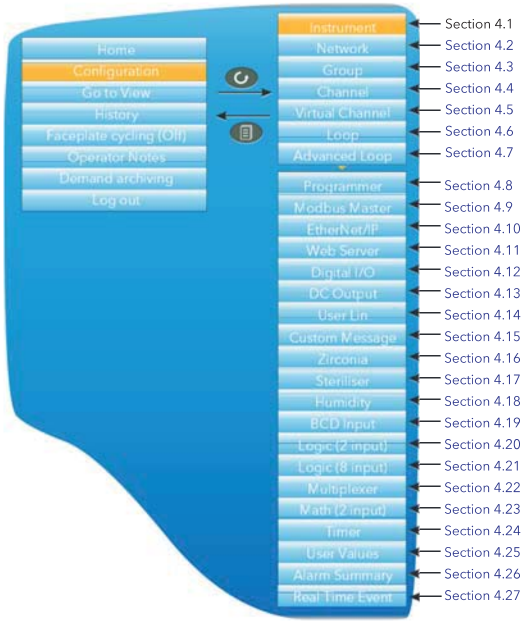


Figure 4 Top level configuration menu

The factory default configuration can be returned-to, if required, by entering a special Engineer password, as described in Section 4.1.6.

4.1 INSTRUMENT MENU

Instrument

- Clock (section 4.1.1)
  - Date
  - Time
- Locale (Section 4.1.2)
  - Language
  - Date format
  - Time zone
  - DST enable
- Display (Section 4.1.3)
  - Brightness
  - Save after
  - Saver Brightness
  - Home page
  - HPage timeout
  - Vertical trend
  - Horizontal trend
  - Future trend
  - Vertical bar
  - Horizontal bar
  - Numeric
  - Alarm panel
  - Loop control
  - Dual loop
  - Cascade
  - Programmer
  - Steriliser
  - Promote list
  - Modbus Master
  - EtherNet/IP
  - Trend background
  - History background
  - H.Trend scaling
  - Faceplate cycling
  - Setpoint colour
  - Number format
  - USB auto scan
- Info (Section 4.1.4)
  - Name
  - Type
  - Version
  - Bootrom
  - Company ID
  - Config Rev
  - Security Rev
  - Nvol writes
  - Line Voltage
  - Wires Free
- Upgrade (Section 4.1.5)
  - Type
  - IP Address
  - Username
  - Password
  - Source Path
  - Initiate
- Security (Section 4.1.6
  - Engineer Password
  - Supervisor Password
  - Operator Password
  - Feature Passwords
  - Comms Password
  - OEM Pass
  - OEM Entry
  - OEM Status
- I/O Fitted (Section 4.1.7
- Save/Restore (Section 4.1.8)
  - Select Save or Restore
- Input Adjust (Section 4.1.9)
  - Select channs
  - Start IP adjust
  - Abort
- Output Adjust (Section 4.1.10)
  - Output
  - Measured o/p
  - Confirm

4.1.1 Clock

The up and down arrows are used to highlight 'Date' (default) or 'Time'.

To set the date, the scroll button is used to display the numeric keyboard described in Section 3.6.1. The up and down arrows are used to highlight the relevant numeral or separator ('/' or ':') and the scroll key used to enter it into the display window.

To set the time, the scroll button is operated to enter edit mode, then the up and down buttons are used to scroll to display a time, say 15 seconds later than the current time. Once the current time matches the display, the scroll button is pressed to confirm the time and to start the clock.

Figure 4.1.1 Clock menu

The 'DST' field appears only If 'DST Enable' is selected 'Yes', in 'Locale' (Section 4.1.2). If the 'box' contains a cross (as shown) then Daylight Saving Time (DST) is not currently active. A 'tick' means that the time shown has been advanced by an hour because DST is active.

4.1.2 Locale

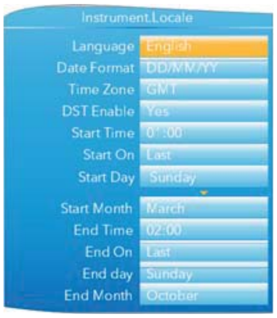


Figure 4.1.2 Typical Instrument configuration menu (expanded to show all fields)

Language	Select the language to be used for displays etc.
Date format	Select MM/DD/YY, YY/MM/DD as the required format.
Time Zone	Select the required offset from GMT (UTC). This setting affects only the displayed time. Archiving, recording etc. times remain in GMT.
DST Enable	Daylight Saving Time enable. Once the selection is enabled, the following (previously hidden) fields appear, allowing the start and end dates for Daylight Saving Time (DST) to be configured. DST affects only the displayed time. Archiving, recording etc. times remain in GMT.
Start Time	Appears only when 'DST Enable' (above) is set to 'Yes'. Use the up/down keys to scroll to the required start time.
Start On	Select 'Last', 'First', 'Second', 'Third' or 'Fourth' as the required week. Used in conjunction with the 'Start Day' and 'Start Month' entries following.
Start Day	Select the day of the week on which DST is to commence.
Start Month	Select the month in which DST is to commence.
End Time, End On, End Day, End Month	As for 'Start Time' etc. above, but specifies the end time and date for daylight savings.

* CNOMO = Comité de normalisation des moyens de production.

4.1.3 Display configuration

This allows the user to set display brightnesses and screen saver details, to select a display mode as the 'Home' page, and to enable/ disable the various display modes. The normal 'Select, Scroll, Enter' editing technique is used as has been previously described.

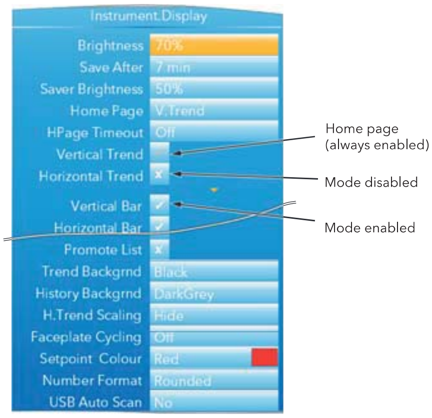


Figure 4.1.3 Display menu (expanded to show all fields)

Brightness	Allows the user to select a normal operating brightness for the screen from 10% to 100%, in 10% steps.
Save After	The elapsed time (since last button press) before the screen switches from 'Brightness' to 'Saver Brightness'. (Off = saver function disabled)
Saver Brightness	The screen saver brightness. Valid entries are 10% to 100% inclusive, in 10% steps. Using a lower power when not 'in use' not only saves power, but also increases display life. Typical screen power consumption is 0.5W at 100%, falling in a linear fashion to 0.05W at 10%.
Home page	Allows any display mode to be chosen as the 'Home' page. This is the page that the recorder displays at power up, and also the page displayed when the 'Home' key is selected from the top level menu (Section 3.3. The selected display mode (vertical trend in figure 4.1.3) is always enabled in the following display mode enable fields (its 'tick' is greyed out and cannot be edited). See Section 3.4 for a description of the available modes.
HPage Timeout	The elapsed time (since last button press) before the display returns to the home screen. (Off = disabled)
Vertical Trend	This is the default home page, and its tick is greyed. If this is not the home page, the tick can be changed to a cross, by highlighting it and operating the scroll button.

4.1.3 Display Configuration (Cont.)

Horizontal Trend, Vertical Bar, Horizontal bar, Numeric, Alarm Panel, Loop control, Dual Loop, Cascade, Programmer, Steriliser, Promote List, Modbus Master, EtherNet/IP. As for Vertical Trend, above. By default some display modes are disabled (grey cross). In order to enable such display modes the relevant cross is highlighted using the up/down arrow buttons, and the scroll button then used to change the grey cross to a white tick.
The tick associated with the selected home page is always grey.

Note: Some display modes are available only if the relevant option is fitted.

Future Trend — This and the associated colour selections appear only if the Programmer option is fitted. See Section 3.4.9 for more details.

Trend Background — Allows the user to select black (default), white dark grey or light gray as the 'chart' colour.

History Background — As above for 'Trend background', but for history displays.

H.Trend Scaling — As described in Section 3.4.2, by default, the scale for horizontal trends appears at the left edge of the chart for a few seconds before the chart expands leftwards to occupy the scale area. Setting 'H.Trend Scaling' to 'Permanent', ensures that the scale remains permanently on display.

Faceplate cycling — Allows the default faceplate cycling state to be defined as 'On' or 'Off' (Section 3.3.5)

Setpoint colour — The colour for the setpoint in Control Loop display pages (Section 3.4.7).

Number Format — Rounded:
Truncated:

USB Auto Scan — If set to 'Yes', bar code data messages are automatically generated and appear on the display and in the Message list without operator intervention. If set to 'No', the Message appears on the screen for editing and/or confirmation, before being displayed etc. Section 8.2 provides further details.

There is a new paramter been added to the Instrument. Display list - Number format.

The options are to "Round" or "Truncate" values. On the previous firmware releases of the nanodac, numbers were truncated (in the same way as the 6000).

From firmware versions V3.01 and above there is an option to allow numbers to be rounded. The reason for this is driven primarily from a control point-of-view. With truncation, it is quite likely that the PV will look as though it never settles onto setpoint. The rounding/truncation affects the UI display and MODBUS scaled integers, the underlying numbers are not affected, nor the values saved in the history files. Over MODBUS comms, all floating point parameters that are read via scaled integer comms will take note of the configured setting for rounding or truncating and reflect this. On the UI, ALL floating point values rendered will adhere to the configured setting of rounding or truncating.

4.1.4 Info menu

Gives information about the recorder hardware and software, and allows the user to enter a descriptor for the instrument. The normal 'Select, Scroll, Enter' editing technique, previously described) is used to edit those fields that are not read only.

Figure 4.1.4 Info menu (expanded to show all fields)

Name	Allows the user to enter a descriptor of up to 20 characters, using the text entry techniques described in Section 3.6. The number of characters visible in the display mode pages varies according to the number of alarm symbols on display.
Type	Nano. Read only display of the instrument model (used by 'iTools').
Version	Read only. The software version of the instrument.
Bootrom	Read only. Instrument software Boot ROM version
Company ID	Read only. For CNOMO* purposes over Modbus (1280 decimal; 0500 hex).
Config Rev	Read only. This value is updated, and a message including this value generated, every time configuration is quit, if any one or more configuration parameter has been changed.
Security Rev	Read only. This number is incremented every time configuration is quit, if any one or more passwords has been changed, or if the FTP Server username has been changed, or if the Comms Enable field has been edited.
Nvol writes	Number of non volatile write operations for diagnostic purposes.
Line voltage	The instantaneous value of the supply voltage applied to the instrument. Used in some control loop operations.
Wires Free	This shows the number of wires free to be used. The value takes into account all user wiring whether carried out at the instrument or downloaded from the iTools graphical wiring editor.

4.1.5 Upgrade

CAUTION

1. Power must not be removed from the unit whilst upgrade is in progress, as to do so will cause permanent damage to the unit.
2. For USB upgrades, the memory stick must not be removed whilst upgrade is in progress or the instrument will be permanently damaged.

This item allows the user to update the instrument firmware, either from a memory stick in the USB socket at the rear of the unit, or via FTP transfer from a host computer. Firmware upgrade files are downloaded from the recorder manufacturer and transferred to the instrument by memory stick or by FTP transfer. Splash screens are prepared by the user and transferred using a memory stick. The unit restarts automatically after an upgrade or splash screen replacement.

Figure 4.1.5 Typical Upgrade menus

Upgrade	Select 'Firmware (USB)', 'Firmware (FTP)', 'Bootrom (USB)' or 'Splash (USB)' as the source of the upgrade.
Server IP Address	For 'Upgrade' = 'Firmware (FTP)' only, this field must contain the IP address of the pc which is to supply the upgrade file.
Account Username	For 'Type' = 'Firmware (FTP)' only, the username set up in the host ftp server
Account Password	For 'Type' = 'Firmware (FTP)' only, the password set up in the host ftp server
Source Path	The name of the directory from which the upgrade file is to be read. This is only the name of the directory without any path elements (e.g. '/') included unless the path is 'release/upgrade/files'.
Initiate	Select 'Yes' to initiate the upgrade.

CUSTOMISING THE SPLASH SCREEN

'Splash (USB)' allows the user to select a new image for the splash screen (i.e. the screen that appears at power up or restart). When 'Initiate' is set to 'Yes', the instrument searches the USB device for a file called 'splash.bmp' located in the 'release' folder. If such a file is found, it is loaded, and the instrument re-starts with the new image as the 'splash' screen. If no file is found, the request is ignored. If the image is not of the correct type or size, the instrument re-starts with the default splash screen.

The original splash screen is included on the 'tools' DVD, so that it can be restored if required.

Rules:

1. This feature is available only with Bootrom versions 2.0 and above.
2. The file must be located in a folder called 'release' and the file name must be 'splash.bmp'.
3. The image must be 320 x 240; 24-bit resolution.
4. The image must be in bitmap (suffix.bmp) format.
5. The image may not exceed 256kB.

4.1.6 Security menu

This allows the user to enter passwords for all security levels (except logged out), and to enable/disable serial communications security.

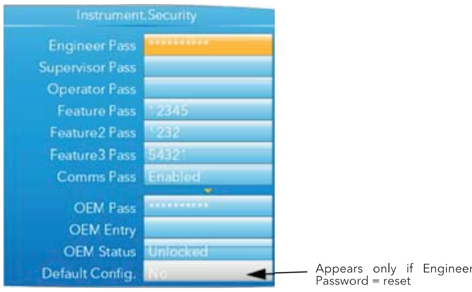


Figure 4.1.6 Security menu

Engineer Pass	Gives access to configuration menus. Set to 100 when despatched, but can be edited here, if required, by entering an alternative of up to 20 characters (note 1). If 'reset' (case sensitive) is entered as the Engineer Password, the 'Default Config.' field appears allowing the instrument default configuration to be restored (note 2).
Supervisor Pass	A password (none by default) of up to 20 characters can be entered here to protect Supervisor level access.
Operator Pass	A password (none by default) of up to 20 characters can be entered here to protect Operator level access.
Feature Pass	This is a password supplied by the manufacturer to enable the software options (e.g. Loop, Zirconia block, Toolkit blocks etc.). When applying for this code, the manufacturer will require the instrument's MAC address (Network.Interface menu Section 4.2.1) and the instrument's firmware Version (Instrument.info menu - Section 4.1.4). The password is MAC address dependent so that it cannot be used on any other instrument.
Feature2/3 Pass	Similar to 'Feature Pass' above, but for additional features.
Comms Pass	Enables/disables password security for external communications (including via iTools). If set to 'Enabled', the Engineer level password will be required if an attempt is made to enter the configuration menus from a remote pc. If set to 'Disabled', then access to configuration can be gained over a communications link, without a password. If enabled, then entry to configuration mode via the Instrument Mode (IM) parameter must be completed within 5 seconds of entering the password, or the attempt will fail.

Notes:
1. It is recommended that only such characters as appear on the user's pc keyboard be used in the Engineer password. The use of other characters makes it necessary to use 'Escape' codes (e.g. Alt 0247 for the '÷' sign) when trying to enter configuration mode from iTools, for example.
2. Restoring factory default configuration can also be carried out in iTools, using the Engineer password 'reset' and selecting Default Config to 'Yes'.

4.1.6 Security Menu (Cont.)

OEM Pass	The configured pass phrase used to enable / disable the OEM security option. This field is editable whilst the OEM Status is 'Unlocked' and the user has 'Engineer' access.
OEM entry	To lock or unlock the OEM security feature, the user must enter the pass phrase entered in 'OEM Pass' above. The default passcode is OEM (in capitals).
OEM Status	Read only 'Locked' or 'Unlocked' status display.
Default Config	This field appears only if 'reset' has been entered as the Engineer Password. Selecting 'Yes' Causes the instrument to restart with default configuration (i.e. the instrument 'cold starts'). See note 2 above.

OEM SECURITY

In products that incorporate user wiring, the value of an application may lie more in the user wiring (connecting the function blocks together) than in the configuration of the instrument's parameters.

OEM Security allows the user to prevent the application from being copied either via comms (by iTools or a third party comms package) or via the instrument's user interface.

When OEM security is enabled, users are prevented from accessing wiring (for reading or writing) from any source (comms or user interface), and it is not possible to Load or Save the configuration of the instrument via iTools or by using the Save/Restore facility (Section 4.1.8).

From firmware version V5.00 onwards OEM Security is enhanced by providing an option, enabled by a new parameter 'Instrument.Security.OEMParamLists. This parameter is available only through iTools and allows the OEM to:-

1. Make all parameters that are read/write in Engineer access level only, read only when the instrument is OEM locked AND it is in Engineer access level. It is possible for the OEM to select up to 100 parameters which are to remain read/write in Engineer access level.
2. Make up to 100 parameters that are read/write in Supervisor access level, read only when the instrument is OEM locked.

Examples of how to set up OEM security are given in the iTools Section 6.6.10.

4.1.7 I/O fitted

This provides a read only display showing what type of input or output circuit is associated with each set of rear terminals.

Figure 4.1.7 I/O fitted display

I/O TYPES

Dig.IO	Digital input/output
Relay	Relay output
Dig.In	Digital input
Dig.Out	Digital output
DC.Op	DC output

Note: The I/O types fitted in locations LALC, LBLC, 4AC and 5AC are always as shown above. The types of I/O fitted in locations 1A1B, 2A2B and 3A3B depends on the options specified at time of order.

4.1.8 Save/Restore

This allows the user to save and/or restore instrument clone configurations to a memory stick inserted into the USB connector at the rear of the unit. The format of the saved/restored files is iTools clone files (*.uic)

Selecting 'Restore' presents a list of clone files in the configured directory on the USB device. (In the example below, the file is located in the basic usb0 directory - it has not been saved to a particular configuration directory.)

When 'Save' is selected, the virtual keyboard must be used to enter the filename. If the file already exists on the USB device, a warning appears offering 'Cancel' or 'Overwrite' alternatives.

Notes:

1. The ability to save and restore is disabled if OEM security is enabled.
2. Configuration save/restore is available only when the unit is logged into at 'Engineer' access level.
3. During USB cloning (USB save/restore), the priority of modbus slave comms is lowered. This allows the save/restore process to complete in a minimal time (around 60 seconds). During this period, modbus slave comms response times will be extended and may result in the master device timing-out.

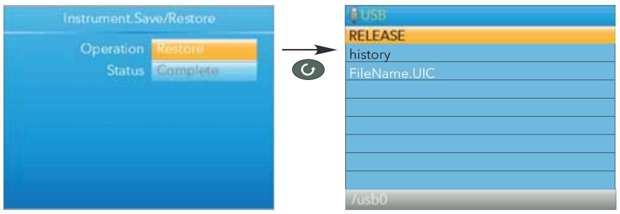


Figure 4.1.8 Save/Restore display

Operation	Select 'Save' or 'Restore'. Use the up/down arrow keys to highlight the required .UIC file, then use the scroll key to initiate the operation.
Status	Shows the status of the operation, as follows:
	Inactive: Neither saving or restoring a clone file has occurred since the last time the instrument was power cycled.
	Complete: Indicates that the cloning process has completed.
	Restoring: Restore operation is currently in progress.
	Saving: A clone file is currently being saved.
	Cold started: A power-cycle of the product occurred whilst a Restore operation was in progress. The product configuration is unreliable and has been reset to factory default.

The 'Restoring' and 'Saving' status text is accompanied by an animated display (circling green 'flash') to indicate that the operation is in progress.

4.1.9 Input adjust

Notes
1. Input adjust cannot be applied to input channels with input type of 'Digital', 'Test' or 'Off'.
2. Input adjustments can be carried out only by users logged in as 'Engineer' (see Section 3.3.8).
3. The instrument must be powered for a sufficient time (e.g. 30 minutes) for it to reach thermal equilibrium before an input adjust is performed.

This facility allows the user to compensate for tolerance errors etc. The technique used is to select those channels to which adjust is to be applied, then for each channel to:

a apply a known low level signal (at or close to the low input range value) to the relevant input. When the recorder reading is steady, press 'Apply'.

b. apply a known high level signal (at, or close to, the high input range value) to the relevant input. When the recorder reading is steady, press 'Apply'.

Figure 4.1.9a shows a typical display when 'Input adjust' is selected from the Instrument menu, and Apply adjust has been selected. As can be seen, channel 3 has previously been adjusted.

Figure 4.1.9a Input adjust top level display

Channel 1 to 4	Shows the adjust status of each channel
Apply Adjust	Selecting 'Yes' initiates the adjustment procedure described below.
Remove Adjust	Selecting 'Yes' initiates the adjustment removal procedure described below.
Abort	Allows the user to abandon input adjustment at any point in the procedure.

ADJUSTMENT PROCEDURE

1. As shown in figure 4.1.9b, highlight the 'Apply Adjust' field, and operate the scroll key to enter edit mode. Use the up or down arrow key to select 'Yes'. Use the scroll button to change Channel 1 'cross' to a 'tick' (check mark). Similarly select any other channels which require adjustment.

Figure 4.1.9b Channel adjustment procedure (1)

4.1.9 Input Adjust (Cont.)

ADJUSTMENT PROCEDURE (Cont.)

2. Highlight the 'Start IP 'Adjust' field and use the scroll and up/down arrow to select 'Yes'. Use the scroll key again to enter the low value adjust page.
3. Apply the known low value and wait for the value to stabilise. Enter the 'Low Target Value' (the value that the recorder is to read for the applied input). When all is steady, use the scroll and up/down arrow to set the 'Confirm Low' field to 'Yes', then operate the scroll button again.

Figure 4.1.9c Channel adjustment procedure (2)

4. The display changes to the high value adjust page.
5. Apply the known high value and wait for the value to stabilise. Enter the High Target Value (the value that the recorder is to read for the applied input). When all is steady, set 'Confirm High' to 'Yes'.

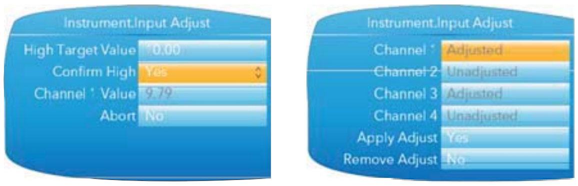


Figure 4.1.9d Channel adjustment procedure (3)

REMOVAL PROCEDURE

1. Set 'Remove Adjust' to 'Yes' and operate the scroll button.
2. Use the scroll and up/down arrow buttons to change the required channel icons from crosses to ticks.
3. Select Remove IP Adjust to 'Yes' and operate the scroll key. The adjustment is removed from all selected channels without further confirmation.

Figure 4.1.9e Channel adjustment removal

4.1.9 Input Adjust (Cont.)

DUAL INPUT CHANNELS

For the dual input channel option, input adjust is carried out as described above, except that for any channel where dual inputs are configured, the user must initiate adjustment to primary and secondary inputs separately. As shown in figure 4.1.9f, a new field 'Input on Channel' is introduced for this purpose.

Only those channels with 'Type' set to 'Dual mA', 'Dual mV' or 'Dual T/C' appear in the list of secondary channels. In this example, only channels 1 and 3 are configured as dual input. (See section 4.4.1 for channel Type configuration.)

Figure 4.1.9f Input adjust top level display (dual input channels)

For primary inputs, all four channels are included in the list and can therefore be selected for adjustment. For secondary inputs, only those channels which have been configured as dual input are included.

4.1.10 Output adjust

This item appears only if one or more of I/O type DC Output is fitted and allows the user to compensate for tolerance errors etc. in connected equipment.

1A1B and 2A2B can be configured only as mA outputs.

3A3B can be configured as mA or Volts.

See Section 4.13 for configuration details.

Figure 4.1.10a Output adjust initial display

ADJUST PROCEDURE

1. Highlight the 'Apply Adjust' field, and operate the scroll key to enter edit mode. Use the up or down arrow key to select the required output and confirm with the scroll key. The output adjust page appears for the low point.
2. Measure the output at the required point, and enter this value in the 'Measured Output' field using the text entry techniques described in Section 3.6. To skip this stage go to step 3.
3. Set 'Confirm Low' to 'Yes'. The output adjust page appears for the high point.
4. Measure the output at the required point, and enter this value in the 'Measured Output' field as described for the low point. To skip this stage go to step 5.
5. Set 'Confirm High' to 'Yes'. The output adjust initial display reappears, with the word 'Adjusted' in the relevant DC Output field.

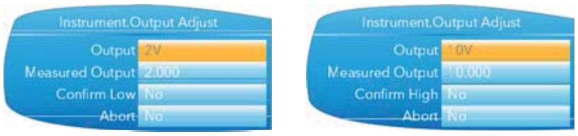


Figure 4.1.10b Low and High adjust point displays

Notes:

1 The figures above show the displays when the DC output is set to 'Volts' (Section 4.13) (3A3B only). The mA displays are similar, but the fixed low and high values are 4mA and 20mA respectively.

2. 'Abort' cancels operations so far and returns to the output adjust initial display (figure 4.1.10a).

Figure 4.1.10c Adjusted display

ADJUST REMOVAL

In the output adjust initial display (figure 4.1.10c) highlight the 'Remove Adjust' field, and operate the scroll key to enter edit mode. Use the up or down arrow key to select the required output and confirm with the scroll key. The output adjustment is removed, without confirmation. The initial display returns to 'Unadjusted' as in figure 4.1.10a.

4.2 NETWORK MENU

Network

Interface (Section 4.2.1)	Archiving (Section 4.2.2)	FTP Server (Section 4.2.3)	Modbus (Section 4.2.4)
MAC address	Media size	User name	Prefmaster IP
Client Identifier	Media free	Password	Address
IP type	Media duration		Input timeout
IP address	Rate		Unit ID Enable
Subnet mask	Destination		Serial Mode
Gateway	File format		Time Format
	On media full		Pref Master Conn
	Remote path		Response time
	Primary server		Master Conn 2
	Primary user		Response time
	Primary password		Master Conn 3
	Secondary server		Response time
	Secondary user		Master Conn 4
	Secondary password		Response time
	Trigger		
	Period		

4.2.1 Interface

This area of configuration allows the user to set up an IP address for the instrument, either by typing one in (Fixed), or automatically (DHCP), assuming a DHCP server is running.

Figure 4.2.1 Network Interface menu

MAC	Read only. Media Access Control. A unique address for each instrument, entered at the factory.
Client Identifier	The client identifier is a unique id used by DHCP servers that implement option 61. Each nano product will have a unique ID built up from its MAC address. If the DHCP server is configured to use option 61, then it will use this id instead of the MAC address to assign a dynamic IP address.
IP Type	If 'Fixed', the user needs to enter an IP address and Subnet Mask in the following fields, and a Gateway address if required. If 'DHCP' the subsequent fields become read only, with the entries automatically generated by the DHCP server. When set to DHCP, it takes several seconds before the IP address is obtained from the DHCP server.
IP Address	Read only if 'IP Type' = 'DHCP'. If 'IP Type' = 'Fixed', the user may enter an IP address (IPV4 dot notation). This would normally be supplied by the user's IT department, or from the Network supervisor.
Subnet Mask	Read only if 'IP Type' = 'DHCP'. If 'IP Type' = 'Fixed', this sets a range of IP addresses that can be accessed. Normally supplied by the user's IT department, or from the Network supervisor.

4.2.1 Interface (Cont.)

Gateway — Read only if 'IP Type' = 'DHCP'.
If 'IP Type' = 'Fixed' this allows the user to enter a gateway address for use when the unit is to communicate outside the local network. Normally supplied by the user's IT department, or from the Network supervisor.

4.2.2 Archiving

This area of configuration is used to set up the parameters for use during unattended archiving. Some of the fields appear only if other fields are set to a particular value. For example, the CSV fields appear only if 'File Format' is set to 'CSV' or to 'Both'.

The archived data is not removed from the flash memory of the instrument. When the flash memory is full, new data causes the oldest file(s) to be discarded.

Note: For remote archiving, the host computer must be set up to respond to 'pings'. This is because the nano pings the host whilst establishing connection, and if it does not receive a response the archive attempt fails.

Remote with Binary file format

Local with CSV files included

Figure 4.2.2a Unattended Archive configuration (typical settings)

Media Size — Appears only for File Format = 'Binary (UHH)'. A read only value showing the capacity of the memory stick inserted in the USB port at the rear of the unit. Shows zero if no memory stick is present.

Media Free — Appears only for File Format = 'Binary (UHH)'. A read only value showing the space remaining in the memory stick inserted in the USB port at the rear of the unit. Shows zero if no memory stick is present.

Media Duration — Appears only for File Format = 'Binary (UHH)'. A read only value showing the time it will take to fill the Memory stick if the recorder configuration remains unchanged.

4.2.2 Archiving (Cont.)

Rate — Allows the user to specify the frequency at which the contents of the Flash memory are archived to the USB port or, via FTP, to a pc. Scrollable settings are:

- None — Automatic archiving is disabled. Any archiving must be initiated by the user using Demand Archiving, as described in Section 3.3.7.
- Hourly — Archive occurs on the hour, every hour.
- Daily — Archive initiated at 00:00* each day
- Weekly — Archive is initiated at midnight* every Sunday
- Monthly — Archive is initiated at 00:00* on the 1st of every month.
- Automatic — The recorder selects the least frequent of the above archive periods which is guaranteed not to lose data as a result of the internal flash memory's running out of space.

*Note: Archive times are not adjusted for daylight saving time (DST). Thus, if the archive is set to 'Daily', 'Weekly' or 'Monthly', then during summer time, the archive will be triggered an hour late (i.e at 01:00 hours instead of midnight).

Destination — Select 'FTP Server' for archive to a remote pc, or 'USB' to archive to the USB port device.

File format — Select 'Binary (UHH)' 'CSV' or 'Both'.

- Binary (UHH) — A proprietary format used by the instrument that needs other software (e.g. Review', to interpret the data before it can be presented in spreadsheets etc. Binary files have the extension '.uhh'.
- CSV — This format is a standard open-file format for numeric data. A simple ASCII-based format, it is readable by a wide range of pc applications as well as being suitable for direct import into many commercial databases. CSV files have the extension '.csv'.
- Both — Archiving includes both .uhh and .csv files.

Note: CSV is ASCII based and cannot interpret Unicode characters. For this reason, some characters available to the user will not be displayed correctly in .csv files.

CSV Values — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then process values are included in the file (see figure 4.2.2b for details).

CSV Messages — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then messages are included in the file (see figure 4.2.2b for details).

CSV Headers — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then Header details are included in the file (see figure 4.2.2b for details).

CSV Headings — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then column headers are included in the file (see figure 4.2.2b for details).

CSV Date Format — Appears only if 'File Format' is set to 'CSV' or 'Both'. Allows 'Text' or 'Spreadsheet' to be selected. Text causes a time/date to appear in the spreadsheet. 'Spreadsheet Nu' displays the number of days since December 30th 1899. The decimal part of the number represents the latest six hours. For example: DDD--- --DD.25 represents 06:00 hours and DDD--- --DD.5 represents 12:00 hours. Spreadsheet Numeric format is more easily interpreted than 'Text' by some spreadsheet applications.

CSV Tab Del — Appears only if 'File Format' is set to 'CSV' or 'Both'.
CSV (Comma Separated Variables) does not always use commas as separators. For example, in some countries the decimal point is represented by a full stop (period), whilst in others a comma is used. In order to avoid confusion between a comma as a decimal point and a comma as a separator, a different separator can be used. This field allows the 'tab' character (^t) to be used instead of a comma.

4.2.2 Archiving (Cont.)

On Media Full — For 'Destination' = 'USB' only, this allows the user to select 'Overwrite' or 'Stop' as the action to be taken when the memory stick is full. 'Overwrite' causes the oldest data to be discarded from the memory stick to make room for newer data. 'Stop' inhibits archiving activity.

Remote Path — Left blank if the archive destination is the home folder. If the destination is to a subfolder within the home folder, then the name of the subfolder is entered here, preceded by a '/' character (e.g. '/history').

Primary Server — Allows the user to enter the IP address for the pc to be used as the primary FTP server.

Primary User/Password — These are the Login name and password of the remote host account, assigned either by the Network administrator, or set up in the 'Guest' account of the remote host's 'FTP server' or 'User Manager' configuration.

Sec. Server/user/password — As Primary server details above, but for the secondary FTP server used when the primary is not available for any reason.

Trigger — This parameter can be 'wired' to, say, an alarm going active, or a digital input, to allow an archive to be triggered remotely. Can also be set to 'yes' manually.

Period — Appears only if 'Trigger' is wired (Section 7). Allows a period of history to be selected for archiving when 'Trigger' goes 'true. Selections are: None, Last Hour, Last Day, Last Week, Last Month, All, Bring to Date. ('Last Month' archives the last 31 days of history.)

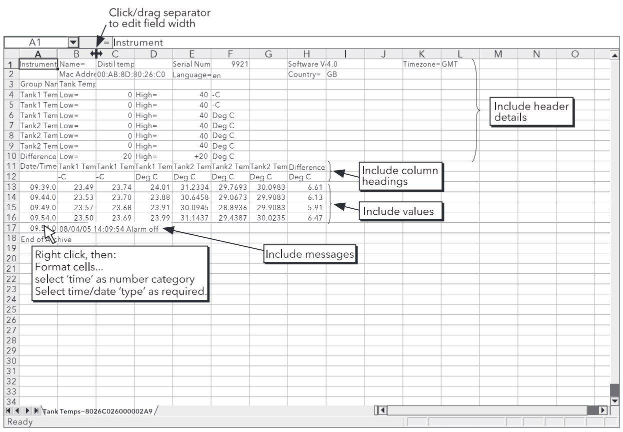


Figure 4.2.2b CSV data example

4.2.3 FTP Server

This area of configuration allows the user to enter the Username and Password used to access the instrument from a remote FTP client.

4.2.4 Modbus TCP

This allows the user to configure the recorder so as to allow it to communicate using Modbus Transmission Control Protocol.

Figure 4.2.4 Modbus TCP configuration menu

PrefMaster IP	The IP address of the relevant Modbus master. The Preferred master is guaranteed to be able to connect, even if all slave connections (max. = 4 for TCP) are in use.	
Address	The Modbus address for this slave. This address must be unique for the network to which it is attached. The recorder will respond to this address and to Address 255.	
Input Timeout	Allows a value of between 0 and 3600 seconds to be entered to set the timeout period for modbus input channels. If a modbus input is not written to within this period the value of the channel is set to -9999.0 with a 'No Data' status. A value of 0 disables the comms inactivity timeout feature.	
Unit ID Enable	Enables/Disables the checking of the Modbus TCP unit identity field.	
	Strict	The Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds only to Hex value FF in the UIF. iTools finds this instrument only at location 255, and then stops scanning.
	Loose	The Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds to any value in the UIF
	Instrument	The Modbus TCP Unit Identity Field (UIF) must match the instrument address or no response will be made to messages.
Serial Mode	Slave communications via the side mounted configuration port interface (CPI) clip (for iTools use.) Parameters: Baud rate 19,200; Parity = none; Number of data bits = 8; Number of stop bits = 1; no flow control. Can be set to 'Modbus Slave' or 'Off'. The unit must be restarted before any change takes effect.	
Time Format	Allows the user to choose milliseconds, seconds, minutes or hours as the time format. Sets the resolution for the reading and writing of time format parameters.	
PrefMaster Conn	Read only. Shows the IP address of the preferred master, when connected.	
Response Time	Read only. Shows the response time for a single communications request to the relevant master.	
Master Conn 1 to 4	Read only. Shows the IP addresses of any other masters connected to this recorder.	

4.3 GROUP CONFIGURATION

Group configuration is separated into two areas, one which defines trending characteristics (for display channels) the other defining the recording characteristics for saving data to the Flash memory ready for archiving.

4.3.1 Group Trend configuration

This allows the user to define which points are to be traced on the display and at what interval, and also allows the number of chart divisions to be set up. Figure 4.3.1 shows a typical configuration page.

Note: The background chart colour is set up as a part of Instrument Display configuration (Section 4.1.3)

Figure 4.3.1 Group Trend Configuration

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the group.
Interval	The trending interval which defines how much data appears on one screen height or width. A number of discrete intervals can be chosen between 0.125 seconds to 1 hour. The selection should be made according to how much detail is required, and how much data is to be visible on the screen.
Major Divisions	Allows the user to select the number of divisions into which the scale is divided and how many gridlines are displayed. Setting the value to 1 results in just the zero and full scale values appearing. Setting the value to 10 (the maximum) results in a scale with zero, full scale and nine intermediate values appearing, with associated grid lines.
Point1 to Point6	Allows the user to select which channels and virtual channels are to be traced. The maximum number of traces is six.

4.3.2 Group Recording configuration

Similar to Trend configuration, above, but for saving the data to Flash memory history files. Each point can individually be enabled or disabled for recording, or recording can be disabled for the whole group.

Figure 4.3.2 shows a typical page.

Figure 4.3.2 Group trend recording configuration

Flash Size	Read only. Shows the size of the Flash memory fitted in MB.
Flash Duration	Read only. Shows the time it will take to fill the Flash memory if the recorder configuration remains unchanged.
Enable	'Yes' enables group recording so that all points set to 'Yes' are stored in the recorder's flash memory. 'No' disables group recording.
Interval	Defines the rate at which data is saved to the recorder's Flash memory. The value affects how much trace history appears on the screen in trend history mode.
UHH Compression	Select 'Normal' or 'High'. 'Normal' compresses the data, but still provides an exact copy. 'High' compresses more, but values are saved only to 1 part in 10^8 resolution. See also note 1, below.
Channel 1 to VirtualChan 30 (see note 2, below)	Read only (greyed 'yes') for points being trended, (these are automatically recorded). For non-trending points the user may enable or disable each point individually.
Suspend	Ignored unless the user has wired to this field. If wired then when set to 'No' recording is active, when set to 'Yes' recording is paused.

Notes:

1. Where very high values are involved, such as in some totaliser values, 'High' compression may cause the value displayed at the recorder, and held in the history file, to be incorrect. The problem may be resolved by changing to 'Normal' compression, or, in the case of a totaliser, by re-scaling it (for example from MegaWatt hours to TeraWatt hours).
2. Virtual channels 1 to 15 are included in the standard build. Channels 16 to 30 are included only if the Modbus Master and / or EtherNet/IP option is fitted.

4.4 INPUT CHANNEL CONFIGURATION

Channel

N Select channel number

- Main (Section 4.4.1)
  - Descriptor
  - Type
  - PV
  - Status
  - IP adjust state
  - Resolution
  - Units
  - Test signal
  - Input low/high
  - Shunt value
  - Linearisation type
  - Range low/high
  - Scale low/high
  - Offset
  - CJ type
  - Filter
  - Sensor break type
  - Fault Response
  - Sensor break value
  - Measured value
  - Internal CJ Temp
- Trend Section 4.4.2)
  - Colour
  - Span low
  - Span high
- Alarm 1/2 Section 4.4.3)
  - Type
  - Status
  - Threshold
  - Hysteresis
  - Latch
  - Block
  - Dwell
  - Acknowledge
  - Active
  - Inactive
  - Not acknowledged
  - Acknowledgement

Figure 4.4 Channel configuration menu

4.4.1 Channel Main

This section describes all possible menu items, but it should be noted that some items are context dependent (e.g. Cold Junction settings appear only for Type = 'Thermocouple').

Channels one to four in the configuration relate to An In 1 (terminals 1I, 1+ and 1-) to An In 4 (terminals 4I, 4+ and 4-) respectively - see figure 2.2.

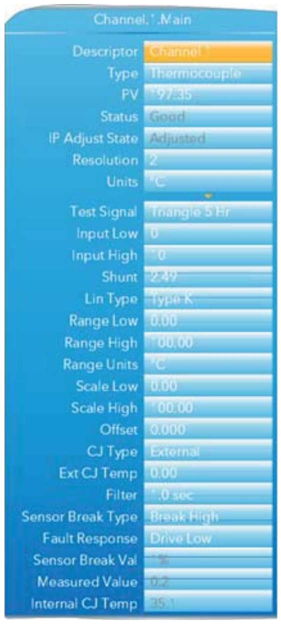


Figure 4.4.1a Channel main menu (expanded)

Note: For the sake of completeness, the figure above shows all possible fields, even though many are mutually exclusive. For example, 'Test signal' appears only when 'Test' is selected as Type. It would never appear when Type = thermocouple (as shown). Similarly, 'Shunt' would appear only for Type = mA.

4.4.1 Channel Main (Cont.)

Descriptor	Allows a (20 character max.) descriptor to be entered for the channel. Some thought should be given to ensure that the descriptor is meaningful because in some display screens it is truncated. For example, 'Furnace 1 area 1' and 'Furnace 1 area 2' might both appear as 'Furnace 1 a' and thus be indistinguishable from one another, except in background colour.
PV	Read only. Displays the current value of the channel.
Status	Read only. Shows the channel status as one of: 'Good', 'Channel Off', 'Over range', 'Under range', 'HW error', 'Ranging', 'HW (capability) exceeded'.
PV2	Read only. For dual inputs only, displays the current value of the secondary input.
Status2	Read only. For dual inputs only, shows the secondary input status (as 'Status' above).
IP Adjust State	Appears only for channels which have been included in the 'Adjust Input' procedure described in Section 4.1.9.
IP Adjust State2	As 'IP Adjust State', above but for secondary channels.
Resolution	Allows the number of decimal places to be defined for the channel. Valid entries are zero to nine.
Units	Allows a units string of up to five characters to be entered.
Type	Allows the user to select an input type for the channel. Available selections are: 'Off', 'Thermocouple', 'mV', 'V', 'mA', 'RTD', 'Digital', 'Test' or 'Ohms'. If the Dual Input option is fitted, Dual mV, Dual mA, Dual T/C (if enabled) are also available.

Note : If Dual T/C is selected then it is essential that the secondary T/C input is field calibrated using the Input Adjust procedure (Section 4.1.9)

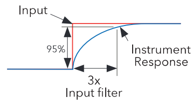
Test signal	Appears only if 'Test' is selected as 'Type'. Allows either a sinusoidal or a triangular waveform to be selected at one of a number of cycle times between 40 seconds and five hours.
Input Low*	For Type = mV, Dual mV, V, mA, Dual mA or Ohms, the lowest value of the applied signal in electrical units.
Input High*	As 'Input Low', but the highest value of the applied signal in electrical units.
Shunt value	For mA and Dual mA input types only, this allows the value of the shunt resistor (in Ohms) to be entered. The recorder does not validate this value - it is up to the user to ensure that the value entered here matches that of the shunt resistor(s) fitted. For Dual mA input type, both primary and secondary inputs must have independent shunts each of the same value.
Lin type	Linear, Square root, x3/2, x5/2, User Lin. Thermocouple types (alphabetical order): B, C, D, E, G2, J, K, L, N, R, S, T, U, NiMo/NiCo, Platinel, Ni/MiMo, Pt20%Rh/Pt40%Rh. User 1 to User 4 Resistance thermometer types: Cu10, Pt100, Pt100A, JPT100, Ni100, Ni120, Cu53. See Appendix A for input ranges, accuracies etc. associated with the above thermocouple and RTD types. See Section 4.14 for details of user linearisations.
Range Low*	For thermocouples, RTDs, User linearisations and retransmitted signals only, the lowest value of the required linearisation range.
Range High*	For thermocouples, RTDs, User linearisations and retransmitted signals only, the highest value of the required linearisation range.
Range Units	For thermocouples only and RTDs, Select °C, °F or K.
Scale Low/High	Maps the process value to (Scale High - Scale Low). For example, an input of 4 to 20mA may be scaled as 0 to 100% by setting Scale low to 0 and Scale High to 100.
Scale Low2/High2	As 'Scale Low/High but for the secondary input (PV2).
Offset	Allows a fixed value to be added to or subtracted from the process variable.

*Note: See Section 4.14 for details of the configuration of Range High/Low and Input High/Low when 'Type' = User 1 to User 4.

4.4.1 Channel Main (Cont.)

Offset2 — The nature of the secondary input results in an offset being introduced into the process variable value.
For mA inputs this offset is removed automatically, without user intervention.
For mV inputs the offset depends on the value of the voltage source impedance and is equal to 199.9μV/Ω. This offset can be compensated for either by using this Offset2 parameter, or by carrying out the 'Input Adjust' procedure (Section 4.1.9).
For Dual T/C inputs, it is recommended that the 'Input Adjust' procedure be used instead of Offset2 as the use of Offset2 results in an offset which is non-linear over the thermocouple range.

Input filter — Damping can be used to filter out noise from slowly changing signals so that the underlying trend can be seen more clearly. Valid input values are between 0 and 60 seconds.



Note: Applying a filter to an input channel can affect the operation of any Rate-of-change alarms configured to act on that channel.

CJC Type — For thermocouple input types only, this allows the user to select 'None', 'Internal', 'External' or 'Remote 1' to 'Remote 4'. For Dual T/C inputs, both primary and secondary inputs use the same cold junction.
None: No Cold junction compensation applied.
'Internal' uses the recorder's internal cold junction temperature measurement.
'External' means that the cold junction is to be maintained by the user, at a fixed, known temperature. This temperature is entered in the 'External CJ Temp' field which appears when 'External' is selected.
Remote 1 (2) (3) (4) means that the cold junction temperature is being measured by input channel 1 (2) (3) (4) respectively. (This must be a different channel from that currently being configured).

Ext. CJ Temp — Appears only if CJC type is set to 'External', and allows the user to enter the temperature at which the external cold junction is being maintained.

Sensor Break Type — Defines whether the sensor break becomes active for circuit impedances greater than expected.
'Off' disables Sensor Break detection.
Break Low: Sensor break active if measured impedance is greater than the 'Break Low impedance' value given in table 4.4.1.
Break High: Sensor break active if measured impedance is greater than the 'Break High Impedance' value given in table 4.4.1.
For mA inputs, limits are applied, such that if the process value lies outside these limits, a sensor break is assumed to have occurred. These limits are (Input lo - 4% Span) and (Input high + 6% Span). For example, for a 4 to 20mA signal, an input below 3.36mA or above 20.96mA will trigger a sensor break event

Range	Break Low impedance	Break High Impedance
40mV	~5kΩ	~20kΩ
80mV	~5kΩ	~20kΩ
2V	~12.5kΩ	~70kΩ
10V	~12.5kΩ	~120kΩ

Table 4.4.1 Minimum impedances for sensor break detection

Note: Break High impedance values would be used typically for sensors which have a high nominal impedance when working normally

4.4.1 Channel Main (Cont.)

Sensor Break type (Cont.)

Input sensor break detection is not supported for secondary inputs. The internal circuit acts as a 'pull up' on the secondary input which therefore saturates high in the event of a sensor break.

Fault Response — Specifies the behaviour of the recorder if a sensor break is detected or if the input is over driven (saturated high or low).
'None' means that the input drifts, with the wiring acting as an aerial.
'Drive High' means that the trace moves to (Scale High +10%). 'Drive Low' means that the trace moves to (Scale Low -10%), where the 10% values represent 10% of (Scale High - Scale Low).

Sensor Break Val — A diagnostic representation of how close the sensor break detection circuitry is to tripping.
Measured ValueThe (read only) input channel measured value before any scaling or linearisation is applied.

Measured Value2 — As 'Measured Value', above but for the secondary input.

Internal CJ temp — The (read only) temperature of the internal cold junction associated with this channel.

4.4.2 Channel Trend configuration

This area allows the configuration of channel colour and span.

Figure 4.4.2a Channel Trend menu

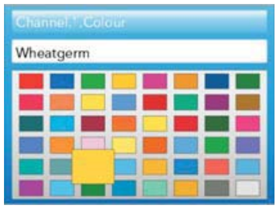


Figure 4.4.2b Colour selection

Colour	Allows a colour to be specified for the channel. The Scroll key is used to enter the colour swatch page. The up and down arrows are used to scroll through the available colours, with each colour being enlarged for as long as it is 'selected'. Once the required colour, is reached, the scroll key is used again to return to the Trend Configuration.
Span Low/High	Span low and high values.

Note: Trend colours and alarm settings for secondary inputs are configured in the maths channels to which they are wired.

SPAN EXAMPLE

In an input range of 0 to 600 degrees C, the temperature range between 500 and 600 degrees is of most interest. In such a case, Span Low is set to 500 and Span High to 600 so that the recorder trends only the required part of the temperature range, effectively magnifying the area of interest.

Note: Trending is restricted to the PV range (Span High - Span Low), but the instrument can display values outside this range.

CHANNEL CONFIGURATION EXAMPLE

A type J thermocouple is used to measure a temperature range of 100 to 200 degrees Celsius. This thermocouple output is transmitted to the recorder by a 4 to 20mA transmitter, for display as a value between 0 and 100%.

In Channel.Main, set the following for the relevant channel:

Type	= mA
Units	= %
Input Low	= 4.00
Input high	= 20.00
Shunt	= 250 Ohms
Lin Type	= Type J
Range Low	= 100.00
Range High	= 200.00
Range Units	= °C
Scale Low	= 0
Scale High	= 100

Other items may be left at their defaults.

4.4.3 Alarm 1 menu

Allows the alarm characteristics for Alarm 1 to be configured. The figure below shows a typical configuration page (expanded for clarity). Actual configuration parameters are context sensitive.

Figure 4.4.3 Typical alarm 1 configuration menu

Type	Select an alarm type from: ‘Off’, ‘Abs. High’ (absolute high). ‘Abs. Low’ (absolute low), ‘Dev. High’ (deviation high), ‘Dev. Low’ (deviation low), ‘Dev. Band’ (deviation band), ‘Rise ROC’ (rate-of-change: rising), ‘Fall ROC’ (rate-of-change: falling), ‘Digital High’, ‘Digital Low’. See ‘Alarm types’, below, for definitions.
Status	Read only. This shows that the alarm is Off, Active, SafeNotAcked or ActiveNotAcked. For ‘Auto’ and ‘Manual’ alarms only, ‘SafeNotAcked’ means that the alarm trigger source has returned to a non-alarm state, but the alarm is still active because it has not been acknowledged. Similarly, ‘ActiveNotAcked’ means that the source is still active and the alarm has not been acknowledged. Always shows ‘Off’ when the alarm is inhibited (see below).
Threshold	For absolute alarms only, this is the trip point for the alarm. For absolute high alarms, if the threshold value is exceeded by the process value (PV) of this channel, then the alarm becomes active, and remains active until the PV falls below the value (threshold - hysteresis). For absolute low alarms, if the PV of this channel falls below the threshold value, then the alarm becomes active and remains active until the PV rises above (Threshold + Hysteresis).
Reference	For deviation alarms only, this provides a ‘centre point’ for the deviation band. For ‘deviation high’ alarms, the alarm becomes active if the process value (PV) rises above the value (Reference + Deviation) and remains active until the PV falls below (Reference + Deviation - Hysteresis). For ‘deviation low’ alarms, the alarm becomes active if the process value (PV) falls below the value (Reference - Deviation) and remains active until the PV rises above (Reference - Deviation + Hysteresis). For ‘deviation band’ alarms, the alarm is active whenever the process value (PV) lies outside the value (Reference ± Deviation) and remains active until the PV returns to within the band, minus or plus Hysteresis as appropriate.
Deviation	For deviation alarms only, ‘Deviation’ defines the width of the deviation band, each side of the Reference value, as described immediately above.

4.4.3 Alarm 1 Menu (Cont.)

Hysteresis	For absolute and deviation alarms, this provides a means of preventing multiple alarm triggering, if the process value is drifting close to the trigger value.
Amount	For rate-of-change alarms only. The alarm becomes active if the process value rises (Rise ROC) or falls (Fall ROC) by more than the specified 'Amount' within the time period defined in 'Change Time', below. The alarm remains active until the rate of change falls below the value (Amount/Change Time) in the relevant sense.
Change Time	Settable to 1 second, 1 minute or 1 hour. See 'Amount' (above).
Average Time	For rate-of-change alarms only. This allows an averaging period (for the process value) to be entered to reduce nuisance trips due to signal noise, or if the rate of change is hovering around the trip value.
Latch	None: the alarm remains active until the monitored value has returned to a non alarm state, when it becomes inactive. Auto: The alarm remains active until the monitored value has returned to a non alarm state and the alarm has been acknowledged. Acknowledgement can take place either before or after the value has returned a non alarm state. Manual: The alarm remains active until the monitored value has returned to a non alarm state and the alarm has been acknowledged. Acknowledgement is permitted only after the value has returned a non alarm state. Trigger: Not enunciated, this mode is used only to initiate an action defined by user wiring either using iTools or using the user interface.
Block	Alarms with 'Block' set to 'On' are inhibited until the monitored value has entered the 'safe' condition after a start-up. This prevents such alarms from becoming active whilst the process is brought into control. If a latching alarm is not acknowledged then the alarm is re-asserted (not blocked), unless the alarm's threshold or reference value is changed, in which case the alarm is blocked again.
Dwell	Initiates a delay between the trigger source becoming active, and the alarm becoming active. If the trigger source returns to a non alarm state before the dwell time has elapsed, then the alarm is not triggered and the dwell timer is reset.
Acknowledge	Select 'yes' to acknowledge the alarm. Display returns to 'No'.
Active	Read only. Shows the status of the alarm as 'Yes' if it is active, or No, if inactive. The active/inactive state depends on the Latch type (above) and acknowledgment status of the alarm. Always shows 'No' if the alarm is inbited (below).
Inactive	As for 'Active' above, but shows 'Yes' if the alarm in inactive and 'No' if the alarm is active. Always shows 'Yes' if the alarm is inbited (below).
N.acknowledged	As for 'Active' above but shows 'Yes' for as long as the alarm is unacknowledged, and 'No' as soon as it is acknowledged. Always shows 'No' if the alarm is inbited (below).
Acknowledgement	Fleetingly goes 'Yes' on alarm acknowledgement, and then returns to 'No'.
Inhibit	When 'Inhibit' is enabled, (tick symbol), the alarm is inhibited. Status is set to 'Off'; 'Active' and 'N.acknowledged' are set to 'No', and 'Inactive' is set to 'Yes'. If the alarm is active when inhibit is enabled, then it becomes inactive until inhibit is disabled, when its status depends on its configuration. Similarly if the alarm trigger becomes active when the alarm is inhibited, the alarm remains 'off' until inhibit is disabled, when its status depends on its configuration.

4.4.4 Alarm 2 menu

As above for Alarm 1 menu.

Note: The parameters 'Acknowledge', 'Active', 'Inactive', 'N(ot) Acknowledged' and, 'Acknowledgement' can all be 'wired' to other parameters, so, for example, a relay can be made to operate whilst the alarm is inactive or whilst it is active or on acknowledgement etc. by wiring the relevant parameter to the relay's 'PV' input. See Section 7 for details of user wiring.

4.4.5 Alarm types

The following figures attempt to show graphically the meanings of the alarm parameters which can be set for the various alarm types available.

ABSOLUTE ALARMS

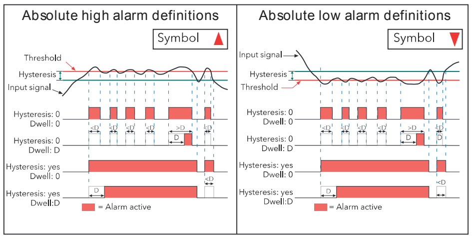


Figure 4.4.5a absolute alarm parameters

DEVIATION ALARMS

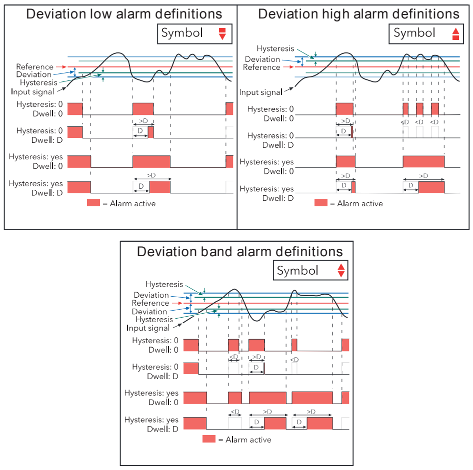


Figure 4.4.5b Deviation alarm parameters

4.4.5 Alarm Types (Cont.)

RATE-OF-CHANGE ALARMS

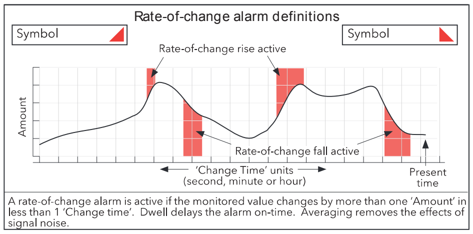


Figure 4.4.5c Rate-of-change alarm parameters

Note: Operation of rate-of-change alarms may be affected if an input filter (Section 4.4.1) is applied to the input signal.

4.5 VIRTUAL CHANNEL CONFIGURATION

This allows the configuration of maths channels, totalisers and counters. The configuration is divided into the following areas: 'Main', 'Trend', 'Alarm 1*' and 'Alarm 2*'. Items appearing in the 'Trend', Alarm 1' and 'Alarm 2' areas are identical with the equivalent items described in Section 4.4 (Input channels), above.

*Note: Virtual channels 16 to 30 (supplied with Modbus Master and EtherNet/IP options only) come without alarms.

4.5.1 Maths channel configuration

The following maths functions are available (listed in up-arrow scroll order)

Off, Add, Subtract, Multiply, Divide, Group Average, Group minimum, Group maximum, Modbus input, Copy, Group minimum (latch), Group maximum (latch), Channel maximum, Channel minimum, Channel Average, Configuration revision, Off.

Figure 4.5.1 shows a typical maths channel configuration

Figure 4.5.1 Maths channel configuration (typical)

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the maths channel
Type	Math selected for this example. (See Section 4.5.2 and Section 4.5.4 for totalisers and counters respectively.)
Operation	Allows the user to select the required maths function. See 'Maths Functions', below.
PV	Read only. Shows the dynamic value of this channel in the units entered in 'Units' below.
Status	Read only. Shows the status of this channel, reflecting the status of the input sources.
Resolution	Enter the number of decimal places required
Units	Allows a five character string to be entered to be used as the channel units.
Input1	The value of input 1. May be entered manually, or it may be wired from another parameter (Section 7). Uses the resolution of the source.
Input 2	As for 'Input 1', Appears only when the operation requires two inputs.
Reset	Allows the user to reset latching functions (e.g. Channel Max) or averaging functions (e.g. Channel Avg). Reset is carried out by setting the field to 'Yes', then operating the scroll key. The display returns to 'No'. Alternatively the function can be reset by another parameter wired to 'Reset'.
Time Remaining	The period of time remaining before the virtual channel performs its operation. For example, the time remaining for the maths channel average operation to sample the input before performing the calculation.
Period	For averaging functions, this allows a period to be entered, over which the value is to be averaged. Selectable periods are: 0.125, 0.25, 0.5, 1, 2, 5, 10, 20, 30 seconds, 1, 2, 5, 10, 20, 30 minutes, 1, 2, 6, 12, 24 hours

4.5.1 Maths Channel Configuration (Cont.)

MATHS FUNCTIONS

Off	Out = -9999; status = Off
Add	Out = Input1 + Input2
Subtract	Out = Input1 - Input2
Multiply	Out = Input1 x Input2
Divide	Out = Input1 □Input2. If Input2 = 0, Out = -9999; Status = 'Bad'.
Group Avg*	Out = Instantaneous sum of all points in the recording group (except this one and any channel that has been configured with operation = group average, group minimum, group maximum, group minimum (latched), group maximum (latched), channel maximum or channel minimum), divided by the number of points in the group (excluding this one). Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Group Min*	Out = Instantaneous value of whichever point (except this one) in the recording group has the lowest value. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Group Max*	Out = Instantaneous value of whichever point (except this one) in the recording group has the highest value. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Modbus Input	Out = value written to this channel's modbus input. If the comms timeout expires, Out = -9999; status = 'No data'.
Copy	Allows an input or other derived channel to be copied.
Grp Min Latch*	Out = Lowest value reached by any point in the recording group (except this one) since last reset. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Grp Max Latch*	Out = Highest value reached by any point in the recording group (except this one) since last reset. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Channel Max	Out = Highest value reached by Input1 since last reset. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Channel Min	Out = Lowest value reached by Input1 since last reset. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Channel Avg	Out = the average value of Input1 over the time specified in 'Period'. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Config Revision	Out = current Configuration Revision value.

*Note: All 'Group' functions operate on the 'Recording' group, not on the 'Trend' group.

4.5.2 Totaliser configuration

Totalisers allow the user to maintain a running total of any input channel, or of any maths channel. Using maths channels, it is possible to totalise combinations of input channels so that, for example, the sum of two channels or the difference between them could be totalised if required.

A totaliser is configured using Virtual Channels. This is in essence a way to convert an input signal representing a rate of change of some parameter, such as a fuel flow being measured, for example, in litres/minute into a cumulative flow. If the fuel flow is constant then, of course, the conversion would be simple, just multiply the flow rate by time and the answer comes out directly in litres. Provided, of course, that the time units of the flow rate and the time measurement are in the same units. Both need to be in Seconds, Minutes, Hours, etc. in order to get the correct answer.

If the flow rate is variable, the calculation has to be done repeatedly over the time period required and the results of the individual calculations must then be added together (Totalised). In order to get reasonable accuracy it is important that the flow should be reasonably constant during each measurement period. This means that the sampling time for the measurements should be sufficiently frequent that significant changes in flow rate are not missed. If the sampling frequency is high enough, the totalisation process is approximately equivalent to mathematical integration of the input signal.

The totaliser block in the Nanodac is intended to automate this process. It uses the built-in sampling rate of the nanodac (125mSec) as the sampling period for the totalisation process. In addition, it provides two separate parameters which can be used to adjust the results of the totalisation process so that the output from the block is scaled in the correct units. Figure 4.5.2. shows the Main configuration parameter list when the Virtual Channel block is being configured as a totaliser.

Wiring is carried out, either at the operator interface (Section 7), or in iTools (Section 6).

The totaliser equation is:

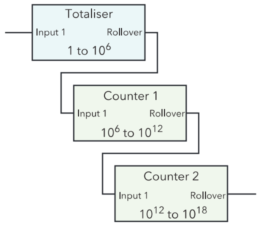
$$tot_t = tot_{t-1} + \frac{ma_t}{PSF \times USF}$$

where,

tot_t = totaliser value this sample
tot_{t-1} = totaliser value last sample
ma_t = process value this sample
PSF = Period Scaling Factor (Period)
USF = Units Scaling Factor (Units scaler)

Note: the time between samples is 125ms.

Figure 4.5.2 shows a typical totaliser configuration page.



Using cascaded counters to expand the totalisation range.

Figure 4.5.2 Typical totaliser configuration menu

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the totaliser.
Type	Select: Math, Counter or Totaliser.
Operation	Allows the user to enable ('On') or disable ('Off') the totaliser.
PV	Read only. This is the dynamic output value of the totaliser.
Status	Read only. Shows the status of the totaliser.
Resolution	The Resolution parameter allows the number of decimal places (up to 6) to be set for the totalised value as displayed on the instrument panel. It does not affect the resolution of the totalisation process. Up to 6 decimal places may be set for the totalised value.
Units	Allows a units string of up to five characters to be entered for the totalised value.
Units Scaler	Allows a units scaler to be selected. Typically this will be used to scale between unit types rather than to influence time period. One example of this would be when an input is measured in Litres/Minute, and Period has been set to 1Minute. If UnitsScaler is set to 1 then the total volume will be measured in Litres. If the volume is required in Cubic Metres then conversion of the total will be needed. There are 1000 Litres in a Cubic Metre so the UnitsScaler should be set to 1000. This produces an additional division of 1000 and results in a total output in Cubic Metres. Another example would be a requirement for the output in Gallons rather than litres, still with an input being measured in Litres/Minute. There are 4.54609 litres in an imperial gallon so the UnitsScaler would be set to 4.54609. (For a US Gallon the figure would be 3.78541.)
Low Cut Off	Used to restrict the input operating range of the totaliser. Minimum value = -100 000
High Cut Off	Used to restrict the input operating range of the totaliser. Maximum value = 100 000

Low Cut Off and High Cut Off are particularly important as they directly affect the totalisation process. Together these two parameters define the range of valid inputs to the totalisation process. If Input1 value lies between them, then the input is considered valid and it contributes to the total for any period during which it remains valid. Negative input values are allowed and will cause the totaliser to decrease in value for negative values. The total increases with positive values.

If the input lies outside the region defined by these CutOff parameters then it will be ignored and not contribute to the total.

Many applications do not wish to use negative values and so LowCutOff would then normally be set to 0. Occasionally though, calibration errors at the low scale end could cause unacceptable errors in the total. In these circumstances, it may be necessary to consider setting LowCutOff to a small positive value.

An example where this may be needed is when a process has a very low input value for long periods of time interspersed with short periods of high input values. The cumulative effect of slightly inaccurate low input values for long periods could then reduce the accuracy of the overall total recorded.

Thoughtful use may produce an increase in the overall accuracy of the total; inappropriate use could introduce significant inaccuracy.

Input1	The value of the source. May be entered manually, or this parameter can be wired from an external channel PV. Input1 is the input signal representing an external measurement which is in the form of Units/Time-Unit, i.e. a rate. The sampling rate internal to the block is fixed at the instrument tick rate of 8 times/second, taking one sample every 125mSec.
Period	The Period parameter divides the signal being applied to Input1 by the number which is needed to generate a Total PV which is scaled in appropriate time units. There is a selection of preset values available for the Period parameter. These are listed in Table 1 below. The totaliser equation works in seconds. If the totalised channel units are other than 'per second', a period scaler different from the default (1 sec) must be used. The 'Period' field presents a number of fixed periods from 0.125 seconds to 24 hours for selection.
Preset	Setting this to 'Yes' causes the totaliser to adopt the Preset Value. The field returns immediately to 'No'. The totaliser can also be preset by an external source 'wired' to this parameter.
Preset Value	Allows the entry of a value, from which the totaliser is to start incrementing or decrementing. The direction of the count is set by the sign of the units scaler: positive = increment; negative = decrement.
Rollover	This is the rollover output which will be set for one execution cycle when the totaliser rolls over. This output can be used to expand the range of the totaliser by wiring it to the Trigger input of a counter.
Rollover Value	This is the value at which the totaliser will rollover to 0. It is configurable (default 1,000,000). When the totaliser rolls over the difference between the rollover value and the calculated output will be added to 0. Example 1: with a rollover value of 1000, a current output of 999 and an input of 5, then the output will become 4. Example 2: with a rollover value of -1000, a current output of -999 and an input of -5, then the output will become -4. Note: in both examples, the Rollover output will be set for 1 execution cycle. Many applications do not require very large values to be totalised and can be scaled so that the Rollover Value will never be reached. The instrument default value of 10^6 is generally satisfactory for these. If, however, higher values are expected, a larger Rollover value than this will have to be used. When configuring very large values the number stored on the instrument display may be slightly larger or slightly smaller. This happens because the numbers are stored in the instrument in IEEE representation as used by all computing systems to save space. The trade-off is that very large values are stored with a small inaccuracy, which increases as the value being stored increases. As an example,

if a value of 9,999,999,999,999 is entered into the instrument screen as the Rollover value, it is read back on the instrument panel as 9,999,999,827,968. The inaccuracy caused by the compression amounts to 0.02 parts per million, considerably smaller than the inaccuracy associated with the input channel which is being used to generate the input to the totaliser.

Disable

Allows the user temporarily to suspend totalising action. The totaliser is toggled between being enabled (cross symbol) and disabled (tick symbol) by means of the scroll key. The output retains the pre-disabled value until the totaliser is re-enabled, when it resumes from that value, or until the value is changed using the Preset parameter mentioned above. In the latter event, it will still be necessary to enable the totalisation by setting the Disable parameter to the cross symbo again.

Table 1: Period

Sec	Divider	Sec	Divider	Min	Divider	Hour	Divider
0.125	1	**1**	**8**	**1**	**480**	**1**	**2880**
0.25	2	2	16	2	960	2	5760
0.5	4	5	40	5	2400	6	17280
		10	80	10	480	12	34560
		20	160	20	960	**24**	**69120**
		30	240	30	1440		

The selections in Bold Italic font are those which set the calculation into common time units, Second, Minute, Hour and Day(24Hours), and are probably going to be the most commonly selected. The other selections may be useful for more unusual applications.

Note 1:

The formula linking Input1 and PV is:

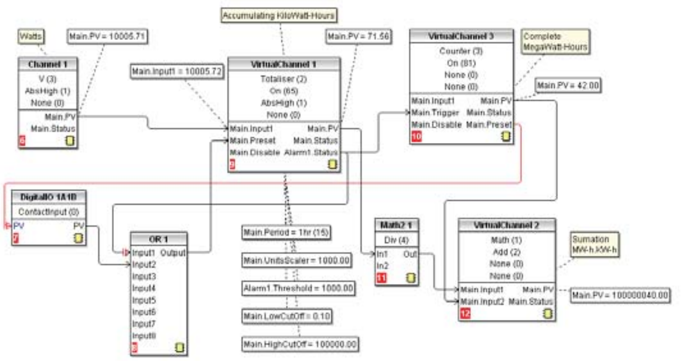
PV Increment each 0.125Sec = Input1/(8*Period(Sec) * UnitsScaler).

There is no reason why the Period and UnitsScaler parameters have to be used only in the way described above, one reflecting the units used by the input channel and the other linked directly to the output units required. There may be application where they may be used in other ways. Use Table 1 showing the divisor associated with a particular selection for Period in combination with a custom value as the UnitsScaler to generate a custom overall divisor.

4.5.3 Wiring Example using a counter in combination with a totaliser

The diagram shows how a counter and totaliser can be linked in a real application using the internal (soft) wiring in iTools. See also Section 6.3.

The application is to provide a running total of power being used by a process.



In this example

Channel 1 input is connected to a wattmeter

Totaliser VC1 uses the period parameter to set the timescale of the units to hours. The UnitsScaler is set to 1000 to set the units of the total to Kilowatt-Hours.

Alarm 1 in VC1 is set as Absolute High and the Alarm Status output resets VC1 and increments the counter VC3 by 1.

Math2 1 takes the output from VC1 and converts it into MegaWatt-Hours so that it can be added to the count (also in MegaWatt-Hours) from VC2 to present a running total value.

Digital Input 1A1B is used to simultaneously reset both the count in VC2 and the total in VC1.

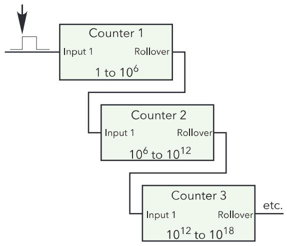
OR 1 is used to allow VC1 to be reset either by 1A1B or by the total reaching 1000.

Note: Firmware version 5.00 uses 64 bit IEEE calculations. Inputs and outputs from the block as wiring to and from other blocks is still in 32bit format, just like all other instrument parameters. Inside the totaliser block these are converted to 64bits and processed in the 64bit domain until their value has to be used by another block or has to be sent over comms, when it is converted back to 32bits.

4.5.4 Counter configuration

This allows the user to set up a counter to count trigger inputs (or it may be incremented from the Configuration page. The Rollover Value of the counter is configurable (default 1,000,000). Counters can be cascaded by wiring from 'Rollover' of one counter to 'trigger' of the next. Wiring is carried out from the operator interface (Section 7) or in iTools (Section 6).

For 'Trend', 'Alarm 1' and 'Alarm 2' configurations please see the relevant parts of Section 4.4.



Cascading counters

Figure 4.5.3 Typical Counter configuration

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the counter.
Type	Select: Math, Counter or Totaliser.
Operation	Allows the user to enable ('On') or disable ('Off') the counter.
PV	Read only. Shows the dynamic value of the counter.
Status	Read only. Reflects the status of the input channel.
Resolution	Allows the number of decimal places (up to six) to be defined for the channel.
Units	Allows a units string of up to five characters to be entered for the counter value
Low Cut Off	Specifies a value below which the counter will not decrement.
High Cut Off	Specifies a value above which the counter will not increment.
Input1	The amount by which the counter is incremented each time 'Trigger' goes high. The value may be entered manually, or wired from another parameter. Negative values cause the counter to decrement.
Preset	Setting this to 'Yes' causes the counter to adopt its Preset Value. The field returns immediately to 'No'. The counter can also be preset by wiring from another parameter.
Preset Val	Allows the entry of a value, from which the counter is to start incrementing or decrementing.
Trigger	Setting this to 1, causes the current value of the input source to be added to the Counter value. This function can be carried out manually, or the input can be wired from another parameter (Section 7.2).
Rollover	This is the rollover output which will be set for one execution cycle when the counter rolls over. This output can be used to expand the range of the cascade counters by wiring it to the Trigger input of the next counter.

Rollover Value	This is the value at which the counter will rollover and is configurable in the same way as the totaliser. When the counter rolls over the difference between the rollover value and the calculated output will be added to 0. Example 1: with a rollover value of 1000 and a current output of 999 and an input of 5, then the output will become 4 when the counter is next triggered. Example 2: with a rollover value of -1000 and a current output of -999 and an input of -5, then the output will become -4 when the counter is next triggered. Note: in both examples, the Rollover output will be set for 1 execution cycle.
Disable	Allows the user temporarily to suspend counting. The output retains the pre-disabled value until the counter is re-enabled, when it resumes counting from that value. The counter is toggled between being enabled (cross symbol) and disabled (tick symbol) by means of the scroll key.

4.6 LOOP OPTION CONFIGURATION

This configuration area allows the user to set up two control loops. This description refers to temperature control loops, but the configuration parameters apply equally to other types of control. For each loop, channel 1 is assumed to be a heating channel; channel 2 a cooling channel.

The configuration is divided into a number of areas, as shown in the overview below.

Loop

N   N = 1 or 2

Main (Section 4.6.1)	Setup (Section 4.6.2)	Tune (Section 4.6.3	PID (Section 4.6.4)	Setpoint (Section 4.6.5)	Output (Section 4.6.6)	Diagnostics (Section 4.6.7)
Auto/Manual	Loop name	Tune Enable	Sched Type	Range Low	Output Low	Error
PV	Ch1 Control	Low Output	No. of sets	Range High	Output High	Target Output
Inhibit	Ch2 Control	High Output	Remote i/p	SP Select	Ch1/2 Output	Working Out Low
Target Setpoint	Control action	State	Active set	SP1	Ch2 Deadband	Working Out High
Working Set-point	PB Units	Stage Time	Boundary 1-2	SP2	Ch1/2 OnOff Hyst	Loop Break
Working Output	Deriv Type		Boundary 2-3	SP Low Limit	Ch1/2 Travel time	Prop Output
Integral Hold	Setpoint Access		PB	SP High Limit	Nudge raise	Integral Output
	Auto/Man Access		Ti	Alt SP Enable	Nudge lower	Deriv Output
	Man.Out Access		Td	Alt SP	Ch1/2 pot pos	Sensor Break
			CBH	Rate	Ch1/2 pot brk	Sched PB
			CBL	Rate Done	Pot Brk mode	Sched Ti
			MR	SP rate disable	Rate	Sched Td
			LBT	Servo to PV	SbrkMode	Sched CBH
			Output Low	SP Trim	Sbrk OP	Sched CBL
			Output High	SP Trim Low	Safe OP	Sched MR
				SP Trim High	Manual Mode	Sched Loop Break
				Manual Track	Manual Output	Sched Out Low
				Setpoint Track	Forced Output	Sched Out High
				Track PV	Manual Startup	
				Track Value	Pff En	
				SP Int Balance	Power In	
					Cool type	
					FF type/gain	
					FF offset/trim lin	
					FF OP	
					Track Output	
					Track Enable	
					Rem. Output Low	
					Rem. Output High	

Figure 4.6 Loop configuration overview

For a general discussion of control loops, please see Appendix B to this manual.

4.6.1 Main menu parameters

Auto/Manual	Selects Auto(matic) or Manual operation. 'Auto' automatically controls output power in a closed loop configuration. In manual mode, the operator controls the output power.
PV	The Process Variable input value. The value can be entered by the user, but is most often 'wired' from an analogue input.
Inhibit	Select 'No' or 'Yes'. 'Yes' stops the loop and sets the output to a 'safe' value, this value being entered as a part of the Output configuration (Section 4.6.6). If an output rate limit is set, then the output ramps to the safe level at that rate, otherwise it performs a step change. If setpoint or manual tracking is enabled (in setpoint configuration Section 4.6.5), Inhibit overrides tracking. If 'No' is selected, the loop operates normally. Inhibit can be enabled/disabled from an external source.
Target Setpoint	The value at which the control loop is aiming. SP may be derived from a number of sources, as described in Appendix B, section B2.5. The value range limited by the setpoint limits (SP High Limit and SP Low Limit) described in Section 4.6.5.
Working Setpoint	A read-only value displaying the current value of setpoint being used by the loop. This might or might not be the Target setpoint. The value may come from a number of sources, but is limited by the setpoint limits (SP High Lim and SP Low Lim) described in Section 4.6.5.
Working Output	The actual working output value before being split into channel 1 and 2 outputs.
Integral Hold	Select 'Yes' or 'No'. 'Yes' freezes the integral term at its current value. IntHold ensures that the power is reapplied smoothly after the loop has been broken for service reasons, for example.

4.6.2 Setup menu parameters

Loop Name	Allows entry of an 11 character name for the loop.
Ch1 Control	Selects the type of control for channel one from: Off: Channel is turned off OnOff: Channel uses on/off control PID: Proportional + integral + derivative (three-term) control. VPU: Valve positioning unbounded VPB: Valve positioning bounded. Appendix B, Section B2.2 provides more details.
Ch2 Control	As above, but for loop channel two.
Control Action	Select 'Reverse' or 'Direct'. 'Reverse' means that the output is 'on' when the process value (PV) is below the target setpoint (SP). This is normal for heating control. 'Direct' means that the output is on when PV is above SP. This is normal for cooling control.
PB Units *	Select 'Engineering' or 'Percent'. 'Engineering' displays values in (for example) temperature units (e.g. °C or °F). 'Percent' displays values as a percentage of loop span (Range Hi - Range Lo).
Deriv Type *	'Error' means that changes to PV or SP cause changes to the derivative output. Derivative on error should be used with a programmer since it tends to reduce ramp overshoot. 'Error' provides rapid response to small setpoint changes which makes it ideal for temperature control systems. 'PV' means that changes in PV alone cause changes to the derivative output. Typically used for process systems using valve control, as it reduces wear on the valve mechanics.
Setpoint Access	Allows setpoint editing permission in the loop display pages (Section 3.4.7). 'Read/Write' allows free access to all users 'Read Only' allows editing only in Configuration or Supervisor modes. 'Operator R/W' allows editing in all modes except 'Logged out'.

4.6.2 Setup Menu Parameters (Cont.)

Auto/Man Access As 'Setpoint Access' above, but for Auto/manual parameter.

Man.Out Access As 'Setpoint Access' above, but configures the read/write access for the Manual Output parameter.

*Note: 'PB Units' and 'Deriv Type' appear only if at least one of Ch1 Control and Ch2 Control is set to 'PID', 'VPU' or' VPB'.

4.6.3 Tune menu parameters

Tune R2G Defines the type of relative cooling gain tuning for the loop.
'Standard' - tunes the relative cooling gain of the loop using the standard R2G tuning algorithm.
'R2GPD' - If the process is heavily lagged, this setting should be used.
'Off' - R2G is not calculated automatically. Enter the value manually as described in section B2.4.7 Manual tuning.
'Manual Tuning'.
Note: This parameter only appears when both channel 1 and channel 2 are configured (for example, in heat/cool processes).
For futher information, refer to section B2.4.6 Relative Cool Gain in Well Lagged Processes.

Tune Enable 'On' initiates autotune. Legend changes to 'Off' when autotune is complete. Can be set to 'Off' manually, to stop the tuning process.

Low Output Sets a low limit to be imposed whilst autotune is running. The value must be greater than or equal to the 'Output Low' value, specified in the Output menu (Section 4.6.6).

High Output Sets a high limit to be imposed whilst autotune is running. The value must be less than or equal to the 'Output High' value, specified in the Output menu (Section 4.6.6).

State Read only display of autotune progress:
Off. Autotune not running
Ready. Fleeting display. Changes immediately to 'Running'.
Running. Autotune is in progress.
Complete. Autotune completed successfully. This is a fleeting display which changes immediately to 'Off'.
Timeout, TI Limit and R2G Limit are error conditions described in Appendix B section B2.4.5. If any of these occurs, tuning is aborted and the PID settings remain unchanged.

Stage A read only display showing the progress of the autotune:
Settling. Displayed during the first minute whilst loop stability is checked (Appendix B, section B2.4.5)
To SP. Heating or cooling switched on.
Wait min. Power output off.
Wait max. Power output on.
Timeout, TI Limit and R2G Limit are error conditions described in Appendix B section B2.4.5.

Stage Time Time into the current stage of the autotune process. 0 to 99999 seconds.

AT.R2G Autotune at R2G. 'Yes' means that the control loop uses the R2G value calculated by autotune. 'No' causes the loop to use the R2G value entered by the user (PID menu) calculated as described in Appendix B section B2.4.5.

4.6.4 PID menu parameters

Note: If control type is set to 'Off', or 'OnOff' in the Setup menu, the PID menu contains only the Loop Break time parameter 'LBT'.

Sched Type	Selects the type of gain scheduling (section B2.3.7) to be applied. Off. Gain scheduling not active Set. The user selects the PID parameter set to be used. Setpoint. Transfer from one set to the next depends on the setpoint value PV. The transfer from one set to another depends on the PV value Error. The transfer between sets depends on the value of the error signal OP. Transfer depends on the value of the output. Rem. Transfer is controlled by a remote input.
Number of Sets	Allows the number of sets of PID parameters for use in Gain scheduling to be selected.
Remote input	For 'Sched Type' = 'Rem' only, this shows the current value of the remote input channel being used to select which set is active. If the remote input value ≤ the Boundary 1-2 value (see below) then set 1 is selected. If it is > Boundary 1-2 value but ≤ Boundary 2-3 value then set 2 is used. If the remote value is > Boundary 2-3 value, then set three is used. If the Remote input is not 'wired', the value is user editable from the front panel.
Active Set	The set number currently in use.
Boundary 1-2	For all Sched Types except 'Set', this allows the user to enter a 'boundary' value, which means that if the relevant value (SP, PV, Error etc.) rises above this boundary, the loop switches from PID set 1 to PID set 2. If it falls below the boundary value, the loop switches from set 2 to set 1.
Boundary 2-3	As above but for switching between sets 2 and 3.
PB/PB2/PB3	Proportional band for set one/two/three. The proportional term in the units (Engineering units or %) set in 'PBUnits' in the Setup menu. See Appendix B section B2.2.2 for more details.
Ti/Ti2/Ti3	Integral time constant for set one/two/three. Valid entries are1 to 9999.9 seconds, or 'Off'. If set Off, then integral action is disabled. Removes steady state control offsets by moving the output up or down at a rate proportional to the error signal.
Td/Td2/Td3	Derivative time constant for set one/two/three. Valid entries are 1 to 9999.9 seconds, or 'Off'. If set Off, then derivative action is disabled. Determines how strongly the controller reacts to a change in the PV. Used to control overshoot and undershoot and to restore the PV rapidly if there is a sudden change in demand.
R2G/R2G2/R2G3	Relative cool gain for set one/two/three. Appears only if cooling has been configured (Ch2 Control not 'Off' or 'OnOff' in Setup menu). Valid entries are 0.1 to 10. Sets the cooling proportional band which compensates for differences between heating and cooling power gains.
CBH/CBH2/CBH3	Cutback high for set one/two/three. Valid entries 'Auto' (3□PB) or 0.1 to 9999.9. The number of display units above setpoint at which the controller output is forced to 0% or -100% (OP min), in order to modify undershoot on cool down. See section B2.3.2 for more details.
CBL/CBL2/CBL3	Cutback low for set one/two/three. Valid entries 'Auto' (3□PB) or 0.1 to 9999.9. The number of display units below setpoint at which the controller output is forced to 100% (OP max), in order to modify overshoot on heat up. See section B2.3.2 for more details.
MR/MR2/MR3	Manual reset for set one/two/three. Valid entries 0 to 100%. Introduces a fixed additional power level to the output in order to eliminate steady state error from proportional only control. Applied instead of the integral component when Ti is set to 'Off'.
LBT/LBT2/LBT3	Loop break time for set one/two/three. valid entries are 1 to 99999 seconds, or 'Off'. See section B2.3.6 for more details.
Output Low/2/3	Output low limit for set one/two/three. Valid entries are in the range Output High/2/3 to -100.
Output High/2/3	Output high limit for set one/two/three. Valid entries are in the range Output Low/2/3 to +100

4.6.5 Setpoint menu parameters

Range High/Low	Range limits. Valid entries from 99999 to -99999. Range limits set absolute maxima and minima for control loop setpoints. If the proportional band is configured as a % span, the span is derived from the range limits.
SP select	Select SP1 or SP2. SP1 is considered to be the primary setpoint for the controller, and SP2 a secondary (standby) setpoint.
SP1, SP2	Allows values for Setpoints 1 and 2 to be entered. Valid entries are any within the range 'SPHigh Limit' to 'SPLowLim'.
SP Low Limit	Minimum setpoint limit for SP1 and SP2. Valid entries are in the range 'Range Lo' and 'SP High Limit'
SP High Limit	Maximum setpoint limit for SP1 and SP2. Valid entries are in the range 'Range Hi' and 'SP Low Limit'
Alt SP Enable	'Yes' enables the alternative setpoint; 'No' disables it. May be wired to an external or internal source.
Alt SP	When wired this is a read only display of the alternative setpoint value. Otherwise, the user may insert a value. Valid values are limited by 'Range Hi' and 'Range Lo'.
Rate	Sets the maximum rate at which the working setpoint may change in Engineering units per minute. Often used to protect the load from thermal shock cause by large step changes in setpoint. 'Off' disables rate limiting.
Rate Done	Read only display. 'Yes' indicates that the working setpoint has completed its change. 'No' indicates that the setpoint is still ramping.
SP Rate Disable	Appears only if Rate is not 'Off'. 'Yes' disables rate limiting; 'No' enables rate limiting.
Servo To PV	If 'Rate' is set to any value other than 'Off', and if 'Servo to PV' is set to 'Yes' then any change in the current setpoint value causes the working setpoint to servo to the current PV before ramping to the new setpoint value.
SP Trim	A positive or negative value added to the setpoint, for local fine tuning. Valid entries are any value between 'SP Trim High' and 'SP Trim Low'.
SP Trim High/Low	Setpoint trim high and low limits
Manual Track	'On' enables manual tracking to allow the local SP to follow the value of the current PV. See section B2.5.5 for more details. 'Off' disables manual tracking.
Setpoint Track	'On' enables setpoint tracking to allow the local SP to follow the value of the alternative SP. See section B2.5.4 for more details. 'Off' disables setpoint tracking.
Track PV	The unit tracks the PV when it is servoing or tracking.
Track Value	The SP to track in manual tracking
SP Int Balance	Allows the user to enable (tick) or disable (cross) debump on PV change.

4.6.6 Output menu items

Appendix B section B2.6 contains details of the output functions.

Output Low	The minimum power, or the maximum 'negative' (i.e. cooling) power to be delivered by the system. The valid input range is -100% and Output High.
Output High	The maximum output power to be delivered by channels 1 and 2, where 100% is full power. The valid input range is Output Low to 100.0%. Reducing this value reduces the rate of change of the process, but it also reduces the controller's ability to react to perturbations.
Ch1 Output	Displays the positive power values used by the heat output. Values range from Output low to Output high
Ch2 Output	Displays the cooling power values for channel two. Appears as a value between Output high and -100%, where -100% represents full cooling power.
Ch2 Deadband	A gap (in %) between output 1 switching off, and output 2 switching on, and vice-versa. Valid inputs are 0 (off) to 100%.
Rate	Limit on the rate at which the output from the PID can change. Can be useful in preventing rapid changes in output that could damage the process, heater elements etc.
Ch1 OnOff Hyst	Appears only if 'Ch1 Control' has been set to 'OnOff' in the Setup menu. Allows the user to enter a hysteresis value for channel one. Valid entries are 0.0 to 200.0.
Ch2 OnOff Hyst	Appears only if 'Ch2 Control' has been set to 'OnOff' in the Setup menu. Allows the user to enter a hysteresis value for channel two. Valid entries are 0.0 to 200.0.
Ch1 Travel Time	Appears only if Setup menu parameter 'Ch1 Control' is set to 'VPB' or 'VPU'. This is the valve travel time from closed (0%) to open (100%). In a valve positioning application, channel 1 output is connected by a single software 'wire' to a Valve Raise/Valve Lower relay pair. For heat/cool applications, channel 1 is associated with the heating valve. Valid entries: 0.0 to 1000.0 seconds.
Ch2 Travel Time	Appears only if Setup menu parameter 'Ch2 Control' is set to 'VPB' or 'VPU'. This is the valve travel time from closed (0%) to open (100%). For heat/cool applications, channel 2 is associated with the cooling valve. Valid entries: 0.0 to 1000.0 seconds.
Nudge Raise	Appears only if Setup menu parameter 'Ch1 Control' or Ch2 Control is set to 'VPU'. If set to 'Yes', the valve can be moved towards the open position by, for example, a contact closure, an up arrow button operation or a serial communications command. The default minimum nudge time is 125 ms, but this can be edited in the relevant relay configuration - see Section 4.11.1. See also Section B2.6.10 for more 'Nudge' details.
Nudge Lower	As for 'Nudge Raise', above but moves the valve towards the closed position.
Ch1 Pot Pos*	The position of the channel one actuator as measured by the feedback potentiometer.
Ch1 Pot Brk*	'On' indicates that the input to the relevant channel is open circuit.
Ch2 Pot Pos*	The position of the channel two actuator as measured by the feedback potentiometer.
Ch2 Pot Brk*	'On' indicates that the input to the relevant channel is open circuit.
Pot Brk Mode*	Defines the action to be taken if a potentiometer break is detected: Raise: opens the valve Lower: closes the valve Rest: the valve remains in its current state. Model: the controller tracks the position of the valve and sets up a model of the system so that it continues to function if the potentiometer becomes faulty.

* Note: These parameters appear only if the 'Setup' menu parameter 'Ch1 Control' or 'Ch2 control' (as appropriate) is set to 'VBP'. The Setup menu is described in Section 4.6.2.

4.6.6 Output Menu Parameters (Cont.)

SBrk Mode	Defines the action to be taken in the event of a sensor break. Safe: The output adopts the value configured in 'Sbrk OP', below. Hold: The output remains at its current level.
Sbrk OP	The value to be output if a sensor break occurs, and SBrk Mode (above) is set to 'Safe'.
Safe OP	The output level adopted when the loop is inhibited (Main menu Section 4.6.1).
Manual Mode	Selects the type of transition to occur when changing to manual mode (Section 4.6.1): Track: Whilst in Auto mode, the manual output tracks the control output so that there is no change of output when manual mode is switched to. Step: On transition to manual mode, the output is set to the value entered for 'Forced-OP' (below). Last Man. Out: On transition to manual mode, the output adopts the manual output value as last set by the operator.
Manual Output	The output when the loop is in manual mode. In manual mode the controller limits the maximum power, but it is not recommended that it be left unattended at high power settings. It is important that over range alarms are fitted to protect the process.

Note: It is recommended that all processes are fitted with an independent over range detection system.

Forced Output	Forced Manual output value. When 'Manual Mode' = 'Step', this is the output value adopted when changing from Auto to Manual mode.
Manual Startup	When set to off (cross symbol), the controller powers up in the same (auto or manual) mode that obtained when it was switched off. When set to on (tick symbol) the controller always powers up in manual mode.
Pff En	Power feed forward enable. 'Yes' enables power feed forward (adjusts the output signal to compensate for variations is supply voltage. 'No' disables Pff. See section B2.6.6 for further details.
Power In	Read only display of the current supply voltage.
Cool Type	Appears only if 'Ch2 Control' = 'PID' in the setup menu (Section 4.6.2) and allows the user to enter the appropriate type of cooling (section B2.6.7): Linear: For use when controller output changes linearly with PID demand. Oil: For oil cooled applications Water: For water cooled applications Fan: For forced air cooling.
FF Type	Feed forward type (section B2.6.8): None: No signal fed forward. Remote: A remote signal fed forward. SP: Setpoint is fed forward. PV: PV is fed forward.
FF Gain	For FF types 'PV' and 'SP', this scales the feed forward signal.
FF Offset	For FF types 'PV' and 'SP', this defines the offset of the scaled feed forward signal.
FF Trim lim	For FF types 'PV' and 'SP', defines symmetrical limits about the PID output which are applied to the scaled feed forward signal.
FF OP	For FF types 'PV' and 'SP', this is the calculated (scaled, offset and trimmed) feed forward signal. FF OP = FF gain (input + FF Offset)
Track Output	If 'Track Enable' (below) is set to 'Yes', this is the value for the control output. PID remains in Auto mode and tracks the output. The Track OP value can be wired to an external source, or can be entered via the front panel. Similar to entering manual mode.
Track Enable	When set to 'Yes', the output follows the Track OP value (above). When subsequently set to 'Off' the loop makes a bump less return to control.
Rem. Output Low/High	Used to limit the output using a remote source. These limits cannot exceed the 'Output Low' and 'Output High' values described earlier in this section.

4.6.7 Loop diagnostics

These 'parameters' are read only unless otherwise stated.

Error	The difference in value between the setpoint and the PV.
Target Output	The requested control output. The target of the active output if rate limiting is active.
Working Out Low	The low limit for the working output. This is the value used to limit the output power of the loop and is derived from the gain scheduled limit, the remote limit and the safety limit.
Working Out High	The high limit for the working output. This is the value used to limit the output power of the loop and is derived from the gain scheduled limit, the remote limit and the safety limit.
Loop Break	Loop Break Alarm. Becomes active 'Yes' if the loop break time (LBT), set in the PID menu (Section 4.6.4) is exceeded, otherwise 'No' is displayed.
Prop. Output	Shows the proportional term contribution to the control output
Integral Output	Shows the integral term contribution to the control output
Deriv. Output	Shows the derivative term contribution to the control output
Sensor Break	Indicates sensor break status. On (tick symbol) indicates a sensor break has occurred; Off (cross symbol) shows that no sensor breaks have been detected.
Sched PB	The scheduled proportional band for the current PID set.
Sched Ti	The scheduled integral time for the current PID set.
Sched Td	The scheduled derivative time for the current PID set.
Sched R2G	The scheduled relative cool gain value for the current PID set.
Sched CBH	The scheduled cutback high value for the current PID set.
Sched CBL	The scheduled cutback low value for the current PID set.
Sched MR	The scheduled manual reset value for the current PID set.
Sched Loop Break	The scheduled loop break time for the current PID set.
Sched Out Low	The scheduled output low limit for the current PID set.
Sched Out High	The scheduled output high limit for the current PID set.

4.7 ADVANCED LOOP CONFIGURATION

Similar to the Loop option described above, advanced loop includes the ability to run a cascade loop. Figure 4.7 is an overview of the configuration menu structure.

Advanced Loop

- Main (Section 4.7.1)
  - Master PV
  - Master WSP
  - Target setpoint
  - Slave PV
  - Slave WSP
  - Working Output
  - Cascade Mode
  - Inhibit
  - Master Int.Hold
  - Slave Int.Hold
- Setup (Section 4.7.2)
  - Master Name
  - Slave Name
  - Master Loop
  - Cascade Type
  - Slave Channel 1
  - Slave Channel 2
  - Setpoint access
  - Mode Access
  - Man.Out Access
- Tune (Section 4.7.3)
  - Tune Type
  - Tune Enable
  - Tune Slave R2G
  - Tune High
  - Tune Low
  - Output High
  - Output Low
  - State
  - Stage Time
  - Diagnostics
- Master PID (Section 4.7.4)
  - Control Action
  - PB Units
  - Derivative Type
  - PB
  - Ti
  - Td
  - CBH
  - CBL
  - MR
  - LBT
- Slave PID (Section 4.7.5)
  - Control Action
  - PB Units
  - Derivative Type
  - Sched Type
  - No of sets
  - Remote input
  - Set boundaries
  - PB
  - Ti
  - Td
  - R2G
  - CBH
  - CBL
  - MR
  - LBT
  - Output Low
  - Output High
- Master SP (Section 4.7.6)
  - Range High
  - Range Low
  - SP Select
  - SP1
  - SP2
  - SP High Limit
  - SP Low Limit
  - Alt SP Enable
  - Alt SP
  - Rate
  - Rate Done
  - SP Trim
  - SP Trim High
  - SP Trim Low
  - Manual Track
  - Setpoint Track
  - Track PV
  - Track SP
  - SP Int Balance
- Slave SP (Section 4.7.7)
  - Range High
  - Range Low
  - SP High Limit
  - SP Low Limit
  - Local SP
  - Alt SP
  - Remote FF
  - Remote FF Enable
  - Remote FF High
  - Remote FF Low
  - Manual Track
- Output (Section 4.7.8)
  - Output High
  - Output Low
  - Ch1 Output
  - Ch2 Output
  - Ch2 Deadband
  - Rate
  - Sbrk Mode
  - Sbrk OP
  - Safe OP
  - Manual Mode
  - Manual Output
  - Forced Output
  - Manual Startup
  - Pff En
  - Line Voltage
  - Cool Type
  - FF Type
  - Track Output
  - Track Enable
  - Rem. Output Low
  - Rem. Output High
- Diagnostics (Section 4.7.9)
  - Master Eror
  - Slave Error
  - (M)Prop. Output
  - (M)Integral Out
  - (M)Deriv. Output
  - (S)Prop. Output
  - (S)Integral Out
  - (S)Deriv. Output
  - Target Output
  - Loop Break (S)
  - Loop Break (M)
  - Sensor Break (S)
  - Sensor Break (M)
  - Sched PB
  - Sched Ti/Td
  - Sched CBH/CBL
  - Sched MR
  - Sched Loop Break
  - Sched R2G
  - Sched Out High
  - Sched Out Low
  - Working Out Low
  - Working Out High

4.7.1 Advanced Loop Main menu

Figure 4.7.1 Main menu

Master PV	This is the process value for the outer (master) loop of cascade control, typically obtained from an analogue input.
Master WSP	This is the (read only) working setpoint for the outer (master) loop of cascade control. The Master WSP can obtain its value from one of a number of sources such as 'Internal SP' or 'Remote SP'.
Target setpoint	The target setpoint is the value which the outer (master) control loop is attempting to reach. The value may come from one of a number of sources, such as internal SP or remote SP
Slave PV	This is the process value for the inner (slave) loop of cascade control, typically wired from an analogue input.
Slave WSP	This is the (read only) working setpoint for the inner (slave) loop. The value may come from one of a number of sources, such as the output from the master loop or the local slave setpoint.
Working Output	The actual output of the inner (slave) loop before it is split into channel 1 and channel 2 outputs.
Cascade Mode	Slave: Also known as 'Slave Local Auto', this is a single loop controlling with a local setpoint. Manual: Also known as 'Slave Manual', this provides a single manual power setting for the slave. Cascade: (Full) cascade. In this mode, the master is in 'Auto' mode and provides the setpoint for the slave.
Inhibit	If set to 'Yes', both outer (master) loop and inner (slave) loops stop controlling and the output of the slave loop is set to the safe output value (SafeOp) set in the Output menu (Section 4.7.8).
Master Int.Hold	If set to 'Yes', the integral component of the outer (master) loop PID calculation is held at its current value and does not integrate any further disturbances in the plant. Essentially this is equivalent to switching into PD control with a manual reset value pre-configured.
Slave Int.Hold	As for Master.IntHold, above, but for the inner (slave) loop.

4.7.2 Advanced Loop Setup menu

Figure 4.7.2 Advanced Loop Setup menu

Master Name	Allows the user to enter a 10-character string for the Master loop name in the Cascade display page (Section 3.4.8)
Slave Name	As above, but for the slave loop.
Master Loop	The control algorithm for the master control loop (PID only for this software release).
Cascade Type	Full Scale: The master generates a setpoint (between SP High limit and SP Low limit) for the slave. Trim: The master working setpoint is used as the base setpoint of the slave. This is then modified by the addition of a setpoint trim, to become the target setpoint for the slave. The PID output from the master is mapped to range set by Trim Range High and Trim Range Low.
Slave Channel 1	Selects the channel 1 control algorithm. Different algorithms can be selected for channels 1 and 2. In temperature control applications, channel 1 is usually the heating channel, and channel 2 the cooling channel. PID: Control Output Configured as PID VPB: Control Output Configured as Bounded VP. Bounded VP is implemented as a PID algorithm driving a position loop and is used in systems with position feedback.
Slave Channel 2	Selects the channel 2 control algorithm. Different algorithms can be selected for channels 1 and 2. In temperature control applications, channel 1 is usually the heating channel, channel 2 the cooling channel. Off: Control output is not configured PID: Control Output Configured as PID
Setpoint Access	Allows the user to select 'Read Only', 'Read/Write', or 'Operator R/W' for setpoint access, where 'Operator R/W means that the setpoint is read write for access levels operator and above, but read only in Logged out mode.
Mode Access	As for 'Setpoint Access', above, but for Auto/Manual mode switching.
Man.Out Access	As for 'Setpoint Access', above, but configures the read/write access for the Manual Output parameter.

4.7.3 Advanced Loop Tune menu

These items appear only if 'Tune Type' = 'Master' and if Diagnostics is enabled (ticked) as shown. (default = disabled)

Figure 4.7.3 Advanced Loop Tune menu

Tune Type	Select 'Master' or 'Slave' for the Tuning process.
Tune Slave R2G	Appears only if the Slave channel 2 is set to 'PID' in the Setup menu (Section 4.7.2), and Tune Type is set to Slave in the Advanced Loop.Tune menu. Standard: Normal compensation applied to account for differences in heating and cooling efficiencies between the heating and cooling channels. R2GPD: Typically used in heavily lagged systems.
Tune Enable	Allows the user to initiate an autotune.

4.7.3 Advanced Loop Tune Menu (Cont.)

Tune High	Sets the maximum value for the master loop setpoint during the tuning process.
Tune Low	Sets the minimum value for the master loop setpoint during the tuning process.
Output High	The maximum output power level which the controller may supply during the tuning process. If 'Output High' in the Output menu (sSection 4.7.8) is lower than 'High Output' then the maximum output is clipped to the 'Output High' value.
Output Low	The minimum output power level which the controller may supply during the tuning process. If 'Output Low' in the Output menu ((Section 4.7.8) is higher than 'Low Output' then the minimum output is clipped to the 'Output Low' value.
State	The current autotune state. Off: Autotune not enabled Ready: Fleeting display. Changes immediately to 'Running' Running: Autotune running Complete: The tune process completed successfully. Fleeting display before returning to 'Off'. Time-Out: A timeout error has occurred and the autotune has been aborted. Ti Limit R2G Limit
Stage	Reset None Settling Current SP New SP To SP Wait Max Wait Min Store CoolT PID Abort Complete NewR2G 1:Half Cycle 2:Full Cycle 3:Full Cycle 4:FinalCycle 5:Calc.
Stage Time	Elapsed time since entering this stage of the tuning.
Diagnostics	If this is enabled, a number of further parameters become visible.
Hysteresis	This defines the hysteresis of the switch used during master autotuning to generate the oscillation. It is set as a % of the master PV range (High Range - Low Range) in engineering units being +/- Hysteresis/2 about the tuning setpoint

4.7.3 Advanced Loop Tune Menu (Cont.)

Band	This defines the band between which the setpoint of the slave controller will be switched during the master autotune oscillation. It is set as a % of the master PV (High Range - Low Range) in engineering units being +/- Band/2 about the tuning setpoint. The actual values applied to the slave may actually be constrained inside this band by the wind-up control mechanism
Timeout	Defines the maximum time permitted for each stage of the master tuning.
OPDel	This is an internal setting of the order of 0.5 during tuning.
WSP	This is the actual setpoint around which the autotuning oscillation of the master takes place. It is used for the calculations associated with the Hysteresis and Band parameters.
ModeMan	This parameter is used by the master autotune algorithm to communicate with the master loop. Puts master controller into 'Not-Auto' mode
OP	This signal is generated within the master loop during the autotune oscillation. It is used only as an input to the calculations which generate the slave loop setpoint. It is not the overall loop output to the load which at all times is under the control of the slave PID calculations.
MasterTune	Master tune in progress
TuneSlave	The autotune process is requesting a slave tune.
Tune Status	This indicates the internal stage of tuning. 0 = Not tuning 1 = Tuning the slave 2 = Tuning the master 3 = Tuning completed -1 = Tuning has aborted or timed-out
Mod_PV	This is the amplitude of the fundamental component of the master PV during the last cycle of the tuning oscillation.
Mod_OP	This is the amplitude of the fundamental component of the master OP during the last cycle of the tuning oscillation.
Arg_PV	This is the argument (phase) of the fundamental component of the master PV during the last cycle of the tuning oscillation. Value in radians.
Arg_OP	This is the argument (phase) of the fundamental component of the master OP during the last cycle of the tuning oscillation. Value in radians.
Gain	This is the gain between the master OP and the master PV over the path via the slave loop and the load, measured at the fundamental frequency of the autotuning oscillation.
Phase	The phase shift in radians between the master OP and the master PV over the path via the slave loop and the load, measured at the fundamental frequency of the autotuning oscillation
Period	This is the period of the last cycle of the autotune oscillation, in seconds.
A1	This is the number of samples actually taken in order to determine the fundamental components of the master PV and OP. The target number is around 100 samples but the actual number taken may differ slightly from this depending on the load's behaviour.
A2	The A2 parameter is a used for diagnostic purposes. Its value indicates the design method chosen by the algorithm which depends on the characteristics of the master tuning oscillation and the measured values of frequency, gain, and phase shift around the master loop. This influences the choices of the P, I and D values set into the master loop.
Alpha_p	R2GPD tuning diagnostic parameter: Heat time / cool time.
OPss	R2GPD tuning diagnostic parameter: Steady state output at the end of the settling period.
Alpha	R2GPD tuning diagnostic parameter: 1/R2G.
Debug	R2GPD tuning diagnostic parameter: 0-PID, 1-PI, 2-PD, 3-P.
CycleNo	R2GPD tuning diagnostic parameter: Number of cycles in auto tune sequence.

4.7.3 Advanced Loop Tune Menu (Cont.)

PBs	R2GPD tuning diagnostic parameter: PBs scales the proportional band which will be used in the PD settling period.
TDs	R2GPD tuning diagnostic parameter: TDs scales the derivative value which will be used during the PD settling period.
Settle	R2GPD tuning diagnostic parameter: Used to scale the last cycle time. The result will be used for the PD settling time.

4.7.4 Advanced Loop Master PID menu

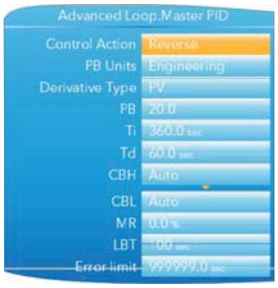


Figure 4.7.4 Advanced Loop master PID menu

Control Action	Select 'Reverse' or 'Direct'. 'Reverse' means that the output is 'on' when the process value (PV) is below the target setpoint (SP). This is normal for heating control. 'Direct' means that the output is on when PV is above SP. This is normal for cooling control.
PB Units	Select 'Engineering' or 'Percent'. 'Engineering' displays values in (for example) temperature units (e.g. °C or °F). 'Percent' displays values as a percentage of loop span (Range High - Range Low).
Deriv Type	'Error' means that changes to PV or SP cause changes to the derivative output. Derivative on error should be used with a programmer since it tends to reduce ramp overshoot. 'Error' provides rapid response to small setpoint changes which makes it ideal for temperature control systems. 'PV' means that changes in PV alone cause changes to the derivative output. Typically used for process systems using valve control, as it reduces wear on the valve mechanics.
PB	Proportional band. The proportional term in the units (Engineering units or %) set in 'PBUnits' above. See Appendix B section B2.2.2 for more details.
Ti	Integral time constant. Valid entries are1 to 9999.9 seconds, or 'Off'. If set Off, then integral action is disabled. Removes steady state control offsets by moving the output up or down at a rate proportional to the error signal.
Td	Derivative time constant. Valid entries are 1 to 9999.9 seconds, or 'Off'. If set Off, then derivative action is disabled. Determines how strongly the controller reacts to the rate-of-change in the PV. Used to control overshoot and undershoot and to restore the PV rapidly if there is a sudden change in demand.
CBH	Cutback high. Valid entries 'Auto' (3×PB) or 0.1 to 9999.9. The number of display units above setpoint at which the controller output is forced to 0% or -100% (OP min), in order to modify undershoot on cool down. See section B2.3.2 for more details.
CBL	Cutback low. Valid entries 'Auto' (3×PB) or 0.1 to 9999.9. The number of display units below setpoint at which the controller output is forced to 100% (OP max), in order to modify overshoot on heat up. See section B2.3.2 for more details.
MR	Manual reset. Valid entries -100% to +100%. Introduces a fixed additional power level to the output in order to eliminate steady state error from proportional only control. Applied instead of the integral component when Ti is set to 'Off'.
LBT	Loop break time. valid entries are 1 to 99999 seconds, or 'Off'. See section B2.3.6 for more details

4.7.5 Advanced Loop Slave PID menu

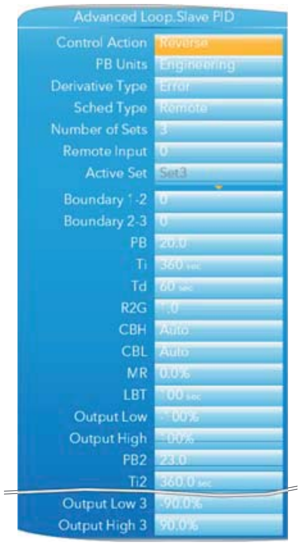


Figure 4.7.5 Advanced Loop Slave PID Menu (Typical)

Control Action	Select 'Reverse' or 'Direct'. 'Reverse' means that the output is 'on' when the process value (PV) is below the target setpoint (SP). This is normal for heating control. 'Direct' means that the output is on when PV is above SP. This is normal for cooling control.
PB Units	Select 'Engineering' or 'Percent'. 'Engineering' displays values in (for example) temperature units (e.g. °C or °F). 'Percent' displays values as a percentage of loop span (Range High - Range Low).
Deriv Type	'Error' means that changes to PV or SP cause changes to the derivative output. Derivative on error should be used with a programmer since it tends to reduce ramp overshoot. 'Error' provides rapid response to small setpoint changes which makes it ideal for temperature control systems. 'PV' means that changes in PV alone cause changes to the derivative output. Typically used for process systems using valve control, as it reduces wear on the valve mechanics.

4.7.5 Advanced Loop Slave Pid Menu (Cont.)

Sched Type	Selects the type of Gain Scheduling (section B2.3.7) to be applied. Off. Gain Scheduling not active Set. The user selects the PID parameter set to be used. Setpoint. Transfer from one set to the next depends on the setpoint value PV. The transfer from one set to another depends on the PV value Error. The transfer between sets depends on the value of the error signal OP. Transfer depends on the value of the output. Rem. Transfer is controlled by a remote input.
Number of Sets	Allows the number of sets of PID parameters for use in Gain scheduling to be selected.
Remote input	For 'Sched Type' = 'Rem' only, this shows the current value of the remote input channel being used to select which set is active. If the remote input value ≤ the Boundary 1-2 value (see below) then set 1 is selected. If it is > Boundary 1-2 value but ≤ Boundary 2-3 value then set 2 is used. If the remote value is > Boundary 2-3 value, then set three is used. If the Remote input is not 'wired', the value is user editable from the front panel.
Active Set	The set number currently in use.
Boundary 1-2	For all Sched Types except 'Set', this allows the user to enter a 'boundary' value, which means that if the relevant value (SP, PV, Error etc.) rises above this boundary, the loop switches from PID set 1 to PID set 2. If it falls below the boundary value, the loop switches from set 2 to set 1.
Boundary 2-3	As above but for switching between sets 2 and 3.
PB/PB2/PB3	Proportional band for set one/two/three. The proportional term in the units (Engineering units or %) set in 'PBUnits' in the Setup menu. See Appendix B section B2.2.2 for more details.
Ti/Ti2/Ti3	Integral time constant for set one/two/three. Valid entries are1 to 9999.9 seconds, or 'Off'. If set Off, then integral action is disabled. Removes steady state control offsets by moving the output up or down at a rate proportional to the error signal.
Td/Td2/Td3	Derivative time constant for set one/two/three. Valid entries are 1 to 9999.9 seconds, or 'Off'. If set Off, then derivative action is disabled. Determines how strongly the controller reacts to the rate-of-change in the PV. Used to control overshoot and undershoot and to restore the PV rapidly if there is a sudden change in demand.
R2G/R2G2/R2G3	Relative cool gain for set one/two/three. Appears only if cooling has been configured (Ch2 Control not 'Off' in the Setup menu). Valid entries are 0.1 to 10. Sets the cooling proportional band which compensates for differences between heating and cooling power gains.
CBH/CBH2/CBH3	Cutback high for set one/two/three. Valid entries 'Auto' (3□PB) or 0.1 to 9999.9. The number of display units above setpoint at which the controller output is forced to 0% or -100% (OP min), in order to modify undershoot on cool down. See section B2.3.2 for more details.
CBL/CBL2/CBL3	Cutback low for set one/two/three. Valid entries 'Auto' (3□PB) or 0.1 to 9999.9. The number of display units below setpoint at which the controller output is forced to 100% (OP max), in order to modify overshoot on heat up. See section B2.3.2 for more details.
MR/MR2/MR3	Manual reset for set one/two/three. Valid entries 0 to 100%. Introduces a fixed additional power level to the output in order to eliminate steady state error from proportional only control. Applied instead of the integral component when Ti is set to 'Off'.
LBT/LBT2/LBT3	Loop break time for set one/two/three. valid entries are 1 to 99999 seconds, or 'Off'. See section B2.3.6 for more details.
Output Low/2/3	Output low limit for set one/two/three. Valid entries are in the range Output High/2/3 to -100.
Output High/2/3	Output high limit for set one/two/three. Valid entries are in the range Output Low/2/3 to +100

4.7.6 Advanced Loop Master SP menu

Figure 4.7.6 Advanced Loop Master SP menu

Range High/Low	Range limits. Range limits set absolute maxima and minima for control loop setpoints. If the proportional band is configured as a % span, the span is derived from the range limits.
SP select	Select SP1 or SP2. SP1 is often considered to be the primary setpoint for the controller, and SP2 a secondary setpoint.
SP1, SP2	Allows values for Setpoints 1 and 2 to be entered. Valid entries are any within the range 'SPHigh Limit' to 'SPLowLim'.
SP High Limit	Maximum setpoint limit for SP1 and SP2. Valid entries are in the range 'Range Hi' and 'SP Low Limit'
SP Low Limit	Minimum setpoint limit for SP1 and SP2. Valid entries are in the range 'Range Lo' and 'SP High Limit'
Alt SP Enable	'Yes' enables the alternative setpoint; 'No' disables it. May be wired to an external or internal source.
Alt SP	When wired this is a read only display of the alternative setpoint value. Otherwise, the user may insert a value. Valid values are limited by 'Range Hi' and 'Range Lo'.
Rate	Sets the maximum rate at which the working setpoint may change in Engineering units per minute. Often used to protect the load from thermal shock caused by large step changes in setpoint. 'Off' disables rate limiting.
Rate Done	Read only display. 'Yes' indicates that the working setpoint has completed its change. 'No' indicates that the setpoint is still ramping.

4.7.6 Advanced Loop Master Sp Menu (Cont.)

SP Rate Disable	Appears only if Rate is not 'Off'. 'Yes' disables rate limiting; 'No' enables rate limiting.
Servo To PV	If 'Rate' is set to any value other than 'Off', and if 'Servo to PV' is set to 'Yes' then any change in the current setpoint value causes the working setpoint to servo to the current PV before ramping to the new setpoint value.
SP Trim	A positive or negative value added to the setpoint, for local fine tuning. Valid entries are any value between 'SP Trim High' and 'SP Trim Low'.
SP Trim High/Low	Setpoint trim high and low limits
Manual Track	'On' enables manual tracking. Manual tracking removes steps in setpoint when switching between M'Man' and 'Auto' modes. When the loop is switched from manual to auto the target setpoint is set to the current PV. See section B2.5.5 for more details. 'Off' disables manual tracking.
Setpoint Track	'On' enables setpoint tracking. When setpoint tracking is enabled, it ensures 'bumpless' transfer in setpoint when switching from Alternative setpoint to a local setpoint. See section B2.5.4 for more details. 'Off' disables setpoint tracking.
Track PV	The unit tracks the PV when it is servoing or tracking.
Track SP	The SP to track in manual tracking - see 'Setpoint Track', above.
SP Int Balance	Allows the user to enable (tick) or disable (cross) debump on PV change.

4.7.7 Advanced Loop Slave SP menu

Figure 4.7.7a Advanced Loop Slave Setpint menu

Range High/Low	Range limits. Valid entries from 99999 to -99999. Range limits set absolute maxima and minima for control loop setpoints. If the proportional band is configured as a % span, the span is derived from the range limits.
SP High Limit	Maximum setpoint limit for the local setpoint. Valid entries are in the range 'Range Hi' and 'SP Low Limit'
SP Low Limit	Minimum setpoint limit for the local setpoint. Valid entries are in the range 'Range Lo' and 'SP High Limit'
Local SP	The Slave local setpoint
Trim Range High	Trim Range upper limit. Appears only if 'Cascade type' has been set to 'Trim' in the Set-up menu.
Trim Range Low	Trim Range upper limit. Appears only if 'Cascade type' has been set to 'Trim' in the Set-up menu.
Trim High Limit	Maximum value for Trim High value. Appears only if 'Cascade type' has been set to 'Trim' in the Setup menu.
Trim Low Limit	Minimum value for Trim Low value. Appears only if 'Cascade type' has been set to 'Trim' in the Setup menu.
Remote FF	The current remote feedforward value
Remote FF Enable	Enables or disables the use of a remote Feedforward signal. Appears only if 'Cascade type' has been set to 'Full Scale' in the Setup menu.
Remote FF High	High limit for the remote feedforward signal value. Appears only if 'Cascade type' has been set to 'Full Scale' in the Setup menu.
Remote FF Low	Low limit for the remote feedforward signal value. Appears only if 'Cascade type' has been set to 'Full Scale' in the Setup menu.
FF Select	Allows the user to select the source of the feedforward signal from 'master PV', Master working setpoint' or Remote FF'. Appears only if 'Cascade type' has been set to 'Trim' in the Setup menu.
Manual Track	'On' enables manual tracking to allow the local SP to follow the value of the current PV to allow bumpless transfer when switching to Auto. See section B2.5.5 for more details. 'Off' disables manual tracking.

4.7.7 Advanced Loop Slave Sp Menu (Cont.)

Sbrk Mode	This defines the behaviour when the master loop process variable is bad, i.e. the sensor has failed.
Sbrk SP	The setpoint for the slave loop when the master sensor has gone into sensor break and the sensor break mode for the master is set to SbrkSP

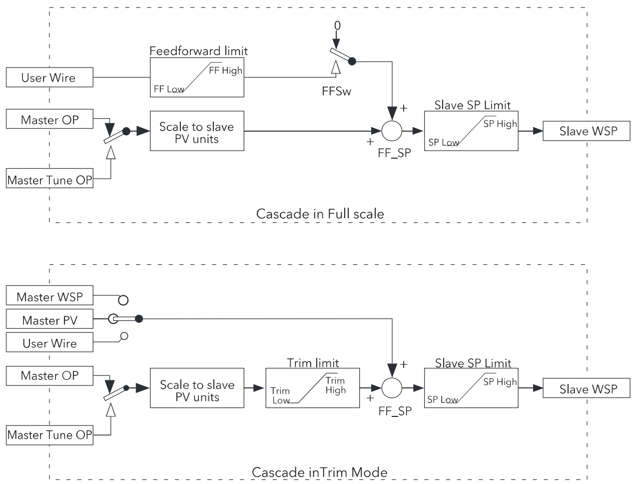


Figure 4.7.7b Slave Working setpoint limits

4.7.8 Advanced Loop Output menu

Appendix B section B2.6 contains details of the output functions.

Figure 4.7.8 Advanced Loop Output menu

4.7.8 Advanced Loop Output Menu (Cont.)

Output High	The maximum output power to be delivered by channels 1 and 2, where 100% is full power. The valid input range is Output Low to 100.0%. Reducing this value reduces the rate of change of the process, but it also reduces the controller's ability to react to perturbations and can even cause it to fail to achieve setpoint.
Output Low	The minimum power, or the maximum 'negative' (i.e. cooling) power to be delivered by the system.
Ch1 Output	Displays the positive power values used by the heat output.
Ch2 Output	Displays the cooling power values for channel two. Appears as a value between Output High and -100%, where -100% represents full cooling power.
Ch2 Deadband	A gap (in %) between output 1 switching off, and output 2 switching on, and vice-versa. Valid inputs are 0 (off) to 100%.
Rate	Limit on the rate at which the output from the PID can change. Can be useful in preventing rapid changes in output that could damage the process, heater elements etc.
Rate Disable	The Output Rate limit may be disabled by setting its value to 0.0. Alternatively, for some applications it is useful to be able to wire to the Output Rate Disable so that 'Rate' can be switched on/off during stages of the process. For example, Rate Disable can be used with the programmer event outputs to control the output rate of change during a particular segment.
Ch1 Travel Time	Appears only if Setup menu parameter 'Slave Channel 1' is set to 'VPB'. This is the valve travel time from closed (0%) to open (100%). In a valve positioning application, channel 1 output is connected by a single software 'wire' to a Valve Raise/Valve Lower relay pair. For heat/cool applications, channel 1 is associated with the heating valve. Valid entries: 0.0 to 1000.0 seconds.
Ch2 Travel Time	Appears only if Setup menu parameter 'Slave Channel 2' is set to 'VPB' . This is the valve travel time from closed (0%) to open (100%). For heat/cool applications, channel 2 is associated with the cooling valve. Valid entries: 0.0 to 1000.0 seconds.
Ch1 Pot Pos*	The position of the channel one actuator as measured by the feedback potentiometer.
Ch1 Pot Brk*	'On' indicates that the input to the relevant channel is open circuit.
Ch2 Pot Pos*	The position of the channel two actuator as measured by the feedback potentiometer.
Ch2 Pot Brk*	'On' indicates that the input to the relevant channel is open circuit.
Pot Brk Mode*	Defines the action to be taken if a potentiometer break is detected: Raise: opens the valve Lower: closes the valve Rest: the valve remains in its current state. Model: the controller tracks the position of the valve and sets up a model of the system so that it continues to function if the potentiometer becomes faulty. This does not mean that the potentiometer can be omitted with VPB, as the accuracy of valve position control is reduced without it.

* Note: These parameters appear only if the 'Setup' menu parameter 'Slave Channel 1' or 'Slave Channel 2' (as appropriate) is set to 'VPB'. The Setup menu is described in Section 4.7.2.

SBrk Mode	Defines the action to be taken in the event of a sensor break. Safe: The output adopts the value configured in 'Sbrk OP', below. Hold: The output remains at its current level.
Sbrk OP	The value to be output if a Slave sensor break occurs, and SBrk Mode (above) is set to 'Safe'.
Safe OP	The output level adopted when the loop is inhibited (Main menu Section 4.7.1).

4.7.8 Advanced Loop Output Menu (Cont.)

Manual Mode	Selects the type of transition to occur when changing to manual cascade mode (Section 4.7.1): Track: Whilst in Auto mode, the manual output tracks the control output so that there is no change of output when manual mode is switched to. Step: On transition to manual mode, the output is set to the value entered for 'Forced-OP' (below). Last Man. Out: On transition to manual mode, the output adopts the manual output value as last set by the operator.
Manual Output	The output when the loop is in manual mode. In manual mode the controller limits the maximum power, but it is not recommended that it be left unattended at high power settings. It is important that over range alarms are fitted to protect the process.

Note: It is recommended that all processes are fitted with an independent over range detection system.

Forced Output	Forced Manual output value. When 'Manual Mode' = 'Step', this is the output value adopted when changing from Auto to Manual mode.
Manual Startup	When set to off (cross symbol), the controller powers up in the same (auto or manual) mode that obtained when it was switched off. When set to on (tick symbol) the controller always powers up in manual mode.
Pff En	Power feed forward enable. 'Yes' enables power feed forward (adjusts the output signal to compensate for variations is supply voltage. 'No' disables Pff. See section B2.6.6 for further details.
Line Voltage	Read only display of the current supply voltage.
Cool Type	Appears only if 'Ch2 Control' = 'PID' in the setup menu (Section 4.7.2 and allows the user to enter the appropriate type of cooling (section B2.6.7): Linear: For use when controller output changes linearly with PID demand. Oil: For oil cooled applications Water: For water cooled applications Fan: For forced air cooling.
FF Type	Feed forward type (section B2.6.8): None: No signal fed forward. Remote: A remote signal is fed forward. SP: Setpoint is fed forward. PV: PV is fed forward.
FF Gain	For FF types 'PV' and 'SP', this scales the feed forward signal.
FF Offset	For FF types 'PV' and 'SP', this defines the offset of the scaled feed forward signal.
FF Trim Limit	For FF types 'PV' and 'SP', defines symmetrical limits about the PID output which are applied to the scaled feed forward signal.
FF Remote	Allows another value from the strategy to be used as the primary control variable in the feed forward strategy. The gain and offset are not applied to the remote value.
FF Output	For FF types 'PV' and 'SP', this is the calculated (scaled, offset and trimmed) feed forward signal. FF OP = FF gain (input + FF Offset)
Track Output	If 'Track Enable' (below) is set to 'Yes', this is the value for the loop output to track when output track is enabled.
Track Enable	When set to 'Yes', the output follows the Track OP value (above). When subsequently set to 'Off' the loop makes a bumpless return to control.
Rem. Output Low/High	Used to limit the output when using a remote source. These limits cannot exceed the 'Output Low' and 'Output High' values described earlier in this section.

4.7.9 Advanced Loop Diagnostics menu

Master Error	The difference in value between the setpoint and the PV for the Master (Read only).
Slave Error	The difference in value between the setpoint and the PV for the Slave (Read only).
(M)Prop. Output	Shows the proportional term contribution to the control output of the Master (Read only).
(M)Integral Out	Shows the integral term contribution to the control output of the Master (Read only).
(M)Deriv. Output	Shows the derivative term contribution to the control output of the Master (Read only).
(S)Prop. Output	Shows the proportional term contribution to the control output of the Slave (Read only).
(S)Integral Out	Shows the integral term contribution to the control output of the Slave (Read only).
(S)Deriv. Output	Shows the derivative term contribution to the control output of the Slave (Read only).
Target Output	The requested control output. The target of the active output if rate limiting is active. (Read only.)
Loop Break (S)	Loop Break Alarm (Read only). Becomes active 'Yes' if the relevant loop break time (LBT1/2/3), set in the Slave PID menu (Section 4.7.5) is exceeded, otherwise 'No' is displayed.
Loop Break (M)	Loop Break Alarm (Read only). Becomes active 'Yes' if the Master loop break time (LBT), set in the Master PID menu (Section 4.7.4) is exceeded, otherwise 'No' is displayed.
Sensor Break (S)	Indicates Slave sensor break status (Read only). On (tick symbol) indicates a sensor break has occurred; Off (cross symbol) shows that no sensor breaks have been detected.
Sensor Break (M)	Indicates Master sensor break status (Read only). On (tick symbol) indicates a sensor break has occurred; Off (cross symbol) shows that no sensor breaks have been detected.
Sched PB	The scheduled proportional band for the current PID set.
Sched Ti	The scheduled integral time for the current PID set.
Sched Td	The scheduled derivative time for the current PID set.
Sched CBH	The scheduled cutback high value for the current PID set.
Sched CBL	The scheduled cutback low value for the current PID set.
Sched MR	The scheduled manual reset value for the current PID set.
Sched Loop Break	The scheduled loop break time for the current PID set.
Sched R2G	The scheduled relative cool gain value for the current PID set.
Sched Out High	The scheduled output high limit for the current PID set.
Sched Out Low	The scheduled output low limit for the current PID set.
Working Out Low	The low limit for the working output (Read only). This is the value used to limit the output power of the loop and is derived from the gain scheduled limit, the remote limit and the safety limit.
Working Out High	The high limit for the working output (Read only). This is the value used to limit the output power of the loop and is derived from the gain scheduled limit, the remote limit and the safety limit.
Master FB	Master FB is the value of the master control output after limiting and is used for Integral desaturation.
Calc OP	Master P+I+D
HiSatLim	HiSatLim is an internally generated limit
LoSatLim	LoSatLim is an internally generated limit
OPPID	Master control output It will be the same as Calc OP if the master is not in Cutback

4.8 PROGRAMMER CONFIGURATION

The programmer option allows the user to configure a setpoint program with one or two channels, as required. The program can be run from the Programmer operator display page (Section 3.4.9) or can be controlled by inputs received from other parameters. In particular, the programmer is intended for use with the loop or advanced loop options.

The programmer configuration is separated into a number of areas as depicted in the overview below. The segment configuration (ramp type etc.) is carried out from the programmer edit page, also described in Section 3.4.9.

Programmer

- Features Section 4.8.1)
  - Holdback
  - PV Event
  - User Value
  - Messages
  - FTP Store
- FTP (Section 4.8.2)
  - IP Address
  - Username
  - password
- Set Up (Section 4.8.3)
  - Channels
  - Prog Mode Access
  - Prog Edit Access
  - Prog Store Access
  - Rate Resolution
  - Ch1(2) Units
  - Ch1(2) Resolution
  - Ch1(2) Servo To
  - Ch1(2) PV Input
  - Ch1(2) SP Input
  - Power Fail Action
  - Max Events
  - Reset Events 1 to 8
  - Reset Ch1(2) UV
  - Run
  - Hold
  - Reset
  - Run reset
  - Run Hold
  - Wait Digital
  - Wait analogue 1(2)
  - Advance
  - Operation
  - Status
  - Program Number
- Run (Section 4.8.4)
  - Mode
  - Status
  - Ch1(2) PSP
  - Segment Name
  - Segment type
  - Segment Time Left
  - Segment Time Run
  - Prog Time Left
  - Prog Time Spent
  - Prog Time Run
  - Duration
  - Ch1(2) TSP
  - Ch1(2) rate
  - Ch1(2) Time
  - Cycles Left
  - Ch1(2) User Val
  - Ch1(2) PV Event
  - Event 1 to 8
  - End Output

4.8.1 Programmer Features menu

This menu allows the user to enable/disable some of the items presented to the user in the Programmer edit page described in Section 3.4.9. Features are enabled/disabled by using the up/down arrow keys to highlight the required item and then using the scroll button to toggle between enabled (tick) and disabled (cross). Typically, items would be left disabled in order to reduce the number of configuration fields presented to a user who may not need all such features.

Figure 4.8.1 Programmer features menu

Holdback — Holdback pauses the program (freezes the Programmer setpoint (PSP) and the time remaining parameters) if the difference between the Process value (PV) and the PSP exceeds a user-specified amount (deviation). The program remains paused until the PV returns to within the specified deviation.
In ramp or step segments, holdback indicates that the PV is lagging the SP by more than the specified amount and that the program is waiting for the process to catch up. In a dwell segment, holdback is used to guarantee that a work piece stays at set-point within a specified tolerance for the specified dwell duration.
Holdback type and deviation value are configured, on a per program basis, to be applied to either the entire program or to individual segments. See Program edit (Section 3.4.9) for details.

PV Event — A PV Event is available for each channel in every segment except for Wait and Go Back segment types. A PV Event is an absolute or deviation analogue alarm on the channel PV, and can be used to trigger a secondary process, or to trigger an analogue alarm.

User Value — A user value can be entered for every segment (except for Wait or Go Back types) and when the segment is entered, this value is transferred to the associated User Value Output parameter, which could be wired to another parameter to form part of an application strategy.

Messages — Table 4.8.1, below, lists the programmer specific events that generate messages that are displayed in the message summary and recorded into the history file.
It is also possible to trigger custom messages from any of the programmer outputs via user wiring. The program name and segment name can be embedded in custom messages by inserting the modbus address for the current program / segment name parameters in square brackets i.e.:

[<current_program_name_modbus_address>]

[<current_segment_name_modbus_address>]

4.8.1 Programmer Features Configuration (Cont.)

Event	Message
Program Run	<program_name>: Run
Program End	<program_name>: Complete
Program Hold	<program_name>: <segment_name>: Hold
Program Resume	<program_name>: <segment_name>: Resume
Program Reset	<program_name>: <segment_name>: Reset
Segment Start	<program_name>: <segment_name>: Segment Start
Advance	<program_name>: <segment_name>: Advanced
Holdback	<program_name>: <segment_name>: Holdback:Channel No.
PV Event	<program_name>: <segment_name>: PV Event:Channel No.

Table 4.8.1 Programmer messages

FTP Store — If this feature is enabled, an FTP menu item appears in the top level Programmer configuration menu. 'FTP' allows the user to enter communications parameters for the host computer which is to act as the ftp server.
FTP Store allows the user to set-up a centralised program store from which several instruments can select their program.

Notes

1 A maximum of 100 entries is supported on all drives. Directory trees are supported for both USB and FTP, and if the root of the drive contains only files (no directories), then up to 100 files are listed. If the root of the drive contains directories then each directory can contain 100 entries (but one of these entries will be taken up by '..' to return to the directory above).
2 Program files are in compressed XML (.uipz) file format.
3 When a program is selected from an FTP server a local copy of the program file is made within the instrument before being processed. It should be noted that the number of program files in the internal 'user' drive does not affect this local copy, and therefore a program from an FTP server can be loaded, even when the internal user drive is full.
4 As the loaded program resides in the current program database it is automatically included in a clone file. In addition, program files stored in the internal program drive are included in a clone file (refer to 'Cloning', below).
5. On the internal program drive only a flat directory structure is supported. However, full tree directories are supported on both the USB memory stick and FTP server (accessed via the HMI File Explorer).
6. It is not possible to store program files on an external device. Programs selected from an external device can, however, be stored in the internal program store.
7. It is not possible to select a program from an external device over comms and iTools.

CLONING

Each program file stored locally on the instrument IS included in a clone file as a Binary Large Object (BLOB), similar to the Graphical Wiring Editor layout. Each program file BLOB contains the program filename.

When loading a clone file, existing programs in the instrument's internal drive are deleted, and program file BLOB(s) in the clone are reformatted into program files by the instrument.

4.8.2 Programmer FTP menu

Note: This menu item is accessible only if 'FTP' has been enabled in the Programmer features menu described above.

Figure 4.8.2 Programmer FTP menu

IP Address	The IP address of the FTP server.
Username	The User Name entered when setting up the FTP server
Password	The password associated with the above User Name.

Section C2 gives an example of how to set up an FTP server using 'Filezilla'

4.8.3 Programmer Setup menu

Figure 4.8.3 Programmer Set Up menu

Channels	The number of channels to be profiled. 1 = single channel mode, 2 = dual channel sync-all mode
Prog Mode Access	Sets the minimum access level (Logged off, Operator, Supervisor) for allowing changes to the current program mode (run, hold or reset)

4.8.3 Programmer Set Up Menu (Cont.)

Prog Edit Access	Sets the minimum access level (Logged off, Operator, Supervisor, Engineer) for loading programs, and for allowing edits to the current program including permission to advance a segment.
Prog Store Access	Sets the minimum access level (Logged off, Operator, Supervisor, Engineer) that allows users to copy, store and delete programs.
Rate Resolution	Sets the resolution (0 to 4 decimal places) of ramp rates when read from / written to via scaled integer comms.
Ch1 Units	Five-character (max.) descriptor for channel 1 units. If wired, the units will be those of the wire source.
Ch1 Resolution	Number of decimal places for channel 1 value. If wired, the value will be that of the wire source.
Ch1 Servo To	Determines whether the programmer starts running channel 1 from the control loop's configured set-point (servo to SP), or from the current process value (servo to PV).
Ch1 PV Input	Various programmer functions (for example Ch1 Servo to PV), require the PV value of the loop that the programmer is trying to control. The parameter is normally wired from the loop's Track PV parameter.
Ch1 SP Input	Various programmer functions (for example Ch1 Servo to SP), require the SP value of the loop that the programmer is trying to control - it is normally wired from the loop's Track SP parameter.
Ch2 Units	As 'Ch1 Units', above but for channel 2. Appears only if 'Channels' is set to '2'.
Ch2 Resolution	As 'Ch1 Resolution', above, but for channel 2. Appears only if 'Channels' is set to '2'.
Ch2 Servo To	As 'Ch1 Servo To', above, but for channel 2. Appears only if 'Channels' is set to '2'.
Ch2 PV Input	As 'Ch1 PV Input', above, but for channel 2. Appears only if 'Channels' is set to '2'.
Ch1 SP Input	As 'Ch1 SP Input', above, but for channel 2. Appears only if 'Channels' is set to '2'.
Power Fail Action	If the power supplied to the instrument is interrupted, the program status is retained and when power is restored, the instrument performs the selected power fail action. Continue: The programmer set-point returns immediately to its last value prior to the power down and the program continue to run from that point. Reset: The program resets. Ramp Back: The programmer servos the programmer set-point to the channel PV, and ramps to the target set-point at the rate prior to the power-fail. The time remaining for the segment is recalculated.

Notes:

1. If the interrupted segment was a 'time to target' ramp, then when power is returned the calculated ramp rate prior to the interruption is used.
2. If the interrupted segment was 'Dwell', then the ramp rate is determined by the previous ramp segment. On achieving the dwell set-point, the dwell period continues.
3. If a previous ramp segment does not exist (i.e. the first segment of a program is a dwell), the dwell continues at the 'servo to PV' programmer set-point.

Max Events	Configures the maximum number of event outputs (0 to 8).
Reset Event N	Sets the state of event output 'N' when the program is in reset. Appears only if 'Max Events' is > (N-1).
Reset Ch1 UV	Enter the value to be written to user value 1 when the program is in reset. Appears only if 'User Value' feature is enabled in Programmer.Features configuration (Section 4.8.1).
Reset Ch2 UV	Enter the value to be written to user value 2 when the program is in reset. Appears only if 'User Value' feature is enabled in Programmer.Features configuration (Section 4.8.1) and 'Channels' = '2'
Run	The input that causes the programmer to place the current program in Run mode.
Hold	The input that causes the programmer to place the current program in Hold mode.

4.8.3 Programmer Set Up Menu (Cont.)

Reset	The input that causes the programmer to place the current program in Reset mode.
Run Reset	Dual functionality input, that causes the programmer to place the current program in Run or Reset mode.
Run Hold	Dual functionality input, that causes the programmer to place the current program in Run or Hold mode.
Wait Digital	The Boolean input that is used in Wait segments.
Wait Analog 1	The analogue input associated with channel 1 that is used in wait segments.
Wait Analog 2	The analogue input associated with channel 2 that is used in wait segments. Appears only if 'Channels' = '2'
Advance	The input to advance the current segment
Operation	Program file operation selection parameter. See 'Program editing' (Section 3.4.9) for further details
Status	Status indication of the selected file operation.See 'Program editing' (Section 3.4.9) for further details
Amended	Indicates whether the current program has been amended since being loaded (Comms only)
File Error Status	File operation error status (Busy, OK, Load Open File Error, Store Open File Error, Delete File Fail, Copy File Fail, Invalid Format, Invalid Device, Invalid Version, Invalid Num Channels, Parameter Write Fail, Store Operation Did Not Complete, Load Operation Did Not Complete, Delete Operation Did Not Complete, Copy Operation Did Not Complete, Invalid Filename, Unspecified Error). Available only over Comms as the error is displayed on the display screen. 'Parameter Write Fail' indicates that one or more program/segment parameters failed to be written to during a 'Load' operation. This is generally caused by a program that contains features (i.e. Holdback, User Values, PV Events) which are disabled in the instrument's Programmer block, or the program contains more Event Outputs than configured in the instrument's Programmer block.
Program Num	A program name may be prefixed by a program number from 1 to 99. This is necessary if a program is to be loaded either using a BCD switch or via a single comms transaction. The parameter shows the last program to be loaded via the program number. See also Section 3.4.9. 'Program Load Via a Program Number'.

4.8.4 Programmer Run menu

Figure 4.8.4 Programmer Run menu

Mode	Current program mode (Run, Hold, Reset).
Status	Current program status (Running, Holding, Holdback, Waiting, Reset, Complete)
Ch1 PSP	The output setpoint for channel 1.
Ch2 PSP	The output setpoint for channel 2. Appears only if 'Channels' = '2' in the Set Up menu (Section 4.8.3).
Segment	Name of the current segment as entered in the Program Edit page (Section 3.4.9)
Segment Type	Current segment type as entered in the Program Edit page (Section 3.4.9)
Seg Time Left	Indicates the minimum amount of time left in the current segment.
Seg Time Run	The length of time that the current segment has been running. This value does not include time spent in Hold, Holdback or Waiting
Prog Time Left	Shows the minimum amount of time left before the program completes. Each segment can be up to 500 hours in length. The maximum display is 500 hours, and if the length of the entire program is greater than this, the display remains at 500 until the remaining time falls below 500 hours.
Prog Time Spent	Indicates the length of time the current program has been running, including time spent in Hold, Holdback or Waiting

4.8.4 Programmer Run Menu (Cont.)

Prog Time Run	The length of time the current program has been running. This value does not include time spent in Hold, Holdback or Waiting
Duration	For Dwell segments only, this is the dwell duration.
Ch1 TSP	For Ramp and Step segments, this is the current target setpoint for channel 1.
Ch1 Time	For Ramp segments, this is the configured time for channel 1 to reach it's Target Setpoint (TSP)
Ch2 TSP	For Ramp and Step segments, this is the current target setpoint for channel 2. Appears only if 'Channels' = '2' in the Programmer Set Up menu (Section 4.8.3).
Ch2 Time	For Ramp segments, this is the configured time for channel 2 to reach it's Target Setpoint (TSP). Appears only if 'Channels' = '2' in the Programmer Set Up menu (Section 4.8.3)
Cycles Left	The number of Go Back cycles remaining before the Go Back loop ends.
Ch1 User Val	The value of user value 1 in the current segment. Appears only if the 'User Value' feature is enabled in the Programmer Features menu (Section 4.8.1).
Ch2 User Val	The value of user value 2 in the current segment. Appears only if the 'User Value' feature is enabled in the Programmer Features menu (Section 4.8.1) and if 'Channels' = '2' in the Programmer Set Up menu (Section 4.8.3)
Ch1 PV Event	The state of channel 1 PV event (Off = Cross symbol, On = Tick). Appears only if the 'PV Event' feature is enabled
Ch2 PV Event	The state of channel 2 PV event (Off = Cross symbol, On = Tick). Appears only if the 'PV Event' feature is enabled and if 'Channels' = '2' in the Programmer Set Up menu (Section 4.8.3).
Event 1 to 8	The state of event output 1 to 8 for the current segment (Off = Cross symbol, On = Tick). The number of events appearing is defined in the Programmer Set Up menu (Section 4.8.3) (Max Events)
End Output	The output that is set by the end segment (Off = Cross symbol, On = Tick).

4.8.5 Connecting the programmer to a loop

Below are some examples of how programmers and loops may be soft-wired together so that the programmer has access to the Loop PV and Loop setpoint. The examples are taken from iTools (Section 6), but may be carried out through User Wiring (Section 7) if more convenient.

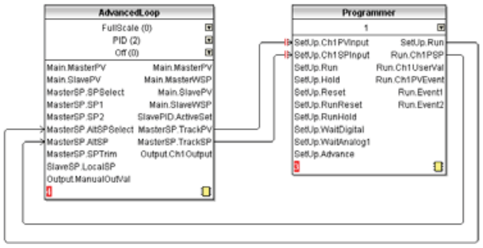


Figure 4.8.5a Advanced loop to Programmer basic wiring

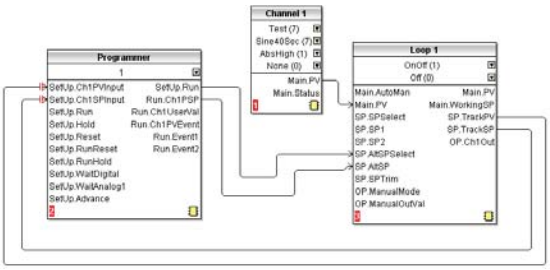


Figure 4.8.5b Programmer to Loop basic wiring

4.8.5 Connecting The Programmer To A Loop (Cont.)

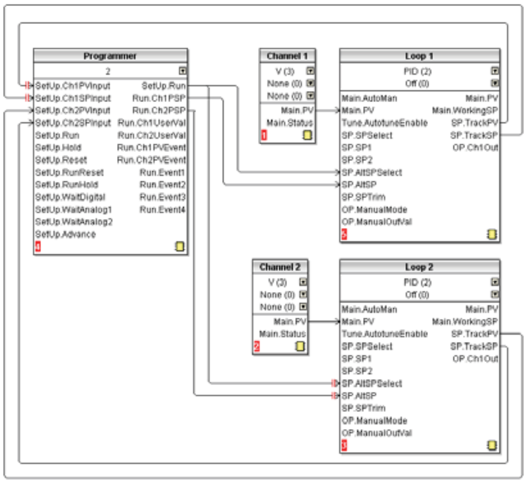


Figure 4.8.5c Dual programmer to two loops basic wiring

4.8.6 Configuration by Modbus Comms

It is possible to configure, store, delete, or load a program via Modbus comms by setting the Program and Segment parameters using either their scaled integer or native modbus addresses (Section 5.3).

EXAMPLE 1: CONFIGURE A PROGRAM

To configure a simple Ramp-Dwell-Ramp program via modbus comms:
Set Segment.1.Type (address 15040) to Ramp (1)
Set Segment.1.Ch1TSP (address 15042) to 60.0 (600 - 1dp)
Set Segment.1.Ch1Time (address 15044) to 60s (60s)
Set Segment.2.Type (address 15088) to Dwell (2)
Set Segment.2.Duration (address 15089) to 120s (120)
Set Segment.3.Type (address 15136) to Ramp (1)
Set Segment.3.Ch1TSP (address 15138) to 0.0 (0 - 1dp)
Set Segment.3.Ch1Time (address 15140) to 180s (180)

EXAMPLE 2: STORE A PROGRAM

To store the current program:
Set Programmer.FileList.FilenameEntry (address 27281) to required filename (e.g. George)
Set Programmer.Setup.Operation (address 14912) to Store (4)
Read Programmer.Setup.Operation (address 14912) until it returns Select (1)
Read Programmer.Setup.Status (address 14913) to get the status of the store operation (Success = 1, Failed = 2)

EXAMPLE 3 LIST STORED PROGRAMS

To get a listing of stored program files:
Set Programmer.FileList.Operation (address 14976) to Get Listing (1)
Read Programmer.FileList.Operation (address 14976) until it returns Complete (0)
Read Programmer.FileList.Filename1 to 100 parameters (address 30976 - 31075)
Note: for each filename parameter perform a 21 register block read starting from the base address of the parameter, 1st null string indicates end of List.

EXAMPLE 4: LOADING PROGRAMS

To load a program:
Get a listing as described above
Set Programmer.FileList.FilenameEntry (address 27281) to the filename to be loaded (e.g. George)
Set Programmer.Setup.Operation (address 14912) to Load (2)
Read Programmer.Setup.Operation (address 14912) until it returns Select (1)
Read Programmer.Setup.Status (address 14913) to get the status of the load operation (Success = 1, Failed = 2).

EXAMPLE 5: LOADING A PROGRAM VIA A PROGRAM NUMBER

Set Programmer.Setup.ProgNum (address 14920) to the program number to be loaded.

4.9 MODBUS MASTER CONFIGURATION

Modbus master configuration is divided into two areas: a) setting up the slave(s), including diagnostics, and b) defining the locations of the parameters to be read. Figure 4.9 shows an overview.

Section 3.4.12 shows the Modbus Master display page, and describes the configuration options available there.

Note: Versions 2.40 to 2.50 of the Mini8 Controller, and versions 2.70 to 3.20 of the Model 3550 controller are supported. It is not guaranteed that later software versions of these instruments will be fully compatible.

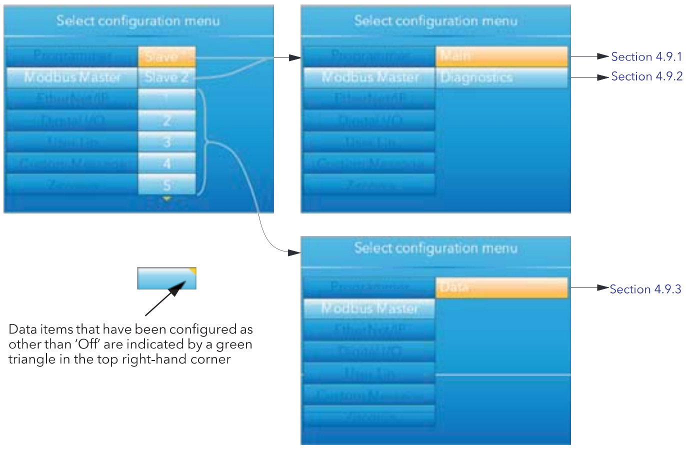


Figure 4.9 Modbus Master configuration top level menus

4.9.1 Slave Main menu

This allows the IP address, Unit ID and other communications parameters to be entered for Slaves 1 and 2.

Available Priority selections		
Seconds	Minutes	Hours
0.125	1	1
0.25	2	
0.5	5	
1	10	
2	20	
5	30	
10		
20		
30		

Figure 4.9.1 Modbus Master Slave 1 configuration (Slave 2 similar)

Descriptor	A descriptor for this instrument. For use in Modbus communications, this is not the same as the 'Name' which appears in the Instrument Info configuration (Section 4.15).
Online	Disabled by default (Cross symbol). Must be enabled (highlighted using the down arrow, then edited by the scroll button) to allow the remaining configuration items to appear and to allow data transactions be processed. Setting the slave offline temporarily disables data transactions - it does not reconfigure them.
Comms Failure	Active (yes) if a data item has failed to respond after all retries.
IP Address	The IP address of the Slave device
Unit ID	The Unit Id or Modbus address to use in each data transaction with the slave device. Limits are 1 to 255
Search Device	Setting this to 'Yes' searches the network to see if the device with the specified IP address and Unit ID is available. If so, the descriptor will be overwritten to indicate what type of device has been found.
Search Result	The status of the selected 'Search Device' request (Searching, Available, Unreachable). Search activity is indicated by a rotating animated display in the 'Searching' field.
Profile	A number of profiles are held within the instrument that match a selection of known devices. If the device is 'known', its type, model number etc. is displayed. If the device is unknown, '3rd Party' appears instead.
Retries	The number of times (0 to 3) to re-send a data transaction to the device if no response is received within the configured timeout period (below).
Timeout	The timeout period for each Modbus transaction in ms
Max Block Size	The maximum number of registers (16bit words) that a single data transaction is permitted to contain
High Priority	The interval rate between each high priority data transaction. Default = 0.125 second.
Medium Priority	The interval rate between each medium priority data transaction. Default = 1 second.
Low Priority	The interval rate between each low priority data transaction. Default = 2 seconds.

4.9.1 Slave Main Menu (Cont.)

PRIORITY LEVELS

Three levels of update rate can be entered for use in data configuration (Section 4.9.3), to define how often a value is read or written. In order to optimise performance, it is recommended that the slowest rate consistent with requirements be selected. The intervals are selected from a scroll list see figure 4.9.1 above.

4.9.2 Slave Diagnostics menu

Figure 4.9.2 Diagnostics menu

Note: Diagnostic values are reset on power up

Actual High	The high priority rate that this slave is actually running at. This can never be faster than the high priority rate that was configured for this device (Slave Main menu, above), but if the master is heavily loaded the rate may be lower than that specified.
Actual Medium	The medium priority rate that this slave is running at. This can never be faster than the medium priority rate that was configured for this device (Slave Main menu, above), but if the master is heavily loaded the rate may be lower than that specified.
Actual Low	The actual low priority rate that this slave is running at. This can never be faster than the low priority rate that was configured for this device (Slave Main menu, above), but if the master is heavily loaded the rate may be lower than that specified.
Device Status	The status of the last transaction to this slave Success: The transaction was successfully actioned by the slave device Timeout: There was no response from the slave device to a given request within the configured time Illegal Address: The request to the slave device contained an invalid modbus address. The address may be for a read only parameter Illegal Value: The request to the slave device contained invalid data for the specified parameter Bad Sub: The sub function code in the request was invalid

4.9.2 Slave Diagnostics Menu (Cont.)

DEVICE STATUS (Cont.)

	Idle: This data item is currently idle and not communicating with the slave device
	Illegal Code: The slave does not support the function code transmitted by the master.
	Pending: The request is waiting to be sent, the most likely cause being that the slave device has not been set to online
Loopback Test	If set to 'Yes', Sends a function code 8 transaction to the slave, and waits for a response.
Total	A count of all the transactions sent to the slave including reads, writes both good and failed transactions.
Successful	A count of all the successful transactions sent to the slave.
Failures	A count of all the unsuccessful (failed) transactions sent to the slave. May be caused by Illegal Function, Illegal Address etc. failures, as detailed below
Retries	The number of transactions that were re-sent because of timed out responses from the slave devices.
Timeouts	A count of all the transactions sent to the slave for which no response was received within the configured timeout period.
Illegal Function	A count of all the transactions sent to the slave that the slave claimed contained an invalid function code. Exception code (1).
Illegal Address	A count of all the transactions sent to the slave that the slave claimed contained an invalid Modbus register address. Exception code (2).
Illegal Data	A count of all the transactions sent to the slave that the slave claimed contained an invalid value. Exception code (3)
Slave Failure	A count of all the times this slave device has failed to communicate. Exception code (4)
No Gateway Path	A count of all the times it has not been possible to access the slave device as it is on another network that requires a gateway for access
Master Rejects	A count of all the transactions that the Modbus Master has refused to send to the slave due to invalid configuration data
Reset	A one shot action that immediately resets all diagnostics counts.

4.9.3 Modbus master data configuration

This is the area of configuration in which the individual data items are selected for transmission across the Modbus master communications link. The configuration fields that appear depends on the parameter selected, so the examples given here will probably not match those that appear to the user. The parameters that appear in the 'parameter List' scroll menu depends on the slave model.

EXAMPLE 1: TARGET SP1 WITH NANODAC SLAVE

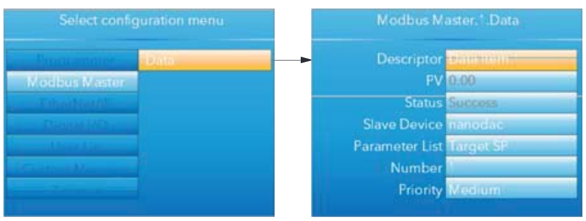


Figure 4.9.3a Target Setpoint

4.9.3 Modbus Master Data Configuration (Cont.)

EXAMPLE 2 USER DEFINED PARAMETER

This allows the user to enter a Modbus address (decimal) and a data type in order to read the value of a parameter from or write a parameter value to the slave. Modbus address and data types must be obtained from the documentation supplied with the slave device. For convenience, this example uses a nanodac as the slave; table 5.3 of this document providing the required data.

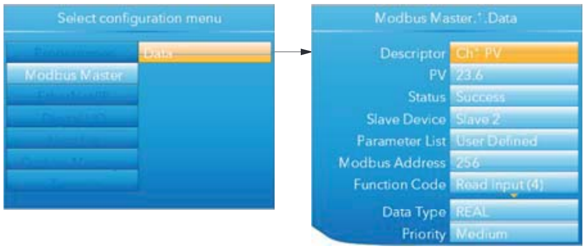


Figure 4.9.3b User defined parameters

DATA PARAMETERS

This lists all possible configuration fields that might appear, not just those shown in the examples above.

Descriptor	Up to 20 characters used to describe the current data item (used in the Modbus Master user page (Section 3.4.12)).
PV	The process value currently being read from the selected slave. Visible only if data item is not an alarm type. The value must be wired to a virtual channel with 'Operation' = 'Copy' if it is to be trended and/or recorded.
Sys Alm status	The status (e.g. None, Active) of the data item. Visible only for specific read profiles. The value must be wired to a virtual channel with 'Operation' = 'Copy' if it is to be trended and/or recorded.
Chan. Alm Status	The status of the data item. Visible only for specific read profiles. The value must be wired to a virtual channel with 'Operation' = 'Copy' if it is to be trended and/or recorded.
Set	Allows the user to set an on/off value. Visible only for specific write profiles.
Mode	Allows the user to set an auto/manual value. Visible only for specific write profiles.
Value	Configured or wired value to be sent to the selected slave. This parameter is available only with function codes 6 & 16
Fall Back Value	The value to be sent to the selected slave if the 'Value' parameter is wired and has a status other than GOOD_PV. This parameter is available only with function codes 6 & 16 It is not possible to wire Fall Back Value from another parameter and it can be configured only manually
Send	A one shot action that sends the data in the 'Value' parameter or the 'Fall Back Value' parameter (depending upon the status of 'Value') to the selected slave. This is classed as an acyclic write and so is available only for function codes 6 & 16. The 'Priority' parameter must be set to 'Acyclic'

4.9.3 Modbus Master Data Configuration (Cont.)

Status — The status of the last transaction sent to the selected slave

Success: The transaction was successfully actioned by the slave device

Timeout: There was no response from the slave device to a given request within the configured time

Illegal Address: The request to the slave device contained an invalid modbus address. The address may be for a read only parameter

Illegal Value: The request to the slave device contained invalid data for the specified parameter

Bad Sub: The sub function code in the request was invalid

Idle: This data item is currently idle and not communicating with the slave device

Illegal Code: The slave does not support the function code transmitted by the master.

Pending: The request is waiting to be sent, the most likely cause being that the slave device has not been set to online.

Slave Device — A list of available slaves that this data is to communicate with.

Parameter List — List of parameters available for the selected slave devices profile. These parameters require no user configuration.

Number — The channel, loop or group etc. instance.

Modbus Address — The Modbus register address that this data is to be read or written to. Limits are 0 - 65535

Function Code — The function code to use, this determines if the data is going to be read or written to the selected slave. Supported function codes are:

Code	Description	Code	Description
1	Read contiguous status coils	5	Write a single coil on or off
2	Read contiguous discrete inputs	6	Write to a single register
3	Read contiguous holding registers	8	Loopback test
4	Read contiguous input registers	16	Write to contiguous registers

Data Type — The data type that defines how this data is going to be represented. The data types listed below are supported.

8-bit signed byte (BYTE)

8-bit unsigned byte (UBYTE)

16-bit signed integer (INT)

16-bit unsigned integer (UINT)

32-bit signed long (DINT)

32-bit unsigned long (UDINT)

32-bit floating point IEEE (REAL)

32-bit signed long (little Endian, word swapped) (DINT (Swap))

32-bit unsigned long (little Endian, word swapped) (UDINT (Swap))

32-bit floating point IEEE (little Endian, word swapped) (REAL (swap))

Bit from register (BIT)

By default all 16 & 32 bit data types (unless specified) will be transmitted in Big Endian format, where the most significant byte in the value is sent first. Byte Ordering: (for big Endian) (0x12 sent first)

16-bit	0x1234	0x12, 0x34
32-bit	0x12345678	0x12, 0x34, 0x56, 0x78

Bit Position — The bit in the register to be extracted, this is only available if the 'Data Type' selected is 'BIT In Register'

Scaling — The decimal placing for scaled 16 bit data types. Visible depending on the 'Data Type' selected.

Priority — The frequency with which this data will be managed. See ‘Priority Levels’, in Section 4.9.1, above.

4.10 ETHERNET/IP CONFIGURATION

This area of configuration allows the 'Client' user to set up an EtherNet/IP communications link with up to two Server units. The 'Server' user has a more limited range of configurable items.

Note: Implicit I/O is used for continuous real-time transfer of multiple data items from instrument to instrument. Explicit I/O is used as a 'one-shot' transfer of a single data item. See Section 3.4.13 for further details.

Figure 4.10 shows that the configuration is split into three areas: Main, Implicit Inputs and Implicit Outputs, but it should be noted that the implicit inputs and implicit outputs are read only, as these can be configured only by using iTools, as described in the EtherNet/IP display mode description (Section 3.4.13).

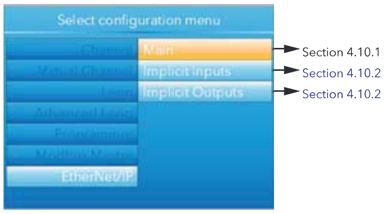


Figure 4.10 Client configuration

4.10.1 Ethernet/IP Configuration Main menu

Figure 4.10.1 Ethernet/IP Main menu

4.10.1 Ethernet/ip Configuration Main Menu (Cont.)

Net Status Code	Network status (Server only) Offline: nanodac online but there are currently no CIP connections Online: nanodac online with at least 1 CIP connection Connection Timeout: The connection has timed out Duplicate IP: A duplicate IP address has been detected on the network Initialisation: nanodac is initialising comms
IO Status Code	IO status (Client (IO) only). As above.
Tag Status code	Tag status (Client (Tags) only. See table 4.10.1, below.
Implicit I/O	Connected IO server IP address
Multicast	Connected IO server IP address (only if multicast selected)
Explicit 1	Connected client/server IP address
Explicit 2	Connected client/server IP address
Mode	Modes of operation: Server, Client (IO) or Client (Tags)
Server Address	IO Server IP address (Client mode only)
Input Instance	Input class instance number (client mode only)
Size (bytes)	The size in bytes of data that the client is expecting to read from the implicit input.
Output Instance	Output class instance number (client mode only)
Size (bytes)	The size of data that the client is expecting to write to the server.
Connection Type	Connection type (client mode only)
Priority	Connection priority (client mode only)
Rpi	IO connection speed (client mode only)
Reset Comms	Applies all changes to the EtherNet/IP stack at the same time. Or can be used to reset communications using the current configuration
Slot Number	PLC slot number (zero indexed) when communicating using tags

4.10.2 Implicit inputs/outputs

This display provides a read-only display of the values in the input and output data tables. Parameters are placed in the input and output tables using the proprietary software tool called 'iTools', as described in Section 3.4.13.

4.10.3 Explicit inputs/outputs

See Section 3.4.13 for details.

* Temperature units are those configured for the channel to which the temperature measuring transducer is connected.

4.10 Ethernet/ip Configuration (Cont.)

0	Success. Service was successful
1	Connection Failed. A connection in the path failed
2	Invalid Parameter. A parameter associated with the request was invalid
3	Memory Unavailable. No available resources in the server to service the request
4	Path Segment Error. The syntax of all or some of the path was not understood
5	Path Dest. Error. The path references an unknown object, class or instance
6	Partial Transfer. Only part of the expected data was transferred
7	Connection Lost. The messaging connection was lost
8	Service Unsupported. Undefined service for requested object
9	Invalid Attribute. Invalid attribute data detected
10	Attribute Error. An attribute in the response has a non zero status
11	Already Requested. The object is already in the mode/state being requested
12	Object Conflict. The object cannot perform the requested service
13	Already Exists. The requested instance or object already exists
14	Attribute Error. Request to modify a non modifiable attribute received
15	No Privileges. Permission/Privilege check failed
16	State Conflict. The current state or mode prohibits the execution of the requested service
17	Reply To Large. Response buffer too small for response data
18	Fragmented Value. For example this service request will return only half a REAL data type
19	Not Enough Data. The service does not provide enough data to complete the request
20	Invalid Attribute. Requested attribute is not supported
21	Too Much Data. The service supplied more than was expected
22	Object Non-Exist. The object specified does not exist in the device
23	Seq. Fragmentation. The fragmentation sequence for this service is not active
24	No Attribute Data. The attribute data for this object was not saved at the server prior to this request service
25	Data Store Failure. The attribute data for this object was not saved due to a failure during the attempt
26	Routing Failed. The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service
27	Routing Failed. The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service
28	Missing Attribute. The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behaviour
29	Invalid Attribute. The service is returning the list of attributes supplied with status information for those attributes that were invalid
30	Embedded Tag Error. An embedded service resulted in an error. This is most commonly an incorrectly formatted tag name
31	Vendor Error. A vendor specific error has encountered
32	Invalid Parameter. A parameter associated with the request was invalid
33	Write Once Error. An attempt to write to a write once only parameter occured
34	Invalid Reply. An invalid reply was received
35	Buffer Overflow. The message received is larger than the receiving buffer
36	Format Error. The format of the received message is not supported
37	Key Path Failure. The key segement in the path does not match destination key
38	Path Size Error. The size of the path in the request is too large
39	Unexpected Attribute. Unable to set the attribute at this time
40	Invalid Member Id. The requested member id does not match class object
41	Member Is R/O. A request to modify a R/O member was received
42	Group 2 Server. Group 2 DeviceNet server response
43	Translation Error. A CIP modbus translator request failed
44	Attribute Is R/O. A request to read a non readable attribute was received
64	No Tags Found. There were no tags configured in the input or output tables
65	Invalid Config. The total length in characters of all the tags in this table will cause the PLC to exceed its internal buffer of 500 bytes. To eliminate this problem, reduce the length of some or all tag names

Table 4.10.1 Tag Status code definition

4.11 WEB SERVER

The Web Server has been added from firmware versions V5.00 onwards and provides the following features:

- Up to four unique client connections
- PC, Tablet and mobile phone client support (using appropriate browsers)
- Full URL translation support
- Runtime data
- Historical data
- Target information
- Alarm information
- Message log
- Promote page
- Full cookie support
- Safari, IE9 or greater and Google chrome browser support

The web server provides visualisation only.

4.11.1 Configuration Display

Figure 4.11.1 Web server configuration page

Status	Read only. Ready - the web server is running. Inactive - the web server is not ready Connected - the web server is connected. It is possible that Status will flip between Ready and Connected during operation.
Enabled	Yes/No
Port	80 or 8080
Security	Yes/No. Yes is the default.
Username	Enter a customised user name. This will be required when logging in to the webserver. Default is 'admin'. Username is only shown when 'Security' is set to 'Yes'.
Password	Enter a customised pass word. This will be required when logging in to the webserver. Default is 'admin'. Password is only shown when 'Security' is set to 'Yes'

Web Server pages are shown in Appendix E.

4.12 DIGITAL I/O

This area of configuration allows the digital I/O types to be selected.

Notes:
1. If 2A2B is set to 'Valve Raise', then 3A3B is set to 'Valve Lower'. Similarly, if relay 4AC is set to 'Valve Raise', then relay 5AC is set to 'Valve Lower'.
   When the loop channel output is wired to the PV input of a Valve Raise function, then the PV input of the associated Valve Lower function becomes unavailable for wiring, and both outputs are controlled by the loop as a pair, using only the single wire.
2. See section B2.6.11 for a description of time proportioning.

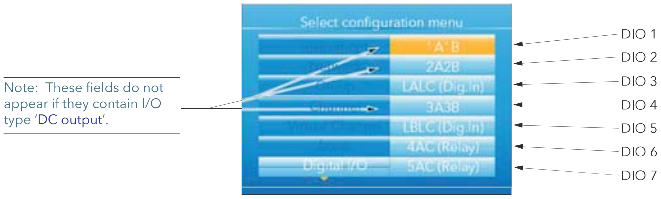


Figure 4.12 Digital I/O top level menu

4.12.1 Digital input/output

This applies to signals at terminals 1A/1B (figure 2.2). Highlight '1A1B', then operate the scroll key to reveal the configuration menu.

Module Ident	Dig IO
Type	On Off O/P, Time Prop O/P or Contact I/P (default)
PV	For inputs, 0 = contact is open; 1 = contact is closed. For On Off O/P, a value ≥ 0.5 drives the output high, otherwise, the output is driven low. For Time Prop O/P, the value is the demanded output %.
Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for digital outputs; or the input signal for digital inputs.
Output	Off = output being driven low; On = output being driven high. Does not appear for Type = Contact I/P

4.12.2 Relay outputs

This may apply to terminal pairs 1A1B, 2A2B, 3A3B, 4AC, 5AC (figure 2.2). Highlight the relevant terminal pair, then operate the scroll key to reveal the configuration menu.

Module Ident	Relay
Type (2A2B, 4AC)	On Off O/P (default), Time Prop O/P, Valve Raise (not if DC output I/O fitted).
Type (3A3B, 5AC)	'On Off O/P' (default), 'Time Prop O/P'. The 3A3B relay is not fitted if 'DC Output' I/O is fitted.
PV	For On Off O/P, a value ≥ 0.5 closes the relay contacts, otherwise, the contacts are open. For Time Prop O/P, the value is the demanded output %.
Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified to reduce relay wear. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for the relays (not applicable if Type = Valve Raise).

(Continued)

4.12.2 Relay Outputs (Cont.)

Inertia	For Type = Valve Raise only, this allows a value to be entered (in seconds) to take into account valve run-on.
Backlash	For Type = Valve Raise only, this allows a value to be entered (in seconds) in order to compensate for backlash in the valve linkage.
Standby action	For Type = Valve Raise only, this specifies the valve action when the instrument is in standby mode. Continue: Output continues at the demanded level Freeze: The valve stops being driven.
Output	Off = relay contacts open; On = relay contacts closed.

4.12.3 Digital inputs

This applies to terminals pairs LALC, LBLC (figure 2.2). Highlight the relevant terminal pair, then operate the scroll key to reveal the configuration menu.

Module Ident	Dig.In
Type	Contact I/P
PV	0 = contact is open; 1 = contact is closed.
Invert	Inverts the sense of the input.

4.12.4 Digital outputs

This applies to terminal pair 2A2B (figure 2.2). Highlight 2A2B, then operate the scroll key to reveal the configuration menu.

Module Ident	Dig.Out
Type	On Off O/P, Time Prop O/P or Valve Raise
PV	For On Off O/P, a value ≥ 0.5 drives the output high, otherwise, the output is driven low. For Time Prop O/P, the value is the demanded output %.
Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for digital outputs; or the input signal for digital inputs.
Inertia	For Type = Valve Raise only, this allows a value to be entered (in seconds) to take into account valve run-on.
Backlash	For Type = Valve Raise only, this allows a value to be entered (in seconds) in order to compensate for backlash in the valve linkage.
Standby action	For Type = Valve Raise only, this specifies the valve action when the instrument is in standby mode. Continue: Output continues at the demanded level Freeze: The valve stops being driven.
Output	Off = output being driven low; On = output being driven high.

4.13 DC OUTPUT

This option provides a voltage (terminals 3A3B only) or mA output. Terminal location is shown in figure 2.2.

CAUTION

There are no mechanical interlocks to prevent a chassis with the dc output option being fitted into a 'sleeve' or 'case' which has previously been wired for the standard relay output. Before fitting the chassis into the case, it should be ensured that the terminal wiring is not attached to live voltage supplies, as such voltages may cause permanent damage to the instrument.

4.13.1 Configuration display

As shown in the figure below, highlight the required DC output, then operate the scroll button to reveal the configuration page.

Figure 4.13.1 DC Output option configuration page (typical)

PARAMETERS

Type	Select V(olts) (3A3B only) or mA as the output type.
PV	Input value to the function. Normally 'wired' to a suitable parameter.
Status	The status of the input parameter.
OP Adjust State	Adjusted. Appears only if the Output Adjust facility (Section 4.1.10) has been used.
Resolution	The number of decimal places to be used for this configuration item.
Output Low	The minimum output value in Volts or mA as appropriate
Output High	The maximum output value to be output in Volts or mA as appropriate.
Scale Low	See 'SCALING INFORMATION' below.
Scale High	See 'SCALING INFORMATION' below.
Fallback PV	The output value when the status of the input parameter is not 'good'.
Measured Value	The Voltage or mA value appearing at the output terminals

Note: The output voltage or current can be calibrated by using the output adjust procedure described in Section 4.1.10.

SCALING INFORMATION

When PV = Scale Low, Output = output low value. When PV = Scale high, Output = output high value. The PV is mapped via the scale range onto the output range according to the equation:

$$\text{Output} = \left(\frac{\text{PV} - \text{Scale Low}}{\text{Scale High} - \text{Scale Low}}\right)(\text{Output High} - \text{Output Low}) + \text{Output Low}$$

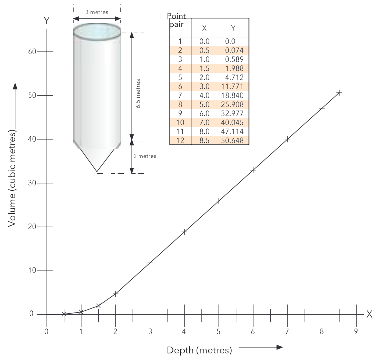
4.14 USER LIN

Allows the entry of up to four user linearisation tables, any one of which can be selected as 'Lin Type' in Channel configuration (Section 4.4.1). Configuration consists of defining the number of points to be included (2 to 32) and then entering an X and a Y value for each point, where X values are the inputs and the Y values are the resulting outputs.

4.14.1 User linearisation table rules

1. Tables must be monotonic - i.e. there may not be more than one X value with the same Y value assigned to it.
2 Each X value must be greater than the preceding one.
3. Each Y value must be greater than the preceding one.
4. If units other than temperature units are to be displayed, the channel scale high and scale low values should be set to the same as the range high and low values, and the required scale units entered.

Figure 4.14.1 shows the first part of the configuration table for an imaginary cylinder example.



Point pair	X	Y
1	0.0	0.0
2	0.5	0.074
3	1.0	0.589
4	1.5	1.988
5	2.0	4.712
6	3.0	11.771
7	4.0	18.840
8	5.0	25.908
9	6.0	32.977
10	7.0	40.045
11	8.0	47.114
12	8.5	50.648

Figure 4.14.1 User Linearisation table example

When configuring a channel (Section 4.4.1) to use a User linearisation table:

If Type = Thermocouple or RTD, then Range High/Low must be set to the highest and lowest 'Y' values to be used, respectively. The instrument automatically looks up the associated 'X' mV or Ohms values.

If Type = mV, V or mA, then Range High/Low must be set to the highest and lowest 'Y' values to be used, respectively. Input High/Low should be set to the highest and lowest 'X' values in the table, respectively.

4.15 CUSTOM MESSAGES

This feature allows the entry of up to 10 messages for sending to the history file, when triggered by a wired source (e.g. an alarm going active).

The messages of up to 100 characters each are entered using either the virtual keyboard, described in Section 3.6, or by means of iTools configuration software.

Up to three parameter values may be embedded in messages in the format [Address], where 'Address' is the decimal Modbus address of the parameter (Section 5.3). E.G. [256] embeds Channel 1 PV.

4.16 ZIRCONIA BLOCK OPTION

This option allows the calculation of Carbon Potential, Dew point or Oxygen concentration. A zirconia (oxygen) probe consists of two platinum electrodes bonded to a pellet or cylinder of zirconia. At elevated temperatures, such a probe develops an emf across it which is proportional to the probe absolute temperature and to the log of the difference in oxygen partial pressure between its two ends.

The temperature of the probe is normally measured using a type K or type R thermocouple. The temperature effect on the thermocouple is such, that for successful operation, the probe temperature must be greater than 973K (700°C).

4.16.1 Definitions

TEMPERATURE CONTROL

The sensor input of the temperature loop may come from the zirconia probe but it is common for a separate thermocouple to be used. The controller provides a heating output which may be used to control gas burners. In some applications a cooling output may also be connected to a circulation fan or exhaust damper.

CARBON POTENTIAL CONTROL

The zirconia probe generates a millivolt signal based on the ratio of oxygen concentrations on the reference side of the probe (outside the furnace) to the amount of oxygen in the furnace.

The controller uses the temperature and carbon potential signals to calculate the actual percentage of carbon in the furnace. This second loop generally has two outputs. One output is connected to a valve which controls the amount of an enrichment gas supplied to the furnace. The second output controls the level of dilution air.

SOOTING ALARM

In addition to other alarms which may be detected by the controller, the instrument can trigger an alarm when the atmospheric conditions are such that carbon will be deposited as soot on all surfaces inside the furnace. The alarm may be wired to an output (e.g. relay) to initiate an external alarm.

CLEAN PROBE

As these sensors are used in furnace environments they require regular cleaning. Cleaning (Burn Off) is performed by forcing compressed air through the probe. Cleaning can be initiated either manually or automatically using a timed period. During cleaning 'PV Frozen' is set to 'Yes'.

AUTOMATIC PROBE CLEANING

The instrument has a probe clean and recovery strategy that can be programmed to occur between batches or be manually requested. At the start of the cleaning process a 'snapshot' of the probe mV is taken, and a short blast of compressed air is used to remove any soot and other particles that may have accumulated on the probe. A minimum and maximum cleaning time can be set by the user. If the probe mV has not recovered to within 5% of the snapshot value within the maximum recovery time set then an alarm is given. This indicates that the probe is ageing and replacement or refurbishment is due. During the cleaning and recovery cycle the PV is frozen, thereby ensuring continuous furnace operation. The 'Pv Frozen' parameter can be used in an individual strategy, for example to hold the integral action during cleaning.

ENDOTHERMIC GAS CORRECTION

A gas analyser may be used to determine the carbon monoxide (CO) concentration of the endothermic gas. If a 4 to 20mA output is available from the analyser, this can be applied to the instrument to adjust the calculated % carbon reading automatically. Alternatively, this value can be entered manually.

OXYGEN CONCENTRATION

In order to measure oxygen concentrations, one end of the probe is inserted into the atmosphere to be measured, whilst the other is subjected to a reference atmosphere. For most applications, air provides a suitable reference (reference input = 20.95 for air).

4.16.2 Configuration

The configuration parameters appear in one of three lists as shown in Figure 4.16.2a.

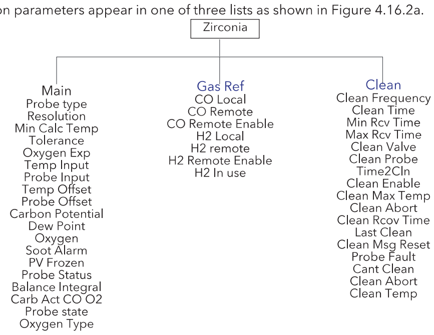


Figure 4.16.2a Zirconia probe configuration layout.

ZIRCONIA MAIN

The parameters that appear depend on the 'Probe Type' setting. For this reason, not all the parameters listed appear for all probe types. Figure 4.16.2b shows a typical configuration page.

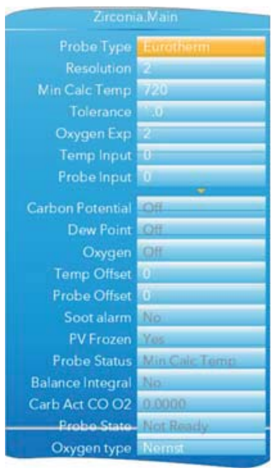


Figure 4.16.2b Zirconia Probe configuration (typical)

4.16.2 Configuration (Cont.)

MAIN PARAMETERS

Probe Type	Select from a variety of probe manufacturers. The subsequent parameter list depends on which manufacturer is selected.
Resolution	Enter the number of decimal places to be used for the value display
Gas Reference	Reference value for the hydrogen concentration in the atmosphere.
Rem Gas Ref	Remote reference value for hydrogen concentration in the atmosphere. Allows hydrogen concentration to be read from an external source.
Rem Gas Enable	'Yes' allows remote gas measurement. 'No' uses the internal Gas Reference value.
Working Gas	Read only. Working Reference Gas value
Min Calc Temp*	The minimum temperature in at which the calculation is valid.
Oxygen Exp	The exponent units of the log oxygen type calculation. valid entries -24 to +24.
Tolerance	Sooting tolerance multiplier. Allows the user to adjust the sensitivity of the Sooting alarm, in order to reduce the incidence of nuisance alarms.
Process Factor	Process factor defined by the probe manufacturer.
Clean Frequency	Allows the interval between probe cleaning cycles to be entered in hours and minutes.
Clean Time	Allows Probe clean time to be entered in hours and minutes.
Min Rcov Time	The minimum recovery time after purging in hours and minutes.
Max Rcov Time	The maximum recovery time after purging in hours and minutes.
Temp Input*	Zirconia probe temperature input value
Temp Offset*	Allows a temperature offset to be entered for the probe.
Probe Input	Zirconia probe mV input
Probe mV Offset	Allows an offset to be entered for the probe mV input
Oxygen	Read only. calculated oxygen value
Carbon Potential	Read only. The calculated carbon potential.
Dew Point	Read only. The dew point value derived from temperature and remote gas reference inputs.
Soot Alarm	Read only. Sooting alarm. Active if sooting is likely to take place. The sensitivity of the alarm can be adjusted by using the 'Tolerance' parameter, above.
Probe Fault	'Yes' indicates a sensor break.
PV Frozen	Read only. Parameter set to 'Yes' during Probe cleaning.
Clean Valve	Read only. Enable the Clean valve.
Clean State	Read only. The burn off state of the zirconia probe: 'Waiting', 'Cleaning' or 'Recovering'.Clean Probe'Yes' = Initiate probe cleaning. 'No' = Do not clean probe.
Time to Clean	Read only. The time remaining, in hours and minutes until the next cleaning cycle is due.
Probe Status	Read only. Current probe status OK — Normal working mV Sensor Brk — Probe input sensor break Temp Sensor Brk — Temperature input sensor break Min Calc Temp — Probe deteriorating
Balance Integral	This output goes 'true' when a step change in the output occurs, which requires an integral re-balance if the readings are used for PID control.
Carb Act CO O2	The carbon activity for the surface gas reaction between Carbon monoxide (CO) and Oxygen (O2)
Probe State	Read only. The current state of the probe. If 'Measuring', then the outputs are updated. For any other state (Clean, Clean Recovery, Test impedance, Impedance Recovery, Waiting), the outputs are not updated.
Oxygen Type	Oxygen equation being used.

4.16.2 Configuration (Cont.)

GAS REFERENCES PARAMETERS

CO Local	Reference value for the carbon monoxide (CO) concentration in the atmosphere.
CO Remote	Remote reference value for the carbon monoxide concentration in the atmosphere. allows the value to be read remotely.
CO Remote En	'Yes' allows remote CO measurement. 'No' uses the internal value.
CO in Use	The CO gas measurement value currently being used.
H2 Local	Reference value for the hydrogen (H) concentration in the atmosphere.
H2 Remote	Remote reference value for the hydrogen concentration in the atmosphere. allows the value to be read remotely.
H2 Remote En	'Yes' allows remote H measurement. 'No' uses the internal value.
H2 In Use	The H gas measurement value currently being used.

CLEAN PARAMETERS

Clean Frequency	Allows the interval between probe cleaning cycles to be entered in hours and minutes.
Clean Time	Allows Probe clean time to be entered in hours and minutes.
Min Rcov Time	The minimum recovery time after purging in hours and minutes.
Max Rcov time	The maximum recovery time after purging in hours and minutes.
Clean Valve	Read only. Enable the Clean valve.
Clean Probe	Initiate probe cleaning
Time to Clean	Read only. The time remaining, in hours and minutes until the next cleaning cycle is due.
Clean Enable	Enable probe cleaning
Clean Max Temp	Maximum temperature for cleaning. If the temperature exceeds this value, cleaning is aborted.
Clean Abort	Abort probe cleaning
Clean Rcov Time	The time taken for the probe to recover to 95% of its original value after the last clean. If the last clean did not recover within the Max Rcov time, this value is set to 0.
Last Clean	The mV output from the probe after the last clean.
Clean Msg Reset	'Yes' clears cleaning related alarms
Probe Fault	'Yes' means that the probe failed to recover to 95% of its original output, following a clean,
Cant Clean	Conditions exist which prevent a clean cycle starting. Can be cleared using 'Clean Msg Reset'.
Clean Abort	A clean cycle was aborted. Can be cleared using 'Clean Msg Reset'.
Clean Temp	A clean cycle was aborted because the temperature was too high. Can be cleared using 'Clean Msg Reset'.

4.16.3 Wiring

Figure 4.16.3 shows a typical wiring arrangement for a Zirconia probe.

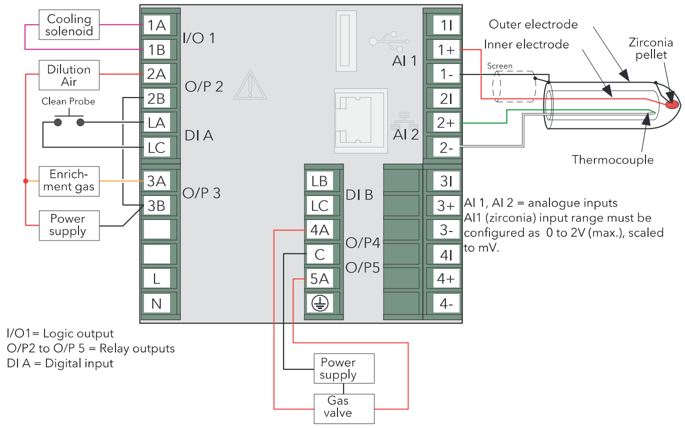


Figure 4.16.3 Typical zirconia probe wiring

4.17 STERILISER OPTION

This block provides a means of recording complete sterilisation cycles, including for example, venting and pumping as well as the actual sterilising period. See Section 3.4.10 for display mode details.

Data is stored in .uhh history files for viewing in Review software.

Figure 4.17 Steriliser block configuration menu

4.17.1 Configuration parameters

Cycle Status Wait start: The cycle is waiting to be started
Waiting: Waiting for input 1 to reach its target setpoint.
Equilibration: Currently in the equilibration period
Sterilising: Currently in the sterilising phase
Passed: The cycle has completed successfully
Failed: The cycle has failed
Test cycle: A test cycle is in progress

4.17.1 Configuration Parameters (Cont.)

Remaining	The sterilising time remaining for the current cycle
Equilibration	The equilibration time period for the current cycle
Sterilising	The time for which the load has currently been at sterilisation conditions
Total Cycle	The total cycle time
F_0 (A_0)	The current F_0, F_H or A_0 value
Running Output	'Yes' = Cycle running; 'No' = Cycle not running
Passed Output	'Yes' = Output passed; 'No' = Output did not pass
Start	Trigger to start a custom cycle (i.e. one for which High and Low band and / or Target setpoint have been changed from their default values.)
Start 121°C	Trigger to start a pre-defined 121°C cycle (Setpoint, Band Low/Band High etc. values are set to their 121° defaults when the cycle is initiated).
121°C Time	Target time for a 121°C cycle. Automatically copied to the 'Target Time' field when Start 121°C requested. Scrollable value in hh:mm:ss format.
Start 134°C	Trigger to start a pre-defined 134°C cycle (Setpoint, Band Low/Band High etc. values are set to their 134° defaults when the cycle is initiated)
134°C Time	Target time for a134°C cycle. Automatically copied to the 'Target Time' field when Start 134°C requested. Scrollable value in hh:mm:ss format.
Target Time	The time for which the input values must remain at their sterilisation values in order that the cycle shall pass. The cycle fails if any input moves outside its specified band limits during the Target Time. Scrollable value in hh:mm:ss format.
Cycle Number	Each execution of the Steriliser block uses a unique cycle number. This may be entered manually, or can be set to increment automatically by setting 'Auto Counter' (below) to 'Yes'.
Auto Counter	'Yes' causes the Cycle Number (above) to increment automatically each time a new cycle is initiated. If Auto counter = 'Yes', the Cycle Number forms part of the historical data and can be used to help identify data during later review.
File By Tag	'Tick' ensures that each cycle is recorded in its own unique history file identified by cycle number and 'File tag' (below).
File tag	This field appears only if 'File By Tag' is enabled (tick symbol). File tag allows a four-character identifier to be entered to be used with the Cycle Number (above) to identify the history file
Input n Type	Select 'Off', 'Thermocouple', 'Rising Pressure', 'Falling pressure', 'Rise Air Detect', or 'Fall Air Detect'. Off: This input will not be included in steriliser monitoring calculations Thermocouple: Degrees Celsius input Rising pressure: A mBar pressure input with a rising pressure expected during the cycle. This pressure input would normally be synchronised with a temperature input, in the same chamber, when performing a 121°C or 134°C cycle. Falling pressure: As 'Rising Pressure' above, but with a falling pressure expected during the cycle Rise Air Detect: A mBar pressure input with a rising pressure expected during the cycle. This pressure input is not synchronised with a temperature input when performing a 121°C or 134°C cycle, as it is (typically) an outside chamber pressure. Fall Air Detect: As 'Rise Air Detect' above, but with a falling pressure expected during the cycle
PV n	Input value (wireable only). See note 1 below.
Target SP	Target setpoint for this input. (Does not appear if relevant Input Type = 'Off'.) See note 2 below.
Band Low/High	The low and high steriliser temperature or pressure band for this input. (Does not appear if relevant Input Type = 'Off'.) See note 2 below. Values are effective only during Sterilisation mode.

4.17.1 Configuration Parameters (Cont.)

Failure Dwell — A failure alarm is set if this input is out of band range for more than the Failure Dwell time. Scrollable value in hh:mm:ss format.

Notes
1. n = 1 to 4, where typically, inputs 1 to 3 are temperature inputs and input 4 is a pressure input.
2. Target SP and Band High/Low values are set to their relevant default values when a 121°C or 134°C cycle is initiated.

Measured Temp. — For F_0 or A_0 calculations, this value must be in °C. Typically wired to an input channel PV .

Target Temp. — For F_0 or A_0 calculations, the target temperature (see Section 3.4.10 for details). This typically is the same value as the Target SP (above).

Z Temp. — For F_0 or A_0 calculations this is a temperature interval representing a factor-of-10 increase in killing efficiency. Z = 10°C for F_0 and A_0, and 20°C for F_H

Low Limit — The temperature below which F_0 or A_0 calculations are suspended.

4.18 HUMIDITY BLOCK OPTION

This block uses wet and dry bulb temperatures, and atmospheric pressure inputs to derive values for relative humidity and dew point.

Figure 4.18 Humidity calculation configuration

4.18.1 Configuration parameters

Resolution	The number of decimal places for the Relative humidity and Dew point displays.
Psychro constant	The psychrometric constant (default = 6.66 x 10^{-4}) (See note below).
Pressure	The current atmospheric pressure in mBar.
Wet Temperature	The wet bulb thermometer temperature.
Wet Offset	Offset for the wet bulb temperature.
Dry Temperature	The dry bulb thermometer temperature.
Relative Hum.	The relative humidity value calculated from the Wet temperature, the Dry temperature and the Pressure inputs. The number of decimal places depends on the Resolution setting.
Dew Point	The dew point value calculated from the Wet temperature, the Dry temperature and the Pressure inputs. The number of decimal places depends on the Resolution setting.
Sensor Break	'Yes' implies that a break has occurred between one (or more) of the temperature or pressure transducer and its input.

Note: The default value 6.66 may be edited, but the multiplier is always 10^{-4} (i.e. it cannot be edited).

4.19 BCD INPUT

Part of the 'Toolkit Blocks' option, this block derives decimal and two-decade binary coded decimal (BCD) values from eight discrete inputs, where input 1 is the least significant input ($2^0 = 1$) and input 8 is the most significant ($2^7 = 128$). The example below shows that for inputs 2, 4, 6 and 8 high, the decimal input value is 170, but the BCD value is invalid. In any such case, the maximum BCD value for each decade is limited to 9.

Input number	8	7	6	5	4	3	2	1	
Input status	1	0	1	0	1	0	1	0	
Decimal input	128	0	32	0	8	0	2	0	(=170)
BCD output	1	0	1	0	1	0	1	0	(=10, 10)

Figure 4.18 BCD block example

4.19.1 Input rules

Valid BCD outputs are produced only with the following inputs set:

1. Any combination of inputs 1, 2, 3, 5, 6 and 7
2. Any combination of Inputs 1, 4, 5 and 8

4.19.2 Configuration

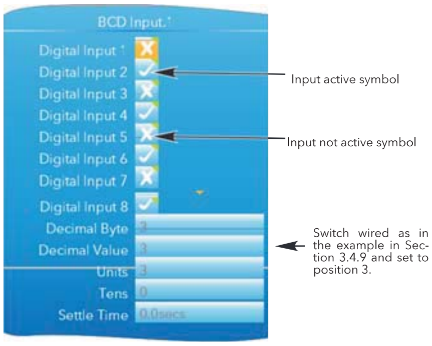


Figure 4.19.2 BCD block configuration

PARAMETERS

Digital Input N	Digital inputs, wired (for example) to contact inputs at the rear panel or to other suitable parameter outputs.
Decimal input	The value defined by the active inputs, where input 1 = 1, when active, input 2 = 2, input 3 = 4, input 4 = 8 and so on.
BCD Output	A two digit output being the binary coded decimal version of the input.
BCD LS Digit	This least significant (right-most) digit represents the value of inputs 1 to 4, where input 1 = 1, input 2 = 2, input 3 = 4, input 4 = 8. Maximum value = 9, even if input is greater than 9.
BCD MS Digit	This most significant (left-most) digit represents the value of inputs 5 to 8, where input 5 = 1, input 6 = 2, input 7 = 4, input 8 = 8. Maximum value = 9, even if input is greater than 9.
Settle Time	As the switch is turned from one value to another, intermediate switch positions may be seen on the inputs which could be used by subsequent blocks. Settle Time applies a filter to prevent these values from affecting other blocks.

4.20 LOGIC (2 INPUT) BLOCK

Part of the 'Toolkit Blocks' option, this block allows a number of logic and comparison operations to be performed on a pair of inputs. For logic functions, the inputs can be inverted to allow, for example, a NOR function to be implemented by inverting the inputs to an AND function. 12 two-input logic blocks are available.

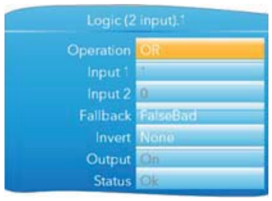


Figure 4.20 Two-input logic block configuration

4.20.1 Parameters

Operation	AND, OR, XOR, LATCH (boolean values only) == (Input 1 = Input 2) <> (Input 1 ≠ Input 2) < (Input 1 < Input 2} <= (Input 1 ≤ Input 2) > (Input 1 > Input 2) => (Input 1 ≥ Input 2)
Input 1(2)	The inputs to the specified operation. For inverted inputs (below), this shows the 'real' (non-inverted) state.
Fallback	Configures the output and status values to be used if either input has a status other than 'Good'. FalseBad: Output = False; Status = Bad TrueBad: Output = True; Status = Bad FalseGood: Output = False; Status = Good TrueGood: Output = True; Status = Good
Invert	For logic operators only allows neither, either or both inputs to be inverted. Input 1 and Input 2 show the non-inverted state.
Output	On or Off depending on input states etc.
Status	The status of the result ('Ok' or 'Error').

4.21 LOGIC (8 INPUT) BLOCK

Part of the 'Toolkit Blocks' option, this block allows AND, OR and cascading* XOR logic operations to be carried out on up to eight inputs.

*Cascading XOR example for inputs 1 to 4: (((Input1 □ Input2) □ Input3) □ Input4).

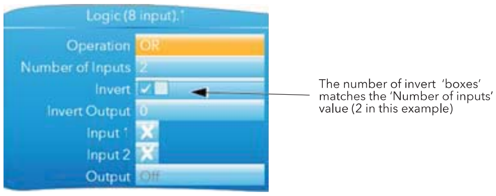


Figure 4.21 Eight input logic block configuration

4.21.1 Parameters

Operation	AND, OR or XOR
Number of inputs	The number of inputs to the logic operator
Invert	Allows the user to invert individual inputs, as described below.
Invert Output	'Yes' inverts the output status
Input 1	The status of input 1, ignoring the Invert status. Cross = off; Tick = on.
Inputs 2 to N	As for input 1, where N = the value of the 'Number of Inputs' parameter.
Output	On or Off. Includes the effect of 'Invert Output' status.

INPUT INVERSION

1. Use the down arrow key to highlight the 'Invert' field and operate the scroll key to enter edit mode
2. Use the up arrow key to highlight the first input to be inverted (the relevant input numbers appear in the display boxes for uninverted inputs when highlighted).
3. Once the required input box is highlighted, use the scroll key to change the numeric character to a tick symbol (to invert) or change the tick character to a numeric character (to remove a previous inversion).
4. Repeat for any further inputs, then operate the page key to confirm the changes and to quit edit mode.

4.21.2 Schematic

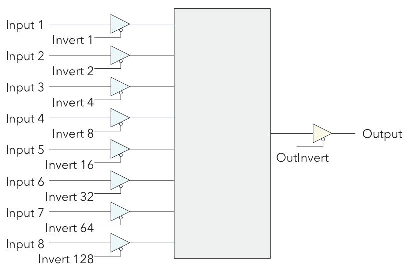


Figure 4.21.2 Logic (8 input) block schematic

4.21.3 Invert input decoding table

Over a communications link, the inversion status is transmitted as a decimal value, which can be encoded/decoded using the following table

Input									
8	7	6	5	4	3	2	1	Hex	Dec
N	N	N	N	N	N	N	N	00	0
N	N	N	N	N	N	N	1	01	1
N	N	N	N	N	N	2	N	02	2
N	N	N	N	N	N	2	1	03	3
N	N	N	N	N	3	N	N	04	4
N	N	N	N	N	3	N	1	05	5
N	N	N	N	N	3	2	N	06	6
N	N	N	N	N	3	2	1	07	7
N	N	N	N	4	N	N	N	08	8
N	N	N	N	4	N	N	1	09	9
N	N	N	N	4	N	2	N	0A	10
N	N	N	N	4	N	2	1	0B	11
N	N	N	N	4	3	N	N	0C	12
N	N	N	N	4	3	N	1	0D	13
N	N	N	N	4	3	2	N	0E	14
N	N	N	N	4	3	2	1	0F	15
N	N	N	5	N	N	N	N	10	16
N	N	N	5	N	N	N	1	11	17
N	N	N	5	N	N	2	N	12	18
N	N	N	5	N	N	2	1	13	19
N	N	N	5	N	3	N	N	14	20
N	N	N	5	N	3	N	1	15	21
N	N	N	5	N	3	2	N	16	22
N	N	N	5	N	3	2	1	17	23
N	N	N	5	4	N	N	N	18	24
N	N	N	5	4	N	N	1	19	25
N	N	N	5	4	N	2	N	1A	26
N	N	N	5	4	N	2	1	1B	27
N	N	N	5	4	3	N	N	1C	28
N	N	N	5	4	3	N	1	1D	29
N	N	N	5	4	3	2	N	1E	30
N	N	N	5	4	3	2	1	1F	31
N	N	6	N	N	N	N	N	20	32
N	N	6	N	N	N	N	1	21	33
N	N	6	N	N	N	2	N	22	34
N	N	6	N	N	N	2	1	23	35
N	N	6	N	N	3	N	N	24	36
N	N	6	N	N	3	N	1	25	37
N	N	6	N	N	3	2	N	26	38
N	N	6	N	N	3	2	1	27	39
N	N	6	N	4	N	N	N	28	40
N	N	6	N	4	N	N	1	29	41
N	N	6	N	4	N	2	N	2A	42
N	N	6	N	4	N	2	1	2B	43
N	N	6	N	4	3	N	N	2C	44
N	N	6	N	4	3	N	1	2D	45
N	N	6	N	4	3	2	N	2E	46
N	N	6	N	4	3	2	1	2F	47
N	N	6	5	N	N	N	N	30	48
N	N	6	5	N	N	N	1	31	49
N	N	6	5	N	N	2	N	32	50
N	N	6	5	N	N	2	1	33	51
N	N	6	5	N	3	N	N	34	52
N	N	6	5	N	3	N	1	35	53
N	N	6	5	N	3	2	N	36	54
N	N	6	5	N	3	2	1	37	55
N	N	6	5	4	N	N	N	38	56
N	N	6	5	4	N	N	1	39	57
N	N	6	5	4	N	2	N	3A	58
N	N	6	5	4	N	2	1	3B	59
N	N	6	5	4	3	N	N	3C	60
N	N	6	5	4	3	N	1	3D	61
N	N	6	5	4	3	2	N	3E	62
N	N	6	5	4	3	2	1	3F	63

Input									
8	7	6	5	4	3	2	1	Hex	Dec
N	7	N	N	N	N	N	N	40	64
N	7	N	N	N	N	N	1	41	65
N	7	N	N	N	N	2	N	42	66
N	7	N	N	N	N	2	1	43	67
N	7	N	N	N	3	N	N	44	68
N	7	N	N	N	3	N	1	45	69
N	7	N	N	N	3	2	N	46	70
N	7	N	N	N	3	2	1	47	71
N	7	N	N	4	N	N	N	48	72
N	7	N	N	4	N	N	1	49	73
N	7	N	N	4	N	2	N	4A	74
N	7	N	N	4	N	2	1	4B	75
N	7	N	N	4	3	N	N	4C	76
N	7	N	N	4	3	N	1	4D	77
N	7	N	N	4	3	2	N	4E	78
N	7	N	N	4	3	2	1	4F	79
N	7	N	5	N	N	N	N	50	80
N	7	N	5	N	N	N	1	51	81
N	7	N	5	N	N	2	N	52	82
N	7	N	5	N	N	2	1	53	83
N	7	N	5	N	3	N	N	54	84
N	7	N	5	N	3	N	1	55	85
N	7	N	5	N	3	2	N	56	86
N	7	N	5	N	3	2	1	57	87
N	7	N	5	4	N	N	N	58	88
N	7	N	5	4	N	N	1	59	89
N	7	N	5	4	N	2	N	5A	90
N	7	N	5	4	N	2	1	5B	91
N	7	N	5	4	3	N	N	5C	92
N	7	N	5	4	3	N	1	5D	93
N	7	N	5	4	3	2	N	5E	94
N	7	N	5	4	3	2	1	5F	95
N	7	6	N	N	N	N	N	60	96
N	7	6	N	N	N	N	1	61	97
N	7	6	N	N	N	2	N	62	98
N	7	6	N	N	N	2	1	63	99
N	7	6	N	N	3	N	N	64	100
N	7	6	N	N	3	N	1	65	101
N	7	6	N	N	3	2	N	66	102
N	7	6	N	N	3	2	1	67	103
N	7	6	N	4	N	N	N	68	104
N	7	6	N	4	N	N	1	69	105
N	7	6	N	4	N	2	N	6A	106
N	7	6	N	4	N	2	1	6B	107
N	7	6	N	4	3	N	N	6C	108
N	7	6	N	4	3	N	1	6D	109
N	7	6	N	4	3	2	N	6E	110
N	7	6	N	4	3	2	1	6F	111
N	7	6	5	N	N	N	N	70	112
N	7	6	5	N	N	N	1	71	113
N	7	6	5	N	N	2	N	72	114
N	7	6	5	N	N	2	1	73	115
N	7	6	5	N	3	N	N	74	116
N	7	6	5	N	3	N	1	75	117
N	7	6	5	N	3	2	N	76	118
N	7	6	5	N	3	2	1	77	119
N	7	6	5	4	N	N	N	78	120
N	7	6	5	4	N	N	1	79	121
N	7	6	5	4	N	2	N	7A	122
N	7	6	5	4	N	2	1	7B	123
N	7	6	5	4	3	N	N	7C	124
N	7	6	5	4	3	N	1	7D	125
N	7	6	5	4	3	2	N	7E	126
N	7	6	5	4	3	2	1	7F	127

Input									
8	7	6	5	4	3	2	1	Hex	Dec
8	N	N	N	N	N	N	N	80	128
8	N	N	N	N	N	N	1	81	129
8	N	N	N	N	N	2	N	82	130
8	N	N	N	N	N	2	1	83	131
8	N	N	N	N	3	N	N	84	132
8	N	N	N	N	3	N	1	85	133
8	N	N	N	N	3	2	N	86	134
8	N	N	N	N	3	2	1	87	135
8	N	N	N	4	N	N	N	88	136
8	N	N	N	4	N	N	1	89	137
8	N	N	N	4	N	2	N	8A	138
8	N	N	N	4	N	2	1	8B	139
8	N	N	N	4	3	N	N	8C	140
8	N	N	N	4	3	N	1	8D	141
8	N	N	N	4	3	2	N	8E	142
8	N	N	N	4	3	2	1	8F	143
8	N	N	5	N	N	N	N	90	144
8	N	N	5	N	N	N	1	91	145
8	N	N	5	N	N	2	N	92	146
8	N	N	5	N	N	2	1	93	147
8	N	N	5	N	3	N	N	94	148
8	N	N	5	N	3	N	1	95	149
8	N	N	5	N	3	2	N	96	150
8	N	N	5	N	3	2	1	97	151
8	N	N	5	4	N	N	N	98	152
8	N	N	5	4	N	N	1	99	153
8	N	N	5	4	N	2	N	9A	154
8	N	N	5	4	N	2	1	9B	155
8	N	N	5	4	3	N	N	9C	156
8	N	N	5	4	3	N	1	9D	157
8	N	N	5	4	3	2	N	9E	158
8	N	N	5	4	3	2	1	9F	159
8	N	6	N	N	N	N	N	A0	160
8	N	6	N	N	N	N	1	A1	161
8	N	6	N	N	N	2	N	A2	162
8	N	6	N	N	N	2	1	A3	163
8	N	6	N	N	3	N	N	A4	164
8	N	6	N	N	3	N	1	A5	165
8	N	6	N	N	3	2	N	A6	166
8	N	6	N	N	3	2	1	A7	167
8	N	6	N	4	N	N	N	A8	168
8	N	6	N	4	N	N	1	A9	169
8	N	6	N	4	N	2	N	AA	170
8	N	6	N	4	N	2	1	AB	171
8	N	6	N	4	3	N	N	AC	172
8	N	6	N	4	3	N	1	AD	173
8	N	6	N	4	3	2	N	AE	174
8	N	6	N	4	3	2	1	AF	175
8	N	6	5	N	N	N	N	B0	176
8	N	6	5	N	N	N	1	B1	177
8	N	6	5	N	N	2	N	B2	178
8	N	6	5	N	N	2	1	B3	179
8	N	6	5	N	3	N	N	B4	180
8	N	6	5	N	3	N	1	B5	181
8	N	6	5	N	3	2	N	B6	182
8	N	6	5	N	3	2	1	B7	183
8	N	6	5	4	N	N	N	B8	184
8	N	6	5	4	N	N	1	B9	185
8	N	6	5	4	N	2	N	BA	186
8	N	6	5	4	N	2	1	BB	187
8	N	6	5	4	3	N	N	BC	188
8	N	6	5	4	3	N	1	BD	189
8	N	6	5	4	3	2	N	BE	190
8	N	6	5	4	3	2	1	BF	191

Input									
8	7	6	5	4	3	2	1	Hex	Dec
8	7	N	N	N	N	N	N	C0	192
8	7	N	N	N	N	N	1	C1	193
8	7	N	N	N	N	2	N	C2	194
8	7	N	N	N	N	2	1	C3	195
8	7	N	N	N	3	N	N	C4	196
8	7	N	N	N	3	N	1	C5	197
8	7	N	N	N	3	2	N	C6	198
8	7	N	N	N	3	2	1	C7	199
8	7	N	N	4	N	N	N	C8	200
8	7	N	N	4	N	N	1	C9	201
8	7	N	N	4	N	2	N	CA	202
8	7	N	N	4	N	2	1	CB	203
8	7	N	N	4	3	N	N	CC	204
8	7	N	N	4	3	N	1	CD	205
8	7	N	N	4	3	2	N	CE	206
8	7	N	N	4	3	2	1	CF	207
8	7	N	5	N	N	N	N	D0	208
8	7	N	5	N	N	N	1	D1	209
8	7	N	5	N	N	2	N	D2	210
8	7	N	5	N	N	2	1	D3	211
8	7	N	5	N	3	N	N	D4	212
8	7	N	5	N	3	N	1	D5	213
8	7	N	5	N	3	2	N	D6	214
8	7	N	5	N	3	2	1	D7	215
8	7	N	5	4	N	N	N	D8	216
8	7	N	5	4	N	N	1	D9	217
8	7	N	5	4	N	2	N	DA	218
8	7	N	5	4	N	2	1	DB	219
8	7	N	5	4	3	N	N	DC	220
8	7	N	5	4	3	N	1	DD	221
8	7	N	5	4	3	2	N	DE	222
8	7	N	5	4	3	2	1	DF	223
8	7	6	N	N	N	N	N	E0	224
8	7	6	N	N	N	N	1	E1	225
8	7	6	N	N	N	2	N	E2	226
8	7	6	N	N	N	2	1	E3	227
8	7	6	N	N	3	N	N	E4	228
8	7	6	N	N	3	N	1	E5	229
8	7	6	N	N	3	2	N	E6	230
8	7	6	N	N	3	2	1	E7	231
8	7	6	N	4	N	N	N	E8	232
8	7	6	N	4	N	N	1	E9	233
8	7	6	N	4	N	2	N	EA	234
8	7	6	N	4	N	2	1	EB	235
8	7	6	N	4	3	N	N	EC	236
8	7	6	N	4	3	N	1	ED	237
8	7	6	N	4	3	2	N	EE	238
8	7	6	N	4	3	2	1	EF	239
8	7	6	5	N	N	N	N	F0	240
8	7	6	5	N	N	N	1	F1	241
8	7	6	5	N	N	2	N	F2	242
8	7	6	5	N	N	2	1	F3	243
8	7	6	5	N	3	N	N	F4	244
8	7	6	5	N	3	N	1	F5	245
8	7	6	5	N	3	2	N	F6	246
8	7	6	5	N	3	2	1	F7	247
8	7	6	5	4	N	N	N	F8	248
8	7	6	5	4	N	N	1	F9	249
8	7	6	5	4	N	2	N	FA	250
8	7	6	5	4	N	2	1	FB	251
8	7	6	5	4	3	N	N	FC	252
8	7	6	5	4	3	N	1	FD	253
8	7	6	5	4	3	2	N	FE	254
8	7	6	5	4	3	2	1	FF	255

Example: Decimal 146 means that inputs 8, 5 and 2 are inverted.

4.22 Multiplexer block

This 'Toolkit' option block selects one of eight analogue inputs to appear at its output.

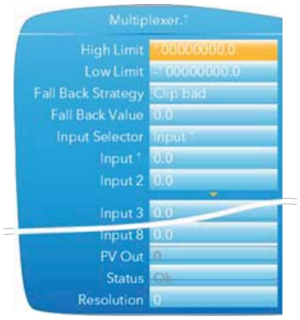


Figure 4.22 Multiplexer block configuration

4.22.1 Configuration parameters

High Limit	The high limit for input, output and fallback values. Minimum value is Low Limit.
Low Limit	The low limit for input and fallback values. Maximum value is High Limit.
Fallback Strategy	Clip Bad: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the appropriate limit, and the status is set to 'Bad'. If the input signal is within the limits, but its status is bad, the output is set to the Fallback value.
	Clip Good: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the appropriate limit, and the status is set to 'Good'. If the input signal is within the limits, but its status is bad, the output is set to the Fallback value.
	Fall Bad: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the Fallback value, and the status is set to 'Bad'
	Fall Good: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the Fallback value, and the status is set to 'Good'
	Upscale: If the input status is bad, or if the input signal is above 'High Limit' or below 'Low Limit', the output value is set to the High limit.
	Downscale: If the input status is bad, or if the input signal is above 'High Limit' or below 'Low Limit', the output value is set to the Low limit.
Fallback Value	The value to be adopted by the output, under error conditions, if 'Fallback Status' is set to 'Fall Good' or 'Fall Bad'.
Input Selector	Selects which of the eight inputs is presented at the output. When wired to a suitable parameter, Input Selector becomes read only. Input 1 is selected for an Input Selector value of 1, Input 2 for a value of 2 and so on. Input Selector values greater than 8 are ignored. If not wired, the user may select the required input using the scroll keys.
Input 1 to 8	Wired to the relevant analogue inputs.
PV Out	The output from the multiplexer block.
Status	Indicates the status of the operation as 'Ok' or 'Error'.
Resolution	The number of decimal places for the output value (maximum = 6)

4.23 MATH (2 INPUT)

This 'Toolkit' option block allows one of a number of operations to be carried out using two input values which may be analogue or digital in nature. Either or both of the inputs can be scaled, using a 'Multiplier'.

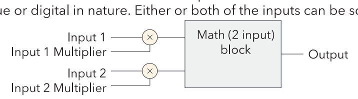


Figure 4.23a Block schematic

Figure 4.23b Block configuration (typical)

4.23.1 Parameters

Operation	Add	Output = Input 1 + Input 2
	Subtract	Output = Input 1 - Input 2
	Multiply	Output = Input 1 x Input 2
	Divide	Output = Input 1 ÷ Input 2
	Abs Diff	Output = the difference between Input 1 and Input 2, ignoring sign
	Select Max	Output = whichever is the larger of Input 1 or Input 2
	Select Min	Output = whichever is the smaller of Input 1 or Input 2
	Hot Swap	Output = Input 2 if Input 1 is 'Bad'; otherwise Output = Input 1
	Sample/Hold	Output tracks Input 1 whilst Input 2 = 1. Output value is held whilst Input 2 = 0 (See Section 4.23.2, below, for more details)
	Power*	Output = Input 1 to the power of Input 2. (Output = Input $1^{\text{Input 2}}$)
	Square Root	Output = √Input 1 (Input 2 ignored)
	Log Base 10	Output = Log_{10} Input 1 (Input 2 ignored)
	Log Base e	Output = Ln Input 1 (Input 2 ignored)
	Exponential	Output = e^{Input1} (Input 2 ignored)
	10 to the X	Output = $10^{\text{Input 1}}$ (Input 2 ignored)
	Sel1	Output = Input 1 if Input Selector = Input1 Output = Input 2 if Input Selector = Input2

* Note... For this implementation:
0 to the power 0 = 1.
Negative values raised to any power result in bad status.
0 raised to a negative power results in bad status.

4.23.1 Parameters (Cont.)

Input 1(2) Multiplier	The scaling factor for input 1(2). This multiplying factor is applied to the input of the function, but does not affect the displayed values of Input1 and Input 2 (below).
Units	Allows a five-character string to be entered for the function
Resolution	Sets the number of decimal places for the Output value. Input resolution (if applicable) is that of the relevant input.
High Limit	The high limit for input, output and fallback values. Minimum value is Low Limit.
Low Limit	The low limit for input and fallback values. Maximum value is High Limit.
Fallback Strategy	Clip Bad: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the appropriate limit, and the status is set to 'Bad'. If the input signal is within the limits, but its status is bad, the output is set to the Fall Back value. Clip Good: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the appropriate limit, and the status is set to 'Good'. If the input signal is within the limits, but its status is bad, the output is set to the Fall Back value. Fall Bad: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the Fall Back value, and the status is set to 'Bad' Fall Good: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the Fall Back value, and the status is set to 'Good' Upscale: If the input status is bad, or if the input signal is above 'High Limit' or below 'Low Limit', the output value is set to the High limit. Downscale: If the input status is bad, or if the input signal is above 'High Limit' or below 'Low Limit', the output value is set to the Low limit.
Fallback Value	The value to be adopted by the output, under error conditions, if 'Fallback Status' is set to 'Fall Good' or 'Fall Bad'.
Input Selector	For 'Select' operation only. When wired to a suitable parameter, Input Select becomes read only. Input 1 is selected if 'Input Select' = 1; Input 2 is selected if 'Input Select' = 2. Input Select values greater than 2 are ignored. If not wired, the user may select the required input using the scroll keys.
Input 1(2)	Wired to suitable input parameters. Displayed values ignore any input multiplier effects.
Output	Gives the output value for the operation.
Status	Shows the status of the output value, as 'Ok' or 'Error'

4.23.2 Sample and Hold details

As described above, Output follows Input1 as long as Input 2 is 'High'. When Input 2 goes Low, the output adopts the instantaneous value of Input 1 until Input 2 goes High again. When Input 2 goes high the output jumps to the current value of Input 1 and tracks it until Input 2 goes low.

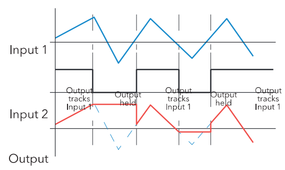


Figure 4.23.2 Sample and Hold example

4.24 TIMER

This 'Toolkit' option allows the user to configure up to four timers as: 'On Pulse', 'On Delay', 'One Shot' or 'Min On' types. The different types are described in Section 4.24.2, below.

Figure 4.24 Timer configuration

4.24.1 Parameters

Mode	Select 'On pulse', 'On delay', 'One shot' or 'Min On'
Time	Allows the user to enter a period for the timer.
Elapsed time	This read-only parameter shows timing progress
Trigger in	Shows if the trigger source is active (tick) or inactive (cross)
Output	Shows if the output is on (tick) or off (cross)
Triggered	Shows if the timer is currently triggered (can remain triggered even after the trigger source has returned to off).

4.24.2 Timer modes

ON PULSE

Output goes 'on' as soon as the trigger input goes active, and remains on until the time period has elapsed. If the timer is re-triggered during the timing period, the timer restarts.

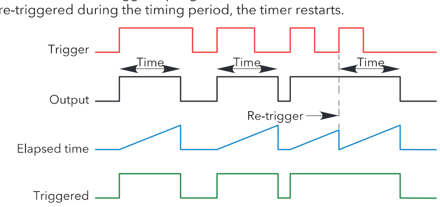


Figure 4.24.2a 'On Pulse' definitions

4.24.2 Timer Modes (Cont.)

ON DELAY

Provides a delay between the trigger point and the timer output becoming active.

Rules

1. After the trigger goes active, the output switches on after the delay time has elapsed, and stays on until the trigger goes inactive.
2. If the trigger goes inactive before the delay time has elapsed, the output does not switch on.

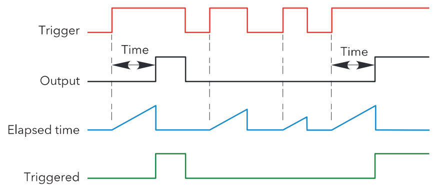


Figure 4.24.2b 'On Delay' definitions

ONE SHOT

If the trigger input is active, countdown timing is initiated as soon as the entered time value is confirmed (scroll key). The entered time decrements to zero, and must be re-entered by the user before any further timer function can be initiated.

Rules

1. The time value decrements only when the trigger input is active.
2. The output is On only when the trigger value is active (and the entered time value has not elapsed).
3. The entered time value can be edited at any time to increase or decrease the remaining time period.

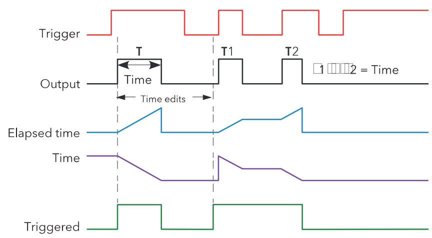


Figure 4.24.2c 'One Shot' timer definitions

Note: For ease of comparison the two time edits in the figure above were both to the same value. This is not a necessary condition.

4.24.2 Timer Modes (Cont.)

MIN ON

This 'Off delay' function provides an output signal that goes 'on' when the trigger goes active and remains on for a specified period after the trigger goes inactive.

If the trigger goes inactive, then active again before the time period has elapsed, then the elapsed time is reset to zero and the output remains on.

The 'Triggered' parameter is on whenever the elapsed time is counting down.

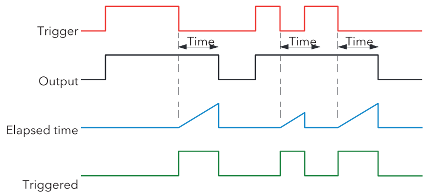


Figure 4.24.2d 'Min On' timer definitions

4.25 USER VALUES

This 'Toolkit' option block allows up to 12 values to be configured for use as inputs to other parameters.

Figure 4.25 User value configuration

4.25.1 Parameters

Units	Allows a five-character string to be entered for the user value units
Resolution	The number of decimal places for the user value (max. = 6)
High/Low Limit	Sets maximum and minimum values that the User value can be set to
Value	The user value, either entered manually, or wired to another appropriate parameter
Status	The output status for the User Value.

4.26 ALARM SUMMARY

Allows the user to view the overall status of the unit's alarms, and to carry out a global acknowledgement of active alarms if required.

Global Ack	Allows the user to acknowledge all applicable alarms simultaneously. 'Manual' alarms must be non-active before they can be acknowledged.
Any Channel alarm	Indicates if there are any channel alarms active, acknowledged etc.
Any Sys Alarm	Indicates if there are any active system alarms.
Any Alarm	Indicates if there are any channel or system alarms active.

Figure 4.26 Alarm summary display

4.27 REAL TIME EVENT CONFIGURATION

This allows the user to configure up to two events to trigger at a specific time and date, or on a particular day, and to remain active for a configurable time, either measured as a duration, or as a specific ‘Off’ time.

Typical applications would be to start and/or stop a programmer at a particular time, or to act as an input to a ‘Wait’ segment.

Figure 4.27 shows the two types of timer: ‘Time and Date’, and ‘Time and Day’, for Event 1.

Figure 4.27 Real Time Events (typical)

Type	Selects the type of the real time event (Off, Time and Day, Time and Date
On Month	For ‘Time and Date’ only, this is the month that the event is to switch on.
On Date	For ‘Time and Date’ only, this is the date in the month that the event is to switch on.
On Day	For ‘Time and Day’ only, this is the day(s) of the week that the event output is to switch on (Mon, Tue, Wed, Thu, Fri, Sat, Sun, Mon-Fri, Sat-Sun, Everyday).
On Time	The time of day that the event output is to switch on (00:00:00 to 23:59:59)
Off Type	Selects the action that will switch the event off (Duration, Time)
Off Month	For ‘Time and Date’ only and with ‘Off Type’ set to ‘Time’, this is the month that the event is to switch off.
Off Date	For ‘Time and Date’ only and with ‘Off Type’ set to ‘Time’, this is the day number in the month that the event is to switch off.
Off Day	For ‘Time and Day’ only and with ‘Off Type’ set to ‘Time’, this is the day of the week that the event output is to switch off (Mon, Tue, Wed, Thu, Fri, Sat, Sun, Mon-Fri, Sat-Sun, Everyday).
Off Time	The time at which the event output is to switch off (00:00:00 - 23:59:59)
Duration	For ‘Off type’ set to ‘Duration’, this specifies the duration for which the event output is to remain on (00:00:01 to 23:59:59 for Time and Day, or 00:00:01 to 500:00:00 for Time and Date)
Output	The output for the real time event (Cross symbol = Off, Tick = On) (Read only)

5 MODBUS TCP SLAVE COMMS

5.1 INSTALLATION

The installation of the Modbus link consists of connecting a standard Ethernet cable between the RJ45 connector at the rear of the unit to a host computer either directly or via a network. A 'straight-through' cable can be used in either case (i.e. a cross-over cable is not required).

5.2 INTRODUCTION

MODBUS TCP allows the instrument to act as a 'slave' device to one or more host computers connected via the RJ45 connector at the rear of the recorder. Each recorder must have a unique Internet Protocol (IP) address, set up as described in Section 4.2.1 (Network.Interface).

MODBUS TCP (Transmission Control Protocol) is a variant of the MODBUS family of communications protocols intended for supervision and control of automated equipment specifically covering the use of MODBUS messaging in an intranet or internet environment, using TCP/IP protocols. Much of the MODBUS detail in this manual is derived from the document openmbus.doc, available at http://www.modbus.org/default.htm The above mentioned document also includes implementation guidelines for users.

Note: The Modbus protocol allows a maximum of 255 data bytes to be read from or written to in one transaction. For this reason, the maximum number of standard (16 bit) registers that can be accessed in one transaction is 255/2 = 127 and the maximum number of IEEE (32-bit) registers is 127/2 = 63.

5.2.1 Function Codes

MODBUS function codes 3, 4, 6, 8 and 16, defined in table 8.2.1a below, are supported and are fully described in section 5.5, below.

Code	Modbus definition	Description
03	Read holding registers	Reads the binary contents if holding registers. In this implementation codes 3 and 4 are identical in operation.
04	Read input registers	Reads the binary contents if holding registers. In this implementation codes 3 and 4 are identical in operation.
06	Preset single register	Writes a single value to a single register.
08	Diagnostics	Performs a simple loop back test.
16	Preset multiple registers	Writes values to multiple holding registers.

Table 5.2.1a MODBUS Function code definition

DIAGNOSTIC CODES

Function code 08, subfunction 00 (Return query data) echoes the query (Loop back).

5.2.1 Function Codes (Cont.)

EXCEPTION CODES

MODBUS TCP provides reserved codes used for exceptions. These codes provide error information relating to failed requests. Exceptions are signalled by hex 80 being added to the function code of the request, followed by one of the codes listed in table 8.2.1b, below.

Code Dec	Code Hex	Modbus definition	Description (see Modbus specification for full details)
01	01	Illegal function	An invalid function code was received
02	02	Illegal Data Address	An invalid data address was received
03	03	Illegal Data Value	An invalid data value was received
04	04	Slave Device Failure	An unrecoverable error occurred in the instrument
09	09	Illegal Sub Function	An invalid sub function was received
10	0A	Gateway path unavailable	Gateway misconfigured or overloaded
11	0B	Gateway target device failed to respond	Device not present on the network

Table 5.2.1b Exception codes

5.2.2 Data types

The following data types are supported:

1. 2's complement signed 16-bit analogue values with implied decimal point. The decimal point position must be configured in both the recorder and the host computer.
2. 16, 32 and 64 bit signed integers.
3. 16-bit unsigned integer values.
4. 32 bit IEEE Floating point values.
5. Strings of limited size, can be transferred across Modbus TCP in Unicode format using a single non-multiplexed set of consecutive registers.

DATA ENCODING

MODBUS uses what is called a 'Big endian' representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first. For example a 32-bit hex value of 12345678 would be transmitted as 12, followed by 34, followed by 56 and finally 78.

5.2.3 Invalid multiple register writes

When a recorder receives a multi-register write request, it is possible that one or more requests will be rejected. Under such a circumstance, the recorder accepts all valid write requests and ignores any invalid writes. No error response is produced.

5.2.4 Master communications timeout

Whilst the instrument is archiving, it is possible that communications responses slow sufficiently to cause communications timouts. The Modbus master device should be configured with a timout value large enough to ensure against nuisance timeouts during archiving.

5.2.5 Non-volatile parameters in EEPROM

CAUTION

The parameters in the following list must not be written-to on a continuous basis as to do so will damage the EEPROM, greatly shortening its useful life.

Note: ‘nvol’ = ‘non-volatile’. Loop ‘N’ = Loop1 and Loop2; Channel ‘N’ = Channel 1, 2, 3 and 4 etc.

AdvancedLoop.MasterPID.ControlAction
AdvancedLoop.MasterPID.CutbackHigh
AdvancedLoop.MasterPID.CutbackLow
AdvancedLoop.MasterPID.DerivativeTime
AdvancedLoop.MasterPID.DerivativeType
AdvancedLoop.MasterPID.ErrorLimit
AdvancedLoop.MasterPID.IntegralTime
AdvancedLoop.MasterPID.LoopBreakTime
AdvancedLoop.MasterPID.ManualReset
AdvancedLoop.MasterPID.PBUnits
AdvancedLoop.MasterPID.ProportionalBand
AdvancedLoop.MasterSP.ManualTrack
AdvancedLoop.MasterSP.RangeHigh
AdvancedLoop.MasterSP.RangeLow
AdvancedLoop.MasterSP.ServoToPV
AdvancedLoop.MasterSP.SPHighLimit
AdvancedLoop.MasterSP.SPIntBal
AdvancedLoop.MasterSP.SPLowLimit
AdvancedLoop.MasterSP.SPTrack
AdvancedLoop.MasterSP.SPTrimHighLimit
AdvancedLoop.MasterSP.SPTrimLowLimit
AdvancedLoop.Output.Ch1OnOffHysteresis
AdvancedLoop.Output.Ch1TravelTime
AdvancedLoop.Output.Ch2Deadband
AdvancedLoop.Output.Ch2OnOffHysteresis
AdvancedLoop.Output.Ch2TravelTime
AdvancedLoop.Output.CoolType
AdvancedLoop.Output.EnablePowerFeedforward
AdvancedLoop.Output.FeedForwardGain
AdvancedLoop.Output.FeedForwardOffset
AdvancedLoop.Output.FeedForwardTrimLimit
AdvancedLoop.Output.FeedForwardType
AdvancedLoop.Output.ManualMode
AdvancedLoop.Output.ManualStartup
AdvancedLoop.Output.OutputHighLimit
AdvancedLoop.Output.OutputLowLimit
AdvancedLoop.Output.PotBreakMode
AdvancedLoop.Output.Rate
AdvancedLoop.Output.RateDisable
AdvancedLoop.Output.SafeOutVal
AdvancedLoop.Output.SbrkOP
AdvancedLoop.Output.SlaveSensorBreakMode
AdvancedLoop.Setup.CascadeType
AdvancedLoop.Setup.ManOutputAccess
AdvancedLoop.Setup.MasterName
AdvancedLoop.Setup.ModeAccess
AdvancedLoop.Setup.SetpointAccess
AdvancedLoop.Setup.SlaveChannel1
AdvancedLoop.Setup.SlaveChannel2
AdvancedLoop.Setup.SlaveName
AdvancedLoop.SlavePID.Boundary1-2
AdvancedLoop.SlavePID.Boundary2-3
AdvancedLoop.SlavePID.ControlAction
AdvancedLoop.SlavePID.CutbackHigh
AdvancedLoop.SlavePID.CutbackHigh2
AdvancedLoop.SlavePID.CutbackHigh3
AdvancedLoop.SlavePID.CutbackLow
AdvancedLoop.SlavePID.CutbackLow2
AdvancedLoop.SlavePID.CutbackLow3
AdvancedLoop.SlavePID.DerivativeTime
AdvancedLoop.SlavePID.DerivativeTime2
AdvancedLoop.SlavePID.DerivativeTime3
AdvancedLoop.SlavePID.DerivativeType
AdvancedLoop.SlavePID.IntegralTime
AdvancedLoop.SlavePID.IntegralTime2
AdvancedLoop.SlavePID.IntegralTime3
AdvancedLoop.SlavePID.LoopBreakTime
AdvancedLoop.SlavePID.LoopBreakTime2
AdvancedLoop.SlavePID.LoopBreakTime3
AdvancedLoop.SlavePID.ManualReset
AdvancedLoop.SlavePID.ManualReset2
AdvancedLoop.SlavePID.ManualReset3
AdvancedLoop.SlavePID.NumberOfSets
AdvancedLoop.SlavePID.PBUnits
AdvancedLoop.SlavePID.ProportionalBand
AdvancedLoop.SlavePID.ProportionalBand2
AdvancedLoop.SlavePID.ProportionalBand3
AdvancedLoop.SlavePID.RelCh2Gain
AdvancedLoop.SlavePID.RelCh2Gain2
AdvancedLoop.SlavePID.RelCh2Gain3
AdvancedLoop.SlavePID.RemoteInput
AdvancedLoop.SlavePID.SchedulerType
AdvancedLoop.SlaveSP.FFSelect
AdvancedLoop.SlaveSP.ManualTrack
AdvancedLoop.SlaveSP.MasterSensorBreakMode
AdvancedLoop.SlaveSP.RangeHigh
AdvancedLoop.SlaveSP.RangeLow
AdvancedLoop.SlaveSP.SbrkSP
AdvancedLoop.Tune.Band
AdvancedLoop.Tune.CycleNo
AdvancedLoop.Tune.Hysteresis
AdvancedLoop.Tune.OutputHighLimit
AdvancedLoop.Tune.OutputLowLimit
AdvancedLoop.Tune.PBs
AdvancedLoop.Tune.Settle
AdvancedLoop.Tune.TDs
AdvancedLoop.Tune.Timeout
AdvancedLoop.Tune.TuneHigh
AdvancedLoop.Tune.TuneLow
AdvancedLoop.Tune.TuneR2G
AdvancedLoop.Tune.TuneType
BCDInput.N.InN
BCDInput.N.SettleTime
Channel.N.AlarmN.Amount
Channel.N.AlarmN.AverageTime
Channel.N.AlarmN.Block
Channel.N.AlarmN.ChangeTime
Channel.N.AlarmN.Deviation
Channel.N.AlarmN.Dwell
Channel.N.AlarmN.Hysteresis
Channel.N.AlarmN.Latch
Channel.N.AlarmN.Threshold
Channel.N.AlarmN.Type
Channel.N.Main.CJType
Channel.N.Main.CloseString
Channel.N.Main.Descriptor
Channel.N.Main.ExtCJTemp
Channel.N.Main.FaultResponse
Channel.N.Main.Filter
Channel.N.Main.InputHigh
Channel.N.Main.InputLow
Channel.N.Main.LinType
Channel.N.Main.Offset
Channel.N.Main.Offset2
Channel.N.Main.OpenString
Channel.N.Main.RangeHigh
Channel.N.Main.RangeLow
Channel.N.Main.RangeUnits
Channel.N.Main.Resolution
Channel.N.Main.ScaleHigh
Channel.N.Main.ScaleHigh2
Channel.N.Main.ScaleLow
Channel.N.Main.ScaleLow2
Channel.N.Main.SensorBreakType
Channel.N.Main.Shunt
Channel.N.Main.TestSignal
Channel.N.Main.Type
Channel.N.Main.Units
Channel.N.Trend.Colour
Channel.N.Trend.SpanHigh
Channel.N.Trend.SpanLow
CustomMessage.MessageN
DCOutput.1A1B_DCOP.FallbackPV
DCOutput.1A1B_DCOP.OutputHigh
DCOutput.1A1B_DCOP.OutputLow
DCOutput.1A1B_DCOP.Resolution
DCOutput.1A1B_DCOP.ScaleHigh
DCOutput.1A1B_DCOP.ScaleLow
DCOutput.1A1B_DCOP.Type
DCOutput.2A2B_DCOP.FallbackPV
DCOutput.2A2B_DCOP.OutputHigh
DCOutput.2A2B_DCOP.OutputLow
DCOutput.2A2B_DCOP.Resolution
DCOutput.2A2B_DCOP.ScaleHigh
DCOutput.2A2B_DCOP.ScaleLow
DCOutput.2A2B_DCOP.Type
DCOutput.3A3B_DCOP.FallbackPV
DCOutput.3A3B_DCOP.OutputHigh
DCOutput.3A3B_DCOP.OutputLow
DCOutput.3A3B_DCOP.Resolution
DCOutput.3A3B_DCOP.ScaleHigh
DCOutput.3A3B_DCOP.ScaleLow
DCOutput.3A3B_DCOP.Type
DigitalIO.1A1B.Backlash
DigitalIO.1A1B.Inertia
DigitalIO.1A1B.Invert
DigitalIO.1A1B.MinOnTime
DigitalIO.1A1B.StandbyAction
DigitalIO.1A1B.Type
DigitalIO.2A2B.Backlash
DigitalIO.2A2B.Inertia
DigitalIO.2A2B.Invert
DigitalIO.2A2B.MinOnTime
DigitalIO.2A2B.StandbyAction
DigitalIO.2A2B.Type
DigitalIO.3A3B.Backlash
DigitalIO.3A3B.Inertia
DigitalIO.3A3B.Invert
DigitalIO.3A3B.MinOnTime
DigitalIO.3A3B.StandbyAction
DigitalIO.3A3B.Type
DigitalIO.DI_LALC.Backlash
DigitalIO.DI_LALC.Inertia
DigitalIO.DI_LALC.Invert
DigitalIO.DI_LALC.MinOnTime
DigitalIO.DI_LALC.StandbyAction
DigitalIO.DI_LALC.Type
DigitalIO.DI_LBLC.Backlash
DigitalIO.DI_LBLC.Inertia
DigitalIO.DI_LBLC.Invert
DigitalIO.DI_LBLC.MinOnTime
DigitalIO.DI_LBLC.StandbyAction
DigitalIO.DI_LBLC.Type
DigitalIO.RELAY_4AC.Backlash
DigitalIO.RELAY_4AC.Inertia
DigitalIO.RELAY_4AC.Invert
DigitalIO.RELAY_4AC.MinOnTime
DigitalIO.RELAY_4AC.StandbyAction
DigitalIO.RELAY_4AC.Type
DigitalIO.RELAY_5AC.Backlash
DigitalIO.RELAY_5AC.Inertia
DigitalIO.RELAY_5AC.Invert
DigitalIO.RELAY_5AC.MinOnTime
DigitalIO.RELAY_5AC.StandbyAction
DigitalIO.RELAY_5AC.Type
EthernetIP.ImplicitInputs.InputN
EthernetIP.ImplicitOutputs.OutputN
EthernetIP.InputTags.InputN
EthernetIP.Main.ConfigInstance
EthernetIP.Main.ConfigSize
EthernetIP.Main.ConnectionType
EthernetIP.Main.InputInstance
EthernetIP.Main.InputSize
EthernetIP.Main.Mode
EthernetIP.Main.OutputInstance
EthernetIP.Main.OutputSize
EthernetIP.Main.Priority
EthernetIP.Main.Rpi
EthernetIP.Main.ServerAddress
EthernetIP.Main.SlotNumber
EthernetIP.OutputTags.OutputN
EthernetIP.OutputTags.Output2
Group.Recording.ChannelNEn
Group.Recording.Compression
Group.Recording.Enable
Group.Recording.Interval
Group.Recording.VirtualChanNEn
Group.Recording.VirtualChan28En
Group.Trend.Descriptor
Group.Trend.Interval
Group.Trend.MajorDivisions
Group.Trend.PointN
Humidity.Pressure
Humidity.PsychroConst
Humidity.Resolution
Humidity.WetOffset
Instrument.Display.AlarmPanel
Instrument.Display.Brightness
Instrument.Display.Cascade
Instrument.Display.DualLoopControl
Instrument.Display.EIPServerPage
Instrument.Display.FutureTrend
Instrument.Display.FutureTrend1Colour
Instrument.Display.FutureTrend2Colour
Instrument.Display.HistoryBackground
Instrument.Display.HomePage
Instrument.Display.HorizontalBar
Instrument.Display.HorizontalTrend
Instrument.Display.HPageTimeout
Instrument.Display.HTrendScaling
Instrument.Display.LoopControl
Instrument.Display.LoopSetpointColour
Instrument.Display.ModbusMaster
Instrument.Display.NumberFormat

Instrument.Display.Numeric
Instrument.Display.Programmer
Instrument.Display.PromoteListView
Instrument.Display.ScreenSaverAfter
Instrument.Display.ScreenSaverBrightness
Instrument.Display.SteriliserPage
Instrument.Display.TrendBackground
Instrument.Display.USBAutoScan
Instrument.Display.VerticalBar
Instrument.Display.VerticalTrend
Instrument.Info.CloneState
Instrument.Info.Name
Instrument.Locale.DateFormat
Instrument.Locale.DSTenable
Instrument.Locale.EndDay
Instrument.Locale.EndMonth
Instrument.Locale.EndOn
Instrument.Locale.EndTime
Instrument.Locale.Language
Instrument.Locale.StartDay
Instrument.Locale.StartMonth
Instrument.Locale.StartOn
Instrument.Locale.StartTime
Instrument.Locale.TimeZone
Instrument.Notes.NoteN
Instrument.PromoteList.PromoteListName
Instrument.PromoteList.PromoteParamN
Instrument.PromoteList.PromoteParamNDesc
Instrument.OEMConfigList.ParameterN
Instrument.OEMSupervisorList.ParameterN
Instrument.Security.CommsPass
Instrument.Security.DefaultConfig
Instrument.Security.EngineerPassword
Instrument.Security.OEMParamLists
Instrument.Security.OEMPass
Instrument.Security.OperatorPassword
Instrument.Security.SupervisorPassword
Lgc2.N.FallbackType
Lgc2.N.In1
Lgc2.N.In2
Lgc2.N.Invert
Lgc2.N.Oper
Lgc8.N.InN
Lgc8.N.InInvert
Lgc8.N.NumIn
Lgc8.N.Oper
Lgc8.N.OutInvert
Loop.N.Diag.LoopMode
Loop.N.OP.Ch1OnOffHysteresis
Loop.N.OP.Ch1TravelTime
Loop.N.OP.Ch2Deadband
Loop.N.OP.Ch2OnOffHysteresis
Loop.N.OP.Ch2TravelTime
Loop.N.OP.CoolType
Loop.N.OP.EnablePowerFeedforward
Loop.N.OP.FeedForwardGain
Loop.N.OP.FeedForwardOffset
Loop.N.OP.FeedForwardTrimLimit
Loop.N.OP.FeedForwardType
Loop.N.OP.ManStartup
Loop.N.OP.ManualMode
Loop.N.OP.OutputHighLimit
Loop.N.OP.OutputLowLimit
Loop.N.OP.PotBreakMode
Loop.N.OP.Rate
Loop.N.OP.RateDisable
Loop.N.OP.SafeOutVal
Loop.N.OP.SbrkOP
Loop.N.OP.SensorBreakMode
Loop.N.PID.Boundary1-2
Loop.N.PID.Boundary2-3
Loop.N.PID.CutbackHigh
Loop.N.PID.CutbackHighN
Loop.N.PID.CutbackLow
Loop.N.PID.CutbackLowN
Loop.N.PID.DerivativeTime
Loop.N.PID.DerivativeTimeN
Loop.N.PID.IntegralTime
Loop.N.PID.IntegralTimeN
Loop.N.PID.LoopBreakTime
Loop.N.PID.LoopBreakTimeN
Loop.N.PID.ManualReset
Loop.N.PID.ManualResetN
Loop.N.PID.NumSets
Loop.N.PID.ProportionalBand
Loop.N.PID.ProportionalBandN
Loop.N.PID.RelCh2Gain
Loop.N.PID.RelCh2GainN
Loop.N.PID.SchedulerRemoteInput
Loop.N.PID.SchedulerType
Loop.N.Setup.AutoManAccess
Loop.N.Setup.CH1ControlType
Loop.N.Setup.CH2ControlType
Loop.N.Setup.ControlAction
Loop.N.Setup.DerivativeType
Loop.N.Setup.LoopName
Loop.N.Setup.ManOutputAccess
Loop.N.Setup.PBUnits
Loop.N.Setup.SPAccess
Loop.N.SP.ManualTrack
Loop.N.SP.RangeHigh
Loop.N.SP.RangeLow
Loop.N.SP.ServoToPV
Loop.N.SP.SPHighLimit
Loop.N.SP.SPIntBal
Loop.N.SP.SPLowLimit
Loop.N.SP.SPTrack
Loop.N.SP.SPTrimHighLimit
Loop.N.SP.SPTrimLowLimit
Loop.N.Tune.CycleNo
Loop.N.Tune.Diagnostics
Loop.N.Tune.OutputHighLimit
Loop.N.Tune.OutputLowLimit
Loop.N.Tune.PBs
Loop.N.Tune.Settle
Loop.N.Tune.TDs
Loop.N.Tune.TuneR2G
Loop.N.Tune.Type
Math2.N.Fallback
Math2.N.FallbackVal
Math2.N.HighLimit
Math2.N.InN
Math2.N.InNMul
Math2.N.LowLimit
Math2.N.Oper
Math2.N.Resolution
Math2.N.Select
Math2.N.Units
ModbusMaster.N.Data.BitPosition
ModbusMaster.N.Data.DataType
ModbusMaster.N.Data.Descriptor
ModbusMaster.N.Data.FallBackValue
ModbusMaster.N.Data.FunctionCode
ModbusMaster.N.Data.ModbusAddress
ModbusMaster.N.Data.Mode
ModbusMaster.N.Data.Number
ModbusMaster.N.Data.ParameterList
ModbusMaster.N.Data.Priority
ModbusMaster.N.Data.Scaling
ModbusMaster.N.Data.Set
ModbusMaster.N.Data.SlaveDevice
ModbusMaster.N.Data.Value
ModbusMaster.SlaveN.Data.BitPosition
ModbusMaster.SlaveN.Data.DataType
ModbusMaster.SlaveN.Data.Descriptor
ModbusMaster.SlaveN.Data.FallBackValue
ModbusMaster.SlaveN.Data.FunctionCode
ModbusMaster.SlaveN.Data.ModbusAddress
ModbusMaster.SlaveN.Data.Mode
ModbusMaster.SlaveN.Data.Number
ModbusMaster.SlaveN.Data.ParameterList
ModbusMaster.SlaveN.Data.Priority
ModbusMaster.SlaveN.Data.Scaling
ModbusMaster.SlaveN.Data.Set
ModbusMaster.SlaveN.Data.SlaveDevice
ModbusMaster.SlaveN.Data.Value
ModbusMaster.SlaveN.Main.Descriptor
ModbusMaster.SlaveN.Main.HighPriority
ModbusMaster.SlaveN.Main.IPAddress
ModbusMaster.SlaveN.Main.LowPriority
ModbusMaster.SlaveN.Main.MaxBlockSize
ModbusMaster.SlaveN.Main.MediumPriority
ModbusMaster.SlaveN.Main.Online
ModbusMaster.SlaveN.Main.Profile
ModbusMaster.SlaveN.Main.Retries
ModbusMaster.SlaveN.Main.Timeout
ModbusMaster.SlaveN.Main.UnitId
Mux8.N.Fallback
Mux8.N.FallbackVal
Mux8.N.HighLimit
Mux8.N.InN
Mux8.N.LowLimit
Mux8.N.Select
Network.Archive.ArchiveRate
Network.Archive.CSVDateFormat
Network.Archive.CSVHeaders
Network.Archive.CSVHeadings
Network.Archive.CSVIncludeValues
Network.Archive.CSVMessages
Network.Archive.CSVTabDelimiter
Network.Archive.Destination
Network.Archive.FileFormat
Network.Archive.OnFull
Network.Archive.Period
Network.Archive.PrimaryPassword
Network.Archive.PrimaryUser
Network.Archive.PServerIPAddress
Network.Archive.RemotePath
Network.Archive.SecondaryPassword
Network.Archive.SecondaryUser
Network.Archive.SServerIPAddress
Network.FTPserver.Password
Network.FTPserver.Username
Network.Interface.DNSserver
Network.Interface.Gateway
Network.Interface.IPaddress
Network.Interface.IPType
Network.Interface.SubnetMask
Network.Modbus.Address
Network.Modbus.InputTimeout
Network.Modbus.PrefMasterIP
Network.Modbus.SerialMode
Network.Modbus.TimeFormat
Network.Modbus.UnitIdEnable
Program.ChNHoldback
Program.ChNHoldbackVal
Program.ChNRampUnits
Program.HoldbackStyle
Program.RampStyle
Programmer.Features.FTPStore
Programmer.Features.Holdback
Programmer.Features.Messages
Programmer.Features.PVEvent
Programmer.Features.UserValue
Programmer.FTP.IPAddress
Programmer.FTP.Password
Programmer.FTP.Username
Programmer.SetUp.ChNResolution
Programmer.SetUp.ChNServoTo
Programmer.SetUp.ChNUnits
Programmer.SetUp.Channels
Programmer.SetUp.MaxEvents
Programmer.SetUp.PowerFailAction
Programmer.SetUp.ProgEditAccess
Programmer.SetUp.ProgModeAccess
Programmer.SetUp.ProgNum
Programmer.SetUp.ProgStoreAccess
Programmer.SetUp.RateResolution
Programmer.SetUp.ResetCh1UserVal
Programmer.SetUp.ResetCh2UserVal
Programmer.SetUp.ResetEventN
RealTimeEvent.N.Duration
RealTimeEvent.N.OffDate
RealTimeEvent.N.OffDay
RealTimeEvent.N.OffMonth
RealTimeEvent.N.OffTime
RealTimeEvent.N.OffType
RealTimeEvent.N.OnDate
RealTimeEvent.N.OnDay
RealTimeEvent.N.OnMonth
RealTimeEvent.N.OnTime
RealTimeEvent.N.Type
Segment.N.ChNHoldback
Segment.N.ChNHoldbackVal
Segment.N.ChNPVEvent
Segment.N.ChNPVEventUse
Segment.N.ChNPVEventVal
Segment.N.ChNRate
Segment.N.ChNTime
Segment.N.ChNTSP
Segment.N.ChNUserVal
Segment.N.ChNWait
Segment.N.ChNWaitVal
Segment.N.Cycles
Segment.N.Duration
Segment.N.EndType
Segment.N.EventN
Segment.N.GoBackTo
Segment.N.SegmentName
Segment.N.Type
Segment.N.WaitFor
Steriliser.AutoCounter
Steriliser.FailureDwellN
Steriliser.FileByTag
Steriliser.FileTag
Steriliser.InputNPV
Steriliser.InputTypeN
Steriliser.IP1BandHigh
Steriliser.IP1BandLow
Steriliser.IP1TargetSP
Steriliser.IP2BandHigh
Steriliser.IP2BandLow
Steriliser.IP2TargetSP
Steriliser.IP3BandHigh
Steriliser.IP3BandLow
Steriliser.IP3TargetSP
Steriliser.IP4BandHigh
Steriliser.IP4BandLow
Steriliser.IP4TargetSP
Steriliser.LowLimit
Steriliser.MeasuredTemp
Steriliser.TargetTemperature
Steriliser.TargetTime
Steriliser.TargetTime121
Steriliser.TargetTime134
Steriliser.ZTemperatureInterval
Timer.N.In
Timer.N.Type
UserLin.N.NumberOfBreakpoints
UserLin.N.XN

UsrVal.N.HighLimit
UsrVal.N.LowLimit
UsrVal.N.Resolution
UsrVal.N.Units
VirtualChannel.N.AlarmN.Amount
VirtualChannel.N.AlarmN.AverageTime
VirtualChannel.N.AlarmN.Block
VirtualChannel.N.AlarmN.ChangeTime
VirtualChannel.N.AlarmN.Deviation
VirtualChannel.N.AlarmN.Dwell
VirtualChannel.N.AlarmN.Hysteresis
VirtualChannel.N.AlarmN.Latch
VirtualChannel.N.AlarmN.Threshold
VirtualChannel.N.AlarmN.Type
VirtualChannel.N.Main.Descriptor
VirtualChannel.N.Main.HighCutOff
VirtualChannel.N.Main.LowCutOff
VirtualChannel.N.Main.Operation
VirtualChannel.N.Main.Period
VirtualChannel.N.Main.PresetValue
VirtualChannel.N.Main.Resolution
VirutalChannel.N.Main.RolloverValue
VirtualChannel.N.Main.Type
VirtualChannel.N.Main.Units
VirtualChannel.N.Main.UnitsScaler
VirtualChannel.N.Trend.Colour
VirtualChannel.N.Trend.SpanHigh
VirtualChannel.N.Trend.SpanLow
WebServer.Enabled
WebServer.Password
WebServer.Port
WebServer.Security
WebServer.Username
Zirconia.Clean.CleanEnable
Zirconia.Clean.CleanFreq
Zirconia.Clean.CleanMaxTemp
Zirconia.Clean.CleanTime
Zirconia.Clean.MaxRcovTime
Zirconia.Clean.MinRcovTime
Zirconia.CleanFreq
Zirconia.CleanTime
Zirconia.GasRef
Zirconia.GasRefs.CO_Ideal
Zirconia.GasRefs.CO_Local
Zirconia.GasRefs.CO_RemoteEn
Zirconia.GasRefs.H2_Local
Zirconia.GasRefs.H2_RemoteEn
Zirconia.MaxRcovTime
Zirconia.MinCalTemp
Zirconia.MinRcovTime
Zirconia.NumResolution
Zirconia.OxygenExp
Zirconia.OxygenType
Zirconia.ProbeOffset
Zirconia.ProbeType
Zirconia.ProcFactor
Zirconia.RemGasEn
Zirconia.TempOffset
Zirconia.Tolerance

5.3 PARAMETER LIST

This list is arranged in alphabetical block order and gives the memory address for each parameter in both hex and decimal.

The Modbus addresses, in the range 0x0001 - 0x3FFF, listed in the table below give access to the parameter values in a scaled integer format. It is possible to gain access to the parameter values in native format by using the following formula:

Native address = (scaled integer address x 2) + 0x8000

The blocks are ordered as follows:

Advanced Loop	Loop 2	Virtual chan 1	Virtual chan 18
Alarm summary	Math (2 input)	Virtual chan 2	Virtual chan 19
BCD Input	Modbus Master	Virtual chan 3	Virtual chan 20
Channel 1	Multiplexer	Virtual chan 4	Virtual chan 21
Channel 2	Network	Virtual chan 5	Virtual chan 22
Channel 3	OR block	Virtual chan 6	Virtual chan 23
Channel 4	Program	Virtual chan 7	Virtual chan 24
Custom messages	Programmer	Virtual chan 8	Virtual chan 25
DC Output	Real Time Events	Virtual chan 9	Virtual chan 26
Digital I/O	Segments	Virtual chan 10	Virtual chan 27
Ether|Net/!P	Steriliser	Virtual chan 11	Virtual chan 28
Group	Timer	Virtual chan 12	Virtual chan 29
Humidity	User Lin 1	Virtual chan 13	Virtual chan 30
Instrument	User Lin 2	Virtual chan 14	Zirconia
Logic (2 Input)	User Lin 3	Virtual chan 15	
Logic (8 input)	User Lin 4	Virtual chan 16	
Loop 1	User values	Virtual chan 17	

Parameter path	Description	Type	Hex	Dec	Resolution
AdvancedLoop.Diag.CalcOP	Calc OP	float32	031f	799	1dp
AdvancedLoop.Diag.HiSatLim	HiSatLim	float32	0320	800	1dp
AdvancedLoop.Diag.LoSatLim	LoSatLim	float32	0321	801	1dp
AdvancedLoop.Diag.MasterDerivativeOutContrib	Master derivative output contribution	float32	0312	786	0dp
AdvancedLoop.Diag.MasterError	Master error	float32	030d	781	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.Diag.MasterFB	Master feedback	float32	031e	798	1dp
AdvancedLoop.Diag.MasterIntegralOutContrib	Master integral output contribution	float32	0311	785	4dp
AdvancedLoop.Diag.MasterLoopBreakAlarm	Master loop break (0 = No; 1 = Yes)	bool	0323	803	Not applicable
AdvancedLoop.Diag.MasterPropOutContrib	Master loop proportional output contribution	float32	0310	784	0dp
AdvancedLoop.Diag.MasterSensorBreak	Master sensor break (0 = Off, 1 = On)	bool	0313	787	Not applicable
AdvancedLoop.Diag.OPPid	OPPID	float32	0322	802	1dp
AdvancedLoop.Diag.SchedCBH	Scheduled cutback high	float32	3195	12693	0dp
AdvancedLoop.Diag.SchedCBL	Scheduled cutback low	float32	3196	12694	0dp
AdvancedLoop.Diag.SchedLPBrk	Scheduled loop break time	float32	3198	12696	0dp
AdvancedLoop.Diag.SchedMR	Scheduled manual reset	float32	3197	12695	1dp
AdvancedLoop.Diag.SchedOutputHigh	Scheduled output high limit	float32	319a	12698	1dp
AdvancedLoop.Diag.SchedOutputLow	Scheduled output low limit	float32	319b	12699	1dp
AdvancedLoop.Diag.SchedPB	Scheduled proportional band	float32	3192	12690	1dp
AdvancedLoop.Diag.SchedR2G	Scheduled relative cool gain	float32	3199	12697	1dp
AdvancedLoop.Diag.SchedTd	Scheduled derivative time	float32	3194	12692	1dp
AdvancedLoop.Diag.SchedTi	Scheduled integral time	float32	3193	12691	1dp
AdvancedLoop.Diag.SlaveDerivativeOutContrib	Slave derivative output contribution	float32	031d	797	0dp
AdvancedLoop.Diag.SlaveError	Slave error	float32	031a	794	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.Diag.SlaveIntegralOutContrib	Slave integral output contribution	float32	031c	796	4dp
AdvancedLoop.Diag.SlaveLoopBreakAlarm	Slave loop break (0 = No; 1 = Yes)	bool	030f	783	Not applicable
AdvancedLoop.Diag.SlavePropOutContrib	Slave loop proportional output contribution	float32	031b	795	0dp
AdvancedLoop.Diag.SlaveSensorBreak	Slave sensor break (0 = Off; 1 = On)	bool	0325	805	Not applicable
AdvancedLoop.Diag.TargetOutput	Target output	float32	030e	782	Same as AdvancedLoop.Output.Out-putHighLimit
AdvancedLoop.Diag.WorkingOutputHigh	Slave output high limit	float32	0315	789	0dp
AdvancedLoop.Diag.WorkingOutputLow	Slave output low limit	float32	0314	788	0dp
AdvancedLoop.Main.ActiveOut	Working output	float32	0303	771	Same as AdvancedLoop.Output.Out-putHighLimit
AdvancedLoop.Main.CascadeMode	Cascade mode (0 = Cascade; 1 = Slave; 2 = Manual)	uint8	0316	790	Not applicable
AdvancedLoop.Main.Inhibit	Control inhibit (0 = No; 1 = Yes)	bool	0304	772	Not applicable
AdvancedLoop.Main.MasterIntHold	Master integral hold (0 = No; 1 = Yes)	uint8	0305	773	Not applicable
AdvancedLoop.Main.MasterPV	Master loop process variable	float32	0317	791	1dp
AdvancedLoop.Main.MasterWSP	Master loop working setpoint	float32	0318	792	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.Main.SlaveIntHold	Slave integral hold (0 = No; 1 = Yes)	uint8	0306	774	Not applicable
AdvancedLoop.Main.SlavePV	Slave loop process variable	float32	0300	768	1dp
AdvancedLoop.Main.SlaveWSP	Slave loop working setpoint	float32	0302	770	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.Main.TargetSetpoint	Target setpoint	float32	0301	769	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterPID.ControlAction	Control action (0 = Reverse acting; 1 = Direct acting)	uint8	3103	12547	Not applicable
AdvancedLoop.MasterPID.CutbackHigh	Cutback high (0 = Auto)	float32	31af	12719	1dp
AdvancedLoop.MasterPID.CutbackLow	Cutback low (0 = Auto)	float32	31b0	12720	1dp
AdvancedLoop.MasterPID.DerivativeTime	Derivative time (0 = Off)	float32	31ae	12718	1dp
AdvancedLoop.MasterPID.DerivativeType	Derivative type (0 = PV; 1 = Eror)	uint8	3105	12549	Not applicable
AdvancedLoop.MasterPID.ErrorLimit	Error limit	float32	31cc	12748	1dp
AdvancedLoop.MasterPID.IntegralTime	Integral time (0 = Off)	float32	31ad	12717	1dp
AdvancedLoop.MasterPID.LoopBreakTime	Loop break time (0 = Off)	float32	31b2	12722	0dp
AdvancedLoop.MasterPID.ManualReset	Manual reset	float32	31b1	12721	1dp
AdvancedLoop.MasterPID.PBUnits	Proportional band units (0 = Engineering; 1 = Percentage)	uint8	3104	12548	Not applicable
AdvancedLoop.MasterPID.ProportionalBand	Proportional band	float32	31ac	12716	1dp
AdvancedLoop.MasterSP.AltSP	Alternative setpoint	float32	3160	12640	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.AltSPSelect	Alternative setpoint enable (0 = No; 1 = Yes)	uint8	3161	12641	Not applicable
AdvancedLoop.MasterSP.ManualTrack	Manual track enable (0 = Off; 1 = On)	uint8	3167	12647	Not applicable
AdvancedLoop.MasterSP.RangeHigh	Range high	float32	3159	12633	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.RangeLow	Range low	float32	315a	12634	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.Rate	Setpoint rate limit value (0 = Off)	float32	3162	12642	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.RateDisable	Setpoint rate limit disable (0 = No; 1 = Yes)	bool	3163	12643	Not applicable
AdvancedLoop.MasterSP.RateDone	Setpoint rate limit complete (0 = No; 1 = Yes)	bool	030a	778	Not applicable
AdvancedLoop.MasterSP.ServoToPV	Servo to PV enable (0 = No; 1 = Yes)	bool	316c	12652	Not applicable
AdvancedLoop.MasterSP.SP1	Setpoint 1	float32	315c	12636	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.SP2	Setpoint 2	float32	315d	12637	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.SPHighLimit	Setpoint high limit	float32	315e	12638	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.SPIntBal	SP integral balance (0 = Off; 1 = On)	bool	316b	12651	Not applicable
AdvancedLoop.MasterSP.SPLowLimit	Setpoint low limit	float32	315f	12639	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.SPSelect	Active setpoint select (0 - Setpoint 1; 1 = Setpoint 2)	uint8	315b	12635	Not applicable
AdvancedLoop.MasterSP.SPTrack	Setpoint tracking enable (0 = Off; 1 = On)	uint8	3168	12648	Not applicable
AdvancedLoop.MasterSP.SPTrim	Setpoint trim	float32	3164	12644	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.SPTrimHighLimit	Setpoint trim high limit	float32	3165	12645	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.SPTrimLowLimit	Setpoint trim low limit	float32	3166	12646	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.TrackPV	Track PV	float32	3169	12649	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.MasterSP.TrackSP	Track SP	float32	316a	12650	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.Output.Ch1OnOffHysteresis	Channel 1 on/off hysteresis	float32	3172	12658	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.Output.Ch1Output	Channel 1 output value	float32	030b	779	Same as AdvancedLoop.Output.Out-putHighLimit
AdvancedLoop.Output.Ch1PotBreak	Channel 1 potentiometer break (0 = Off; 1 = On)	uint8	3179	12665	Not applicable
AdvancedLoop.Output.Ch1PotPosition	Channel 1 valve position	float32	3178	12664	0dp
AdvancedLoop.Output.Ch1TravelTime	Channel 1 travel time	float32	3174	12660	1dp
AdvancedLoop.Output.Ch2Deadband	Channel 2 deadband (0 = Off)	float32	316f	12655	Same as AdvancedLoop.Output.Out-

Parameter path	Description	Type	Hex	Dec	Resolution
					putHighLimit
AdvancedLoop.Output.Ch2OnOffHysteresis	Channel 2 on/off hysteresis	float32	3173	12659	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.Output.Ch2Output	Channel 2 (cool) output value	float32	030c	780	Same as AdvancedLoop.Output.OutputHighLimit
AdvancedLoop.Output.Ch2PotBreak	Channel 2 potentiometer break (0 = Off; 1 = On)	uint8	317b	12667	Not applicable
AdvancedLoop.Output.Ch2PotPosition	Channel 2 valve position	float32	317a	12666	0dp
AdvancedLoop.Output.Ch2TravelTime	Channel 2 travel time	float32	3175	12661	1dp
AdvancedLoop.Output.CoolType	Cooling algorithm type 0 = Linear 1 = Oil 2 = Water 3 = Fan	uint8	3183	12675	Not applicable
AdvancedLoop.Output.EnablePowerFeedforward	Power feed forward enable (0 = No; 1 = Yes)	uint8	3181	12673	Not applicable
AdvancedLoop.Output.FeedForwardGain	Feedforward gain	float32	3185	12677	3dp
AdvancedLoop.Output.FeedForwardOffset	Feedforward offset	float32	3186	12678	0dp
AdvancedLoop.Output.FeedForwardOutput	Feedforward output	float32	3188	12680	0dp
AdvancedLoop.Output.FeedForwardRemote	Feedforward remote	float32	318d	12685	0dp
AdvancedLoop.Output.FeedForwardTrimLimit	Feedforward trim limit	float32	3187	12679	0dp
AdvancedLoop.Output.FeedForwardType	Feedforward type 0 = None 1 = Remote 2 = SP 3 = PV	uint8	3184	12676	Not applicable
AdvancedLoop.Output.ForcedOP	Forced manual output value	float32	318f	12687	1dp
AdvancedLoop.Output.ManualMode	Manual output mode (0 = Track; 1 = Step; 2 = LastMOP)	uint8	317f	12671	Not applicable
AdvancedLoop.Output.ManualOutVal	Manual output value	float32	3180	12672	Same as AdvancedLoop.Output.OutputHighLimit
AdvancedLoop.Output.ManualStartup	Manual startup mode (0 = Off; 1 = On)	bool	3190	12688	Not applicable
AdvancedLoop.Output.MeasuredPower	Measured mains voltage	float32	3182	12674	0dp
AdvancedLoop.Output.NudgeLower	Valve nudge lower (0 = No; 1 = Yes)	uint8	3177	12663	Not applicable
AdvancedLoop.Output.NudgeRaise	Valve nudge raise (0 = No; 1 = Yes)	uint8	3176	12662	Not applicable
AdvancedLoop.Output.OutputHighLimit	Output high limit	float32	316d	12653	1dp
AdvancedLoop.Output.OutputLowLimit	Output low limit	float32	316e	12654	Same as AdvancedLoop.Output.OutputHighLimit
AdvancedLoop.Output.PotBreakMode	Potentiometer break mode 0 = Raise 1 = Lower 2 = Reset 3 = Model	uint8	317c	12668	Not applicable
AdvancedLoop.Output.Rate	Output rate limit value (0 = Off)	float32	3170	12656	1dp
AdvancedLoop.Output.RateDisable	Rate disable (0 = No; 1 = Yes)	bool	3171	12657	Not applicable
AdvancedLoop.Output.RemoteOutputHigh	Remote output high limit	float32	318c	12684	Same as AdvancedLoop.Main.ActiveOut
AdvancedLoop.Output.RemoteOutputLow	Remote output low limit	float32	318b	12683	Same as AdvancedLoop.Main.ActiveOut
AdvancedLoop.Output.SafeOutVal	Safe output value	float32	317e	12670	Same as AdvancedLoop.Output.OutputHighLimit
AdvancedLoop.Output.SbrkOP	Sensor break output	float32	318e	12686	Same as AdvancedLoop.Output.OutputHighLimit
AdvancedLoop.Output.SlaveSensorBreakMode	Slave sensor break mode (0 = SbrkOP; 1 = Hold)	uint8	317d	12669	Not applicable
AdvancedLoop.Output.TrackEnable	Enable output tracking (0 = Off; 1 = On)	uint8	318a	12682	Not applicable
AdvancedLoop.Output.TrackOutput	Output track value	float32	3189	12681	0dp
AdvancedLoop.Setup.CascadeType	Cascade type (0 = Full scale; 1 = Trim)	uint8	1606	5638	Not applicable
AdvancedLoop.Setup.MasterLoop	Master loop type (0 = PID)	uint8	31b3	12723	Not applicable
AdvancedLoop.Setup.MasterName	Master loop name	string_t	7010	28688	Not applicable
AdvancedLoop.Setup.ManOutputAccess	Manual output access	uint8	31a9	12713	Not applicable
AdvancedLoop.Setup.ModeAccess	Mode access 0 = R/W (Logged out) 1 = R/W (Operator) 2 = Read Only	uint8	31a8	12712	Not applicable
AdvancedLoop.Setup.SetpointAccess	Setpoint access (as Mode Access, above)	uint8	31a7	12711	Not applicable
AdvancedLoop.Setup.SlaveChannel1	Slave heat/channel 1 control type 0 = Off 1 = On/Off 2 = PID 3 = VPU 4 = VPB	uint8	3101	12545	Not applicable
AdvancedLoop.Setup.SlaveChannel2	Slave cool/channel 2 control type (as above)	uint8	3102	12546	Not applicable
AdvancedLoop.Setup.SlaveName	Slave loop name	string_t	7020	28704	Not applicable
AdvancedLoop.Setup.ManOutputAccess	Manual output access	uint8	31a9	12713	Not applicable
AdvancedLoop.SlavePID.ActiveSet	Active set (1 = Set 1; 2 = Set 2; 3 = Set 3)	uint8	3138	12600	Not applicable
AdvancedLoop.SlavePID.Boundary1-2	Scheduler boundary 1-2	float32	3139	12601	0dp
AdvancedLoop.SlavePID.Boundary2-3	Scheduler boundary 2-3	float32	133a	4922	0dp
AdvancedLoop.SlavePID.ControlAction	Control action (0 = Reverse acting; 1 = Direct acting)	uint8	3106	12550	Not applicable
AdvancedLoop.SlavePID.CutbackHigh	Cutback high set 1 (0 = Auto)	float32	313f	12607	1dp
AdvancedLoop.SlavePID.CutbackHigh2	Cutback high set 2 (0 = Auto)	float32	3147	12615	1dp
AdvancedLoop.SlavePID.CutbackHigh3	Cutback high set 3 (0 = Auto)	float32	314f	12623	1dp
AdvancedLoop.SlavePID.CutbackLow	Cutback low set 1 (0 = Auto)	float32	3140	12608	1dp
AdvancedLoop.SlavePID.CutbackLow2	Cutback low set 2 (0 = Auto)	float32	3148	12616	1dp
AdvancedLoop.SlavePID.CutbackLow3	Cutback low set 3 (0 = Auto)	float32	3150	12624	1dp
AdvancedLoop.SlavePID.DerivativeTime	Derivative time set 1 (0 = Off)	float32	313d	12605	1dp
AdvancedLoop.SlavePID.DerivativeTime2	Derivative time set 2 (0 = Off)	float32	3145	12613	1dp
AdvancedLoop.SlavePID.DerivativeTime3	Derivative time set 3 (0 = Off)	float32	314d	12621	1dp
AdvancedLoop.SlavePID.DerivativeType	Derivative type (0 = PV; 1 = Error)	uint8	3305	13061	Not applicable
AdvancedLoop.SlavePID.IntegralTime	Integral time set 1 (0 = Off)	float32	313c	12604	1dp
AdvancedLoop.SlavePID.IntegralTime2	Integral time set 2 (0 = Off)	float32	3144	12612	1dp
AdvancedLoop.SlavePID.IntegralTime3	Integral time set 3 (0 = Off)	float32	314c	12620	1dp
AdvancedLoop.SlavePID.LoopBreakTime	Loop break time set 1 (0 = Off)	float32	3142	12610	0dp
AdvancedLoop.SlavePID.LoopBreakTime2	Loop break time set 2 (0 = Off)	float32	314a	12618	0dp
AdvancedLoop.SlavePID.LoopBreakTime3	Loop break time set 3 (0 = Off)	float32	3152	12626	0dp
AdvancedLoop.SlavePID.ManualReset	Manual reset	float32	3141	12609	1dp
AdvancedLoop.SlavePID.ManualReset2	Manual reset 2	float32	3149	12617	1dp
AdvancedLoop.SlavePID.ManualReset3	Manual reset 3	float32	3151	12625	1dp
AdvancedLoop.SlavePID.NumberOfSets	Number of PID sets	uint8	3136	12598	Not applicable
AdvancedLoop.SlavePID.OutputHi2	Output high limit	float32	3155	12629	1dp
AdvancedLoop.SlavePID.OutputHi3	Output high limit	float32	3157	12631	1dp
AdvancedLoop.SlavePID.OutputHigh	Output high limit	float32	3153	12627	1dp
AdvancedLoop.SlavePID.OutputLo2	Output low limit 2	float32	3156	12630	1dp

Parameter path	Description	Type	Hex	Dec	Resolution
AdvancedLoop.SlavePID.OutputLo3	Output low limit	float32	3158	12632	1dp
AdvancedLoop.SlavePID.OutputLow	Output low limit	float32	3154	12628	1dp
AdvancedLoop.SlavePID.PBUnits	Proportional band units (0 = Engineering; 1 = Percentage)	uint8	3304	13060	Not applicable
AdvancedLoop.SlavePID.ProportionalBand	Proportional band set 1	float32	313b	12603	1dp
AdvancedLoop.SlavePID.ProportionalBand2	Proportional band set 2	float32	3143	12611	1dp
AdvancedLoop.SlavePID.ProportionalBand3	Proportional band set 3	float32	314b	12619	1dp
AdvancedLoop.SlavePID.RelCh2Gain	Relative cool/channel 2 gain	float32	313e	12606	1dp
AdvancedLoop.SlavePID.RelCh2Gain2	Relative cool/channel 2 gain 2	float32	3146	12614	1dp
AdvancedLoop.SlavePID.RelCh2Gain3	Relative cool/channel 2 gain 3	float32	314e	12622	1dp
AdvancedLoop.SlavePID.RemoteInput	Scheduler remote input	float32	3137	12599	0dp
AdvancedLoop.SlavePID.SchedulerType	Scheduler type 0 = Off 1 = Manually set 2 = Setpoint 3 = PV 4 = Error 5 = Output 6 = Remote	uint8	3135	12597	Not applicable
AdvancedLoop.SlaveSP.FFSelect	Feedforward select 0 = Master PV 1 = Master WSP 2 = Remote FF	uint8	31bf	12735	Not applicable
AdvancedLoop.SlaveSP.LocalSP	Local setpoint	float32	31b4	12724	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.ManualTrack	Manual track enable (0 = Off; 1 = On)	uint8	31ca	12746	Not applicable
AdvancedLoop.SlaveSP.MasterSensorBreakMode	Master sensor break mode 0 = SbrkSP 1 = Hold 2 = SlaveSB	uint8	31c2	12738	Not applicable
AdvancedLoop.SlaveSP.RangeHigh	Range high	float32	31c0	12736	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.RangeLow	Range low	float32	31c1	12737	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.RemoteFeedForward	Remote feedforward input	float32	31bb	12731	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.RemoteFFEnable	Remote feedforward enable (0 = No; 1 = Yes)	bool	31be	12734	Not applicable
AdvancedLoop.SlaveSP.RemoteFFHigh	Remote feedforward high	float32	31bc	12732	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.RemoteFFLow	Remote feedforward low	float32	31bd	12733	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.SbrkSP	Sensor break setpoint	float32	31c3	12739	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.SPHighLimit	Setpoint high limit	float32	31b5	12725	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.SPLowLimit	Setpoint low limit	float32	31b6	12726	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.TrimHighLimit	Trim high limit	float32	31b9	12729	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.SlaveSP.TrimLowLimit	Trim low limit	float32	31ba	12730	Same as AdvancedLoop.Main.MasterPV
AdvancedLoop.SlaveSP.TrimRangeHigh	Trim range high	float32	31b7	12727	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.SlaveSP.TrimRangeLow	Trim range low	float32	31b8	12728	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.Tune.A1	A1	float32	320d	12813	0dp
AdvancedLoop.Tune.A2	A2	float32	320e	12814	0dp
AdvancedLoop.Tune.Alpha	Alpha	float32	3211	12817	4dp
AdvancedLoop.Tune.Alpha_p	Alpha_p	float32	320f	12815	2dp
AdvancedLoop.Tune.ArgOP	Argument Output	float32	3209	12809	1dp
AdvancedLoop.Tune.ArgPV	Argument PV	float32	3208	12808	1dp
AdvancedLoop.Tune.Band	Band	float32	31c7	12743	1dp
AdvancedLoop.Tune.CycleNo	CycleNo	float32	3213	12819	0dp
AdvancedLoop.Tune.Debug	Debug	float32	3212	12818	2dp
AdvancedLoop.Tune.Diagnostics	Tuning diagnostics	bool	31cb	12747	Not applicable
AdvancedLoop.Tune.Gain	Gain	float32	320a	12810	1dp
AdvancedLoop.Tune.Hysteresis	Hysteresis	float32	31c6	12742	1dp
AdvancedLoop.Tune.MasterTune	Master tune	float32	3203	12803	0dp
AdvancedLoop.Tune.ModeMan	Mode Man	float32	3201	12801	0dp
AdvancedLoop.Tune.ModOP	Modulus OP	float32	3207	12807	1dp
AdvancedLoop.Tune.ModPV	Modulus PV	float32	3206	12806	1dp
AdvancedLoop.Tune.OP	Output	float32	3202	12802	1dp
AdvancedLoop.Tune.OPDel	OPDel	float32	0319	793	2dp
AdvancedLoop.Tune.OPss	OPss	float32	3210	12816	2dp
AdvancedLoop.Tune.OutputHighLimit	Output high	float32	3132	12594	Same as AdvancedLoop.Output.Out-putHighLimit
AdvancedLoop.Tune.OutputLowLimit	Output low	float32	3133	12595	Same as AdvancedLoop.Output.Out-putHighLimit
AdvancedLoop.Tune.PBs	PBs	float32	3214	12820	2dp
AdvancedLoop.Tune.Period	Period	float32	320c	12812	0dp
AdvancedLoop.Tune.Phase	Phase	float32	320b	12811	1dp
AdvancedLoop.Tune.Settle	Settle	float32	3216	12822	2dp
AdvancedLoop.Tune.Stage	Stage 0 = Reset 1 = None 2 = Settling 3 = Current SP 4 = New SP 5 = To SP 6 = Wait Max. 7 = Wait Min 8 = Store 9 = CoolT 10 = PID 11 = Abort 12 = Complete 13 = New R2g 14 = 1: Half Cycle 15 = 2: Full Cycle 16 = 3: Full Cycle 17 = 4: Final cycle 18 = 5: Calculating	uint8	0308	776	Not applicable
AdvancedLoop.Tune.StageTime	Stage time	float32	0309	777	0dp
AdvancedLoop.Tune.State	State 0 = Off 1 = Ready 2 - Running 3 = Complete 4 = Time-out 5 = Ti Limit 6 = R2G limit	uint8	0307	775	Not applicable
AdvancedLoop.Tune.TDs	TDs	float32	3215	12821	2dp
AdvancedLoop.Tune.Timeout	Timeout	float32	0326	806	0dp
AdvancedLoop.Tune.TuneEnable	Autotune enable (0 = Off; 1 = On)	bool	3131	12593	Not applicable
AdvancedLoop.Tune.TuneHigh	Tune high	float32	31c8	12744	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.Tune.TuneLow	Tune low	float32	31c9	12745	Same as AdvancedLoop.Main.SlavePV
AdvancedLoop.Tune.TuneR2G	Slave R2G tuning type 0 = Standard R2G tuning 1 = R2GPD tuning 2 = Off	uint8	3130	12592	Not applicable
AdvancedLoop.Tune.TuneSlave	Tune slave	float32	3204	12804	1dp
AdvancedLoop.Tune.TuneStatus	Tune Status 0 = Not tuning 1 = Tuning the slave 2 = Tuning the master 3 = Tuning complete	float32	3205	12805	0dp

Parameter path	Description	Type	Hex	Dec	Resolution
	-1 = Tuning aborted or timed-out				
AdvancedLoop.Tune.TuneType	Autotune algorithm type (0 = Slave; 1 = Master)	uint8	31c5	12741	Not applicable
AdvancedLoop.Tune.WSP	Working setpoint	float32	3200	12800	Same as AdvancedLoop.Main.MasterPV
AlarmSummary.AnyAlarm	0 = No active alarms; 1 = one or more alarms active	bool	01a2	418	Not applicable
AlarmSummary.AnyChanAlarm	0 = No channel alarms 1 = Channel alarm(s) active but all ack'd. 2 = Channel alarm(s) active but not all ack'd	uint8	01a0	416	Not applicable
AlarmSummary.AnySystemAlarm	0 = No system alarms; 1 = 1 or more system alm(s)	bool	01a1	417	Not applicable
AlarmSummary.Channel.Alarm1Ack	Acknowledge the most recent channel alarm	bool	1192	4498	Not applicable
AlarmSummary.Channel.Alarm1Num	Channel and alarm number of most recent alarm 0 = No alarm 4 = Ch1;Al1 5 =Ch1;Al2 8 = Ch2;Al1 9 = Ch2Al2 12 = Ch3;Al1 13 = Ch3;Al2 16 = Ch4;Al1 17 = Ch4;Al2 132 = VC1;Al1 133 = VC1;Al2 136 = VC2;Al1 137 = VC2;Al2 140 = VC3;Al1 141 = VC3;Al2 144 = VC4;Al1 145 = VC4;Al2 148 = VC5;Al1 149 = VC5;Al2 152 = VC6;Al1 153 = VC6;Al2 156 = VC7;Al1 157 = VC7;Al2 160 = VC8;Al1 161 = VC8;Al2 164 = VC9;Al1 165 = VC9;Al2 168 = VC10;Al1 169 = VC10;Al2 172 = VC11;Al1 173 = VC11;Al2 176 = VC12;Al1 177 = VC12;Al2 180 = VC13;Al1 181 = VC13;Al2 184 = VC14;Al1 185 = VC14;Al2 188 = VC15;Al1 189 = VC15:Al2	uint8	1190	4496	Not applicable
AlarmSummary.Channel.Alarm1Status	Status of most recent alarm 0 = Off 1 = Active 2 = Safe unack 3 = Active unack	uint8	1191	4497	Not applicable
AlarmSummary.Channel.Alarm2Ack	Acknowledge the 2nd most recent channel alarm	bool	1195	4501	Not applicable
AlarmSummary.Channel.Alarm2Num	As Alarm1Num, but for 2nd most recent alarm	uint8	1193	4499	Not applicable
AlarmSummary.Channel.Alarm2Status	As Alarm1Status, but for 2nd most recent alarm	uint8	1194	4500	Not applicable
AlarmSummary.Channel.Alarm3Ack	Acknowledge the 3rd most recent channel alarm	bool	1198	4504	Not applicable
AlarmSummary.Channel.Alarm3Num	As Alarm1Num, but for 3rd most recent alarm	uint8	1196	4502	Not applicable
AlarmSummary.Channel.Alarm3Status	As Alarm1Status, but for 3rd most recent alarm	uint8	1197	4503	Not applicable
AlarmSummary.Channel.Alarm4Ack	Acknowledge the 4th most recent channel alarm	bool	119b	4507	Not applicable
AlarmSummary.Channel.Alarm4Num	As Alarm1Num, but for 4th most recent alarm	uint8	1199	4505	Not applicable
AlarmSummary.Channel.Alarm4Status	As Alarm1Status, but for 4th most recent alarm	uint8	119a	4506	Not applicable
AlarmSummary.Channel.Alarm5Ack	Acknowledge the 5th most recent channel alarm	bool	119e	4510	Not applicable
AlarmSummary.Channel.Alarm5Num	As Alarm1Num, but for 5th most recent alarm	uint8	119c	4508	Not applicable
AlarmSummary.Channel.Alarm5Status	As Alarm1Status, but for 5th most recent alarm	uint8	119d	4509	Not applicable
AlarmSummary.Channel.Alarm6Ack	Acknowledge the 6th most recent channel alarm	bool	11a1	4513	Not applicable
AlarmSummary.Channel.Alarm6Num	As Alarm1Num, but for 6th most recent alarm	uint8	119f	4511	Not applicable
AlarmSummary.Channel.Alarm6Status	As Alarm1Status, but for 6th most recent alarm	uint8	11a0	4512	Not applicable
AlarmSummary.Channel.Alarm7Ack	Acknowledge the 7th most recent channel alarm	bool	11a4	4516	Not applicable
AlarmSummary.Channel.Alarm7Num	As Alarm1Num, but for 7th most recent alarm	uint8	11a2	4514	Not applicable
AlarmSummary.Channel.Alarm7Status	As Alarm1Status, but for 7th most recent alarm	uint8	11a3	4515	Not applicable
AlarmSummary.Channel.Alarm8Ack	Acknowledge the 8th most recent channel alarm	bool	11a7	4519	Not applicable
AlarmSummary.Channel.Alarm8Num	As Alarm1Num, but for 8th most recent alarm	uint8	11a5	4517	Not applicable
AlarmSummary.Channel.Alarm8Status	As Alarm1Status, but for 8th most recent alarm	uint8	11a6	4518	Not applicable
AlarmSummary.Channel.Alarm9Ack	Acknowledge the 9th most recent channel alarm	bool	11aa	4522	Not applicable
AlarmSummary.Channel.Alarm9Num	As Alarm1Num, but for 9th most recent alarm	uint8	11a8	4520	Not applicable
AlarmSummary.Channel.Alarm9Status	As Alarm1Status, but for 9th most recent alarm	uint8	11a9	4521	Not applicable
AlarmSummary.Channel.Alarm10Ack	Acknowledge the 10th most recent channel alarm	bool	11ad	4525	Not applicable
AlarmSummary.Channel.Alarm10Num	As Alarm1Num, but for 10th most recent alarm	uint8	11ab	4523	Not applicable
AlarmSummary.Channel.Alarm10Status	As Alarm1Status, but for 10th most recent alarm	uint8	11ac	4524	Not applicable
AlarmSummary.Channel.Alarm11Ack	Acknowledge the 11th most recent channel alarm	bool	11b0	4528	Not applicable
AlarmSummary.Channel.Alarm11Num	As Alarm1Num, but for 11th most recent alarm	uint8	11ae	4526	Not applicable
AlarmSummary.Channel.Alarm11Status	As Alarm1Status, but for 11th most recent alarm	uint8	11af	4527	Not applicable
AlarmSummary.Channel.Alarm12Ack	Acknowledge the 12th most recent channel alarm	bool	11b3	4531	Not applicable
AlarmSummary.Channel.Alarm12Num	As Alarm1Num, but for 12th most recent alarm	uint8	11b1	4529	Not applicable
AlarmSummary.Channel.Alarm12Status	As Alarm1Status, but for 12th most recent alarm	uint8	11b2	4530	Not applicable
AlarmSummary.Channel.Alarm13Ack	Acknowledge the 13th most recent channel alarm	bool	11b6	4534	Not applicable
AlarmSummary.Channel.Alarm13Num	As Alarm1Num, but for 13th most recent alarmr	uint8	11b4	4532	Not applicable
AlarmSummary.Channel.Alarm13Status	As Alarm1Status, but for 13th most recent alarm	uint8	11b5	4533	Not applicable
AlarmSummary.Channel.Alarm14Ack	Acknowledge the 14th most recent channel alarm	bool	11b9	4537	Not applicable
AlarmSummary.Channel.Alarm14Num	As Alarm1Num, but for 14th most recent alarmr	uint8	11b7	4535	Not applicable
AlarmSummary.Channel.Alarm14Status	As Alarm1Status, but for 14th most recent alarm	uint8	11b8	4536	Not applicable
AlarmSummary.Channel.Alarm15Ack	Acknowledge the 15th most recent channel alarm	bool	11bc	4540	Not applicable
AlarmSummary.Channel.Alarm15Num	As Alarm1Num, but for 15th most recent alarm	uint8	11ba	4538	Not applicable
AlarmSummary.Channel.Alarm15Status	As Alarm1Status, but for 15th most recent alarm	uint8	11bb	4539	Not applicable
AlarmSummary.Channel.Alarm16Ack	Acknowledge the 16th most recent channel alarm	bool	11bf	4543	Not applicable
AlarmSummary.Channel.Alarm16Num	As Alarm1Num, but for 16th most recent alarm	uint8	11bd	4541	Not applicable
AlarmSummary.Channel.Alarm16Status	As Alarm1Status, but for 16th most recent alarm	uint8	11be	4542	Not applicable
AlarmSummary.Channel.Alarm17Ack	Acknowledge the 17th most recent channel alarm	bool	11c2	4546	Not applicable
AlarmSummary.Channel.Alarm17Num	As Alarm1Num, but for 17th most recent alarm	uint8	11c0	4544	Not applicable
AlarmSummary.Channel.Alarm17Status	As Alarm1Status, but for 17th most recent alarm	uint8	11c1	4545	Not applicable
AlarmSummary.Channel.Alarm18Ack	Acknowledge the 18th most recent channel alarm	bool	11c5	4549	Not applicable
AlarmSummary.Channel.Alarm18Num	As Alarm1Num, but for 18th most recent alarm	uint8	11c3	4547	Not applicable
AlarmSummary.Channel.Alarm18Status	As Alarm1Status, but for 18th most recent alarm	uint8	11c4	4548	Not applicable
AlarmSummary.Channel.Alarm19Ack	Acknowledge the 19th most recent channel alarm	bool	11c8	4552	Not applicable
AlarmSummary.Channel.Alarm19Num	As Alarm1Num, but for 19th most recent alarm	uint8	11c6	4550	Not applicable
AlarmSummary.Channel.Alarm19Status	As Alarm1Status, but for 19th most recent alarm	uint8	11c7	4551	Not applicable
AlarmSummary.Channel.Alarm20Ack	Acknowledge the 20th most recent channel alarm	bool	11cb	4555	Not applicable
AlarmSummary.Channel.Alarm20Num	As Alarm1Num, but for 20th most recent alarm	uint8	11c9	4553	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
AlarmSummary.Channel.Alarm20Status	As Alarm1Status, but for 20th most recent alarm	uint8	11ca	4554	Not applicable
AlarmSummary.Channel.Alarm21Ack	Acknowledge the 21st most recent channel alarm	bool	11ce	4558	Not applicable
AlarmSummary.Channel.Alarm21Num	As Alarm1Num, but for 21st most recent alarm	uint8	11cc	4556	Not applicable
AlarmSummary.Channel.Alarm21Status	As Alarm1Status, but for 21st most recent alarm	uint8	11cd	4557	Not applicable
AlarmSummary.Channel.Alarm22Ack	Acknowledge the 22nd most recent channel alarm	bool	11d1	4561	Not applicable
AlarmSummary.Channel.Alarm22Num	As Alarm1Num, but for 22nd most recent alarm	uint8	11cf	4559	Not applicable
AlarmSummary.Channel.Alarm22Status	As Alarm1Status, but for 22nd most recent alarm	uint8	11d0	4560	Not applicable
AlarmSummary.Channel.Alarm23Ack	Acknowledge the 23rd most recent channel alarm	bool	11d4	4564	Not applicable
AlarmSummary.Channel.Alarm23Num	As Alarm1Num, but for 23th most recent alarm	uint8	11d2	4562	Not applicable
AlarmSummary.Channel.Alarm23Status	As Alarm1Status, but for 23rd most recent alarm	uint8	11d3	4563	Not applicable
AlarmSummary.Channel.Alarm24Ack	Acknowledge the 24th most recent channel alarm	bool	11d7	4567	Not applicable
AlarmSummary.Channel.Alarm24Num	As Alarm1Num, but for 24th most recent alarm	uint8	11d5	4565	Not applicable
AlarmSummary.Channel.Alarm24Status	As Alarm1Status, but for 24th most recent alarm	uint8	11d6	4566	Not applicable
AlarmSummary.Channel.Alarm25Ack	Acknowledge the 25th most recent channel alarm	bool	11da	4570	Not applicable
AlarmSummary.Channel.Alarm25Num	As Alarm1Num, but for 25th most recent alarm	uint8	11d8	4568	Not applicable
AlarmSummary.Channel.Alarm25Status	As Alarm1Status, but for 25th most recent alarm	uint8	11d9	4569	Not applicable
AlarmSummary.Channel.Alarm26Ack	Acknowledge the 26th most recent channel alarm	bool	11dd	4573	Not applicable
AlarmSummary.Channel.Alarm26Num	As Alarm1Num, but for 26th most recent alarm	uint8	11db	4571	Not applicable
AlarmSummary.Channel.Alarm26Status	As Alarm1Status, but for 26th most recent alarm	uint8	11dc	4572	Not applicable
AlarmSummary.Channel.Alarm27Ack	Acknowledge the 27th most recent channel alarm	bool	11e0	4576	Not applicable
AlarmSummary.Channel.Alarm27Num	As Alarm1Num, but for 27th most recent alarm	uint8	11de	4574	Not applicable
AlarmSummary.Channel.Alarm27Status	As Alarm1Status, but for 27th most recent alarm	uint8	11df	4575	Not applicable
AlarmSummary.Channel.Alarm28Ack	Acknowledge the 28th most recent channel alarm	bool	11e3	4579	Not applicable
AlarmSummary.Channel.Alarm28Num	As Alarm1Num, but for 28th most recent alarm	uint8	11e1	4577	Not applicable
AlarmSummary.Channel.Alarm28Status	As Alarm1Status, but for 28th most recent alarm	uint8	11e2	4578	Not applicable
AlarmSummary.Channel.Alarm29Ack	Acknowledge the 29th most recent channel alarm	bool	11e6	4582	Not applicable
AlarmSummary.Channel.Alarm29Num	As Alarm1Num, but for 29th most recent alarm	uint8	11e4	4580	Not applicable
AlarmSummary.Channel.Alarm29Status	As Alarm1Status, but for 29th most recent alarm	uint8	11e5	4581	Not applicable
AlarmSummary.Channel.Alarm30Ack	Acknowledge the 30th most recent channel alarm	bool	11e9	4585	Not applicable
AlarmSummary.Channel.Alarm30Num	As Alarm1Num, but for 30th most recent alarm	uint8	11e7	4583	Not applicable
AlarmSummary.Channel.Alarm30Status	As Alarm1Status, but for 30th most recent alarm	uint8	11e8	4584	Not applicable
AlarmSummary.Channel.Alarm31Ack	Acknowledge the 31st most recent channel alarm	bool	11ec	4588	Not applicable
AlarmSummary.Channel.Alarm31Num	As Alarm1Num, but for 31st most recent alarm	uint8	11ea	4586	Not applicable
AlarmSummary.Channel.Alarm31Status	As Alarm1Status, but for 31st most recent alarm	uint8	11eb	4587	Not applicable
AlarmSummary.Channel.Alarm32Ack	Acknowledge the 32nd most recent channel alarm	bool	11ef	4591	Not applicable
AlarmSummary.Channel.Alarm32Num	As Alarm1Num, but for 32nd most recent alarm	uint8	11ed	4589	Not applicable
AlarmSummary.Channel.Alarm32Status	As Alarm1Status, but for 32nd most recent alarm	uint8	11ee	4590	Not applicable
AlarmSummary.Channel.Alarm33Ack	Acknowledge the 33rd most recent channel alarm	bool	11f2	4594	Not applicable
AlarmSummary.Channel.Alarm33Num	As Alarm1Num, but for 33rd most recent alarm	uint8	11f0	4592	Not applicable
AlarmSummary.Channel.Alarm33Status	As Alarm1Status, but for 33rd most recent alarm	uint8	11f1	4593	Not applicable
AlarmSummary.Channel.Alarm34Ack	Acknowledge the 34th most recent channel alarm	bool	11f5	4597	Not applicable
AlarmSummary.Channel.Alarm34Num	As Alarm1Num, but for 34th most recent alarm	uint8	11f3	4595	Not applicable
AlarmSummary.Channel.Alarm34Status	As Alarm1Status, but for 34th most recent alarm	uint8	11f4	4596	Not applicable
AlarmSummary.Channel.Alarm35Ack	Acknowledge the 35th most recent channel alarm	bool	11f8	4600	Not applicable
AlarmSummary.Channel.Alarm35Num	As Alarm1Num, but for 35th most recent alarm	uint8	11f6	4598	Not applicable
AlarmSummary.Channel.Alarm35Status	As Alarm1Status, but for 35th most recent alarm	uint8	11f7	4599	Not applicable
AlarmSummary.Channel.Alarm36Ack	Acknowledge the 36th most recent channel alarm	bool	11fb	4603	Not applicable
AlarmSummary.Channel.Alarm36Num	As Alarm1Num, but for 36th most recent alarm	uint8	11f9	4601	Not applicable
AlarmSummary.Channel.Alarm36Status	As Alarm1Status, but for 36th most recent alarm	uint8	11fa	4602	Not applicable
AlarmSummary.Channel.Alarm37Ack	Acknowledge the 37th most recent channel alarm	bool	11fe	4606	Not applicable
AlarmSummary.Channel.Alarm37Num	As Alarm1Num, but for 37th most recent alarm	uint8	11fc	4604	Not applicable
AlarmSummary.Channel.Alarm37Status	As Alarm1Status, but for 38th most recent alarm	uint8	11fd	4605	Not applicable
AlarmSummary.Channel.Alarm38Ack	Acknowledge the 38th most recent channel alarm	bool	1201	4609	Not applicable
AlarmSummary.Channel.Alarm38Num	As Alarm1Num, but for 38th most recent alarm	uint8	11ff	4607	Not applicable
AlarmSummary.Channel.Alarm38Status	As Alarm1Status, but for 38th most recent alarm	uint8	1200	4608	Not applicable
AlarmSummary.GlobalAck	Acknowledge all alarms. 0=No;1 = yes	bool	01a3	419	Not applicable
AlarmSummary.StatusWord1	A summary of Channel 1-4 alarms Bit 0: 1 = Channel 1 Alarm 1 active Bit 1: 1 = Channel 1 Alarm 1 not acknowledged Bit 2: 1 = Channel 1 Alarm 2 active Bit 3: 1 = Channel 1 Alarm 2 not acknowledged Bit 4: 1 = Channel 2 Alarm 1 active Bit 5: 1 = Channel 2 Alarm 1 not acknowledged Bit 6: 1 = Channel 2 Alarm 2 active Bit 7: 1 = Channel 2 Alarm 2 not acknowledged Bit 8: 1 = Channel 3 Alarm 1 active Bit 9: 1 = Channel 3 Alarm 1 not acknowledged Bit 10: 1 = Channel 3 Alarm 2 active Bit 11: 1 = Channel 3 Alarm 2 not acknowledged Bit 12: 1 = Channel 4 Alarm 1 active Bit 13: 1 = Channel 4 Alarm 1 not acknowledged Bit 14: 1 = Channel 4 Alarm 2 active Bit 15: 1 = Channel 4 Alarm 2 not acknowledged	int16	01a4	420	Not applicable
AlarmSummary.StatusWord2	A summary of Virtual Channel 1 to 4 alarms Bit 0: 1 = Virtual channel 1 Alarm 1 active Bit 1: 1 = Virtual channel 1 Alarm 1 not ack'd Bit 2: 1 = Virtual channel 1 Alarm 2 active Bit 3: 1 = Virtual channel 1 Alarm 2 not ack'd Bit 4: 1 = Virtual channel 2 Alarm 1 active Bit 5: 1 = Virtual channel 2 Alarm 1 not ack'd Bit 6: 1 = Virtual channel 2 Alarm 2 active	int16	01a5	421	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
AlarmSummary.StatusWord2 (Cont.)	Bit 7: 1 = Virtual channel 2 Alarm 2 not ack'd Bit 8: 1 = Virtual channel 3 Alarm 1 active Bit 9: 1 = Virtual channel 3 Alarm 1 not ack'd Bit 10: 1 = Virtual channel 3 Alarm 2 active Bit 11: 1 = Virtual channel 3 Alarm 2 not ack'd Bit 12: 1 = Virtual channel 4 Alarm 1 active Bit 13: 1 = Virtual channel 4 Alarm 1 not ack'd Bit 14: 1 = Virtual channel 4 Alarm 2 active Bit 15: 1 = Virtual channel 4 Alarm 2 not ack'd				
AlarmSummary.StatusWord3	A summary of Virtual Channel 5 to 8 alarms As for Status Word 2 but for virtual channs 5 to 8	int16	01a6	422	Not applicable
AlarmSummary.StatusWord4	A summary of Virtual Channel 9 to 12 alarms As for Status Word 2 but for virtual channs 9 to 12	int16	01a7	423	Not applicable
AlarmSummary.StatusWord5	A summary of Virtual Channel 13 to 14 alarms As for Status Word 2 but for virtual channs 13 to 14	int16	01a8	424	Not applicable
AlarmSummary.System.Alarm1ID	Most recent active system alarm 0 = No Alarm 1 = Low battery 2 = Battery failure 3 = System clock fail 4 = Channel error 5 = Channel fail 6 = DHCP server fail 7 = FTP Archive file lost 8 = FTP Archive slow 9 = FTP Primary server failure 10 = FTP Secondary server failure 11 = Insufficient non-volatile memory 12 = Maths channel failure 13 = Media archive file lost 14 = Media archive slow 15 = Network boot failure 16 = DC Output Cal. Error 17 = Recording failure 18 = Media failure 19: = Media full 20 =SNTP failure 21 = Time synchronisation failure 22 = Media missing 23: Archive disabled 24 = Archiving failed 25 = Archiving timed out 26 = USB Over Current 27 = USB unsuported 28 = Invalid parameter database 29 = Invalid non-volatile data 30 = Flash write failure 31 = Wiring failure 32 = Broadcast Storm 33 = Non-volatile memory write frequency warning	uint8	1210	4624	Not applicable
AlarmSummary.System.Alarm2ID	2nd most recent active system alarm (as Alarm1ID)	uint8	1211	4625	Not applicable
AlarmSummary.System.Alarm3ID	3rd most recent active system alarm (as Alarm1ID)	uint8	1212	4626	Not applicable
AlarmSummary.System.Alarm4ID	4th most recent active system alarm (as Alarm1ID)	uint8	1213	4627	Not applicable
AlarmSummary.System.Alarm5ID	5th most recent active system alarm (as Alarm1ID)	uint8	1214	4628	Not applicable
AlarmSummary.System.Alarm6ID	6th most recent active system alarm (as Alarm1ID)	uint8	1215	4629	Not applicable
AlarmSummary.System.Alarm7ID	7th most recent active system alarm (as Alarm1ID)	uint8	1216	4630	Not applicable
AlarmSummary.System.Alarm8ID	8th most recent active system alarm (as Alarm1ID)	uint8	1217	4631	Not applicable
AlarmSummary.System.Alarm9ID	9th most recent active system alarm (as Alarm1ID)	uint8	1218	4632	Not applicable
AlarmSummary.System.Alarm10ID	10th most recent active system alarm (as Alarm1ID)	uint8	1219	4633	Not applicable
AlarmSummary.System.Alarm11ID	11th most recent active system alarm (as Alarm1ID)	uint8	121a	4634	Not applicable
AlarmSummary.System.Alarm12ID	12th most recent active system alarm (as Alarm1ID)	uint8	121b	4635	Not applicable
AlarmSummary.System.Alarm13ID	13th most recent active system alarm (as Alarm1ID)	uint8	121c	4636	Not applicable
AlarmSummary.System.Alarm14ID	14th most recent active system alarm (as Alarm1ID)	uint8	121d	4637	Not applicable
AlarmSummary.System.Alarm15ID	15th most recent active system alarm (as Alarm1ID)	uint8	121e	4638	Not applicable
AlarmSummary.System.Alarm16ID	16th most recent active system alarm (as Alarm1ID)	uint8	121f	4639	Not applicable
AlarmSummary.System.Alarm17ID	17th most recent active system alarm (as Alarm1ID)	uint8	1220	4640	Not applicable
AlarmSummary.System.Alarm18ID	18th most recent active system alarm (as Alarm1ID)	uint8	1221	4641	Not applicable
AlarmSummary.System.Alarm19ID	19th most recent active system alarm (as Alarm1ID)	uint8	1222	4642	Not applicable
AlarmSummary.System.Alarm20ID	20th most recent active system alarm (as Alarm1ID)	uint8	1223	4643	Not applicable
AlarmSummary.System.Alarm21ID	21st most recent active system alarm (as Alarm1ID)	uint8	1224	4644	Not applicable
AlarmSummary.System.Alarm22ID	22nd most recent active system alarm (as Alarm1ID)	uint8	1225	4645	Not applicable
AlarmSummary.System.Alarm23ID	23rd most recent active system alarm (as Alarm1ID)	uint8	1226	4646	Not applicable
AlarmSummary.System.Alarm24ID	24th most recent active system alarm (as Alarm1ID)	uint8	1227	4647	Not applicable
AlarmSummary.System.Alarm25ID	25th most recent active system alarm (as Alarm1ID)	uint8	1228	4648	Not applicable
AlarmSummary.System.Alarm26ID	26th most recent active system alarm (as Alarm1ID)	uint8	1229	4649	Not applicable
AlarmSummary.System.Alarm27ID	27th most recent active system alarm (as Alarm1ID)	uint8	122a	4650	Not applicable
AlarmSummary.System.Alarm28ID	28th most recent active system alarm (as Alarm1ID)	uint8	122b	4651	Not applicable
AlarmSummary.System.Alarm29ID	29th most recent active system alarm (as Alarm1ID)	uint8	122c	4652	Not applicable
AlarmSummary.System.Alarm30ID	30th most recent active system alarm (as Alarm1ID)	uint8	122d	4653	Not applicable
AlarmSummary.System.Alarm31ID	31st most recent active system alarm (as Alarm1ID)	uint8	122e	4654	Not applicable
AlarmSummary.System.Alarm32ID	32nd most recent active system alarm (as Alarm1ID)	uint8	122f	4655	Not applicable
BCDInput.1.BCDVal	BCD1 BCD Value	uint8	2ed1	11985	Not applicable
BCDInput.1.DecByte	BCD1 Decimal Value	uint8	2ed0	11984	Not applicable
BCDInput.1.In1	BCD1 Input 1 (0 = Off; 1 = On)	bool	2ec8	11976	Not applicable
BCDInput.1.In2	BCD1 Input 2 (0 = Off; 1 = On)	bool	2ec9	11977	Not applicable
BCDInput.1.In3	BCD1 Input 3 (0 = Off; 1 = On)	bool	2eca	11978	Not applicable
BCDInput.1.In4	BCD1 Input 4 (0 = Off; 1 = On)	bool	2ecb	11979	Not applicable
BCDInput.1.In5	BCD1 Input 5 (0 = Off; 1 = On)	bool	2ecc	11980	Not applicable
BCDInput.1.In6	BCD1 Input 6 (0 = Off; 1 = On)	bool	2ecd	11981	Not applicable
BCDInput.1.In7	BCD1 Input 7 (0 = Off; 1 = On)	bool	2ece	11982	Not applicable
BCDInput.1.In8	BCD1 Input 8 (0 = Off; 1 = On)	bool	2ecf	11983	Not applicable
BCDInput.1.Tens	BCD1 Tens (MSD)	uint8	2ed3	11987	Not applicable
BCDInput.1.Units	BCD1 Units (LSD)	uint8	2ed2	11986	Not applicable
BCDInput.1.SettleTime	Settle Time	float32	3042	12354	1dp

Parameter path	Description	Type	Hex	Dec	Resolution
BCDInput.2.BCDVal	BCD2 BCD Value	uint8	2edd	11997	Not applicable
BCDInput.2.DecByte	BCD2 Decimal Value	uint8	2edc	11996	Not applicable
BCDInput.2.In1	BCD2 Input 1 (0 = Off; 1 = On)	bool	2ed4	11988	Not applicable
BCDInput.2.In2	BCD2 Input 2 (0 = Off; 1 = On)	bool	2ed5	11989	Not applicable
BCDInput.2.In3	BCD2 Input 3 (0 = Off; 1 = On)	bool	2ed6	11990	Not applicable
BCDInput.2.In4	BCD2 Input 4 (0 = Off; 1 = On)	bool	2ed7	11991	Not applicable
BCDInput.2.In5	BCD2 Input 5 (0 = Off; 1 = On)	bool	2ed8	11992	Not applicable
BCDInput.2.In6	BCD2 Input 6 (0 = Off; 1 = On)	bool	2ed9	11993	Not applicable
BCDInput.2.In7	BCD2 Input 7 (0 = Off; 1 = On)	bool	2eda	11994	Not applicable
BCDInput.2.In8	BCD2 Input 8 (0 = Off; 1 = On)	bool	2edb	11995	Not applicable
BCDInput.2.Tens	BCD2 Tens (MSD)	uint8	2edf	11999	Not applicable
BCDInput.2.Units	BCD2 Units (LSD)	uint8	2ede	11998	Not applicable
BCDInput.2.SettleTime	Settle Time	float32	3043	12355	1dp
Channel.1.Alarm1.Acknowledge	1 = Acknowledge alarm	bool	01b0	432	Not applicable
Channel.1.Alarm1.Acknowledgement	1 = Alarm acknowledged	bool	1850	6224	Not applicable
Channel.1.Alarm1.Active	1 = Alarm source active, or safe but not ack'd	bool	184b	6219	Not applicable
Channel.1.Alarm1.Amount	Alarm amount	float32	1848	6216	Same as Channel.1.Main.PV
Channel.1.Alarm1.AverageTime	Average time	time_t	184a	6218	Set by Network.Modbus.TimeFormat
Channel.1.Alarm1.Block	Blocking enable (0 = Off; 1 = On)	uint8	1842	6210	Not applicable
Channel.1.Alarm1.ChangeTime	Change time (0 = Per second; 1= Per minute; 2 =Per hour)	uint8	1849	6217	Not applicable
Channel.1.Alarm1.Deviation	Alarm deviation	float32	1847	6215	Same as Channel.1.Main.PV
Channel.1.Alarm1.Dwell	Alarm dwell	time_t	1845	6213	Set by Network.Modbus.TimeFormat
Channel.1.Alarm1.Hysteresis	Alarm hysteresis	float32	1844	6212	Same as Channel.1.Main.PV
Channel.1.Alarm1.Inactive	1 = the alarm is safe and acknowledged	bool	184e	6222	Not applicable
Channel.1.Alarm1.Inhibit	1 = the alarm is inhibited	bool	1851	6225	Not applicable
Channel.1.Alarm1.Latch	Alarm latch type 0 = None 1 = Auto 2 = Manual 3 = Trigger	uint8	1841	6209	Not applicable
Channel.1.Alarm1.NotAcknowledged	1 = the alarm has not been acknowledged	bool	184f	6223	Not applicable
Channel.1.Alarm1.Reference	Alarm reference	float32	1846	6214	Same as Channel.1.Main.PV
Channel.1.Alarm1.Status	Alarm status 0 = Off 1 = Active 2 = Safe not acknowledged 3 = Active not acknowledged	uint8	0102	258	Not applicable
Channel.1.Alarm1.Threshold	Alarm threshold	float32	1843	6211	Same as Channel.1.Main.PV
Channel.1.Alarm1.Type	Alarm type 0 = None 1 = Abs High 2 = Abs Low 3 = Dev high 4 = Dev Low 5 = Dev band 6 = ROC rising 7 = ROC falling 10 = Dig Off 11 = Dig high 12 = Dig Low	uint8	1840	6208	Not applicable
Channel.1.Alarm2.Acknowledge	1 = Acknowledge alarm	bool	01b1	433	Not applicable
Channel.1.Alarm2.Acknowledgement	1 = Alarm acknowledged	bool	1870	6256	Not applicable
Channel.1.Alarm2.Active	1 = Alarm source active, or safe but not ack'd	bool	186b	6251	Not applicable
Channel.1.Alarm2.Amount	Alarm amount	float32	1868	6248	Same as Channel.1.Main.PV
Channel.1.Alarm2.AverageTime	Average time	time_t	186a	6250	Set by Network.Modbus.TimeFormat
Channel.1.Alarm2.Block	Blocking enable (0 = Off; 1 = On)	uint8	1862	6242	Not applicable
Channel.1.Alarm2.ChangeTime	Change time (0 = Per second; 1= Per minute; 2 =Per hour)	uint8	1869	6249	Not applicable
Channel.1.Alarm2.Deviation	Alarm deviation	float32	1867	6247	Same as Channel.1.Main.PV
Channel.1.Alarm2.Dwell	Alarm dwell	time_t	1865	6245	Set by Network.Modbus.TimeFormat
Channel.1.Alarm2.Hysteresis	Alarm hysteresis	float32	1864	6244	Same as Channel.1.Main.PV
Channel.1.Alarm2.Inactive	1 = the alarm is safe and acknowledged	bool	186e	6254	Not applicable
Channel.1.Alarm2.Inhibit	1 = the alarm is inhibited	bool	1871	6257	Not applicable
Channel.1.Alarm2.Latch	Configures the latching type of the alarm (As Alarm1.Latch)	uint8	1861	6241	Not applicable
Channel.1.Alarm2.NotAcknowledged	1 = the alarm has not been acknowledged	bool	186f	6255	Not applicable
Channel.1.Alarm2.Reference	Alarm reference	float32	1866	6246	Same as Channel.1.Main.PV
Channel.1.Alarm2.Status	As Alarm1.Status	uint8	0103	259	Not applicable
Channel.1.Alarm2.Threshold	Alarm threshold	float32	1863	6243	Same as Channel.1.Main.PV
Channel.1.Alarm2.Type	Alarm type (as Alarm1.Type	uint8	1860	6240	Not applicable
Channel.1.Main.CJType	Cold junction compensation type 0 = None 1 = Internal 2 = External 3 = Remote (Ch1) 4 = Remote (Ch2) 5 = Remote (Ch3) 6 = Remote (Ch4)	uint8	180c	6156	Not applicable
Channel.1.Main.CloseString	Close String	string_t	4990	18832	Not applicable
Channel.1.Main.Descriptor	Text string to describe the channel	string_t	4900	18688	Not applicable
Channel.1.Main.ExtCJTemp	External CJ temperature	float32	180d	6157	1dp
Channel.1.Main.FaultResponse	Fault response. 0 = none; 1 = Drive high; 2 = Drive low	uint8	1810	6160	Not applicable
Channel.1.Main.Filter	Filter time constant	float32	180e	6158	1dp
Channel.1.Main.InputHigh	Input range high value	float32	1804	6148	1dp
Channel.1.Main.InputLow	Input range low value	float32	1803	6147	1dp
Channel.1.Main.InternalCJTemp	Channel internal cold junction temperature	float32	1815	6165	1dp
Channel.1.Main.IPAdjustState	Input Adjust state (0 = Unadjusted; 1 = Adjusted)	bool	1816	6166	Not applicable
Channel.1.Main.IPAdjustState2	Secondary Input Adjust state (0 = Unadjusted; 1 = Adjusted)	bool	181c	6172	Not applicable
Channel.1.Main.LinType	Linearisation type 0 =Type B 1 = Type C 2 = Type D 3 = Type E 4 = Type G2 5 = Type J 6 =Type K 7 = Type L 8 = Type N 9 = Type R 10 = Type S 11 = Type T 12 = Type U 13 = NiMoNiCo 14 = Platinel 15 = NiNiMo 16 = Pt20RhPt40Rh 17 = User 1 18 = User 2 19 = User 3 20 = User 4	uint8	1806	6150	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
	21 = Cu10 22 = Pt100 23 = Pt100A				
	24 = JPT100 25 = Ni100 26 = Ni120				
	27 = Cu53 28 = Linear 29 = Sqrt				
	30 = $x^{3/2}$ 32 = $x^{5/2}$				
Channel.1.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1814	6164	Set by Channel.1.Main.Resolution
Channel.1.Main.MeasuredValue2	Measured value of the secondary input	float32	1819	6169	Set by Channel.1.Main.Resolution
Channel.1.Main.Offset	Fixed value to be added to/subtracted from PV	float32	1817	6167	3dp
Channel.1.Main.Offset2	Secondary input offset (as above).	float32	1818	6168	3dp
Channel.1.Main.OpenString	Open String	string_t	496c	18796	Not applicable
Channel.1.Main.PV	The process variable (output) of the channel	float32	0100	256	Set by Channel.1.Main.Resolution
Channel.1.Main.PV2	The secondary input process variable (output) of the channel	float32	0110	272	Set by Channel.1.Main.Resolution
Channel.1.Main.RangeHigh	Range high value	float32	1808	6152	Set by Channel.1.Main.Resolution
Channel.1.Main.RangeLow	Range low value	float32	1807	6151	Set by Channel.1.Main.Resolution
Channel.1.Main.RangeUnits	Range units: 0 = °C; 1 = °F; 2 = Kelvins	uint8	1809	6153	Not applicable
Channel.1.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1801	6145	Not applicable
Channel.1.Main.ScaleHigh	Scale high value	float32	180b	6155	Set by Channel.1.Main.Resolution
Channel.1.Main.ScaleHigh2	Scale high value for the secondary input	float32	181b	6171	Set by Channel.1.Main.Resolution
Channel.1.Main.ScaleLow	Scale low value	float32	180a	6154	Set by Channel.1.Main.Resolution
Channel.1.Main.ScaleLow2	Scale low value for the secondary input	float32	181a	6170	Set by Channel.1.Main.Resolution
Channel.1.Main.SensorBreakType	Sensor break type: 0 =Off; 1 = Low; 2 = High	uint8	180f	6159	Not applicable
Channel.1.Main.SensorBreakVal	Sensor break value	uint8	1811	6161	Not applicable
Channel.1.Main.Shunt	Shunt value (Ohms)	float32	1805	6149	2dp
Channel.1.Main.Status	The PV (output) status	uint8	0101	257	Not applicable
	0 =Good 1 = Off 2 = Over range				
	3 = Under range 4 = HW error 5 = Ranging				
	6 = Overflow 7 = bad 8 = HW exceeded				
	9 = No data 12 = Comm channel error				
Channel.1.Main.Status2	The secondary input PV (output) status (as above)	uint8	0111	273	Not applicable
Channel.1.Main.TestSignal	Channel test waveform	uint8	1802	6146	Not applicable
	0 = Triangle 5hr 1 = Triangle 40 min				
	2 = Triangle 4 min 3 = Triangle 40 sec				
	4 = Sine 5 hr 5 = Sine 40 min				
	6 = Sine 4 min 7 = Sine 40 sec				
Channel.1.Main.Type	Specifies the type of channel	uint8	1800	6144	Not applicable
	0 = Off 1 = TC 2 = mV				
	3 = V 4 = mA 5 = RTD				
	6 = Digital 7 = Test 8 = Ohms				
	9 = Dual mV 10 = Dual mA 11 = Dual TC				
Channel.1.Main.Units	Units descriptor	string_t	4915	18709	Not applicable
Channel.1.Trend.Colour	Configures the trend colour for this channel	uint8	1820	6176	Not applicable
	0 = Red 1 = Blue 2 = Green				
	3 = Honey 4 = Violet 5 = Russet				
	6 = Dark blue 7 = Jade 8 = Magenta				
	9 = Dusky rose 10 = Yellow 11 = Powder blue				
	12 = Dark red 13 = Avocado 14 = Indigo				
	15 = Dark brown 16 = Aegean 17 = Cyan				
	18 = Aubergine 19 = Dark orange 20 = Pale yellow				
	21 = Hyacinth 22 = Dark green 23 = Sugar pink				
	24 = Bluebell 25 = Orange 26 = Pink				
	27 = Buttersilk 28 = Terracotta 29 = Blue babe				
	30 = Lime 31 = Blue jive 32 = Cucumber				
	33 = Eurogreen 34 = Wheatgerm 35 = Sea Blue				
	36 = Ginger 37 = Aqua pool 38 = Pale red				
	39 = Pale blue 40 = Lilac 41 = Sky blue				
	42 = Wild moss 43 = Turquoise 44 = Pale green				
	45 = Coffee 49 = Dark Grey 53 = Light grey				
Channel.1.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1822	6178	Same as Channel.1.Main.PV
Channel.1.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1821	6177	Same as Channel.1.Main.PV
Channel.2.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01b2	434	Not applicable
Channel.2.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	18d0	6352	Not applicable
Channel.2.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	18cb	6347	Not applicable
Channel.2.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	18c8	6344	Same as Channel.2.Main.PV
Channel.2.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	18ca	6346	Set by Network.Modbus.TimeFormat
Channel.2.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	18c2	6338	Not applicable
Channel.2.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	18c9	6345	Not applicable
Channel.2.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	18c7	6343	Same as Channel.2.Main.PV
Channel.2.Alarm1.Dwell	Alarm dwell time	time_t	18c5	6341	Set by Network.Modbus.TimeFormat
Channel.2.Alarm1.Hysteresis	Alarm hysteresis value	float32	18c4	6340	Same as Channel.2.Main.PV
Channel.2.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	18ce	6350	Not applicable
Channel.2.Alarm1.Inhibit	1 = Alarm inhibited	bool	18d1	6353	Not applicable
Channel.2.Alarm1.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	18c1	6337	Not applicable
Channel.2.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	18cf	6351	Not applicable
Channel.2.Alarm1.Reference	Deviation alarm 'Reference' value	float32	18c6	6342	Same as Channel.2.Main.PV
Channel.2.Alarm1.Status	Alarm status (as for Channel.1.Alarm1)	uint8	0106	262	Not applicable
Channel.2.Alarm1.Threshold	Alarm trigger threshold	float32	18c3	6339	Same as Channel.2.Main.PV
Channel.2.Alarm1.Type	Alarm type (as for Channel.1.Alarm1)	uint8	18c0	6336	Not applicable
Channel.2.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01b3	435	Not applicable
Channel.2.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	18f0	6384	Not applicable
Channel.2.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	18eb	6379	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Channel.2.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	18e8	6376	Same as Channel.2.Main.PV
Channel.2.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	18ea	6378	Set by Network.Modbus.TimeFormat
Channel.2.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	18e2	6370	Not applicable
Channel.2.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	18e9	6377	Not applicable
Channel.2.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	18e7	6375	Same as Channel.2.Main.PV
Channel.2.Alarm2.Dwell	Alarm dwell time	time_t	18e5	6373	Set by Network.Modbus.TimeFormat
Channel.2.Alarm2.Hysteresis	Alarm hysteresis value	float32	18e4	6372	Same as Channel.2.Main.PV
Channel.2.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	18ee	6382	Not applicable
Channel.2.Alarm2.Inhibit	1 = Alarm inhibited	bool	18f1	6385	Not applicable
Channel.2.Alarm2.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	18e1	6369	Not applicable
Channel.2.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	18ef	6383	Not applicable
Channel.2.Alarm2.Reference	Deviation alarm 'Reference' value	float32	18e6	6374	Same as Channel.2.Main.PV
Channel.2.Alarm2.Status	Alarm status (as for Channel.1.Alarm1)	uint8	0107	263	Not applicable
Channel.2.Alarm2.Threshold	Alarm trigger threshold	float32	18e3	6371	Same as Channel.2.Main.PV
Channel.2.Alarm2.Type	Alarm type (as for Channel.1.Alarm1)	uint8	18e0	6368	Not applicable
Channel.2.Main.CJType	Cold junction compensation type (as for Channel.1.Main)	uint8	188c	6284	Not applicable
Channel.2.Main.CloseString	Close String	string_t	4999	18841	Not applicable
Channel.2.Main.Descriptor	Text string to describe the channel	string_t	491b	18715	Not applicable
Channel.2.Main.ExtCJTemp	External CJ temperature	float32	188d	6285	1dp
Channel.2.Main.FaultResponse	Input fault response	uint8	1890	6288	Not applicable
Channel.2.Main.Filter	Filter time constant	float32	188e	6286	1dp
Channel.2.Main.InputHigh	Input range high value	float32	1884	6276	1dp
Channel.2.Main.InputLow	Input range low value	float32	1883	6275	1dp
Channel.2.Main.InternalCJTemp	Channel 2 internal cold junction temperature	float32	1895	6293	1dp
Channel.2.Main.IPAdjustState	Input Adjust state (0 = Unadjusted; 1 =Adjusted)	bool	1896	6294	Not applicable
Channel.2.Main.IPAdjustState2	Secondary Input Adjust state (0 = Unadjusted; 1 = Adjusted)	bool	189c	6300	Not applicable
Channel.2.Main.LinType	Linearisation type (as for Channel.1.Main)	uint8	1886	6278	Not applicable
Channel.2.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1894	6292	Set by Channel.2.Main.Resolution
Channel.2.Main.MeasuredValue2	Measured value of the secondary input	float32	1899	6297	Set by Channel.2.Main.Resolution
Channel.2.Main.Offset	Fixed value to be added to/subtracted from PV	float32	1897	6295	3dp
Channel.2.Main.Offset2	Secondary input offset	float32	1898	6296	3dp
Channel.2.Main.OpenString	Open String	string_t	4975	18805	Not applicable
Channel.2.Main.PV	The output (displayed) value of the channel.	float32	0104	260	Set by Channel.2.Main.Resolution
Channel.2.Main.PV2	The secondary input process variable (output) of the channel	float32	0114	276	Set by Channel.2.Main.Resolution
Channel.2.Main.RangeHigh	Range high value	float32	1888	6280	Set by Channel.2.Main.Resolution
Channel.2.Main.RangeLow	Range low value	float32	1887	6279	Set by Channel.2.Main.Resolution
Channel.2.Main.RangeUnits	Range units (as channel.1.Main)	uint8	1889	6281	Not applicable
Channel.2.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1881	6273	Not applicable
Channel.2.Main.ScaleHigh	Scale high value	float32	188b	6283	Set by Channel.2.Main.Resolution
Channel.2.Main.ScaleHigh2	Scale high value for the secondary input	float32	189b	6299	Set by Channel.2.Main.Resolution
Channel.2.Main.ScaleLow	Scale low value	float32	188a	6282	Set by Channel.2.Main.Resolution
Channel.2.Main.ScaleLow2	Scale low value for the secondary input	float32	189a	6298	Set by Channel.2.Main.Resolution
Channel.2.Main.SensorBreakType	Sensor break type (as for Channel.1.Main)	uint8	188f	6287	Not applicable
Channel.2.Main.SensorBreakVal	Sensor break value	uint8	1891	6289	Not applicable
Channel.2.Main.Shunt	Shunt value in Ohms	float32	1885	6277	2dp
Channel.2.Main.Status	Channel status (as for Channel.1.Main.Status)	uint8	0105	261	Not applicable
Channel.2.Main.Status2	The secondary input PV (output) status (as above)	uint8	0115	277	Not applicable
Channel.2.Main.TestSignal	Channel test waveform (as for Channel.1.Main)	uint8	1882	6274	Not applicable
Channel.2.Main.Type	Channel function (as for Channel.1.Main.Type)	uint8	1880	6272	Not applicable
Channel.2.Main.Units	Channel units string	string_t	4930	18736	Not applicable
Channel.2.Trend.Colour	Trend colour (as for Channel.1.Trend.Colour)	uint8	18a0	6304	Not applicable
Channel.2.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	18a2	6306	Same as Channel.2.Main.PV
Channel.2.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	18a1	6305	Same as Channel.2.Main.PV
Channel.3.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1950	6480	Not applicable
Channel.3.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	194b	6475	Not applicable
Channel.3.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1948	6472	Same as Channel.3.Main.PV
Channel.3.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	194a	6474	Set by Network.Modbus.TimeFormat
Channel.3.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	1942	6466	Not applicable
Channel.3.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1949	6473	Not applicable
Channel.3.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1947	6471	Same as Channel.3.Main.PV
Channel.3.Alarm1.Dwell	Alarm dwell time	time_t	1945	6469	Set by Network.Modbus.TimeFormat
Channel.3.Alarm1.Hysteresis	Alarm hysteresis value	float32	1944	6468	Same as Channel.3.Main.PV
Channel.3.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	194e	6478	Not applicable
Channel.3.Alarm1.Inhibit	1 = alarm inhibited	bool	1951	6481	Not applicable
Channel.3.Alarm1.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	1941	6465	Not applicable
Channel.3.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	194f	6479	Not applicable
Channel.3.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1946	6470	Same as Channel.3.Main.PV
Channel.3.Alarm1.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010a	266	Not applicable
Channel.3.Alarm1.Threshold	Alarm trigger threshold	float32	1943	6467	Same as Channel.3.Main.PV
Channel.3.Alarm1.Type	Alarm type (as for Channel.1.Alarm1)	uint8	1940	6464	Not applicable
Channel.3.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01b5	437	Not applicable
Channel.3.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1970	6512	Not applicable
Channel.3.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	196b	6507	Not applicable
Channel.3.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1968	6504	Same as Channel.3.Main.PV
Channel.3.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	196a	6506	Set by Network.Modbus.TimeFormat
Channel.3.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	1962	6498	Not applicable
Channel.3.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1969	6505	Not applicable
Channel.3.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1967	6503	Same as Channel.3.Main.PV
Channel.3.Alarm2.Dwell	Alarm dwell time	time_t	1965	6501	Set by Network.Modbus.TimeFormat
Channel.3.Alarm2.Hysteresis	Alarm hysteresis value	float32	1964	6500	Same as Channel.3.Main.PV

Parameter path	Description	Type	Hex	Dec	Resolution
Channel.3.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	196e	6510	Not applicable
Channel.3.Alarm2.Inhibit	1 = Alarm inhibited	bool	1971	6513	Not applicable
Channel.3.Alarm2.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	1961	6497	Not applicable
Channel.3.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	196f	6511	Not applicable
Channel.3.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1966	6502	Same as Channel.3.Main.PV
Channel.3.Alarm2.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010b	267	Not applicable
Channel.3.Alarm2.Threshold	Alarm trigger threshold	float32	1963	6499	Same as Channel.3.Main.PV
Channel.3.Alarm2.Type	Alarm type (as for Channel.1.Alarm1)	uint8	1960	6496	Not applicable
Channel.3.Main.CJType	Cold junction compensation type (as for Channel.1.Main)	uint8	190c	6412	Not applicable
Channel.3.Main.CloseString	Close String	string_t	49a2	18850	Not applicable
Channel.3.Main.Descriptor	Text string to describe the channel	string_t	4936	18742	Not applicable
Channel.3.Main.ExtCJTemp	External CJ temperature	float32	190d	6413	1dp
Channel.3.Main.FaultResponse	Input fault response (As for Channel.1.Main)	uint8	1910	6416	Not applicable
Channel.3.Main.Filter	Filter time constant	float32	190e	6414	1dp
Channel.3.Main.InputHigh	Input range maximum value	float32	1904	6404	1dp
Channel.3.Main.InputLow	Input range minimum value	float32	1903	6403	1dp
Channel.3.Main.InternalCJTemp	Channel internal cold junction temperature	float32	1915	6421	1dp
Channel.3.Main.IPAdjustState	Input Adjust state (0 = Unadjusted; 1 = Adjusted)	bool	1916	6422	Not applicable
Channel.3.Main.IPAdjustState2	Secondary Input Adjust state (0 = Unadjusted; 1 = Adjusted)	bool	191c	6428	Not applicable
Channel.3.Main.LinType	Linearisation type (as for Channel.1.Main.LinType)	uint8	1906	6406	Not applicable
Channel.3.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1914	6420	Set by Channel.3.Main.Resolution
Channel.3.Main.MeasuredValue2	Measured value of the secondary input	float32	1919	6425	Set by Channel.3.Main.Resolution
Channel.3.Main.Offset	Input offset	float32	1917	6423	3dp
Channel.3.Main.Offset2	Secondary input offset	float32	1918	6424	3dp
Channel.3.Main.OpenString	Open String	string_t	497e	18814	Not applicable
Channel.3.Main.PV	The output (displayed) value of the channel.	float32	0108	264	Set by Channel.3.Main.Resolution
Channel.3.Main.PV2	The secondary input process variable (output) of the channel	float32	0118	280	Set by Channel.3.Main.Resolution
Channel.3.Main.RangeHigh	Range high value	float32	1908	6408	Set by Channel.3.Main.Resolution
Channel.3.Main.RangeLow	Range low value	float32	1907	6407	Set by Channel.3.Main.Resolution
Channel.3.Main.RangeUnits	Range units	uint8	1909	6409	Not applicable
Channel.3.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1901	6401	Not applicable
Channel.3.Main.ScaleHigh	Scale high value	float32	190b	6411	Set by Channel.3.Main.Resolution
Channel.3.Main.ScaleHigh2	Scale high value for the secondary input	float32	191b	6427	Set by Channel.3.Main.Resolution
Channel.3.Main.ScaleLow	Scale low value	float32	190a	6410	Set by Channel.3.Main.Resolution
Channel.3.Main.ScaleLow2	Scale low value for the secondary input	float32	191a	6426	Set by Channel.3.Main.Resolution
Channel.3.Main.SensorBreakType	Sensor break type (as for Channel.1.Main)	uint8	190f	6415	Not applicable
Channel.3.Main.SensorBreakVal	Sensor break value	uint8	1911	6417	Not applicable
Channel.3.Main.Shunt	Shunt value in Ohms	float32	1905	6405	2dp
Channel.3.Main.Status	Channel status (as for Channel.1.Main.Status)	uint8	0109	265	Not applicable
Channel.3.Main.Status2	The secondary input PV (output) status	uint8	0119	281	Not applicable
Channel.3.Main.TestSignal	Channel test waveform (as for Channel.1.Main)	uint8	1902	6402	Not applicable
Channel.3.Main.Type	Channel function (as for Channel.1.Main.Type)	uint8	1900	6400	Not applicable
Channel.3.Main.Units	Units descriptor	string_t	494b	18763	Not applicable
Channel.3.Trend.Colour	Trend colour (as for Channel.1.Trend.Colour)	uint8	1920	6432	Not applicable
Channel.3.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1922	6434	Same as Channel.3.Main.PV
Channel.3.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1921	6433	Same as Channel.3.Main.PV
Channel.4.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01b6	438	Not applicable
Channel.4.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	19d0	6608	Not applicable
Channel.4.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	19cb	6603	Not applicable
Channel.4.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	19c8	6600	Same as Channel.4.Main.PV
Channel.4.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	19ca	6602	Set by Network.Modbus.TimeFormat
Channel.4.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	19c2	6594	Not applicable
Channel.4.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	19c9	6601	Not applicable
Channel.4.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	19c7	6599	Same as Channel.4.Main.PV
Channel.4.Alarm1.Dwell	Alarm dwell time	time_t	19c5	6597	Set by Network.Modbus.TimeFormat
Channel.4.Alarm1.Hysteresis	Alarm hysteresis value	float32	19c4	6596	Same as Channel.4.Main.PV
Channel.4.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	19ce	6606	Not applicable
Channel.4.Alarm1.Inhibit	1 = alarm inhibited	bool	19d1	6609	Not applicable
Channel.4.Alarm1.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	19c1	6593	Not applicable
Channel.4.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	19cf	6607	Not applicable
Channel.4.Alarm1.Reference	Deviation alarm 'Reference' value	float32	19c6	6598	Same as Channel.4.Main.PV
Channel.4.Alarm1.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010e	270	Not applicable
Channel.4.Alarm1.Threshold	Alarm trigger threshold	float32	19c3	6595	Same as Channel.4.Main.PV
Channel.4.Alarm1.Type	Alarm type (as for Channel.1.Alarm1)	uint8	19c0	6592	Not applicable
Channel.4.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01b7	439	Not applicable
Channel.4.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	19f0	6640	Not applicable
Channel.4.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	19eb	6635	Not applicable
Channel.4.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	19e8	6632	Same as Channel.4.Main.PV
Channel.4.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	19ea	6634	Set by Network.Modbus.TimeFormat
Channel.4.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	19e2	6626	Not applicable
Channel.4.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	19e9	6633	Not applicable
Channel.4.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	19e7	6631	Same as Channel.4.Main.PV
Channel.4.Alarm2.Dwell	Alarm dwell time	time_t	19e5	6629	Set by Network.Modbus.TimeFormat
Channel.4.Alarm2.Hysteresis	Alarm hysteresis value	float32	19e4	6628	Same as Channel.4.Main.PV
Channel.4.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	19ee	6638	Not applicable
Channel.4.Alarm2.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	19e1	6625	Not applicable
Channel.4.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	19ef	6639	Not applicable
Channel.4.Alarm2.Reference	Deviation alarm 'Reference' value	float32	19e6	6630	Same as Channel.4.Main.PV
Channel.4.Alarm2.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010f	271	Not applicable
Channel.4.Alarm2.Threshold	Alarm trigger threshold	float32	19e3	6627	Same as Channel.4.Main.PV

Parameter path	Description	Type	Hex	Dec	Resolution
Channel.4.Alarm2.Type	Alarm type (as for Channel.1.Alarm1)	uint8	19e0	6624	Not applicable
Channel.4.Main.CJType	Cold junction compensation type(as for Channel.1.Main)	uint8	198c	6540	Not applicable
Channel.4.Main.CloseString	Close String	string_t	49ab	18859	Not applicable
Channel.4.Main.Descriptor	Text string to describe the channel	string_t	4951	18769	Not applicable
Channel.4.Main.ExtCJTemp	External CJ temperature	float32	198d	6541	1dp
Channel.4.Main.FaultResponse	Input fault response (as for Channel.1.Main)	uint8	1990	6544	Not applicable
Channel.4.Main.Filter	Filter time constant	float32	198e	6542	1dp
Channel.4.Main.InputHigh	Input range maximum value	float32	1984	6532	1dp
Channel.4.Main.InputLow	Input range minimum value	float32	1983	6531	1dp
Channel.4.Main.InternalCJTemp	Channel internal cold junction temperature	float32	1995	6549	1dp
Channel.4.Main.IPAdjustState	Input Adjust state (0 = Unadjusted;1 =Adjusted)	bool	1996	6550	Not applicable
Channel.4.Main.IPAdjustState2	Secondary Input Adjust state (0 = Unadjusted; 1 = Adjusted	bool	199c	6556	Not applicable
Channel.4.Main.LinType	Linearisation type (as for Channel.1.Main.LinType)	uint8	1986	6534	Not applicable
Channel.4.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1994	6548	Set by Channel.4.Main.Resolution
Channel.4.Main.MeasuredValue2	Measured value of the secondary input	float32	1999	6553	Set by Channel.4.Main.Resolution
Channel.4.Main.Offset	Fixed value to be added to/subtracted from PV	float32	1997	6551	3dp
Channel.4.Main.Offset2	Secondary input offset	float32	1998	6552	3dp
Channel.4.Main.OpenString	Open String	string_t	4987	18823	Not applicable
Channel.4.Main.PV	The output (displayed) value of the channel.	float32	010c	268	Set by Channel.4.Main.Resolution
Channel.4.Main.PV2	The secondary input process variable (output) of the channel	float32	011c	284	Set by Channel.4.Main.Resolution
Channel.4.Main.RangeHigh	Range high value	float32	1988	6536	Set by Channel.4.Main.Resolution
Channel.4.Main.RangeLow	Range low value	float32	1987	6535	Set by Channel.4.Main.Resolution
Channel.4.Main.RangeUnits	Range units (as channel.1.Main.RangeUnits)	uint8	1989	6537	Not applicable
Channel.4.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1981	6529	Not applicable
Channel.4.Main.ScaleHigh	Scale high value	float32	198b	6539	Set by Channel.4.Main.Resolution
Channel.4.Main.ScaleHigh2	Scale high value for the secondary input	float32	199b	6555	Set by Channel.4.Main.Resolution
Channel.4.Main.ScaleLow	Scale low value	float32	198a	6538	Set by Channel.4.Main.Resolution
Channel.4.Main.ScaleLow2	Scale low value for the secondary input	float32	199a	6554	Set by Channel.4.Main.Resolution
Channel.4.Main.SensorBreakType	Sensor break type (as for Channel.1.Main)	uint8	198f	6543	Not applicable
Channel.4.Main.SensorBreakVal	Sensor break value	uint8	1991	6545	Not applicable
Channel.4.Main.Shunt	Shunt value in Ohms	float32	1985	6533	2dp
Channel.4.Main.Status	Channel status (as for Channel.1.Main.Status)	uint8	010d	269	Not applicable
Channel.4.Main.Status2	The secondary input PV (output) status	uint8	011d	285	Not applicable
Channel.4.Main.TestSignal	Channel test waveform (as for Channel.1.Main.TestSignal)	uint8	1982	6530	Not applicable
Channel.4.Main.Type	Channel function (as for Channel.1.Main.Type)	uint8	1980	6528	Not applicable
Channel.4.Main.Units	Units descriptor	string_t	4966	18790	Not applicable
Channel.4.Trend.Colour	Trend colour (as for Channel.1.Trend.Colour)	uint8	19a0	6560	Not applicable
Channel.4.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	19a2	6562	Same as Channel.4.Main.PV
Channel.4.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	19a1	6561	Same as Channel.4.Main.PV
CustomMessage.Message1	Custom message No 1	string_t	5e00	24064	Not applicable
CustomMessage.Message2	Custom message No 2	string_t	5e65	24165	Not applicable
CustomMessage.Message3	Custom message No 3	string_t	5eca	24266	Not applicable
CustomMessage.Message4	Custom message No 4	string_t	5f2f	24367	Not applicable
CustomMessage.Message5	Custom message No 5	string_t	5f94	24468	Not applicable
CustomMessage.Message6	Custom message No 6	string_t	5ff9	24569	Not applicable
CustomMessage.Message7	Custom message No 7	string_t	605e	24670	Not applicable
CustomMessage.Message8	Custom message No 8	string_t	60c3	24771	Not applicable
CustomMessage.Message9	Custom message No 9	string_t	6128	24872	Not applicable
CustomMessage.Message10	Custom message No 10	string_t	618d	24973	Not applicable
CustomMessage.Trigger1	Trigger for custom message No 1	bool	28f0	10480	Not applicable
CustomMessage.Trigger2	Trigger for custom message No 2	bool	28f1	10481	Not applicable
CustomMessage.Trigger3	Trigger for custom message No 3	bool	28f2	10482	Not applicable
CustomMessage.Trigger4	Trigger for custom message No 4	bool	28f3	10483	Not applicable
CustomMessage.Trigger5	Trigger for custom message No 5	bool	28f4	10484	Not applicable
CustomMessage.Trigger6	Trigger for custom message No 6	bool	28f5	10485	Not applicable
CustomMessage.Trigger7	Trigger for custom message No 7	bool	28f6	10486	Not applicable
CustomMessage.Trigger8	Trigger for custom message No 8	bool	28f7	10487	Not applicable
CustomMessage.Trigger9	Trigger for custom message No 9	bool	28f8	10488	Not applicable
CustomMessage.Trigger10	Trigger for custom message No 10	bool	28f9	10489	Not applicable
DCOutput.1A1B_DCOP.FallbackPV	Fallback PV value	float32	15c9	5577	Set by DCOutput.1A1B_DCOP.Resolution
DCOutput.1A1B_DCOP.MeasuredValue	Measured Value	float32	15ca	5578	2dp
DCOutput.1A1B_DCOP.OPAdjustState	0 = Unadjusted, 1 = Adjusted	bool	15c3	5571	Not applicable
DCOutput.1A1B_DCOP.OutputHigh	DC Output High value	float32	15c6	5574	2dp
DCOutput.1A1B_DCOP.OutputLow	DC Output Low value	float32	15c5	5573	2dp
DCOutput.1A1B_DCOP.PV	DC Output PV	float32	15c1	5569	Set by DCOutput.1A1B_DCOP.Resolution
DCOutput.1A1B_DCOP.Resolution	Specifies the resolution/number of decimal places	uint8	15c4	5572	Not applicable
DCOutput.1A1B_DCOP.ScaleHigh	Scale High value	float32	15c8	5576	Set by DCOutput.1A1B_DCOP.Resolution
DCOutput.1A1B_DCOP.ScaleLow	Scale Low value	float32	15c7	5575	Set by DCOutput.1A1B_DCOP.Resolution
DCOutput.1A1B_DCOP.Status	PV Status 0 = Good 1 = Off 2 = Over range 3 = Under range 4 = HW error 5 = Ranging 6 = Overflow 7 = Bad 8 = HW exceeded 9 = No data	uint8	15c2	5570	Not applicable
DCOutput.1A1B_DCOP.Type	DC Output Type (0 = Volts; 1 = mA)	uint8	15c0	5568	Not applicable
DCOutput.2A2B_DCOP.FallbackPV	Fallback PV value	float32	15b9	5561	Set by DCOutput.2A2B_DCOP.Resolution
DCOutput.2A2B_DCOP.MeasuredValue	Measured Value	float32	15ba	5562	2dp

Parameter path	Description	Type	Hex	Dec	Resolution
DCOutput.2A2B_DCOP.OPAdjustState	0 = Unadjusted, 1 = Adjusted	bool	15b3	5555	Not applicable
DCOutput.2A2B_DCOP.OutputHigh	DC Output High value	float32	15b6	5558	2dp
DCOutput.2A2B_DCOP.OutputLow	DC Output Low value	float32	15b5	5557	2dp
DCOutput.2A2B_DCOP.PV	DC Output PV	float32	15b1	5553	Set by DCOutput.2A2B_DCOP.Resolution
DCOutput.2A2B_DCOP.Resolution	Specifies the resolution/number of decimal places	uint8	15b4	5556	Not applicable
DCOutput.2A2B_DCOP.ScaleHigh	Scale High value	float32	15b8	5560	Set by DCOutput.2A2B_DCOP.Resolution
DCOutput.2A2B_DCOP.ScaleLow	Scale Low value	float32	15b7	5559	Set by DCOutput.2A2B_DCOP.Resolution
DCOutput.2A2B_DCOP.Status	PV Status (as DCOutput.1A1B_DCOP.Status)	uint8	15b2	5554	Not applicable
DCOutput.2A2B_DCOP.Type	DC Output Type (0 = Volts; 1 = mA)	uint8	15b0	5552	Not applicable
DCOutput.3A3B_DCOP.FallbackPV	Fallback PV value	float32	15a9	5545	Set by DCOutput.3A3B_DCOP.Resolution
DCOutput.3A3B_DCOP.MeasuredValue	Measured Value	float32	15aa	5546	2dp
DCOutput.3A3B_DCOP.OPAdjustState	0 = Unadjusted, 1 = Adjusted	bool	15a3	5539	Not applicable
DCOutput.3A3B_DCOP.OutputHigh	DC Output High value	float32	15a6	5542	2dp
DCOutput.3A3B_DCOP.OutputLow	DC Output Low value	float32	15a5	5541	2dp
DCOutput.3A3B_DCOP.PV	DC Output PV	float32	15a1	5537	Set by DCOutput.3A3B_DCOP.Resolution
DCOutput.3A3B_DCOP.Resolution	Specifies the resolution/number of decimal places	uint8	15a4	5540	Not applicable
DCOutput.3A3B_DCOP.ScaleHigh	Scale High value	float32	15a8	5544	Set by DCOutput.3A3B_DCOP.Resolution
DCOutput.3A3B_DCOP.ScaleLow	Scale Low value	float32	15a7	5543	Set by DCOutput.3A3B_DCOP.Resolution
DCOutput.3A3B_DCOP.Status	PV Status (as DCOutput.1A1B_DCOP.Status)	uint8	15a2	5538	Not applicable
DCOutput.3A3B_DCOP.Type	DC Output Type (0 = Volts; 1 = mA)	uint8	15a0	5536	Not applicable
DigitalIO.1A1B.Backlash	Valve positioning backlash compensation (seconds)	float32	1508	5384	1dp
DigitalIO.1A1B.Inertia	Inertia value for the valve	float32	1507	5383	1dp
DigitalIO.1A1B.Invert	1 = Invert; 0 = Do not invert	bool	1503	5379	Not applicable
DigitalIO.1A1B.MinOnTime	Time proportioned output minimum on time	float32	1502	5378	2dp
DigitalIO.1A1B.ModuleIdent	Module Identification 0 = Digital I/O 1 = Relay output 2 = Triac output 3 = Digital input 4 = Digital output	uint8	150a	5386	Not applicable
DigitalIO.1A1B.Output	0 = Output off, 1 = Output on	bool	1504	5380	Not applicable
DigitalIO.1A1B.PV	For contact inputs, 0 = Open, 1 = Closed. For On Off outputs, <0.5 = Drive low, else drive high For Time Proportional outputs, PV = demanded output %	float32	1501	5377	0dp
DigitalIO.1A1B.StandbyAction	Valve positioning standby action (0 = Continue; 1 = Freeze).	uint8	1509	5385	Not applicable
DigitalIO.1A1B.Type	Specifies the type of the digital input / output 0 = Contact closure input 1 = On Off output 2 = Time proportioniing output 3 = Valve raise 4 = Valve lower	uint8	1500	5376	Not applicable
DigitalIO.2A2B.Backlash	Valve positioning backlash compensation (seconds)	float32	1518	5400	1dp
DigitalIO.2A2B.Inertia	Inertia value for the valve	float32	1517	5399	1dp
DigitalIO.2A2B.Invert	1 = Invert; 0 = Do not invert	bool	1513	5395	Not applicable
DigitalIO.2A2B.MinOnTime	Time proportioned output minimum on time	float32	1512	5394	2dp
DigitalIO.2A2B.ModuleIdent	As DigitalIO.1A1B.ModuleIdent	uint8	151a	5402	Not applicable
DigitalIO.2A2B.Output	0 = Output off, 1 = Output on	bool	1514	5396	Not applicable
DigitalIO.2A2B.PV	Digital I/O process value (as DigitalIO.1A1B.PV)	float32	1511	5393	0dp
DigitalIO.2A2B.StandbyAction	Valve positioning standby action (0 = Continue; 1 = Freeze).	uint8	1519	5401	Not applicable
DigitalIO.2A2B.Type	Digital I/O type (as DigitalIO.1A1B.Type).	uint8	1510	5392	Not applicable
DigitalIO.3A3B.Backlash	Valve positioning backlash compensation (seconds)	float32	1538	5432	1dp
DigitalIO.3A3B.Inertia	Inertia value for the valve	float32	1537	5431	1dp
DigitalIO.3A3B.Invert	1 = Invert; 0 = Do not invert	bool	1533	5427	Not applicable
DigitalIO.3A3B.MinOnTime	Time proportioned output minimum on time	float32	1532	5426	2dp
DigitalIO.3A3B.ModuleIdent	As DigitalIO.1A1B.ModuleIdent	uint8	153a	5434	Not applicable
DigitalIO.3A3B.Output	0 = Output off, 1 = Output on	bool	1534	5428	Not applicable
DigitalIO.3A3B.PV	Digital I/O process value (as DigitalIO.1A1B.PV)	float32	1531	5425	0dp
DigitalIO.3A3B.StandbyAction	Valve positioning standby action (0 = Continue; 1 = Freeze).	uint8	1539	5433	Not applicable
DigitalIO.3A3B.Type	Digital I/O type (as DigitalIO.1A1B.Type).	uint8	1530	5424	Not applicable
DigitalIO.DI_LALC.Backlash	Valve positioning backlash compensation (seconds)	float32	1528	5416	1dp
DigitalIO.DI_LALC.Inertia	Inertia value for the valve	float32	1527	5415	1dp
DigitalIO.DI_LALC.Invert	1 = Invert; 0 = Do not invert	bool	1523	5411	Not applicable
DigitalIO.DI_LALC.MinOnTime	Time proportioned output minimum on time	float32	1522	5410	2dp
DigitalIO.DI_LALC.ModuleIdent	As DigitalIO.1A1B.ModuleIdent	uint8	152a	5418	Not applicable
DigitalIO.DI_LALC.Output	0 = Output off, 1 = Output on	bool	1524	5412	Not applicable
DigitalIO.DI_LALC.PV	Digital I/O process value (as DigitalIO.1A1B.PV)	float32	1521	5409	0dp
DigitalIO.DI_LALC.StandbyAction	Valve positioning standby action (0 = Continue; 1 = Freeze).	uint8	1529	5417	Not applicable
DigitalIO.DI_LALC.Type	Digital I/O type (as DigitalIO.1A1B.Type).	uint8	1520	5408	Not applicable
DigitalIO.DI_LBLC.Backlash	Valve positioning backlash compensation (seconds)	float32	1548	5448	1dp
DigitalIO.DI_LBLC.Inertia	Inertia value for the valve	float32	1547	5447	1dp
DigitalIO.DI_LBLC.Invert	1 = Invert; 0 = Do not invert	bool	1543	5443	Not applicable
DigitalIO.DI_LBLC.MinOnTime	Time proportioned output minimum on time	float32	1542	5442	2dp
DigitalIO.DI_LBLC.ModuleIdent	As DigitalIO.1A1B.ModuleIdent	uint8	154a	5450	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
DigitalIO.DI_LBLC.Output	0 = Output off, 1 = Output on	bool	1544	5444	Not applicable
DigitalIO.DI_LBLC.PV	Digital I/O process value (as DigitalIO.1A1B.PV)	float32	1541	5441	0dp
DigitalIO.DI_LBLC.StandbyAction	Valve positioning standby action (0 = Continue; 1 = Freeze).	uint8	1549	5449	Not applicable
DigitalIO.DI_LBLC.Type	Digital I/O type (as DigitalIO.1A1B.Type).	uint8	1540	5440	Not applicable
DigitalIO.RELAY_4AC.Backlash	Valve positioning backlash compensation (seconds)	float32	1558	5464	1dp
DigitalIO.RELAY_4AC.Inertia	Inertia value for the valve	float32	1557	5463	1dp
DigitalIO.RELAY_4AC.Invert	1 = Invert; 0 = Do not invert	bool	1553	5459	Not applicable
DigitalIO.RELAY_4AC.MinOnTime	Time proportioned output minimum on time	float32	1552	5458	2dp
DigitalIO.RELAY_4AC.ModuleIdent	As DigitalIO.1A1B.ModuleIdent	uint8	155a	5466	Not applicable
DigitalIO.RELAY_4AC.Output	0 = Output off, 1 = Output on	bool	1554	5460	Not applicable
DigitalIO.RELAY_4AC.PV	Digital I/O process value (as DigitalIO.1A1B.PV)	float32	1551	5457	0dp
DigitalIO.RELAY_4AC.StandbyAction	Valve positioning standby action (0 = Continue; 1 = Freeze).	uint8	1559	5465	Not applicable
DigitalIO.RELAY_4AC.Type	Digital I/O type (as DigitalIO.1A1B.Type).	uint8	1550	5456	Not applicable
DigitalIO.RELAY_5AC.Backlash	Valve positioning backlash compensation (seconds)	float32	1568	5480	1dp
DigitalIO.RELAY_5AC.Inertia	Inertia value for the valve	float32	1567	5479	1dp
DigitalIO.RELAY_5AC.Invert	1 = Invert; 0 = Do not invert	bool	1563	5475	Not applicable
DigitalIO.RELAY_5AC.MinOnTime	Time proportioned output minimum on time	float32	1562	5474	2dp
DigitalIO.RELAY_5AC.ModuleIdent	As DigitalIO.1A1B.ModuleIdent	uint8	156a	5482	Not applicable
DigitalIO.RELAY_5AC.Output	0 = Output off, 1 = Output on	bool	1564	5476	Not applicable
DigitalIO.RELAY_5AC.PV	Digital I/O process value (as DigitalIO.1A1B.PV)	float32	1561	5473	0dp
DigitalIO.RELAY_5AC.StandbyAction	Valve positioning standby action (0 = Continue; 1 = Freeze).	uint8	1569	5481	Not applicable
DigitalIO.RELAY_5AC.Type	Digital I/O type (as DigitalIO.1A1B.Type).	uint8	1560	5472	Not applicable
EthernetIP.ImplicitInputs.Input1	Read only input from an EtherNet/IP client	eint32	7e66	32358	Not applicable
EthernetIP.ImplicitInputs.Input2	See input 1 for details	eint32	7e6a	32362	Not applicable
EthernetIP.ImplicitInputs.Input3	See input 1 for details	eint32	7e6e	32366	Not applicable
EthernetIP.ImplicitInputs.Input4	See input 1 for details	eint32	7e72	32370	Not applicable
EthernetIP.ImplicitInputs.Input5	See input 1 for details	eint32	7e76	32374	Not applicable
EthernetIP.ImplicitInputs.Input6	See input 1 for details	eint32	7e7a	32378	Not applicable
EthernetIP.ImplicitInputs.Input7	See input 1 for details	eint32	7e7e	32382	Not applicable
EthernetIP.ImplicitInputs.Input8	See input 1 for details	eint32	7e82	32386	Not applicable
EthernetIP.ImplicitInputs.Input9	See input 1 for details	eint32	7e86	32390	Not applicable
EthernetIP.ImplicitInputs.Input10	See input 1 for details	eint32	7e8a	32394	Not applicable
EthernetIP.ImplicitInputs.Input11	See input 1 for details	eint32	7e8e	32398	Not applicable
EthernetIP.ImplicitInputs.Input12	See input 1 for details	eint32	7e92	32402	Not applicable
EthernetIP.ImplicitInputs.Input13	See input 1 for details	eint32	7e96	32406	Not applicable
EthernetIP.ImplicitInputs.Input14	See input 1 for details	eint32	7e9a	32410	Not applicable
EthernetIP.ImplicitInputs.Input15	See input 1 for details	eint32	7e9e	32414	Not applicable
EthernetIP.ImplicitInputs.Input16	See input 1 for details	eint32	7ea2	32418	Not applicable
EthernetIP.ImplicitInputs.Input17	See input 1 for details	eint32	7ea6	32422	Not applicable
EthernetIP.ImplicitInputs.Input18	See input 1 for details	eint32	7eaa	32426	Not applicable
EthernetIP.ImplicitInputs.Input19	See input 1 for details	eint32	7eae	32430	Not applicable
EthernetIP.ImplicitInputs.Input20	See input 1 for details	eint32	7eb2	32434	Not applicable
EthernetIP.ImplicitInputs.Input21	See input 1 for details	eint32	7eb6	32438	Not applicable
EthernetIP.ImplicitInputs.Input22	See input 1 for details	eint32	7eba	32442	Not applicable
EthernetIP.ImplicitInputs.Input23	See input 1 for details	eint32	7ebe	32446	Not applicable
EthernetIP.ImplicitInputs.Input24	See input 1 for details	eint32	7ec2	32450	Not applicable
EthernetIP.ImplicitInputs.Input25	See input 1 for details	eint32	7ec6	32454	Not applicable
EthernetIP.ImplicitInputs.Input26	See input 1 for details	eint32	7eca	32458	Not applicable
EthernetIP.ImplicitInputs.Input27	See input 1 for details	eint32	7ece	32462	Not applicable
EthernetIP.ImplicitInputs.Input28	See input 1 for details	eint32	7ed2	32466	Not applicable
EthernetIP.ImplicitInputs.Input29	See input 1 for details	eint32	7ed6	32470	Not applicable
EthernetIP.ImplicitInputs.Input30	See input 1 for details	eint32	7eda	32474	Not applicable
EthernetIP.ImplicitInputs.Input31	See input 1 for details	eint32	7ede	32478	Not applicable
EthernetIP.ImplicitInputs.Input32	See input 1 for details	eint32	7ee2	32482	Not applicable
EthernetIP.ImplicitInputs.Input33	See input 1 for details	eint32	7ee6	32486	Not applicable
EthernetIP.ImplicitInputs.Input34	See input 1 for details	eint32	7eea	32490	Not applicable
EthernetIP.ImplicitInputs.Input35	See input 1 for details	eint32	7eee	32494	Not applicable
EthernetIP.ImplicitInputs.Input36	See input 1 for details	eint32	7ef2	32498	Not applicable
EthernetIP.ImplicitInputs.Input37	See input 1 for details	eint32	7ef6	32502	Not applicable
EthernetIP.ImplicitInputs.Input38	See input 1 for details	eint32	7efa	32506	Not applicable
EthernetIP.ImplicitInputs.Input39	See input 1 for details	eint32	7efe	32510	Not applicable
EthernetIP.ImplicitInputs.Input40	See input 1 for details	eint32	7f02	32514	Not applicable
EthernetIP.ImplicitInputs.Input41	See input 1 for details	eint32	7f06	32518	Not applicable
EthernetIP.ImplicitInputs.Input42	See input 1 for details	eint32	7f0a	32522	Not applicable
EthernetIP.ImplicitInputs.Input43	See input 1 for details	eint32	7f0e	32526	Not applicable
EthernetIP.ImplicitInputs.Input44	See input 1 for details	eint32	7f12	32530	Not applicable
EthernetIP.ImplicitInputs.Input45	See input 1 for details	eint32	7f16	32534	Not applicable
EthernetIP.ImplicitInputs.Input46	See input 1 for details	eint32	7f1a	32538	Not applicable
EthernetIP.ImplicitInputs.Input47	See input 1 for details	eint32	7f1e	32542	Not applicable
EthernetIP.ImplicitInputs.Input48	See input 1 for details	eint32	7f22	32546	Not applicable
EthernetIP.ImplicitInputs.Input49	See input 1 for details	eint32	7f26	32550	Not applicable
EthernetIP.ImplicitInputs.Input50	See input 1 for details	eint32	7f2a	32554	Not applicable
EthernetIP.ImplicitInputs.InputValue1	Value of the Input 1 parameter	int16	7e68	32360	Not applicable
EthernetIP.ImplicitInputs.InputValue2	See input 1 value for details	int16	7e6c	32364	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
EthernetIP.ImplicitInputs.InputValue3	See input 1 value for details	int16	7e70	32368	Not applicable
EthernetIP.ImplicitInputs.InputValue4	See input 1 value for details	int16	7e74	32372	Not applicable
EthernetIP.ImplicitInputs.InputValue5	See input 1 value for details	int16	7e78	32376	Not applicable
EthernetIP.ImplicitInputs.InputValue6	See input 1 value for details	int16	7e7c	32380	Not applicable
EthernetIP.ImplicitInputs.InputValue7	See input 1 value for details	int16	7e80	32384	Not applicable
EthernetIP.ImplicitInputs.InputValue8	See input 1 value for details	int16	7e84	32388	Not applicable
EthernetIP.ImplicitInputs.InputValue9	See input 1 value for details	int16	7e88	32392	Not applicable
EthernetIP.ImplicitInputs.InputValue10	See input 1 value for details	int16	7e8c	32396	Not applicable
EthernetIP.ImplicitInputs.InputValue11	See input 1 value for details	int16	7e90	32400	Not applicable
EthernetIP.ImplicitInputs.InputValue12	See input 1 value for details	int16	7e94	32404	Not applicable
EthernetIP.ImplicitInputs.InputValue13	See input 1 value for details	int16	7e98	32408	Not applicable
EthernetIP.ImplicitInputs.InputValue14	See input 1 value for details	int16	7e9c	32412	Not applicable
EthernetIP.ImplicitInputs.InputValue15	See input 1 value for details	int16	7ea0	32416	Not applicable
EthernetIP.ImplicitInputs.InputValue16	See input 1 value for details	int16	7ea4	32420	Not applicable
EthernetIP.ImplicitInputs.InputValue17	See input 1 value for details	int16	7ea8	32424	Not applicable
EthernetIP.ImplicitInputs.InputValue18	See input 1 value for details	int16	7eac	32428	Not applicable
EthernetIP.ImplicitInputs.InputValue19	See input 1 value for details	int16	7eb0	32432	Not applicable
EthernetIP.ImplicitInputs.InputValue20	See input 1 value for details	int16	7eb4	32436	Not applicable
EthernetIP.ImplicitInputs.InputValue21	See input 1 value for details	int16	7eb8	32440	Not applicable
EthernetIP.ImplicitInputs.InputValue22	See input 1 value for details	int16	7ebc	32444	Not applicable
EthernetIP.ImplicitInputs.InputValue23	See input 1 value for details	int16	7ec0	32448	Not applicable
EthernetIP.ImplicitInputs.InputValue24	See input 1 value for details	int16	7ec4	32452	Not applicable
EthernetIP.ImplicitInputs.InputValue25	See input 1 value for details	int16	7ec8	32456	Not applicable
EthernetIP.ImplicitInputs.InputValue26	See input 1 value for details	int16	7ecc	32460	Not applicable
EthernetIP.ImplicitInputs.InputValue27	See input 1 value for details	int16	7ed0	32464	Not applicable
EthernetIP.ImplicitInputs.InputValue28	See input 1 value for details	int16	7ed4	32468	Not applicable
EthernetIP.ImplicitInputs.InputValue29	See input 1 value for details	int16	7ed8	32472	Not applicable
EthernetIP.ImplicitInputs.InputValue30	See input 1 value for details	int16	7edc	32476	Not applicable
EthernetIP.ImplicitInputs.InputValue31	See input 1 value for details	int16	7ee0	32480	Not applicable
EthernetIP.ImplicitInputs.InputValue32	See input 1 value for details	int16	7ee4	32484	Not applicable
EthernetIP.ImplicitInputs.InputValue33	See input 1 value for details	int16	7ee8	32488	Not applicable
EthernetIP.ImplicitInputs.InputValue34	See input 1 value for details	int16	7eec	32492	Not applicable
EthernetIP.ImplicitInputs.InputValue35	See input 1 value for details	int16	7ef0	32496	Not applicable
EthernetIP.ImplicitInputs.InputValue36	See input 1 value for details	int16	7ef4	32500	Not applicable
EthernetIP.ImplicitInputs.InputValue37	See input 1 value for details	int16	7ef8	32504	Not applicable
EthernetIP.ImplicitInputs.InputValue38	See input 1 value for details	int16	7efc	32508	Not applicable
EthernetIP.ImplicitInputs.InputValue39	See input 1 value for details	int16	7f00	32512	Not applicable
EthernetIP.ImplicitInputs.InputValue40	See input 1 value for details	int16	7f04	32516	Not applicable
EthernetIP.ImplicitInputs.InputValue41	See input 1 value for details	int16	7f08	32520	Not applicable
EthernetIP.ImplicitInputs.InputValue42	See input 1 value for details	int16	7f0c	32524	Not applicable
EthernetIP.ImplicitInputs.InputValue43	See input 1 value for details	int16	7f10	32528	Not applicable
EthernetIP.ImplicitInputs.InputValue44	See input 1 value for details	int16	7f14	32532	Not applicable
EthernetIP.ImplicitInputs.InputValue45	See input 1 value for details	int16	7f18	32536	Not applicable
EthernetIP.ImplicitInputs.InputValue46	See input 1 value for details	int16	7f1c	32540	Not applicable
EthernetIP.ImplicitInputs.InputValue47	See input 1 value for details	int16	7f20	32544	Not applicable
EthernetIP.ImplicitInputs.InputValue48	See input 1 value for details	int16	7f24	32548	Not applicable
EthernetIP.ImplicitInputs.InputValue49	See input 1 value for details	int16	7f28	32552	Not applicable
EthernetIP.ImplicitInputs.InputValue50	See input 1 value for details	int16	7f2c	32556	Not applicable
EthernetIP.ImplicitOutputs.Output1	Writable output to the EtherNet/IP client	eint32	7f2e	32558	Not applicable
EthernetIP.ImplicitOutputs.Output2	See output 1 for details	eint32	7f32	32562	Not applicable
EthernetIP.ImplicitOutputs.Output3	See output 1 for details	eint32	7f36	32566	Not applicable
EthernetIP.ImplicitOutputs.Output4	See output 1 for details	eint32	7f3a	32570	Not applicable
EthernetIP.ImplicitOutputs.Output5	See output 1 for details	eint32	7f3e	32574	Not applicable
EthernetIP.ImplicitOutputs.Output6	See output 1 for details	eint32	7f42	32578	Not applicable
EthernetIP.ImplicitOutputs.Output7	See output 1 for details	eint32	7f46	32582	Not applicable
EthernetIP.ImplicitOutputs.Output8	See output 1 for details	eint32	7f4a	32586	Not applicable
EthernetIP.ImplicitOutputs.Output9	See output 1 for details	eint32	7f4e	32590	Not applicable
EthernetIP.ImplicitOutputs.Output10	See output 1 for details	eint32	7f52	32594	Not applicable
EthernetIP.ImplicitOutputs.Output11	See output 1 for details	eint32	7f56	32598	Not applicable
EthernetIP.ImplicitOutputs.Output12	See output 1 for details	eint32	7f5a	32602	Not applicable
EthernetIP.ImplicitOutputs.Output13	See output 1 for details	eint32	7f5e	32606	Not applicable
EthernetIP.ImplicitOutputs.Output14	See output 1 for details	eint32	7f62	32610	Not applicable
EthernetIP.ImplicitOutputs.Output15	See output 1 for details	eint32	7f66	32614	Not applicable
EthernetIP.ImplicitOutputs.Output16	See output 1 for details	eint32	7f6a	32618	Not applicable
EthernetIP.ImplicitOutputs.Output17	See output 1 for details	eint32	7f6e	32622	Not applicable
EthernetIP.ImplicitOutputs.Output18	See output 1 for details	eint32	7f72	32626	Not applicable
EthernetIP.ImplicitOutputs.Output19	See output 1 for details	eint32	7f76	32630	Not applicable
EthernetIP.ImplicitOutputs.Output20	See output 1 for details	eint32	7f7a	32634	Not applicable
EthernetIP.ImplicitOutputs.Output21	See output 1 for details	eint32	7f7e	32638	Not applicable
EthernetIP.ImplicitOutputs.Output22	See output 1 for details	eint32	7f82	32642	Not applicable
EthernetIP.ImplicitOutputs.Output23	See output 1 for details	eint32	7f86	32646	Not applicable
EthernetIP.ImplicitOutputs.Output24	See output 1 for details	eint32	7f8a	32650	Not applicable
EthernetIP.ImplicitOutputs.Output25	See output 1 for details	eint32	7f8e	32654	Not applicable
EthernetIP.ImplicitOutputs.Output26	See output 1 for details	eint32	7f92	32658	Not applicable
EthernetIP.ImplicitOutputs.Output27	See output 1 for details	eint32	7f96	32662	Not applicable
EthernetIP.ImplicitOutputs.Output28	See output 1 for details	eint32	7f9a	32666	Not applicable
EthernetIP.ImplicitOutputs.Output29	See output 1 for details	eint32	7f9e	32670	Not applicable
EthernetIP.ImplicitOutputs.Output30	See output 1 for details	eint32	7fa2	32674	Not applicable
EthernetIP.ImplicitOutputs.Output31	See output 1 for details	eint32	7fa6	32678	Not applicable
EthernetIP.ImplicitOutputs.Output32	See output 1 for details	eint32	7faa	32682	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
EthernetIP.ImplicitOutputs.Output33	See output 1 for details	eint32	7fae	32686	Not applicable
EthernetIP.ImplicitOutputs.Output34	See output 1 for details	eint32	7fb2	32690	Not applicable
EthernetIP.ImplicitOutputs.Output35	See output 1 for details	eint32	7fb6	32694	Not applicable
EthernetIP.ImplicitOutputs.Output36	See output 1 for details	eint32	7fba	32698	Not applicable
EthernetIP.ImplicitOutputs.Output37	See output 1 for details	eint32	7fbe	32702	Not applicable
EthernetIP.ImplicitOutputs.Output38	See output 1 for details	eint32	7fc2	32706	Not applicable
EthernetIP.ImplicitOutputs.Output39	See output 1 for details	eint32	7fc6	32710	Not applicable
EthernetIP.ImplicitOutputs.Output40	See output 1 for details	eint32	7fca	32714	Not applicable
EthernetIP.ImplicitOutputs.Output41	See output 1 for details	eint32	7fce	32718	Not applicable
EthernetIP.ImplicitOutputs.Output42	See output 1 for details	eint32	7fd2	32722	Not applicable
EthernetIP.ImplicitOutputs.Output43	See output 1 for details	eint32	7fd6	32726	Not applicable
EthernetIP.ImplicitOutputs.Output44	See output 1 for details	eint32	7fda	32730	Not applicable
EthernetIP.ImplicitOutputs.Output45	See output 1 for details	eint32	7fde	32734	Not applicable
EthernetIP.ImplicitOutputs.Output46	See output 1 for details	eint32	7fe2	32738	Not applicable
EthernetIP.ImplicitOutputs.Output47	See output 1 for details	eint32	7fe6	32742	Not applicable
EthernetIP.ImplicitOutputs.Output48	See output 1 for details	eint32	7fea	32746	Not applicable
EthernetIP.ImplicitOutputs.Output49	See output 1 for details	eint32	7fee	32750	Not applicable
EthernetIP.ImplicitOutputs.Output50	See output 1 for details	eint32	7ff2	32754	Not applicable
EthernetIP.ImplicitOutputs.OutputValue1	Value of the Output 1 parameter	int16	7f30	32560	Not applicable
EthernetIP.ImplicitOutputs.OutputValue2	See output 1 value for details	int16	7f34	32564	Not applicable
EthernetIP.ImplicitOutputs.OutputValue3	See output 1 value for details	int16	7f38	32568	Not applicable
EthernetIP.ImplicitOutputs.OutputValue4	See output 1 value for details	int16	7f3c	32572	Not applicable
EthernetIP.ImplicitOutputs.OutputValue5	See output 1 value for details	int16	7f40	32576	Not applicable
EthernetIP.ImplicitOutputs.OutputValue6	See output 1 value for details	int16	7f44	32580	Not applicable
EthernetIP.ImplicitOutputs.OutputValue7	See output 1 value for details	int16	7f48	32584	Not applicable
EthernetIP.ImplicitOutputs.OutputValue8	See output 1 value for details	int16	7f4c	32588	Not applicable
EthernetIP.ImplicitOutputs.OutputValue9	See output 1 value for details	int16	7f50	32592	Not applicable
EthernetIP.ImplicitOutputs.OutputValue10	See output 1 value for details	int16	7f54	32596	Not applicable
EthernetIP.ImplicitOutputs.OutputValue11	See output 1 value for details	int16	7f58	32600	Not applicable
EthernetIP.ImplicitOutputs.OutputValue12	See output 1 value for details	int16	7f5c	32604	Not applicable
EthernetIP.ImplicitOutputs.OutputValue13	See output 1 value for details	int16	7f60	32608	Not applicable
EthernetIP.ImplicitOutputs.OutputValue14	See output 1 value for details	int16	7f64	32612	Not applicable
EthernetIP.ImplicitOutputs.OutputValue15	See output 1 value for details	int16	7f68	32616	Not applicable
EthernetIP.ImplicitOutputs.OutputValue16	See output 1 value for details	int16	7f6c	32620	Not applicable
EthernetIP.ImplicitOutputs.OutputValue17	See output 1 value for details	int16	7f70	32624	Not applicable
EthernetIP.ImplicitOutputs.OutputValue18	See output 1 value for details	int16	7f74	32628	Not applicable
EthernetIP.ImplicitOutputs.OutputValue19	See output 1 value for details	int16	7f78	32632	Not applicable
EthernetIP.ImplicitOutputs.OutputValue20	See output 1 value for details	int16	7f7c	32636	Not applicable
EthernetIP.ImplicitOutputs.OutputValue21	See output 1 value for details	int16	7f80	32640	Not applicable
EthernetIP.ImplicitOutputs.OutputValue22	See output 1 value for details	int16	7f84	32644	Not applicable
EthernetIP.ImplicitOutputs.OutputValue23	See output 1 value for details	int16	7f88	32648	Not applicable
EthernetIP.ImplicitOutputs.OutputValue24	See output 1 value for details	int16	7f8c	32652	Not applicable
EthernetIP.ImplicitOutputs.OutputValue25	See output 1 value for details	int16	7f90	32656	Not applicable
EthernetIP.ImplicitOutputs.OutputValue26	See output 1 value for details	int16	7f94	32660	Not applicable
EthernetIP.ImplicitOutputs.OutputValue27	See output 1 value for details	int16	7f98	32664	Not applicable
EthernetIP.ImplicitOutputs.OutputValue28	See output 1 value for details	int16	7f9c	32668	Not applicable
EthernetIP.ImplicitOutputs.OutputValue29	See output 1 value for details	int16	7fa0	32672	Not applicable
EthernetIP.ImplicitOutputs.OutputValue30	See output 1 value for details	int16	7fa4	32676	Not applicable
EthernetIP.ImplicitOutputs.OutputValue31	See output 1 value for details	int16	7fa8	32680	Not applicable
EthernetIP.ImplicitOutputs.OutputValue32	See output 1 value for details	int16	7fac	32684	Not applicable
EthernetIP.ImplicitOutputs.OutputValue33	See output 1 value for details	int16	7fb0	32688	Not applicable
EthernetIP.ImplicitOutputs.OutputValue34	See output 1 value for details	int16	7fb4	32692	Not applicable
EthernetIP.ImplicitOutputs.OutputValue35	See output 1 value for details	int16	7fb8	32696	Not applicable
EthernetIP.ImplicitOutputs.OutputValue36	See output 1 value for details	int16	7fbc	32700	Not applicable
EthernetIP.ImplicitOutputs.OutputValue37	See output 1 value for details	int16	7fc0	32704	Not applicable
EthernetIP.ImplicitOutputs.OutputValue38	See output 1 value for details	int16	7fc4	32708	Not applicable
EthernetIP.ImplicitOutputs.OutputValue39	See output 1 value for details	int16	7fc8	32712	Not applicable
EthernetIP.ImplicitOutputs.OutputValue40	See output 1 value for details	int16	7fcc	32716	Not applicable
EthernetIP.ImplicitOutputs.OutputValue41	See output 1 value for details	int16	7fd0	32720	Not applicable
EthernetIP.ImplicitOutputs.OutputValue42	See output 1 value for details	int16	7fd4	32724	Not applicable
EthernetIP.ImplicitOutputs.OutputValue43	See output 1 value for details	int16	7fd8	32728	Not applicable
EthernetIP.ImplicitOutputs.OutputValue44	See output 1 value for details	int16	7fdc	32732	Not applicable
EthernetIP.ImplicitOutputs.OutputValue45	See output 1 value for details	int16	7fe0	32736	Not applicable
EthernetIP.ImplicitOutputs.OutputValue46	See output 1 value for details	int16	7fe4	32740	Not applicable
EthernetIP.ImplicitOutputs.OutputValue47	See output 1 value for details	int16	7fe8	32744	Not applicable
EthernetIP.ImplicitOutputs.OutputValue48	See output 1 value for details	int16	7fec	32748	Not applicable
EthernetIP.ImplicitOutputs.OutputValue49	See output 1 value for details	int16	7ff0	32752	Not applicable
EthernetIP.ImplicitOutputs.OutputValue50	See output 1 value for details	int16	7ff4	32756	Not applicable
EthernetIP.InputTags.Input1	A read only input from a PLC device	string_t	7838	30776	Not applicable
EthernetIP.InputTags.Input2	See input 1 for details	string_t	7839	30777	Not applicable
EthernetIP.InputTags.Input3	See input 1 for details	string_t	783a	30778	Not applicable
EthernetIP.InputTags.Input4	See input 1 for details	string_t	783b	30779	Not applicable
EthernetIP.InputTags.Input5	See input 1 for details	string_t	783c	30780	Not applicable
EthernetIP.InputTags.Input6	See input 1 for details	string_t	783d	30781	Not applicable
EthernetIP.InputTags.Input7	See input 1 for details	string_t	783e	30782	Not applicable
EthernetIP.InputTags.Input8	See input 1 for details	string_t	783f	30783	Not applicable
EthernetIP.InputTags.Input9	See input 1 for details	string_t	7840	30784	Not applicable
EthernetIP.InputTags.Input10	See input 1 for details	string_t	7841	30785	Not applicable
EthernetIP.InputTags.Input11	See input 1 for details	string_t	7842	30786	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
EthernetIP.InputTags.Input12	See input 1 for details	string_t	7843	30787	Not applicable
EthernetIP.InputTags.Input13	See input 1 for details	string_t	7844	30788	Not applicable
EthernetIP.InputTags.Input14	See input 1 for details	string_t	7845	30789	Not applicable
EthernetIP.InputTags.Input15	See input 1 for details	string_t	7846	30790	Not applicable
EthernetIP.InputTags.Input16	See input 1 for details	string_t	7847	30791	Not applicable
EthernetIP.InputTags.Input17	See input 1 for details	string_t	7848	30792	Not applicable
EthernetIP.InputTags.Input18	See input 1 for details	string_t	7849	30793	Not applicable
EthernetIP.InputTags.Input19	See input 1 for details	string_t	784a	30794	Not applicable
EthernetIP.InputTags.Input20	See input 1 for details	string_t	784b	30795	Not applicable
EthernetIP.InputTags.Input21	See input 1 for details	string_t	784c	30796	Not applicable
EthernetIP.InputTags.Input22	See input 1 for details	string_t	784d	30797	Not applicable
EthernetIP.InputTags.Input23	See input 1 for details	string_t	784e	30798	Not applicable
EthernetIP.InputTags.Input24	See input 1 for details	string_t	784f	30799	Not applicable
EthernetIP.InputTags.Input25	See input 1 for details	string_t	7850	30800	Not applicable
EthernetIP.InputTags.Input26	See input 1 for details	string_t	7851	30801	Not applicable
EthernetIP.InputTags.Input27	See input 1 for details	string_t	7852	30802	Not applicable
EthernetIP.InputTags.Input28	See input 1 for details	string_t	7853	30803	Not applicable
EthernetIP.InputTags.Input29	See input 1 for details	string_t	7854	30804	Not applicable
EthernetIP.InputTags.Input30	See input 1 for details	string_t	7855	30805	Not applicable
EthernetIP.Main.ConfigInstance	Configuration assembly instance number	int16	7ffa	32762	Not applicable
EthernetIP.Main.ConfigSize	Configuration assembly data size in bytes	int16	7ffb	32763	Not applicable
EthernetIP.Main.ConnectionType	Implicit I/O connection type (0 = Point to point; 1 = Multicast)	uint8	7ffe	32766	Not applicable
EthernetIP.Main.Explicit1	Explicit TCP connection 1	string_t	65f1	26097	Not applicable
EthernetIP.Main.Explicit2	Explicit TCP connection 2	string_t	6601	26113	Not applicable
EthernetIP.Main.ImplicitIO	Implicit I/O data channel	string_t	65e1	26081	Not applicable
EthernetIP.Main.InputInstance	Implicit input assembly instance number	int16	7ff6	32758	Not applicable
EthernetIP.Main.InputSize	Implicit input assembly data size in bytes	int16	7ff7	32759	Not applicable
EthernetIP.Main.Mode	EtherNet/IP operation mode 0 = Server 1 = Client (IO) 2 = Client (Tags)	uint8	7fff	32767	Not applicable
EthernetIP.Main.Multicast	Implicit I/O data channel multicast address	string_t	6611	26129	Not applicable
EthernetIP.Main.NetworkStatusCode	EtherNet/IP communications network status 0 = Offline 2 = On line 3 = Connection timout 4 = Duplicate IP address 5 = Initialisation	uint8	7e64	32356	Not applicable
EthernetIP.Main.OutputInstance	Implicit output assembly instance number	int16	7ff8	32760	Not applicable
EthernetIP.Main.OutputSize	Implicit output assembly data size in bytes	int16	7ff9	32761	Not applicable
EthernetIP.Main.Priority	Level of message priority 0 = Low 1 = High 2 = Scheduled 3 = Urgent	uint8	7ffc	32764	Not applicable
EthernetIP.Main.ResetComms	Resets the client or server communications (0 = No; 1 = Yes)	uint8	7e63	32355	Not applicable
EthernetIP.Main.Rpi	Requested Packet Interval (milliseconds)	int16	7ffd	32765	Not applicable
EthernetIP.Main.ServerAddress	IP address of a server device	string_t	7129	28969	Not applicable
EthernetIP.Main.SlotNumber	PLC slot number	int16	7e60	32352	Not applicable
EthernetIP.Main.TagStatusCode	EtherNet/IP Tag server status code (see table 4.10.1)	uint8	7e62	32354	Not applicable
EthernetIP.Main.UCMM	Unconnected Message Manager (UCMM)	string_t	65d1	26065	Not applicable
EthernetIP.OutputTags.Output1	Writable output to the PLC device	string_t	7880	30848	Not applicable
EthernetIP.OutputTags.Output2	See output 1 for details	string_t	7881	30849	Not applicable
EthernetIP.OutputTags.Output3	See output 1 for details	string_t	7882	30850	Not applicable
EthernetIP.OutputTags.Output4	See output 1 for details	string_t	7883	30851	Not applicable
EthernetIP.OutputTags.Output5	See output 1 for details	string_t	7884	30852	Not applicable
EthernetIP.OutputTags.Output6	See output 1 for details	string_t	7885	30853	Not applicable
EthernetIP.OutputTags.Output7	See output 1 for details	string_t	7886	30854	Not applicable
EthernetIP.OutputTags.Output8	See output 1 for details	string_t	7887	30855	Not applicable
EthernetIP.OutputTags.Output9	See output 1 for details	string_t	7888	30856	Not applicable
EthernetIP.OutputTags.Output10	See output 1 for details	string_t	7889	30857	Not applicable
EthernetIP.OutputTags.Output11	See output 1 for details	string_t	788a	30858	Not applicable
EthernetIP.OutputTags.Output12	See output 1 for details	string_t	788b	30859	Not applicable
EthernetIP.OutputTags.Output13	See output 1 for details	string_t	788c	30860	Not applicable
EthernetIP.OutputTags.Output14	See output 1 for details	string_t	788d	30861	Not applicable
EthernetIP.OutputTags.Output15	See output 1 for details	string_t	788e	30862	Not applicable
EthernetIP.OutputTags.Output16	See output 1 for details	string_t	788f	30863	Not applicable
EthernetIP.OutputTags.Output17	See output 1 for details	string_t	7890	30864	Not applicable
EthernetIP.OutputTags.Output18	See output 1 for details	string_t	7891	30865	Not applicable
EthernetIP.OutputTags.Output19	See output 1 for details	string_t	7892	30866	Not applicable
EthernetIP.OutputTags.Output20	See output 1 for details	string_t	7893	30867	Not applicable
EthernetIP.OutputTags.Output21	See output 1 for details	string_t	7894	30868	Not applicable
EthernetIP.OutputTags.Output22	See output 1 for details	string_t	7895	30869	Not applicable
EthernetIP.OutputTags.Output23	See output 1 for details	string_t	7896	30870	Not applicable
EthernetIP.OutputTags.Output24	See output 1 for details	string_t	7897	30871	Not applicable
EthernetIP.OutputTags.Output25	See output 1 for details	string_t	7898	30872	Not applicable
EthernetIP.OutputTags.Output26	See output 1 for details	string_t	7899	30873	Not applicable
EthernetIP.OutputTags.Output27	See output 1 for details	string_t	789a	30874	Not applicable
EthernetIP.OutputTags.Output28	See output 1 for details	string_t	789b	30875	Not applicable
EthernetIP.OutputTags.Output29	See output 1 for details	string_t	789c	30876	Not applicable
EthernetIP.OutputTags.Output30	See output 1 for details	string_t	789d	30877	Not applicable
Group.Recording.Channel1En	Channel 1 enable (0 = Disabled; 1 = Enabled)	bool	1023	4131	Not applicable
Group.Recording.Channel2En	Channel 2 enable (0 = Disabled; 1 = Enabled)	bool	1024	4132	Not applicable
Group.Recording.Channel3En	Channel 3 enable (0 = Disabled; 1 = Enabled)	bool	1025	4133	Not applicable
Group.Recording.Channel4En	Channel 4 enable (0 = Disabled; 1 = Enabled)	bool	1026	4134	Not applicable
Group.Recording.Compression	The UHH file compression rate (0 = Normal; 1 = High)	uint8	1040	4160	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Group.Recording.Enable	0 = Recording disabled; 1 = Recording enabled	uint8	1020	4128	Not applicable
Group.Recording.FlashDuration	Time in days until flash history files begin to be overwitten	float32	1039	4153	2dp
Group.Recording.FlashFree	Size of the internal flash in MBytes	float32	1038	4152	2dp
Group.Recording.FlashSize	Size of the internal flash in MBytes	float32	1037	4151	2dp
Group.Recording.Interval	Recording interval 0 = 0.125 secs 1 = 0.25 secs 2 = 0.5 secs 3 = 1Hz 4 = 2 sec 5 = 5 sec 6 = 10 sec 7 = 20 sec 8 = 30 sec 9 = 1 min 10 = 2 min 11 = 5 min 12 = 10 min 13 = 20 min 14 = 30 min 15 = 1 hr	int32	1022	4130	Not applicable
Group.Recording.Status	Recording status 0 = Not recording 1 = Disabled 2 = Messages only 3 = Recording enabled 4 = Recording paused	int16	1036	4150	Not applicable
Group.Recording.Suspend	1 = Suspend recording	bool	1035	4149	Not applicable
Group.Recording.VirtualChan1En	Virtual Channel 1 enable (0 = Disabled; 1 = Enabled)	bool	1027	4135	Not applicable
Group.Recording.VirtualChan2En	Virtual Channel 2 enable (0 = Disabled; 1 = Enabled)	bool	1028	4136	Not applicable
Group.Recording.VirtualChan3En	Virtual Channel 3 enable (0 = Disabled; 1 = Enabled)	bool	1029	4137	Not applicable
Group.Recording.VirtualChan4En	Virtual Channel 4 enable (0 = Disabled; 1 = Enabled)	bool	102a	4138	Not applicable
Group.Recording.VirtualChan5En	Virtual Channel 5 enable (0 = Disabled; 1 = Enabled)	bool	102b	4139	Not applicable
Group.Recording.VirtualChan6En	Virtual Channel 6 enable (0 = Disabled; 1 = Enabled)	bool	102c	4140	Not applicable
Group.Recording.VirtualChan7En	Virtual Channel 7 enable (0 = Disabled; 1 = Enabled)	bool	102d	4141	Not applicable
Group.Recording.VirtualChan8En	Virtual Channel 8 enable (0 = Disabled; 1 = Enabled)	bool	102e	4142	Not applicable
Group.Recording.VirtualChan9En	Virtual Channel 9 enable (0 = Disabled; 1 = Enabled)	bool	102f	4143	Not applicable
Group.Recording.VirtualChan10En	Virtual Channel 10 enable (0 = Disabled; 1 = Enabled)	bool	1030	4144	Not applicable
Group.Recording.VirtualChan11En	Virtual Channel 11 enable (0 = Disabled; 1 = Enabled)	bool	1031	4145	Not applicable
Group.Recording.VirtualChan12En	Virtual Channel 12 enable (0 = Disabled; 1 = Enabled)	bool	1032	4146	Not applicable
Group.Recording.VirtualChan13En	Virtual Channel 13 enable (0 = Disabled; 1 = Enabled)	bool	1033	4147	Not applicable
Group.Recording.VirtualChan14En	Virtual Channel 14 enable (0 = Disabled; 1 = Enabled)	bool	1034	4148	Not applicable
Group.Recording.VirtualChan15En	Virtual Channel 15 enable (0 = Disabled; 1 = Enabled)	bool	103a	4154	Not applicable
Group.Recording.VirtualChan16En	Virtual Channel 16 enable (0 = Disabled; 1 = Enabled)	bool	103b	4155	Not applicable
Group.Recording.VirtualChan17En	Virtual Channel 17 enable (0 = Disabled; 1 = Enabled)	bool	103c	4156	Not applicable
Group.Recording.VirtualChan18En	Virtual Channel 18 enable (0 = Disabled; 1 = Enabled)	bool	103d	4157	Not applicable
Group.Recording.VirtualChan19En	Virtual Channel 19 enable (0 = Disabled; 1 = Enabled)	bool	103e	4158	Not applicable
Group.Recording.VirtualChan20En	Virtual Channel 20 enable (0 = Disabled; 1 = Enabled)	bool	103f	4159	Not applicable
Group.Recording.VirtualChan21En	Virtual Channel 21 enable (0 = Disabled; 1 = Enabled)	bool	1041	4161	Not applicable
Group.Recording.VirtualChan22En	Virtual Channel 22 enable (0 = Disabled; 1 = Enabled)	bool	1042	4162	Not applicable
Group.Recording.VirtualChan23En	Virtual Channel 23 enable (0 = Disabled; 1 = Enabled)	bool	1043	4163	Not applicable
Group.Recording.VirtualChan24En	Virtual Channel 24 enable (0 = Disabled; 1 = Enabled)	bool	1044	4164	Not applicable
Group.Recording.VirtualChan25En	Virtual Channel 25 enable (0 = Disabled; 1 = Enabled)	bool	1045	4165	Not applicable
Group.Recording.VirtualChan26En	Virtual Channel 26 enable (0 = Disabled; 1 = Enabled)	bool	1046	4166	Not applicable
Group.Recording.VirtualChan27En	Virtual Channel 27 enable (0 = Disabled; 1 = Enabled)	bool	1047	4167	Not applicable
Group.Recording.VirtualChan28En	Virtual Channel 28 enable (0 = Disabled; 1 = Enabled)	bool	1048	4168	Not applicable
Group.Recording.VirtualChan29En	Virtual Channel 29 enable (0 = Disabled; 1 = Enabled)	bool	1049	4169	Not applicable
Group.Recording.VirtualChan30En	Virtual Channel 30 enable (0 = Disabled; 1 = Enabled)	bool	104a	4170	Not applicable
Group.Trend.Descriptor	Group descriptor	string_t	5b00	23296	Not applicable
Group.Trend.Interval	Trend interval. As Group.Recording.Interval, above	int32	1002	4098	Not applicable
Group.Trend.MajorDivisions	Number of major divisions	uint8	1004	4100	Not applicable
Group.Trend.Point1	1st point in the group (VCh = Virtual channel) 0 =No trend 1 = Channel 1 2 = Channel 2 3 = Channel 3 4 = Channel 4 5 = VCh1 6 = VCh2 7 = VCh3 8 = VCh4 9 = VCh5 10 = VCh6 11 = VCh7 12 = VCh8 13 = VCh9 14 = VCh10 15 = VCh11 16 = VCh12 17 = VCH13 18 = VCh14 19 = VCh15 20 = VCh 16 21 = VCh17 22 = VCh18 23 = VCh 19 24 = VCh20 25 = VCh21 26 = VCh 22 27 = VCh23 28 = VCh24 29 = VCh 25 30 = VCh26 31 = VCh27 32 = VCh 28 33 = VCh29 34 = VCh30	uint8	1006	4102	Not applicable
Group.Trend.Point2	As Group.Trend.Point1 but for 2nd point in group	uint8	1007	4103	Not applicable
Group.Trend.Point3	As Group.Trend.Point1 but for 3rd point in group	uint8	1008	4104	Not applicable
Group.Trend.Point4	As Group.Trend.Point1 but for 4th point in group	uint8	1009	4105	Not applicable
Group.Trend.Point5	As Group.Trend.Point1 but for 5th point in group	uint8	100a	4106	Not applicable
Group.Trend.Point6	As Group.Trend.Point1 but for 6th point in group	uint8	100b	4107	Not applicable
Humidity.DewPoint	Dewpoint	float32	2e79	11897	Set by Humidity.Resolution
Humidity.DryTemp	Dry Bulb Temperature Measurement	float32	2e7d	11901	0dp
Humidity.Pressure	Current Atmospheric Pressure	float32	2e80	11904	1dp
Humidity.PsychroConst	Psychrometric Constant	float32	2e7f	11903	2dp
Humidity.RelHumid	Calculated Relative Humidity	float32	2e78	11896	Set by Humidity.Resolution

Parameter path	Description	Type	Hex	Dec	Resolution
Humidity.Resolution	Result Resolution	uint8	2e81	11905	Not applicable
Humidity.SBrk	Sensor Broken (0 = No; 1 = Yes)	bool	2e7e	11902	Not applicable
Humidity.WetOffset	Offset of the Wet Bulb Temperature	float32	2e7b	11899	Same as Humidity.WetTemp
Humidity.WetTemp	Wet Bulb Temperature Measurement	float32	2e7c	11900	0dp
Instrument.Clock.Date	Local Date	string_t	4400	17408	Not applicable
Instrument.Clock.DST	1 = DST active; 0 = DST not active	bool	1082	4226	Not applicable
Instrument.Clock.Time	Local time (including Zone and DST effects)	time_t	1081	4225	Set by Network.Modbus.TimeFormat
Instrument.Display.AlarmPanel	1 = Alarm Panel display mode enabled	bool	10eb	4331	Not applicable
Instrument.Display.Brightness	Display brightness 10 = 10%; 20 = 20% etc. (whole decades)	uint8	1090	4240	Not applicable
Instrument.Display.Cascade	1 = Cascade control display mode enabled	bool	10f2	4338	Not applicable
Instrument.Display.DualLoopControl	1 = Dual loop control display mode enabled	bool	109b	4251	Not applicable
Instrument.Display.EIPServerPage	1 = EtherNet/IPdisplay mode enabled	bool	10ef	4335	Not applicable
Instrument.Display.FaceplateCycling	1 = Faceplate cycling On	bool	109e	4254	Not applicable
Instrument.Display.FutureTrend	1 = Future trend display mode enabled	bool	10fb	4347	Not applicable
Instrument.Display.FutureTrend1Colour	Future trend colour(1) (As Channel.1.Trend.Colour)	uint8	10fc	4348	Not applicable
Instrument.Display.FutureTrend2Colour	Future trend colour(2) (As Channel.1.Trend.Colour)	uint8	10fd	4349	Not applicable
Instrument.Display.HistoryBackground	History background colour 0 = Black; 1 = Dark grey; 2 = Light grey; 3 = White	uint8	10a8	4264	Not applicable
Instrument.Display.HomePage	Home page	uint8	1093	4243	Not applicable
Instrument.Display.HorizontalBar	1 = Horizontal bar mode enabled	bool	1098	4248	Not applicable
Instrument.Display.HorizontalTrend	1 = Horizontal trend mode enabled	bool	1096	4246	Not applicable
Instrument.Display.HPageTimeout	Home time out value in minutes (0 = no timeout)	int16	1094	4244	Not applicable
Instrument.Display.HTrendScaling	0 = hide horizontal trend scale; 1 = scale permanent	uint8	109d	4253	Not applicable
Instrument.Display.LoopControl	1 = Loop control display mode enabled	bool	109a	4250	Not applicable
Instrument.Display.LoopSetpointColour	Loop setpoint colour (As Channel.1.Trend.Colour)	uint8	109f	4255	Not applicable
Instrument.Display.ModbusMaster	1 = Modbus Master display mode enabled	bool	10ee	4334	Not applicable
Instrument.Display.NumberFormat	Number format (0 = Rounded; 1 - Truncated)	uint8	10fe	4350	Not applicable
Instrument.Display.Numeric	1 = Numeric display mode enabled	bool	1099	4249	Not applicable
Instrument.Display.Programmer	1 = Programmer interface display mode enabled	bool	10f3	4339	Not applicable
Instrument.Display.PromoteListView	1 = Promote list display mode enabled	bool	10ea	4330	Not applicable
Instrument.Display.ScreenSaverAfter	Screen save after (in minutes)	int16	1091	4241	Not applicable
Instrument.Display.ScreenSaverBrightness	Screen saver brightness 10 = 10%; 20 = 20% etc. (whole decades only)	uint8	1092	4242	Not applicable
Instrument.Display.SteriliserPage	1 = Steriliser display mode enabled	bool	10ec	4332	Not applicable
Instrument.Display.TrendBackground	Trend chart colour: 0 = Black; 1 = Dark Grey; 2 = Light grey; 3 = White.	uint8	109c	4252	Not applicable
Instrument.Display.VerticalBar	1 = Vertical bar display mode enabled	bool	1097	4247	Not applicable
Instrument.Display.VerticalTrend	1 = Vertical trend display mode enabled	bool	1095	4245	Not applicable
Instrument.Info.Bootrom	Instrument bootrom version	string_t	447a	17530	Not applicable
Instrument.Info.CompanyID	Company identification. Always returns 1280	int16	0079	121	Not applicable
Instrument.Info.ConfigRev	The instrument configuration revision number	int32	10a0	4256	Not applicable
Instrument.Info.IM	Instrument mode Operating: All algorithms and I/O active. Standby: Control o/p off. Absolute alarms active Engineer: All outputs inactive.	uint8	00c7	199	Not applicable
Instrument.Info.LineVoltage	Displays the current line voltage	float32	10a6	4262	1dp
Instrument.Info.MicroBoardIssue	Micro Board Issue	uint8	10aa	4266	Not applicable
Instrument.Info.Name	The instrument descriptor	string_t	445f	17503	Not applicable
Instrument.Info.NvolWrites	Displays the number of non-volatile writes performed	int32	10a5	4261	Not applicable
Instrument.Info.PSUType	PSU type. 0 = 240Vac; 1 = 24v ac/dc	uint8	10a9	4265	Not applicable
Instrument.Info.SecurityRev	The instrument security revision number	int32	10a4	4260	Not applicable
Instrument.Info.Type	Instrument type	uint8	10a2	4258	Not applicable
Instrument.Info.Version	Instrument version	string_t	4474	17524	Not applicable
Instrument.Info.WiresFree	Number of wires free	int16	10ab	4267	Not applicable
Instrument.IOFitted.1A1B	I/O fitted at terminals 1A1B 0 = Digital IO 1= Non-isolated dc op (mA only) 2 = Relay op 3 = TRIAC 1a1b 4 = Relay OP 5 = Isolated dc op (V/mA) 6 = Digital ip 7 = Isolated dc output (mA only) 8 = Digital op 9 = Relay op 10 = Triac 2A2B	uint8	10f4	4340	Not applicable
Instrument.IOFitted.2A2B	I/O fitted at terminals 2A2B (as for 1A1B above)	uint8	10f5	4341	Not applicable
Instrument.IOFitted.3A3B	I/O type fitted at terminals 3A3B (as for 1A1B above)	uint8	10f7	4343	Not applicable
Instrument.IOFitted.4AC	I/O type fitted at terminals 4AC (as for 1A1B above)	uint8	10f9	4345	Not applicable
Instrument.IOFitted.5AC	I/O type fitted at terminals 5AC (as for 1A1B above)	uint8	10fa	4346	Not applicable
Instrument.IOFitted.LALC	I/O type fitted at terminals LALC (as for 1A1B above)	uint8	10f6	4342	Not applicable
Instrument.IOFitted.LBLC	I/O type fitted at terminals LBLC (as for 1A1B above)	uint8	10f8	4344	Not applicable
Instrument.Locale.DateFormat	Date format (0 = DDMMYY. 1 = MMDDYY; 2 = YYMMDD)	uint8	10b1	4273	Not applicable
Instrument.Locale.DSTenable	1 = Daylight Saving Time enabled	bool	10b3	4275	Not applicable
Instrument.Locale.EndDay	Daylight savings: End day 0 = Sunday 1= Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday	uint8	10ba	4282	Not applicable
Instrument.Locale.EndMonth	Daylight savings: End month 0 = January 1= February 2 = March 3 = April 4 = May 5 = June 6 = July 7 = August 8 = September 9 = October 10 = November 11 = December	uint8	10bb	4283	Not applicable
Instrument.Locale.EndOn	Week for changing to/from DST	uint8	10b9	4281	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
	0 = First 1= Second 2 = Third 3 = Fourth 4 = Last 5 = Second to last				
Instrument.Locale.EndTime	DST end time in hours, minutes, seconds and milliseconds	time_t	10b8	4280	Set by Network.Modbus.TimeFormat
Instrument.Locale.Language	Language (0 = English)	uint8	10b0	4272	Not applicable
Instrument.Locale.StartDay	DST start day. As Instrument.Locale.EndDay, above	uint8	10b6	4278	Not applicable
Instrument.Locale.StartMonth	DST start month As Instrument.Locale.EndMonth, above	uint8	10b7	4279	Not applicable
Instrument.Locale.StartOn	Start DST on. As Instrument.Locale.EndOn, above	uint8	10b5	4277	Not applicable
Instrument.Locale.StartTime	DST start time. As Instrument.Locale.EndTime above	time_t	10b4	4276	Set by Network.Modbus.TimeFormat
Instrument.Locale.TimeZone	Time zone 0 = GMT - 12 hours 1 = GMT - 11 hours 2 = GMT - 10 hours 3 = GMT - 9 hours 4 = GMT - 8 hours 5 = GMT - 7 hours 6 = GMT - 6 hours 7 = GMT - 5 hours 8 = GMT - 4 hours 9 = GMT - 3.5 hours 10 = GMT - 3 hours 11 = GMT - 2 hours 12 = GMT - 1 hour 13 = GMT 14 = GMT + 1 hour 15 = GMT + 2 hours 16 = GMT + 3 hours 17 = GMT + 3.5 hours 18 = GMT + 4 hours 19 = GMT + 4.5 hours 20 = GMT + 5 hours 21 = GMT + 5.5 hours 22 = GMT + 5.75 hours 23 = GMT + 6 hours 24 = GMT + 6.5 hours 25 = GMT + 7 hours 26 = GMT + 8 hours 27 = GMT + 9 hours 28 = GMT + 9.5 hours 29 = GMT + 10 hours 30 = GMT + 11 hours 31 = GMT + 12 hours 32 = GMT + 13 hours	uint8	10b2	4274	Not applicable
Instrument.Notes.Note	Operator Note	string_t	5500	21760	Not applicable
Instrument.Notes.Note1	Operator note 1	string_t	5580	21888	Not applicable
Instrument.Notes.Note2	Operator note 2	string_t	5600	22016	Not applicable
Instrument.Notes.Note3	Operator note 3	string_t	5680	22144	Not applicable
Instrument.Notes.Note4	Operator note 4	string_t	5700	22272	Not applicable
Instrument.Notes.Note5	Operator note 5	string_t	5780	22400	Not applicable
Instrument.Notes.Note6	Operator note 6	string_t	5800	22528	Not applicable
Instrument.Notes.Note7	Operator note 7	string_t	5880	22656	Not applicable
Instrument.Notes.Note8	Operator note 8	string_t	5900	22784	Not applicable
Instrument.Notes.Note9	Operator note 9	string_t	5980	22912	Not applicable
Instrument.Notes.Note10	Operator note 10	string_t	5a00	23040	Not applicable
Instrument.PromoteList.PromoteListName	Promote list (operator view) title	string_t	6d07	27911	Not applicable
Instrument.PromoteList.PromoteParam1	Promote parameter (1)	eint32	10e0	4320	Not applicable
strument.PromoteList.PromoteParam1Desc	Descriptor for promote parameter (1)	string_t	6300	25344	Not applicable
Instrument.PromoteList.PromoteParam2	Promote parameter (2)	eint32	10e1	4321	Not applicable
Instrument.PromoteList.PromoteParam2Desc	Descriptor for promote parameter (2)	string_t	6315	25365	Not applicable
Instrument.PromoteList.PromoteParam3	Promote parameter (3)	eint32	10e2	4322	Not applicable
Instrument.PromoteList.PromoteParam3Desc	Descriptor for promote parameter (3)	string_t	632a	25386	Not applicable
Instrument.PromoteList.PromoteParam4	Promote parameter (4)	eint32	10e3	4323	Not applicable
Instrument.PromoteList.PromoteParam4Desc	Descriptor for promote parameter (4)	string_t	633f	25407	Not applicable
Instrument.PromoteList.PromoteParam5	Promote parameter (5)	eint32	10e4	4324	Not applicable
Instrument.PromoteList.PromoteParam5Desc	Descriptor for promote parameter (5)	string_t	6354	25428	Not applicable
Instrument.PromoteList.PromoteParam6	Promote parameter (6)	eint32	10e5	4325	Not applicable
Instrument.PromoteList.PromoteParam6Desc	Descriptor for promote parameter (6)	string_t	6369	25449	Not applicable
Instrument.PromoteList.PromoteParam7	Promote parameter (7)	eint32	10e6	4326	Not applicable
Instrument.PromoteList.PromoteParam7Desc	Descriptor for promote parameter (7)	string_t	637e	25470	Not applicable
Instrument.PromoteList.PromoteParam8	Promote parameter (8)	eint32	10e7	4327	Not applicable
Instrument.PromoteList.PromoteParam8Desc	Descriptor for promote parameter (8)	string_t	6393	25491	Not applicable
Instrument.PromoteList.PromoteParam9	Promote parameter (9)	eint32	10e8	4328	Not applicable
Instrument.PromoteList.PromoteParam9Desc	Descriptor for promote parameter (9)	string_t	63a8	25512	Not applicable
Instrument.PromoteList.PromoteParam10	Promote parameter (10)	eint32	10e9	4329	Not applicable
Instrument.PromoteList.PromoteParam10Desc	Descriptor for promote parameter (10)	string_t	63bd	25533	Not applicable
Instrument.OEMConfigList.Parameter1	Parameter that is to be alterable	eint32	1230	4656	Not applicable
Instrument.OEMConfigList.Parameter2	Parameter that is to be alterable	eint32	1231	4657	Not applicable
Instrument.OEMConfigList.Parameter3	Parameter that is to be alterable	eint32	1232	4658	Not applicable
Instrument.OEMConfigList.Parameter4	Parameter that is to be alterable	eint32	1233	4659	Not applicable
Instrument.OEMConfigList.Parameter5	Parameter that is to be alterable	eint32	1234	4660	Not applicable
Instrument.OEMConfigList.Parameter6	Parameter that is to be alterable	eint32	1235	4661	Not applicable
Instrument.OEMConfigList.Parameter7	Parameter that is to be alterable	eint32	1236	4662	Not applicable
Instrument.OEMConfigList.Parameter8	Parameter that is to be alterable	eint32	1237	4663	Not applicable
Instrument.OEMConfigList.Parameter9	Parameter that is to be alterable	eint32	1238	4664	Not applicable
Instrument.OEMConfigList.Parameter10	Parameter that is to be alterable	eint32	1239	4665	Not applicable
Instrument.OEMConfigList.Parameter11	Parameter that is to be alterable	eint32	123a	4666	Not applicable
Instrument.OEMConfigList.Parameter12	Parameter that is to be alterable	eint32	123b	4667	Not applicable
Instrument.OEMConfigList.Parameter13	Parameter that is to be alterable	eint32	123c	4668	Not applicable
Instrument.OEMConfigList.Parameter14	Parameter that is to be alterable	eint32	123d	4669	Not applicable
Instrument.OEMConfigList.Parameter15	Parameter that is to be alterable	eint32	123e	4670	Not applicable
Instrument.OEMConfigList.Parameter16	Parameter that is to be alterable	eint32	123f	4671	Not applicable
Instrument.OEMConfigList.Parameter17	Parameter that is to be alterable	eint32	1240	4672	Not applicable
Instrument.OEMConfigList.Parameter18	Parameter that is to be alterable	eint32	1241	4673	Not applicable
Instrument.OEMConfigList.Parameter19	Parameter that is to be alterable	eint32	1242	4674	Not applicable
Instrument.OEMConfigList.Parameter20	Parameter that is to be alterable	eint32	1243	4675	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Instrument.OEMConfigList.Parameter21	Parameter that is to be alterable	eint32	1244	4676	Not applicable
Instrument.OEMConfigList.Parameter22	Parameter that is to be alterable	eint32	1245	4677	Not applicable
Instrument.OEMConfigList.Parameter23	Parameter that is to be alterable	eint32	1246	4678	Not applicable
Instrument.OEMConfigList.Parameter24	Parameter that is to be alterable	eint32	1247	4679	Not applicable
Instrument.OEMConfigList.Parameter25	Parameter that is to be alterable	eint32	1248	4680	Not applicable
Instrument.OEMConfigList.Parameter26	Parameter that is to be alterable	eint32	1249	4681	Not applicable
Instrument.OEMConfigList.Parameter27	Parameter that is to be alterable	eint32	124a	4682	Not applicable
Instrument.OEMConfigList.Parameter28	Parameter that is to be alterable	eint32	124b	4683	Not applicable
Instrument.OEMConfigList.Parameter29	Parameter that is to be alterable	eint32	124c	4684	Not applicable
Instrument.OEMConfigList.Parameter30	Parameter that is to be alterable	eint32	124d	4685	Not applicable
Instrument.OEMConfigList.Parameter31	Parameter that is to be alterable	eint32	124e	4686	Not applicable
Instrument.OEMConfigList.Parameter32	Parameter that is to be alterable	eint32	124f	4687	Not applicable
Instrument.OEMConfigList.Parameter33	Parameter that is to be alterable	eint32	1250	4688	Not applicable
Instrument.OEMConfigList.Parameter34	Parameter that is to be alterable	eint32	1251	4689	Not applicable
Instrument.OEMConfigList.Parameter35	Parameter that is to be alterable	eint32	1252	4690	Not applicable
Instrument.OEMConfigList.Parameter36	Parameter that is to be alterable	eint32	1253	4691	Not applicable
Instrument.OEMConfigList.Parameter37	Parameter that is to be alterable	eint32	1254	4692	Not applicable
Instrument.OEMConfigList.Parameter38	Parameter that is to be alterable	eint32	1255	4693	Not applicable
Instrument.OEMConfigList.Parameter39	Parameter that is to be alterable	eint32	1256	4694	Not applicable
Instrument.OEMConfigList.Parameter40	Parameter that is to be alterable	eint32	1257	4695	Not applicable
Instrument.OEMConfigList.Parameter41	Parameter that is to be alterable	eint32	1258	4696	Not applicable
Instrument.OEMConfigList.Parameter42	Parameter that is to be alterable	eint32	1259	4697	Not applicable
Instrument.OEMConfigList.Parameter43	Parameter that is to be alterable	eint32	125a	4698	Not applicable
Instrument.OEMConfigList.Parameter44	Parameter that is to be alterable	eint32	125b	4699	Not applicable
Instrument.OEMConfigList.Parameter45	Parameter that is to be alterable	eint32	125c	4700	Not applicable
Instrument.OEMConfigList.Parameter46	Parameter that is to be alterable	eint32	125d	4701	Not applicable
Instrument.OEMConfigList.Parameter47	Parameter that is to be alterable	eint32	125e	4702	Not applicable
Instrument.OEMConfigList.Parameter48	Parameter that is to be alterable	eint32	125f	4703	Not applicable
Instrument.OEMConfigList.Parameter49	Parameter that is to be alterable	eint32	1260	4704	Not applicable
Instrument.OEMConfigList.Parameter50	Parameter that is to be alterable	eint32	1261	4705	Not applicable
Instrument.OEMConfigList.Parameter51	Parameter that is to be alterable	eint32	1262	4706	Not applicable
Instrument.OEMConfigList.Parameter52	Parameter that is to be alterable	eint32	1263	4707	Not applicable
Instrument.OEMConfigList.Parameter53	Parameter that is to be alterable	eint32	1264	4708	Not applicable
Instrument.OEMConfigList.Parameter54	Parameter that is to be alterable	eint32	1265	4709	Not applicable
Instrument.OEMConfigList.Parameter55	Parameter that is to be alterable	eint32	1266	4710	Not applicable
Instrument.OEMConfigList.Parameter56	Parameter that is to be alterable	eint32	1267	4711	Not applicable
Instrument.OEMConfigList.Parameter57	Parameter that is to be alterable	eint32	1268	4712	Not applicable
Instrument.OEMConfigList.Parameter58	Parameter that is to be alterable	eint32	1269	4713	Not applicable
Instrument.OEMConfigList.Parameter59	Parameter that is to be alterable	eint32	126a	4714	Not applicable
Instrument.OEMConfigList.Parameter60	Parameter that is to be alterable	eint32	126b	4715	Not applicable
Instrument.OEMConfigList.Parameter61	Parameter that is to be alterable	eint32	126c	4716	Not applicable
Instrument.OEMConfigList.Parameter62	Parameter that is to be alterable	eint32	126d	4717	Not applicable
Instrument.OEMConfigList.Parameter63	Parameter that is to be alterable	eint32	126e	4718	Not applicable
Instrument.OEMConfigList.Parameter64	Parameter that is to be alterable	eint32	126f	4719	Not applicable
Instrument.OEMConfigList.Parameter65	Parameter that is to be alterable	eint32	1270	4720	Not applicable
Instrument.OEMConfigList.Parameter66	Parameter that is to be alterable	eint32	1271	4721	Not applicable
Instrument.OEMConfigList.Parameter67	Parameter that is to be alterable	eint32	1272	4722	Not applicable
Instrument.OEMConfigList.Parameter68	Parameter that is to be alterable	eint32	1273	4723	Not applicable
Instrument.OEMConfigList.Parameter69	Parameter that is to be alterable	eint32	1274	4724	Not applicable
Instrument.OEMConfigList.Parameter70	Parameter that is to be alterable	eint32	1275	4725	Not applicable
Instrument.OEMConfigList.Parameter71	Parameter that is to be alterable	eint32	1276	4726	Not applicable
Instrument.OEMConfigList.Parameter72	Parameter that is to be alterable	eint32	1277	4727	Not applicable
Instrument.OEMConfigList.Parameter73	Parameter that is to be alterable	eint32	1278	4728	Not applicable
Instrument.OEMConfigList.Parameter74	Parameter that is to be alterable	eint32	1279	4729	Not applicable
Instrument.OEMConfigList.Parameter75	Parameter that is to be alterable	eint32	127a	4730	Not applicable
Instrument.OEMConfigList.Parameter76	Parameter that is to be alterable	eint32	127b	4731	Not applicable
Instrument.OEMConfigList.Parameter77	Parameter that is to be alterable	eint32	127c	4732	Not applicable
Instrument.OEMConfigList.Parameter78	Parameter that is to be alterable	eint32	127d	4733	Not applicable
Instrument.OEMConfigList.Parameter79	Parameter that is to be alterable	eint32	127e	4734	Not applicable
Instrument.OEMConfigList.Parameter80	Parameter that is to be alterable	eint32	127f	4735	Not applicable
Instrument.OEMConfigList.Parameter81	Parameter that is to be alterable	eint32	1280	4736	Not applicable
Instrument.OEMConfigList.Parameter82	Parameter that is to be alterable	eint32	1281	4737	Not applicable
Instrument.OEMConfigList.Parameter83	Parameter that is to be alterable	eint32	1282	4738	Not applicable
Instrument.OEMConfigList.Parameter84	Parameter that is to be alterable	eint32	1283	4739	Not applicable
Instrument.OEMConfigList.Parameter85	Parameter that is to be alterable	eint32	1284	4740	Not applicable
Instrument.OEMConfigList.Parameter86	Parameter that is to be alterable	eint32	1285	4741	Not applicable
Instrument.OEMConfigList.Parameter87	Parameter that is to be alterable	eint32	1286	4742	Not applicable
Instrument.OEMConfigList.Parameter88	Parameter that is to be alterable	eint32	1287	4743	Not applicable
Instrument.OEMConfigList.Parameter89	Parameter that is to be alterable	eint32	1288	4744	Not applicable
Instrument.OEMConfigList.Parameter90	Parameter that is to be alterable	eint32	1289	4745	Not applicable
Instrument.OEMConfigList.Parameter91	Parameter that is to be alterable	eint32	128a	4746	Not applicable
Instrument.OEMConfigList.Parameter92	Parameter that is to be alterable	eint32	128b	4747	Not applicable
Instrument.OEMConfigList.Parameter93	Parameter that is to be alterable	eint32	128c	4748	Not applicable
Instrument.OEMConfigList.Parameter94	Parameter that is to be alterable	eint32	128d	4749	Not applicable
Instrument.OEMConfigList.Parameter95	Parameter that is to be alterable	eint32	128e	4750	Not applicable
Instrument.OEMConfigList.Parameter96	Parameter that is to be alterable	eint32	128f	4751	Not applicable
Instrument.OEMConfigList.Parameter97	Parameter that is to be alterable	eint32	1290	4752	Not applicable
Instrument.OEMConfigList.Parameter98	Parameter that is to be alterable	eint32	1291	4753	Not applicable
Instrument.OEMConfigList.Parameter99	Parameter that is to be alterable	eint32	1292	4754	Not applicable
Instrument.OEMConfigList.Parameter100	Parameter that is to be alterable	eint32	1293	4755	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Instrument.OEMSupervisorList.Parameter1	Parameter that is to be read only	eint32	1294	4756	Not applicable
Instrument.OEMSupervisorList.Parameter2	Parameter that is to be read only	eint32	1295	4757	Not applicable
Instrument.OEMSupervisorList.Parameter3	Parameter that is to be read only	eint32	1296	4758	Not applicable
Instrument.OEMSupervisorList.Parameter4	Parameter that is to be read only	eint32	1297	4759	Not applicable
Instrument.OEMSupervisorList.Parameter5	Parameter that is to be read only	eint32	1298	4760	Not applicable
Instrument.OEMSupervisorList.Parameter6	Parameter that is to be read only	eint32	1299	4761	Not applicable
Instrument.OEMSupervisorList.Parameter7	Parameter that is to be read only	eint32	129a	4762	Not applicable
Instrument.OEMSupervisorList.Parameter8	Parameter that is to be read only	eint32	129b	4763	Not applicable
Instrument.OEMSupervisorList.Parameter9	Parameter that is to be read only	eint32	129c	4764	Not applicable
Instrument.OEMSupervisorList.Parameter10	Parameter that is to be read only	eint32	129d	4765	Not applicable
Instrument.OEMSupervisorList.Parameter11	Parameter that is to be read only	eint32	129e	4766	Not applicable
Instrument.OEMSupervisorList.Parameter12	Parameter that is to be read only	eint32	129f	4767	Not applicable
Instrument.OEMSupervisorList.Parameter13	Parameter that is to be read only	eint32	12a0	4768	Not applicable
Instrument.OEMSupervisorList.Parameter14	Parameter that is to be read only	eint32	12a1	4769	Not applicable
Instrument.OEMSupervisorList.Parameter15	Parameter that is to be read only	eint32	12a2	4770	Not applicable
Instrument.OEMSupervisorList.Parameter16	Parameter that is to be read only	eint32	12a3	4771	Not applicable
Instrument.OEMSupervisorList.Parameter17	Parameter that is to be read only	eint32	12a4	4772	Not applicable
Instrument.OEMSupervisorList.Parameter18	Parameter that is to be read only	eint32	12a5	4773	Not applicable
Instrument.OEMSupervisorList.Parameter19	Parameter that is to be read only	eint32	12a6	4774	Not applicable
Instrument.OEMSupervisorList.Parameter20	Parameter that is to be read only	eint32	12a7	4775	Not applicable
Instrument.OEMSupervisorList.Parameter21	Parameter that is to be read only	eint32	12a8	4776	Not applicable
Instrument.OEMSupervisorList.Parameter22	Parameter that is to be read only	eint32	12a9	4777	Not applicable
Instrument.OEMSupervisorList.Parameter23	Parameter that is to be read only	eint32	12aa	4778	Not applicable
Instrument.OEMSupervisorList.Parameter24	Parameter that is to be read only	eint32	12ab	4779	Not applicable
Instrument.OEMSupervisorList.Parameter25	Parameter that is to be read only	eint32	12ac	4780	Not applicable
Instrument.OEMSupervisorList.Parameter26	Parameter that is to be read only	eint32	12ad	4781	Not applicable
Instrument.OEMSupervisorList.Parameter27	Parameter that is to be read only	eint32	12ae	4782	Not applicable
Instrument.OEMSupervisorList.Parameter28	Parameter that is to be read only	eint32	12af	4783	Not applicable
Instrument.OEMSupervisorList.Parameter29	Parameter that is to be read only	eint32	12b0	4784	Not applicable
Instrument.OEMSupervisorList.Parameter30	Parameter that is to be read only	eint32	12b1	4785	Not applicable
Instrument.OEMSupervisorList.Parameter31	Parameter that is to be read only	eint32	12b2	4786	Not applicable
Instrument.OEMSupervisorList.Parameter32	Parameter that is to be read only	eint32	12b3	4787	Not applicable
Instrument.OEMSupervisorList.Parameter33	Parameter that is to be read only	eint32	12b4	4788	Not applicable
Instrument.OEMSupervisorList.Parameter34	Parameter that is to be read only	eint32	12b5	4789	Not applicable
Instrument.OEMSupervisorList.Parameter35	Parameter that is to be read only	eint32	12b6	4790	Not applicable
Instrument.OEMSupervisorList.Parameter36	Parameter that is to be read only	eint32	12b7	4791	Not applicable
Instrument.OEMSupervisorList.Parameter37	Parameter that is to be read only	eint32	12b8	4792	Not applicable
Instrument.OEMSupervisorList.Parameter38	Parameter that is to be read only	eint32	12b9	4793	Not applicable
Instrument.OEMSupervisorList.Parameter39	Parameter that is to be read only	eint32	12ba	4794	Not applicable
Instrument.OEMSupervisorList.Parameter40	Parameter that is to be read only	eint32	12bb	4795	Not applicable
Instrument.OEMSupervisorList.Parameter41	Parameter that is to be read only	eint32	12bc	4796	Not applicable
Instrument.OEMSupervisorList.Parameter42	Parameter that is to be read only	eint32	12bd	4797	Not applicable
Instrument.OEMSupervisorList.Parameter43	Parameter that is to be read only	eint32	12be	4798	Not applicable
Instrument.OEMSupervisorList.Parameter44	Parameter that is to be read only	eint32	12bf	4799	Not applicable
Instrument.OEMSupervisorList.Parameter45	Parameter that is to be read only	eint32	12c0	4800	Not applicable
Instrument.OEMSupervisorList.Parameter46	Parameter that is to be read only	eint32	12c1	4801	Not applicable
Instrument.OEMSupervisorList.Parameter47	Parameter that is to be read only	eint32	12c2	4802	Not applicable
Instrument.OEMSupervisorList.Parameter48	Parameter that is to be read only	eint32	12c3	4803	Not applicable
Instrument.OEMSupervisorList.Parameter49	Parameter that is to be read only	eint32	12c4	4804	Not applicable
Instrument.OEMSupervisorList.Parameter50	Parameter that is to be read only	eint32	12c5	4805	Not applicable
Instrument.OEMSupervisorList.Parameter51	Parameter that is to be read only	eint32	12c6	4806	Not applicable
Instrument.OEMSupervisorList.Parameter52	Parameter that is to be read only	eint32	12c7	4807	Not applicable
Instrument.OEMSupervisorList.Parameter53	Parameter that is to be read only	eint32	12c8	4808	Not applicable
Instrument.OEMSupervisorList.Parameter54	Parameter that is to be read only	eint32	12c9	4809	Not applicable
Instrument.OEMSupervisorList.Parameter55	Parameter that is to be read only	eint32	12ca	4810	Not applicable
Instrument.OEMSupervisorList.Parameter56	Parameter that is to be read only	eint32	12cb	4811	Not applicable
Instrument.OEMSupervisorList.Parameter57	Parameter that is to be read only	eint32	12cc	4812	Not applicable
Instrument.OEMSupervisorList.Parameter58	Parameter that is to be read only	eint32	12cd	4813	Not applicable
Instrument.OEMSupervisorList.Parameter59	Parameter that is to be read only	eint32	12ce	4814	Not applicable
Instrument.OEMSupervisorList.Parameter60	Parameter that is to be read only	eint32	12cf	4815	Not applicable
Instrument.OEMSupervisorList.Parameter61	Parameter that is to be read only	eint32	12d0	4816	Not applicable
Instrument.OEMSupervisorList.Parameter62	Parameter that is to be read only	eint32	12d1	4817	Not applicable
Instrument.OEMSupervisorList.Parameter63	Parameter that is to be read only	eint32	12d2	4818	Not applicable
Instrument.OEMSupervisorList.Parameter64	Parameter that is to be read only	eint32	12d3	4819	Not applicable
Instrument.OEMSupervisorList.Parameter65	Parameter that is to be read only	eint32	12d4	4820	Not applicable
Instrument.OEMSupervisorList.Parameter66	Parameter that is to be read only	eint32	12d5	4821	Not applicable
Instrument.OEMSupervisorList.Parameter67	Parameter that is to be read only	eint32	12d6	4822	Not applicable
Instrument.OEMSupervisorList.Parameter68	Parameter that is to be read only	eint32	12d7	4823	Not applicable
Instrument.OEMSupervisorList.Parameter69	Parameter that is to be read only	eint32	12d8	4824	Not applicable
Instrument.OEMSupervisorList.Parameter70	Parameter that is to be read only	eint32	12d9	4825	Not applicable
Instrument.OEMSupervisorList.Parameter71	Parameter that is to be read only	eint32	12da	4826	Not applicable
Instrument.OEMSupervisorList.Parameter72	Parameter that is to be read only	eint32	12db	4827	Not applicable
Instrument.OEMSupervisorList.Parameter73	Parameter that is to be read only	eint32	12dc	4828	Not applicable
Instrument.OEMSupervisorList.Parameter74	Parameter that is to be read only	eint32	12dd	4829	Not applicable
Instrument.OEMSupervisorList.Parameter75	Parameter that is to be read only	eint32	12de	4830	Not applicable
Instrument.OEMSupervisorList.Parameter76	Parameter that is to be read only	eint32	12df	4831	Not applicable
Instrument.OEMSupervisorList.Parameter77	Parameter that is to be read only	eint32	12e0	4832	Not applicable
Instrument.OEMSupervisorList.Parameter78	Parameter that is to be read only	eint32	12e1	4833	Not applicable
Instrument.OEMSupervisorList.Parameter79	Parameter that is to be read only	eint32	12e2	4834	Not applicable
Instrument.OEMSupervisorList.Parameter80	Parameter that is to be read only	eint32	12e3	4835	Not applicable
Instrument.OEMSupervisorList.Parameter81	Parameter that is to be read only	eint32	12e4	4836	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Instrument.OEMSupervisorList.Parameter82	Parameter that is to be read only	eint32	12e5	4837	Not applicable
Instrument.OEMSupervisorList.Parameter83	Parameter that is to be read only	eint32	12e6	4838	Not applicable
Instrument.OEMSupervisorList.Parameter84	Parameter that is to be read only	eint32	12e7	4839	Not applicable
Instrument.OEMSupervisorList.Parameter85	Parameter that is to be read only	eint32	12e8	4840	Not applicable
Instrument.OEMSupervisorList.Parameter86	Parameter that is to be read only	eint32	12e9	4841	Not applicable
Instrument.OEMSupervisorList.Parameter87	Parameter that is to be read only	eint32	12ea	4842	Not applicable
Instrument.OEMSupervisorList.Parameter88	Parameter that is to be read only	eint32	12eb	4843	Not applicable
Instrument.OEMSupervisorList.Parameter89	Parameter that is to be read only	eint32	12ec	4844	Not applicable
Instrument.OEMSupervisorList.Parameter90	Parameter that is to be read only	eint32	12ed	4845	Not applicable
Instrument.OEMSupervisorList.Parameter91	Parameter that is to be read only	eint32	12ee	4846	Not applicable
Instrument.OEMSupervisorList.Parameter92	Parameter that is to be read only	eint32	12ef	4847	Not applicable
Instrument.OEMSupervisorList.Parameter93	Parameter that is to be read only	eint32	12f0	4848	Not applicable
Instrument.OEMSupervisorList.Parameter94	Parameter that is to be read only	eint32	12f1	4849	Not applicable
Instrument.OEMSupervisorList.Parameter95	Parameter that is to be read only	eint32	12f2	4850	Not applicable
Instrument.OEMSupervisorList.Parameter96	Parameter that is to be read only	eint32	12f3	4851	Not applicable
Instrument.OEMSupervisorList.Parameter97	Parameter that is to be read only	eint32	12f4	4852	Not applicable
Instrument.OEMSupervisorList.Parameter98	Parameter that is to be read only	eint32	12f5	4853	Not applicable
Instrument.OEMSupervisorList.Parameter99	Parameter that is to be read only	eint32	12f6	4854	Not applicable
Instrument.OEMSupervisorList.Parameter100	Parameter that is to be read only	eint32	12f7	4855	Not applicable
Instrument.Security.CommsPass	1 = Password required for comms access	bool	10c1	4289	Not applicable
Instrument.Security.DefaultConfig	1 = set all parameters to factory settings	bool	10c2	4290	Not applicable
Instrument.Security.EngineerAccess	1 = Engineer access required	bool	10c0	4288	Not applicable
Instrument.Security.EngineerPassword	Engineer pass phrase (default 100)	string_t	63d3	25555	Not applicable
Instrument.Security.Feature2Pass	Features2 pass code	int32	10c4	4292	Not applicable
Instrument.Security.Feature3Pass	Features3 pass code	int32	10c5	4293	Not applicable
Instrument.Security.FeaturePass	Features pass code	int32	10c3	4291	Not applicable
Instrument.Security.OEMEntry	OEM pass phrase entry	string_t	6d61	28001	Not applicable
Instrument.Security.OEMParamLists	OEM Parameter Lists	bool	10c7	4295	Not applicable
Instrument.Security.OEMPass	OEM pass phrase	string_t	6d30	27952	Not applicable
Instrument.Security.OEMStatus	OEM status (0 = Unlocked; 1 = Locked)	bool	10c6	4294	Not applicable
Instrument.Security.OperatorPassword	Operator pass phrase (default = 100)	string_t	6437	25655	Not applicable
Instrument.Security.PassPhrase	The parameter to be written to if comms security is enabled	string_t	4416	17430	Not applicable
Instrument.Security.SupervisorPassword	Supervisor pass phrase (default = blank	string_t	6405	25605	Not applicable
Lgc2.1.FallbackType	Fallback Condition 0 = Output False; Status Bad. 1 = Output True; Status Bad 2 = Output False; Status Good. 3 = Output True; Status good	uint8	2efb	12027	Not applicable
Lgc2.1.In1	Input Value 1	float32	2ef9	12025	0dp
Lgc2.1.In2	Input Value 2	float32	2efa	12026	0dp
Lgc2.1.Invert	Sense of Input Values 0 = Neither input inverted 1 = Input 1 inverted 2 = Input 2 inverted 3 = Both inputs inverted	uint8	2efc	12028	Not applicable
Lgc2.1.Oper	Logic Operation 0 = Off; 1 = AND; 2 = OR; 3 = XOR; 4 = 1 set/2 reset 5 = Input 1 = Input 2 6 = Input 1 ≠ Input 2 7 = Input 1 > Input 2 8 = Input 1< Input 2 9 = Input 1 ≥ Input 2; 10 = Input 1 ≤ Input 2	uint8	2ef8	12024	Not applicable
Lgc2.1.Out	Output Value (0 = Off (false); 1 = On (true))	bool	2efd	12029	Not applicable
Lgc2.1.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2efe	12030	Not applicable
Lgc2.2.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f02	12034	Not applicable
Lgc2.2.In1	Input Value 1	float32	2f00	12032	0dp
Lgc2.2.In2	Input Value 2	float32	2f01	12033	0dp
Lgc2.2.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f03	12035	Not applicable
Lgc2.2.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2eff	12031	Not applicable
Lgc2.2.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f04	12036	Not applicable
Lgc2.2.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f05	12037	Not applicable
Lgc2.3.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f09	12041	Not applicable
Lgc2.3.In1	Input Value 1	float32	2f07	12039	0dp
Lgc2.3.In2	Input Value 2	float32	2f08	12040	0dp
Lgc2.3.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f0a	12042	Not applicable
Lgc2.3.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f06	12038	Not applicable
Lgc2.3.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f0b	12043	Not applicable
Lgc2.3.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f0c	12044	Not applicable
Lgc2.4.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f10	12048	Not applicable
Lgc2.4.In1	Input Value 1	float32	2f0e	12046	0dp
Lgc2.4.In2	Input Value 2	float32	2f0f	12047	0dp
Lgc2.4.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f11	12049	Not applicable
Lgc2.4.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f0d	12045	Not applicable
Lgc2.4.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f12	12050	Not applicable
Lgc2.4.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f13	12051	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Lgc2.5.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f17	12055	Not applicable
Lgc2.5.In1	Input Value 1	float32	2f15	12053	0dp
Lgc2.5.In2	Input Value 2	float32	2f16	12054	0dp
Lgc2.5.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f18	12056	Not applicable
Lgc2.5.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f14	12052	Not applicable
Lgc2.5.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f19	12057	Not applicable
Lgc2.5.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f1a	12058	Not applicable
Lgc2.6.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f1e	12062	Not applicable
Lgc2.6.In1	Input Value 1	float32	2f1c	12060	0dp
Lgc2.6.In2	Input Value 2	float32	2f1d	12061	0dp
Lgc2.6.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f1f	12063	Not applicable
Lgc2.6.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f1b	12059	Not applicable
Lgc2.6.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f20	12064	Not applicable
Lgc2.6.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f21	12065	Not applicable
Lgc2.7.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f25	12069	Not applicable
Lgc2.7.In1	Input Value 1	float32	2f23	12067	0dp
Lgc2.7.In2	Input Value 2	float32	2f24	12068	0dp
Lgc2.7.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f26	12070	Not applicable
Lgc2.7.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f22	12066	Not applicable
Lgc2.7.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f27	12071	Not applicable
Lgc2.7.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f28	12072	Not applicable
Lgc2.8.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f2c	12076	Not applicable
Lgc2.8.In1	Input Value 1	float32	2f2a	12074	0dp
Lgc2.8.In2	Input Value 2	float32	2f2b	12075	0dp
Lgc2.8.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f2d	12077	Not applicable
Lgc2.8.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f29	12073	Not applicable
Lgc2.8.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f2e	12078	Not applicable
Lgc2.8.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f2f	12079	Not applicable
Lgc2.9.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f33	12083	Not applicable
Lgc2.9.In1	Input Value 1	float32	2f31	12081	0dp
Lgc2.9.In2	Input Value 2	float32	2f32	12082	0dp
Lgc2.9.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f34	12084	Not applicable
Lgc2.9.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f30	12080	Not applicable
Lgc2.9.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f35	12085	Not applicable
Lgc2.9.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f36	12086	Not applicable
Lgc2.10.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f3a	12090	Not applicable
Lgc2.10.In1	Input Value 1	float32	2f38	12088	0dp
Lgc2.10.In2	Input Value 2	float32	2f39	12089	0dp
Lgc2.10.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f3b	12091	Not applicable
Lgc2.10.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f37	12087	Not applicable
Lgc2.10.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f3c	12092	Not applicable
Lgc2.10.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f3d	12093	Not applicable
Lgc2.11.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f41	12097	Not applicable
Lgc2.11.In1	Input Value 1	float32	2f3f	12095	0dp
Lgc2.11.In2	Input Value 2	float32	2f40	12096	0dp
Lgc2.11.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f42	12098	Not applicable
Lgc2.11.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f3e	12094	Not applicable
Lgc2.11.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f43	12099	Not applicable
Lgc2.11.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f44	12100	Not applicable
Lgc2.12.FallbackType	Fallback Condition (as Lgc2.1.FallbackType)	uint8	2f48	12104	Not applicable
Lgc2.12.In1	Input Value 1	float32	2f46	12102	0dp
Lgc2.12.In2	Input Value 2	float32	2f47	12103	0dp
Lgc2.12.Invert	Sense of Input Value (as Lgc2.1.Invert)	uint8	2f49	12105	Not applicable
Lgc2.12.Oper	Logic Operation (as Lgc2.1.Oper)	uint8	2f45	12101	Not applicable
Lgc2.12.Out	The result of the logic operation (as Lgc2.1.Out)	bool	2f4a	12106	Not applicable
Lgc2.12.OutputStatus	Output Status (0 = Good; 1 = Bad)	uint8	2f4b	12107	Not applicable
Lgc8.1.In1	Input 1 Value (0 = Off; 1 = On)	bool	2f4f	12111	Not applicable
Lgc8.1.In2	Input 2 Value (0 = Off; 1 = On)	bool	2f50	12112	Not applicable
Lgc8.1.In3	Input 3 Value (0 = Off; 1 = On)	bool	2f51	12113	Not applicable
Lgc8.1.In4	Input 4 Value (0 = Off; 1 = On)	bool	2f52	12114	Not applicable
Lgc8.1.In5	Input 5 Value (0 = Off; 1 = On)	bool	2f53	12115	Not applicable
Lgc8.1.In6	Input 6 Value (0 = Off; 1 = On)	bool	2f54	12116	Not applicable
Lgc8.1.In7	Input 7 Value (0 = Off; 1 = On)	bool	2f55	12117	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Lgc8.1.In8	Input 8 Value (0 = Off; 1 = On)	bool	2f56	12118	Not applicable
Lgc8.1.InInvert	Invert Selected Inputs (See also section 4.20.3) Hex0001 = Invert input 1 Hex0010 = invert input 5 Hex0002 = Invert input 2 Hex0020 = invert input 6 Hex0003 = Invert input 3 Hex0030 = invert input 7 Hex0004 = invert input 4 Hex0040 = invert input 8	uint8	2f4d	12109	Not applicable
Lgc8.1.NumIn	Number of Inputs	uint8	2f4e	12110	Not applicable
Lgc8.1.Oper	Logic Operation (0 = Off; 1 = AND; 2 = OR; 3 = XOR)	uint8	2f4c	12108	Not applicable
Lgc8.1.Out	Output Value (0 = Off (false); 1 = On (true))	bool	2f57	12119	Not applicable
Lgc8.1.OutInvert	Invert the Output (0 = No; 1 = Yes)	bool	2f58	12120	Not applicable
Lgc8.2.In1	Input 1 Value (0 = Off; 1 = On)	bool	2f5c	12124	Not applicable
Lgc8.2.In2	Input 2 Value (0 = Off; 1 = On)	bool	2f5d	12125	Not applicable
Lgc8.2.In3	Input 3 Value (0 = Off; 1 = On)	bool	2f5e	12126	Not applicable
Lgc8.2.In4	Input 4 Value (0 = Off; 1 = On)	bool	2f5f	12127	Not applicable
Lgc8.2.In5	Input 5 Value (0 = Off; 1 = On)	bool	2f60	12128	Not applicable
Lgc8.2.In6	Input 6 Value (0 = Off; 1 = On)	bool	2f61	12129	Not applicable
Lgc8.2.In7	Input 7 Value (0 = Off; 1 = On)	bool	2f62	12130	Not applicable
Lgc8.2.In8	Input 8 Value (0 = Off; 1 = On)	bool	2f63	12131	Not applicable
Lgc8.2.InInvert	Invert Selected Inputs (as Lgc8.1.InInvert)	uint8	2f5a	12122	Not applicable
Lgc8.2.NumIn	Number of Inputs	uint8	2f5b	12123	Not applicable
Lgc8.2.Oper	Logic Operation (0 = Off; 1 = AND; 2 = OR; 3 = XOR)	uint8	2f59	12121	Not applicable
Lgc8.2.Out	Output Value (as Lgc8.1.Out)	bool	2f64	12132	Not applicable
Lgc8.2.OutInvert	Invert the Output (0 = No; 1 = Yes)	bool	2f65	12133	Not applicable
Loop.1.Diag.DerivativeOutContrib	Derivative Output Contribution	float32	0212	530	0dp
Loop.1.Diag.Error	Calculated error	float32	020d	525	Same as Loop.1.Main.PV
Loop.1.Diag.IntegralOutContrib	Integral Output Contribution	float32	0211	529	0dp
Loop.1.Diag.LoopBreakAlarm	Loop Break (0 = No break; 1 = Break)	bool	020f	527	Not applicable
Loop.1.Diag.LoopMode	Mode of the Loop (0 = Auto; 1 = Man; 2 = Off)	uint8	1691	5777	Not applicable
Loop.1.Diag.PropOutContrib	Proportional Output Contribution	float32	0210	528	0dp
Loop.1.Diag.SBrk	Sensor Break Status (0 = No break; 1 = Break)	bool	0213	531	Not applicable
Loop.1.Diag.SchedCBH	The Scheduled Cutback High (0 = Auto)	float32	1695	5781	0dp
Loop.1.Diag.SchedCBL	The Scheduled Cutback Low (0 = Auto)	float32	1696	5782	0dp
Loop.1.Diag.SchedLPBrk	The Scheduled Loop Break Time (0 = Off)	float32	1698	5784	0dp
Loop.1.Diag.SchedMR	The Scheduled Manual Reset	float32	1697	5783	1dp
Loop.1.Diag.SchedOPHi	The Scheduled Output High Limit	float32	169a	5786	1dp
Loop.1.Diag.SchedOPLo	The Scheduled Output Low Limit	float32	169b	5787	1dp
Loop.1.Diag.SchedPB	The Scheduled Proportional Band	float32	1692	5778	1dp
Loop.1.Diag.SchedR2G	The Scheduled Relative Cool Gain	float32	1699	5785	1dp
Loop.1.Diag.SchedTd	The Scheduled Derivative Time (0 = Off)	float32	1694	5780	0dp
Loop.1.Diag.SchedTi	The Scheduled Integral Time (0 = Off)	float32	1693	5779	0dp
Loop.1.Diag.TargetOutVal	Target Output value	float32	020e	526	Same as Loop.1.OP.OutputHighLimit
Loop.1.Diag.WrkOPHi	Working Output High Limit	float32	0215	533	0dp
Loop.1.Diag.WrkOPLo	Working Output Low Limit	float32	0214	532	0dp
Loop.1.Main.ActiveOut	Working Output	float32	0204	516	Same as Loop.1.OP.OutputHighLimit
Loop.1.Main.AutoMan	Auto/Manual Mode (0 = Auto; 1 = Man)	bool	0201	513	Not applicable
Loop.1.Main.Inhibit	Control Inhibit (0 = No; 1 = Yes)	bool	0205	517	Not applicable
Loop.1.Main.IntHold	Integral action inhibit. 0 = No; 1 = Yes	uint8	0206	518	Not applicable
Loop1.Maim.PV	Process varaible	float32	0200	512	1dp
Loop.1.Main.TargetSP	Target Setpoint	float32	0202	514	Same as Loop.1.Main.PV
Loop.1.Main.WorkingSP	Working Setpoint	float32	0203515	Same as	Loop.1.Main.PV
Loop.1.OP.Ch1OnOffHysteresis	Ch1 On/Off Hysteresis in Engineering Units	float32	1672	5746	Same as Loop.1.Main.PV
Loop.1.OP.Ch1Out	Channel 1 Output Value	float32	020b	523	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.Ch1PotBreak	Ch1 Potentiometer Break (0 = Off; 1 = On)	uint8	1679	5753	Not applicable
Loop.1.OP.Ch1PotPosition	Ch1 Valve Position	float32	1678	5752	0dp
Loop.1.OP.Ch1TravelTime	Channel 1 Travel Time	float32	1674	5748	1dp
Loop.1.OP.Ch2Deadband	Channel 2 Deadband	float32	166f	5743	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.Ch2OnOffHysteresis	Ch2 On/Off Hysteresis in Eng Units	float32	1673	5747	Same as Loop.1.Main.PV
Loop.1.OP.Ch2Out	Channel 2 (Cool) Output Value	float32	020c	524	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.Ch2PotBreak	Ch2 Potentiometer Break (0 = Off; 1 = On)	uint8	167b	5755	Not applicable
Loop.1.OP.Ch2PotPosition	Ch2 Valve Position	float32	167a	5754	0dp
Loop.1.OP.Ch2TravelTime	Channel 2 Travel Time	float32	1675	5749	1dp
Loop.1.OP.CoolType	Cooling Algorithm Type 0 = Linear 1 = Oil 2 = Water 3 = Fan	uint8	1683	5763	Not applicable
Loop.1.OP.EnablePowerFeedforward	0 = Power Feedforward disabled; 1 = PFF enabled	uint8	1681	5761	Not applicable
Loop.1.OP.FeedForwardGain	Feedforward Gain	float32	1685	5765	3dp
Loop.1.OP.FeedForwardOffset	Feedforward Offset	float32	1686	5766	0dp
Loop.1.OP.FeedForwardTrimLimit	Feedforward Trim Limit	float32	1687	5767	0dp
Loop.1.OP.FeedForwardType	Feedforward Type (0 = None; 1 = Remote; 2 = SP; 3 = PV)	uint8	1684	5764	Not applicable
Loop.1.OP.FeedForwardVal	Feedforward Value	float32	1688	5768	0dp
Loop.1.OP.FF_Rem	Remote Feed Forward Input	float32	168d	5773	0dp
Loop.1.OP.ForcedOP	Forced manual output value	float32	168f	5775	1dp
Loop.1.OP.ManStartup	Manual Startup Mode (0 = Off; 1 = On)	bool	1690	5776	Not applicable
Loop.1.OP.ManualMode	Manual Output Mode (0 = Track; 1 = Step; 2 = Last MOP)	uint8	167f	5759	Not applicable
Loop.1.OP.ManualOutVal	Manual Output Value	float32	1680	5760	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.MeasuredPower	Measured Mains Voltage	float32	1682	5762	0dp
Loop.1.OP.NudgeLower	Valve Nudge Lower (1 = Lower)	uint8	1677	5751	Not applicable
Loop.1.OP.NudgeRaise	Valve Nudge Raise (1 = Raise)	uint8	1676	5750	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Loop.1.OP.OutputHighLimit	Output High Limit	float32	166d	5741	1dp
Loop.1.OP.OutputLowLimit	Output Low Limit	float32	166e	5742	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.PotBreakMode	Potentiometer Break Mode (0 = Raise; 1 = Lower; 2 = Rest: 3 = Model)	uint8	167c	5756	Not applicable
Loop.1.OP.Rate	Output Rate Limit Value (0 = Off)	float32	1670	5744	1dp
Loop.1.OP.RateDisable	Output Rate Limit Disable (1 = Disabled)	bool	1671	5745	Not applicable
Loop.1.OP.RemOPH	Remote Output High Limit	float32	168c	5772	Same as Loop.1.Main.ActiveOut
Loop.1.OP.RemOPL	Remote Output Low Limit	float32	168b	5771	Same as Loop.1.Main.ActiveOut
Loop.1.OP.SafeOutVal	Safe Output Value	float32	167e	5758	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.SbrkOP	The output power in sensor break	float32	168e	5774	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.SensorBreakMode	Sensor Break Mode (0 = SbrkOP; 1 = Hold)	uint8	167d	5757	Not applicable
Loop.1.OP.TrackEnable	Enable Output Tracking (0 = Disabled; 1 = Enabled)	uint8	168a	5770	Not applicable
Loop.1.OP.TrackOutVal	Output Track Value	float32	1689	5769	0dp
Loop.1.PID.ActiveSet	Current PID Set	uint8	1638	5688	Not applicable
Loop.1.PID.Boundary1-2	Threshold for swapping between set 1 and set 2	float32	1639	5689	0dp
Loop.1.PID.Boundary2-3	Threshold for swapping between set 2 and set 3	float32	163a	5690	0dp
Loop.1.PID.CutbackHigh	Cutback high value for PID set 1 (0 = Auto)	float32	163f	5695	1dp
Loop.1.PID.CutbackHigh2	Cutback high value for PID set 2 (0 = Auto)	float32	1647	5703	1dp
Loop.1.PID.CutbackHigh3	Cutback high value for PID set 3 (0 = Auto)	float32	164f	5711	1dp
Loop.1.PID.CutbackLow	Cutback low value for PID set 1 (0 = Auto)	float32	1640	5696	1dp
Loop.1.PID.CutbackLow2	Cutback low value for PID set 2 (0 = Auto)	float32	1648	5704	1dp
Loop.1.PID.CutbackLow3	Cutback low value for PID set 3 (0 = Auto)	float32	1650	5712	1dp
Loop.1.PID.DerivativeTime	Derivative time for PID set 1	float32	163d	5693	0dp
Loop.1.PID.DerivativeTime2	Derivative time for PID set 2	float32	1645	5701	0dp
Loop.1.PID.DerivativeTime3	Derivative time for PID set 3	float32	164d	5709	0dp
Loop.1.PID.IntegralTime	Integral time for PID set 1	float32	163c	5692	0dp
Loop.1.PID.IntegralTime2	Integral time for PID set 2	float32	1644	5700	0dp
Loop.1.PID.IntegralTime3	Integral time for PID set 3	float32	164c	5708	0dp
Loop.1.PID.LoopBreakTime	Loop break time for PID set 1	float32	1642	5698	0dp
Loop.1.PID.LoopBreakTime2	Loop break time for PID set 2	float32	164a	5706	0dp
Loop.1.PID.LoopBreakTime3	Loop break time for PID set 3	float32	1652	5714	0dp
Loop.1.PID.ManualReset	Manual reset value for PID set 1	float32	1641	5697	1dp
Loop.1.PID.ManualReset2	Manual reset value for PID set 2	float32	1649	5705	1dp
Loop.1.PID.ManualReset3	Manual reset value for PID set 3	float32	1651	5713	1dp
Loop.1.PID.NumSets	Number of PID Sets to be used (max = 3)	uint8	1636	5686	Not applicable
Loop.1.PID.OutputHi	Gain scheduled output high limit for PID set 1	float32	1653	5715	1dp
Loop.1.PID.OutputHi2	Gain scheduled output high limit for PID set 2	float32	1655	5717	1dp
Loop.1.PID.OutputHi3	Gain scheduled output high limit for PID set 3	float32	1657	5719	1dp
Loop.1.PID.OutputLo	Gain scheduled output low limit for PID set 1	float32	1654	5716	1dp
Loop.1.PID.OutputLo2	Gain scheduled output low limit for PID set 2	float32	1656	5718	1dp
Loop.1.PID.OutputLo3	Gain scheduled output low limit for PID set 3	float32	1658	5720	1dp
Loop.1.PID.ProportionalBand	Proportional band value for PID set 1	float32	163b	5691	1dp
Loop.1.PID.ProportionalBand2	Proportional band value for PID set 2	float32	1643	5699	1dp
Loop.1.PID.ProportionalBand3	Proportional band value for PID set 3	float32	164b	5707	1dp
Loop.1.PID.RelCh2Gain	Channel 2 relative cool gain value for PID set 1	float32	163e	5694	1dp
Loop.1.PID.RelCh2Gain2	Channel 2 relative cool gain value for PID set 2	float32	1646	5702	1dp
Loop.1.PID.RelCh2Gain3	Channel 2 relative cool gain value for PID set 3	float32	164e	5710	1dp
Loop.1.PID.SchedulerRemoteInput	Scheduler Remote Input	float32	1637	5687	0dp
Loop.1.PID.SchedulerType	Scheduler Type 0 = Off 1 = Set 2 = SP 3 = PV 4 = Error 5 = OP 6 = Rem	uint8	1635	5685	Not applicable
Loop.1.Setup.AutoManAccess	Edit access to 'Auto Man' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels	uint8	16a8	5800	Not applicable
Loop.1.Setup.CH1ControlType	Heat/Ch1 Control Type 0 =Off; 1 = On Off; 2 = PID; 3 = VPU; 4 = VPB	uint8	1601	5633	Not applicable
Loop.1.Setup.CH2ControlType	Channel 2 control type (As channel 1, above)	uint8	1602	5634	Not applicable
Loop.1.Setup.ControlAction	Control Action (0 = Reverse; 1 = Direct)	uint8	1603	5635	Not applicable
Loop.1.Setup.DerivativeType	Derivative Type (0 = PV; 1 = Error)	uint8	1605	5637	Not applicable
Loop.1.Setup.ManOutputAccess	Manual output access	uint8	16a9	5801	Not applicable
Loop.1.Setup.LoopName	Loop Name	string_t	5d00	23808	Not applicable
Loop.1.Setup.LoopType	Loop Type (0 = Single; 1 = Cascade; 2 = Override; 3 = Ratio)	uint8	1600	5632	Not applicable
Loop.1.Setup.PBUnits	Proportional Band Units	uint8	1604	5636	Not applicable
Loop.1.Setup.SPAccess	Edit access to 'SP' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels		uint8	16a7	5799Not applicable
Loop.1.SP.AltSP	Alternative Setpoint	float32	1660	5728	Same as Loop.1.Main.PV
Loop.1.SP.AltSPSelect	Alternative Setpoint Enable (0 = disable; 1 = enable)	uint8	1661	5729	Not applicable
Loop.1.SP.ManualTrack	Manual Track Enable (0 = disable; 1 = enable)	uint8	1667	5735	Not applicable
Loop.1.SP.RangeHigh	Setpoint Range High Limit	float32	1659	5721	Same as Loop.1.Main.PV
Loop.1.SP.RangeLow	Setpoint Range Low Limit	float32	165a	5722	Same as Loop.1.Main.PV
Loop.1.SP.Rate	Setpoint Rate Limit Value (0 = Rate limit off)	float32	1662	5730	Same as Loop.1.Main.PV
Loop.1.SP.RateDisable	Setpoint Rate Limit Disable (0 = No; 1 = Yes)	bool	1663	5731	Not applicable
Loop.1.SP.RateDone	Setpoint Rate Limit Complete (0 = No; 1 = Yes)	bool	020a	522	Not applicable
Loop.1.SP.ServoToPV	Servo to PV Enable (0 = No; 1 = Yes)	bool	166c	5740	Not applicable
Loop.1.SP.SP1	Setpoint 1	float32	165c	5724	Same as Loop.1.Main.PV
Loop.1.SP.SP2	Setpoint 2	float32	165d	5725	Same as Loop.1.Main.PV
Loop.1.SP.SPHighLimit	Setpoint High Limit	float32	165e	5726	Same as Loop.1.Main.PV

Parameter path	Description	Type	Hex	Dec	Resolution
Loop.1.SP.SPIntBal	SP Integral Balance (0 = Off; 1 = On)	bool	166b	5739	Not applicable
Loop.1.SP.SPLowLimit	Setpoint Low Limit	float32	165f	5727	Same as Loop.1.Main.PV
Loop.1.SP.SPSelect	Active Setpoint Select (0 = SP1; 1 = SP2)	uint8	165b	5723	Not applicable
Loop.1.SP.SPTrack	Enables setpoint tracking (0 = Off; 1 = On)	uint8	1668	5736	Not applicable
Loop.1.SP.SPTrim	Setpoint Trim value	float32	1664	5732	Same as Loop.1.Main.PV
Loop.1.SP.SPTrimHighLimit	Setpoint Trim High Limit	float32	1665	5733	Same as Loop.1.Main.PV
Loop.1.SP.SPTrimLowLimit	Setpoint Trim Low Limit	float32	1666	5734	Same as Loop.1.Main.PV
Loop.1.SP.TrackPV	Track PV	float32	1669	5737	Same as Loop.1.Main.PV
Loop.1.SP.TrackSP	Manual Tracking Value	float32	166a	5738	Same as Loop.1.Main.PV
Loop.1.Tune.Alpha	Alpha	float32	16ad	5805	4dp
Loop.1.Tune.Alpha_p	Alpha_p	float32	16ab	5803	2dp
Loop.1.Tune.AutotuneEnable	Autotune Enable (0 = Autotune Off; 1 = on)	bool	1631	5681	Not applicable
Loop.1.Tune.CycleNo	CycleNo	float32	16af	5807	0dp
Loop.1.Tune.Debug	Debug	float32	16ae	5806	2dp
Loop.1.Tune.Diagnostics	Tuning diagnostics	bool	31cd	12749	Not applicable
Loop.1.Tune.OPss	OPss	float32	16ac	5804	2dp
Loop.1.Tune.OutputHighLimit	Autotune High Output Power Limit	float32	1632	5682	Same as Loop.1.OP.OutputHighLimit
Loop.1.Tune.OutputLowLimit	Autotune Low Output Power Limit	float32	1633	5683	Same as Loop.1.OP.OutputHighLimit
Loop.1.Tune.PBs	PBs	float32	16b0	5808	2dp
Loop.1.Tune.Settle	Settle	float32	16b2	5810	2dp
Loop.1.Tune.Stage	Autotune stage 0 = Reset 1 = None 2 = Monitor 3 = Current SP 4 = NewSP 5 = ToSp 6 = Max 7 = Min	uint8	0208	520	Not applicable
Loop.1.Tune.StageTime	Time in this Stage of Tune	float32	0209	521	0dp
Loop.1.Tune.State	Tune status 0 = Off 1 = Ready 2 = Running 3 = Complete 4 = Timeout 5 = Ti Limit 6 = R2g limit	uint8	0207	519	Not applicable
Loop.1.Tune.TDs	TDs	float32	16b1	5809	2dp
Loop.1.Tune.TuneR2G	R2G Tuning Type	uint8	1607	5639	Not applicable
Loop.1.Tune.Tuning	Tuning	float32	16aa	5802	0dp
Loop.1.Tune.Type	Autotune Algorithm Type (0 = Cycle; 1 = Single; 2 = Adaptive; 3 = R2GPD)	uint8	1630	5680	Not applicable
Loop.2.Diag.DerivativeOutContrib	Derivative Output Contribution	float32	0292	658	0dp
Loop.2.Diag.Error	Calculated Error	float32	028d	653	Same as Loop.2.Main.PV
Loop.2.Diag.IntegralOutContrib	Integral Output Contribution	float32	0291	657	0dp
Loop.2.Diag.LoopBreakAlarm	Loop Break (0 = No break; 1 = Break)	bool	028f	655	Not applicable
Loop.2.Diag.LoopMode	Loop mode (0 = Auto; 1 = Man; 2 = Off)	uint8	1791	6033	Not applicable
Loop.2.Diag.PropOutContrib	Proportional Output Contribution	float32	0290	656	0dp
Loop.2.Diag.SBrk	Sensor break status (0 = No break; 1 = Break)	bool	0293	659	Not applicable
Loop.2.Diag.SchedCBH	The Scheduled Cutback Hi (0 = Auto)	float32	1795	6037	0dp
Loop.2.Diag.SchedCBL	The Scheduled Cutback Lo (0 = Auto)	float32	1796	6038	0dp
Loop.2.Diag.SchedLPBrk	The Scheduled Loop Break Time	float32	1798	6040	0dp
Loop.2.Diag.SchedMR	The Scheduled Manual Reset	float32	1797	6039	1dp
Loop.2.Diag.SchedOPHi	The Scheduled Output High Limit	float32	179a	6042	1dp
Loop.2.Diag.SchedOPLo	The Scheduled Output Low Limit	float32	179b	6043	1dp
Loop.2.Diag.SchedPB	The Scheduled Proportional Band	float32	1792	6034	1dp
Loop.2.Diag.SchedR2G	The Scheduled Relative Cool Gain	float32	1799	6041	1dp
Loop.2.Diag.SchedTd	The Scheduled Derivative Time (0 = Off)	float32	1794	6036	0dp
Loop.2.Diag.SchedTi	The Scheduled Integral Time (0 = Off)	float32	1793	6035	0dp
Loop.2.Diag.TargetOutVal	Target Output	float32	028e	654	Same as Loop.2.OP.OutputHighLimit
Loop.2.Diag.WrkOPHi	Working Output Hi Limit	float32	0295	661	0dp
Loop.2.Diag.WrkOPLo	Working Output Lo Limit	float32	0294	660	0dp
Loop.2.Main.ActiveOut	Working Output	float32	0284	644	Same as Loop.2.OP.OutputHighLimit
Loop.2.Main.AutoMan	Auto/Manual Mode (Mode. 0 = Auto; 1 = Man)	bool	0281	641	Not applicable
Loop.2.Main.Inhibit	Control Inhibit (0 = No; 1 = Yes)	bool	0285	645	Not applicable
Loop.2.Main.IntHold	Integral action inhibit. 0 = No; 1 = Yes	uint8	0286	646	Not applicable
Loop.2.Main.PV	Process Variable value	float32	0280	640	1dp
Loop.2.Main.TargetSP	Target Setpoint	float32	0282	642	Same as Loop.2.Main.PV
Loop.2.Main.WorkingSP	Working Setpoint	float32	0283	643	Same as Loop.2.Main.PV
Loop.2.OP.Ch1OnOffHysteresis	Channel 1 hysteresis in engineering units	float32	1772	6002	Same as Loop.2.Main.PV
Loop.2.OP.Ch1Out	Channel 1 Output Value	float32	028b	651	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.Ch1PotBreak	Ch1 Potentiometer Break (0 = Off; 1 = On)	uint8	1779	6009	Not applicable
Loop.2.OP.Ch1PotPosition	Ch1 Valve Position	float32	1778	6008	0dp
Loop.2.OP.Ch1TravelTime	Channel 1 Travel Time	float32	1774	6004	1dp
Loop.2.OP.Ch2Deadband	Channel 2 Deadband	float32	176f	5999	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.Ch2OnOffHysteresis	Channel 2 hysteresis in engineering units	float32	1773	6003	Same as Loop.2.Main.PV
Loop.2.OP.Ch2Out	Channel 2 output value	float32	028c	652	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.Ch2PotBreak	Channel 2 Potentiometer Break (0 = Off; 1 = On)	uint8	177b	6011	Not applicable
Loop.2.OP.Ch2PotPosition	Channel 2 Valve Position	float32	177a	6010	0dp
Loop.2.OP.Ch2TravelTime	Channel 2 Travel Time	float32	1775	6005	1dp
Loop.2.OP.CoolType	Cooling Algorithm Type 0 = Linear; 1 = Oil; 2 = Water; 3 = Fan	uint8	1783	6019	Not applicable
Loop.2.OP.EnablePowerFeedforward	0 = Power Feedforward disabled; 1 = PFF enabled	uint8	1781	6017	Not applicable
Loop.2.OP.FeedForwardGain	Feedforward Gain	float32	1785	6021	3dp
Loop.2.OP.FeedForwardOffset	Feedforward Offset	float32	1786	6022	0dp
Loop.2.OP.FeedForwardTrimLimit	Feedforward Trim Limit	float32	1787	6023	0dp
Loop.2.OP.FeedForwardType	Feedforward Type (0 = None; 1 = Remote; 2 = SP; 3 = PV)	uint8	1784	6020	Not applicable
Loop.2.OP.FeedForwardVal	Feedforward Value	float32	1788	6024	0dp

Parameter path	Description	Type	Hex	Dec	Resolution
Loop.2.OP.FF_Rem	Remote Feed Forward Input	float32	178d	6029	0dp
Loop.2.OP.ForcedOP	Forced manual output value	float32	178f	6031	1dp
Loop.2.OP.ManStartup	Manual Startup Mode (0 = Off; 1 = On)	bool	1790	6032	Not applicable
Loop.2.OP.ManualMode	Manual Output Mode (0 = Track; 1 = Step; 2 = Last MOP)	uint8	177f	6015	Not applicable
Loop.2.OP.ManualOutVal	Manual Output Value	float32	1780	6016	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.MeasuredPower	Measured Mains Voltage	float32	1782	6018	0dp
Loop.2.OP.NudgeLower	Valve Nudge Lower (1 = Lower)	uint8	1777	6007	Not applicable
Loop.2.OP.NudgeRaise	Valve Nudge Raise (1 = Raise)	uint8	1776	6006	Not applicable
Loop.2.OP.OutputHighLimit	Output High Limit	float32	176d	5997	1dp
Loop.2.OP.OutputLowLimit	Output Low Limit	float32	176e	5998	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.PotBreakMode	Potentiometer Break Mode (0 = Raise; 1 = Lower; 2 = Rest; 3 = Model)	uint8	177c	6012	Not applicable
Loop.2.OP.Rate	Output Rate Limit Value (0 = off)	float32	1770	6000	1dp
Loop.2.OP.RateDisable	Output Rate Limit Disable (0 = No, 1 = Yes)	bool	1771	6001	Not applicable
Loop.2.OP.RemOPH	Remote Output High Limit	float32	178c	6028	Same as Loop.2.Main.ActiveOut
Loop.2.OP.RemOPL	Remote Output Low Limit	float32	178b	6027	Same as Loop.2.Main.ActiveOut
Loop.2.OP.SafeOutVal	Safe Output Value	float32	177e	6014	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.SbrkOP	The output power under sensor break conditions	float32	178e	6030	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.SensorBreakMode	Sensor Break Mode (0 = SbrkOP; 1 = Hold)	uint8	177d	6013	Not applicable
Loop.2.OP.TrackEnable	Enable Output Tracking (0 = Off; 1 = On)	uint8	178a	6026	Not applicable
Loop.2.OP.TrackOutVal	Output Track Value	float32	1789	6025	0dp
Loop.2.PID.ActiveSet	Current PID set	uint8	1738	5944	Not applicable
Loop.2.PID.Boundary1-2	Threshold for swapping between set 1 and set 2	float32	1739	5945	0dp
Loop.2.PID.Boundary2-3	Threshold for swapping between set 2 and set 3	float32	173a	5946	0dp
Loop.2.PID.CutbackHigh	Cutback high value for PID set 1 (0 = Auto)	float32	173f	5951	1dp
Loop.2.PID.CutbackHigh2	Cutback high value for PID set 2 (0 = Auto)	float32	1747	5959	1dp
Loop.2.PID.CutbackHigh3	Cutback high value for PID set 3 (0 = Auto)	float32	174f	5967	1dp
Loop.2.PID.CutbackLow	Cutback low value for PID set 1 (0 = Auto)	float32	1740	5952	1dp
Loop.2.PID.CutbackLow2	Cutback low value for PID set 2 (0 = Auto)	float32	1748	5960	1dp
Loop.2.PID.CutbackLow3	Cutback low value for PID set 3 (0 = Auto)	float32	1750	5968	1dp
Loop.2.PID.DerivativeTime	Derivative time for PID set 1	float32	173d	5949	0dp
Loop.2.PID.DerivativeTime2	Derivative time for PID set 2	float32	1745	5957	0dp
Loop.2.PID.DerivativeTime3	Derivative time for PID set 3	float32	174d	5965	0dp
Loop.2.PID.IntegralTime	Integral time for PID set 1	float32	173c	5948	0dp
Loop.2.PID.IntegralTime2	Integral time for PID set 2	float32	1744	5956	0dp
Loop.2.PID.IntegralTime3	Integral time for PID set 3	float32	174c	5964	0dp
Loop.2.PID.LoopBreakTime	Loop break time for PID set 1	float32	1742	5954	0dp
Loop.2.PID.LoopBreakTime2	Loop break time for PID set 2	float32	174a	5962	0dp
Loop.2.PID.LoopBreakTime3	Loop break time for PID set 3	float32	1752	5970	0dp
Loop.2.PID.ManualReset	Manual reset value for PID set 1	float32	1741	5953	1dp
Loop.2.PID.ManualReset2	Manual reset value for PID set 2	float32	1749	5961	1dp
Loop.2.PID.ManualReset3	Manual reset value for PID set 3	float32	1751	5969	1dp
Loop.2.PID.NumSets	Number of PID sets to be used (max. 3)	uint8	1736	5942	Not applicable
Loop.2.PID.OutputHi	Gain scheduled output high limit for PID set 1	float32	1753	5971	1dp
Loop.2.PID.OutputHi2	Gain scheduled output high limit for PID set 2	float32	1755	5973	1dp
Loop.2.PID.OutputHi3	Gain scheduled output high limit for PID set 3	float32	1757	5975	1dp
Loop.2.PID.OutputLo	Gain scheduled output low limit for PID set 1	float32	1754	5972	1dp
Loop.2.PID.OutputLo2	Gain scheduled output low limit for PID set 2	float32	1756	5974	1dp
Loop.2.PID.OutputLo3	Gain scheduled output low limit for PID set 3	float32	1758	5976	1dp
Loop.2.PID.ProportionalBand	Proportional band value for PID set 1	float32	173b	5947	1dp
Loop.2.PID.ProportionalBand2	Proportional band value for PID set 2	float32	1743	5955	1dp
Loop.2.PID.ProportionalBand3	Proportional band value for PID set 3	float32	174b	5963	1dp
Loop.2.PID.RelCh2Gain	Channel 2 relative cool gain value for PID set 1	float32	173e	5950	1dp
Loop.2.PID.RelCh2Gain2	Channel 2 relative cool gain value for PID set 2	float32	1746	5958	1dp
Loop.2.PID.RelCh2Gain3	Channel 2 relative cool gain value for PID set 3	float32	174e	5966	1dp
Loop.2.PID.SchedulerRemoteInput	Scheduler Remote Input	float32	1737	5943	0dp
Loop.2.PID.SchedulerType	Scheduler Type 0 = Off 1 = Set 2 = SP 3 = PV 4 = Error 5 = OP 6 = Rem	uint8	1735	5941	Not applicable
Loop.2.Setup.AutoManAccess	Edit access to 'Auto Man' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels	uint8	17a8	6056	Not applicable
Loop.2.Setup.CH1ControlType	Channel 1 Control Type 0 =Off; 1 = On Off; 2 = PID; 3 = VPU; 4 = VPB	uint8	1701	5889	Not applicable
Loop.2.Setup.CH2ControlType	Channel 2 Control Type (As channel 1, above)	uint8	1702	5890	Not applicable
Loop.2.Setup.ControlAction	Control Action (0 = Reverse; 1 = Direct)	uint8	1703	5891	Not applicable
Loop.2.Setup.DerivativeType	Derivative Type (0 = PV; 1 = Error)	uint8	1705	5893	Not applicable
Loop.2.Setup.LoopName	Loop Name	string_t	5d10	23824	Not applicable
Loop.2.Setup.ManOutputAccess	Manual output access	uint8	17a9	6057	Not applicable
Loop.2.Setup.LoopType	Loop Type (0 = single; 1 = cascade; 2 = override; 3 = ratio)	uint8	1700	5888	Not applicable
Loop.2.Setup.PBUnits	Proportional Band Units (0 = Engineering units; 1 = percent)	uint8	1704	5892	Not applicable
Loop.2.Setup.SPAccess	Edit access to 'SP' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels	uint8	17a7	6055	Not applicable
Loop.2.SP.AltSP	Alternative Setpoint	float32	1760	5984	Same as Loop.2.Main.PV
Loop.2.SP.AltSPSelect	Select alternative setpoint (0 = No; 1 = Yes)	uint8	1761	5985	Not applicable
Loop.2.SP.ManualTrack	Manual Track Enable (0 = disable; 1 = enable)	uint8	1767	5991	Not applicable
Loop.2.SP.RangeHigh	Setpoint Range High Limit	float32	1759	5977	Same as Loop.2.Main.PV
Loop.2.SP.RangeLow	Setpoint Range Low Limit	float32	175a	5978	Same as Loop.2.Main.PV

Parameter path	Description	Type	Hex	Dec	Resolution
Loop.2.SP.Rate	Setpoint Rate Limit Value (0 = Rate limit off)	float32	1762	5986	Same as Loop.2.Main.PV
Loop.2.SP.RateDisable	Setpoint Rate Limit Disable (0 = No; 1 = Yes)	bool	1763	5987	Not applicable
Loop.2.SP.RateDone	Setpoint Rate Limit Complete (0 = No; 1 = Yes)	bool	028a	650	Not applicable
Loop.2.SP.ServoToPV	Servo to PV Enable (0 = No; 1 = Yes)	bool	176c	5996	Not applicable
Loop.2.SP.SP1	Setpoint 1	float32	175c	5980	Same as Loop.2.Main.PV
Loop.2.SP.SP2	Setpoint 2	float32	175d	5981	Same as Loop.2.Main.PV
Loop.2.SP.SPHighLimit	Setpoint High Limit	float32	175e	5982	Same as Loop.2.Main.PV
Loop.2.SP.SPIntBal	SP Integral Balance (0 = Off; 1 = On)	bool	176b	5995	Not applicable
Loop.2.SP.SPLowLimit	Setpoint Low Limit	float32	175f	5983	Same as Loop.2.Main.PV
Loop.2.SP.SPSelect	Active Setpoint Select (0 = SP1; 1 = SP2)	uint8	175b	5979	Not applicable
Loop.2.SP.SPTrack	Enables setpoint tracking (0 = Off; 1 = On)	uint8	1768	5992	Not applicable
Loop.2.SP.SPTrim	Setpoint Trim	float32	1764	5988	Same as Loop.2.Main.PV
Loop.2.SP.SPTrimHighLimit	Setpoint Trim High Limit	float32	1765	5989	Same as Loop.2.Main.PV
Loop.2.SP.SPTrimLowLimit	Setpoint Trim Low Limit	float32	1766	5990	Same as Loop.2.Main.PV
Loop.2.SP.TrackPV	PV for Programmer to Track	float32	1769	5993	Same as Loop.2.Main.PV
Loop.2.SP.TrackSP	Manual Tracking Value	float32	176a	5994	Same as Loop.2.Main.PV
Loop.2.Tune.Alpha	Alpha	float32	17ad	6061	4dp
Loop.2.Tune.Alpha_p	Alpha_p	float32	17ab	6059	2dp
Loop.2.Tune.AutotuneEnable	Initiate autotune (0 = Autotune Off; 1 = on)	bool	1731	5937	Not applicable
Loop.2.Tune.CycleNo	CycleNo	float32	17af	6063	0dp
Loop.2.Tune.Debug	Debug	float32	17ae	6062	2dp
Loop.2.Tune.Diagnostics	Tuning diagnostics	bool	31ce	12750	Not applicable
Loop.2.Tune.OPss	OPss	float32	17ac	6060	2dp
Loop.2.Tune.OutputHighLimit	Autotune High Output Power Limit	float32	1732	5938	Same as Loop.2.OP.OutputHighLimit
Loop.2.Tune.OutputLowLimit	Autotune Low Output Power Limit	float32	1733	5939	Same as Loop.2.OP.OutputHighLimit
Loop.2.Tune.PBs	PBs	float32	17b0	6064	2dp
Loop.2.Tune.Settle	Settle	float32	17b2	6066	2dp
Loop.2.Tune.Stage	Stage of Tune 0 = Reset 1 = None 2 = Monitor 3 = Current SP 4 = NewSP 5 = ToSp 6 = Max 7 = Min	uint8	0288	648	Not applicable
Loop.2.Tune.StageTime	Time in this Stage of Tune	float32	0289	649	0dp
Loop.2.Tune.State	Autotune state 0 = Off 1 = Ready 2 = Complete 3 = Timeout 4 = Ti Lmit 5 = R2g limit	uint8	0287	647	Not applicable
Loop.2.Tune.TDs	TDs	float32	17b1	6065	2dp
Loop.2.Tune.TuneR2G	R2G Tuning Type	uint8	1608	5640	Not applicable
Loop.2.Tune.Tuning	Tuning	float32	17aa	6058	0dp
Loop.2.Tune.Type	Autotune Algorithm Type (0 = Cycle; 1 = Single; 2 = Adaptive; 3 = R2GPD)	uint8	1730	5936	Not applicable
Math2.1.Fallback	Fallback strategy 0 = Clip Bad; 1 = Clip Good; 2 = Fallback Bad 3 = Fallback Good; 4 = Up scale; 5 = Down scale.	uint8	2faf	12207	Not applicable
Math2.1.FallbackVal	Fallback Value	float32	2fab	12203	Same as Math2.1.Out
Math2.1.HighLimit	Output High Limit	float32	2fac	12204	Same as Math2.1.Out
Math2.1.In1	Input 1 Value	float32	2fa7	12199	0dp
Math2.1.In1Mul	Input 1 Multiplier	float32	2fa6	12198	1dp
Math2.1.In2	Input 2 Value	float32	2fa9	12201	0dp
Math2.1.In2Mul	Input 2 Multiplier	float32	2fa8	12200	1dp
Math2.1.LowLimit	Output Low Limit	float32	2fad	12205	Same as Math2.1.Out
Math2.1.Oper	Operation 0 = Off 1 = Add 2 = Subtract 3 = Multiply 4 =Divide 5 = Abs diff 6 = Select Max 7 = Select Min 8 = Hot Swap 9 = Sample & Hold 10 = Power 11 = Square root 12 = Log 13 = Ln 14 = Exponential 15 = 10 to the X 51 = Select	uint8	2faa	12202	Not applicable
Math2.1.Out	Output Value	float32	2fae	12206	Set by Math2.1.Resolution
Math2.1.Resolution	Output Resolution	uint8	2fb2	12210	Not applicable
Math2.1.Select	Select Input 1 or Input 2	bool	2fb0	12208	Not applicable
Math2.1.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	2fb1	12209	Not applicable
Math2.1.Units	Output Units	string_t	6944	26948	Not applicable
Math2.2.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	2fbc	12220	Not applicable
Math2.2.FallbackVal	Fallback Value	float32	2fb8	12216	Same as Math2.2.Out
Math2.2.HighLimit	Output High Limit	float32	2fb9	12217	Same as Math2.2.Out
Math2.2.In1	Input 1 Value	float32	2fb4	12212	0dp
Math2.2.In1Mul	Input 1 Scale	float32	2fb3	12211	1dp
Math2.2.In2	Input 2 Value	float32	2fb6	12214	0dp
Math2.2.In2Mul	Input 2 Scale	float32	2fb5	12213	1dp
Math2.2.LowLimit	Output Low Limit	float32	2fba	12218	Same as Math2.2.Out
Math2.2.Oper	Operation (as Math2.1.Oper)	uint8	2fb7	12215	Not applicable
Math2.2.Out	Output Value	float32	2fbb	12219	Set by Math2.2.Resolution
Math2.2.Resolution	Output Resolution	uint8	2fbf	12223	Not applicable
Math2.2.Select	Select Input 1 or Input 2	bool	2fbd	12221	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Math2.2.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	2fbe	12222	Not applicable
Math2.2.Units	Output Units	string_t	694a	26954	Not applicable
Math2.3.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	2fc9	12233	Not applicable
Math2.3.FallbackVal	Fallback Value	float32	2fc5	12229	Same as Math2.3.Out
Math2.3.HighLimit	Output High Limit	float32	2fc6	12230	Same as Math2.3.Out
Math2.3.In1	Input 1 Value	float32	2fc1	12225	0dp
Math2.3.In1Mul	Input 1 Scale	float32	2fc0	12224	1dp
Math2.3.In2	Input 2 Value	float32	2fc3	12227	0dp
Math2.3.In2Mul	Input 2 Scale	float32	2fc2	12226	1dp
Math2.3.LowLimit	Output Low Limit	float32	2fc7	12231	Same as Math2.3.Out
Math2.3.Oper	Operation (as Math2.1.Oper)	uint8	2fc4	12228	Not applicable
Math2.3.Out	Output Value	float32	2fc8	12232	Set by Math2.3.Resolution
Math2.3.Resolution	Output Resolution	uint8	2fcc	12236	Not applicable
Math2.3.Select	Select Between Input 1 and Input 2	bool	2fca	12234	Not applicable
Math2.3.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	2fcb	12235	Not applicable
Math2.3.Units	Output Units	string_t	6950	26960	Not applicable
Math2.4.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	2fd6	12246	Not applicable
Math2.4.FallbackVal	Fallback Value	float32	2fd2	12242	Same as Math2.4.Out
Math2.4.HighLimit	Output High Limit	float32	2fd3	12243	Same as Math2.4.Out
Math2.4.In1	Input 1 Value	float32	2fce	12238	0dp
Math2.4.In1Mul	Input 1 Scale	float32	2fcd	12237	1dp
Math2.4.In2	Input 2 Value	float32	2fd0	12240	0dp
Math2.4.In2Mul	Input 2 Scale	float32	2fcf	12239	1dp
Math2.4.LowLimit	Output Low Limit	float32	2fd4	12244	Same as Math2.4.Out
Math2.4.Oper	Operation (as Math2.1.Oper)	uint8	2fd1	12241	Not applicable
Math2.4.Out	Output Value	float32	2fd5	12245	Set by Math2.4.Resolution
Math2.4.Resolution	Output Resolution	uint8	2fd9	12249	Not applicable
Math2.4.Select	Select Between Input 1 and Input 2	bool	2fd7	12247	Not applicable
Math2.4.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	2fd8	12248	Not applicable
Math2.4.Units	Output Units	string_t	6956	26966	Not applicable
Math2.5.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	2fe3	12259	Not applicable
Math2.5.FallbackVal	Fallback Value	float32	2fdf	12255	Same as Math2.5.Out
Math2.5.HighLimit	Output High Limit	float32	2fe0	12256	Same as Math2.5.Out
Math2.5.In1	Input 1 Value	float32	2fdb	12251	0dp
Math2.5.In1Mul	Input 1 Scale	float32	2fda	12250	1dp
Math2.5.In2	Input 2 Value	float32	2fdd	12253	0dp
Math2.5.In2Mul	Input 2 Scale	float32	2fdc	12252	1dp
Math2.5.LowLimit	Output Low Limit	float32	2fe1	12257	Same as Math2.5.Out
Math2.5.Oper	Operation (as Math2.1.Oper)	uint8	2fde	12254	Not applicable
Math2.5.Out	Output Value	float32	2fe2	12258	Set by Math2.5.Resolution
Math2.5.Resolution	Output Resolution	uint8	2fe6	12262	Not applicable
Math2.5.Select	Select Between Input 1 and Input 2	bool	2fe4	12260	Not applicable
Math2.5.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	2fe5	12261	Not applicable
Math2.5.Units	Output Units	string_t	695c	26972	Not applicable
Math2.6.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	2ff0	12272	Not applicable
Math2.6.FallbackVal	Fallback Value	float32	2fec	12268	Same as Math2.6.Out
Math2.6.HighLimit	Output High Limit	float32	2fed	12269	Same as Math2.6.Out
Math2.6.In1	Input 1 Value	float32	2fe8	12264	0dp
Math2.6.In1Mul	Input 1 Scale	float32	2fe7	12263	1dp
Math2.6.In2	Input 2 Value	float32	2fea	12266	0dp
Math2.6.In2Mul	Input 2 Scale	float32	2fe9	12265	1dp
Math2.6.LowLimit	Output Low Limit	float32	2fee	12270	Same as Math2.6.Out
Math2.6.Oper	Operation (as Math2.1.Oper)	uint8	2feb	12267	Not applicable
Math2.6.Out	Output Value	float32	2fef	12271	Set by Math2.6.Resolution
Math2.6.Resolution	Output Resolution	uint8	2ff3	12275	Not applicable
Math2.6.Select	Select Between Input 1 and Input 2	bool	2ff1	12273	Not applicable
Math2.6.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	2ff2	12274	Not applicable
Math2.6.Units	Output Units	string_t	6962	26978	Not applicable
Math2.7.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	2ffd	12285	Not applicable
Math2.7.FallbackVal	Fallback Value	float32	2ff9	12281	Same as Math2.7.Out
Math2.7.HighLimit	Output High Limit	float32	2ffa	12282	Same as Math2.7.Out
Math2.7.In1	Input 1 Value	float32	2ff5	12277	0dp
Math2.7.In1Mul	Input 1 Scale	float32	2ff4	12276	1dp
Math2.7.In2	Input 2 Value	float32	2ff7	12279	0dp
Math2.7.In2Mul	Input 2 Scale	float32	2ff6	12278	1dp
Math2.7.LowLimit	Output Low Limit	float32	2ffb	12283	Same as Math2.7.Out

Parameter path	Description	Type	Hex	Dec	Resolution
Math2.7.Oper	Operation (as Math2.1.Oper)	uint8	2ff8	12280	Not applicable
Math2.7.Out	Output Value	float32	2ffc	12284	Set by Math2.7.Resolution
Math2.7.Resolution	Output Resolution	uint8	3000	12288	Not applicable
Math2.7.Select	Select Between Input 1 and Input 2	bool	2ffe	12286	Not applicable
Math2.7.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	2fff	12287	Not applicable
Math2.7.Units	Output Units	string_t	6968	26984	Not applicable
Math2.8.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	300a	12298	Not applicable
Math2.8.FallbackVal	Fallback Value	float32	3006	12294	Same as Math2.8.Out
Math2.8.HighLimit	Output High Limit	float32	3007	12295	Same as Math2.8.Out
Math2.8.In1	Input 1 Value	float32	3002	12290	0dp
Math2.8.In1Mul	Input 1 Scale	float32	3001	12289	1dp
Math2.8.In2	Input 2 Value	float32	3004	12292	0dp
Math2.8.In2Mul	Input 2 Scale	float32	3003	12291	1dp
Math2.8.LowLimit	Output Low Limit	float32	3008	12296	Same as Math2.8.Out
Math2.8.Oper	Operation (as Math2.1.Oper)	uint8	3005	12293	Not applicable
Math2.8.Out	Output Value	float32	3009	12297	Set by Math2.8.Resolution
Math2.8.Resolution	Output Resolution	uint8	300d	12301	Not applicable
Math2.8.Select	Select Between Input 1 and Input 2	bool	300b	12299	Not applicable
Math2.8.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	300c	12300	Not applicable
Math2.8.Units	Output Units	string_t	696e	26990	Not applicable
Math2.9.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	3017	12311	Not applicable
Math2.9.FallbackVal	Fallback Value	float32	3013	12307	Same as Math2.9.Out
Math2.9.HighLimit	Output High Limit	float32	3014	12308	Same as Math2.9.Out
Math2.9.In1	Input 1 Value	float32	300f	12303	0dp
Math2.9.In1Mul	Input 1 Scale	float32	300e	12302	1dp
Math2.9.In2	Input 2 Value	float32	3011	12305	0dp
Math2.9.In2Mul	Input 2 Scale	float32	3010	12304	1dp
Math2.9.LowLimit	Output Low Limit	float32	3015	12309	Same as Math2.9.Out
Math2.9.Oper	Operation (as Math2.1.Oper)	uint8	3012	12306	Not applicable
Math2.9.Out	Output Value	float32	3016	12310	Set by Math2.9.Resolution
Math2.9.Resolution	Output Resolution	uint8	301a	12314	Not applicable
Math2.9.Select	Select Between Input 1 and Input 2	bool	3018	12312	Not applicable
Math2.9.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	3019	12313	Not applicable
Math2.9.Units	Output Units	string_t	6974	26996	Not applicable
Math2.10.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	3024	12324	Not applicable
Math2.10.FallbackVal	Fallback Value	float32	3020	12320	Same as Math2.10.Out
Math2.10.HighLimit	Output High Limit	float32	3021	12321	Same as Math2.10.Out
Math2.10.In1	Input 1 Value	float32	301c	12316	0dp
Math2.10.In1Mul	Input 1 Scale	float32	301b	12315	1dp
Math2.10.In2	Input 2 Value	float32	301e	12318	0dp
Math2.10.In2Mul	Input 2 Scale	float32	301d	12317	1dp
Math2.10.LowLimit	Output Low Limit	float32	3022	12322	Same as Math2.10.Out
Math2.10.Oper	Operation (as Math2.1.Oper)	uint8	301f	12319	Not applicable
Math2.10.Out	Output Value	float32	3023	12323	Set by Math2.10.Resolution
Math2.10.Resolution	Output Resolution	uint8	3027	12327	Not applicable
Math2.10.Select	Select Between Input 1 and Input 2	bool	3025	12325	Not applicable
Math2.10.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	3026	12326	Not applicable
Math2.10.Units	Output Units	string_t	697a	27002	Not applicable
Math2.11.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	3031	12337	Not applicable
Math2.11.FallbackVal	Fallback Value	float32	302d	12333	Same as Math2.11.Out
Math2.11.HighLimit	Output High Limit	float32	302e	12334	Same as Math2.11.Out
Math2.11.In1	Input 1 Value	float32	3029	12329	0dp
Math2.11.In1Mul	Input 1 Scale	float32	3028	12328	1dp
Math2.11.In2	Input 2 Value	float32	302b	12331	0dp
Math2.11.In2Mul	Input 2 Scale	float32	302a	12330	1dp
Math2.11.LowLimit	Output Low Limit	float32	302f	12335	Same as Math2.11.Out
Math2.11.Oper	Operation (as Math2.1.Oper)	uint8	302c	12332	Not applicable
Math2.11.Out	Output Value	float32	3030	12336	Set by Math2.11.Resolution
Math2.11.Resolution	Output Resolution	uint8	3034	12340	Not applicable
Math2.11.Select	Select Between Input 1 and Input 2	bool	3032	12338	Not applicable
Math2.11.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	3033	12339	Not applicable
Math2.11.Units	Output Units	string_t	6980	27008	Not applicable
Math2.12.Fallback	Fallback strategy (as Math2.1.Fallback)	uint8	303e	12350	Not applicable
Math2.12.FallbackVal	Fallback Value	float32	303a	12346	Same as Math2.12.Out
Math2.12.HighLimit	Output High Limit	float32	303b	12347	Same as Math2.12.Out
Math2.12.In1	Input 1 Value	float32	3036	12342	0dp

Parameter path	Description	Type	Hex	Dec	Resolution
Math2.12.In1Mul	Input 1 Scale	float32	3035	12341	1dp
Math2.12.In2	Input 2 Value	float32	3038	12344	0dp
Math2.12.In2Mul	Input 2 Scale	float32	3037	12343	1dp
Math2.12.LowLimit	Output Low Limit	float32	303c	12348	Same as Math2.12.Out
Math2.12.Oper	Operation (as Math2.1.Oper)	uint8	3039	12345	Not applicable
Math2.12.Out	Output Value	float32	303d	12349	Set by Math2.12.Resolution
Math2.12.Resolution	Output Resolution	uint8	3041	12353	Not applicable
Math2.12.Select	Select Between Input 1 and Input 2	bool	303f	12351	Not applicable
Math2.12.Status	Status. 0 = Good (OK); 7 = Bad (Error)	uint8	3040	12352	Not applicable
Math2.12.Units	Output Units	string_t	6986	27014	Not applicable
ModbusMaster.1.Data.AlarmStatus	Alarm status (0 = No alarms; 1 = one or more alarms active)	uint8	7dbb	32187	Not applicable
ModbusMaster.1.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d4f	32079	Not applicable
ModbusMaster.1.Data.ChanAlarmStatus	Channel alarm status 0 = Off 1 = Active 2 = Safe Nackd 3 = Active Nackd	uint8	7ddb	32219	Not applicable
ModbusMaster.1.Data.DataType	Data type of the data being read/written 0 = Real 1 = DINT 2 = INT 3 = Byte 4 = UDINT 5 = UINT 6 = UBYTE 8 = Real (Swap) 9 = DINT (Swap) 10 = UDINT (Swap) 11 = BIT	uint8	7c06	31750	Not applicable
ModbusMaster.1.Data.Descriptor	Description for this data item	string_t	6687	26247	Not applicable
ModbusMaster.1.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e1b	32283	Not applicable
ModbusMaster.1.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c7e	31870	2dp
ModbusMaster.1.Data.FunctionCode	The modbus function code 1 = Read coil 2 = Read discrete 3 = Read holding 4 = Read input 5 = Write coil 6 = Write single 16 = Write multiple	uint8	7be8	31720	Not applicable
ModbusMaster.1.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b8c	31628	0dp
ModbusMaster.1.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7d9b	32155	Not applicable
ModbusMaster.1.Data.Number	Used for multiple instance parameters	uint8	7d13	32019	Not applicable
ModbusMaster.1.Data.ParameterList	Parameter list for a specific slave device	uint8	7cf5	31989	Not applicable
ModbusMaster.1.Data.Priority	Frequency at which the data is read/written 0 = High 1 = Medium 2 = Low 3 = Acyclic	uint8	7c24	31780	Not applicable
ModbusMaster.1.Data.PV	Process value recieved from slave device	float32	7b32	31538	2dp
ModbusMaster.1.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d31	32049	Not applicable
ModbusMaster.1.Data.Send	1 = send the write value to the slave	bool	7cb9	31929	Not applicable
ModbusMaster.1.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7dfb	32251	Not applicable
ModbusMaster.1.Data.SlaveDevice	Slave device to communicate with.	uint8	7b14	31508	Not applicable
ModbusMaster.1.Data.Status	Transaction status 0 = Success 1 = Illegal function 2 = Ilegal address 6 = Slave busy 8 = Parity error 9 = Bad sub 10 = Bad gateway 11 = No response 12 = Idle 13 = Pending 14 = Timeout 15 = Unknown host 16 = Connect fail 17 = No sockets 18 = Loopback fail 19 = Login fail 20 = Unknown error 22 = Write fail 23 = Master reject	uint8	7cd7	31959	Not applicable
ModbusMaster.1.Data.Value	The value to be written to the slave device	float32	7c42	31810	2dp
ModbusMaster.2.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dbc	32188	Not applicable
ModbusMaster.2.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d50	32080	Not applicable
ModbusMaster.2.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7ddc	32220	Not applicable
ModbusMaster.2.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c07	31751	Not applicable
ModbusMaster.2.Data.Descriptor	Description for this data item	string_t	669c	26268	Not applicable
ModbusMaster.2.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e1c	32284	Not applicable
ModbusMaster.2.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c80	31872	2dp
ModbusMaster.2.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7be9	31721	Not applicable
ModbusMaster.2.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b8e	31630	0dp
ModbusMaster.2.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7d9c	32156	Not applicable
ModbusMaster.2.Data.Number	Used for multiple instance parameters	uint8	7d14	32020	Not applicable
ModbusMaster.2.Data.ParameterList	Parameter list for a specific slave device	uint8	7cf6	31990	Not applicable
ModbusMaster.2.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c25	31781	Not applicable
ModbusMaster.2.Data.PV	Process value recieved from slave device	float32	7b34	31540	2dp
ModbusMaster.2.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d32	32050	Not applicable
ModbusMaster.2.Data.Send	1 = send the write value to the slave	bool	7cba	31930	Not applicable
ModbusMaster.2.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7dfc	32252	Not applicable
ModbusMaster.2.Data.SlaveDevice	Slave device to communicate with.	uint8	7b15	31509	Not applicable
ModbusMaster.2.Data.Status	Transaction status (as for Modbus Master.1)	uint8	7cd8	31960	Not applicable
ModbusMaster.2.Data.Value	The value to be written to the slave device	float32	7c44	31812	2dp
ModbusMaster.3.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dbd	32189	Not applicable
ModbusMaster.3.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d51	32081	Not applicable
ModbusMaster.3.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7ddd	32221	Not applicable
ModbusMaster.3.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c08	31752	Not applicable
ModbusMaster.3.Data.Descriptor	Description for this data item	string_t	66b1	26289	Not applicable
ModbusMaster.3.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e1d	32285	Not applicable
ModbusMaster.3.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c82	31874	2dp
ModbusMaster.3.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bea	31722	Not applicable
ModbusMaster.3.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b90	31632	0dp
ModbusMaster.3.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7d9d	32157	Not applicable
ModbusMaster.3.Data.Number	Used for multiple instance parameters	uint8	7d15	32021	Not applicable
ModbusMaster.3.Data.ParameterList	Parameter list for a specific slave device	uint8	7cf7	31991	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.3.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c26	31782	Not applicable
ModbusMaster.3.Data.PV	Process value recieved from slave device	float32	7b36	31542	2dp
ModbusMaster.3.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d33	32051	Not applicable
ModbusMaster.3.Data.Send	1 = send the write value to the slave	bool	7cbb	31931	Not applicable
ModbusMaster.3.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7dfd	32253	Not applicable
ModbusMaster.3.Data.SlaveDevice	Slave device to communicate with.	uint8	7b16	31510	Not applicable
ModbusMaster.3.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cd9	31961	Not applicable
ModbusMaster.3.Data.Value	The value to be written to the slave device	float32	7c46	31814	2dp
ModbusMaster.4.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dbe	32190	Not applicable
ModbusMaster.4.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d52	32082	Not applicable
ModbusMaster.4.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7dde	32222	Not applicable
ModbusMaster.4.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c09	31753	Not applicable
ModbusMaster.4.Data.Descriptor	Description for this data item	string_t	66c6	26310	Not applicable
ModbusMaster.4.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e1e	32286	Not applicable
ModbusMaster.4.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c84	31876	2dp
ModbusMaster.4.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7beb	31723	Not applicable
ModbusMaster.4.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b92	31634	0dp
ModbusMaster.4.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7d9e	32158	Not applicable
ModbusMaster.4.Data.Number	Used for multiple instance parameters	uint8	7d16	32022	Not applicable
ModbusMaster.4.Data.ParameterList	Parameter list for a specific slave device	uint8	7cf8	31992	Not applicable
ModbusMaster.4.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c27	31783	Not applicable
ModbusMaster.4.Data.PV	Process value recieved from slave device	float32	7b38	31544	2dp
ModbusMaster.4.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d34	32052	Not applicable
ModbusMaster.4.Data.Send	1 = send the write value to the slave	bool	7cbc	31932	Not applicable
ModbusMaster.4.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7dfe	32254	Not applicable
ModbusMaster.4.Data.SlaveDevice	Slave device to communicate with.	uint8	7b17	31511	Not applicable
ModbusMaster.4.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cda	31962	Not applicable
ModbusMaster.4.Data.Value	The value to be written to the slave device	float32	7c48	31816	2dp
ModbusMaster.5.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dbf	32191	Not applicable
ModbusMaster.5.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d53	32083	Not applicable
ModbusMaster.5.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7ddf	32223	Not applicable
ModbusMaster.5.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c0a	31754	Not applicable
ModbusMaster.5.Data.Descriptor	Description for this data item	string_t	66db	26331	Not applicable
ModbusMaster.5.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e1f	32287	Not applicable
ModbusMaster.5.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c86	31878	2dp
ModbusMaster.5.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bec	31724	Not applicable
ModbusMaster.5.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b94	31636	0dp
ModbusMaster.5.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7d9f	32159	Not applicable
ModbusMaster.5.Data.Number	Used for multiple instance parameters	uint8	7d17	32023	Not applicable
ModbusMaster.5.Data.ParameterList	Parameter list for a specific slave device	uint8	7cf9	31993	Not applicable
ModbusMaster.5.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c28	31784	Not applicable
ModbusMaster.5.Data.PV	Process value recieved from slave device	float32	7b3a	31546	2dp
ModbusMaster.5.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d35	32053	Not applicable
ModbusMaster.5.Data.Send	1 = send the write value to the slave	bool	7cbd	31933	Not applicable
ModbusMaster.5.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7dff	32255	Not applicable
ModbusMaster.5.Data.SlaveDevice	Slave device to communicate with.	uint8	7b18	31512	Not applicable
ModbusMaster.5.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cdb	31963	Not applicable
ModbusMaster.5.Data.Value	The value to be written to the slave device	float32	7c4a	31818	2dp
ModbusMaster.6.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc0	32192	Not applicable
ModbusMaster.6.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d54	32084	Not applicable
ModbusMaster.6.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de0	32224	Not applicable
ModbusMaster.6.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c0b	31755	Not applicable
ModbusMaster.6.Data.Descriptor	Description for this data item	string_t	66f0	26352	Not applicable
ModbusMaster.6.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e20	32288	Not applicable
ModbusMaster.6.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c88	31880	2dp
ModbusMaster.6.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bed	31725	Not applicable
ModbusMaster.6.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b96	31638	0dp
ModbusMaster.6.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da0	32160	Not applicable
ModbusMaster.6.Data.Number	Used for multiple instance parameters	uint8	7d18	32024	Not applicable
ModbusMaster.6.Data.ParameterList	Parameter list for a specific slave device	uint8	7cfa	31994	Not applicable
ModbusMaster.6.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c29	31785	Not applicable
ModbusMaster.6.Data.PV	Process value recieved from slave device	float32	7b3c	31548	2dp
ModbusMaster.6.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d36	32054	Not applicable
ModbusMaster.6.Data.Send	1 = send the write value to the slave	bool	7cbe	31934	Not applicable
ModbusMaster.6.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e00	32256	Not applicable
ModbusMaster.6.Data.SlaveDevice	Slave device to communicate with.	uint8	7b19	31513	Not applicable
ModbusMaster.6.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cdc	31964	Not applicable
ModbusMaster.6.Data.Value	The value to be written to the slave device	float32	7c4c	31820	2dp
ModbusMaster.7.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc1	32193	Not applicable
ModbusMaster.7.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d55	32085	Not applicable
ModbusMaster.7.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de1	32225	Not applicable
ModbusMaster.7.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c0c	31756	Not applicable
ModbusMaster.7.Data.Descriptor	Description for this data item	string_t	6705	26373	Not applicable
ModbusMaster.7.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e21	32289	Not applicable
ModbusMaster.7.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c8a	31882	2dp
ModbusMaster.7.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bee	31726	Not applicable
ModbusMaster.7.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b98	31640	0dp
ModbusMaster.7.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da1	32161	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.7.Data.Number	Used for multiple instance parameters	uint8	7d19	32025	Not applicable
ModbusMaster.7.Data.ParameterList	Parameter list for a specific slave device	uint8	7cfb	31995	Not applicable
ModbusMaster.7.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c2a	31786	Not applicable
ModbusMaster.7.Data.PV	Process value recieved from slave device	float32	7b3e	31550	2dp
ModbusMaster.7.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d37	32055	Not applicable
ModbusMaster.7.Data.Send	1 = send the write value to the slave	bool	7cbf	31935	Not applicable
ModbusMaster.7.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e01	32257	Not applicable
ModbusMaster.7.Data.SlaveDevice	Slave device to communicate with.	uint8	7b1a	31514	Not applicable
ModbusMaster.7.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cdd	31965	Not applicable
ModbusMaster.7.Data.Value	The value to be written to the slave device	float32	7c4e	31822	2dp
ModbusMaster.8.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc2	32194	Not applicable
ModbusMaster.8.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d56	32086	Not applicable
ModbusMaster.8.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de2	32226	Not applicable
ModbusMaster.8.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c0d	31757	Not applicable
ModbusMaster.8.Data.Descriptor	Description for this data item	string_t	671a	26394	Not applicable
ModbusMaster.8.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e22	32290	Not applicable
ModbusMaster.8.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c8c	31884	2dp
ModbusMaster.8.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bef	31727	Not applicable
ModbusMaster.8.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b9a	31642	0dp
ModbusMaster.8.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da2	32162	Not applicable
ModbusMaster.8.Data.Number	Used for multiple instance parameters	uint8	7d1a	32026	Not applicable
ModbusMaster.8.Data.ParameterList	Parameter list for a specific slave device	uint8	7cfc	31996	Not applicable
ModbusMaster.8.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c2b	31787	Not applicable
ModbusMaster.8.Data.PV	Process value recieved from slave device	float32	7b40	31552	2dp
ModbusMaster.8.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d38	32056	Not applicable
ModbusMaster.8.Data.Send	1 = send the write value to the slave	bool	7cc0	31936	Not applicable
ModbusMaster.8.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e02	32258	Not applicable
ModbusMaster.8.Data.SlaveDevice	Slave device to communicate with.	uint8	7b1b	31515	Not applicable
ModbusMaster.8.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cde	31966	Not applicable
ModbusMaster.8.Data.Value	The value to be written to the slave device	float32	7c50	31824	2dp
ModbusMaster.9.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc3	32195	Not applicable
ModbusMaster.9.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d57	32087	Not applicable
ModbusMaster.9.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de3	32227	Not applicable
ModbusMaster.9.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c0e	31758	Not applicable
ModbusMaster.9.Data.Descriptor	Description for this data item	string_t	672f	26415	Not applicable
ModbusMaster.9.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e23	32291	Not applicable
ModbusMaster.9.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c8e	31886	2dp
ModbusMaster.9.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf0	31728	Not applicable
ModbusMaster.9.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b9c	31644	0dp
ModbusMaster.9.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da3	32163	Not applicable
ModbusMaster.9.Data.Number	Used for multiple instance parameters	uint8	7d1b	32027	Not applicable
ModbusMaster.9.Data.ParameterList	Parameter list for a specific slave device	uint8	7cfd	31997	Not applicable
ModbusMaster.9.Data.Priority	FRead/Write frequency (as for Modbus Master.1)	uint8	7c2c	31788	Not applicable
ModbusMaster.9.Data.PV	Process value recieved from slave device	float32	7b42	31554	2dp
ModbusMaster.9.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d39	32057	Not applicable
ModbusMaster.9.Data.Send	1 = send the write value to the slave	bool	7cc1	31937	Not applicable
ModbusMaster.9.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e03	32259	Not applicable
ModbusMaster.9.Data.SlaveDevice	Slave device to communicate with.	uint8	7b1c	31516	Not applicable
ModbusMaster.9.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cdf	31967	Not applicable
ModbusMaster.9.Data.Value	The value to be written to the slave device	float32	7c52	31826	2dp
ModbusMaster.10.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc4	32196	Not applicable
ModbusMaster.10.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d58	32088	Not applicable
ModbusMaster.10.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de4	32228	Not applicable
ModbusMaster.10.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c0f	31759	Not applicable
ModbusMaster.10.Data.Descriptor	Description for this data item	string_t	6744	26436	Not applicable
ModbusMaster.10.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e24	32292	Not applicable
ModbusMaster.10.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c90	31888	2dp
ModbusMaster.10.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf1	31729	Not applicable
ModbusMaster.10.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7b9e	31646	0dp
ModbusMaster.10.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da4	32164	Not applicable
ModbusMaster.10.Data.Number	Used for multiple instance parameters	uint8	7d1c	32028	Not applicable
ModbusMaster.10.Data.ParameterList	Parameter list for a specific slave device	uint8	7cfe	31998	Not applicable
ModbusMaster.10.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c2d	31789	Not applicable
ModbusMaster.10.Data.PV	Process value recieved from slave device	float32	7b44	31556	2dp
ModbusMaster.10.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d3a	32058	Not applicable
ModbusMaster.10.Data.Send	1 = send the write value to the slave	bool	7cc2	31938	Not applicable
ModbusMaster.10.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e04	32260	Not applicable
ModbusMaster.10.Data.SlaveDevice	Slave device to communicate with.	uint8	7b1d	31517	Not applicable
ModbusMaster.10.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce0	31968	Not applicable
ModbusMaster.10.Data.Value	The value to be written to the slave device	float32	7c54	31828	2dp
ModbusMaster.11.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc5	32197	Not applicable
ModbusMaster.11.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d59	32089	Not applicable
ModbusMaster.11.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de5	32229	Not applicable
ModbusMaster.11.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c10	31760	Not applicable
ModbusMaster.11.Data.Descriptor	Description for this data item	string_t	6759	26457	Not applicable
ModbusMaster.11.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e25	32293	Not applicable
ModbusMaster.11.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c92	31890	2dp

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.11.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf2	31730	Not applicable
ModbusMaster.11.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bc0	31680	0dp
ModbusMaster.11.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da5	32165	Not applicable
ModbusMaster.11.Data.Number	Used for multiple instance parameters	uint8	7d1d	32029	Not applicable
ModbusMaster.11.Data.ParameterList	Parameter list for a specific slave device	uint8	7cff	31999	Not applicable
ModbusMaster.11.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c2e	31790	Not applicable
ModbusMaster.11.Data.PV	Process value recieved from slave device	float32	7b46	31558	2dp
ModbusMaster.11.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d3b	32059	Not applicable
ModbusMaster.11.Data.Send	1 = send the write value to the slave	bool	7cc3	31939	Not applicable
ModbusMaster.11.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e05	32261	Not applicable
ModbusMaster.11.Data.SlaveDevice	Slave device to communicate with.	uint8	7b1e	31518	Not applicable
ModbusMaster.11.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce1	31969	Not applicable
ModbusMaster.11.Data.Value	The value to be written to the slave device	float32	7c56	31830	2dp
ModbusMaster.12.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc6	32198	Not applicable
ModbusMaster.12.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d5a	32090	Not applicable
ModbusMaster.12.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de6	32230	Not applicable
ModbusMaster.12.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c11	31761	Not applicable
ModbusMaster.12.Data.Descriptor	Description for this data item	string_t	676e	26478	Not applicable
ModbusMaster.12.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e26	32294	Not applicable
ModbusMaster.12.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c94	31892	2dp
ModbusMaster.12.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf3	31731	Not applicable
ModbusMaster.12.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bc2	31682	0dp
ModbusMaster.12.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da6	32166	Not applicable
ModbusMaster.12.Data.Number	Used for multiple instance parameters	uint8	7d1e	32030	Not applicable
ModbusMaster.12.Data.ParameterList	Parameter list for a specific slave device	uint8	7d00	32000	Not applicable
ModbusMaster.12.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c2f	31791	Not applicable
ModbusMaster.12.Data.PV	Process value recieved from slave device	float32	7b48	31560	2dp
ModbusMaster.12.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d3c	32060	Not applicable
ModbusMaster.12.Data.Send	1 = send the write value to the slave	bool	7cc4	31940	Not applicable
ModbusMaster.12.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e06	32262	Not applicable
ModbusMaster.12.Data.SlaveDevice	Slave device to communicate with.	uint8	7b1f	31519	Not applicable
ModbusMaster.12.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce2	31970	Not applicable
ModbusMaster.12.Data.Value	The value to be written to the slave device	float32	7c58	31832	2dp
ModbusMaster.13.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc7	32199	Not applicable
ModbusMaster.13.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d5b	32091	Not applicable
ModbusMaster.13.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de7	32231	Not applicable
ModbusMaster.13.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c12	31762	Not applicable
ModbusMaster.13.Data.Descriptor	Description for this data item	string_t	6783	26499	Not applicable
ModbusMaster.13.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e27	32295	Not applicable
ModbusMaster.13.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c96	31894	2dp
ModbusMaster.13.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf4	31732	Not applicable
ModbusMaster.13.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bc4	31684	0dp
ModbusMaster.13.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da7	32167	Not applicable
ModbusMaster.13.Data.Number	Used for multiple instance parameters	uint8	7d1f	32031	Not applicable
ModbusMaster.13.Data.ParameterList	Parameter list for a specific slave device	uint8	7d01	32001	Not applicable
ModbusMaster.13.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c30	31792	Not applicable
ModbusMaster.13.Data.PV	Process value recieved from slave device	float32	7b4a	31562	2dp
ModbusMaster.13.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d3d	32061	Not applicable
ModbusMaster.13.Data.Send	1 = send the write value to the slave	bool	7cc5	31941	Not applicable
ModbusMaster.13.Data.Set	SSets a digital value (1 = on; 0 = off)	bool	7e07	32263	Not applicable
ModbusMaster.13.Data.SlaveDevice	Slave device to communicate with.	uint8	7b20	31520	Not applicable
ModbusMaster.13.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce3	31971	Not applicable
ModbusMaster.13.Data.Value	The value to be written to the slave device	float32	7c5a	31834	2dp
ModbusMaster.14.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc8	32200	Not applicable
ModbusMaster.14.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d5c	32092	Not applicable
ModbusMaster.14.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de8	32232	Not applicable
ModbusMaster.14.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c13	31763	Not applicable
ModbusMaster.14.Data.Descriptor	Description for this data item	string_t	6798	26520	Not applicable
ModbusMaster.14.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e28	32296	Not applicable
ModbusMaster.14.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c98	31896	2dp
ModbusMaster.14.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf5	31733	Not applicable
ModbusMaster.14.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bc6	31686	0dp
ModbusMaster.14.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da8	32168	Not applicable
ModbusMaster.14.Data.Number	Used for multiple instance parameters	uint8	7d20	32032	Not applicable
ModbusMaster.14.Data.ParameterList	Parameter list for a specific slave device	uint8	7d02	32002	Not applicable
ModbusMaster.14.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c31	31793	Not applicable
ModbusMaster.14.Data.PV	Process value recieved from slave device	float32	7b4c	31564	2dp
ModbusMaster.14.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d3e	32062	Not applicable
ModbusMaster.14.Data.Send	1 = send the write value to the slave	bool	7cc6	31942	Not applicable
ModbusMaster.14.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e08	32264	Not applicable
ModbusMaster.14.Data.SlaveDevice	Slave device to communicate with.	uint8	7b21	31521	Not applicable
ModbusMaster.14.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce4	31972	Not applicable
ModbusMaster.14.Data.Value	The value to be written to the slave device	float32	7c5c	31836	2dp
ModbusMaster.15.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dc9	32201	Not applicable
ModbusMaster.15.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d5d	32093	Not applicable
ModbusMaster.15.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7de9	32233	Not applicable
ModbusMaster.15.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c14	31764	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.15.Data.Descriptor	Description for this data item	string_t	67ad	26541	Not applicable
ModbusMaster.15.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e29	32297	Not applicable
ModbusMaster.15.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c9a	31898	2dp
ModbusMaster.15.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf6	31734	Not applicable
ModbusMaster.15.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bc8	31688	0dp
ModbusMaster.15.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7da9	32169	Not applicable
ModbusMaster.15.Data.Number	Used for multiple instance parameters	uint8	7d21	32033	Not applicable
ModbusMaster.15.Data.ParameterList	Parameter list for a specific slave device	uint8	7d03	32003	Not applicable
ModbusMaster.15.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c32	31794	Not applicable
ModbusMaster.15.Data.PV	Process value recieved from slave device	float32	7b4e	31566	2dp
ModbusMaster.15.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d3f	32063	Not applicable
ModbusMaster.15.Data.Send	1 = send the write value to the slave	bool	7cc7	31943	Not applicable
ModbusMaster.15.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e09	32265	Not applicable
ModbusMaster.15.Data.SlaveDevice	Slave device to communicate with.	uint8	7b22	31522	Not applicable
ModbusMaster.15.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce5	31973	Not applicable
ModbusMaster.15.Data.Value	The value to be written to the slave device	float32	7c5e	31838	2dp
ModbusMaster.16.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dca	32202	Not applicable
ModbusMaster.16.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d5e	32094	Not applicable
ModbusMaster.16.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7dea	32234	Not applicable
ModbusMaster.16.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c15	31765	Not applicable
ModbusMaster.16.Data.Descriptor	Description for this data item	string_t	67c2	26562	Not applicable
ModbusMaster.16.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e2a	32298	Not applicable
ModbusMaster.16.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c9c	31900	2dp
ModbusMaster.16.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf7	31735	Not applicable
ModbusMaster.16.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bca	31690	0dp
ModbusMaster.16.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7daa	32170	Not applicable
ModbusMaster.16.Data.Number	Used for multiple instance parameters	uint8	7d22	32034	Not applicable
ModbusMaster.16.Data.ParameterList	Parameter list for a specific slave device	uint8	7d04	32004	Not applicable
ModbusMaster.16.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c33	31795	Not applicable
ModbusMaster.16.Data.PV	Process value recieved from slave device	float32	7b50	31568	2dp
ModbusMaster.16.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d40	32064	Not applicable
ModbusMaster.16.Data.Send	1 = send the write value to the slave	bool	7cc8	31944	Not applicable
ModbusMaster.16.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e0a	32266	Not applicable
ModbusMaster.16.Data.SlaveDevice	Slave device to communicate with.	uint8	7b23	31523	Not applicable
ModbusMaster.16.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce6	31974	Not applicable
ModbusMaster.16.Data.Value	The value to be written to the slave device	float32	7c60	31840	2dp
ModbusMaster.17.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dcb	32203	Not applicable
ModbusMaster.17.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d5f	32095	Not applicable
ModbusMaster.17.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7deb	32235	Not applicable
ModbusMaster.17.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c16	31766	Not applicable
ModbusMaster.17.Data.Descriptor	Description for this data item	string_t	67d7	26583	Not applicable
ModbusMaster.17.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e2b	32299	Not applicable
ModbusMaster.17.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7c9e	31902	2dp
ModbusMaster.17.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf8	31736	Not applicable
ModbusMaster.17.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bcc	31692	0dp
ModbusMaster.17.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7dab	32171	Not applicable
ModbusMaster.17.Data.Number	Used for multiple instance parameters	uint8	7d23	32035	Not applicable
ModbusMaster.17.Data.ParameterList	Parameter list for a specific slave device	uint8	7d05	32005	Not applicable
ModbusMaster.17.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c34	31796	Not applicable
ModbusMaster.17.Data.PV	Process value recieved from slave device	float32	7b52	31570	2dp
ModbusMaster.17.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d41	32065	Not applicable
ModbusMaster.17.Data.Send	1 = send the write value to the slave	bool	7cc9	31945	Not applicable
ModbusMaster.17.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e0b	32267	Not applicable
ModbusMaster.17.Data.SlaveDevice	Slave device to communicate with.	uint8	7b24	31524	Not applicable
ModbusMaster.17.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce7	31975	Not applicable
ModbusMaster.17.Data.Value	The value to be written to the slave device	float32	7c62	31842	2dp
ModbusMaster.18.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dcc	32204	Not applicable
ModbusMaster.18.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d60	32096	Not applicable
ModbusMaster.18.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7dec	32236	Not applicable
ModbusMaster.18.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c17	31767	Not applicable
ModbusMaster.18.Data.Descriptor	Description for this data item	string_t	67ec	26604	Not applicable
ModbusMaster.18.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e2c	32300	Not applicable
ModbusMaster.18.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7ca0	31904	2dp
ModbusMaster.18.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bf9	31737	Not applicable
ModbusMaster.18.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bce	31694	0dp
ModbusMaster.18.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7dac	32172	Not applicable
ModbusMaster.18.Data.Number	Used for multiple instance parameters	uint8	7d24	32036	Not applicable
ModbusMaster.18.Data.ParameterList	Parameter list for a specific slave device	uint8	7d06	32006	Not applicable
ModbusMaster.18.Data.Priority	FRead/Write frequency (as for Modbus Master.1)	uint8	7c35	31797	Not applicable
ModbusMaster.18.Data.PV	Process value recieved from slave device	float32	7b54	31572	2dp
ModbusMaster.18.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d42	32066	Not applicable
ModbusMaster.18.Data.Send	1 = send the write value to the slave	bool	7cca	31946	Not applicable
ModbusMaster.18.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e0c	32268	Not applicable
ModbusMaster.18.Data.SlaveDevice	Slave device to communicate with.	uint8	7b25	31525	Not applicable
ModbusMaster.18.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce8	31976	Not applicable
ModbusMaster.18.Data.Value	The value to be written to the slave device	float32	7c64	31844	2dp
ModbusMaster.19.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dcd	32205	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.19.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d61	32097	Not applicable
ModbusMaster.19.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7ded	32237	Not applicable
ModbusMaster.19.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c18	31768	Not applicable
ModbusMaster.19.Data.Descriptor	Description for this data item	string_t	6801	26625	Not applicable
ModbusMaster.19.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e2d	32301	Not applicable
ModbusMaster.19.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7ca2	31906	2dp
ModbusMaster.19.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bfa	31738	Not applicable
ModbusMaster.19.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bd0	31696	0dp
ModbusMaster.19.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7dad	32173	Not applicable
ModbusMaster.19.Data.Number	Used for multiple instance parameters	uint8	7d25	32037	Not applicable
ModbusMaster.19.Data.ParameterList	Parameter list for a specific slave device	uint8	7d07	32007	Not applicable
ModbusMaster.19.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c36	31798	Not applicable
ModbusMaster.19.Data.PV	Process value recieved from slave device	float32	7b56	31574	2dp
ModbusMaster.19.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d43	32067	Not applicable
ModbusMaster.19.Data.Send	1 = send the write value to the slave	bool	7ccb	31947	Not applicable
ModbusMaster.19.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e0d	32269	Not applicable
ModbusMaster.19.Data.SlaveDevice	Slave device to communicate with.	uint8	7b26	31526	Not applicable
ModbusMaster.19.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ce9	31977	Not applicable
ModbusMaster.19.Data.Value	The value to be written to the slave device	float32	7c66	31846	2dp
ModbusMaster.20.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dce	32206	Not applicable
ModbusMaster.20.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d62	32098	Not applicable
ModbusMaster.20.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7dee	32238	Not applicable
ModbusMaster.20.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c19	31769	Not applicable
ModbusMaster.20.Data.Descriptor	Description for this data item	string_t	6816	26646	Not applicable
ModbusMaster.20.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e2e	32302	Not applicable
ModbusMaster.20.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7ca4	31908	2dp
ModbusMaster.20.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bfb	31739	Not applicable
ModbusMaster.20.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bd2	31698	0dp
ModbusMaster.20.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7dae	32174	Not applicable
ModbusMaster.20.Data.Number	Used for multiple instance parameters	uint8	7d26	32038	Not applicable
ModbusMaster.20.Data.ParameterList	Parameter list for a specific slave device	uint8	7d08	32008	Not applicable
ModbusMaster.20.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c37	31799	Not applicable
ModbusMaster.20.Data.PV	Process value recieved from slave device	float32	7b58	31576	2dp
ModbusMaster.20.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d44	32068	Not applicable
ModbusMaster.20.Data.Send	1 = send the write value to the slave	bool	7ccc	31948	Not applicable
ModbusMaster.20.Data.Set	SSets a digital value (1 = on; 0 = off)	bool	7e0e	32270	Not applicable
ModbusMaster.20.Data.SlaveDevice	Slave device to communicate with.	uint8	7b27	31527	Not applicable
ModbusMaster.20.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cea	31978	Not applicable
ModbusMaster.20.Data.Value	The value to be written to the slave device	float32	7c68	31848	2dp
ModbusMaster.21.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dcf	32207	Not applicable
ModbusMaster.21.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d63	32099	Not applicable
ModbusMaster.21.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7def	32239	Not applicable
ModbusMaster.21.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c1a	31770	Not applicable
ModbusMaster.21.Data.Descriptor	Description for this data item	string_t	682b	26667	Not applicable
ModbusMaster.21.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e2f	32303	Not applicable
ModbusMaster.21.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7ca6	31910	2dp
ModbusMaster.21.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bfc	31740	Not applicable
ModbusMaster.21.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bd4	31700	0dp
ModbusMaster.21.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7daf	32175	Not applicable
ModbusMaster.21.Data.Number	Used for multiple instance parameters	uint8	7d27	32039	Not applicable
ModbusMaster.21.Data.ParameterList	Parameter list for a specific slave device	uint8	7d09	32009	Not applicable
ModbusMaster.21.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c38	31800	Not applicable
ModbusMaster.21.Data.PV	Process value recieved from slave device	float32	7b5a	31578	2dp
ModbusMaster.21.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d45	32069	Not applicable
ModbusMaster.21.Data.Send	1 = send the write value to the slave	bool	7ccd	31949	Not applicable
ModbusMaster.21.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e0f	32271	Not applicable
ModbusMaster.21.Data.SlaveDevice	Slave device to communicate with.	uint8	7b28	31528	Not applicable
ModbusMaster.21.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ceb	31979	Not applicable
ModbusMaster.21.Data.Value	The value to be written to the slave device	float32	7c6a	31850	2dp
ModbusMaster.22.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd0	32208	Not applicable
ModbusMaster.22.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d64	32100	Not applicable
ModbusMaster.22.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df0	32240	Not applicable
ModbusMaster.22.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c1b	31771	Not applicable
ModbusMaster.22.Data.Descriptor	Description for this data item	string_t	6840	26688	Not applicable
ModbusMaster.22.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e30	32304	Not applicable
ModbusMaster.22.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7ca8	31912	2dp
ModbusMaster.22.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bfd	31741	Not applicable
ModbusMaster.22.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bd6	31702	0dp
ModbusMaster.22.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db0	32176	Not applicable
ModbusMaster.22.Data.Number	Used for multiple instance parameters	uint8	7d28	32040	Not applicable
ModbusMaster.22.Data.ParameterList	Parameter list for a specific slave device	uint8	7d0a	32010	Not applicable
ModbusMaster.22.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c39	31801	Not applicable
ModbusMaster.22.Data.PV	Process value recieved from slave device	float32	7b5c	31580	2dp
ModbusMaster.22.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d46	32070	Not applicable
ModbusMaster.22.Data.Send	1 = send the write value to the slave	bool	7cce	31950	Not applicable
ModbusMaster.22.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e10	32272	Not applicable
ModbusMaster.22.Data.SlaveDevice	Slave device to communicate with.	uint8	7b29	31529	Not applicable
ModbusMaster.22.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cec	31980	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.22.Data.Value	The value to be written to the slave device	float32	7c6c	31852	2dp
ModbusMaster.23.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd1	32209	Not applicable
ModbusMaster.23.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d65	32101	Not applicable
ModbusMaster.23.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df1	32241	Not applicable
ModbusMaster.23.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c1c	31772	Not applicable
ModbusMaster.23.Data.Descriptor	Description for this data item	string_t	6855	26709	Not applicable
ModbusMaster.23.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e31	32305	Not applicable
ModbusMaster.23.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7caa	31914	2dp
ModbusMaster.23.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bfe	31742	Not applicable
ModbusMaster.23.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bd8	31704	0dp
ModbusMaster.23.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db1	32177	Not applicable
ModbusMaster.23.Data.Number	Used for multiple instance parameters	uint8	7d29	32041	Not applicable
ModbusMaster.23.Data.ParameterList	Parameter list for a specific slave device	uint8	7d0b	32011	Not applicable
ModbusMaster.23.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c3a	31802	Not applicable
ModbusMaster.23.Data.PV	Process value recieved from slave device	float32	7b5e	31582	2dp
ModbusMaster.23.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d47	32071	Not applicable
ModbusMaster.23.Data.Send	1 = send the write value to the slave	bool	7ccf	31951	Not applicable
ModbusMaster.23.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e11	32273	Not applicable
ModbusMaster.23.Data.SlaveDevice	Slave device to communicate with.	uint8	7b2a	31530	Not applicable
ModbusMaster.23.Data.Status	Transaction status (as for Modbus Master.1	uint8	7ced	31981	Not applicable
ModbusMaster.23.Data.Value	The value to be written to the slave device	float32	7c6e	31854	2dp
ModbusMaster.24.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd2	32210	Not applicable
ModbusMaster.24.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d66	32102	Not applicable
ModbusMaster.24.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df2	32242	Not applicable
ModbusMaster.24.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c1d	31773	Not applicable
ModbusMaster.24.Data.Descriptor	Description for this data item	string_t	686a	26730	Not applicable
ModbusMaster.24.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e32	32306	Not applicable
ModbusMaster.24.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7cac	31916	2dp
ModbusMaster.24.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7bff	31743	Not applicable
ModbusMaster.24.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bda	31706	0dp
ModbusMaster.24.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db2	32178	Not applicable
ModbusMaster.24.Data.Number	Used for multiple instance parameters	uint8	7d2a	32042	Not applicable
ModbusMaster.24.Data.ParameterList	Parameter list for a specific slave device	uint8	7d0c	32012	Not applicable
ModbusMaster.24.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c3b	31803	Not applicable
ModbusMaster.24.Data.PV	Process value recieved from slave device	float32	7b60	31584	2dp
ModbusMaster.24.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d48	32072	Not applicable
ModbusMaster.24.Data.Send	1 = send the write value to the slave	bool	7cd0	31952	Not applicable
ModbusMaster.24.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e12	32274	Not applicable
ModbusMaster.24.Data.SlaveDevice	Slave device to communicate with.	uint8	7b2b	31531	Not applicable
ModbusMaster.24.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cee	31982	Not applicable
ModbusMaster.24.Data.Value	The value to be written to the slave device	float32	7c70	31856	2dp
ModbusMaster.25.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd3	32211	Not applicable
ModbusMaster.25.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d67	32103	Not applicable
ModbusMaster.25.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df3	32243	Not applicable
ModbusMaster.25.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c1e	31774	Not applicable
ModbusMaster.25.Data.Descriptor	Description for this data item	string_t	687f	26751	Not applicable
ModbusMaster.25.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e33	32307	Not applicable
ModbusMaster.25.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7cae	31918	2dp
ModbusMaster.25.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7c00	31744	Not applicable
ModbusMaster.25.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bdc	31708	0dp
ModbusMaster.25.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db3	32179	Not applicable
ModbusMaster.25.Data.Number	Used for multiple instance parameters	uint8	7d2b	32043	Not applicable
ModbusMaster.25.Data.ParameterList	Parameter list for a specific slave device	uint8	7d0d	32013	Not applicable
ModbusMaster.25.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c3c	31804	Not applicable
ModbusMaster.25.Data.PV	Process value recieved from slave device	float32	7b62	31586	2dp
ModbusMaster.25.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d49	32073	Not applicable
ModbusMaster.25.Data.Send	1 = send the write value to the slave	bool	7cd1	31953	Not applicable
ModbusMaster.25.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e13	32275	Not applicable
ModbusMaster.25.Data.SlaveDevice	Slave device to communicate with.	uint8	7b2c	31532	Not applicable
ModbusMaster.25.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cef	31983	Not applicable
ModbusMaster.25.Data.Value	The value to be written to the slave device	float32	7c72	31858	2dp
ModbusMaster.26.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd4	32212	Not applicable
ModbusMaster.26.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d68	32104	Not applicable
ModbusMaster.26.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df4	32244	Not applicable
ModbusMaster.26.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c1f	31775	Not applicable
ModbusMaster.26.Data.Descriptor	Description for this data item	string_t	6894	26772	Not applicable
ModbusMaster.26.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e34	32308	Not applicable
ModbusMaster.26.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7cb0	31920	2dp
ModbusMaster.26.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7c01	31745	Not applicable
ModbusMaster.26.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7bde	31710	0dp
ModbusMaster.26.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db4	32180	Not applicable
ModbusMaster.26.Data.Number	Used for multiple instance parameters	uint8	7d2c	32044	Not applicable
ModbusMaster.26.Data.ParameterList	Parameter list for a specific slave device	uint8	7d0e	32014	Not applicable
ModbusMaster.26.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c3d	31805	Not applicable
ModbusMaster.26.Data.PV	Process value recieved from slave device	float32	7b64	31588	2dp
ModbusMaster.26.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d4a	32074	Not applicable
ModbusMaster.26.Data.Send	1 = send the write value to the slave	bool	7cd2	31954	Not applicable
ModbusMaster.26.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e14	32276	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.26.Data.SlaveDevice	Slave device to communicate with.	uint8	7b2d	31533	Not applicable
ModbusMaster.26.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cf0	31984	Not applicable
ModbusMaster.26.Data.Value	The value to be written to the slave device	float32	7c74	31860	2dp
ModbusMaster.27.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd5	32213	Not applicable
ModbusMaster.27.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d69	32105	Not applicable
ModbusMaster.27.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df5	32245	Not applicable
ModbusMaster.27.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c20	31776	Not applicable
ModbusMaster.27.Data.Descriptor	Description for this data item	string_t	68a9	26793	Not applicable
ModbusMaster.27.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e35	32309	Not applicable
ModbusMaster.27.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7cb2	31922	2dp
ModbusMaster.27.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7c02	31746	Not applicable
ModbusMaster.27.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7be0	31712	0dp
ModbusMaster.27.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db5	32181	Not applicable
ModbusMaster.27.Data.Number	Used for multiple instance parameters	uint8	7d2d	32045	Not applicable
ModbusMaster.27.Data.ParameterList	Parameter list for a specific slave device	uint8	7d0f	32015	Not applicable
ModbusMaster.27.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c3e	31806	Not applicable
ModbusMaster.27.Data.PV	Process value recieved from slave device	float32	7b66	31590	2dp
ModbusMaster.27.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d4b	32075	Not applicable
ModbusMaster.27.Data.Send	1 = send the write value to the slave	bool	7cd3	31955	Not applicable
ModbusMaster.27.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e15	32277	Not applicable
ModbusMaster.27.Data.SlaveDevice	Slave device to communicate with.	uint8	7b2e	31534	Not applicable
ModbusMaster.27.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cf1	31985	Not applicable
ModbusMaster.27.Data.Value	The value to be written to the slave device	float32	7c76	31862	2dp
ModbusMaster.28.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd6	32214	Not applicable
ModbusMaster.28.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d6a	32106	Not applicable
ModbusMaster.28.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df6	32246	Not applicable
ModbusMaster.28.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c21	31777	Not applicable
ModbusMaster.28.Data.Descriptor	Description for this data item	string_t	68be	26814	Not applicable
ModbusMaster.28.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e36	32310	Not applicable
ModbusMaster.28.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7cb4	31924	2dp
ModbusMaster.28.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7c03	31747	Not applicable
ModbusMaster.28.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7be2	31714	0dp
ModbusMaster.28.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db6	32182	Not applicable
ModbusMaster.28.Data.Number	Used for multiple instance parameters	uint8	7d2e	32046	Not applicable
ModbusMaster.28.Data.ParameterList	Parameter list for a specific slave device	uint8	7d10	32016	Not applicable
ModbusMaster.28.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c3f	31807	Not applicable
ModbusMaster.28.Data.PV	Process value recieved from slave device	float32	7b68	31592	2dp
ModbusMaster.28.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d4c	32076	Not applicable
ModbusMaster.28.Data.Send	1 = send the write value to the slave	bool	7cd4	31956	Not applicable
ModbusMaster.28.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e16	32278	Not applicable
ModbusMaster.28.Data.SlaveDevice	Slave device to communicate with.	uint8	7b2f	31535	Not applicable
ModbusMaster.28.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cf2	31986	Not applicable
ModbusMaster.28.Data.Value	The value to be written to the slave device	float32	7c78	31864	2dp
ModbusMaster.29.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd7	32215	Not applicable
ModbusMaster.29.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d6b	32107	Not applicable
ModbusMaster.29.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df7	32247	Not applicable
ModbusMaster.29.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c22	31778	Not applicable
ModbusMaster.29.Data.Descriptor	Description for this data item	string_t	70ff	28927	Not applicable
ModbusMaster.29.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e37	32311	Not applicable
ModbusMaster.29.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7cb6	31926	2dp
ModbusMaster.29.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7c04	31748	Not applicable
ModbusMaster.29.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7be4	31716	0dp
ModbusMaster.29.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db7	32183	Not applicable
ModbusMaster.29.Data.Number	Used for multiple instance parameters	uint8	7d2f	32047	Not applicable
ModbusMaster.29.Data.ParameterList	Parameter list for a specific slave device	uint8	7d11	32017	Not applicable
ModbusMaster.29.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c40	31808	Not applicable
ModbusMaster.29.Data.PV	Process value recieved from slave device	float32	7b6a	31594	2dp
ModbusMaster.29.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d4d	32077	Not applicable
ModbusMaster.29.Data.Send	1 = send the write value to the slave	bool	7cd5	31957	Not applicable
ModbusMaster.29.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e17	32279	Not applicable
ModbusMaster.29.Data.SlaveDevice	Slave device to communicate with.	uint8	7b30	31536	Not applicable
ModbusMaster.29.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cf3	31987	Not applicable
ModbusMaster.29.Data.Value	The value to be written to the slave device	float32	7c7a	31866	2dp
ModbusMaster.30.Data.AlarmStatus	Alarm status (as for Modbus Master.1)	uint8	7dd8	32216	Not applicable
ModbusMaster.30.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d6c	32108	Not applicable
ModbusMaster.30.Data.ChanAlarmStatus	Channel alarm status (as for Modbus Master.1)	uint8	7df8	32248	Not applicable
ModbusMaster.30.Data.DataType	Type of data being read/written (as for Modbus Master.1)	uint8	7c23	31779	Not applicable
ModbusMaster.30.Data.Descriptor	Description for this data item	string_t	7114	28948	Not applicable
ModbusMaster.30.Data.Digital	Digital status (0 = Off, 1 = On)	bool	7e38	32312	Not applicable
ModbusMaster.30.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7cb8	31928	2dp
ModbusMaster.30.Data.FunctionCode	The modbus function code (as for Modbus Master.1)	uint8	7c05	31749	Not applicable
ModbusMaster.30.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7be6	31718	0dp
ModbusMaster.30.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7db8	32184	Not applicable
ModbusMaster.30.Data.Number	Used for multiple instance parameters	uint8	7d30	32048	Not applicable
ModbusMaster.30.Data.ParameterList	Parameter list for a specific slave device	uint8	7d12	32018	Not applicable
ModbusMaster.30.Data.Priority	Read/Write frequency (as for Modbus Master.1)	uint8	7c41	31809	Not applicable
ModbusMaster.30.Data.PV	Process value recieved from slave device	float32	7b6c	31596	2dp

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.30.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d4e	32078	Not applicable
ModbusMaster.30.Data.Send	1 = send the write value to the slave	bool	7cd6	31958	Not applicable
ModbusMaster.30.Data.Set	Sets a digital value (1 = on; 0 = off)	bool	7e18	32280	Not applicable
ModbusMaster.30.Data.SlaveDevice	Slave device to communicate with.	uint8	7b31	31537	Not applicable
ModbusMaster.30.Data.Status	Transaction status (as for Modbus Master.1	uint8	7cf4	31988	Not applicable
ModbusMaster.30.Data.Value	The value to be written to the slave device	float32	7c7c	31868	2dp
ModbusMaster.Slave1.Data.AlarmStatus	Alarm status (0 = none; 1 = one or more alarms active)	uint8	7db9	32185	Not applicable
ModbusMaster.Slave1.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d95	32149	Not applicable
ModbusMaster.Slave1.Data.ChanAlarmStatus	Channel alarm status 0 = Off 1 = Active 2 = Safe Nak'd 3 = Active Nack'd	uint8	7dd9	32217	Not applicable
ModbusMaster.Slave1.Data.DataType	Data type of the data being read/written 0 = Real 1 = DINT 2 = INT 3 = Byte 4 = UDINT 5 = UINT 6 = UBYTE 8 = Real (Swap) 9 = DINT (Swap) 10 = UDINT (Swap) 11 = BIT	uint8	7d7f	32127	Not applicable
ModbusMaster.Slave1.Data.Descriptor	Description for this data item	string_t	665d	26205	Not applicable
ModbusMaster.Slave1.Data.Digital	Digital status (0 = Off; 1 = On)	bool	7e19	32281	Not applicable
ModbusMaster.Slave1.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7d87	32135	2dp
ModbusMaster.Slave1.Data.FunctionCode	The modbus function code 1 = Read coil 2 = Read discrete 3 = Read holding 4 = Read input 5 = Write coil 6 = Write single 16 = Write multiple	uint8	7d7d	32125	Not applicable
ModbusMaster.Slave1.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7d79	32121	0dp
ModbusMaster.Slave1.Data.Mode	Auto Manual mode selection (0 = Auto; 1 = Manual)	uint8	7d99	32153	Not applicable
ModbusMaster.Slave1.Data.Number	Used for multiple instance parameters	uint8	7d91	32145	Not applicable
ModbusMaster.Slave1.Data.ParameterList	Parameter list for a specific slave device	uint8	7d8f	32143	Not applicable
ModbusMaster.Slave1.Data.Priority	Frequency at which the data is read/written 0 = High 1 = Medium 2 = Low 3 = Acyclic	uint8	7d81	32129	Not applicable
ModbusMaster.Slave1.Data.PV	Process value recieved from slave device	float32	7d73	32115	2dp
ModbusMaster.Slave1.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d93	32147	Not applicable
ModbusMaster.Slave1.Data.Send	1 = send the write value to the slave	bool	7d8b	32139	Not applicable
ModbusMaster.Slave1.Data.Set	Sets a digital value to on (1) or off (0)	bool	7df9	32249	Not applicable
ModbusMaster.Slave1.Data.SlaveDevice	Slave device to communicate with.	uint8	7d71	32113	Not applicable
ModbusMaster.Slave1.Data.Status	Transaction status 0 = Success 1 = Illegal function 2 = llegal address 3 = Illegal value 6 = Slave busy 8 = Parity error 9 = Bad sub 10 = Bad gateway 11 = No response 12 = Idle 13 = Pending 14 = Timeout 15 = Unknown host 16 = Connect fail 17 = No sockets 18 = Loopback fail 19 = Login fail 20 = Unknown error 22 = Write fail 23 = Master reject	uint8	7d8d	32141	Not applicable
ModbusMaster.Slave1.Data.Value	The value to be written to the slave device	float32	7d83	32131	2dp
ModbusMaster.Slave1.Main.CommsFailure	1 = a device communications failure	bool	7d97	32151	Not applicable
ModbusMaster.Slave1.Main.Descriptor	Device descriptor	string_t	6633	26163	Not applicable
ModbusMaster.Slave1.Main.HighPriority	High priority rate 0 = 125ms 1 = 250ms 2 = 500 ms 3 = 1 sec 4 = 2 secs 5 = 5 secs 6 = 10 secs 7 = 20 secs 8 = 30 secs 9 = 1 min 10 = 2 mins 11 = 5 mins 12 = 10 mins 13 = 20 mins 14 = 30 mins 15 = 1 hr	uint8	7b0c	31500	Not applicable
ModbusMaster.Slave1.Main.IPAddress	Internet Protocol (IP) address for a slave device	string_t	68d3	26835	Not applicable
ModbusMaster.Slave1.Main.LowPriority	Low priority rate (as 'high priority' above)	uint8	7b10	31504	Not applicable
ModbusMaster.Slave1.Main.MaxBlockSize	Maximum amount of data in a single transaction	uint8	7b0a	31498	Not applicable
ModbusMaster.Slave1.Main.MediumPriority	Medium priority rate (as 'high priority' above)	uint8	7b0e	31502	Not applicable
ModbusMaster.Slave1.Main.Online	Enables communications (0 = offline; 1 = online)	bool	7b00	31488	Not applicable
ModbusMaster.Slave1.Main.Profile	A profile that defines the device type 0 = 3rd party 1 = Mini8 2 = 3xxx 3 = 35xx 4 = 2xxx 5 = 2500 6 = 5000 7 = 6000 8 = nanodac 9 = EPower	uint8	7b12	31506	Not applicable
ModbusMaster.Slave1.Main.Retries	Transaction retries	uint8	7b04	31492	Not applicable
ModbusMaster.Slave1.Main.SearchDevice	Initiates a slave search (0 = No; 1 = Yes)	bool	7d6d	32109	Not applicable
ModbusMaster.Slave1.Main.SearchResult	Current search status 0 = Searching 1 = Available 2 = Unavailable 3 = Unreachable 4 = Aborted	uint8	7d6f	32111	Not applicable
ModbusMaster.Slave1.Main.Timeout	Time in milliseconds the master will wait for a response	float32	7b06	31494	0dp
ModbusMaster.Slave1.Main.UnitId	Unit id for a slave device	uint8	7b02	31490	Not applicable
ModbusMaster.Slave2.Data.AlarmStatus	Alarm status (0 = none; 1 = one or more alarms active)	uint8	7dba	32186	Not applicable
ModbusMaster.Slave2.Data.BitPosition	Bit position of the bit of interest in a 16 bit data type	uint8	7d96	32150	Not applicable
ModbusMaster.Slave2.Data.ChanAlarmStatus	Channel alarm status (as Slave1.Data)	uint8	7dda	32218	Not applicable
ModbusMaster.Slave2.Data.DataType	Data type of the data being read/written (as Slave1.Data)	uint8	7d80	32128	Not applicable
ModbusMaster.Slave2.Data.Descriptor	Description for this data item	string_t	6672	26226	Not applicable
ModbusMaster.Slave2.Data.Digital	Digital status (0 = Off; 1 = On)	bool	7e1a	32282	Not applicable
ModbusMaster.Slave2.Data.FallBackValue	Fall back value to be writen to the slave device	float32	7d89	32137	2dp
ModbusMaster.Slave2.Data.FunctionCode	The modbus function code (as Slave1.Data)	uint8	7d7e	32126	Not applicable
ModbusMaster.Slave2.Data.ModbusAddress	Modbus register address of the data to be read/written	float32	7d7b	32123	0dp
ModbusMaster.Slave2.Data.Mode	Auto Manual mode selectionn (0 = Auto; 1 = Manual)	uint8	7d9a	32154	Not applicable
ModbusMaster.Slave2.Data.Number	Used for multiple instance parameters	uint8	7d92	32146	Not applicable
ModbusMaster.Slave2.Data.ParameterList	Parameter list for a specific slave device	uint8	7d90	32144	Not applicable
ModbusMaster.Slave2.Data.Priority	Frequency at which the data is read/written (as Slave1.Data)	uint8	7d82	32130	Not applicable
ModbusMaster.Slave2.Data.PV	Process value recieved from slave device	float32	7d75	32117	2dp
ModbusMaster.Slave2.Data.Scaling	Scaling in decimal places for non floating point data types	uint8	7d94	32148	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
ModbusMaster.Slave2.Data.Send	1 = send the write value to the slave	bool	7d8c	32140	Not applicable
ModbusMaster.Slave2.Data.Set	SSets a digital value to on (1) or off (0)	bool	7dfa	32250	Not applicable
ModbusMaster.Slave2.Data.SlaveDevice	Slave device to communicate with.	uint8	7d72	32114	Not applicable
ModbusMaster.Slave2.Data.Status	Transaction status (as for Slave 1)	uint8	7d8e	32142	Not applicable
ModbusMaster.Slave2.Data.Value	The value to be written to the slave device	float32	7d85	32133	2dp
ModbusMaster.Slave2.Main.CommsFailure	1 = a device communications failure	bool	7d98	32152	Not applicable
ModbusMaster.Slave2.Main.Descriptor	Device descriptor	string_t	6648	26184	Not applicable
ModbusMaster.Slave2.Main.HighPriority	High priority rate (as for Slave 1)	uint8	7b0d	31501	Not applicable
ModbusMaster.Slave2.Main.IPAddress	Internet Protocol (IP) address for a slave device	string_t	68e5	26853	Not applicable
ModbusMaster.Slave2.Main.LowPriority	Low priority rate (as for Slave 1)	uint8	7b11	31505	Not applicable
ModbusMaster.Slave2.Main.MaxBlockSize	Maximum amount of data in a single transaction	uint8	7b0b	31499	Not applicable
ModbusMaster.Slave2.Main.MediumPriority	Medium priority rate (as for Slave 1)	uint8	7b0f	31503	Not applicable
ModbusMaster.Slave2.Main.Online	Enables communications (0 = offline; 1 = online)	bool	7b01	31489	Not applicable
ModbusMaster.Slave2.Main.Profile	A profile that defines the device type (as Slave1.Data)	uint8	7b13	31507	Not applicable
ModbusMaster.Slave2.Main.Retries	Transaction retries	uint8	7b05	31493	Not applicable
ModbusMaster.Slave2.Main.SearchDevice	Initiates a slave search (0 = No; 1 = Yes)	bool	7d6e	32110	Not applicable
ModbusMaster.Slave2.Main.SearchResult	Current search status (as Slave1.Data)	uint8	7d70	32112	Not applicable
ModbusMaster.Slave2.Main.Timeout	Time in milliseconds the master will wait for a response	float32	7b08	31496	0dp
ModbusMaster.Slave2.Main.UnitId	Unit id for a slave device	uint8	7b03	31491	Not applicable
Mux8.1.Fallback	Fallback Strategy 0 = Clip Bad; 1 = Clip Good; 2 = Fallback Bad 3 = Fallback Good; 4 = Up scale; 5 = Down scale.	uint8	2f66	12134	Not applicable
Mux8.1.FallbackVal	Fallback Value	float32	2f67	12135	1dp
Mux8.1.HighLimit	High Limit	float32	2f69	12137	1dp
Mux8.1.In1	Input 1	float32	2f6b	12139	1dp
Mux8.1.In2	Input 2	float32	2f6c	12140	1dp
Mux8.1.In3	Input 3	float32	2f6d	12141	1dp
Mux8.1.In4	Input 4	float32	2f6e	12142	1dp
Mux8.1.In5	Input 5	float32	2f6f	12143	1dp
Mux8.1.In6	Input 6	float32	2f70	12144	1dp
Mux8.1.In7	Input 7	float32	2f71	12145	1dp
Mux8.1.In8	Input 8	float32	2f72	12146	1dp
Mux8.1.LowLimit	Low Limit	float32	2f6a	12138	1dp
Mux8.1.Out	Output	float32	2f73	12147	Set by Mux8.1.Resolution
Mux8.1.Resolution	Resolution	uint8	2f75	12149	Not applicable
Mux8.1.Select	Input Selection Switch 1 to 8 = input 1 to 8 (respectively) selected for output	uint8	2f68	12136	Not applicable
Mux8.1.Status	Status. 0 = Good (OK); 7 = Bad (Error)	bool	2f74	12148	Not applicable
Mux8.2.Fallback	Fallback Strategy (as Mux8.1.Fallback)	uint8	2f76	12150	Not applicable
Mux8.2.FallbackVal	Fallback Value	float32	2f77	12151	1dp
Mux8.2.HighLimit	High Limit	float32	2f79	12153	1dp
Mux8.2.In1	Input 1	float32	2f7b	12155	1dp
Mux8.2.In2	Input 2	float32	2f7c	12156	1dp
Mux8.2.In3	Input 3	float32	2f7d	12157	1dp
Mux8.2.In4	Input 4	float32	2f7e	12158	1dp
Mux8.2.In5	Input 5	float32	2f7f	12159	1dp
Mux8.2.In6	Input 6	float32	2f80	12160	1dp
Mux8.2.In7	Input 7	float32	2f81	12161	1dp
Mux8.2.In8	Input 8	float32	2f82	12162	1dp
Mux8.2.LowLimit	Low Limit	float32	2f7a	12154	1dp
Mux8.2.Out	Output	float32	2f83	12163	Set by Mux8.2.Resolution
Mux8.2.Resolution	Resolution	uint8	2f85	12165	Not applicable
Mux8.2.Select	Input Selection (as Mux8.1.Select)	uint8	2f78	12152	Not applicable
Mux8.2.Status	Status. 0 = Good (OK); 7 = Bad (Error)	bool	2f84	12164	Not applicable
Mux8.3.Fallback	Fallback Strategy (as Mux8.1.Fallback)	uint8	2f86	12166	Not applicable
Mux8.3.FallbackVal	Fallback Value	float32	2f87	12167	1dp
Mux8.3.HighLimit	High Limit	float32	2f89	12169	1dp
Mux8.3.In1	Input 1	float32	2f8b	12171	1dp
Mux8.3.In2	Input 2	float32	2f8c	12172	1dp
Mux8.3.In3	Input 3	float32	2f8d	12173	1dp
Mux8.3.In4	Input 4	float32	2f8e	12174	1dp
Mux8.3.In5	Input 5	float32	2f8f	12175	1dp
Mux8.3.In6	Input 6	float32	2f90	12176	1dp
Mux8.3.In7	Input 7	float32	2f91	12177	1dp
Mux8.3.In8	Input 8	float32	2f92	12178	1dp
Mux8.3.LowLimit	Low Limit	float32	2f8a	12170	1dp
Mux8.3.Out	Output	float32	2f93	12179	Set by Mux8.3.Resolution
Mux8.3.Resolution	Resolution	uint8	2f95	12181	Not applicable
Mux8.3.Select	Input Selection (as Mux8.1.Select)	uint8	2f88	12168	Not applicable
Mux8.3.Status	Status. 0 = Good (OK); 7 = Bad (Error)	bool	2f94	12180	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Mux8.4.Fallback	Fallback Strategy (as Mux8.1.Fallback)	uint8	2f96	12182	Not applicable
Mux8.4.FallbackVal	Fallback Value	float32	2f97	12183	1dp
Mux8.4.HighLimit	High Limit	float32	2f99	12185	1dp
Mux8.4.In1	Input 1	float32	2f9b	12187	1dp
Mux8.4.In2	Input 2	float32	2f9c	12188	1dp
Mux8.4.In3	Input 3	float32	2f9d	12189	1dp
Mux8.4.In4	Input 4	float32	2f9e	12190	1dp
Mux8.4.In5	Input 5	float32	2f9f	12191	1dp
Mux8.4.In6	Input 6	float32	2fa0	12192	1dp
Mux8.4.In7	Input 7	float32	2fa1	12193	1dp
Mux8.4.In8	Input 8	float32	2fa2	12194	1dp
Mux8.4.LowLimit	Low Limit	float32	2f9a	12186	1dp
Mux8.4.Out	Output	float32	2fa3	12195	Set by Mux8.4.Resolution
Mux8.4.Resolution	Resolution	uint8	2fa5	12197	Not applicable
Mux8.4.Select	Input Selection (as Mux8.1.Select)	uint8	2f98	12184	Not applicable
Mux8.4.Status	Status. 0 = Good (OK); 7 = Bad (Error)	bool	2fa4	12196	Not applicable
nano_ui.Access	Access level 0 = Logged out; 1 = Operator; 2 = Supervisor; 3 = Engineer	uint8	2c00	11264	Not applicable
nano_ui.Password	Password	string_t	5400	21504	Not applicable
Network.Archive.ArchiveRate	Rate at which to archive history files 0 = None 1 = Every minute 2 = Hourly 3 = Daily 4 = Weekly 5 = Monthly 6 = Automatic	uint8	1114	4372	Not applicable
Network.Archive.CSVDateFormat	Date/Time format (0 = Text; 1 = spreadsheet numeric)	uint8	111d	4381	Not applicable
Network.Archive.CSVHeaders	Include header details (0 = No; 1 = Yes)	bool	111b	4379	Not applicable
Network.Archive.CSVHeadings	Include headings (0 = No; 1 = Yes)	bool	111c	4380	Not applicable
Network.Archive.CSVIncludeValues	Include process values (0 = No; 1 = Yes)	bool	1119	4377	Not applicable
Network.Archive.CSVMessages	Include messages (0 = No; 1 = Yes)	bool	111a	4378	Not applicable
Network.Archive.CSVTabDelimiter	Use Tab delimeter instead of comma (0 = No; 1 = Yes)	bool	111e	4382	Not applicable
Network.Archive.Destination	Archive destination. 0 = USB; 1 = FTP Server	uint8	1111	4369	Not applicable
Network.Archive.FileFormat	Archive file format (0 = Binary; 1 = CSV; 2 = both)	uint8	1115	4373	Not applicable
Network.Archive.MediaDuration	Time in days until the USB is full	float32	1118	4376	2dp
Network.Interface.Gateway	Default gateway internet protocol address	string_t	4524	17700	Not applicable
Network.Interface.IPaddress	Internet Protocol (IP) address of this instrument	string_t	4500	17664	Not applicable
Network.Interface.IPType	IP Lookup. 0 = DHCP, 1 = Fixed	uint8	1102	4354	Not applicable
Network.Interface.MAC	Media Access Control (MAC) address of this instrument	string_t	4548	17736	Not applicable
Network.Interface.SubnetMask	Sub network identification mask	string_t	4512	17682	Not applicable
Network.Modbus.Address	Modbus address for this instrument	uint8	1140	4416	Not applicable
Network.Modbus.InputTimeout	Modbus Input inactivity timeout (in seconds)	int16	1141	4417	Not applicable
Network.Modbus.PrefMasterIP	Preferred master IP	string_t	469c	18076	Not applicable
Network.Modbus.SerialMode	Modbus serial port mode	uint8	1143	4419	Not applicable
Network.Modbus.TimeFormat	Time parameter comms resolution	uint8	1144	4420	Not applicable
Network.Modbus.UnitIdEnable	Unit ident enable	uint8	1142	4418	Not applicable
OR.1.Input1	OR Block 1, input 1. 0 = off; 1 = on	bool	2d00	11520	Not applicable
OR.1.Input2	OR Block 1, input 2. 0 = off; 1 = on	bool	2d01	11521	Not applicable
OR.1.Input3	OR Block 1, input 3. 0 = off; 1 = on	bool	2d02	11522	Not applicable
OR.1.Input4	OR Block 1, input 4. 0 = off; 1 = on	bool	2d03	11523	Not applicable
OR.1.Input5	OR Block 1, input 5. 0 = off; 1 = on	bool	2d04	11524	Not applicable
OR.1.Input6	OR Block 1, input 6. 0 = off; 1 = on	bool	2d05	11525	Not applicable
OR.1.Input7	OR Block 1, input 7. 0 = off; 1 = on	bool	2d06	11526	Not applicable
OR.1.Input8	OR Block 1, input 8. 0 = off; 1 = on	bool	2d07	11527	Not applicable
OR.1.Output	OR Block 1, output. 0 = off; 1 = on	bool	2d08	11528	Not applicable
OR.2.Input1	OR Block 2, input 1. 0 = off; 1 = on	bool	2d10	11536	Not applicable
OR.2.Input2	OR Block 2, input 2. 0 = off; 1 = on	bool	2d11	11537	Not applicable
OR.2.Input3	OR Block 2, input 3. 0 = off; 1 = on	bool	2d12	11538	Not applicable
OR.2.Input4	OR Block 2, input 4. 0 = off; 1 = on	bool	2d13	11539	Not applicable
OR.2.Input5	OR Block 2, input 5. 0 = off; 1 = on	bool	2d14	11540	Not applicable
OR.2.Input6	OR Block 2, input 6. 0 = off; 1 = on	bool	2d15	11541	Not applicable
OR.2.Input7	OR Block 2, input 7. 0 = off; 1 = on	bool	2d16	11542	Not applicable
OR.2.Input8	OR Block 2, input 8. 0 = off; 1 = on	bool	2d17	11543	Not applicable
OR.2.Output	OR Block 1, output. 0 = off; 1 = on	bool	2d18	11544	Not applicable
OR.3.Input1	OR Block 3, input 1. 0 = off; 1 = on	bool	2d20	11552	Not applicable
OR.3.Input2	OR Block 3, input 2. 0 = off; 1 = on	bool	2d21	11553	Not applicable
OR.3.Input3	OR Block 3, input 3. 0 = off; 1 = on	bool	2d22	11554	Not applicable
OR.3.Input4	OR Block 3, input 4. 0 = off; 1 = on	bool	2d23	11555	Not applicable
OR.3.Input5	OR Block 3, input 5. 0 = off; 1 = on	bool	2d24	11556	Not applicable
OR.3.Input6	OR Block 3, input 6. 0 = off; 1 = on	bool	2d25	11557	Not applicable
OR.3.Input7	OR Block 3, input 7. 0 = off; 1 = on	bool	2d26	11558	Not applicable
OR.3.Input8	OR Block 3, input 8. 0 = off; 1 = on	bool	2d27	11559	Not applicable
OR.3.Output	OR Block 3, output. 0 = off; 1 = on	bool	2d28	11560	Not applicable
OR.4.Input1	OR Block 4, input 1. 0 = off; 1 = on	bool	2d30	11568	Not applicable
OR.4.Input2	OR Block 4, input 2. 0 = off; 1 = on	bool	2d31	11569	Not applicable
OR.4.Input3	OR Block 4, input 3. 0 = off; 1 = on	bool	2d32	11570	Not applicable
OR.4.Input4	OR Block 4, input 4. 0 = off; 1 = on	bool	2d33	11571	Not applicable
OR.4.Input5	OR Block 4, input 5. 0 = off; 1 = on	bool	2d34	11572	Not applicable
OR.4.Input6	OR Block 4, input 6. 0 = off; 1 = on	bool	2d35	11573	Not applicable
OR.4.Input7	OR Block 4, input 7. 0 = off; 1 = on	bool	2d36	11574	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
OR.4.Input8	OR Block 4, input 8. 0 = off; 1 = on	bool	2d37	11575	Not applicable
OR.4.Output	OR Block 4, output. 0 = off; 1 = on	bool	2d38	11576	Not applicable
OR.5.Input1	OR Block 5, input 1. 0 = off; 1 = on	bool	2d40	11584	Not applicable
OR.5.Input2	OR Block 5, input 2. 0 = off; 1 = on	bool	2d41	11585	Not applicable
OR.5.Input3	OR Block 5, input 3. 0 = off; 1 = on	bool	2d42	11586	Not applicable
OR.5.Input4	OR Block 5, input 4. 0 = off; 1 = on	bool	2d43	11587	Not applicable
OR.5.Input5	OR Block 5, input 5. 0 = off; 1 = on	bool	2d44	11588	Not applicable
OR.5.Input6	OR Block 5, input 6. 0 = off; 1 = on	bool	2d45	11589	Not applicable
OR.5.Input7	OR Block 5, input 7. 0 = off; 1 = on	bool	2d46	11590	Not applicable
OR.5.Input8	OR Block 5, input 8. 0 = off; 1 = on	bool	2d47	11591	Not applicable
OR.5.Output	OR Block 5, output. 0 = off; 1 = on	bool	2d48	11592	Not applicable
OR.6.Input1	OR Block 6, input 1. 0 = off; 1 = on	bool	2d50	11600	Not applicable
OR.6.Input2	OR Block 6, input 2. 0 = off; 1 = on	bool	2d51	11601	Not applicable
OR.6.Input3	OR Block 6, input 3. 0 = off; 1 = on	bool	2d52	11602	Not applicable
OR.6.Input4	OR Block 6, input 4. 0 = off; 1 = on	bool	2d53	11603	Not applicable
OR.6.Input5	OR Block 6, input 5. 0 = off; 1 = on	bool	2d54	11604	Not applicable
OR.6.Input6	OR Block 6, input 6. 0 = off; 1 = on	bool	2d55	11605	Not applicable
OR.6.Input7	OR Block 6, input 7. 0 = off; 1 = on	bool	2d56	11606	Not applicable
OR.6.Input8	OR Block 6, input 8. 0 = off; 1 = on	bool	2d57	11607	Not applicable
OR.6.Output	OR Block 6, output. 0 = off; 1 = on	bool	2d58	11608	Not applicable
OR.7.Input1	OR Block 7, input 1. 0 = off; 1 = on	bool	2d60	11616	Not applicable
OR.7.Input2	OR Block 7, input 2. 0 = off; 1 = on	bool	2d61	11617	Not applicable
OR.7.Input3	OR Block 7, input 3. 0 = off; 1 = on	bool	2d62	11618	Not applicable
OR.7.Input4	OR Block 7, input 4. 0 = off; 1 = on	bool	2d63	11619	Not applicable
OR.7.Input5	OR Block 7, input 5. 0 = off; 1 = on	bool	2d64	11620	Not applicable
OR.7.Input6	OR Block 7, input 6. 0 = off; 1 = on	bool	2d65	11621	Not applicable
OR.7.Input7	OR Block 7, input 7. 0 = off; 1 = on	bool	2d66	11622	Not applicable
OR.7.Input8	OR Block 7, input 8. 0 = off; 1 = on	bool	2d67	11623	Not applicable
OR.7.Output	OR Block 7, output. 0 = off; 1 = on	bool	2d68	11624	Not applicable
OR.8.Input1	OR Block 8, input 1. 0 = off; 1 = on	bool	2d70	11632	Not applicable
OR.8.Input2	OR Block 8, input 2. 0 = off; 1 = on	bool	2d71	11633	Not applicable
OR.8.Input3	OR Block 8, input 3. 0 = off; 1 = on	bool	2d72	11634	Not applicable
OR.8.Input4	OR Block 8, input 4. 0 = off; 1 = on	bool	2d73	11635	Not applicable
OR.8.Input5	OR Block 8, input 5. 0 = off; 1 = on	bool	2d74	11636	Not applicable
OR.8.Input6	OR Block 8, input 6. 0 = off; 1 = on	bool	2d75	11637	Not applicable
OR.8.Input7	OR Block 8, input 7. 0 = off; 1 = on	bool	2d76	11638	Not applicable
OR.8.Input8	OR Block 8, input 8. 0 = off; 1 = on	bool	2d77	11639	Not applicable
OR.8.Output	OR Block 8, output. 0 = off; 1 = on	bool	2d78	11640	Not applicable
OR.9.Input1	OR Block 9, input 1. 0 = off; 1 = on	bool	2d80	11648	Not applicable
OR.9.Input2	OR Block 9, input 2. 0 = off; 1 = on	bool	2d81	11649	Not applicable
OR.9.Input3	OR Block 9, input 3. 0 = off; 1 = on	bool	2d82	11650	Not applicable
OR.9.Input4	OR Block 9, input 4. 0 = off; 1 = on	bool	2d83	11651	Not applicable
OR.9.Input5	OR Block 9, input 5. 0 = off; 1 = on	bool	2d84	11652	Not applicable
OR.9.Input6	OR Block 9, input 6. 0 = off; 1 = on	bool	2d85	11653	Not applicable
OR.9.Input7	OR Block 9, input 7. 0 = off; 1 = on	bool	2d86	11654	Not applicable
OR.9.Input8	OR Block 9, input 8. 0 = off; 1 = on	bool	2d87	11655	Not applicable
OR.9.Output	OR Block 9, output. 0 = off; 1 = on	bool	2d88	11656	Not applicable
OR.10.Input1	OR Block 10, input 1. 0 = off; 1 = on	bool	2d90	11664	Not applicable
OR.10.Input2	OR Block 10, input 2. 0 = off; 1 = on	bool	2d91	11665	Not applicable
OR.10.Input3	OR Block 10, input 3. 0 = off; 1 = on	bool	2d92	11666	Not applicable
OR.10.Input4	OR Block 10, input 4. 0 = off; 1 = on	bool	2d93	11667	Not applicable
OR.10.Input5	OR Block 10, input 5. 0 = off; 1 = on	bool	2d94	11668	Not applicable
OR.10.Input6	OR Block 10, input 6. 0 = off; 1 = on	bool	2d95	11669	Not applicable
OR.10.Input7	OR Block 10, input 7. 0 = off; 1 = on	bool	2d96	11670	Not applicable
OR.10.Input8	OR Block 10, input 8. 0 = off; 1 = on	bool	2d97	11671	Not applicable
OR.10.Output	OR Block 10, output. 0 = off; 1 = on	bool	2d98	11672	Not applicable
OR.11.Input1	OR Block 11, input 1. 0 = off; 1 = on	bool	2da0	11680	Not applicable
OR.11.Input2	OR Block 11, input 2. 0 = off; 1 = on	bool	2da1	11681	Not applicable
OR.11.Input3	OR Block 11, input 3. 0 = off; 1 = on	bool	2da2	11682	Not applicable
OR.11.Input4	OR Block 11, input 4. 0 = off; 1 = on	bool	2da3	11683	Not applicable
OR.11.Input5	OR Block 11, input 5. 0 = off; 1 = on	bool	2da4	11684	Not applicable
OR.11.Input6	OR Block 11, input 6. 0 = off; 1 = on	bool	2da5	11685	Not applicable
OR.11.Input7	OR Block 11, input 7. 0 = off; 1 = on	bool	2da6	11686	Not applicable
OR.11.Input8	OR Block 11, input 8. 0 = off; 1 = on	bool	2da7	11687	Not applicable
OR.11.Output	OR Block 11, output. 0 = off; 1 = on	bool	2da8	11688	Not applicable
OR.12.Input1	OR Block 12, input 1. 0 = off; 1 = on	bool	2db0	11696	Not applicable
OR.12.Input2	OR Block 12, input 2. 0 = off; 1 = on	bool	2db1	11697	Not applicable
OR.12.Input3	OR Block 12, input 3. 0 = off; 1 = on	bool	2db2	11698	Not applicable
OR.12.Input4	OR Block 12, input 4. 0 = off; 1 = on	bool	2db3	11699	Not applicable
OR.12.Input5	OR Block 12, input 5. 0 = off; 1 = on	bool	2db4	11700	Not applicable
OR.12.Input6	OR Block 12, input 6. 0 = off; 1 = on	bool	2db5	11701	Not applicable
OR.12.Input7	OR Block 12, input 7. 0 = off; 1 = on	bool	2db6	11702	Not applicable
OR.12.Input8	OR Block 12, input 8. 0 = off; 1 = on	bool	2db7	11703	Not applicable
OR.12.Output	OR Block 12, output. 0 = off; 1 = on	bool	2db8	11704	Not applicable
Program.Ch1Holdback	Channel 1 holdback type 0 = Off 1 = Low 2 = High 3 = Band	uint8	3aa1	15009	Not applicable
Program.Ch1HoldbackVal	Channel 1 holdback value	float32	3aa3	15011	Same as Programmer.SetUp.Ch1PVInput
Program.Ch1RampUnits	Channel 1 ramp units	uint8	3aa6	15014	Not applicable
Program.Ch2Holdback	Channel 2 holdback type (as for Program.Ch1, above)	uint8	3aa2	15010	Not applicable
Program.Ch2HoldbackVal	Channel 2 holdback value	float32	3aa4	15012	Same as Programmer.SetUp.Ch2PVInput

Parameter path	Description	Type	Hex	Dec	Resolution
Program.Ch2RampUnits	Channel 2 ramp units	uint8	3aa7	15015	Not applicable
Program.HoldbackStyle	Holdback style (0 = per segment; 1 = per program)	uint8	3aa0	15008	Not applicable
Program.Program	Program	string_t	6abb	27323	Not applicable
Program.RampStyle	Ramp style (0 = Time; 1 = Rate)	uint8	3aa5	15013	Not applicable
Programmer.Features.FTPStore	FTP store feature enable	bool	3a04	14852	Not applicable
Programmer.Features.Holdback	Holdback feature enable	bool	3a00	14848	Not applicable
Programmer.Features.Messages	Messages feature enable	bool	3a03	14851	Not applicable
Programmer.Features.PVEvent	PV Event feature enable	bool	3a01	14849	Not applicable
Programmer.Features.UserValue	User value feature enable	bool	3a02	14850	Not applicable
Programmer.FileList.Filename1	Filename	string_t	7900	30976	Not applicable
Programmer.FileList.Filename2	Filename	string_t	7901	30977	Not applicable
Programmer.FileList.Filename3	Filename	string_t	7902	30978	Not applicable
Programmer.FileList.Filename4	Filename	string_t	7903	30979	Not applicable
Programmer.FileList.Filename5	Filename	string_t	7904	30980	Not applicable
Programmer.FileList.Filename6	Filename	string_t	7905	30981	Not applicable
Programmer.FileList.Filename7	Filename	string_t	7906	30982	Not applicable
Programmer.FileList.Filename8	Filename	string_t	7907	30983	Not applicable
Programmer.FileList.Filename9	Filename	string_t	7908	30984	Not applicable
Programmer.FileList.Filename10	Filename	string_t	7909	30985	Not applicable
Programmer.FileList.Filename11	Filename	string_t	790a	30986	Not applicable
Programmer.FileList.Filename12	Filename	string_t	790b	30987	Not applicable
Programmer.FileList.Filename13	Filename	string_t	790c	30988	Not applicable
Programmer.FileList.Filename14	Filename	string_t	790d	30989	Not applicable
Programmer.FileList.Filename15	Filename	string_t	790e	30990	Not applicable
Programmer.FileList.Filename16	Filename	string_t	790f	30991	Not applicable
Programmer.FileList.Filename17	Filename	string_t	7910	30992	Not applicable
Programmer.FileList.Filename18	Filename	string_t	7911	30993	Not applicable
Programmer.FileList.Filename19	Filename	string_t	7912	30994	Not applicable
Programmer.FileList.Filename20	Filename	string_t	7913	30995	Not applicable
Programmer.FileList.Filename21	Filename	string_t	7914	30996	Not applicable
Programmer.FileList.Filename22	Filename	string_t	7915	30997	Not applicable
Programmer.FileList.Filename23	Filename	string_t	7916	30998	Not applicable
Programmer.FileList.Filename24	Filename	string_t	7917	30999	Not applicable
Programmer.FileList.Filename25	Filename	string_t	7918	31000	Not applicable
Programmer.FileList.Filename26	Filename	string_t	7919	31001	Not applicable
Programmer.FileList.Filename27	Filename	string_t	791a	31002	Not applicable
Programmer.FileList.Filename28	Filename	string_t	791b	31003	Not applicable
Programmer.FileList.Filename29	Filename	string_t	791c	31004	Not applicable
Programmer.FileList.Filename30	Filename	string_t	791d	31005	Not applicable
Programmer.FileList.Filename31	Filename	string_t	791e	31006	Not applicable
Programmer.FileList.Filename32	Filename	string_t	791f	31007	Not applicable
Programmer.FileList.Filename33	Filename	string_t	7920	31008	Not applicable
Programmer.FileList.Filename34	Filename	string_t	7921	31009	Not applicable
Programmer.FileList.Filename35	Filename	string_t	7922	31010	Not applicable
Programmer.FileList.Filename36	Filename	string_t	7923	31011	Not applicable
Programmer.FileList.Filename37	Filename	string_t	7924	31012	Not applicable
Programmer.FileList.Filename38	Filename	string_t	7925	31013	Not applicable
Programmer.FileList.Filename39	Filename	string_t	7926	31014	Not applicable
Programmer.FileList.Filename40	Filename	string_t	7927	31015	Not applicable
Programmer.FileList.Filename41	Filename	string_t	7928	31016	Not applicable
Programmer.FileList.Filename42	Filename	string_t	7929	31017	Not applicable
Programmer.FileList.Filename43	Filename	string_t	792a	31018	Not applicable
Programmer.FileList.Filename44	Filename	string_t	792b	31019	Not applicable
Programmer.FileList.Filename45	Filename	string_t	792c	31020	Not applicable
Programmer.FileList.Filename46	Filename	string_t	792d	31021	Not applicable
Programmer.FileList.Filename47	Filename	string_t	792e	31022	Not applicable
Programmer.FileList.Filename48	Filename	string_t	792f	31023	Not applicable
Programmer.FileList.Filename49	Filename	string_t	7930	31024	Not applicable
Programmer.FileList.Filename50	Filename	string_t	7931	31025	Not applicable
Programmer.FileList.Filename51	Filename	string_t	7932	31026	Not applicable
Programmer.FileList.Filename52	Filename	string_t	7933	31027	Not applicable
Programmer.FileList.Filename53	Filename	string_t	7934	31028	Not applicable
Programmer.FileList.Filename54	Filename	string_t	7935	31029	Not applicable
Programmer.FileList.Filename55	Filename	string_t	7936	31030	Not applicable
Programmer.FileList.Filename56	Filename	string_t	7937	31031	Not applicable
Programmer.FileList.Filename57	Filename	string_t	7938	31032	Not applicable
Programmer.FileList.Filename58	Filename	string_t	7939	31033	Not applicable
Programmer.FileList.Filename59	Filename	string_t	793a	31034	Not applicable
Programmer.FileList.Filename60	Filename	string_t	793b	31035	Not applicable
Programmer.FileList.Filename61	Filename	string_t	793c	31036	Not applicable
Programmer.FileList.Filename62	Filename	string_t	793d	31037	Not applicable
Programmer.FileList.Filename63	Filename	string_t	793e	31038	Not applicable
Programmer.FileList.Filename64	Filename	string_t	793f	31039	Not applicable
Programmer.FileList.Filename65	Filename	string_t	7940	31040	Not applicable
Programmer.FileList.Filename66	Filename	string_t	7941	31041	Not applicable
Programmer.FileList.Filename67	Filename	string_t	7942	31042	Not applicable
Programmer.FileList.Filename68	Filename	string_t	7943	31043	Not applicable
Programmer.FileList.Filename69	Filename	string_t	7944	31044	Not applicable
Programmer.FileList.Filename70	Filename	string_t	7945	31045	Not applicable
Programmer.FileList.Filename71	Filename	string_t	7946	31046	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Programmer.FileList.Filename72	Filename	string_t	7947	31047	Not applicable
Programmer.FileList.Filename73	Filename	string_t	7948	31048	Not applicable
Programmer.FileList.Filename74	Filename	string_t	7949	31049	Not applicable
Programmer.FileList.Filename75	Filename	string_t	794a	31050	Not applicable
Programmer.FileList.Filename76	Filename	string_t	794b	31051	Not applicable
Programmer.FileList.Filename77	Filename	string_t	794c	31052	Not applicable
Programmer.FileList.Filename78	Filename	string_t	794d	31053	Not applicable
Programmer.FileList.Filename79	Filename	string_t	794e	31054	Not applicable
Programmer.FileList.Filename80	Filename	string_t	794f	31055	Not applicable
Programmer.FileList.Filename81	Filename	string_t	7950	31056	Not applicable
Programmer.FileList.Filename82	Filename	string_t	7951	31057	Not applicable
Programmer.FileList.Filename83	Filename	string_t	7952	31058	Not applicable
Programmer.FileList.Filename84	Filename	string_t	7953	31059	Not applicable
Programmer.FileList.Filename85	Filename	string_t	7954	31060	Not applicable
Programmer.FileList.Filename86	Filename	string_t	7955	31061	Not applicable
Programmer.FileList.Filename87	Filename	string_t	7956	31062	Not applicable
Programmer.FileList.Filename88	Filename	string_t	7957	31063	Not applicable
Programmer.FileList.Filename89	Filename	string_t	7958	31064	Not applicable
Programmer.FileList.Filename90	Filename	string_t	7959	31065	Not applicable
Programmer.FileList.Filename91	Filename	string_t	795a	31066	Not applicable
Programmer.FileList.Filename92	Filename	string_t	795b	31067	Not applicable
Programmer.FileList.Filename93	Filename	string_t	795c	31068	Not applicable
Programmer.FileList.Filename94	Filename	string_t	795d	31069	Not applicable
Programmer.FileList.Filename95	Filename	string_t	795e	31070	Not applicable
Programmer.FileList.Filename96	Filename	string_t	795f	31071	Not applicable
Programmer.FileList.Filename97	Filename	string_t	7960	31072	Not applicable
Programmer.FileList.Filename98	Filename	string_t	7961	31073	Not applicable
Programmer.FileList.Filename99	Filename	string_t	7962	31074	Not applicable
Programmer.FileList.Filename100	Filename	string_t	7963	31075	Not applicable
Programmer.FileList.FilenameEntry	Filename of the program to loaded or stored	string_t	6a91	27281	Not applicable
Programmer.FileList.Operation	Operation (0 = Complete; 1 = Get listing; 2 = iTools only)	uint8	3a80	14976	Not applicable
Programmer.FileList.RefreshList	Refresh list (0 = No; 1 = Yes)	bool	3a81	14977	Not applicable
Programmer.FTP.IPAddress	Internet Protocol address	string_t	698c	27020	Not applicable
Programmer.FTP.Password	Password	string_t	6a2c	27180	Not applicable
Programmer.FTP.Username	Username	string_t	6a03	27139	Not applicable
Programmer.Run.Ch1PSP	Channel 1 programmer set-point	float32	3a53	14931	Same as Programmer.SetUp.Ch1PVInput
Programmer.Run.Ch1PVEvent	Channel 1 PV event (0 = Off; 1 = On)	bool	3a6c	14956	Not applicable
Programmer.Run.Ch1Rate	Channel 1 rate	float32	3a5e	14942	Set by Programmer.SetUp.RateResolution
Programmer.Run.Ch1Time	Channel 1 time	time_t	3a5c	14940	Set by Network.Modbus.TimeFormat
Programmer.Run.Ch1TSP	Channel 1 target set-point	float32	3a5a	14938	Same as Programmer.SetUp.Ch1PVInput
Programmer.Run.Ch1UserVal	Channel 1 user value	float32	3a6a	14954	0dp
Programmer.Run.Ch2PSP	Channel 2 programmer set-point	float32	3a54	14932	Same as Programmer.SetUp.Ch2PVInput
Programmer.Run.Ch2PVEvent	Channel 2 PV event (0 = Off; 1 = On)	bool	3a6d	14957	Not applicable
Programmer.Run.Ch2Rate	Channel 2 rate	float32	3a5f	14943	Set by Programmer.SetUp.RateResolution
Programmer.Run.Ch2Time	Channel 2 time	time_t	3a5d	14941	Set by Network.Modbus.TimeFormat
Programmer.Run.Ch2TSP	Channel 2 target set-point	float32	3a5b	14939	Same as Programmer.SetUp.Ch2PVInput
Programmer.Run.Ch2UserVal	Channel 2 user value	float32	3a6b	14955	0dp
Programmer.Run.CyclesLeft	Cycles left (-1 = continuous)	int16	3a60	14944	Not applicable
Programmer.Run.Duration	Duration	time_t	3a59	14937	Set by Network.Modbus.TimeFormat
Programmer.Run.EndOutput	End output (0 = Off; 1 = On)	bool	3a61	14945	Not applicable
Programmer.Run.Event1	Event 1 (0 = Off; 1 = On)	bool	3a62	14946	Not applicable
Programmer.Run.Event2	Event 2 (0 = Off; 1 = On)	bool	3a63	14947	Not applicable
Programmer.Run.Event3	Event 3 (0 = Off; 1 = On)	bool	3a64	14948	Not applicable
Programmer.Run.Event4	Event 4 (0 = Off; 1 = On)	bool	3a65	14949	Not applicable
Programmer.Run.Event5	Event 5 (0 = Off; 1 = On)	bool	3a66	14950	Not applicable
Programmer.Run.Event6	Event 6 (0 = Off; 1 = On)	bool	3a67	14951	Not applicable
Programmer.Run.Event7	Event 7 (0 = Off; 1 = On)	bool	3a68	14952	Not applicable
Programmer.Run.Event8	Event 8 (0 = Off; 1 = On)	bool	3a69	14953	Not applicable
Programmer.Run.Intervention	Intervention 0 = No Program 1 = None 2 = User intervention 4 = PV Event	uint8	3a6f	14959	Not applicable
Programmer.Run.Mode	Mode (1 = Reset; 2 = Run; 4 = Hold)	uint8	3a50	14928	Not applicable
Programmer.Run.ProgTimeLeft	Program time left	time_t	3a57	14935	Set by Network.Modbus.TimeFormat
Programmer.Run.ProgTimeRunning	Program time running	time_t	3a70	14960	Set by Network.Modbus.TimeFormat
Programmer.Run.ProgTimeSpent	Program time spent	time_t	3a58	14936	Set by Network.Modbus.TimeFormat
Programmer.Run.Segment	Segment	string_t	6aa6	27302	Not applicable
Programmer.Run.SegmentType	Segment type 0 = End 1 = Ramp 2 = Dwell 3 = Step 4 = Wait 5 = Go back	uint8	3a52	14930	Not applicable
Programmer.Run.SegTimeLeft	Segment time left	time_t	3a55	14933	Set by Network.Modbus.TimeFormat
Programmer.Run.SegTimeRun	Segment time run	time_t	3a56	14934	Set by Network.Modbus.TimeFormat
Programmer.Run.Status	Status 1 = Reset 2 = Running 4 = Holding 8 = Holdback 16 = Waiting 32 = Complete	uint8	3a51	14929	Not applicable
Programmer.SetUp.Advance	Advance (0 = No 1 = Yes)	bool	3a42	14914	Not applicable
Programmer.SetUp.Amended	Amended (0 = No 1 = Yes)	bool	3a44	14916	Not applicable
Programmer.SetUp.Ch1PVInput	Channel 1 PV input	float32	3a26	14886	Set by Programmer.SetUp.Ch1Resolution
Programmer.SetUp.Ch1Resolution	Channel 1 Resolution	uint8	3a46	14918	Not applicable
Programmer.SetUp.Ch1ServoTo	Channel 1 servo to (0 = PV; 1 = SP)	uint8	3a2a	14890	Not applicable
Programmer.SetUp.Ch1SPInput	Channel 1 SP input	float32	3a28	14888	0dp
Programmer.SetUp.Ch1Units	Channel 1 units	string_t	6a85	27269	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
Programmer.SetUp.Ch2PVInput	Channel 2 PV input	float32	3a27	14887	Set by Programmer.SetUp.Ch2Resolution
Programmer.SetUp.Ch2Resolution	Channel 2 Resolution	uint8	3a47	14919	Not applicable
Programmer.SetUp.Ch2ServoTo	Channel 2 servo to (0 = PV; 1 = SP)	uint8	3a2b	14891	Not applicable
Programmer.SetUp.Ch2SPInput	Channel 2 SP input	float32	3a29	14889	0dp
Programmer.SetUp.Ch2Units	Channel 2 units	string_t	6a8b	27275	Not applicable
Programmer.SetUp.Channels	Number of channels	uint8	3a20	14880	Not applicable
Programmer.SetUp.FileErrorStatus	File error status 0 = Busy 1 = OK 2 = Load open file 3 = Store open file 4 =Delete fail 5 = Copy fail 6 = Invalid format 7 = Invalid device 8 = Invalid version 9 = Invalid number of channels 10 = Parameter write failed 11 = Store operation failed to complete 12 = Load operation failed to complete 13 = Delete operation failed to complete 14 = Copy operation failed to complete 15 = Invalid filename entered or selected 16 = General file operation error 17 = Would result in more than the ma.x no. of program files	uint8	3a45	14917	Not applicable
Programmer.SetUp.Hold	Hold (0 = No 1 = Yes)	bool	3a39	14905	Not applicable
Programmer.SetUp.MaxEvents	Maximum events	uint8	3a2d	14893	Not applicable
Programmer.SetUp.Operation	Operation 1 = Select 2 =Load 4 = Store 8 = Delete 16 = Delete All 32=Copy 64 = Copy All	uint8	3a40	14912	Not applicable
Programmer.SetUp.PowerFailAction	Power fail action (0 = ramp back; 1 = Reset; 2 = Continue)	uint8	3a2c	14892	Not applicable
Programmer.SetUp.ProgEditAccess	Program edit access level 0 = Logged out 1 = Operator 2 = Supervisor 3 = Engineer	uint8	3a22	14882	Not applicable
Programmer.SetUp.ProgModeAccess	Program mode access level (as Program Edit Access, above)	uint8	3a21	14881	Not applicable
Programmer.SetUp.ProgNum	Program Number	uint8	3a48	14920	Not applicable
Programmer.SetUp.ProgStoreAccess	Program store access level (as Program Edit Access, above)	uint8	3a23	14883	Not applicable
Programmer.SetUp.RateResolution	Rate resolution	uint8	3a24	14884	Not applicable
Programmer.SetUp.Reset	Reset (0 = No 1 = Yes)	bool	3a3a	14906	Not applicable
Programmer.SetUp.ResetCh1UserVal	Reset channel 1 user value	float32	3a36	14902	1dp
Programmer.SetUp.ResetCh2UserVal	Reset channel 2 user value	float32	3a37	14903	1dp
Programmer.SetUp.ResetEvent1	Reset event 1 (0 = Off, 1 = On)	bool	3a2e	14894	Not applicable
Programmer.SetUp.ResetEvent2	Reset event 2 (0 = Off, 1 = On)	bool	3a2f	14895	Not applicable
Programmer.SetUp.ResetEvent3	Reset event 3 (0 = Off, 1 = On)	bool	3a30	14896	Not applicable
Programmer.SetUp.ResetEvent4	Reset event 4 (0 = Off, 1 = On)	bool	3a31	14897	Not applicable
Programmer.SetUp.ResetEvent5	Reset event 5 (0 = Off, 1 = On)	bool	3a32	14898	Not applicable
Programmer.SetUp.ResetEvent6	Reset event 6 (0 = Off, 1 = On)	bool	3a33	14899	Not applicable
Programmer.SetUp.ResetEvent7	Reset event 7 (0 = Off, 1 = On)	bool	3a34	14900	Not applicable
Programmer.SetUp.ResetEvent8	Reset event 8 (0 = Off, 1 = On)	bool	3a35	14901	Not applicable
Programmer.SetUp.Run	Run (0 = No 1 = Yes)	bool	3a38	14904	Not applicable
Programmer.SetUp.RunHold	Run Hold (0 = No 1 = Yes)	bool	3a3c	14908	Not applicable
Programmer.SetUp.RunReset	Run Rese (0 = No 1 = Yes)t	bool	3a3b	14907	Not applicable
Programmer.SetUp.Status	Status 0 = Inactive 1 = Success 2 = Failed 3 = Loading 4 = Storing 5 = Deleting 6 = Copying	uint8	3a41	14913	Not applicable
Programmer.SetUp.WaitAnalog1	Wait analog input 1	float32	3a3e	14910	0dp
Programmer.SetUp.WaitAnalog2	Wait analog input 2	float32	3a3f	14911	0dp
Programmer.SetUp.WaitDigital	Wait Digital (0 = Off 1 = On)	bool	3a3d	14909	Not applicable
RealTimeEvent.1.Duration	Sets the duration for the event to remain On	time_t	30e6	12518	Set by Network.Modbus.TimeFormat
RealTimeEvent.1.OffDate	Sets the date in the month that the event is to switch off	uint8	30e8	12520	Not applicable
RealTimeEvent.1.OffDay	Sets the day the the event is to switch Off 0 = Sunday 1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Monday to Friday 8 = Saturday to Sunday 9 = Every day	uint8	30e9	12521	Not applicable
RealTimeEvent.1.OffMonth	The month number when the event is to switch off	uint8	30e7	12519	Not applicable
RealTimeEvent.1.OffTime	Sets the time that the event is to switch Off	time_t	30ea	12522	Set by Network.Modbus.TimeFormat
RealTimeEvent.1.OffType	0 = Duration; 1 = Time	uint8	30e5	12517	Not applicable
RealTimeEvent.1.OnDate	Sets the date in the month that the event is to switch on	uint8	30e2	12514	Not applicable
RealTimeEvent.1.OnDay	Sets the day on which event is to switch on (as 'OffDay', above)	uint8	30e3	12515	Not applicable
RealTimeEvent.1.OnMonth	The month number when the event is to switch on	uint8	30e1	12513	Not applicable
RealTimeEvent.1.OnTime	Sets the time that the event is to switch On	time_t	30e4	12516	Set by Network.Modbus.TimeFormat
RealTimeEvent.1.Output	The output from the real time event (0 = Off; 1 = On)	bool	30eb	12523	Not applicable
RealTimeEvent.1.Type	Selects the type of Real Time Event 0 = Off 1 = Time and Day 2 = Time and Date	uint8	30e0	12512	Not applicable
RealTimeEvent.2.Duration	Sets the duration for the event to remain On	time_t	30f6	12534	Set by Network.Modbus.TimeFormat
RealTimeEvent.2.OffDate	Sets the date in the month that the event is to switch off	uint8	30f8	12536	Not applicable
RealTimeEvent.2.OffDay	Sets the day the the event is to switch Off (as for Event 1)	uint8	30f9	12537	Not applicable
RealTimeEvent.2.OffMonth	Sets the month that the event is to switch off	uint8	30f7	12535	Not applicable
RealTimeEvent.2.OffTime	Sets the time that the event is to switch Off	time_t	30fa	12538	Set by Network.Modbus.TimeFormat
RealTimeEvent.2.OffType	Selects the type that will switch off the event (as for Event 1)	uint8	30f5	12533	Not applicable
RealTimeEvent.2.OnDate	Sets the date in the month that the event is to switch on	uint8	30f2	12530	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
RealTimeEvent.2.OnDay	Sets the day the event is to switch on (as for Event 1)	uint8	30f3	12531	Not applicable
RealTimeEvent.2.OnMonth	Sets the month that the event is to switch on	uint8	30f1	12529	Not applicable
RealTimeEvent.2.OnTime	Sets the time that the event is to switch On	time_t	30f4	12532	Set by Network.Modbus.TimeFormat
RealTimeEvent.2.Output	The output from the real time event (0 = Off; 1 = On)	bool	30fb	12539	Not applicable
RealTimeEvent.2.Type	Selects the type of Real Time Event 0 = Off 1 = Time and Day 2 = Time and Date	uint8	30f0	12528	Not applicable
Segment.1.Ch1Holdback	Channel 1 holdback type 0 = Off 1 = Low 2= High 3 = Band	uint8	3ac9	15049	Not applicable
Segment.1.Ch1HoldbackVal	Channel 1 holdback value	float32	3acb	15051	Same as Programmer.SetUp.Ch1PVInput
Segment.1.Ch1PVEvent	Channel 1 PV event 0 = Off 1 = Absolute High 2 = Absolute Low 3 = Deviation High 4 = Deviation Low 5 = Deviation Band	uint8	3ad4	15060	Not applicable
Segment.1.Ch1PVEventUse	Channel 1 PV event use (0 = Trigger; 1 = Alarm)	bool	3ae2	15074	Not applicable
Segment.1.Ch1PVEventVal	Channel 1 PV event value	float32	3ad6	15062	Same as Programmer.SetUp.Ch1PVInput
Segment.1.Ch1Rate	Channel 1 rate	float32	3ac6	15046	Set by Programmer.SetUp.RateResolution
Segment.1.Ch1Time	Channel 1 time	time_t	3ac4	15044	Set by Network.Modbus.TimeFormat
Segment.1.Ch1TSP	Channel 1 target set-point	float32	3ac2	15042	Same as Programmer.SetUp.Ch1PVInput
Segment.1.Ch1UserVal	Channel 1 user value	float32	3ad8	15064	Same as Programmer.SetUp.ResetCh1UserVal
Segment.1.Ch1Wait	Channel 1 Wait (Analogue 1 criterion) 1= Abs high 2 = Abs low 3 = Dev high 4 = Dev Low	uint8	3ace	15054	Not applicable
Segment.1.Ch1WaitVal	Channel 1 wait value	float32	3ad0	15056	Same as Programmer.SetUp.PVWait1
Segment.1.Ch2Holdback	Channel 2 holdback type (as for Ch1Holdback, above)	uint8	3aca	15050	Not applicable
Segment.1.Ch2HoldbackVal	Channel 2 holdback value	float32	3acc	15052	Same as Programmer.SetUp.Ch2PVInput
Segment.1.Ch2PVEvent	Channel 2 PV event (as for Ch1PVEvent, above)	uint8	3ad5	15061	Not applicable
Segment.1.Ch2PVEventUse	Channel 2 PV event use (as for Ch1PVEventUse, above)	bool	3ae3	15075	Not applicable
Segment.1.Ch2PVEventVal	Channel 2 PV event value	float32	3ad7	15063	Same as Programmer.SetUp.Ch2PVInput
Segment.1.Ch2Rate	Channel 2 rate	float32	3ac7	15047	Set by Programmer.SetUp.RateResolu-tion
Segment.1.Ch2Time	Channel 2 time	time_t	3ac5	15045	Set by Network.Modbus.TimeFormat
Segment.1.Ch2TSP	Channel 2 target set-point	float32	3ac3	15043	Same as Programmer.SetUp.Ch2PVInput
Segment.1.Ch2UserVal	Channel 2 user value	float32	3ad9	15065	Same as Program-mer.SetUp.ResetCh2UserVal
Segment.1.Ch2Wait	Channel 2 Wait (analogue 2 criterion; as for Ch1Wait, above)	uint8	3acf	15055	Not applicable
Segment.1.Ch2WaitVal	Channel 2 wait value	float32	3ad1	15057	Same as Programmer.SetUp.PVWait2
Segment.1.Cycles	Cycles (0 = Continuous)	int16	3ad3	15059	Not applicable
Segment.1.Duration	Duration	time_t	3ac1	15041	Set by Network.Modbus.TimeFormat
Segment.1.EndType	End type (0 = Dwell; 1 = Reset)	uint8	3ac8	15048	Not applicable
Segment.1.Event1	Event 1 (0 = Off; 1 = On)	bool	3ada	15066	Not applicable
Segment.1.Event2	Event 2 (0 = Off; 1 = On)	bool	3adb	15067	Not applicable
Segment.1.Event3	Event 3 (0 = Off; 1 = On)	bool	3adc	15068	Not applicable
Segment.1.Event4	Event 4 (0 = Off; 1 = On)	bool	3add	15069	Not applicable
Segment.1.Event5	Event 5 (0 = Off; 1 = On)	bool	3ade	15070	Not applicable
Segment.1.Event6	Event 6 (0 = Off; 1 = On)	bool	3adf	15071	Not applicable
Segment.1.Event7	Event 7 (0 = Off; 1 = On)	bool	3ae0	15072	Not applicable
Segment.1.Event8	Event 8 (0 = Off; 1 = On)	bool	3ae1	15073	Not applicable
Segment.1.GoBackTo	Go back to	uint8	3ad2	15058	Not applicable
Segment.1.SegmentName	Segment name	string_t	6ad0	27344	Not applicable
Segment.1.Type	Type 0 = End 1 = Ramp 2 = Dwell 3 = Step 4 = Wait 5 = GoBack	uint8	3ac0	15040	Not applicable
Segment.1.WaitFor	Wait for 0 = Digital High 1 = Wait analogue 1 2 = Wait analogue 2 3 = Wait analogue 1 and analogue 2	uint8	3acd	15053	Not applicable
Segment.2.Ch1Holdback	Channel 1 holdback type	uint8	3af9	15097	Not applicable
Segment.2.Ch1HoldbackVal	Channel 1 holdback value	float32	3afb	15099	Same as Programmer.SetUp.Ch1PVInput
Segment.2.Ch1PVEvent	Channel 1 PV event	uint8	3b04	15108	Not applicable
Segment.2.Ch1PVEventUse	Channel 1 PV event use	bool	3b12	15122	Not applicable
Segment.2.Ch1PVEventVal	Channel 1 PV event value	float32	3b06	15110	Same as Programmer.SetUp.Ch1PVInput
Segment.2.Ch1Rate	Channel 1 rate	float32	3af6	15094	Set by Programmer.SetUp.RateResolution
Segment.2.Ch1Time	Channel 1 time	time_t	3af4	15092	Set by Network.Modbus.TimeFormat
Segment.2.Ch1TSP	Channel 1 target set-point	float32	3af2	15090	Same as Programmer.SetUp.Ch1PVInput
Segment.2.Ch1UserVal	Channel 1 user value	float32	3b08	15112	Same as Programmer.SetUp.ResetCh1UserVal
Segment.2.Ch1Wait	Channel 1 Wait	uint8	3afe	15102	Not applicable
Segment.2.Ch1WaitVal	Channel 1 wait value	float32	3b00	15104	Same as Programmer.SetUp.PVWait1
Segment.2.Ch2Holdback	Channel 2 holdback type	uint8	3afa	15098	Not applicable
Segment.2.Ch2HoldbackVal	Channel 2 holdback value	float32	3afc	15100	Same as Programmer.SetUp.Ch2PVInput
Segment.2.Ch2PVEvent	Channel 2 PV event	uint8	3b05	15109	Not applicable
Segment.2.Ch2PVEventUse	Channel 2 PV event use	bool	3b13	15123	Not applicable
Segment.2.Ch2PVEventVal	Channel 2 PV event value	float32	3b07	15111	Same as Programmer.SetUp.Ch2PVInput
Segment.2.Ch2Rate	Channel 2 rate	float32	3af7	15095	Set by Programmer.SetUp.RateResolution
Segment.2.Ch2Time	Channel 2 time	time_t	3af5	15093	Set by Network.Modbus.TimeFormat
Segment.2.Ch2TSP	Channel 2 target set-point	float32	3af3	15091	Same as Programmer.SetUp.Ch2PVInput
Segment.2.Ch2UserVal	Channel 2 user value	float32	3b09	15113	Same as Programmer.SetUp.ResetCh2UserVal
Segment.2.Ch2Wait	Channel 2 Wait	uint8	3aff	15103	Not applicable
Segment.2.Ch2WaitVal	Channel 2 wait value	float32	3b01	15105	Same as Programmer.SetUp.PVWait2
Segment.2.Cycles	Cycles	int16	3b03	15107	Not applicable
Segment.2.Duration	Duration	time_t	3af1	15089	Set by Network.Modbus.TimeFormat
Segment.2.EndType	End type	uint8	3af8	15096	Not applicable
Segment.2.Event1	Event 1	bool	3b0a	15114	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.2.Event2	Event 2	bool	3b0b	15115	Not applicable
Segment.2.Event3	Event 3	bool	3b0c	15116	Not applicable
Segment.2.Event4	Event 4	bool	3b0d	15117	Not applicable
Segment.2.Event5	Event 5	bool	3b0e	15118	Not applicable
Segment.2.Event6	Event 6	bool	3b0f	15119	Not applicable
Segment.2.Event7	Event 7	bool	3b10	15120	Not applicable
Segment.2.Event8	Event 8	bool	3b11	15121	Not applicable
Segment.2.GoBackTo	Go back to	uint8	3b02	15106	Not applicable
Segment.2.SegmentName	Segment name	string_t	6ae5	27365	Not applicable
Segment.2.Type	Type	uint8	3af0	15088	Not applicable
Segment.2.WaitFor	Wait for	uint8	3afd	15101	Not applicable
Segment.3.Ch1Holdback	Channel 1 holdback type	uint8	3b29	15145	Not applicable
Segment.3.Ch1HoldbackVal	Channel 1 holdback value	float32	3b2b	15147	Same as Programmer.SetUp.Ch1PVInput
Segment.3.Ch1PVEvent	Channel 1 PV event	uint8	3b34	15156	Not applicable
Segment.3.Ch1PVEventUse	Channel 1 PV event use	bool	3b42	15170	Not applicable
Segment.3.Ch1PVEventVal	Channel 1 PV event value	float32	3b36	15158	Same as Programmer.SetUp.Ch1PVInput
Segment.3.Ch1Rate	Channel 1 rate	float32	3b26	15142	Set by Programmer.SetUp.RateResolution
Segment.3.Ch1Time	Channel 1 time	time_t	3b24	15140	Set by Network.Modbus.TimeFormat
Segment.3.Ch1TSP	Channel 1 target set-point	float32	3b22	15138	Same as Programmer.SetUp.Ch1PVInput
Segment.3.Ch1UserVal	Channel 1 user value	float32	3b38	15160	Same as Programmer.SetUp.ResetCh1UserVal
Segment.3.Ch1Wait	Channel 1 Wait	uint8	3b2e	15150	Not applicable
Segment.3.Ch1WaitVal	Channel 1 wait value	float32	3b30	15152	Same as Programmer.SetUp.PVWait1
Segment.3.Ch2Holdback	Channel 2 holdback type	uint8	3b2a	15146	Not applicable
Segment.3.Ch2HoldbackVal	Channel 2 holdback value	float32	3b2c	15148	Same as Programmer.SetUp.Ch2PVInput
Segment.3.Ch2PVEvent	Channel 2 PV event	uint8	3b35	15157	Not applicable
Segment.3.Ch2PVEventUse	Channel 2 PV event use	bool	3b43	15171	Not applicable
Segment.3.Ch2PVEventVal	Channel 2 PV event value	float32	3b37	15159	Same as Programmer.SetUp.Ch2PVInput
Segment.3.Ch2Rate	Channel 2 rate	float32	3b27	15143	Set by Programmer.SetUp.RateResolution
Segment.3.Ch2Time	Channel 2 time	time_t	3b25	15141	Set by Network.Modbus.TimeFormat
Segment.3.Ch2TSP	Channel 2 target set-point	float32	3b23	15139	Same as Programmer.SetUp.Ch2PVInput
Segment.3.Ch2UserVal	Channel 2 user value	float32	3b39	15161	Same as Programmer.SetUp.ResetCh2UserVal
Segment.3.Ch2Wait	Channel 2 Wait	uint8	3b2f	15151	Not applicable
Segment.3.Ch2WaitVal	Channel 2 wait value	float32	3b31	15153	Same as Programmer.SetUp.PVWait2
Segment.3.Cycles	Cycles	int16	3b33	15155	Not applicable
Segment.3.Duration	Duration	time_t	3b21	15137	Set by Network.Modbus.TimeFormat
Segment.3.EndType	End type	uint8	3b28	15144	Not applicable
Segment.3.Event1	Event 1	bool	3b3a	15162	Not applicable
Segment.3.Event2	Event 2	bool	3b3b	15163	Not applicable
Segment.3.Event3	Event 3	bool	3b3c	15164	Not applicable
Segment.3.Event4	Event 4	bool	3b3d	15165	Not applicable
Segment.3.Event5	Event 5	bool	3b3e	15166	Not applicable
Segment.3.Event6	Event 6	bool	3b3f	15167	Not applicable
Segment.3.Event7	Event 7	bool	3b40	15168	Not applicable
Segment.3.Event8	Event 8	bool	3b41	15169	Not applicable
Segment.3.GoBackTo	Go back to	uint8	3b32	15154	Not applicable
Segment.3.SegmentName	Segment name	string_t	6afa	27386	Not applicable
Segment.3.Type	Type	uint8	3b20	15136	Not applicable
Segment.3.WaitFor	Wait for	uint8	3b2d	15149	Not applicable
Segment.4.Ch1Holdback	Channel 1 holdback type	uint8	3b59	15193	Not applicable
Segment.4.Ch1HoldbackVal	Channel 1 holdback value	float32	3b5b	15195	Same as Programmer.SetUp.Ch1PVInput
Segment.4.Ch1PVEvent	Channel 1 PV event	uint8	3b64	15204	Not applicable
Segment.4.Ch1PVEventUse	Channel 1 PV event use	bool	3b72	15218	Not applicable
Segment.4.Ch1PVEventVal	Channel 1 PV event value	float32	3b66	15206	Same as Programmer.SetUp.Ch1PVInput
Segment.4.Ch1Rate	Channel 1 rate	float32	3b56	15190	Set by Programmer.SetUp.RateResolution
Segment.4.Ch1Time	Channel 1 time	time_t	3b54	15188	Set by Network.Modbus.TimeFormat
Segment.4.Ch1TSP	Channel 1 target set-point	float32	3b52	15186	Same as Programmer.SetUp.Ch1PVInput
Segment.4.Ch1UserVal	Channel 1 user value	float32	3b68	15208	Same as Programmer.SetUp.ResetCh1UserVal
Segment.4.Ch1Wait	Channel 1 Wait	uint8	3b5e	15198	Not applicable
Segment.4.Ch1WaitVal	Channel 1 wait value	float32	3b60	15200	Same as Programmer.SetUp.PVWait1
Segment.4.Ch2Holdback	Channel 2 holdback type	uint8	3b5a	15194	Not applicable
Segment.4.Ch2HoldbackVal	Channel 2 holdback value	float32	3b5c	15196	Same as Programmer.SetUp.Ch2PVInput
Segment.4.Ch2PVEvent	Channel 2 PV event	uint8	3b65	15205	Not applicable
Segment.4.Ch2PVEventUse	Channel 2 PV event use	bool	3b73	15219	Not applicable
Segment.4.Ch2PVEventVal	Channel 2 PV event value	float32	3b67	15207	Same as Programmer.SetUp.Ch2PVInput
Segment.4.Ch2Rate	Channel 2 rate	float32	3b57	15191	Set by Programmer.SetUp.RateResolution
Segment.4.Ch2Time	Channel 2 time	time_t	3b55	15189	Set by Network.Modbus.TimeFormat
Segment.4.Ch2TSP	Channel 2 target set-point	float32	3b53	15187	Same as Programmer.SetUp.Ch2PVInput
Segment.4.Ch2UserVal	Channel 2 user value	float32	3b69	15209	Same as Programmer.SetUp.ResetCh2UserVal
Segment.4.Ch2Wait	Channel 2 Wait	uint8	3b5f	15199	Not applicable
Segment.4.Ch2WaitVal	Channel 2 wait value	float32	3b61	15201	Same as Programmer.SetUp.PVWait2
Segment.4.Cycles	Cycles	int16	3b63	15203	Not applicable
Segment.4.Duration	Duration	time_t	3b51	15185	Set by Network.Modbus.TimeFormat
Segment.4.EndType	End type	uint8	3b58	15192	Not applicable
Segment.4.Event1	Event 1	bool	3b6a	15210	Not applicable
Segment.4.Event2	Event 2	bool	3b6b	15211	Not applicable
Segment.4.Event3	Event 3	bool	3b6c	15212	Not applicable
Segment.4.Event4	Event 4	bool	3b6d	15213	Not applicable
Segment.4.Event5	Event 5	bool	3b6e	15214	Not applicable
Segment.4.Event6	Event 6	bool	3b6f	15215	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.4.Event7	Event 7	bool	3b70	15216	Not applicable
Segment.4.Event8	Event 8	bool	3b71	15217	Not applicable
Segment.4.GoBackTo	Go back to	uint8	3b62	15202	Not applicable
Segment.4.SegmentName	Segment name	string_t	6b0f	27407	Not applicable
Segment.4.Type	Type	uint8	3b50	15184	Not applicable
Segment.4.WaitFor	Wait for	uint8	3b5d	15197	Not applicable
Segment.5.Ch1Holdback	Channel 1 holdback type	uint8	3b89	15241	Not applicable
Segment.5.Ch1HoldbackVal	Channel 1 holdback value	float32	3b8b	15243	Same as Programmer.SetUp.Ch1PVInput
Segment.5.Ch1PVEvent	Channel 1 PV event	uint8	3b94	15252	Not applicable
Segment.5.Ch1PVEventUse	Channel 1 PV event use	bool	3ba2	15266	Not applicable
Segment.5.Ch1PVEventVal	Channel 1 PV event value	float32	3b96	15254	Same as Programmer.SetUp.Ch1PVInput
Segment.5.Ch1Rate	Channel 1 rate	float32	3b86	15238	Set by Programmer.SetUp.RateResolution
Segment.5.Ch1Time	Channel 1 time	time_t	3b84	15236	Set by Network.Modbus.TimeFormat
Segment.5.Ch1TSP	Channel 1 target set-point	float32	3b82	15234	Same as Programmer.SetUp.Ch1PVInput
Segment.5.Ch1UserVal	Channel 1 user value	float32	3b98	15256	Same as Programmer.SetUp.ResetCh1UserVal
Segment.5.Ch1Wait	Channel 1 Wait	uint8	3b8e	15246	Not applicable
Segment.5.Ch1WaitVal	Channel 1 wait value	float32	3b90	15248	Same as Programmer.SetUp.PVWait1
Segment.5.Ch2Holdback	Channel 2 holdback type	uint8	3b8a	15242	Not applicable
Segment.5.Ch2HoldbackVal	Channel 2 holdback value	float32	3b8c	15244	Same as Programmer.SetUp.Ch2PVInput
Segment.5.Ch2PVEvent	Channel 2 PV event	uint8	3b95	15253	Not applicable
Segment.5.Ch2PVEventUse	Channel 2 PV event use	bool	3ba3	15267	Not applicable
Segment.5.Ch2PVEventVal	Channel 2 PV event value	float32	3b97	15255	Same as Programmer.SetUp.Ch2PVInput
Segment.5.Ch2Rate	Channel 2 rate	float32	3b87	15239	Set by Programmer.SetUp.RateResolution
Segment.5.Ch2Time	Channel 2 time	time_t	3b85	15237	Set by Network.Modbus.TimeFormat
Segment.5.Ch2TSP	Channel 2 target set-point	float32	3b83	15235	Same as Programmer.SetUp.Ch2PVInput
Segment.5.Ch2UserVal	Channel 2 user value	float32	3b99	15257	Same as Programmer.SetUp.ResetCh2UserVal
Segment.5.Ch2Wait	Channel 2 Wait	uint8	3b8f	15247	Not applicable
Segment.5.Ch2WaitVal	Channel 2 wait value	float32	3b91	15249	Same as Programmer.SetUp.PVWait2
Segment.5.Cycles	Cycles	int16	3b93	15251	Not applicable
Segment.5.Duration	Duration	time_t	3b81	15233	Set by Network.Modbus.TimeFormat
Segment.5.EndType	End type	uint8	3b88	15240	Not applicable
Segment.5.Event1	Event 1	bool	3b9a	15258	Not applicable
Segment.5.Event2	Event 2	bool	3b9b	15259	Not applicable
Segment.5.Event3	Event 3	bool	3b9c	15260	Not applicable
Segment.5.Event4	Event 4	bool	3b9d	15261	Not applicable
Segment.5.Event5	Event 5	bool	3b9e	15262	Not applicable
Segment.5.Event6	Event 6	bool	3b9f	15263	Not applicable
Segment.5.Event7	Event 7	bool	3ba0	15264	Not applicable
Segment.5.Event8	Event 8	bool	3ba1	15265	Not applicable
Segment.5.GoBackTo	Go back to	uint8	3b92	15250	Not applicable
Segment.5.SegmentName	Segment name	string_t	6b24	27428	Not applicable
Segment.5.Type	Type	uint8	3b80	15232	Not applicable
Segment.5.WaitFor	Wait for	uint8	3b8d	15245	Not applicable
Segment.6.Ch1Holdback	Channel 1 holdback type	uint8	3bb9	15289	Not applicable
Segment.6.Ch1HoldbackVal	Channel 1 holdback value	float32	3bbb	15291	Same as Programmer.SetUp.Ch1PVInput
Segment.6.Ch1PVEvent	Channel 1 PV event	uint8	3bc4	15300	Not applicable
Segment.6.Ch1PVEventUse	Channel 1 PV event use	bool	3bd2	15314	Not applicable
Segment.6.Ch1PVEventVal	Channel 1 PV event value	float32	3bc6	15302	Same as Programmer.SetUp.Ch1PVInput
Segment.6.Ch1Rate	Channel 1 rate	float32	3bb6	15286	Set by Programmer.SetUp.RateResolution
Segment.6.Ch1Time	Channel 1 time	time_t	3bb4	15284	Set by Network.Modbus.TimeFormat
Segment.6.Ch1TSP	Channel 1 target set-point	float32	3bb2	15282	Same as Programmer.SetUp.Ch1PVInput
Segment.6.Ch1UserVal	Channel 1 user value	float32	3bc8	15304	Same as Programmer.SetUp.ResetCh1UserVal
Segment.6.Ch1Wait	Channel 1 Wait	uint8	3bbe	15294	Not applicable
Segment.6.Ch1WaitVal	Channel 1 wait value	float32	3bc0	15296	Same as Programmer.SetUp.PVWait1
Segment.6.Ch2Holdback	Channel 2 holdback type	uint8	3bba	15290	Not applicable
Segment.6.Ch2HoldbackVal	Channel 2 holdback value	float32	3bbc	15292	Same as Programmer.SetUp.Ch2PVInput
Segment.6.Ch2PVEvent	Channel 2 PV event	uint8	3bc5	15301	Not applicable
Segment.6.Ch2PVEventUse	Channel 2 PV event use	bool	3bd3	15315	Not applicable
Segment.6.Ch2PVEventVal	Channel 2 PV event value	float32	3bc7	15303	Same as Programmer.SetUp.Ch2PVInput
Segment.6.Ch2Rate	Channel 2 rate	float32	3bb7	15287	Set by Programmer.SetUp.RateResolution
Segment.6.Ch2Time	Channel 2 time	time_t	3bb5	15285	Set by Network.Modbus.TimeFormat
Segment.6.Ch2TSP	Channel 2 target set-point	float32	3bb3	15283	Same as Programmer.SetUp.Ch2PVInput
Segment.6.Ch2UserVal	Channel 2 user value	float32	3bc9	15305	Same as Programmer.SetUp.ResetCh2UserVal
Segment.6.Ch2Wait	Channel 2 Wait	uint8	3bbf	15295	Not applicable
Segment.6.Ch2WaitVal	Channel 2 wait value	float32	3bc1	15297	Same as Programmer.SetUp.PVWait2
Segment.6.Cycles	Cycles	int16	3bc3	15299	Not applicable
Segment.6.Duration	Duration	time_t	3bb1	15281	Set by Network.Modbus.TimeFormat
Segment.6.EndType	End type	uint8	3bb8	15288	Not applicable
Segment.6.Event1	Event 1	bool	3bca	15306	Not applicable
Segment.6.Event2	Event 2	bool	3bcb	15307	Not applicable
Segment.6.Event3	Event 3	bool	3bcc	15308	Not applicable
Segment.6.Event4	Event 4	bool	3bcd	15309	Not applicable
Segment.6.Event5	Event 5	bool	3bce	15310	Not applicable
Segment.6.Event6	Event 6	bool	3bcf	15311	Not applicable
Segment.6.Event7	Event 7	bool	3bd0	15312	Not applicable
Segment.6.Event8	Event 8	bool	3bd1	15313	Not applicable
Segment.6.GoBackTo	Go back to	uint8	3bc2	15298	Not applicable
Segment.6.SegmentName	Segment name	string_t	6b39	27449	Not applicable
Segment.6.Type	Type	uint8	3bb0	15280	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.6.WaitFor	Wait for	uint8	3bbd	15293	Not applicable
Segment.7.Ch1Holdback	Channel 1 holdback type	uint8	3be9	15337	Not applicable
Segment.7.Ch1HoldbackVal	Channel 1 holdback value	float32	3beb	15339	Same as Programmer.SetUp.Ch1PVInput
Segment.7.Ch1PVEvent	Channel 1 PV event	uint8	3bf4	15348	Not applicable
Segment.7.Ch1PVEventUse	Channel 1 PV event use	bool	3c02	15362	Not applicable
Segment.7.Ch1PVEventVal	Channel 1 PV event value	float32	3bf6	15350	Same as Programmer.SetUp.Ch1PVInput
Segment.7.Ch1Rate	Channel 1 rate	float32	3be6	15334	Set by Programmer.SetUp.RateResolution
Segment.7.Ch1Time	Channel 1 time	time_t	3be4	15332	Set by Network.Modbus.TimeFormat
Segment.7.Ch1TSP	Channel 1 target set-point	float32	3be2	15330	Same as Programmer.SetUp.Ch1PVInput
Segment.7.Ch1UserVal	Channel 1 user value	float32	3bf8	15352	Same as Programmer.SetUp.ResetCh1UserVal
Segment.7.Ch1Wait	Channel 1 Wait	uint8	3bee	15342	Not applicable
Segment.7.Ch1WaitVal	Channel 1 wait value	float32	3bf0	15344	Same as Programmer.SetUp.PVWait1
Segment.7.Ch2Holdback	Channel 2 holdback type	uint8	3bea	15338	Not applicable
Segment.7.Ch2HoldbackVal	Channel 2 holdback value	float32	3bec	15340	Same as Programmer.SetUp.Ch2PVInput
Segment.7.Ch2PVEvent	Channel 2 PV event	uint8	3bf5	15349	Not applicable
Segment.7.Ch2PVEventUse	Channel 2 PV event use	bool	3c03	15363	Not applicable
Segment.7.Ch2PVEventVal	Channel 2 PV event value	float32	3bf7	15351	Same as Programmer.SetUp.Ch2PVInput
Segment.7.Ch2Rate	Channel 2 rate	float32	3be7	15335	Set by Programmer.SetUp.RateResolution
Segment.7.Ch2Time	Channel 2 time	time_t	3be5	15333	Set by Network.Modbus.TimeFormat
Segment.7.Ch2TSP	Channel 2 target set-point	float32	3be3	15331	Same as Programmer.SetUp.Ch2PVInput
Segment.7.Ch2UserVal	Channel 2 user value	float32	3bf9	15353	Same as Programmer.SetUp.ResetCh2UserVal
Segment.7.Ch2Wait	Channel 2 Wait	uint8	3bef	15343	Not applicable
Segment.7.Ch2WaitVal	Channel 2 wait value	float32	3bf1	15345	Same as Programmer.SetUp.PVWait2
Segment.7.Cycles	Cycles	int16	3bf3	15347	Not applicable
Segment.7.Duration	Duration	time_t	3be1	15329	Set by Network.Modbus.TimeFormat
Segment.7.EndType	End type	uint8	3be8	15336	Not applicable
Segment.7.Event1	Event 1	bool	3bfa	15354	Not applicable
Segment.7.Event2	Event 2	bool	3bfb	15355	Not applicable
Segment.7.Event3	Event 3	bool	3bfc	15356	Not applicable
Segment.7.Event4	Event 4	bool	3bfd	15357	Not applicable
Segment.7.Event5	Event 5	bool	3bfe	15358	Not applicable
Segment.7.Event6	Event 6	bool	3bff	15359	Not applicable
Segment.7.Event7	Event 7	bool	3c00	15360	Not applicable
Segment.7.Event8	Event 8	bool	3c01	15361	Not applicable
Segment.7.GoBackTo	Go back to	uint8	3bf2	15346	Not applicable
Segment.7.SegmentName	Segment name	string_t	6b4e	27470	Not applicable
Segment.7.Type	Type	uint8	3be0	15328	Not applicable
Segment.7.WaitFor	Wait for	uint8	3bed	15341	Not applicable
Segment.8.Ch1Holdback	Channel 1 holdback type	uint8	3c19	15385	Not applicable
Segment.8.Ch1HoldbackVal	Channel 1 holdback value	float32	3c1b	15387	Same as Programmer.SetUp.Ch1PVInput
Segment.8.Ch1PVEvent	Channel 1 PV event	uint8	3c24	15396	Not applicable
Segment.8.Ch1PVEventUse	Channel 1 PV event use	bool	3c32	15410	Not applicable
Segment.8.Ch1PVEventVal	Channel 1 PV event value	float32	3c26	15398	Same as Programmer.SetUp.Ch1PVInput
Segment.8.Ch1Rate	Channel 1 rate	float32	3c16	15382	Set by Programmer.SetUp.RateResolution
Segment.8.Ch1Time	Channel 1 time	time_t	3c14	15380	Set by Network.Modbus.TimeFormat
Segment.8.Ch1TSP	Channel 1 target set-point	float32	3c12	15378	Same as Programmer.SetUp.Ch1PVInput
Segment.8.Ch1UserVal	Channel 1 user value	float32	3c28	15400	Same as Programmer.SetUp.ResetCh1UserVal
Segment.8.Ch1Wait	Channel 1 Wait	uint8	3c1e	15390	Not applicable
Segment.8.Ch1WaitVal	Channel 1 wait value	float32	3c20	15392	Same as Programmer.SetUp.PVWait1
Segment.8.Ch2Holdback	Channel 2 holdback type	uint8	3c1a	15386	Not applicable
Segment.8.Ch2HoldbackVal	Channel 2 holdback value	float32	3c1c	15388	Same as Programmer.SetUp.Ch2PVInput
Segment.8.Ch2PVEvent	Channel 2 PV event	uint8	3c25	15397	Not applicable
Segment.8.Ch2PVEventUse	Channel 2 PV event use	bool	3c33	15411	Not applicable
Segment.8.Ch2PVEventVal	Channel 2 PV event value	float32	3c27	15399	Same as Programmer.SetUp.Ch2PVInput
Segment.8.Ch2Rate	Channel 2 rate	float32	3c17	15383	Set by Programmer.SetUp.RateResolution
Segment.8.Ch2Time	Channel 2 time	time_t	3c15	15381	Set by Network.Modbus.TimeFormat
Segment.8.Ch2TSP	Channel 2 target set-point	float32	3c13	15379	Same as Programmer.SetUp.Ch2PVInput
Segment.8.Ch2UserVal	Channel 2 user value	float32	3c29	15401	Same as Programmer.SetUp.ResetCh2UserVal
Segment.8.Ch2Wait	Channel 2 Wait	uint8	3c1f	15391	Not applicable
Segment.8.Ch2WaitVal	Channel 2 wait value	float32	3c21	15393	Same as Programmer.SetUp.PVWait2
Segment.8.Cycles	Cycles	int16	3c23	15395	Not applicable
Segment.8.Duration	Duration	time_t	3c11	15377	Set by Network.Modbus.TimeFormat
Segment.8.EndType	End type	uint8	3c18	15384	Not applicable
Segment.8.Event1	Event 1	bool	3c2a	15402	Not applicable
Segment.8.Event2	Event 2	bool	3c2b	15403	Not applicable
Segment.8.Event3	Event 3	bool	3c2c	15404	Not applicable
Segment.8.Event4	Event 4	bool	3c2d	15405	Not applicable
Segment.8.Event5	Event 5	bool	3c2e	15406	Not applicable
Segment.8.Event6	Event 6	bool	3c2f	15407	Not applicable
Segment.8.Event7	Event 7	bool	3c30	15408	Not applicable
Segment.8.Event8	Event 8	bool	3c31	15409	Not applicable
Segment.8.GoBackTo	Go back to	uint8	3c22	15394	Not applicable
Segment.8.SegmentName	Segment name	string_t	6b63	27491	Not applicable
Segment.8.Type	Type	uint8	3c10	15376	Not applicable
Segment.8.WaitFor	Wait for	uint8	3c1d	15389	Not applicable
Segment.9.Ch1Holdback	Channel 1 holdback type	uint8	3c49	15433	Not applicable
Segment.9.Ch1HoldbackVal	Channel 1 holdback value	float32	3c4b	15435	Same as Programmer.SetUp.Ch1PVInput
Segment.9.Ch1PVEvent	Channel 1 PV event	uint8	3c54	15444	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.9.Ch1PVEventUse	Channel 1 PV event use	bool	3c62	15458	Not applicable
Segment.9.Ch1PVEventVal	Channel 1 PV event value	float32	3c56	15446	Same as Programmer.SetUp.Ch1PVInput
Segment.9.Ch1Rate	Channel 1 rate	float32	3c46	15430	Set by Programmer.SetUp.RateResolution
Segment.9.Ch1Time	Channel 1 time	time_t	3c44	15428	Set by Network.Modbus.TimeFormat
Segment.9.Ch1TSP	Channel 1 target set-point	float32	3c42	15426	Same as Programmer.SetUp.Ch1PVInput
Segment.9.Ch1UserVal	Channel 1 user value	float32	3c58	15448	Same as Programmer.SetUp.ResetCh1UserVal
Segment.9.Ch1Wait	Channel 1 Wait	uint8	3c4e	15438	Not applicable
Segment.9.Ch1WaitVal	Channel 1 wait value	float32	3c50	15440	Same as Programmer.SetUp.PVWait1
Segment.9.Ch2Holdback	Channel 2 holdback type	uint8	3c4a	15434	Not applicable
Segment.9.Ch2HoldbackVal	Channel 2 holdback value	float32	3c4c	15436	Same as Programmer.SetUp.Ch2PVInput
Segment.9.Ch2PVEvent	Channel 2 PV event	uint8	3c55	15445	Not applicable
Segment.9.Ch2PVEventUse	Channel 2 PV event use	bool	3c63	15459	Not applicable
Segment.9.Ch2PVEventVal	Channel 2 PV event value	float32	3c57	15447	Same as Programmer.SetUp.Ch2PVInput
Segment.9.Ch2Rate	Channel 2 rate	float32	3c47	15431	Set by Programmer.SetUp.RateResolution
Segment.9.Ch2Time	Channel 2 time	time_t	3c45	15429	Set by Network.Modbus.TimeFormat
Segment.9.Ch2TSP	Channel 2 target set-point	float32	3c43	15427	Same as Programmer.SetUp.Ch2PVInput
Segment.9.Ch2UserVal	Channel 2 user value	float32	3c59	15449	Same as Programmer.SetUp.ResetCh2UserVal
Segment.9.Ch2Wait	Channel 2 Wait	uint8	3c4f	15439	Not applicable
Segment.9.Ch2WaitVal	Channel 2 wait value	float32	3c51	15441	Same as Programmer.SetUp.PVWait2
Segment.9.Cycles	Cycles	int16	3c53	15443	Not applicable
Segment.9.Duration	Duration	time_t	3c41	15425	Set by Network.Modbus.TimeFormat
Segment.9.EndType	End type	uint8	3c48	15432	Not applicable
Segment.9.Event1	Event 1	bool	3c5a	15450	Not applicable
Segment.9.Event2	Event 2	bool	3c5b	15451	Not applicable
Segment.9.Event3	Event 3	bool	3c5c	15452	Not applicable
Segment.9.Event4	Event 4	bool	3c5d	15453	Not applicable
Segment.9.Event5	Event 5	bool	3c5e	15454	Not applicable
Segment.9.Event6	Event 6	bool	3c5f	15455	Not applicable
Segment.9.Event7	Event 7	bool	3c60	15456	Not applicable
Segment.9.Event8	Event 8	bool	3c61	15457	Not applicable
Segment.9.GoBackTo	Go back to	uint8	3c52	15442	Not applicable
Segment.9.SegmentName	Segment name	string_t	6b78	27512	Not applicable
Segment.9.Type	Type	uint8	3c40	15424	Not applicable
Segment.9.WaitFor	Wait for	uint8	3c4d	15437	Not applicable
Segment.10.Ch1Holdback	Channel 1 holdback type	uint8	3c79	15481	Not applicable
Segment.10.Ch1HoldbackVal	Channel 1 holdback value	float32	3c7b	15483	Same as Programmer.SetUp.Ch1PVInput
Segment.10.Ch1PVEvent	Channel 1 PV event	uint8	3c84	15492	Not applicable
Segment.10.Ch1PVEventUse	Channel 1 PV event use	bool	3c92	15506	Not applicable
Segment.10.Ch1PVEventVal	Channel 1 PV event value	float32	3c86	15494	Same as Programmer.SetUp.Ch1PVInput
Segment.10.Ch1Rate	Channel 1 rate	float32	3c76	15478	Set by Programmer.SetUp.RateResolution
Segment.10.Ch1Time	Channel 1 time	time_t	3c74	15476	Set by Network.Modbus.TimeFormat
Segment.10.Ch1TSP	Channel 1 target set-point	float32	3c72	15474	Same as Programmer.SetUp.Ch1PVInput
Segment.10.Ch1UserVal	Channel 1 user value	float32	3c88	15496	Same as Programmer.SetUp.ResetCh1UserVal
Segment.10.Ch1Wait	Channel 1 Wait	uint8	3c7e	15486	Not applicable
Segment.10.Ch1WaitVal	Channel 1 wait value	float32	3c80	15488	Same as Programmer.SetUp.PVWait1
Segment.10.Ch2Holdback	Channel 2 holdback type	uint8	3c7a	15482	Not applicable
Segment.10.Ch2HoldbackVal	Channel 2 holdback value	float32	3c7c	15484	Same as Programmer.SetUp.Ch2PVInput
Segment.10.Ch2PVEvent	Channel 2 PV event	uint8	3c85	15493	Not applicable
Segment.10.Ch2PVEventUse	Channel 2 PV event use	bool	3c93	15507	Not applicable
Segment.10.Ch2PVEventVal	Channel 2 PV event value	float32	3c87	15495	Same as Programmer.SetUp.Ch2PVInput
Segment.10.Ch2Rate	Channel 2 rate	float32	3c77	15479	Set by Programmer.SetUp.RateResolution
Segment.10.Ch2Time	Channel 2 time	time_t	3c75	15477	Set by Network.Modbus.TimeFormat
Segment.10.Ch2TSP	Channel 2 target set-point	float32	3c73	15475	Same as Programmer.SetUp.Ch2PVInput
Segment.10.Ch2UserVal	Channel 2 user value	float32	3c89	15497	Same as Programmer.SetUp.ResetCh2UserVal
Segment.10.Ch2Wait	Channel 2 Wait	uint8	3c7f	15487	Not applicable
Segment.10.Ch2WaitVal	Channel 2 wait value	float32	3c81	15489	Same as Programmer.SetUp.PVWait2
Segment.10.Cycles	Cycles	int16	3c83	15491	Not applicable
Segment.10.Duration	Duration	time_t	3c71	15473	Set by Network.Modbus.TimeFormat
Segment.10.EndType	End type	uint8	3c78	15480	Not applicable
Segment.10.Event1	Event 1	bool	3c8a	15498	Not applicable
Segment.10.Event2	Event 2	bool	3c8b	15499	Not applicable
Segment.10.Event3	Event 3	bool	3c8c	15500	Not applicable
Segment.10.Event4	Event 4	bool	3c8d	15501	Not applicable
Segment.10.Event5	Event 5	bool	3c8e	15502	Not applicable
Segment.10.Event6	Event 6	bool	3c8f	15503	Not applicable
Segment.10.Event7	Event 7	bool	3c90	15504	Not applicable
Segment.10.Event8	Event 8	bool	3c91	15505	Not applicable
Segment.10.GoBackTo	Go back to	uint8	3c82	15490	Not applicable
Segment.10.SegmentName	Segment name	string_t	6b8d	27533	Not applicable
Segment.10.Type	Type	uint8	3c70	15472	Not applicable
Segment.10.WaitFor	Wait for	uint8	3c7d	15485	Not applicable
Segment.11.Ch1Holdback	Channel 1 holdback type	uint8	3ca9	15529	Not applicable
Segment.11.Ch1HoldbackVal	Channel 1 holdback value	float32	3cab	15531	Same as Programmer.SetUp.Ch1PVInput
Segment.11.Ch1PVEvent	Channel 1 PV event	uint8	3cb4	15540	Not applicable
Segment.11.Ch1PVEventUse	Channel 1 PV event use	bool	3cc2	15554	Not applicable
Segment.11.Ch1PVEventVal	Channel 1 PV event value	float32	3cb6	15542	Same as Programmer.SetUp.Ch1PVInput
Segment.11.Ch1Rate	Channel 1 rate	float32	3ca6	15526	Set by Programmer.SetUp.RateResolution
Segment.11.Ch1Time	Channel 1 time	time_t	3ca4	15524	Set by Network.Modbus.TimeFormat
Segment.11.Ch1TSP	Channel 1 target set-point	float32	3ca2	15522	Same as Programmer.SetUp.Ch1PVInput

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.11.Ch1UserVal	Channel 1 user value	float32	3cb8	15544	Same as Programmer.SetUp.ResetCh1UserVal
Segment.11.Ch1Wait	Channel 1 Wait	uint8	3cae	15534	Not applicable
Segment.11.Ch1WaitVal	Channel 1 wait value	float32	3cb0	15536	Same as Programmer.SetUp.PVWait1
Segment.11.Ch2Holdback	Channel 2 holdback type	uint8	3caa	15530	Not applicable
Segment.11.Ch2HoldbackVal	Channel 2 holdback value	float32	3cac	15532	Same as Programmer.SetUp.Ch2PVInput
Segment.11.Ch2PVEvent	Channel 2 PV event	uint8	3cb5	15541	Not applicable
Segment.11.Ch2PVEventUse	Channel 2 PV event use	bool	3cc3	15555	Not applicable
Segment.11.Ch2PVEventVal	Channel 2 PV event value	float32	3cb7	15543	Same as Programmer.SetUp.Ch2PVInput
Segment.11.Ch2Rate	Channel 2 rate	float32	3ca7	15527	Set by Programmer.SetUp.RateResolution
Segment.11.Ch2Time	Channel 2 time	time_t	3ca5	15525	Set by Network.Modbus.TimeFormat
Segment.11.Ch2TSP	Channel 2 target set-point	float32	3ca3	15523	Same as Programmer.SetUp.Ch2PVInput
Segment.11.Ch2UserVal	Channel 2 user value	float32	3cb9	15545	Same as Programmer.SetUp.ResetCh2UserVal
Segment.11.Ch2Wait	Channel 2 Wait	uint8	3caf	15535	Not applicable
Segment.11.Ch2WaitVal	Channel 2 wait value	float32	3cb1	15537	Same as Programmer.SetUp.PVWait2
Segment.11.Cycles	Cycles	int16	3cb3	15539	Not applicable
Segment.11.Duration	Duration	time_t	3ca1	15521	Set by Network.Modbus.TimeFormat
Segment.11.EndType	End type	uint8	3ca8	15528	Not applicable
Segment.11.Event1	Event 1	bool	3cba	15546	Not applicable
Segment.11.Event2	Event 2	bool	3cbb	15547	Not applicable
Segment.11.Event3	Event 3	bool	3cbc	15548	Not applicable
Segment.11.Event4	Event 4	bool	3cbd	15549	Not applicable
Segment.11.Event5	Event 5	bool	3cbe	15550	Not applicable
Segment.11.Event6	Event 6	bool	3cbf	15551	Not applicable
Segment.11.Event7	Event 7	bool	3cc0	15552	Not applicable
Segment.11.Event8	Event 8	bool	3cc1	15553	Not applicable
Segment.11.GoBackTo	Go back to	uint8	3cb2	15538	Not applicable
Segment.11.SegmentName	Segment name	string_t	6ba2	27554	Not applicable
Segment.11.Type	Type	uint8	3ca0	15520	Not applicable
Segment.11.WaitFor	Wait for	uint8	3cad	15533	Not applicable
Segment.12.Ch1Holdback	Channel 1 holdback type	uint8	3cd9	15577	Not applicable
Segment.12.Ch1HoldbackVal	Channel 1 holdback value	float32	3cdb	15579	Same as Programmer.SetUp.Ch1PVInput
Segment.12.Ch1PVEvent	Channel 1 PV event	uint8	3ce4	15588	Not applicable
Segment.12.Ch1PVEventUse	Channel 1 PV event use	bool	3cf2	15602	Not applicable
Segment.12.Ch1PVEventVal	Channel 1 PV event value	float32	3ce6	15590	Same as Programmer.SetUp.Ch1PVInput
Segment.12.Ch1Rate	Channel 1 rate	float32	3cd6	15574	Set by Programmer.SetUp.RateResolution
Segment.12.Ch1Time	Channel 1 time	time_t	3cd4	15572	Set by Network.Modbus.TimeFormat
Segment.12.Ch1TSP	Channel 1 target set-point	float32	3cd2	15570	Same as Programmer.SetUp.Ch1PVInput
Segment.12.Ch1UserVal	Channel 1 user value	float32	3ce8	15592	Same as Programmer.SetUp.ResetCh1UserVal
Segment.12.Ch1Wait	Channel 1 Wait	uint8	3cde	15582	Not applicable
Segment.12.Ch1WaitVal	Channel 1 wait value	float32	3ce0	15584	Same as Programmer.SetUp.PVWait1
Segment.12.Ch2Holdback	Channel 2 holdback type	uint8	3cda	15578	Not applicable
Segment.12.Ch2HoldbackVal	Channel 2 holdback value	float32	3cdc	15580	Same as Programmer.SetUp.Ch2PVInput
Segment.12.Ch2PVEvent	Channel 2 PV event	uint8	3ce5	15589	Not applicable
Segment.12.Ch2PVEventUse	Channel 2 PV event use	bool	3cf3	15603	Not applicable
Segment.12.Ch2PVEventVal	Channel 2 PV event value	float32	3ce7	15591	Same as Programmer.SetUp.Ch2PVInput
Segment.12.Ch2Rate	Channel 2 rate	float32	3cd7	15575	Set by Programmer.SetUp.RateResolution
Segment.12.Ch2Time	Channel 2 time	time_t	3cd5	15573	Set by Network.Modbus.TimeFormat
Segment.12.Ch2TSP	Channel 2 target set-point	float32	3cd3	15571	Same as Programmer.SetUp.Ch2PVInput
Segment.12.Ch2UserVal	Channel 2 user value	float32	3ce9	15593	Same as Programmer.SetUp.ResetCh2UserVal
Segment.12.Ch2Wait	Channel 2 Wait	uint8	3cdf	15583	Not applicable
Segment.12.Ch2WaitVal	Channel 2 wait value	float32	3ce1	15585	Same as Programmer.SetUp.PVWait2
Segment.12.Cycles	Cycles	int16	3ce3	15587	Not applicable
Segment.12.Duration	Duration	time_t	3cd1	15569	Set by Network.Modbus.TimeFormat
Segment.12.EndType	End type	uint8	3cd8	15576	Not applicable
Segment.12.Event1	Event 1	bool	3cea	15594	Not applicable
Segment.12.Event2	Event 2	bool	3ceb	15595	Not applicable
Segment.12.Event3	Event 3	bool	3cec	15596	Not applicable
Segment.12.Event4	Event 4	bool	3ced	15597	Not applicable
Segment.12.Event5	Event 5	bool	3cee	15598	Not applicable
Segment.12.Event6	Event 6	bool	3cef	15599	Not applicable
Segment.12.Event7	Event 7	bool	3cf0	15600	Not applicable
Segment.12.Event8	Event 8	bool	3cf1	15601	Not applicable
Segment.12.GoBackTo	Go back to	uint8	3ce2	15586	Not applicable
Segment.12.SegmentName	Segment name	string_t	6bb7	27575	Not applicable
Segment.12.Type	Type	uint8	3cd0	15568	Not applicable
Segment.12.WaitFor	Wait for	uint8	3cdd	15581	Not applicable
Segment.13.Ch1Holdback	Channel 1 holdback type	uint8	3d09	15625	Not applicable
Segment.13.Ch1HoldbackVal	Channel 1 holdback value	float32	3d0b	15627	Same as Programmer.SetUp.Ch1PVInput
Segment.13.Ch1PVEvent	Channel 1 PV event	uint8	3d14	15636	Not applicable
Segment.13.Ch1PVEventUse	Channel 1 PV event use	bool	3d22	15650	Not applicable
Segment.13.Ch1PVEventVal	Channel 1 PV event value	float32	3d16	15638	Same as Programmer.SetUp.Ch1PVInput
Segment.13.Ch1Rate	Channel 1 rate	float32	3d06	15622	Set by Programmer.SetUp.RateResolution
Segment.13.Ch1Time	Channel 1 time	time_t	3d04	15620	Set by Network.Modbus.TimeFormat
Segment.13.Ch1TSP	Channel 1 target set-point	float32	3d02	15618	Same as Programmer.SetUp.Ch1PVInput
Segment.13.Ch1UserVal	Channel 1 user value	float32	3d18	15640	Same as Programmer.SetUp.ResetCh1UserVal
Segment.13.Ch1Wait	Channel 1 Wait	uint8	3d0e	15630	Not applicable
Segment.13.Ch1WaitVal	Channel 1 wait value	float32	3d10	15632	Same as Programmer.SetUp.PVWait1
Segment.13.Ch2Holdback	Channel 2 holdback type	uint8	3d0a	15626	Not applicable
Segment.13.Ch2HoldbackVal	Channel 2 holdback value	float32	3d0c	15628	Same as Programmer.SetUp.Ch2PVInput

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.13.Ch2PVEvent	Channel 2 PV event	uint8	3d15	15637	Not applicable
Segment.13.Ch2PVEventUse	Channel 2 PV event use	bool	3d23	15651	Not applicable
Segment.13.Ch2PVEventVal	Channel 2 PV event value	float32	3d17	15639	Same as Programmer.SetUp.Ch2PVInput
Segment.13.Ch2Rate	Channel 2 rate	float32	3d07	15623	Set by Programmer.SetUp.RateResolution
Segment.13.Ch2Time	Channel 2 time	time_t	3d05	15621	Set by Network.Modbus.TimeFormat
Segment.13.Ch2TSP	Channel 2 target set-point	float32	3d03	15619	Same as Programmer.SetUp.Ch2PVInput
Segment.13.Ch2UserVal	Channel 2 user value	float32	3d19	15641	Same as Programmer.SetUp.ResetCh2UserVal
Segment.13.Ch2Wait	Channel 2 Wait	uint8	3d0f	15631	Not applicable
Segment.13.Ch2WaitVal	Channel 2 wait value	float32	3d11	15633	Same as Programmer.SetUp.PVWait2
Segment.13.Cycles	Cycles	int16	3d13	15635	Not applicable
Segment.13.Duration	Duration	time_t	3d01	15617	Set by Network.Modbus.TimeFormat
Segment.13.EndType	End type	uint8	3d08	15624	Not applicable
Segment.13.Event1	Event 1	bool	3d1a	15642	Not applicable
Segment.13.Event2	Event 2	bool	3d1b	15643	Not applicable
Segment.13.Event3	Event 3	bool	3d1c	15644	Not applicable
Segment.13.Event4	Event 4	bool	3d1d	15645	Not applicable
Segment.13.Event5	Event 5	bool	3d1e	15646	Not applicable
Segment.13.Event6	Event 6	bool	3d1f	15647	Not applicable
Segment.13.Event7	Event 7	bool	3d20	15648	Not applicable
Segment.13.Event8	Event 8	bool	3d21	15649	Not applicable
Segment.13.GoBackTo	Go back to	uint8	3d12	15634	Not applicable
Segment.13.SegmentName	Segment name	string_t	6bcc	27596	Not applicable
Segment.13.Type	Type	uint8	3d00	15616	Not applicable
Segment.13.WaitFor	Wait for	uint8	3d0d	15629	Not applicable
Segment.14.Ch1Holdback	Channel 1 holdback type	uint8	3d39	15673	Not applicable
Segment.14.Ch1HoldbackVal	Channel 1 holdback value	float32	3d3b	15675	Same as Programmer.SetUp.Ch1PVInput
Segment.14.Ch1PVEvent	Channel 1 PV event	uint8	3d44	15684	Not applicable
Segment.14.Ch1PVEventUse	Channel 1 PV event use	bool	3d52	15698	Not applicable
Segment.14.Ch1PVEventVal	Channel 1 PV event value	float32	3d46	15686	Same as Programmer.SetUp.Ch1PVInput
Segment.14.Ch1Rate	Channel 1 rate	float32	3d36	15670	Set by Programmer.SetUp.RateResolution
Segment.14.Ch1Time	Channel 1 time	time_t	3d34	15668	Set by Network.Modbus.TimeFormat
Segment.14.Ch1TSP	Channel 1 target set-point	float32	3d32	15666	Same as Programmer.SetUp.Ch1PVInput
Segment.14.Ch1UserVal	Channel 1 user value	float32	3d48	15688	Same as Programmer.SetUp.ResetCh1UserVal
Segment.14.Ch1Wait	Channel 1 Wait	uint8	3d3e	15678	Not applicable
Segment.14.Ch1WaitVal	Channel 1 wait value	float32	3d40	15680	Same as Programmer.SetUp.PVWait1
Segment.14.Ch2Holdback	Channel 2 holdback type	uint8	3d3a	15674	Not applicable
Segment.14.Ch2HoldbackVal	Channel 2 holdback value	float32	3d3c	15676	Same as Programmer.SetUp.Ch2PVInput
Segment.14.Ch2PVEvent	Channel 2 PV event	uint8	3d45	15685	Not applicable
Segment.14.Ch2PVEventUse	Channel 2 PV event use	bool	3d53	15699	Not applicable
Segment.14.Ch2PVEventVal	Channel 2 PV event value	float32	3d47	15687	Same as Programmer.SetUp.Ch2PVInput
Segment.14.Ch2Rate	Channel 2 rate	float32	3d37	15671	Set by Programmer.SetUp.RateResolution
Segment.14.Ch2Time	Channel 2 time	time_t	3d35	15669	Set by Network.Modbus.TimeFormat
Segment.14.Ch2TSP	Channel 2 target set-point	float32	3d33	15667	Same as Programmer.SetUp.Ch2PVInput
Segment.14.Ch2UserVal	Channel 2 user value	float32	3d49	15689	Same as Programmer.SetUp.ResetCh2UserVal
Segment.14.Ch2Wait	Channel 2 Wait	uint8	3d3f	15679	Not applicable
Segment.14.Ch2WaitVal	Channel 2 wait value	float32	3d41	15681	Same as Programmer.SetUp.PVWait2
Segment.14.Cycles	Cycles	int16	3d43	15683	Not applicable
Segment.14.Duration	Duration	time_t	3d31	15665	Set by Network.Modbus.TimeFormat
Segment.14.EndType	End type	uint8	3d38	15672	Not applicable
Segment.14.Event1	Event 1	bool	3d4a	15690	Not applicable
Segment.14.Event2	Event 2	bool	3d4b	15691	Not applicable
Segment.14.Event3	Event 3	bool	3d4c	15692	Not applicable
Segment.14.Event4	Event 4	bool	3d4d	15693	Not applicable
Segment.14.Event5	Event 5	bool	3d4e	15694	Not applicable
Segment.14.Event6	Event 6	bool	3d4f	15695	Not applicable
Segment.14.Event7	Event 7	bool	3d50	15696	Not applicable
Segment.14.Event8	Event 8	bool	3d51	15697	Not applicable
Segment.14.GoBackTo	Go back to	uint8	3d42	15682	Not applicable
Segment.14.SegmentName	Segment name	string_t	6be1	27617	Not applicable
Segment.14.Type	Type	uint8	3d30	15664	Not applicable
Segment.14.WaitFor	Wait for	uint8	3d3d	15677	Not applicable
Segment.15.Ch1Holdback	Channel 1 holdback type	uint8	3d69	15721	Not applicable
Segment.15.Ch1HoldbackVal	Channel 1 holdback value	float32	3d6b	15723	Same as Programmer.SetUp.Ch1PVInput
Segment.15.Ch1PVEvent	Channel 1 PV event	uint8	3d74	15732	Not applicable
Segment.15.Ch1PVEventUse	Channel 1 PV event use	bool	3d82	15746	Not applicable
Segment.15.Ch1PVEventVal	Channel 1 PV event value	float32	3d76	15734	Same as Programmer.SetUp.Ch1PVInput
Segment.15.Ch1Rate	Channel 1 rate	float32	3d66	15718	Set by Programmer.SetUp.RateResolution
Segment.15.Ch1Time	Channel 1 time	time_t	3d64	15716	Set by Network.Modbus.TimeFormat
Segment.15.Ch1TSP	Channel 1 target set-point	float32	3d62	15714	Same as Programmer.SetUp.Ch1PVInput
Segment.15.Ch1UserVal	Channel 1 user value	float32	3d78	15736	Same as Programmer.SetUp.ResetCh1UserVal
Segment.15.Ch1Wait	Channel 1 Wait	uint8	3d6e	15726	Not applicable
Segment.15.Ch1WaitVal	Channel 1 wait value	float32	3d70	15728	Same as Programmer.SetUp.PVWait1
Segment.15.Ch2Holdback	Channel 2 holdback type	uint8	3d6a	15722	Not applicable
Segment.15.Ch2HoldbackVal	Channel 2 holdback value	float32	3d6c	15724	Same as Programmer.SetUp.Ch2PVInput
Segment.15.Ch2PVEvent	Channel 2 PV event	uint8	3d75	15733	Not applicable
Segment.15.Ch2PVEventUse	Channel 2 PV event use	bool	3d83	15747	Not applicable
Segment.15.Ch2PVEventVal	Channel 2 PV event value	float32	3d77	15735	Same as Programmer.SetUp.Ch2PVInput
Segment.15.Ch2Rate	Channel 2 rate	float32	3d67	15719	Set by Programmer.SetUp.RateResolution
Segment.15.Ch2Time	Channel 2 time	time_t	3d65	15717	Set by Network.Modbus.TimeFormat

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.15.Ch2TSP	Channel 2 target set-point	float32	3d63	15715	Same as Programmer.SetUp.Ch2PVInput
Segment.15.Ch2UserVal	Channel 2 user value	float32	3d79	15737	Same as Programmer.SetUp.ResetCh2UserVal
Segment.15.Ch2Wait	Channel 2 Wait	uint8	3d6f	15727	Not applicable
Segment.15.Ch2WaitVal	Channel 2 wait value	float32	3d71	15729	Same as Programmer.SetUp.PVWait2
Segment.15.Cycles	Cycles	int16	3d73	15731	Not applicable
Segment.15.Duration	Duration	time_t	3d61	15713	Set by Network.Modbus.TimeFormat
Segment.15.EndType	End type	uint8	3d68	15720	Not applicable
Segment.15.Event1	Event 1	bool	3d7a	15738	Not applicable
Segment.15.Event2	Event 2	bool	3d7b	15739	Not applicable
Segment.15.Event3	Event 3	bool	3d7c	15740	Not applicable
Segment.15.Event4	Event 4	bool	3d7d	15741	Not applicable
Segment.15.Event5	Event 5	bool	3d7e	15742	Not applicable
Segment.15.Event6	Event 6	bool	3d7f	15743	Not applicable
Segment.15.Event7	Event 7	bool	3d80	15744	Not applicable
Segment.15.Event8	Event 8	bool	3d81	15745	Not applicable
Segment.15.GoBackTo	Go back to	uint8	3d72	15730	Not applicable
Segment.15.SegmentName	Segment name	string_t	6bf6	27638	Not applicable
Segment.15.Type	Type	uint8	3d60	15712	Not applicable
Segment.15.WaitFor	Wait for	uint8	3d6d	15725	Not applicable
Segment.16.Ch1Holdback	Channel 1 holdback type	uint8	3d99	15769	Not applicable
Segment.16.Ch1HoldbackVal	Channel 1 holdback value	float32	3d9b	15771	Same as Programmer.SetUp.Ch1PVInput
Segment.16.Ch1PVEvent	Channel 1 PV event	uint8	3da4	15780	Not applicable
Segment.16.Ch1PVEventUse	Channel 1 PV event use	bool	3db2	15794	Not applicable
Segment.16.Ch1PVEventVal	Channel 1 PV event value	float32	3da6	15782	Same as Programmer.SetUp.Ch1PVInput
Segment.16.Ch1Rate	Channel 1 rate	float32	3d96	15766	Set by Programmer.SetUp.RateResolution
Segment.16.Ch1Time	Channel 1 time	time_t	3d94	15764	Set by Network.Modbus.TimeFormat
Segment.16.Ch1TSP	Channel 1 target set-point	float32	3d92	15762	Same as Programmer.SetUp.Ch1PVInput
Segment.16.Ch1UserVal	Channel 1 user value	float32	3da8	15784	Same as Programmer.SetUp.ResetCh1UserVal
Segment.16.Ch1Wait	Channel 1 Wait	uint8	3d9e	15774	Not applicable
Segment.16.Ch1WaitVal	Channel 1 wait value	float32	3da0	15776	Same as Programmer.SetUp.PVWait1
Segment.16.Ch2Holdback	Channel 2 holdback type	uint8	3d9a	15770	Not applicable
Segment.16.Ch2HoldbackVal	Channel 2 holdback value	float32	3d9c	15772	Same as Programmer.SetUp.Ch2PVInput
Segment.16.Ch2PVEvent	Channel 2 PV event	uint8	3da5	15781	Not applicable
Segment.16.Ch2PVEventUse	Channel 2 PV event use	bool	3db3	15795	Not applicable
Segment.16.Ch2PVEventVal	Channel 2 PV event value	float32	3da7	15783	Same as Programmer.SetUp.Ch2PVInput
Segment.16.Ch2Rate	Channel 2 rate	float32	3d97	15767	Set by Programmer.SetUp.RateResolution
Segment.16.Ch2Time	Channel 2 time	time_t	3d95	15765	Set by Network.Modbus.TimeFormat
Segment.16.Ch2TSP	Channel 2 target set-point	float32	3d93	15763	Same as Programmer.SetUp.Ch2PVInput
Segment.16.Ch2UserVal	Channel 2 user value	float32	3da9	15785	Same as Programmer.SetUp.ResetCh2UserVal
Segment.16.Ch2Wait	Channel 2 Wait	uint8	3d9f	15775	Not applicable
Segment.16.Ch2WaitVal	Channel 2 wait value	float32	3da1	15777	Same as Programmer.SetUp.PVWait2
Segment.16.Cycles	Cycles	int16	3da3	15779	Not applicable
Segment.16.Duration	Duration	time_t	3d91	15761	Set by Network.Modbus.TimeFormat
Segment.16.EndType	End type	uint8	3d98	15768	Not applicable
Segment.16.Event1	Event 1	bool	3daa	15786	Not applicable
Segment.16.Event2	Event 2	bool	3dab	15787	Not applicable
Segment.16.Event3	Event 3	bool	3dac	15788	Not applicable
Segment.16.Event4	Event 4	bool	3dad	15789	Not applicable
Segment.16.Event5	Event 5	bool	3dae	15790	Not applicable
Segment.16.Event6	Event 6	bool	3daf	15791	Not applicable
Segment.16.Event7	Event 7	bool	3db0	15792	Not applicable
Segment.16.Event8	Event 8	bool	3db1	15793	Not applicable
Segment.16.GoBackTo	Go back to	uint8	3da2	15778	Not applicable
Segment.16.SegmentName	Segment name	string_t	6c0b	27659	Not applicable
Segment.16.Type	Type	uint8	3d90	15760	Not applicable
Segment.16.WaitFor	Wait for	uint8	3d9d	15773	Not applicable
Segment.17.Ch1Holdback	Channel 1 holdback type	uint8	3dc9	15817	Not applicable
Segment.17.Ch1HoldbackVal	Channel 1 holdback value	float32	3dcb	15819	Same as Programmer.SetUp.Ch1PVInput
Segment.17.Ch1PVEvent	Channel 1 PV event	uint8	3dd4	15828	Not applicable
Segment.17.Ch1PVEventUse	Channel 1 PV event use	bool	3de2	15842	Not applicable
Segment.17.Ch1PVEventVal	Channel 1 PV event value	float32	3dd6	15830	Same as Programmer.SetUp.Ch1PVInput
Segment.17.Ch1Rate	Channel 1 rate	float32	3dc6	15814	Set by Programmer.SetUp.RateResolution
Segment.17.Ch1Time	Channel 1 time	time_t	3dc4	15812	Set by Network.Modbus.TimeFormat
Segment.17.Ch1TSP	Channel 1 target set-point	float32	3dc2	15810	Same as Programmer.SetUp.Ch1PVInput
Segment.17.Ch1UserVal	Channel 1 user value	float32	3dd8	15832	Same as Programmer.SetUp.ResetCh1UserVal
Segment.17.Ch1Wait	Channel 1 Wait	uint8	3dce	15822	Not applicable
Segment.17.Ch1WaitVal	Channel 1 wait value	float32	3dd0	15824	Same as Programmer.SetUp.PVWait1
Segment.17.Ch2Holdback	Channel 2 holdback type	uint8	3dca	15818	Not applicable
Segment.17.Ch2HoldbackVal	Channel 2 holdback value	float32	3dcc	15820	Same as Programmer.SetUp.Ch2PVInput
Segment.17.Ch2PVEvent	Channel 2 PV event	uint8	3dd5	15829	Not applicable
Segment.17.Ch2PVEventUse	Channel 2 PV event use	bool	3de3	15843	Not applicable
Segment.17.Ch2PVEventVal	Channel 2 PV event value	float32	3dd7	15831	Same as Programmer.SetUp.Ch2PVInput
Segment.17.Ch2Rate	Channel 2 rate	float32	3dc7	15815	Set by Programmer.SetUp.RateResolution
Segment.17.Ch2Time	Channel 2 time	time_t	3dc5	15813	Set by Network.Modbus.TimeFormat
Segment.17.Ch2TSP	Channel 2 target set-point	float32	3dc3	15811	Same as Programmer.SetUp.Ch2PVInput
Segment.17.Ch2UserVal	Channel 2 user value	float32	3dd9	15833	Same as Programmer.SetUp.ResetCh2UserVal
Segment.17.Ch2Wait	Channel 2 Wait	uint8	3dcf	15823	Not applicable
Segment.17.Ch2WaitVal	Channel 2 wait value	float32	3dd1	15825	Same as Programmer.SetUp.PVWait2
Segment.17.Cycles	Cycles	int16	3dd3	15827	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.17.Duration	Duration	time_t	3dc1	15809	Set by Network.Modbus.TimeFormat
Segment.17.EndType	End type	uint8	3dc8	15816	Not applicable
Segment.17.Event1	Event 1	bool	3dda	15834	Not applicable
Segment.17.Event2	Event 2	bool	3ddb	15835	Not applicable
Segment.17.Event3	Event 3	bool	3ddc	15836	Not applicable
Segment.17.Event4	Event 4	bool	3ddd	15837	Not applicable
Segment.17.Event5	Event 5	bool	3dde	15838	Not applicable
Segment.17.Event6	Event 6	bool	3ddf	15839	Not applicable
Segment.17.Event7	Event 7	bool	3de0	15840	Not applicable
Segment.17.Event8	Event 8	bool	3de1	15841	Not applicable
Segment.17.GoBackTo	Go back to	uint8	3dd2	15826	Not applicable
Segment.17.SegmentName	Segment name	string_t	6c20	27680	Not applicable
Segment.17.Type	Type	uint8	3dc0	15808	Not applicable
Segment.17.WaitFor	Wait for	uint8	3dcd	15821	Not applicable
Segment.18.Ch1Holdback	Channel 1 holdback type	uint8	3df9	15865	Not applicable
Segment.18.Ch1HoldbackVal	Channel 1 holdback value	float32	3dfb	15867	Same as Programmer.SetUp.Ch1PVInput
Segment.18.Ch1PVEvent	Channel 1 PV event	uint8	3e04	15876	Not applicable
Segment.18.Ch1PVEventUse	Channel 1 PV event use	bool	3e12	15890	Not applicable
Segment.18.Ch1PVEventVal	Channel 1 PV event value	float32	3e06	15878	Same as Programmer.SetUp.Ch1PVInput
Segment.18.Ch1Rate	Channel 1 rate	float32	3df6	15862	Set by Programmer.SetUp.RateResolution
Segment.18.Ch1Time	Channel 1 time	time_t	3df4	15860	Set by Network.Modbus.TimeFormat
Segment.18.Ch1TSP	Channel 1 target set-point	float32	3df2	15858	Same as Programmer.SetUp.Ch1PVInput
Segment.18.Ch1UserVal	Channel 1 user value	float32	3e08	15880	Same as Programmer.SetUp.ResetCh1UserVal
Segment.18.Ch1Wait	Channel 1 Wait	uint8	3dfe	15870	Not applicable
Segment.18.Ch1WaitVal	Channel 1 wait value	float32	3e00	15872	Same as Programmer.SetUp.PVWait1
Segment.18.Ch2Holdback	Channel 2 holdback type	uint8	3dfa	15866	Not applicable
Segment.18.Ch2HoldbackVal	Channel 2 holdback value	float32	3dfc	15868	Same as Programmer.SetUp.Ch2PVInput
Segment.18.Ch2PVEvent	Channel 2 PV event	uint8	3e05	15877	Not applicable
Segment.18.Ch2PVEventUse	Channel 2 PV event use	bool	3e13	15891	Not applicable
Segment.18.Ch2PVEventVal	Channel 2 PV event value	float32	3e07	15879	Same as Programmer.SetUp.Ch2PVInput
Segment.18.Ch2Rate	Channel 2 rate	float32	3df7	15863	Set by Programmer.SetUp.RateResolution
Segment.18.Ch2Time	Channel 2 time	time_t	3df5	15861	Set by Network.Modbus.TimeFormat
Segment.18.Ch2TSP	Channel 2 target set-point	float32	3df3	15859	Same as Programmer.SetUp.Ch2PVInput
Segment.18.Ch2UserVal	Channel 2 user value	float32	3e09	15881	Same as Programmer.SetUp.ResetCh2UserVal
Segment.18.Ch2Wait	Channel 2 Wait	uint8	3dff	15871	Not applicable
Segment.18.Ch2WaitVal	Channel 2 wait value	float32	3e01	15873	Same as Programmer.SetUp.PVWait2
Segment.18.Cycles	Cycles	int16	3e03	15875	Not applicable
Segment.18.Duration	Duration	time_t	3df1	15857	Set by Network.Modbus.TimeFormat
Segment.18.EndType	End type	uint8	3df8	15864	Not applicable
Segment.18.Event1	Event 1	bool	3e0a	15882	Not applicable
Segment.18.Event2	Event 2	bool	3e0b	15883	Not applicable
Segment.18.Event3	Event 3	bool	3e0c	15884	Not applicable
Segment.18.Event4	Event 4	bool	3e0d	15885	Not applicable
Segment.18.Event5	Event 5	bool	3e0e	15886	Not applicable
Segment.18.Event6	Event 6	bool	3e0f	15887	Not applicable
Segment.18.Event7	Event 7	bool	3e10	15888	Not applicable
Segment.18.Event8	Event 8	bool	3e11	15889	Not applicable
Segment.18.GoBackTo	Go back to	uint8	3e02	15874	Not applicable
Segment.18.SegmentName	Segment name	string_t	6c35	27701	Not applicable
Segment.18.Type	Type	uint8	3df0	15856	Not applicable
Segment.18.WaitFor	Wait for	uint8	3dfd	15869	Not applicable
Segment.19.Ch1Holdback	Channel 1 holdback type	uint8	3e29	15913	Not applicable
Segment.19.Ch1HoldbackVal	Channel 1 holdback value	float32	3e2b	15915	Same as Programmer.SetUp.Ch1PVInput
Segment.19.Ch1PVEvent	Channel 1 PV event	uint8	3e34	15924	Not applicable
Segment.19.Ch1PVEventUse	Channel 1 PV event use	bool	3e42	15938	Not applicable
Segment.19.Ch1PVEventVal	Channel 1 PV event value	float32	3e36	15926	Same as Programmer.SetUp.Ch1PVInput
Segment.19.Ch1Rate	Channel 1 rate	float32	3e26	15910	Set by Programmer.SetUp.RateResolution
Segment.19.Ch1Time	Channel 1 time	time_t	3e24	15908	Set by Network.Modbus.TimeFormat
Segment.19.Ch1TSP	Channel 1 target set-point	float32	3e22	15906	Same as Programmer.SetUp.Ch1PVInput
Segment.19.Ch1UserVal	Channel 1 user value	float32	3e38	15928	Same as Programmer.SetUp.ResetCh1UserVal
Segment.19.Ch1Wait	Channel 1 Wait	uint8	3e2e	15918	Not applicable
Segment.19.Ch1WaitVal	Channel 1 wait value	float32	3e30	15920	Same as Programmer.SetUp.PVWait1
Segment.19.Ch2Holdback	Channel 2 holdback type	uint8	3e2a	15914	Not applicable
Segment.19.Ch2HoldbackVal	Channel 2 holdback value	float32	3e2c	15916	Same as Programmer.SetUp.Ch2PVInput
Segment.19.Ch2PVEvent	Channel 2 PV event	uint8	3e35	15925	Not applicable
Segment.19.Ch2PVEventUse	Channel 2 PV event use	bool	3e43	15939	Not applicable
Segment.19.Ch2PVEventVal	Channel 2 PV event value	float32	3e37	15927	Same as Programmer.SetUp.Ch2PVInput
Segment.19.Ch2Rate	Channel 2 rate	float32	3e27	15911	Set by Programmer.SetUp.RateResolution
Segment.19.Ch2Time	Channel 2 time	time_t	3e25	15909	Set by Network.Modbus.TimeFormat
Segment.19.Ch2TSP	Channel 2 target set-point	float32	3e23	15907	Same as Programmer.SetUp.Ch2PVInput
Segment.19.Ch2UserVal	Channel 2 user value	float32	3e39	15929	Same as Programmer.SetUp.ResetCh2UserVal
Segment.19.Ch2Wait	Channel 2 Wait	uint8	3e2f	15919	Not applicable
Segment.19.Ch2WaitVal	Channel 2 wait value	float32	3e31	15921	Same as Programmer.SetUp.PVWait2
Segment.19.Cycles	Cycles	int16	3e33	15923	Not applicable
Segment.19.Duration	Duration	time_t	3e21	15905	Set by Network.Modbus.TimeFormat
Segment.19.EndType	End type	uint8	3e28	15912	Not applicable
Segment.19.Event1	Event 1	bool	3e3a	15930	Not applicable
Segment.19.Event2	Event 2	bool	3e3b	15931	Not applicable
Segment.19.Event3	Event 3	bool	3e3c	15932	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.19.Event4	Event 4	bool	3e3d	15933	Not applicable
Segment.19.Event5	Event 5	bool	3e3e	15934	Not applicable
Segment.19.Event6	Event 6	bool	3e3f	15935	Not applicable
Segment.19.Event7	Event 7	bool	3e40	15936	Not applicable
Segment.19.Event8	Event 8	bool	3e41	15937	Not applicable
Segment.19.GoBackTo	Go back to	uint8	3e32	15922	Not applicable
Segment.19.SegmentName	Segment name	string_t	6c4a	27722	Not applicable
Segment.19.Type	Type	uint8	3e20	15904	Not applicable
Segment.19.WaitFor	Wait for	uint8	3e2d	15917	Not applicable
Segment.20.Ch1Holdback	Channel 1 holdback type	uint8	3e59	15961	Not applicable
Segment.20.Ch1HoldbackVal	Channel 1 holdback value	float32	3e5b	15963	Same as Programmer.SetUp.Ch1PVInput
Segment.20.Ch1PVEvent	Channel 1 PV event	uint8	3e64	15972	Not applicable
Segment.20.Ch1PVEventUse	Channel 1 PV event use	bool	3e72	15986	Not applicable
Segment.20.Ch1PVEventVal	Channel 1 PV event value	float32	3e66	15974	Same as Programmer.SetUp.Ch1PVInput
Segment.20.Ch1Rate	Channel 1 rate	float32	3e56	15958	Set by Programmer.SetUp.RateResolution
Segment.20.Ch1Time	Channel 1 time	time_t	3e54	15956	Set by Network.Modbus.TimeFormat
Segment.20.Ch1TSP	Channel 1 target set-point	float32	3e52	15954	Same as Programmer.SetUp.Ch1PVInput
Segment.20.Ch1UserVal	Channel 1 user value	float32	3e68	15976	Same as Programmer.SetUp.ResetCh1UserVal
Segment.20.Ch1Wait	Channel 1 Wait	uint8	3e5e	15966	Not applicable
Segment.20.Ch1WaitVal	Channel 1 wait value	float32	3e60	15968	Same as Programmer.SetUp.PVWait1
Segment.20.Ch2Holdback	Channel 2 holdback type	uint8	3e5a	15962	Not applicable
Segment.20.Ch2HoldbackVal	Channel 2 holdback value	float32	3e5c	15964	Same as Programmer.SetUp.Ch2PVInput
Segment.20.Ch2PVEvent	Channel 2 PV event	uint8	3e65	15973	Not applicable
Segment.20.Ch2PVEventUse	Channel 2 PV event use	bool	3e73	15987	Not applicable
Segment.20.Ch2PVEventVal	Channel 2 PV event value	float32	3e67	15975	Same as Programmer.SetUp.Ch2PVInput
Segment.20.Ch2Rate	Channel 2 rate	float32	3e57	15959	Set by Programmer.SetUp.RateResolution
Segment.20.Ch2Time	Channel 2 time	time_t	3e55	15957	Set by Network.Modbus.TimeFormat
Segment.20.Ch2TSP	Channel 2 target set-point	float32	3e53	15955	Same as Programmer.SetUp.Ch2PVInput
Segment.20.Ch2UserVal	Channel 2 user value	float32	3e69	15977	Same as Programmer.SetUp.ResetCh2UserVal
Segment.20.Ch2Wait	Channel 2 Wait	uint8	3e5f	15967	Not applicable
Segment.20.Ch2WaitVal	Channel 2 wait value	float32	3e61	15969	Same as Programmer.SetUp.PVWait2
Segment.20.Cycles	Cycles	int16	3e63	15971	Not applicable
Segment.20.Duration	Duration	time_t	3e51	15953	Set by Network.Modbus.TimeFormat
Segment.20.EndType	End type	uint8	3e58	15960	Not applicable
Segment.20.Event1	Event 1	bool	3e6a	15978	Not applicable
Segment.20.Event2	Event 2	bool	3e6b	15979	Not applicable
Segment.20.Event3	Event 3	bool	3e6c	15980	Not applicable
Segment.20.Event4	Event 4	bool	3e6d	15981	Not applicable
Segment.20.Event5	Event 5	bool	3e6e	15982	Not applicable
Segment.20.Event6	Event 6	bool	3e6f	15983	Not applicable
Segment.20.Event7	Event 7	bool	3e70	15984	Not applicable
Segment.20.Event8	Event 8	bool	3e71	15985	Not applicable
Segment.20.GoBackTo	Go back to	uint8	3e62	15970	Not applicable
Segment.20.SegmentName	Segment name	string_t	6c5f	27743	Not applicable
Segment.20.Type	Type	uint8	3e50	15952	Not applicable
Segment.20.WaitFor	Wait for	uint8	3e5d	15965	Not applicable
Segment.21.Ch1Holdback	Channel 1 holdback type	uint8	3e89	16009	Not applicable
Segment.21.Ch1HoldbackVal	Channel 1 holdback value	float32	3e8b	16011	Same as Programmer.SetUp.Ch1PVInput
Segment.21.Ch1PVEvent	Channel 1 PV event	uint8	3e94	16020	Not applicable
Segment.21.Ch1PVEventUse	Channel 1 PV event use	bool	3ea2	16034	Not applicable
Segment.21.Ch1PVEventVal	Channel 1 PV event value	float32	3e96	16022	Same as Programmer.SetUp.Ch1PVInput
Segment.21.Ch1Rate	Channel 1 rate	float32	3e86	16006	Set by Programmer.SetUp.RateResolution
Segment.21.Ch1Time	Channel 1 time	time_t	3e84	16004	Set by Network.Modbus.TimeFormat
Segment.21.Ch1TSP	Channel 1 target set-point	float32	3e82	16002	Same as Programmer.SetUp.Ch1PVInput
Segment.21.Ch1UserVal	Channel 1 user value	float32	3e98	16024	Same as Programmer.SetUp.ResetCh1UserVal
Segment.21.Ch1Wait	Channel 1 Wait	uint8	3e8e	16014	Not applicable
Segment.21.Ch1WaitVal	Channel 1 wait value	float32	3e90	16016	Same as Programmer.SetUp.PVWait1
Segment.21.Ch2Holdback	Channel 2 holdback type	uint8	3e8a	16010	Not applicable
Segment.21.Ch2HoldbackVal	Channel 2 holdback value	float32	3e8c	16012	Same as Programmer.SetUp.Ch2PVInput
Segment.21.Ch2PVEvent	Channel 2 PV event	uint8	3e95	16021	Not applicable
Segment.21.Ch2PVEventUse	Channel 2 PV event use	bool	3ea3	16035	Not applicable
Segment.21.Ch2PVEventVal	Channel 2 PV event value	float32	3e97	16023	Same as Programmer.SetUp.Ch2PVInput
Segment.21.Ch2Rate	Channel 2 rate	float32	3e87	16007	Set by Programmer.SetUp.RateResolution
Segment.21.Ch2Time	Channel 2 time	time_t	3e85	16005	Set by Network.Modbus.TimeFormat
Segment.21.Ch2TSP	Channel 2 target set-point	float32	3e83	16003	Same as Programmer.SetUp.Ch2PVInput
Segment.21.Ch2UserVal	Channel 2 user value	float32	3e99	16025	Same as Programmer.SetUp.ResetCh2UserVal
Segment.21.Ch2Wait	Channel 2 Wait	uint8	3e8f	16015	Not applicable
Segment.21.Ch2WaitVal	Channel 2 wait value	float32	3e91	16017	Same as Programmer.SetUp.PVWait2
Segment.21.Cycles	Cycles	int16	3e93	16019	Not applicable
Segment.21.Duration	Duration	time_t	3e81	16001	Set by Network.Modbus.TimeFormat
Segment.21.EndType	End type	uint8	3e88	16008	Not applicable
Segment.21.Event1	Event 1	bool	3e9a	16026	Not applicable
Segment.21.Event2	Event 2	bool	3e9b	16027	Not applicable
Segment.21.Event3	Event 3	bool	3e9c	16028	Not applicable
Segment.21.Event4	Event 4	bool	3e9d	16029	Not applicable
Segment.21.Event5	Event 5	bool	3e9e	16030	Not applicable
Segment.21.Event6	Event 6	bool	3e9f	16031	Not applicable
Segment.21.Event7	Event 7	bool	3ea0	16032	Not applicable
Segment.21.Event8	Event 8	bool	3ea1	16033	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.21.GoBackTo	Go back to	uint8	3e92	16018	Not applicable
Segment.21.SegmentName	Segment name	string_t	6c74	27764	Not applicable
Segment.21.Type	Type	uint8	3e80	16000	Not applicable
Segment.21.WaitFor	Wait for	uint8	3e8d	16013	Not applicable
Segment.22.Ch1Holdback	Channel 1 holdback type	uint8	3eb9	16057	Not applicable
Segment.22.Ch1HoldbackVal	Channel 1 holdback value	float32	3ebb	16059	Same as Programmer.SetUp.Ch1PVInput
Segment.22.Ch1PVEvent	Channel 1 PV event	uint8	3ec4	16068	Not applicable
Segment.22.Ch1PVEventUse	Channel 1 PV event use	bool	3ed2	16082	Not applicable
Segment.22.Ch1PVEventVal	Channel 1 PV event value	float32	3ec6	16070	Same as Programmer.SetUp.Ch1PVInput
Segment.22.Ch1Rate	Channel 1 rate	float32	3eb6	16054	Set by Programmer.SetUp.RateResolution
Segment.22.Ch1Time	Channel 1 time	time_t	3eb4	16052	Set by Network.Modbus.TimeFormat
Segment.22.Ch1TSP	Channel 1 target set-point	float32	3eb2	16050	Same as Programmer.SetUp.Ch1PVInput
Segment.22.Ch1UserVal	Channel 1 user value	float32	3ec8	16072	Same as Programmer.SetUp.ResetCh1UserVal
Segment.22.Ch1Wait	Channel 1 Wait	uint8	3ebe	16062	Not applicable
Segment.22.Ch1WaitVal	Channel 1 wait value	float32	3ec0	16064	Same as Programmer.SetUp.PVWait1
Segment.22.Ch2Holdback	Channel 2 holdback type	uint8	3eba	16058	Not applicable
Segment.22.Ch2HoldbackVal	Channel 2 holdback value	float32	3ebc	16060	Same as Programmer.SetUp.Ch2PVInput
Segment.22.Ch2PVEvent	Channel 2 PV event	uint8	3ec5	16069	Not applicable
Segment.22.Ch2PVEventUse	Channel 2 PV event use	bool	3ed3	16083	Not applicable
Segment.22.Ch2PVEventVal	Channel 2 PV event value	float32	3ec7	16071	Same as Programmer.SetUp.Ch2PVInput
Segment.22.Ch2Rate	Channel 2 rate	float32	3eb7	16055	Set by Programmer.SetUp.RateResolution
Segment.22.Ch2Time	Channel 2 time	time_t	3eb5	16053	Set by Network.Modbus.TimeFormat
Segment.22.Ch2TSP	Channel 2 target set-point	float32	3eb3	16051	Same as Programmer.SetUp.Ch2PVInput
Segment.22.Ch2UserVal	Channel 2 user value	float32	3ec9	16073	Same as Programmer.SetUp.ResetCh2UserVal
Segment.22.Ch2Wait	Channel 2 Wait	uint8	3ebf	16063	Not applicable
Segment.22.Ch2WaitVal	Channel 2 wait value	float32	3ec1	16065	Same as Programmer.SetUp.PVWait2
Segment.22.Cycles	Cycles	int16	3ec3	16067	Not applicable
Segment.22.Duration	Duration	time_t	3eb1	16049	Set by Network.Modbus.TimeFormat
Segment.22.EndType	End type	uint8	3eb8	16056	Not applicable
Segment.22.Event1	Event 1	bool	3eca	16074	Not applicable
Segment.22.Event2	Event 2	bool	3ecb	16075	Not applicable
Segment.22.Event3	Event 3	bool	3ecc	16076	Not applicable
Segment.22.Event4	Event 4	bool	3ecd	16077	Not applicable
Segment.22.Event5	Event 5	bool	3ece	16078	Not applicable
Segment.22.Event6	Event 6	bool	3ecf	16079	Not applicable
Segment.22.Event7	Event 7	bool	3ed0	16080	Not applicable
Segment.22.Event8	Event 8	bool	3ed1	16081	Not applicable
Segment.22.GoBackTo	Go back to	uint8	3ec2	16066	Not applicable
Segment.22.SegmentName	Segment name	string_t	6c89	27785	Not applicable
Segment.22.Type	Type	uint8	3eb0	16048	Not applicable
Segment.22.WaitFor	Wait for	uint8	3ebd	16061	Not applicable
Segment.23.Ch1Holdback	Channel 1 holdback type	uint8	3ee9	16105	Not applicable
Segment.23.Ch1HoldbackVal	Channel 1 holdback value	float32	3eeb	16107	Same as Programmer.SetUp.Ch1PVInput
Segment.23.Ch1PVEvent	Channel 1 PV event	uint8	3ef4	16116	Not applicable
Segment.23.Ch1PVEventUse	Channel 1 PV event use	bool	3f02	16130	Not applicable
Segment.23.Ch1PVEventVal	Channel 1 PV event value	float32	3ef6	16118	Same as Programmer.SetUp.Ch1PVInput
Segment.23.Ch1Rate	Channel 1 rate	float32	3ee6	16102	Set by Programmer.SetUp.RateResolution
Segment.23.Ch1Time	Channel 1 time	time_t	3ee4	16100	Set by Network.Modbus.TimeFormat
Segment.23.Ch1TSP	Channel 1 target set-point	float32	3ee2	16098	Same as Programmer.SetUp.Ch1PVInput
Segment.23.Ch1UserVal	Channel 1 user value	float32	3ef8	16120	Same as Programmer.SetUp.ResetCh1UserVal
Segment.23.Ch1Wait	Channel 1 Wait	uint8	3eee	16110	Not applicable
Segment.23.Ch1WaitVal	Channel 1 wait value	float32	3ef0	16112	Same as Programmer.SetUp.PVWait1
Segment.23.Ch2Holdback	Channel 2 holdback type	uint8	3eea	16106	Not applicable
Segment.23.Ch2HoldbackVal	Channel 2 holdback value	float32	3eec	16108	Same as Programmer.SetUp.Ch2PVInput
Segment.23.Ch2PVEvent	Channel 2 PV event	uint8	3ef5	16117	Not applicable
Segment.23.Ch2PVEventUse	Channel 2 PV event use	bool	3f03	16131	Not applicable
Segment.23.Ch2PVEventVal	Channel 2 PV event value	float32	3ef7	16119	Same as Programmer.SetUp.Ch2PVInput
Segment.23.Ch2Rate	Channel 2 rate	float32	3ee7	16103	Set by Programmer.SetUp.RateResolution
Segment.23.Ch2Time	Channel 2 time	time_t	3ee5	16101	Set by Network.Modbus.TimeFormat
Segment.23.Ch2TSP	Channel 2 target set-point	float32	3ee3	16099	Same as Programmer.SetUp.Ch2PVInput
Segment.23.Ch2UserVal	Channel 2 user value	float32	3ef9	16121	Same as Programmer.SetUp.ResetCh2UserVal
Segment.23.Ch2Wait	Channel 2 Wait	uint8	3eef	16111	Not applicable
Segment.23.Ch2WaitVal	Channel 2 wait value	float32	3ef1	16113	Same as Programmer.SetUp.PVWait2
Segment.23.Cycles	Cycles	int16	3ef3	16115	Not applicable
Segment.23.Duration	Duration	time_t	3ee1	16097	Set by Network.Modbus.TimeFormat
Segment.23.EndType	End type	uint8	3ee8	16104	Not applicable
Segment.23.Event1	Event 1	bool	3efa	16122	Not applicable
Segment.23.Event2	Event 2	bool	3efb	16123	Not applicable
Segment.23.Event3	Event 3	bool	3efc	16124	Not applicable
Segment.23.Event4	Event 4	bool	3efd	16125	Not applicable
Segment.23.Event5	Event 5	bool	3efe	16126	Not applicable
Segment.23.Event6	Event 6	bool	3eff	16127	Not applicable
Segment.23.Event7	Event 7	bool	3f00	16128	Not applicable
Segment.23.Event8	Event 8	bool	3f01	16129	Not applicable
Segment.23.GoBackTo	Go back to	uint8	3ef2	16114	Not applicable
Segment.23.SegmentName	Segment name	string_t	6c9e	27806	Not applicable
Segment.23.Type	Type	uint8	3ee0	16096	Not applicable
Segment.23.WaitFor	Wait for	uint8	3eed	16109	Not applicable

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.24.Ch1Holdback	Channel 1 holdback type	uint8	3f19	16153	Not applicable
Segment.24.Ch1HoldbackVal	Channel 1 holdback value	float32	3f1b	16155	Same as Programmer.SetUp.Ch1PVInput
Segment.24.Ch1PVEvent	Channel 1 PV event	uint8	3f24	16164	Not applicable
Segment.24.Ch1PVEventUse	Channel 1 PV event use	bool	3f32	16178	Not applicable
Segment.24.Ch1PVEventVal	Channel 1 PV event value	float32	3f26	16166	Same as Programmer.SetUp.Ch1PVInput
Segment.24.Ch1Rate	Channel 1 rate	float32	3f16	16150	Set by Programmer.SetUp.RateResolution
Segment.24.Ch1Time	Channel 1 time	time_t	3f14	16148	Set by Network.Modbus.TimeFormat
Segment.24.Ch1TSP	Channel 1 target set-point	float32	3f12	16146	Same as Programmer.SetUp.Ch1PVInput
Segment.24.Ch1UserVal	Channel 1 user value	float32	3f28	16168	Same as Programmer.SetUp.ResetCh1UserVal
Segment.24.Ch1Wait	Channel 1 Wait	uint8	3f1e	16158	Not applicable
Segment.24.Ch1WaitVal	Channel 1 wait value	float32	3f20	16160	Same as Programmer.SetUp.PVWait1
Segment.24.Ch2Holdback	Channel 2 holdback type	uint8	3f1a	16154	Not applicable
Segment.24.Ch2HoldbackVal	Channel 2 holdback value	float32	3f1c	16156	Same as Programmer.SetUp.Ch2PVInput
Segment.24.Ch2PVEvent	Channel 2 PV event	uint8	3f25	16165	Not applicable
Segment.24.Ch2PVEventUse	Channel 2 PV event use	bool	3f33	16179	Not applicable
Segment.24.Ch2PVEventVal	Channel 2 PV event value	float32	3f27	16167	Same as Programmer.SetUp.Ch2PVInput
Segment.24.Ch2Rate	Channel 2 rate	float32	3f17	16151	Set by Programmer.SetUp.RateResolution
Segment.24.Ch2Time	Channel 2 time	time_t	3f15	16149	Set by Network.Modbus.TimeFormat
Segment.24.Ch2TSP	Channel 2 target set-point	float32	3f13	16147	Same as Programmer.SetUp.Ch2PVInput
Segment.24.Ch2UserVal	Channel 2 user value	float32	3f29	16169	Same as Programmer.SetUp.ResetCh2UserVal
Segment.24.Ch2Wait	Channel 2 Wait	uint8	3f1f	16159	Not applicable
Segment.24.Ch2WaitVal	Channel 2 wait value	float32	3f21	16161	Same as Programmer.SetUp.PVWait2
Segment.24.Cycles	Cycles	int16	3f23	16163	Not applicable
Segment.24.Duration	Duration	time_t	3f11	16145	Set by Network.Modbus.TimeFormat
Segment.24.EndType	End type	uint8	3f18	16152	Not applicable
Segment.24.Event1	Event 1	bool	3f2a	16170	Not applicable
Segment.24.Event2	Event 2	bool	3f2b	16171	Not applicable
Segment.24.Event3	Event 3	bool	3f2c	16172	Not applicable
Segment.24.Event4	Event 4	bool	3f2d	16173	Not applicable
Segment.24.Event5	Event 5	bool	3f2e	16174	Not applicable
Segment.24.Event6	Event 6	bool	3f2f	16175	Not applicable
Segment.24.Event7	Event 7	bool	3f30	16176	Not applicable
Segment.24.Event8	Event 8	bool	3f31	16177	Not applicable
Segment.24.GoBackTo	Go back to	uint8	3f22	16162	Not applicable
Segment.24.SegmentName	Segment name	string_t	6cb3	27827	Not applicable
Segment.24.Type	Type	uint8	3f10	16144	Not applicable
Segment.24.WaitFor	Wait for	uint8	3f1d	16157	Not applicable
Segment.25.Ch1Holdback	Channel 1 holdback type	uint8	3f49	16201	Not applicable
Segment.25.Ch1HoldbackVal	Channel 1 holdback value	float32	3f4b	16203	Same as Programmer.SetUp.Ch1PVInput
Segment.25.Ch1PVEvent	Channel 1 PV event	uint8	3f54	16212	Not applicable
Segment.25.Ch1PVEventUse	Channel 1 PV event use	bool	3f62	16226	Not applicable
Segment.25.Ch1PVEventVal	Channel 1 PV event value	float32	3f56	16214	Same as Programmer.SetUp.Ch1PVInput
Segment.25.Ch1Rate	Channel 1 rate	float32	3f46	16198	Set by Programmer.SetUp.RateResolution
Segment.25.Ch1Time	Channel 1 time	time_t	3f44	16196	Set by Network.Modbus.TimeFormat
Segment.25.Ch1TSP	Channel 1 target set-point	float32	3f42	16194	Same as Programmer.SetUp.Ch1PVInput
Segment.25.Ch1UserVal	Channel 1 user value	float32	3f58	16216	Same as Programmer.SetUp.ResetCh1UserVal
Segment.25.Ch1Wait	Channel 1 Wait	uint8	3f4e	16206	Not applicable
Segment.25.Ch1WaitVal	Channel 1 wait value	float32	3f50	16208	Same as Programmer.SetUp.PVWait1
Segment.25.Ch2Holdback	Channel 2 holdback type	uint8	3f4a	16202	Not applicable
Segment.25.Ch2HoldbackVal	Channel 2 holdback value	float32	3f4c	16204	Same as Programmer.SetUp.Ch2PVInput
Segment.25.Ch2PVEvent	Channel 2 PV event	uint8	3f55	16213	Not applicable
Segment.25.Ch2PVEventUse	Channel 2 PV event use	bool	3f63	16227	Not applicable
Segment.25.Ch2PVEventVal	Channel 2 PV event value	float32	3f57	16215	Same as Programmer.SetUp.Ch2PVInput
Segment.25.Ch2Rate	Channel 2 rate	float32	3f47	16199	Set by Programmer.SetUp.RateResolution
Segment.25.Ch2Time	Channel 2 time	time_t	3f45	16197	Set by Network.Modbus.TimeFormat
Segment.25.Ch2TSP	Channel 2 target set-point	float32	3f43	16195	Same as Programmer.SetUp.Ch2PVInput
Segment.25.Ch2UserVal	Channel 2 user value	float32	3f59	16217	Same as Programmer.SetUp.ResetCh2UserVal
Segment.25.Ch2Wait	Channel 2 Wait	uint8	3f4f	16207	Not applicable
Segment.25.Ch2WaitVal	Channel 2 wait value	float32	3f51	16209	Same as Programmer.SetUp.PVWait2
Segment.25.Cycles	Cycles	int16	3f53	16211	Not applicable
Segment.25.Duration	Duration	time_t	3f41	16193	Set by Network.Modbus.TimeFormat
Segment.25.EndType	End type	uint8	3f48	16200	Not applicable
Segment.25.Event1	Event 1	bool	3f5a	16218	Not applicable
Segment.25.Event2	Event 2	bool	3f5b	16219	Not applicable
Segment.25.Event3	Event 3	bool	3f5c	16220	Not applicable
Segment.25.Event4	Event 4	bool	3f5d	16221	Not applicable
Segment.25.Event5	Event 5	bool	3f5e	16222	Not applicable
Segment.25.Event6	Event 6	bool	3f5f	16223	Not applicable
Segment.25.Event7	Event 7	bool	3f60	16224	Not applicable
Segment.25.Event8	Event 8	bool	3f61	16225	Not applicable
Segment.25.GoBackTo	Go back to	uint8	3f52	16210	Not applicable
Segment.25.SegmentName	Segment name	string_t	6cc8	27848	Not applicable
Segment.25.Type	Type	uint8	3f40	16192	Not applicable
Segment.25.WaitFor	Wait for	uint8	3f4d	16205	Not applicable
Segment.26.Ch1Holdback	Channel 1 holdback type	uint8	3f79	16249	Not applicable
Segment.26.Ch1HoldbackVal	Channel 1 holdback value	float32	3f7b	16251	Same as Programmer.SetUp.Ch1PVInput
Segment.26.Ch1PVEvent	Channel 1 PV event	uint8	3f84	16260	Not applicable
Segment.26.Ch1PVEventUse	Channel 1 PV event use	bool	3f92	16274	Not applicable
Segment.26.Ch1PVEventVal	Channel 1 PV event value	float32	3f86	16262	Same as Programmer.SetUp.Ch1PVInput
Segment.26.Ch1Rate	Channel 1 rate	float32	3f76	16246	Set by Programmer.SetUp.RateResolution

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Segment.26.Ch1Time	Channel 1 time	time_t	3f74	16244	Set by Network.Modbus.TimeFormat
Segment.26.Ch1TSP	Channel 1 target set-point	float32	3f72	16242	Same as Programmer.SetUp.Ch1PVInput
Segment.26.Ch1UserVal	Channel 1 user value	float32	3f88	16264	Same as Programmer.SetUp.ResetCh1UserVal
Segment.26.Ch1Wait	Channel 1 Wait	uint8	3f7e	16254	Not applicable
Segment.26.Ch1WaitVal	Channel 1 wait value	float32	3f80	16256	Same as Programmer.SetUp.PVWait1
Segment.26.Ch2Holdback	Channel 2 holdback type	uint8	3f7a	16250	Not applicable
Segment.26.Ch2HoldbackVal	Channel 2 holdback value	float32	3f7c	16252	Same as Programmer.SetUp.Ch2PVInput
Segment.26.Ch2PVEvent	Channel 2 PV event	uint8	3f85	16261	Not applicable
Segment.26.Ch2PVEventUse	Channel 2 PV event use	bool	3f93	16275	Not applicable
Segment.26.Ch2PVEventVal	Channel 2 PV event value	float32	3f87	16263	Same as Programmer.SetUp.Ch2PVInput
Segment.26.Ch2Rate	Channel 2 rate	float32	3f77	16247	Set by Programmer.SetUp.RateResolution
Segment.26.Ch2Time	Channel 2 time	time_t	3f75	16245	Set by Network.Modbus.TimeFormat
Segment.26.Ch2TSP	Channel 2 target set-point	float32	3f73	16243	Same as Programmer.SetUp.Ch2PVInput
Segment.26.Ch2UserVal	Channel 2 user value	float32	3f89	16265	Same as Programmer.SetUp.ResetCh2UserVal
Segment.26.Ch2Wait	Channel 2 Wait	uint8	3f7f	16255	Not applicable
Segment.26.Ch2WaitVal	Channel 2 wait value	float32	3f81	16257	Same as Programmer.SetUp.PVWait2
Segment.26.Cycles	Cycles	int16	3f83	16259	Not applicable
Segment.26.Duration	Duration	time_t	3f71	16241	Set by Network.Modbus.TimeFormat
Segment.26.EndType	End type	uint8	3f78	16248	Not applicable
Segment.26.Event1	Event 1	bool	3f8a	16266	Not applicable
Segment.26.Event2	Event 2	bool	3f8b	16267	Not applicable
Segment.26.Event3	Event 3	bool	3f8c	16268	Not applicable
Segment.26.Event4	Event 4	bool	3f8d	16269	Not applicable
Segment.26.Event5	Event 5	bool	3f8e	16270	Not applicable
Segment.26.Event6	Event 6	bool	3f8f	16271	Not applicable
Segment.26.Event7	Event 7	bool	3f90	16272	Not applicable
Segment.26.Event8	Event 8	bool	3f91	16273	Not applicable
Segment.26.GoBackTo	Go back to	uint8	3f82	16258	Not applicable
Segment.26.SegmentName	Segment name	string_t	6cdd	27869	Not applicable
Segment.26.Type	Type	uint8	3f70	16240	Not applicable
Segment.26.WaitFor	Wait for	uint8	3f7d	16253	Not applicable
Steriliser.AutoCounter	Automatically increments the cycle number	bool	2e0f	11791	Not applicable
Steriliser.CycleNumber	Current cycle number	int32	2e04	11780	Not applicable
Steriliser.CycleStatus	The current cycle status. 0 = Waiting start 1 = Waiting 2 = Equilibrisation 3 = Sterilising 4 = Passed 5 = Failed 6 = Aborted 7 = Test cycle	uint8	2e08	11784	Not applicable
Steriliser.CycleTime	The total cycle time	time_t	2e25	11813	Set by Network.Modbus.TimeFormat
Steriliser.EquilibrationTime	The equilibration time period for the current cycle.	time_t	2e0c	11788	Set by Network.Modbus.TimeFormat
Steriliser.FailureDwell1	Failure alarm dwell time for input 1	time_t	2e22	11810	Set by Network.Modbus.TimeFormat
Steriliser.FailureDwell2	Failure alarm dwell time for input 2	time_t	2e2b	11819	Set by Network.Modbus.TimeFormat
Steriliser.FailureDwell3	Failure alarm dwell time for input 3	time_t	2e2c	11820	Set by Network.Modbus.TimeFormat
Steriliser.FailureDwell4	Failure alarm dwell time for input 4	time_t	2e2d	11821	Set by Network.Modbus.TimeFormat
Steriliser.FileByTag	Name historical files by cycle number and tag 0 = File by Tag Off; 1 = File by Tag On	bool	2e21	11809	Not applicable
Steriliser.FileTag	Used as part of the historical filename	string_t	68f7	26871	Not applicable
Steriliser.Fvalue	F0 (A0)	time_t	2e26	11814	Set by Network.Modbus.TimeFormat
Steriliser.Input1PV	Input 1	float32	2e00	11776	0dp
Steriliser.Input2PV	Input 2	float32	2e01	11777	0dp
Steriliser.Input3PV	Input 3	float32	2e02	11778	0dp
Steriliser.Input4PV	Input 4	float32	2e03	11779	0dp
Steriliser.InputType1	Input type 1 0 = Off 1 = thermocouple 2 = Rising pressure 3 = Falling pressure 4 = Rise air detect 5 = Fall air detect	uint8	2e1d	11805	Not applicable
Steriliser.InputType2	Input type 2 (as Input type 1, above)	uint8	2e1e	11806	Not applicable
Steriliser.InputType3	Input type 3 (as Input type 1, above)	uint8	2e1f	11807	Not applicable
Steriliser.InputType4	Input type 4 (as Input type 1, above)	uint8	2e20	11808	Not applicable
Steriliser.IP1BandHigh	Sterilisation temperature input 1 band high.	float32	2e0a	11786	Same as Steriliser.Input1PV
Steriliser.IP1BandLow	Sterilisation temperature input 1 band low.	float32	2e0b	11787	Same as Steriliser.Input1PV
Steriliser.IP1TargetSP	Input 1 target setpoint	float32	2e07	11783	Same as Steriliser.Input1PV
Steriliser.IP2BandHigh	Sterilisation temperature input 2 band high.	float32	2e10	11792	Same as Steriliser.Input2PV
Steriliser.IP2BandLow	Sterilisation temperature input 2 band low.	float32	2e11	11793	Same as Steriliser.Input2PV
Steriliser.IP2TargetSP	Input 2 target setpoint	float32	2e16	11798	Same as Steriliser.Input2PV
Steriliser.IP3BandHigh	Sterilisation temperature input 3 band high.	float32	2e12	11794	Same as Steriliser.Input3PV
Steriliser.IP3BandLow	Sterilisation temperature input 3 band low.	float32	2e13	11795	Same as Steriliser.Input3PV
Steriliser.IP3TargetSP	Input 3 target setpoint	float32	2e17	11799	Same as Steriliser.Input3PV
Steriliser.IP4BandHigh	Sterilisation temperature input 4 band high.	float32	2e14	11796	Same as Steriliser.Input4PV
Steriliser.IP4BandLow	Sterilisation temperature input 4 band low.	float32	2e15	11797	Same as Steriliser.Input3PV
Steriliser.IP4TargetSP	Input 4 target setpoint	float32	2e18	11800	Same as Steriliser.Input4PV
Steriliser.LowLimit	Low temperature limit for the F0 calculation.	float32	2e2a	11818	0dp
Steriliser.MeasuredTemp	Measured Temperature used in the F0 calculation.	float32	2e27	11815	0dp
Steriliser.PassedOutput	1 = cycle passed; 0 = cycle failed.	uint8	2e1c	11804	Not applicable
Steriliser.Remaining	The holding time remaining for the current cycle.	time_t	2e0e	11790	Set by Network.Modbus.TimeFormat

For parameter values and settings (enumerations), see Segment 1

Parameter path	Description	Type	Hex	Dec	Resolution
Steriliser.RunningOutput	1 = cycle running; 0 = cycle not running	uint8	2e1b	11803	Not applicable
Steriliser.Start121	Start a predefined 121°C cycle	bool	2e19	11801	Not applicable
Steriliser.Start134	Start a predefined 134°C cycle	bool	2e1a	11802	Not applicable
Steriliser.StartCycle	Start a custom cycle	bool	2e05	11781	Not applicable
Steriliser.SterilisingTime	The total time the load was at sterilisation conditions.	time_t	2e0d	11789	Set by Network.Modbus.TimeFormat
Steriliser.TargetTemperature	Target Temperature for the F0 calculation.	float32	2e29	11817	0dp
Steriliser.TargetTime	The target time of the sterilisation period.	time_t	2e09	11785	Set by Network.Modbus.TimeFormat
Steriliser.TargetTime121	The target time for a 121°C cycle	time_t	2e23	11811	Set by Network.Modbus.TimeFormat
Steriliser.TargetTime134	The target time for a 134°C cycle	time_t	2e24	11812	Set by Network.Modbus.TimeFormat
Steriliser.ZTemperatureInterval	The Z temperature interval for the F0 calculation.	float32	2e28	11816	0dp
Timer.1.ElapsedTime	Elapsed Time	time_t	2ee0	12000	Set by Network.Modbus.TimeFormat
Timer.1.In	Trigger/Gate input	bool	2ee5	12005	Not applicable
Timer.1.Out	Output (1 = On; 0 = Off)	bool	2ee1	12001	Not applicable
Timer.1.Time	Period for the timer (hh:mm:ss)	time_t	2ee2	12002	Set by Network.Modbus.TimeFormat
Timer.1.Triggered	1 = Timer triggered; 0 = Timer not triggered	bool	2ee3	12003	Not applicable
Timer.1.Type	Type of Timer 0 = Disabled (off) 1 = On Pulse 2 = On delay 3 = One shot 4 = Min on.	uint8	2ee4	12004	Not applicable
Timer.2.ElapsedTime	Elapsed Time	time_t	2ee6	12006	Set by Network.Modbus.TimeFormat
Timer.2.In	Trigger/Gate input	bool	2eeb	12011	Not applicable
Timer.2.Out	Output (1 = On; 0 = Off)	bool	2ee7	12007	Not applicable
Timer.2.Time	Period for the timer (hh:mm:ss)	time_t	2ee8	12008	Set by Network.Modbus.TimeFormat
Timer.2.Triggered	1 = Timer triggered; 0 = Timer not triggered	bool	2ee9	12009	Not applicable
Timer.2.Type	Type of Timer (as Timer.1.Type)	uint8	2eea	12010	Not applicable
Timer.3.ElapsedTime	Elapsed Time	time_t	2eec	12012	Set by Network.Modbus.TimeFormat
Timer.3.In	Trigger/Gate input	bool	2ef1	12017	Not applicable
Timer.3.Out	Output (1 = On; 0 = Off)	bool	2eed	12013	Not applicable
Timer.3.Time	Period for the timer (hh:mm:ss)	time_t	2eee	12014	Set by Network.Modbus.TimeFormat
Timer.3.Triggered	1 = Timer triggered; 0 = Timer not triggered	bool	2eef	12015	Not applicable
Timer.3.Type	Type of Timer (as Timer.1.Type)	uint8	2ef0	12016	Not applicable
Timer.4.ElapsedTime	Elapsed Time	time_t	2ef2	12018	Set by Network.Modbus.TimeFormat
Timer.4.In	Trigger/Gate input	bool	2ef7	12023	Not applicable
Timer.4.Out	Output (1 = On; 0 = Off)	bool	2ef3	12019	Not applicable
Timer.4.Time	Period for the timer (hh:mm:ss)	time_t	2ef4	12020	Set by Network.Modbus.TimeFormat
Timer.4.Triggered	1 = Timer triggered; 0 = Timer not triggered	bool	2ef5	12021	Not applicable
Timer.4.Type	Type of Timer (as Timer.1.Type)	uint8	2ef6	12022	Not applicable
UserLin.1.NumberOfBreakpoints	Number of points in user linearisation table 1	uint8	2900	10496	Not applicable
UserLin.1.X1	User linearisation table 1 'X' value 1	float32	2901	10497	2dp
UserLin.1.X2	User linearisation table 1 'X' value 2	float32	2903	10499	2dp
UserLin.1.X3	User linearisation table 1 'X' value 3	float32	2905	10501	2dp
UserLin.1.X4	User linearisation table 1 'X' value 4	float32	2907	10503	2dp
UserLin.1.X5	User linearisation table 1 'X' value 5	float32	2909	10505	2dp
UserLin.1.X6	User linearisation table 1 'X' value 6	float32	290b	10507	2dp
UserLin.1.X7	User linearisation table 1 'X' value 7	float32	290d	10509	2dp
UserLin.1.X8	User linearisation table 1 'X' value 8	float32	290f	10511	2dp
UserLin.1.X9	User linearisation table 1 'X' value 9	float32	2911	10513	2dp
UserLin.1.X10	User linearisation table 1 'X' value 10	float32	2913	10515	2dp
UserLin.1.X11	User linearisation table 1 'X' value 11	float32	2915	10517	2dp
UserLin.1.X12	User linearisation table 1 'X' value 12	float32	2917	10519	2dp
UserLin.1.X13	User linearisation table 1 'X' value 13	float32	2919	10521	2dp
UserLin.1.X14	User linearisation table 1 'X' value 14	float32	291b	10523	2dp
UserLin.1.X15	User linearisation table 1 'X' value 15	float32	291d	10525	2dp
UserLin.1.X16	User linearisation table 1 'X' value 16	float32	291f	10527	2dp
UserLin.1.X17	User linearisation table 1 'X' value 17	float32	2921	10529	2dp
UserLin.1.X18	User linearisation table 1 'X' value 18	float32	2923	10531	2dp
UserLin.1.X19	User linearisation table 1 'X' value 19	float32	2925	10533	2dp
UserLin.1.X20	User linearisation table 1 'X' value 20	float32	2927	10535	2dp
UserLin.1.X21	User linearisation table 1 'X' value 21	float32	2929	10537	2dp
UserLin.1.X22	User linearisation table 1 'X' value 22	float32	292b	10539	2dp
UserLin.1.X23	User linearisation table 1 'X' value 23	float32	292d	10541	2dp
UserLin.1.X24	User linearisation table 1 'X' value 24	float32	292f	10543	2dp
UserLin.1.X25	User linearisation table 1 'X' value 25	float32	2931	10545	2dp
UserLin.1.X26	User linearisation table 1 'X' value 26	float32	2933	10547	2dp
UserLin.1.X27	User linearisation table 1 'X' value 27	float32	2935	10549	2dp
UserLin.1.X28	User linearisation table 1 'X' value 28	float32	2937	10551	2dp
UserLin.1.X29	User linearisation table 1 'X' value 29	float32	2939	10553	2dp
UserLin.1.X30	User linearisation table 1 'X' value 30	float32	293b	10555	2dp
UserLin.1.X31	User linearisation table 1 'X' value 31	float32	293d	10557	2dp
UserLin.1.X32	User linearisation table 1 'X' value 32	float32	293f	10559	2dp
UserLin.1.Y1	User linearisation table 1 'Y' value 1	float32	2902	10498	2dp

Parameter path	Description	Type	Hex	Dec	Resolution
UserLin.1.Y2	User linearisation table 1 'Y' value 2	float32	2904	10500	2dp
UserLin.1.Y3	User linearisation table 1 'Y' value 3	float32	2906	10502	2dp
UserLin.1.Y4	User linearisation table 1 'Y' value 4	float32	2908	10504	2dp
UserLin.1.Y5	User linearisation table 1 'Y' value 5	float32	290a	10506	2dp
UserLin.1.Y6	User linearisation table 1 'Y' value 6	float32	290c	10508	2dp
UserLin.1.Y7	User linearisation table 1 'Y' value 7	float32	290e	10510	2dp
UserLin.1.Y8	User linearisation table 1 'Y' value 8	float32	2910	10512	2dp
UserLin.1.Y9	User linearisation table 1 'Y' value 9	float32	2912	10514	2dp
UserLin.1.Y10	User linearisation table 1 'Y' value 10	float32	2914	10516	2dp
UserLin.1.Y11	User linearisation table 1 'Y' value 11	float32	2916	10518	2dp
UserLin.1.Y12	User linearisation table 1 'Y' value 12	float32	2918	10520	2dp
UserLin.1.Y13	User linearisation table 1 'Y' value 13	float32	291a	10522	2dp
UserLin.1.Y14	User linearisation table 1 'Y' value 14	float32	291c	10524	2dp
UserLin.1.Y15	User linearisation table 1 'Y' value 15	float32	291e	10526	2dp
UserLin.1.Y16	User linearisation table 1 'Y' value 16	float32	2920	10528	2dp
UserLin.1.Y17	User linearisation table 1 'Y' value 17	float32	2922	10530	2dp
UserLin.1.Y18	User linearisation table 1 'Y' value 18	float32	2924	10532	2dp
UserLin.1.Y19	User linearisation table 1 'Y' value 19	float32	2926	10534	2dp
UserLin.1.Y20	User linearisation table 1 'Y' value 20	float32	2928	10536	2dp
UserLin.1.Y21	User linearisation table 1 'Y' value 21	float32	292a	10538	2dp
UserLin.1.Y22	User linearisation table 1 'Y' value 22	float32	292c	10540	2dp
UserLin.1.Y23	User linearisation table 1 'Y' value 23	float32	292e	10542	2dp
UserLin.1.Y24	User linearisation table 1 'Y' value 24	float32	2930	10544	2dp
UserLin.1.Y25	User linearisation table 1 'Y' value 25	float32	2932	10546	2dp
UserLin.1.Y26	User linearisation table 1 'Y' value 26	float32	2934	10548	2dp
UserLin.1.Y27	User linearisation table 1 'Y' value 27	float32	2936	10550	2dp
UserLin.1.Y28	User linearisation table 1 'Y' value 28	float32	2938	10552	2dp
UserLin.1.Y29	User linearisation table 1 'Y' value 29	float32	293a	10554	2dp
UserLin.1.Y30	User linearisation table 1 'Y' value 30	float32	293c	10556	2dp
UserLin.1.Y31	User linearisation table 1 'Y' value 31	float32	293e	10558	2dp
UserLin.1.Y32	User linearisation table 1 'Y' value 32	float32	2940	10560	2dp
UserLin.2.NumberOfBreakpoints	Number of points in user linearisation table 2	uint8	29c0	10688	Not applicable
UserLin.2.X1	User linearisation table 2 'X' value 1	float32	29c1	10689	2dp
UserLin.2.X2	User linearisation table 2 'X' value 2	float32	29c3	10691	2dp
UserLin.2.X3	User linearisation table 2 'X' value 3	float32	29c5	10693	2dp
UserLin.2.X4	User linearisation table 2 'X' value 4	float32	29c7	10695	2dp
UserLin.2.X5	User linearisation table 2 'X' value 5	float32	29c9	10697	2dp
UserLin.2.X6	User linearisation table 2 'X' value 6	float32	29cb	10699	2dp
UserLin.2.X7	User linearisation table 2 'X' value 7	float32	29cd	10701	2dp
UserLin.2.X8	User linearisation table 2 'X' value 8	float32	29cf	10703	2dp
UserLin.2.X9	User linearisation table 2 'X' value 9	float32	29d1	10705	2dp
UserLin.2.X10	User linearisation table 2 'X' value 10	float32	29d3	10707	2dp
UserLin.2.X11	User linearisation table 2 'X' value 11	float32	29d5	10709	2dp
UserLin.2.X12	User linearisation table 2 'X' value 12	float32	29d7	10711	2dp
UserLin.2.X13	User linearisation table 2 'X' value 13	float32	29d9	10713	2dp
UserLin.2.X14	User linearisation table 2 'X' value 14	float32	29db	10715	2dp
UserLin.2.X15	User linearisation table 2 'X' value 15	float32	29dd	10717	2dp
UserLin.2.X16	User linearisation table 2 'X' value 16	float32	29df	10719	2dp
UserLin.2.X17	User linearisation table 2 'X' value 17	float32	29e1	10721	2dp
UserLin.2.X18	User linearisation table 2 'X' value 18	float32	29e3	10723	2dp
UserLin.2.X19	User linearisation table 2 'X' value 19	float32	29e5	10725	2dp
UserLin.2.X20	User linearisation table 2 'X' value 20	float32	29e7	10727	2dp
UserLin.2.X21	User linearisation table 2 'X' value 21	float32	29e9	10729	2dp
UserLin.2.X22	User linearisation table 2 'X' value 22	float32	29eb	10731	2dp
UserLin.2.X23	User linearisation table 2 'X' value 23	float32	29ed	10733	2dp
UserLin.2.X24	User linearisation table 2 'X' value 24	float32	29ef	10735	2dp
UserLin.2.X25	User linearisation table 2 'X' value 25	float32	29f1	10737	2dp
UserLin.2.X26	User linearisation table 2 'X' value 26	float32	29f3	10739	2dp
UserLin.2.X27	User linearisation table 2 'X' value 27	float32	29f5	10741	2dp
UserLin.2.X28	User linearisation table 2 'X' value 28	float32	29f7	10743	2dp
UserLin.2.X29	User linearisation table 2 'X' value 29	float32	29f9	10745	2dp
UserLin.2.X30	User linearisation table 2 'X' value 30	float32	29fb	10747	2dp
UserLin.2.X31	User linearisation table 2 'X' value 31	float32	29fd	10749	2dp
UserLin.2.X32	User linearisation table 2 'X' value 32	float32	29ff	10751	2dp
UserLin.2.Y1	User linearisation table 2 'Y' value 1	float32	29c2	10690	2dp
UserLin.2.Y2	User linearisation table 4 'Y' value 2	float32	29c4	10692	2dp
UserLin.2.Y3	User linearisation table 4 'Y' value 3	float32	29c6	10694	2dp
UserLin.2.Y4	User linearisation table 4 'Y' value 4	float32	29c8	10696	2dp
UserLin.2.Y5	User linearisation table 4 'Y' value 5	float32	29ca	10698	2dp
UserLin.2.Y6	User linearisation table 4 'Y' value 6	float32	29cc	10700	2dp
UserLin.2.Y7	User linearisation table 4 'Y' value 7	float32	29ce	10702	2dp
UserLin.2.Y8	User linearisation table 4 'Y' value 8	float32	29d0	10704	2dp
UserLin.2.Y9	User linearisation table 4 'Y' value 9	float32	29d2	10706	2dp
UserLin.2.Y10	User linearisation table 4 'Y' value 10	float32	29d4	10708	2dp
UserLin.2.Y11	User linearisation table 4 'Y' value 11	float32	29d6	10710	2dp
UserLin.2.Y12	User linearisation table 4 'Y' value 12	float32	29d8	10712	2dp
UserLin.2.Y13	User linearisation table 4 'Y' value 13	float32	29da	10714	2dp
UserLin.2.Y14	User linearisation table 4 'Y' value 14	float32	29dc	10716	2dp
UserLin.2.Y15	User linearisation table 4 'Y' value 15	float32	29de	10718	2dp
UserLin.2.Y16	User linearisation table 4 'Y' value 16	float32	29e0	10720	2dp

Parameter path	Description	Type	Hex	Dec	Resolution
UserLin.2.Y17	User linearisation table 4 'Y' value 17	float32	29e2	10722	2dp
UserLin.2.Y18	User linearisation table 4 'Y' value 18	float32	29e4	10724	2dp
UserLin.2.Y19	User linearisation table 4 'Y' value 19	float32	29e6	10726	2dp
UserLin.2.Y20	User linearisation table 4 'Y' value 20	float32	29e8	10728	2dp
UserLin.2.Y21	User linearisation table 4 'Y' value 21	float32	29ea	10730	2dp
UserLin.2.Y22	User linearisation table 4 'Y' value 22	float32	29ec	10732	2dp
UserLin.2.Y23	User linearisation table 4 'Y' value 23	float32	29ee	10734	2dp
UserLin.2.Y24	User linearisation table 4 'Y' value 24	float32	29f0	10736	2dp
UserLin.2.Y25	User linearisation table 4 'Y' value 25	float32	29f2	10738	2dp
UserLin.2.Y26	User linearisation table 4 'Y' value 26	float32	29f4	10740	2dp
UserLin.2.Y27	User linearisation table 4 'Y' value 27	float32	29f6	10742	2dp
UserLin.2.Y28	User linearisation table 4 'Y' value 28	float32	29f8	10744	2dp
UserLin.2.Y29	User linearisation table 4 'Y' value 29	float32	29fa	10746	2dp
UserLin.2.Y30	User linearisation table 4 'Y' value 30	float32	29fc	10748	2dp
UserLin.2.Y31	User linearisation table 4 'Y' value 31	float32	29fe	10750	2dp
UserLin.2.Y32	User linearisation table 4 'Y' value 32	float32	2a00	10752	2dp
UserLin.3.NumberOfBreakpoints	Number of points in user linearisation table 32	uint8	2a80	10880	Not applicable
UserLin.3.X1	User linearisation table 3 'X' value 1	float32	2a81	10881	2dp
UserLin.3.X2	User linearisation table 3 'X' value 2	float32	2a83	10883	2dp
UserLin.3.X3	User linearisation table 3 'X' value 3	float32	2a85	10885	2dp
UserLin.3.X4	User linearisation table 3 'X' value 4	float32	2a87	10887	2dp
UserLin.3.X5	User linearisation table 3 'X' value 5	float32	2a89	10889	2dp
UserLin.3.X6	User linearisation table 3 'X' value 6	float32	2a8b	10891	2dp
UserLin.3.X7	User linearisation table 3 'X' value 7	float32	2a8d	10893	2dp
UserLin.3.X8	User linearisation table 3 'X' value 8	float32	2a8f	10895	2dp
UserLin.3.X9	User linearisation table 3 'X' value 9	float32	2a91	10897	2dp
UserLin.3.X10	User linearisation table 3 'X' value 10	float32	2a93	10899	2dp
UserLin.3.X11	User linearisation table 3 'X' value 11	float32	2a95	10901	2dp
UserLin.3.X12	User linearisation table 3 'X' value 12	float32	2a97	10903	2dp
UserLin.3.X13	User linearisation table 3 'X' value 13	float32	2a99	10905	2dp
UserLin.3.X14	User linearisation table 3 'X' value 14	float32	2a9b	10907	2dp
UserLin.3.X15	User linearisation table 3 'X' value 15	float32	2a9d	10909	2dp
UserLin.3.X16	User linearisation table 3 'X' value 16	float32	2a9f	10911	2dp
UserLin.3.X17	User linearisation table 3 'X' value 17	float32	2aa1	10913	2dp
UserLin.3.X18	User linearisation table 3 'X' value 18	float32	2aa3	10915	2dp
UserLin.3.X19	User linearisation table 3 'X' value 19	float32	2aa5	10917	2dp
UserLin.3.X20	User linearisation table 3 'X' value 20	float32	2aa7	10919	2dp
UserLin.3.X21	User linearisation table 3 'X' value 21	float32	2aa9	10921	2dp
UserLin.3.X22	User linearisation table 3 'X' value 22	float32	2aab	10923	2dp
UserLin.3.X23	User linearisation table 3 'X' value 23	float32	2aad	10925	2dp
UserLin.3.X24	User linearisation table 3 'X' value 24	float32	2aaf	10927	2dp
UserLin.3.X25	User linearisation table 3 'X' value 25	float32	2ab1	10929	2dp
UserLin.3.X26	User linearisation table 3 'X' value 26	float32	2ab3	10931	2dp
UserLin.3.X27	User linearisation table 3 'X' value 27	float32	2ab5	10933	2dp
UserLin.3.X28	User linearisation table 3 'X' value 28	float32	2ab7	10935	2dp
UserLin.3.X29	User linearisation table 3 'X' value 29	float32	2ab9	10937	2dp
UserLin.3.X30	User linearisation table 3 'X' value 30	float32	2abb	10939	2dp
UserLin.3.X31	User linearisation table 3 'X' value 31	float32	2abd	10941	2dp
UserLin.3.X32	User linearisation table 3 'X' value 32	float32	2abf	10943	2dp
UserLin.3.Y1	User linearisation table 4 'Y' value 1	float32	2a82	10882	2dp
UserLin.3.Y2	User linearisation table 4 'Y' value 2	float32	2a84	10884	2dp
UserLin.3.Y3	User linearisation table 4 'Y' value 3	float32	2a86	10886	2dp
UserLin.3.Y4	User linearisation table 4 'Y' value 4	float32	2a88	10888	2dp
UserLin.3.Y5	User linearisation table 4 'Y' value 5	float32	2a8a	10890	2dp
UserLin.3.Y6	User linearisation table 4 'Y' value 6	float32	2a8c	10892	2dp
UserLin.3.Y7	User linearisation table 4 'Y' value 7	float32	2a8e	10894	2dp
UserLin.3.Y8	User linearisation table 4 'Y' value 8	float32	2a90	10896	2dp
UserLin.3.Y9	User linearisation table 4 'Y' value 9	float32	2a92	10898	2dp
UserLin.3.Y10	User linearisation table 4 'Y' value 10	float32	2a94	10900	2dp
UserLin.3.Y11	User linearisation table 4 'Y' value 11	float32	2a96	10902	2dp
UserLin.3.Y12	User linearisation table 4 'Y' value 12	float32	2a98	10904	2dp
UserLin.3.Y13	User linearisation table 4 'Y' value 13	float32	2a9a	10906	2dp
UserLin.3.Y14	User linearisation table 4 'Y' value 14	float32	2a9c	10908	2dp
UserLin.3.Y15	User linearisation table 4 'Y' value 15	float32	2a9e	10910	2dp
UserLin.3.Y16	User linearisation table 4 'Y' value 16	float32	2aa0	10912	2dp
UserLin.3.Y17	User linearisation table 4 'Y' value 17	float32	2aa2	10914	2dp
UserLin.3.Y18	User linearisation table 4 'Y' value 18	float32	2aa4	10916	2dp
UserLin.3.Y19	User linearisation table 4 'Y' value 19	float32	2aa6	10918	2dp
UserLin.3.Y20	User linearisation table 4 'Y' value 20	float32	2aa8	10920	2dp
UserLin.3.Y21	User linearisation table 4 'Y' value 21	float32	2aaa	10922	2dp
UserLin.3.Y22	User linearisation table 4 'Y' value 22	float32	2aac	10924	2dp
UserLin.3.Y23	User linearisation table 4 'Y' value 23	float32	2aae	10926	2dp
UserLin.3.Y24	User linearisation table 4 'Y' value 24	float32	2ab0	10928	2dp
UserLin.3.Y25	User linearisation table 4 'Y' value 25	float32	2ab2	10930	2dp
UserLin.3.Y26	User linearisation table 4 'Y' value 26	float32	2ab4	10932	2dp
UserLin.3.Y27	User linearisation table 4 'Y' value 27	float32	2ab6	10934	2dp
UserLin.3.Y28	User linearisation table 4 'Y' value 28	float32	2ab8	10936	2dp
UserLin.3.Y29	User linearisation table 4 'Y' value 29	float32	2aba	10938	2dp
UserLin.3.Y30	User linearisation table 4 'Y' value 30	float32	2abc	10940	2dp
UserLin.3.Y31	User linearisation table 4 'Y' value 31	float32	2abe	10942	2dp

Parameter path	Description	Type	Hex	Dec	Resolution
UserLin.3.Y32	User linearisation table 4 'Y' value 32	float32	2ac0	10944	2dp
UserLin.4.NumberOfBreakpoints	Number of points in user linearisation table 4	uint8	2b40	11072	Not applicable
UserLin.4.X1	User linearisation table 4 'X' value 1	float32	2b41	11073	2dp
UserLin.4.X2	User linearisation table 4 'X' value 2	float32	2b43	11075	2dp
UserLin.4.X3	User linearisation table 4 'X' value 3	float32	2b45	11077	2dp
UserLin.4.X4	User linearisation table 4 'X' value 4	float32	2b47	11079	2dp
UserLin.4.X5	User linearisation table 4 'X' value v5	float32	2b49	11081	2dp
UserLin.4.X6	User linearisation table 4 'X' value 6	float32	2b4b	11083	2dp
UserLin.4.X7	User linearisation table 4 'X' value 7	float32	2b4d	11085	2dp
UserLin.4.X8	User linearisation table 4 'X' value 8	float32	2b4f	11087	2dp
UserLin.4.X9	User linearisation table 4 'X' value 9	float32	2b51	11089	2dp
UserLin.4.X10	User linearisation table 4 'X' value 10	float32	2b53	11091	2dp
UserLin.4.X11	User linearisation table 4 'X' value 11	float32	2b55	11093	2dp
UserLin.4.X12	User linearisation table 4 'X' value 12	float32	2b57	11095	2dp
UserLin.4.X13	User linearisation table 4 'X' value 13	float32	2b59	11097	2dp
UserLin.4.X14	User linearisation table 4 'X' value 14	float32	2b5b	11099	2dp
UserLin.4.X15	User linearisation table 4 'X' value 15	float32	2b5d	11101	2dp
UserLin.4.X16	User linearisation table 4 'X' value 16	float32	2b5f	11103	2dp
UserLin.4.X17	User linearisation table 4 'X' value 17	float32	2b61	11105	2dp
UserLin.4.X18	User linearisation table 4 'X' value 18	float32	2b63	11107	2dp
UserLin.4.X19	User linearisation table 4 'X' value 19	float32	2b65	11109	2dp
UserLin.4.X20	User linearisation table 4 'X' value 20	float32	2b67	11111	2dp
UserLin.4.X21	User linearisation table 4 'X' value 21	float32	2b69	11113	2dp
UserLin.4.X22	User linearisation table 4 'X' value 22	float32	2b6b	11115	2dp
UserLin.4.X23	User linearisation table 4 'X' value 23	float32	2b6d	11117	2dp
UserLin.4.X24	User linearisation table 4 'X' value 24	float32	2b6f	11119	2dp
UserLin.4.X25	User linearisation table 4 'X' value 25	float32	2b71	11121	2dp
UserLin.4.X26	User linearisation table 4 'X' value 26	float32	2b73	11123	2dp
UserLin.4.X27	User linearisation table 4 'X' value 27	float32	2b75	11125	2dp
UserLin.4.X28	User linearisation table 4 'X' value 28	float32	2b77	11127	2dp
UserLin.4.X29	User linearisation table 4 'X' value 29	float32	2b79	11129	2dp
UserLin.4.X30	User linearisation table 4 'X' value 30	float32	2b7b	11131	2dp
UserLin.4.X31	User linearisation table 4 'X' value 31	float32	2b7d	11133	2dp
UserLin.4.X32	User linearisation table 4 'X' value 32	float32	2b7f	11135	2dp
UserLin.4.Y1	User linearisation table 4 'Y' value 1	float32	2b42	11074	2dp
UserLin.4.Y2	User linearisation table 4 'Y' value 2	float32	2b44	11076	2dp
UserLin.4.Y3	User linearisation table 4 'Y' value 3	float32	2b46	11078	2dp
UserLin.4.Y4	User linearisation table 4 'Y' value 4	float32	2b48	11080	2dp
UserLin.4.Y5	User linearisation table 4 'Y' value 5	float32	2b4a	11082	2dp
UserLin.4.Y6	User linearisation table 4 'Y' value 6	float32	2b4c	11084	2dp
UserLin.4.Y7	User linearisation table 4 'Y' value 7	float32	2b4e	11086	2dp
UserLin.4.Y8	User linearisation table 4 'Y' value 8	float32	2b50	11088	2dp
UserLin.4.Y9	User linearisation table 4 'Y' value 9	float32	2b52	11090	2dp
UserLin.4.Y10	User linearisation table 4 'Y' value 10	float32	2b54	11092	2dp
UserLin.4.Y11	User linearisation table 4 'Y' value 11	float32	2b56	11094	2dp
UserLin.4.Y12	User linearisation table 4 'Y' value 12	float32	2b58	11096	2dp
UserLin.4.Y13	User linearisation table 4 'Y' value 13	float32	2b5a	11098	2dp
UserLin.4.Y14	User linearisation table 4 'Y' value 14	float32	2b5c	11100	2dp
UserLin.4.Y15	User linearisation table 4 'Y' value 15	float32	2b5e	11102	2dp
UserLin.4.Y16	User linearisation table 4 'Y' value 16	float32	2b60	11104	2dp
UserLin.4.Y17	User linearisation table 4 'Y' value 17	float32	2b62	11106	2dp
UserLin.4.Y18	User linearisation table 4 'Y' value 18	float32	2b64	11108	2dp
UserLin.4.Y19	User linearisation table 4 'Y' value 19	float32	2b66	11110	2dp
UserLin.4.Y20	User linearisation table 4 'Y' value 20	float32	2b68	11112	2dp
UserLin.4.Y21	User linearisation table 4 'Y' value 21	float32	2b6a	11114	2dp
UserLin.4.Y22	User linearisation table 4 'Y' value 22	float32	2b6c	11116	2dp
UserLin.4.Y23	User linearisation table 4 'Y' value 23	float32	2b6e	11118	2dp
UserLin.4.Y24	User linearisation table 4 'Y' value 24	float32	2b70	11120	2dp
UserLin.4.Y25	User linearisation table 4 'Y' value 25	float32	2b72	11122	2dp
UserLin.4.Y26	User linearisation table 4 'Y' value 26	float32	2b74	11124	2dp
UserLin.4.Y27	User linearisation table 4 'Y' value 27	float32	2b76	11126	2dp
UserLin.4.Y28	User linearisation table 4 'Y' value 28	float32	2b78	11128	2dp
UserLin.4.Y29	User linearisation table 4 'Y' value 29	float32	2b7a	11130	2dp
UserLin.4.Y30	User linearisation table 4 'Y' value 30	float32	2b7c	11132	2dp
UserLin.4.Y31	User linearisation table 4 'Y' value 31	float32	2b7e	11134	2dp
UserLin.4.Y32	User linearisation table 4 'Y' value 32	float32	2b80	11136	2dp
UsrVal.1.HighLimit	User Value High Limit	float32	2e8c	11916	Set by UsrVal.1.Resolution
UsrVal.1.LowLimit	User Value Low Limit	float32	2e8d	11917	Set by UsrVal.1.Resolution
UsrVal.1.Resolution	Result Resolution	uint8	2e90	11920	Not applicable
UsrVal.1.Status	User Value 1 Status (0 = Good (OK); 7 = Bad (Error))	bool	2e8f	11919	Not applicable
UsrVal.1.Units	Units of the value	string_t	68fc	26876	Not applicable
UsrVal.1.Val	The User Value	float32	2e8e	11918	Set by UsrVal.1.Resolution
UsrVal.2.HighLimit	User Value High Limit	float32	2e91	11921	Set by UsrVal.2.Resolution
UsrVal.2.LowLimit	User Value Low Limit	float32	2e92	11922	Set by UsrVal.2.Resolution
UsrVal.2.Resolution	Result Resolution	uint8	2e95	11925	Not applicable
UsrVal.2.Status	User Value 2 Status (0 = Good (OK); 7 = Bad (Error))	bool	2e94	11924	Not applicable
UsrVal.2.Units	Units of the value	string_t	6902	26882	Not applicable
UsrVal.2.Val	The User Value	float32	2e93	11923	Set by UsrVal.2.Resolution

Parameter path	Description	Type	Hex	Dec	Resolution
UsrVal.3.HighLimit	User Value High Limit	float32	2e96	11926	Set by UsrVal.3.Resolution
UsrVal.3.LowLimit	User Value Low Limit	float32	2e97	11927	Set by UsrVal.3.Resolution
UsrVal.3.Resolution	Result Resolution	uint8	2e9a	11930	Not applicable
UsrVal.3.Status	User Value 3 Status (0 = Good (OK); 7 = Bad (Error))	bool	2e99	11929	Not applicable
UsrVal.3.Units	Units of the value	string_t	6908	26888	Not applicable
UsrVal.3.Val	The User Value	float32	2e98	11928	Set by UsrVal.3.Resolution
UsrVal.4.HighLimit	User Value High Limit	float32	2e9b	11931	Set by UsrVal.4.Resolution
UsrVal.4.LowLimit	User Value Low Limit	float32	2e9c	11932	Set by UsrVal.4.Resolution
UsrVal.4.Resolution	Result Resolution	uint8	2e9f	11935	Not applicable
UsrVal.4.Status	User Value 4 Status (0 = Good (OK); 7 = Bad (Error))	bool	2e9e	11934	Not applicable
UsrVal.4.Units	Units of the value	string_t	690e	26894	Not applicable
UsrVal.4.Val	The User Value	float32	2e9d	11933	Set by UsrVal.4.Resolution
UsrVal.5.HighLimit	User Value High Limit	float32	2ea0	11936	Set by UsrVal.5.Resolution
UsrVal.5.LowLimit	User Value Low Limit	float32	2ea1	11937	Set by UsrVal.5.Resolution
UsrVal.5.Resolution	Result Resolution	uint8	2ea4	11940	Not applicable
UsrVal.5.Status	User Value 5 Status (0 = Good (OK); 7 = Bad (Error))	bool	2ea3	11939	Not applicable
UsrVal.5.Units	Units of the value	string_t	6914	26900	Not applicable
UsrVal.5.Val	The User Value	float32	2ea2	11938	Set by UsrVal.5.Resolution
UsrVal.6.HighLimit	User Value High Limit	float32	2ea5	11941	Set by UsrVal.6.Resolution
UsrVal.6.LowLimit	User Value Low Limit	float32	2ea6	11942	Set by UsrVal.6.Resolution
UsrVal.6.Resolution	Result Resolution	uint8	2ea9	11945	Not applicable
UsrVal.6.Status	User Value 6 Status (0 = Good (OK); 7 = Bad (Error))	bool	2ea8	11944	Not applicable
UsrVal.6.Units	Units of the value	string_t	691a	26906	Not applicable
UsrVal.6.Val	The User Value	float32	2ea7	11943	Set by UsrVal.6.Resolution
UsrVal.7.HighLimit	User Value High Limit	float32	2eaa	11946	Set by UsrVal.7.Resolution
UsrVal.7.LowLimit	User Value Low Limit	float32	2eab	11947	Set by UsrVal.7.Resolution
UsrVal.7.Resolution	Result Resolution	uint8	2eae	11950	Not applicable
UsrVal.7.Status	User Value 7 Status (0 = Good (OK); 7 = Bad (Error))	bool	2ead	11949	Not applicable
UsrVal.7.Units	Units of the value	string_t	6920	26912	Not applicable
UsrVal.7.Val	The User Value	float32	2eac	11948	Set by UsrVal.7.Resolution
UsrVal.8.HighLimit	User Value High Limit	float32	2eaf	11951	Set by UsrVal.8.Resolution
UsrVal.8.LowLimit	User Value Low Limit	float32	2eb0	11952	Set by UsrVal.8.Resolution
UsrVal.8.Resolution	Result Resolution	uint8	2eb3	11955	Not applicable
UsrVal.8.Status	User Value 8 Status (0 = Good (OK); 7 = Bad (Error))	bool	2eb2	11954	Not applicable
UsrVal.8.Units	Units of the value	string_t	6926	26918	Not applicable
UsrVal.8.Val	The User Value	float32	2eb1	11953	Set by UsrVal.8.Resolution
UsrVal.9.HighLimit	User Value High Limit	float32	2eb4	11956	Set by UsrVal.9.Resolution
UsrVal.9.LowLimit	User Value Low Limit	float32	2eb5	11957	Set by UsrVal.9.Resolution
UsrVal.9.Resolution	Result Resolution	uint8	2eb8	11960	Not applicable
UsrVal.9.Status	User Value 9 Status (0 = Good (OK); 7 = Bad (Error))	bool	2eb7	11959	Not applicable
UsrVal.9.Units	Units of the value	string_t	692c	26924	Not applicable
UsrVal.9.Val	The User Value	float32	2eb6	11958	Set by UsrVal.9.Resolution
UsrVal.10.HighLimit	User Value High Limit	float32	2eb9	11961	Set by UsrVal.10.Resolution
UsrVal.10.LowLimit	User Value Low Limit	float32	2eba	11962	Set by UsrVal.10.Resolution
UsrVal.10.Resolution	Result Resolution	uint8	2ebd	11965	Not applicable
UsrVal.10.Status	User Value 10 Status (0 = Good (OK); 7 = Bad (Error))	bool	2ebc	11964	Not applicable
UsrVal.10.Units	Units of the value	string_t	6932	26930	Not applicable
UsrVal.10.Val	The User Value	float32	2ebb	11963	Set by UsrVal.10.Resolution
UsrVal.11.HighLimit	User Value High Limit	float32	2ebe	11966	Set by UsrVal.11.Resolution
UsrVal.11.LowLimit	User Value Low Limit	float32	2ebf	11967	Set by UsrVal.11.Resolution
UsrVal.11.Resolution	Result Resolution	uint8	2ec2	11970	Not applicable
UsrVal.11.Status	User Value 11 Status (0 = Good (OK); 7 = Bad (Error))	bool	2ec1	11969	Not applicable
UsrVal.11.Units	Units of the value	string_t	6938	26936	Not applicable
UsrVal.11.Val	The User Value	float32	2ec0	11968	Set by UsrVal.11.Resolution
UsrVal.12.HighLimit	User Value High Limit	float32	2ec3	11971	Set by UsrVal.12.Resolution
UsrVal.12.LowLimit	User Value Low Limit	float32	2ec4	11972	Set by UsrVal.12.Resolution
UsrVal.12.Resolution	Result Resolution	uint8	2ec7	11975	Not applicable
UsrVal.12.Status	User Value 12 Status (0 = Good (OK); 7 = Bad (Error))	bool	2ec6	11974	Not applicable
UsrVal.12.Units	Units of the value	string_t	693e	26942	Not applicable
UsrVal.12.Val	The User Value	float32	2ec5	11973	Set by UsrVal.12.Resolution

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.1.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c0	448	Not applicable
VirtualChannel.1.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1c50	7248	Not applicable
VirtualChannel.1.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1c4b	7243	Not applicable
VirtualChannel.1.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1c48	7240	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1c4a	7242	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1c42	7234	Not applicable
VirtualChannel.1.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1c49	7241	Not applicable
VirtualChannel.1.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1c47	7239	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Dwell	Alarm dwell time	time_t	1c45	7237	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm1.Hysteresis	Alarm hysteresis value	float32	1c44	7236	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1c4e	7246	Not applicable
VirtualChannel.1.Alarm1.Inhibit	1 = alarm inhibited	bool	1c51	7249	Not applicable
VirtualChannel.1.Alarm1.Latch	Alarm latch type (0 = None; 1 = Auto; 2 = Manual; 3 = Trigger	uint8	1c41	7233	Not applicable
VirtualChannel.1.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1c4f	7247	Not applicable
VirtualChannel.1.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1c46	7238	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Status	Indication of the active and acknowledge status 0 = Unacknowledged 1 = None 2 = Active 3 = Inactive 4 = Acknowledged	uint8	0122	290	Not applicable
VirtualChannel.1.Alarm1.Threshold	Alarm trigger threshold	float32	1c43	7235	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Type	Alarm type 0 = None 1 = Abs High 2 = Abs Low 3 = Dev high 4 = Dev Low 5 = Dev band 6 = ROC rising 7 = ROC falling 10 = Dig Off 11 = Dig High 12 = Dig Low	uint8	1c40	7232	Not applicable
VirtualChannel.1.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c1	449	Not applicable
VirtualChannel.1.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1c70	7280	Not applicable
VirtualChannel.1.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1c6b	7275	Not applicable
VirtualChannel.1.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1c68	7272	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1c6a	7274	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1c62	7266	Not applicable
VirtualChannel.1.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time	uint8	1c69	7273	Not applicable
VirtualChannel.1.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1c67	7271	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Dwell	Alarm dwell time	time_t	1c65	7269	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm2.Hysteresis	Alarm hysteresis value	float32	1c64	7268	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1c6e	7278	Not applicable
VirtualChannel.1.Alarm2.Inhibit	1 = alarm inhibited	bool	1c71	7281	Not applicable
VirtualChannel.1.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1c61	7265	Not applicable
VirtualChannel.1.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1c6f	7279	Not applicable
VirtualChannel.1.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1c66	7270	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0123	291	Not applicable
VirtualChannel.1.Alarm2.Threshold	Alarm trigger threshold	float32	1c63	7267	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1c60	7264	Not applicable
VirtualChannel.1.Main.Descriptor	Virtual Channel descriptor	string_t	4b00	19200	Not applicable
VirtualChannel.1.Main.Disable	1 = Virtual channel disabled	bool	1c23	7203	Not applicable
VirtualChannel.1.Main.HighCutOff	High cut off value for totalisers and counters	float32	1c05	7173	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Input1	Input 1 value	float32	1c07	7175	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Input2	Input 2 value	float32	1c08	7176	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.LowCutOff	Low cutoff value for totalisers and counters	float32	1c04	7172	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.ModbusInput	Modbus input value	float32	1c06	7174	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Operation	Specifies the operation of the virtual channel 0 = Off 2 = Add 3 = Subtract 4 = Multiply 5 = Divide 6 = Group avg 7 = Group min 8 = Group max 9 = Modbus i/p 11 = Copy 20 = Grp min latch 21 = Grp max latch 34 = Chan max 35 = Chan min 36 = Chan avg 43 = Config rev 64 = Off 65 = On 80 = Off 81 = On	uint8	1c01	7169	Not applicable
VirtualChannel.1.Main.Period	The time period over which the calculation is made	int32	1c0a	7178	Not applicable
VirtualChannel.1.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1c0c	7180	Not applicable
VirtualChannel.1.Main.PresetValue	The preset value	float32	1c0d	7181	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.PV	The virtual channel output value	float32	0120	288	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1c0b	7179	Not applicable
VirtualChannel.1.Main.Resolution	Number of decimal places (0 to 6)	uint8	1c02	7170	Not applicable
VirtualChannel.1.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1c11	7185	Not applicable
VirtualChannel.1.Main.RolloverValue	Rollover value	float32	1c12	7186	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Status	Virtual Channel output status 0 =Good 1 = Off 2 = Over range 3 = Under range 4 = HW error 5 = Ranging 6 = Overflow 7 = bad 8 = HW exceeded 9 = No data 12 = Comms channel error	uint8	0121	289	Not applicable
VirtualChannel.1.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1c09	7177	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1c0e	7182	Not applicable
VirtualChannel.1.Main.Type	Specifies the type of virtual channel 1 = Maths; 2 = Totaliser; 3 = Counter	uint8	1c00	7168	Not applicable
VirtualChannel.1.Main.Units	Units descriptor	string_t	4b15	19221	Not applicable
VirtualChannel.1.Main.UnitsScaler	Units scaler for totalisers	float32	1c03	7171	1dp
VirtualChannel.1.Trend.Colour	Configures the trend colour for this virtual channel 0 = Red 1 = Blue 2 = Green 3 = Honey 4 = Violet 5 = Russet 6 = Dark blue 7 = Jade 8 = Magenta	uint8	1c20	7200	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
	9 = Dusky rose 10 = Yellow 11 = Powder blue 12 = Dark red 13 = Avocado 14 = Indigo 15 = Dark brown 16 = Aegean 17 = Cyan 18 = Aubergine 19 = Dark orange 20 = Pale yellow 21 = Hyacinth 22 = Dark green 23 = Sugar pink 24 = Bluebell 25 = Orange 26 = Pink 27 = Buttersilk 28 = Terracotta 29 = Blue babe 30 = Lime 31 = Blue jive 32 = Cucumber 33 = Eurogreen 34 = Wheatgerm 35 = Sea Blue 36 = Ginger 37 = Aqua pool 38 = Pale red 39 = Pale blue 40 = Lilac 41 = Sky blue 42 = Wild moss 43 = Turquoise 44 = Pale green 45 = Coffee 49 = Dark Grey 53 = Light grey				
VirtualChannel.1.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1c22	7202	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1c21	7201	Same as VirtualChannel.1.Main.PV
VirtualChannel.2.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c2	450	Not applicable
VirtualChannel.2.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1cd0	7376	Not applicable
VirtualChannel.2.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1ccb	7371	Not applicable
VirtualChannel.2.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1cc8	7368	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1cca	7370	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1cc2	7362	Not applicable
VirtualChannel.2.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1cc9	7369	Not applicable
VirtualChannel.2.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1cc7	7367	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Dwell	Alarm dwell time	time_t	1cc5	7365	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm1.Hysteresis	Alarm hysteresis value	float32	1cc4	7364	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1cce	7374	Not applicable
VirtualChannel.2.Alarm1.Inhibit	1 = alarm inhibited	bool	1cd1	7377	Not applicable
VirtualChannel.2.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1cc1	7361	Not applicable
VirtualChannel.2.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1ccf	7375	Not applicable
VirtualChannel.2.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1cc6	7366	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0126	294	Not applicable
VirtualChannel.2.Alarm1.Threshold	Alarm trigger threshold	float32	1cc3	7363	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1cc0	7360	Not applicable
VirtualChannel.2.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c3	451	Not applicable
VirtualChannel.2.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1cf0	7408	Not applicable
VirtualChannel.2.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1ceb	7403	Not applicable
VirtualChannel.2.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1ce8	7400	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1cea	7402	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1ce2	7394	Not applicable
VirtualChannel.2.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1ce9	7401	Not applicable
VirtualChannel.2.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1ce7	7399	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Dwell	Alarm dwell time	time_t	1ce5	7397	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm2.Hysteresis	Alarm hysteresis value	float32	1ce4	7396	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1cee	7406	Not applicable
VirtualChannel.2.Alarm2.Inhibit	1 = alarm inhibited	bool	1cf1	7409	Not applicable
VirtualChannel.2.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1ce1	7393	Not applicable
VirtualChannel.2.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1cef	7407	Not applicable
VirtualChannel.2.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1ce6	7398	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0127	295	Not applicable
VirtualChannel.2.Alarm2.Threshold	Alarm trigger threshold	float32	1ce3	7395	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1ce0	7392	Not applicable
VirtualChannel.2.Main.Descriptor	Virtual Channel descriptor	string_t	4b1b	19227	Not applicable
VirtualChannel.2.Main.Disable	1 = Virtual channel disabled	bool	1ca3	7331	Not applicable
VirtualChannel.2.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1c85	7301	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Input1	Input 1 value	float32	1c87	7303	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Input2	Input 2 value	float32	1c88	7304	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1c84	7300	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.ModbusInput	Modbus input value	float32	1c86	7302	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1c81	7297	Not applicable
VirtualChannel.2.Main.Period	The time period over which the calculation is made	int32	1c8a	7306	Not applicable
VirtualChannel.2.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1c8c	7308	Not applicable
VirtualChannel.2.Main.PresetValue	The Preset value	float32	1c8d	7309	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.PV	The virtual channel output value	float32	0124	292	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1c8b	7307	Not applicable
VirtualChannel.2.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1c82	7298	Not applicable
VirtualChannel.2.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1c91	7313	Not applicable
VirtualChannel.2.Main.RolloverValue	Rollover value	float32	1c92	7314	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Status	As VirtualChannel1.Main.Status	uint8	0125	293	Not applicable
VirtualChannel.2.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1c89	7305	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1c8e	7310	Not applicable
VirtualChannel.2.Main.Type	As VirtualChannel1.Main.Type	uint8	1c80	7296	Not applicable
VirtualChannel.2.Main.Units	Units descriptor	string_t	4b30	19248	Not applicable
VirtualChannel.2.Main.UnitsScaler	Units scaler for totalisers	float32	1c83	7299	1dp
VirtualChannel.2.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1ca0	7328	Not applicable
VirtualChannel.2.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1ca2	7330	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1ca1	7329	Same as VirtualChannel.2.Main.PV
VirtualChannel.3.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c4	452	Not applicable
VirtualChannel.3.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1d50	7504	Not applicable
VirtualChannel.3.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1d4b	7499	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.3.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1d48	7496	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1d4a	7498	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1d42	7490	Not applicable
VirtualChannel.3.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1d49	7497	Not applicable
VirtualChannel.3.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1d47	7495	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Dwell	Alarm dwell time	time_t	1d45	7493	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm1.Hysteresis	Alarm hysteresis value	float32	1d44	7492	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1d4e	7502	Not applicable
VirtualChannel.3.Alarm1.Inhibit	1 = alarm inhibited	bool	1d51	7505	Not applicable
VirtualChannel.3.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1d41	7489	Not applicable
VirtualChannel.3.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1d4f	7503	Not applicable
VirtualChannel.3.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1d46	7494	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	012a	298	Not applicable
VirtualChannel.3.Alarm1.Threshold	Alarm trigger threshold	float32	1d43	7491	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1d40	7488	Not applicable
VirtualChannel.3.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c5	453	Not applicable
VirtualChannel.3.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1d70	7536	Not applicable
VirtualChannel.3.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1d6b	7531	Not applicable
VirtualChannel.3.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1d68	7528	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1d6a	7530	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1d62	7522	Not applicable
VirtualChannel.3.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1d69	7529	Not applicable
VirtualChannel.3.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1d67	7527	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Dwell	Alarm dwell time	time_t	1d65	7525	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm2.Hysteresis	Alarm hysteresis value	float32	1d64	7524	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1d6e	7534	Not applicable
VirtualChannel.3.Alarm2.Inhibit	1 = alarm inhibited	bool	1d71	7537	Not applicable
VirtualChannel.3.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1d61	7521	Not applicable
VirtualChannel.3.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1d6f	7535	Not applicable
VirtualChannel.3.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1d66	7526	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	012b	299	Not applicable
VirtualChannel.3.Alarm2.Threshold	Alarm trigger threshold	float32	1d63	7523	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1d60	7520	Not applicable
VirtualChannel.3.Main.Descriptor	Virtual Channel descriptor	string_t	4b36	19254	Not applicable
VirtualChannel.3.Main.Disable	1 = Virtual channel disabled	bool	1d23	7459	Not applicable
VirtualChannel.3.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1d05	7429	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Input1	Input 1	float32	1d07	7431	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Input2	Input 2	float32	1d08	7432	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1d04	7428	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.ModbusInput	Modbus input value	float32	1d06	7430	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1d01	7425	Not applicable
VirtualChannel.3.Main.Period	The time period over which the calculation is made	int32	1d0a	7434	Not applicable
VirtualChannel.3.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1d0c	7436	Not applicable
VirtualChannel.3.Main.PresetValue	The Preset value	float32	1d0d	7437	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.PV	The virtual channel output value	float32	0128	296	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1d0b	7435	Not applicable
VirtualChannel.3.Main.Resolution	Number of decimal places (0 to 6)	uint8	1d02	7426	Not applicable
VirtualChannel.3.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1d11	7441	Not applicable
VirtualChannel.3.Main.RolloverValue	Rollover value	float32	1d12	7442	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Status	As VirtualChannel1.Main.Status	uint8	0129	297	Not applicable
VirtualChannel.3.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1d09	7433	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1d0e	7438	Not applicable
VirtualChannel.3.Main.Type	As VirtualChannel1.Main.Type	uint8	1d00	7424	Not applicable
VirtualChannel.3.Main.Units	Units descriptor	string_t	4b4b	19275	Not applicable
VirtualChannel.3.Main.UnitsScaler	Units scaler for totalisers	float32	1d03	7427	1dp
VirtualChannel.3.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1d20	7456	Not applicable
VirtualChannel.3.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1d22	7458	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1d21	7457	Same as VirtualChannel.3.Main.PV
VirtualChannel.4.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c6	454	Not applicable
VirtualChannel.4.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1dd0	7632	Not applicable
VirtualChannel.4.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1dcb	7627	Not applicable
VirtualChannel.4.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1dc8	7624	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1dca	7626	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1dc2	7618	Not applicable
VirtualChannel.4.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1dc9	7625	Not applicable
VirtualChannel.4.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1dc7	7623	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.Dwell	Alarm dwell time	time_t	1dc5	7621	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Alarm1.Hysteresis	Alarm hysteresis value	float32	1dc4	7620	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1dce	7630	Not applicable
VirtualChannel.4.Alarm1.Inhibit	1 = alarm inhibited	bool	1dd1	7633	Not applicable
VirtualChannel.4.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1dc1	7617	Not applicable
VirtualChannel.4.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1dcf	7631	Not applicable
VirtualChannel.4.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1dc6	7622	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	012e	302	Not applicable
VirtualChannel.4.Alarm1.Threshold	Alarm trigger threshold	float32	1dc3	7619	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1dc0	7616	Not applicable
VirtualChannel.4.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c7	455	Not applicable
VirtualChannel.4.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1df0	7664	Not applicable
VirtualChannel.4.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1deb	7659	Not applicable
VirtualChannel.4.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1de8	7656	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1dea	7658	Set by Network.Modbus.TimeFormat

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.4.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1de2	7650	Not applicable
VirtualChannel.4.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1de9	7657	Not applicable
VirtualChannel.4.Alarm2.Deviation	Deviation alarm 'Deviation Value'	time_t	1de5	7653	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Alarm2.Hysteresis	Alarm hysteresis value	float32	1de4	7652	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1dee	7662	Not applicable
VirtualChannel.4.Alarm2.Inhibit	1 = alarm inhibited	bool	1df1	7665	Not applicable
VirtualChannel.4.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1de1	7649	Not applicable
VirtualChannel.4.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1def	7663	Not applicable
VirtualChannel.4.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1de6	7654	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	012f	303	Not applicable
VirtualChannel.4.Alarm2.Threshold	Alarm trigger threshold	float32	1de3	7651	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1de0	7648	Not applicable
VirtualChannel.4.Main.Descriptor	Virtual Channel descriptor	string_t	4b51	19281	Not applicable
VirtualChannel.4.Main.Disable	1 = Virtual channel disabled	bool	1da3	7587	Not applicable
VirtualChannel.4.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1d85	7557	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Input1	Input 1 value	float32	1d87	7559	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Input2	Input 2 value	float32	1d88	7560	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1d84	7556	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.ModbusInput	Modbus input value	float32	1d86	7558	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1d81	7553	Not applicable
VirtualChannel.4.Main.Period	Averaging period	int32	1d8a	7562	Not applicable
VirtualChannel.4.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1d8c	7564	Not applicable
VirtualChannel.4.Main.PresetValue	The Preset value	float32	1d8d	7565	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.PV	The virtual channel output value	float32	012c	300	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1d8b	7563	Not applicable
VirtualChannel.4.Main.Resolution	Number of decimal places (0 to 6)	uint8	1d82	7554	Not applicable
VirtualChannel.4.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1d91	7569	Not applicable
VirtualChannel.4.Main.RolloverValue	Rollover value	float32	1d92	7570	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Status	As VirtualChannel1.Main.Status	uint8	012d	301	Not applicable
VirtualChannel.4.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1d89	7561	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1d8e	7566	Not applicable
VirtualChannel.4.Main.Type	As VirtualChannel1.Main.Type	uint8	1d80	7552	Not applicable
VirtualChannel.4.Main.Units	Units descriptor	string_t	4b66	19302	Not applicable
VirtualChannel.4.Main.UnitsScaler	Units scaler for totalisers	float32	1d83	7555	1dp
VirtualChannel.4.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1da0	7584	Not applicable
VirtualChannel.4.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1da2	7586	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1da1	7585	Same as VirtualChannel.4.Main.PV
VirtualChannel.5.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c8	456	Not applicable
VirtualChannel.5.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1e50	7760	Not applicable
VirtualChannel.5.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1e4b	7755	Not applicable
VirtualChannel.5.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1e48	7752	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1e4a	7754	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1e42	7746	Not applicable
VirtualChannel.5.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1e49	7753	Not applicable
VirtualChannel.5.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1e47	7751	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Dwell	Alarm dwell time	time_t	1e45	7749	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm1.Hysteresis	Alarm hysteresis value	float32	1e44	7748	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1e4e	7758	Not applicable
VirtualChannel.5.Alarm1.Inhibit	1 = alarm inhibited	bool	1e51	7761	Not applicable
VirtualChannel.5.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1e41	7745	Not applicable
VirtualChannel.5.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1e4f	7759	Not applicable
VirtualChannel.5.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1e46	7750	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0132	306	Not applicable
VirtualChannel.5.Alarm1.Threshold	Alarm trigger threshold	float32	1e43	7747	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1e40	7744	Not applicable
VirtualChannel.5.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c9	457	Not applicable
VirtualChannel.5.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1e70	7792	Not applicable
VirtualChannel.5.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1e6b	7787	Not applicable
VirtualChannel.5.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1e68	7784	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1e6a	7786	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1e62	7778	Not applicable
VirtualChannel.5.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1e69	7785	Not applicable
VirtualChannel.5.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1e67	7783	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.Dwell	Alarm dwell time	time_t	1e65	7781	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm2.Hysteresis	Alarm hysteresis value	float32	1e64	7780	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1e6e	7790	Not applicable
VirtualChannel.5.Alarm2.Inhibit	1 = alarm inhibited	bool	1e71	7793	Not applicable
VirtualChannel.5.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1e61	7777	Not applicable
VirtualChannel.5.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1e6f	7791	Not applicable
VirtualChannel.5.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1e66	7782	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0133	307	Not applicable
VirtualChannel.5.Alarm2.Threshold	Alarm trigger threshold	float32	1e63	7779	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1e60	7776	Not applicable
VirtualChannel.5.Main.Descriptor	Virtual Channel descriptor	string_t	4b6c	19308	Not applicable
VirtualChannel.5.Main.Disable	1 = Virtual channel disabled	bool	1e23	7715	Not applicable
VirtualChannel.5.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1e05	7685	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Input1	Input 1 value	float32	1e07	7687	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Input2	Input 2 value	float32	1e08	7688	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1e04	7684	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.ModbusInput	Modbus input value	float32	1e06	7686	Set by VirtualChannel.5.Main.Resolution

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.5.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1e01	7681	Not applicable
VirtualChannel.5.Main.Period	The time period over which the calculation is made	int32	1e0a	7690	Not applicable
VirtualChannel.5.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1e0c	7692	Not applicable
VirtualChannel.5.Main.PresetValue	The Preset value	float32	1e0d	7693	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.PV	The virtual channel output value	float32	0130	304	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1e0b	7691	Not applicable
VirtualChannel.5.Main.Resolution	Number of decimal places (0 to 6)	uint8	1e02	7682	Not applicable
VirtualChannel.5.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1e11	7697	Not applicable
VirtualChannel.5.Main.RolloverValue	Rollover value	float32	1e12	7698	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Status	As VirtualChannel1.Main.Status	uint8	0131	305	Not applicable
VirtualChannel.5.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1e09	7689	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1e0e	7694	Not applicable
VirtualChannel.5.Main.Type	As VirtualChannel1.Main.Type	uint8	1e00	7680	Not applicable
VirtualChannel.5.Main.Units	Units descriptor	string_t	4b81	19329	Not applicable
VirtualChannel.5.Main.UnitsScaler	Units scaler for totalisers	float32	1e03	7683	1dp
VirtualChannel.5.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1e20	7712	Not applicable
VirtualChannel.5.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1e22	7714	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1e21	7713	Same as VirtualChannel.5.Main.PV
VirtualChannel.6.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01ca	458	Not applicable
VirtualChannel.6.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1ed0	7888	Not applicable
VirtualChannel.6.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1ecb	7883	Not applicable
VirtualChannel.6.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1ec8	7880	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1eca	7882	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1ec2	7874	Not applicable
VirtualChannel.6.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1ec9	7881	Not applicable
VirtualChannel.6.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1ec7	7879	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Dwell	Alarm dwell time	time_t	1ec5	7877	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm1.Hysteresis	Alarm hysteresis value	float32	1ec4	7876	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1ece	7886	Not applicable
VirtualChannel.6.Alarm1.Inhibit	1 = alarm inhibited	bool	1ed1	7889	Not applicable
VirtualChannel.6.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1ec1	7873	Not applicable
VirtualChannel.6.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1ecf	7887	Not applicable
VirtualChannel.6.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1ec6	7878	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0136	310	Not applicable
VirtualChannel.6.Alarm1.Threshold	Alarm trigger threshold	float32	1ec3	7875	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1ec0	7872	Not applicable
VirtualChannel.6.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01cb	459	Not applicable
VirtualChannel.6.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1ef0	7920	Not applicable
VirtualChannel.6.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1eeb	7915	Not applicable
VirtualChannel.6.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1ee8	7912	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1eea	7914	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1ee2	7906	Not applicable
VirtualChannel.6.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1ee9	7913	Not applicable
VirtualChannel.6.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1ee7	7911	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Dwell	Alarm dwell time	time_t	1ee5	7909	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm2.Hysteresis	Alarm hysteresis value	float32	1ee4	7908	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1eee	7918	Not applicable
VirtualChannel.6.Alarm2.Inhibit	1 = alarm inhibited	bool	1ef1	7921	Not applicable
VirtualChannel.6.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1ee1	7905	Not applicable
VirtualChannel.6.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1eef	7919	Not applicable
VirtualChannel.6.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1ee6	7910	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0137	311	Not applicable
VirtualChannel.6.Alarm2.Threshold	Alarm trigger threshold	float32	1ee3	7907	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1ee0	7904	Not applicable
VirtualChannel.6.Main.Descriptor	Virtual Channel descriptor	string_t	4b87	19335	Not applicable
VirtualChannel.6.Main.Disable	1 = Virtual channel disabled	bool	1ea3	7843	Not applicable
VirtualChannel.6.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1e85	7813	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Input1	Input 1 value	float32	1e87	7815	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Input2	Input 2 value	float32	1e88	7816	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1e84	7812	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.ModbusInput	Modbus input value	float32	1e86	7814	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1e81	7809	Not applicable
VirtualChannel.6.Main.Period	The time period over which the calculation is made	int32	1e8a	7818	Not applicable
VirtualChannel.6.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1e8c	7820	Not applicable
VirtualChannel.6.Main.PresetValue	The Preset value	float32	1e8d	7821	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.PV	The virtual channel output value	float32	0134	308	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1e8b	7819	Not applicable
VirtualChannel.6.Main.Resolution	Number of decimal places (0 to 6)	uint8	1e82	7810	Not applicable
VirtualChannel.6.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1e91	7825	Not applicable
VirtualChannel.6.Main.RolloverValue	Rollover value	float32	1e92	7826	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Status	As VirtualChannel1.Main.Status	uint8	0135	309	Not applicable
VirtualChannel.6.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1e89	7817	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1e8e	7822	Not applicable
VirtualChannel.6.Main.Type	As VirtualChannel1.Main.Type	uint8	1e80	7808	Not applicable
VirtualChannel.6.Main.Units	Units descriptor	string_t	4b9c	19356	Not applicable
VirtualChannel.6.Main.UnitsScaler	Units scaler for totalisers	float32	1e83	7811	1dp
VirtualChannel.6.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1ea0	7840	Not applicable
VirtualChannel.6.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1ea2	7842	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1ea1	7841	Same as VirtualChannel.6.Main.PV

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.7.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01cc	460	Not applicable
VirtualChannel.7.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1f50	8016	Not applicable
VirtualChannel.7.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1f4b	8011	Not applicable
VirtualChannel.7.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1f48	8008	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1f4a	8010	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1f42	8002	Not applicable
VirtualChannel.7.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1f49	8009	Not applicable
VirtualChannel.7.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1f47	8007	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Dwell	Alarm dwell time	time_t	1f45	8005	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm1.Hysteresis	Alarm hysteresis value	float32	1f44	8004	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1f4e	8014	Not applicable
VirtualChannel.7.Alarm1.Inhibit	1 = alarm inhibited	bool	1f51	8017	Not applicable
VirtualChannel.7.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1f41	8001	Not applicable
VirtualChannel.7.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1f4f	8015	Not applicable
VirtualChannel.7.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1f46	8006	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	013a	314	Not applicable
VirtualChannel.7.Alarm1.Threshold	Alarm trigger threshold	float32	1f43	8003	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1f40	8000	Not applicable
VirtualChannel.7.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01cd	461	Not applicable
VirtualChannel.7.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1f70	8048	Not applicable
VirtualChannel.7.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1f6b	8043	Not applicable
VirtualChannel.7.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1f68	8040	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1f6a	8042	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1f62	8034	Not applicable
VirtualChannel.7.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1f69	8041	Not applicable
VirtualChannel.7.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1f67	8039	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Dwell	Alarm dwell time	time_t	1f65	8037	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm2.Hysteresis	Alarm hysteresis value	float32	1f64	8036	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1f6e	8046	Not applicable
VirtualChannel.7.Alarm2.Inhibit	1 = alarm inhibited	bool	1f71	8049	Not applicable
VirtualChannel.7.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1f61	8033	Not applicable
VirtualChannel.7.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1f6f	8047	Not applicable
VirtualChannel.7.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1f66	8038	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Status	As VirtualChanneAlarm trigger thresholdAlarm threshold	float32	1f63	8035	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1f60	8032	Not applicable
VirtualChannel.7.Main.Descriptor	Virtual Channel descriptor	string_t	4ba2	19362	Not applicable
VirtualChannel.7.Main.Disable	1 = Virtual channel disabled	bool	1f23	7971	Not applicable
VirtualChannel.7.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1f05	7941	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Input1	Input 1 value	float32	1f07	7943	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Input2	Input 2 value	float32	1f08	7944	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1f04	7940	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.ModbusInput	Modbus input value	float32	1f06	7942	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1f01	7937	Not applicable
VirtualChannel.7.Main.Period	Averaging period	int32	1f0a	7946	Not applicable
VirtualChannel.7.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1f0c	7948	Not applicable
VirtualChannel.7.Main.PresetValue	The Preset value	float32	1f0d	7949	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.PV	The virtual channel output value	float32	0138	312	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1f0b	7947	Not applicable
VirtualChannel.7.Main.Resolution	Number of decimal places (0 to 6)	uint8	1f02	7938	Not applicable
VirtualChannel.7.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1f11	7953	Not applicable
VirtualChannel.7.Main.RolloverValue	Rollover value	float32	1f12	7954	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Status	As VirtualChannel1.Main.Status	uint8	0139	313	Not applicable
VirtualChannel.7.Main.TimeRemaining	Time remaining before calculation is made	time_t	1f09	7945	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1f0e	7950	Not applicable
VirtualChannel.7.Main.Type	As VirtualChannel1.Main.Type	uint8	1f00	7936	Not applicable
VirtualChannel.7.Main.Units	Units descriptor	string_t	4bb7	19383	Not applicable
VirtualChannel.7.Main.UnitsScaler	Units scaler for totalisers	float32	1f03	7939	1dp
VirtualChannel.7.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1f20	7968	Not applicable
VirtualChannel.7.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1f22	7970	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1f21	7969	Same as VirtualChannel.7.Main.PV
VirtualChannel.8.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01ce	462	Not applicable
VirtualChannel.8.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1fd0	8144	Not applicable
VirtualChannel.8.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1fcb	8139	Not applicable
VirtualChannel.8.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1fc8	8136	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1fca	8138	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1fc2	8130	Not applicable
VirtualChannel.8.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1fc9	8137	Not applicable
VirtualChannel.8.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1fc7	8135	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Dwell	Alarm dwell time	time_t	1fc5	8133	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm1.Hysteresis	Alarm hysteresis value	float32	1fc4	8132	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1fce	8142	Not applicable
VirtualChannel.8.Alarm1.Inhibit	1 = alarm inhibited	bool	1fd1	8145	Not applicable
VirtualChannel.8.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1fc1	8129	Not applicable
VirtualChannel.8.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1fcf	8143	Not applicable
VirtualChannel.8.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1fc6	8134	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	013e	318	Not applicable
VirtualChannel.8.Alarm1.Threshold	Alarm trigger threshold	float32	1fc3	8131	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1fc0	8128	Not applicable
VirtualChannel.8.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01cf	463	Not applicable
VirtualChannel.8.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1ff0	8176	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.8.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1feb	8171	Not applicable
VirtualChannel.8.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1fe8	8168	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1fea	8170	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1fe2	8162	Not applicable
VirtualChannel.8.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1fe9	8169	Not applicable
VirtualChannel.8.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1fe7	8167	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Dwell	Alarm dwell time	time_t	1fe5	8165	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm2.Hysteresis	Alarm hysteresis value	float32	1fe4	8164	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1fee	8174	Not applicable
VirtualChannel.8.Alarm2.Inhibit	1 = alarm inhibited	bool	1ff1	8177	Not applicable
VirtualChannel.8.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1fe1	8161	Not applicable
VirtualChannel.8.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1fef	8175	Not applicable
VirtualChannel.8.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1fe6	8166	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	013f	319	Not applicable
VirtualChannel.8.Alarm2.Threshold	Alarm trigger threshold	float32	1fe3	8163	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1fe0	8160	Not applicable
VirtualChannel.8.Main.Descriptor	Virtual Channel descriptor	string_t	4bbd	19389	Not applicable
VirtualChannel.8.Main.Disable	1 = Virtual channel disabled	bool	1fa3	8099	Not applicable
VirtualChannel.8.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1f85	8069	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Input1	Input 1 value	float32	1f87	8071	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Input2	Input 2 value	float32	1f88	8072	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1f84	8068	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.ModbusInput	Modbus input value	float32	1f86	8070	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1f81	8065	Not applicable
VirtualChannel.8.Main.Period	The time period over which the calculation is made	int32	1f8a	8074	Not applicable
VirtualChannel.8.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1f8c	8076	Not applicable
VirtualChannel.8.Main.PresetValue	The Preset value	float32	1f8d	8077	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.PV	The virtual channel output value	float32	013c	316	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1f8b	8075	Not applicable
VirtualChannel.8.Main.Resolution	Number of decimal places (0 to 6)	uint8	1f82	8066	Not applicable
VirtualChannel.8.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1f91	8081	Not applicable
VirtualChannel.8.Main.RolloverValue	Rollover value	float32	1f92	8082	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Status	As VirtualChannel1.Main.Status	uint8	013d	317	Not applicable
VirtualChannel.8.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1f89	8073	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1f8e	8078	Not applicable
VirtualChannel.8.Main.Type	As VirtualChannel1.Main.Type	uint8	1f80	8064	Not applicable
VirtualChannel.8.Main.Units	Units descriptor	string_t	4bd2	19410	Not applicable
VirtualChannel.8.Main.UnitsScaler	Units scaler for totalisers	float32	1f83	8067	1dp
VirtualChannel.8.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1fa0	8096	Not applicable
VirtualChannel.8.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1fa2	8098	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1fa1	8097	Same as VirtualChannel.8.Main.PV
VirtualChannel.9.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d0	464	Not applicable
VirtualChannel.9.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	2050	8272	Not applicable
VirtualChannel.9.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	204b	8267	Not applicable
VirtualChannel.9.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	2048	8264	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	204a	8266	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2042	8258	Not applicable
VirtualChannel.9.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2049	8265	Not applicable
VirtualChannel.9.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	2047	8263	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Dwell	Alarm dwell time	time_t	2045	8261	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm1.Hysteresis	Alarm hysteresis value	float32	2044	8260	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	204e	8270	Not applicable
VirtualChannel.9.Alarm1.Inhibit	1 = alarm inhibited	bool	2051	8273	Not applicable
VirtualChannel.9.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2041	8257	Not applicable
VirtualChannel.9.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	204f	8271	Not applicable
VirtualChannel.9.Alarm1.Reference	Deviation alarm 'Reference' value	float32	2046	8262	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0142	322	Not applicable
VirtualChannel.9.Alarm1.Threshold	Alarm trigger threshold	float32	2043	8259	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	2040	8256	Not applicable
VirtualChannel.9.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d1	465	Not applicable
VirtualChannel.9.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	2070	8304	Not applicable
VirtualChannel.9.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	206b	8299	Not applicable
VirtualChannel.9.Alarm2.Amount	Rate-of-change alarm 'Amount't	float32	2068	8296	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	206a	8298	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2062	8290	Not applicable
VirtualChannel.9.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2069	8297	Not applicable
VirtualChannel.9.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	2067	8295	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Dwell	Alarm dwell time	time_t	2065	8293	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm2.Hysteresis	Alarm hysteresis value	float32	2064	8292	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	206e	8302	Not applicable
VirtualChannel.9.Alarm2.Inhibit	Inhibit	bool	2071	8305	Not applicable
VirtualChannel.9.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2061	8289	Not applicable
VirtualChannel.9.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	206f	8303	Not applicable
VirtualChannel.9.Alarm2.Reference	Deviation alarm 'Reference' value	float32	2066	8294	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0143	323	Not applicable
VirtualChannel.9.Alarm2.Threshold	Alarm trigger threshold	float32	2063	8291	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	2060	8288	Not applicable
VirtualChannel.9.Main.Descriptor	Virtual Channel descriptor	string_t	4bd8	19416	Not applicable
VirtualChannel.9.Main.Disable	1 = Virtual channel disabled	bool	2023	8227	Not applicable
VirtualChannel.9.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2005	8197	Set by VirtualChannel.9.Main.Resolution

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.9.Main.Input1	Input 1 value	float32	2007	8199	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Input2	Input 2 value	float32	2008	8200	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2004	8196	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.ModbusInput	Modbus input value	float32	2006	8198	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2001	8193	Not applicable
VirtualChannel.9.Main.Period	The time period over which the calculation is made	int32	200a	8202	Not applicable
VirtualChannel.9.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	200c	8204	Not applicable
VirtualChannel.9.Main.PresetValue	The Preset value	float32	200d	8205	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.PV	The virtual channel output value	float32	0140	320	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	200b	8203	Not applicable
VirtualChannel.9.Main.Resolution	Number of decimal places (0 to 6)	uint8	2002	8194	Not applicable
VirtualChannel.9.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2011	8209	Not applicable
VirtualChannel.9.Main.RolloverValue	Rollover value	float32	2012	8210	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Status	As VirtualChannel1.Main.Status	uint8	0141	321	Not applicable
VirtualChannel.9.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2009	8201	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	200e	8206	Not applicable
VirtualChannel.9.Main.Type	As VirtualChannel1.Main.Type	uint8	2000	8192	Not applicable
VirtualChannel.9.Main.Units	Units descriptor	string_t	4bed	19437	Not applicable
VirtualChannel.9.Main.UnitsScaler	Units scaler for totalisers	float32	2003	8195	1dp
VirtualChannel.9.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2020	8224	Not applicable
VirtualChannel.9.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2022	8226	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2021	8225	Same as VirtualChannel.9.Main.PV
VirtualChannel.10.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d2	466	Not applicable
VirtualChannel.10.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	20d0	8400	Not applicable
VirtualChannel.10.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	20cb	8395	Not applicable
VirtualChannel.10.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	20c8	8392	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	20ca	8394	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	20c2	8386	Not applicable
VirtualChannel.10.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	20c9	8393	Not applicable
VirtualChannel.10.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	20c7	8391	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Dwell	Alarm dwell time	time_t	20c5	8389	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm1.Hysteresis	Alarm hysteresis value	float32	20c4	8388	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	20ce	8398	Not applicable
VirtualChannel.10.Alarm1.Inhibit	1 = alarm inhibited	bool	20d1	8401	Not applicable
VirtualChannel.10.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	20c1	8385	Not applicable
VirtualChannel.10.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	20cf	8399	Not applicable
VirtualChannel.10.Alarm1.Reference	Deviation alarm 'Reference' value	float32	20c6	8390	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0146	326	Not applicable
VirtualChannel.10.Alarm1.Threshold	Alarm trigger threshold	float32	20c3	8387	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	20c0	8384	Not applicable
VirtualChannel.10.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d3	467	Not applicable
VirtualChannel.10.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	20f0	8432	Not applicable
VirtualChannel.10.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	20eb	8427	Not applicable
VirtualChannel.10.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	20e8	8424	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	20ea	8426	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	20e2	8418	Not applicable
VirtualChannel.10.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	20e9	8425	Not applicable
VirtualChannel.10.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	20e7	8423	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Dwell	Alarm dwell time	time_t	20e5	8421	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm2.Hysteresis	Alarm hysteresis value	float32	20e4	8420	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	20ee	8430	Not applicable
VirtualChannel.10.Alarm2.Inhibit	1 = alarm inhibited	bool	20f1	8433	Not applicable
VirtualChannel.10.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	20e1	8417	Not applicable
VirtualChannel.10.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	20ef	8431	Not applicable
VirtualChannel.10.Alarm2.Reference	Deviation alarm 'Reference' value	float32	20e6	8422	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0147	327	Not applicable
VirtualChannel.10.Alarm2.Threshold	Alarm trigger threshold	float32	20e3	8419	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	20e0	8416	Not applicable
VirtualChannel.10.Main.Descriptor	Virtual Channel descriptor	string_t	4bf3	19443	Not applicable
VirtualChannel.10.Main.Disable	1 = Virtual channel disabled	bool	20a3	8355	Not applicable
VirtualChannel.10.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2085	8325	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Input1	Input 1 value	float32	2087	8327	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Input2	Input 2 value	float32	2088	8328	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2084	8324	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.ModbusInput	Modbus input value	float32	2086	8326	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2081	8321	Not applicable
VirtualChannel.10.Main.Period	Averaging period	int32	208a	8330	Not applicable
VirtualChannel.10.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	208c	8332	Not applicable
VirtualChannel.10.Main.PresetValue	The Preset value	float32	208d	8333	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.PV	The virtual channel output value	float32	0144	324	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	208b	8331	Not applicable
VirtualChannel.10.Main.Resolution	Number of decimal places (0 to 6)	uint8	2082	8322	Not applicable
VirtualChannel.10.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2091	8337	Not applicable
VirtualChannel.10.Main.RolloverValue	Rollover value	float32	2092	8338	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Status	As VirtualChannel1.Main.Status	uint8	0145	325	Not applicable
VirtualChannel.10.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2089	8329	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	208e	8334	Not applicable
VirtualChannel.10.Main.Type	As VirtualChannel1.Main.Type	uint8	2080	8320	Not applicable
VirtualChannel.10.Main.Units	Units descriptor	string_t	4c08	19464	Not applicable
VirtualChannel.10.Main.UnitsScaler	Units scaler for totalisers	float32	2083	8323	1dp

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.10.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	20a0	8352	Not applicable
VirtualChannel.10.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	20a2	8354	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	20a1	8353	Same as VirtualChannel.10.Main.PV
VirtualChannel.11.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d4	468	Not applicable
VirtualChannel.11.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	2150	8528	Not applicable
VirtualChannel.11.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	214b	8523	Not applicable
VirtualChannel.11.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	2148	8520	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	214a	8522	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2142	8514	Not applicable
VirtualChannel.11.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2149	8521	Not applicable
VirtualChannel.11.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	2147	8519	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Dwell	Alarm dwell time	time_t	2145	8517	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm1.Hysteresis	Alarm hysteresis value	float32	2144	8516	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	214e	8526	Not applicable
VirtualChannel.11.Alarm1.Inhibit	1 = alarm inhibited	bool	2151	8529	Not applicable
VirtualChannel.11.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2141	8513	Not applicable
VirtualChannel.11.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	214f	8527	Not applicable
VirtualChannel.11.Alarm1.Reference	Deviation alarm 'Reference' value	float32	2146	8518	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	014a	330	Not applicable
VirtualChannel.11.Alarm1.Threshold	Alarm trigger threshold	float32	2143	8515	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	2140	8512	Not applicable
VirtualChannel.11.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d5	469	Not applicable
VirtualChannel.11.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	2170	8560	Not applicable
VirtualChannel.11.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	216b	8555	Not applicable
VirtualChannel.11.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	2168	8552	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	216a	8554	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2162	8546	Not applicable
VirtualChannel.11.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2169	8553	Not applicable
VirtualChannel.11.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	2167	8551	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Dwell	Alarm dwell time	time_t	2165	8549	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm2.Hysteresis	Alarm hysteresis value	float32	2164	8548	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	216e	8558	Not applicable
VirtualChannel.11.Alarm2.Inhibit	1 = alarm inhibited	bool	2171	8561	Not applicable
VirtualChannel.11.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2161	8545	Not applicable
VirtualChannel.11.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	216f	8559	Not applicable
VirtualChannel.11.Alarm2.Reference	Deviation alarm 'Reference' value	float32	2166	8550	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	014b	331	Not applicable
VirtualChannel.11.Alarm2.Threshold	Alarm trigger threshold	float32	2163	8547	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	2160	8544	Not applicable
VirtualChannel.11.Main.Descriptor	Virtual Channel descriptor	string_t	4c0e	19470	Not applicable
VirtualChannel.11.Main.Disable	1 = Virtual channel disabled	bool	2123	8483	Not applicable
VirtualChannel.11.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2105	8453	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Input1	Input 1 value	float32	2107	8455	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Input2	Input 2 value	float32	2108	8456	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2104	8452	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.ModbusInput	Modbus input value	float32	2106	8454	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2101	8449	Not applicable
VirtualChannel.11.Main.Period	The time period over which the calculation is made	int32	210a	8458	Not applicable
VirtualChannel.11.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	210c	8460	Not applicable
VirtualChannel.11.Main.PresetValue	The Preset value	float32	210d	8461	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.PV	The virtual channel output value	float32	0148	328	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	210b	8459	Not applicable
VirtualChannel.11.Main.Resolution	Number of decimal places (0 to 6)	uint8	2102	8450	Not applicable
VirtualChannel.11.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2111	8465	Not applicable
VirtualChannel.11.Main.RolloverValue	Rollover value	float32	2112	8466	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Status	As VirtualChannel1.Main.Status	uint8	0149	329	Not applicable
VirtualChannel.11.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2109	8457	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	210e	8462	Not applicable
VirtualChannel.11.Main.Type	As VirtualChannel1.Main.Type	uint8	2100	8448	Not applicable
VirtualChannel.11.Main.Units	Units descriptor	string_t	4c23	19491	Not applicable
VirtualChannel.11.Main.UnitsScaler	Units scaler for totalisers	float32	2103	8451	1dp
VirtualChannel.11.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2120	8480	Not applicable
VirtualChannel.11.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2122	8482	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2121	8481	Same as VirtualChannel.11.Main.PV
VirtualChannel.12.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d6	470	Not applicable
VirtualChannel.12.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	21d0	8656	Not applicable
VirtualChannel.12.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	21cb	8651	Not applicable
VirtualChannel.12.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	21c8	8648	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	21ca	8650	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	21c2	8642	Not applicable
VirtualChannel.12.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	21c9	8649	Not applicable
VirtualChannel.12.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	21c7	8647	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.Dwell	Alarm dwell time	time_t	21c5	8645	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm1.Hysteresis	Alarm hysteresis value	float32	21c4	8644	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	21ce	8654	Not applicable
VirtualChannel.12.Alarm1.Inhibit	1 = alarm inhibited	bool	21d1	8657	Not applicable
VirtualChannel.12.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	21c1	8641	Not applicable
VirtualChannel.12.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	21cf	8655	Not applicable
VirtualChannel.12.Alarm1.Reference	Deviation alarm 'Reference' value	float32	21c6	8646	Same as VirtualChannel.12.Main.PV

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.12.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	014e	334	Not applicable
VirtualChannel.12.Alarm1.Threshold	Alarm trigger threshold	float32	21c3	8643	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	21c0	8640	Not applicable
VirtualChannel.12.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d7	471	Not applicable
VirtualChannel.12.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	21f0	8688	Not applicable
VirtualChannel.12.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	21eb	8683	Not applicable
VirtualChannel.12.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	21e8	8680	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	21ea	8682	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	21e2	8674	Not applicable
VirtualChannel.12.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	21e9	8681	Not applicable
VirtualChannel.12.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	21e7	8679	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Dwell	Alarm dwell time	time_t	21e5	8677	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm2.Hysteresis	Alarm hysteresis value	float32	21e4	8676	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	21ee	8686	Not applicable
VirtualChannel.12.Alarm2.Inhibit	1 = alarm inhibited	bool	21f1	8689	Not applicable
VirtualChannel.12.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	21e1	8673	Not applicable
VirtualChannel.12.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	21ef	8687	Not applicable
VirtualChannel.12.Alarm2.Reference	Deviation alarm 'Reference' value	float32	21e6	8678	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	014f	335	Not applicable
VirtualChannel.12.Alarm2.Threshold	Alarm trigger threshold	float32	21e3	8675	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	21e0	8672	Not applicable
VirtualChannel.12.Main.Descriptor	Virtual Channel descriptorl	string_t	4c29	19497	Not applicable
VirtualChannel.12.Main.Disable	1 = Virtual channel disabled	bool	21a3	8611	Not applicable
VirtualChannel.12.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2185	8581	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Input1	Input 1 value	float32	2187	8583	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Input2	Input 2 value	float32	2188	8584	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2184	8580	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.ModbusInput	Modbus input value	float32	2186	8582	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2181	8577	Not applicable
VirtualChannel.12.Main.Period	The time period over which the calculation is made	int32	218a	8586	Not applicable
VirtualChannel.12.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	218c	8588	Not applicable
VirtualChannel.12.Main.PresetValue	The Preset value	float32	218d	8589	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.PV	The virtual channel output value	float32	014c	332	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	218b	8587	Not applicable
VirtualChannel.12.Main.Resolution	Number of decimal places (0 to 6)	uint8	2182	8578	Not applicable
VirtualChannel.12.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2191	8593	Not applicable
VirtualChannel.12.Main.RolloverValue	Rollover value	float32	2192	8594	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Status	As VirtualChannel1.Main.Status	uint8	014d	333	Not applicable
VirtualChannel.12.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2189	8585	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	218e	8590	Not applicable
VirtualChannel.12.Main.Type	As VirtualChannel1.Main.Type	uint8	2180	8576	Not applicable
VirtualChannel.12.Main.Units	Units descriptor	string_t	4c3e	19518	Not applicable
VirtualChannel.12.Main.UnitsScaler	Units scaler for totalisers	float32	2183	8579	1dp
VirtualChannel.12.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	21a0	8608	Not applicable
VirtualChannel.12.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	21a2	8610	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	21a1	8609	Same as VirtualChannel.12.Main.PV
VirtualChannel.13.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d8	472	Not applicable
VirtualChannel.13.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	2250	8784	Not applicable
VirtualChannel.13.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	224b	8779	Not applicable
VirtualChannel.13.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	2248	8776	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	224a	8778	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2242	8770	Not applicable
VirtualChannel.13.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2249	8777	Not applicable
VirtualChannel.13.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	2247	8775	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Dwell	Alarm dwell time	time_t	2245	8773	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm1.Hysteresis	Alarm hysteresis value	float32	2244	8772	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Inhibit	1 = alarm inhibited	bool	2251	8785	Not applicable
VirtualChannel.13.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	224e	8782	Not applicable
VirtualChannel.13.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2241	8769	Not applicable
VirtualChannel.13.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	224f	8783	Not applicable
VirtualChannel.13.Alarm1.Reference	Deviation alarm 'Reference' value	float32	2246	8774	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0152	338	Not applicable
VirtualChannel.13.Alarm1.Threshold	Alarm trigger threshold	float32	2243	8771	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	2240	8768	Not applicable
VirtualChannel.13.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d9	473	Not applicable
VirtualChannel.13.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	2270	8816	Not applicable
VirtualChannel.13.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	226b	8811	Not applicable
VirtualChannel.13.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	2268	8808	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	226a	8810	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2262	8802	Not applicable
VirtualChannel.13.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2269	8809	Not applicable
VirtualChannel.13.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	2267	8807	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Dwell	Alarm dwell time	time_t	2265	8805	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm2.Hysteresis	Alarm hysteresis value	float32	2264	8804	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	226e	8814	Not applicable
VirtualChannel.13.Alarm2.Inhibit	1 = alarm inhibited	bool	2271	8817	Not applicable
VirtualChannel.13.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2261	8801	Not applicable
VirtualChannel.13.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	226f	8815	Not applicable
VirtualChannel.13.Alarm2.Reference	Deviation alarm 'Reference' value	float32	2266	8806	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0153	339	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.13.Alarm2.Threshold	Alarm trigger threshold	float32	2263	8803	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	2260	8800	Not applicable
VirtualChannel.13.Main.Descriptor	Virtual Channel descriptor	string_t	4c44	19524	Not applicable
VirtualChannel.13.Main.Disable	1 = Virtual channel disabled	bool	2223	8739	Not applicable
VirtualChannel.13.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2205	8709	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Input1	Input 1 value	float32	2207	8711	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Input2	Input 2 value	float32	2208	8712	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2204	8708	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.ModbusInput	Modbus input value	float32	2206	8710	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2201	8705	Not applicable
VirtualChannel.13.Main.Period	The time period over which the calculation is made	int32	220a	8714	Not applicable
VirtualChannel.13.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	220c	8716	Not applicable
VirtualChannel.13.Main.PresetValue	The Preset value	float32	220d	8717	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.PV	The virtual channel output value	float32	0150	336	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	220b	8715	Not applicable
VirtualChannel.13.Main.Resolution	Number of decimal places (0 to 6)	uint8	2202	8706	Not applicable
VirtualChannel.13.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2211	8721	Not applicable
VirtualChannel.13.Main.RolloverValue	Rollover value	float32	2212	8722	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Status	As VirtualChannel1.Main.Status	uint8	0151	337	Not applicable
VirtualChannel.13.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2209	8713	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	220e	8718	Not applicable
VirtualChannel.13.Main.Type	As VirtualChannel1.Main.Type	uint8	2200	8704	Not applicable
VirtualChannel.13.Main.Units	Units descriptor	string_t	4c59	19545	Not applicable
VirtualChannel.13.Main.UnitsScaler	Units scaler for totalisers	float32	2203	8707	1dp
VirtualChannel.13.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2220	8736	Not applicable
VirtualChannel.13.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2222	8738	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2221	8737	Same as VirtualChannel.13.Main.PV
VirtualChannel.14.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01da	474	Not applicable
VirtualChannel.14.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	22d0	8912	Not applicable
VirtualChannel.14.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	22cb	8907	Not applicable
VirtualChannel.14.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	22c8	8904	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	22ca	8906	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	22c2	8898	Not applicable
VirtualChannel.14.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	22c9	8905	Not applicable
VirtualChannel.14.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	22c7	8903	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Dwell	Alarm dwell time	time_t	22c5	8901	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm1.Hysteresis	Alarm hysteresis value	float32	22c4	8900	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	22ce	8910	Not applicable
VirtualChannel.14.Alarm1.Inhibit	1 = alarm inhibited	bool	22d1	8913	Not applicable
VirtualChannel.14.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	22c1	8897	Not applicable
VirtualChannel.14.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	22cf	8911	Not applicable
VirtualChannel.14.Alarm1.Reference	Deviation alarm 'Reference' value	float32	22c6	8902	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0156	342	Not applicable
VirtualChannel.14.Alarm1.Threshold	Alarm trigger threshold	float32	22c3	8899	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	22c0	8896	Not applicable
VirtualChannel.14.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01db	475	Not applicable
VirtualChannel.14.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	22f0	8944	Not applicable
VirtualChannel.14.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	22eb	8939	Not applicable
VirtualChannel.14.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	22e8	8936	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	22ea	8938	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	22e2	8930	Not applicable
VirtualChannel.14.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	22e9	8937	Not applicable
VirtualChannel.14.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	22e7	8935	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Dwell	Alarm dwell time	time_t	22e5	8933	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm2.Hysteresis	Alarm hysteresis value	float32	22e4	8932	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	22ee	8942	Not applicable
VirtualChannel.14.Alarm2.Inhibit	1 = alarm inhibited	bool	22f1	8945	Not applicable
VirtualChannel.14.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	22e1	8929	Not applicable
VirtualChannel.14.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	22ef	8943	Not applicable
VirtualChannel.14.Alarm2.Reference	Deviation alarm 'Reference' value	float32	22e6	8934	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0157	343	Not applicable
VirtualChannel.14.Alarm2.Threshold	Alarm trigger threshold	float32	22e3	8931	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	22e0	8928	Not applicable
VirtualChannel.14.Main.Descriptor	Virtual Channel descriptor	string_t	4c5f	19551	Not applicable
VirtualChannel.14.Main.Disable	1 = Virtual channel disabled	bool	22a3	8867	Not applicable
VirtualChannel.14.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2285	8837	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Input1	Input 1 value	float32	2287	8839	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Input2	Input 2 value	float32	2288	8840	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2284	8836	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.ModbusInput	Modbus input value	float32	2286	8838	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2281	8833	Not applicable
VirtualChannel.14.Main.Period	The time period over which the calculation is made	int32	228a	8842	Not applicable
VirtualChannel.14.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	228c	8844	Not applicable
VirtualChannel.14.Main.PresetValue	The preset value	float32	228d	8845	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.PV	The virtual channel output value	float32	0154	340	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	228b	8843	Not applicable
VirtualChannel.14.Main.Resolution	Number of decimal places (0 to 6)	uint8	2282	8834	Not applicable
VirtualChannel.14.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2291	8849	Not applicable
VirtualChannel.14.Main.RolloverValue	Rollover value	float32	2292	8850	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Status	As VirtualChannel1.Main.Status	uint8	0155	341	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.14.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2289	8841	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	228e	8846	Not applicable
VirtualChannel.14.Main.Type	As VirtualChannel1.Main.Type	uint8	2280	8832	Not applicable
VirtualChannel.14.Main.Units	Units descriptor	string_t	4c75	19573	Not applicable
VirtualChannel.14.Main.UnitsScaler	Units scaler for totalisers	float32	2283	8835	1dp
VirtualChannel.14.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	22a0	8864	Not applicable
VirtualChannel.14.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	22a2	8866	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	22a1	8865	Same as VirtualChannel.14.Main.PV
VirtualChannel.15.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01de	478	Not applicable
VirtualChannel.15.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	2350	9040	Not applicable
VirtualChannel.15.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	234b	9035	Not applicable
VirtualChannel.15.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	2348	9032	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	234a	9034	Set by Network.Modbus.TimeFormat
VirtualChannel.15.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2342	9026	Not applicable
VirtualChannel.15.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2349	9033	Not applicable
VirtualChannel.15.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	2347	9031	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm1.Dwell	Alarm dwell time	time_t	2345	9029	Set by Network.Modbus.TimeFormat
VirtualChannel.15.Alarm1.Hysteresis	Alarm hysteresis value	float32	2344	9028	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	234e	9038	Not applicable
VirtualChannel.15.Alarm1.Inhibit	1 = Alarm inhibited	bool	2351	9041	Not applicable
VirtualChannel.15.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2341	9025	Not applicable
VirtualChannel.15.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	234f	9039	Not applicable
VirtualChannel.15.Alarm1.Reference	Deviation alarm 'Reference' value	float32	2346	9030	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	015a	346	Not applicable
VirtualChannel.15.Alarm1.Threshold	Alarm trigger threshold	float32	2343	9027	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	2340	9024	Not applicable
VirtualChannel.15.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01dd	477	Not applicable
VirtualChannel.15.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	2370	9072	Not applicable
VirtualChannel.15.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	236b	9067	Not applicable
VirtualChannel.15.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	2368	9064	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	236a	9066	Set by Network.Modbus.TimeFormat
VirtualChannel.15.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2362	9058	Not applicable
VirtualChannel.15.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2369	9065	Not applicable
VirtualChannel.15.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	2367	9063	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm2.Dwell	Alarm dwell time	time_t	2365	9061	Set by Network.Modbus.TimeFormat
VirtualChannel.15.Alarm2.Hysteresis	Alarm hysteresis value	float32	2364	9060	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	236e	9070	Not applicable
VirtualChannel.15.Alarm2.Inhibit	1 = alarm inhibited	bool	2371	9073	Not applicable
VirtualChannel.15.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2361	9057	Not applicable
VirtualChannel.15.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	236f	9071	Not applicable
VirtualChannel.15.Alarm2.Reference	Deviation alarm 'Reference' value	float32	2366	9062	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	015b	347	Not applicable
VirtualChannel.15.Alarm2.Threshold	Alarm trigger threshold	float32	2363	9059	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	2360	9056	Not applicable
VirtualChannel.15.Main.Descriptor	Virtual Channel descriptor	string_t	4c7b	19579	Not applicable
VirtualChannel.15.Main.Disable	1 = Virtual channel disabled	bool	2323	8995	Not applicable
VirtualChannel.15.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2305	8965	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.Input1	Input 1 value	float32	2307	8967	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.Input2	Input 2 value	float32	2308	8968	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2304	8964	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.ModbusInput	Modbus input value	float32	2306	8966	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.Operation	Specifies the operation of the virtual channel	uint8	2301	8961	Not applicable
VirtualChannel.15.Main.Period	The time period over which the calculation is made	int32	230a	8970	Not applicable
VirtualChannel.15.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	230c	8972	Not applicable
VirtualChannel.15.Main.PresetValue	Specifies the preset value	float32	230d	8973	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.PV	The virtual channel output value	float32	0158	344	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	230b	8971	Not applicable
VirtualChannel.15.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2302	8962	Not applicable
VirtualChannel.15.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2311	8977	Not applicable
VirtualChannel.15.Main.RolloverValue	Rollover value	float32	2312	8978	Set by VirtualChannel.15.Main.Resolution
VirtualChannel.15.Main.Status	As VirtualChannel1.Main.Status	uint8	0159	345	Not applicable
VirtualChannel.15.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2309	8969	Set by Network.Modbus.TimeFormat
VirtualChannel.15.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	230e	8974	Not applicable
VirtualChannel.15.Main.Type	As VirtualChannel1.Main.Type	uint8	2300	8960	Not applicable
VirtualChannel.15.Main.Units	Units descriptor	string_t	4c90	19600	Not applicable
VirtualChannel.15.Main.UnitsScaler	Units scaler for totalisers	float32	2303	8963	1dp
VirtualChannel.15.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2320	8992	Not applicable
VirtualChannel.15.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2322	8994	Same as VirtualChannel.15.Main.PV
VirtualChannel.15.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2321	8993	Same as VirtualChannel.15.Main.PV
VirtualChannel.16.Main.Descriptor	Virtual Channel descriptor	string_t	4c96	19606	Not applicable
VirtualChannel.16.Main.Disable	1 = Virtual channel disabled	bool	23a3	9123	Not applicable
VirtualChannel.16.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2385	9093	Set by VirtualChannel.16.Main.Resolution
VirtualChannel.16.Main.Input1	Input 1 value	float32	2387	9095	Set by VirtualChannel.16.Main.Resolution
VirtualChannel.16.Main.Input2	Input 2 value	float32	2388	9096	Set by VirtualChannel.16.Main.Resolution
VirtualChannel.16.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2384	9092	Set by VirtualChannel.16.Main.Resolution
VirtualChannel.16.Main.ModbusInput	Modbus input value	float32	2386	9094	Set by VirtualChannel.16.Main.Resolution
VirtualChannel.16.Main.Operation	Specifies the operation of the virtual channel	uint8	2381	9089	Not applicable
VirtualChannel.16.Main.Period	The time period over which the calculation is made	int32	238a	9098	Not applicable
VirtualChannel.16.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	238c	9100	Not applicable
VirtualChannel.16.Main.PresetValue	Specifies the preset value	float32	238d	9101	Set by VirtualChannel.16.Main.Resolution

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.16.Main.PV	The virtual channel output value	float32	015c	348	Set by VirtualChannel.16.Main.Resolution
VirtualChannel.16.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	238b	9099	Not applicable
VirtualChannel.16.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2382	9090	Not applicable
VirtualChannel.16.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2391	9105	Not applicable
VirtualChannel.16.Main.RolloverValue	Rollover value	float32	2392	9106	Set by VirtualChannel.16.Main.Resolution
VirtualChannel.16.Main.Status	As VirtualChannel1.Main.Status	uint8	015d	349	Not applicable
VirtualChannel.16.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2389	9097	Set by Network.Modbus.TimeFormat
VirtualChannel.16.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	238e	9102	Not applicable
VirtualChannel.16.Main.Type	As VirtualChannel1.Main.Type	uint8	2380	9088	Not applicable
VirtualChannel.16.Main.Units	Units descriptor	string_t	4cab	19627	Not applicable
VirtualChannel.16.Main.UnitsScaler	Units scaler for totalisers	float32	2383	9091	1dp
VirtualChannel.16.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	23a0	9120	Not applicable
VirtualChannel.16.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	23a2	9122	Same as VirtualChannel.16.Main.PV
VirtualChannel.16.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	23a1	9121	Same as VirtualChannel.16.Main.PV
VirtualChannel.17.Main.Descriptor	Virtual Channel descriptor	string_t	4cb1	19633	Not applicable
VirtualChannel.17.Main.Disable	1 = Virtual channel disabled	bool	23e3	9187	Not applicable
VirtualChannel.17.Main.HighCutOff	The highest input value that will be totalised/counted	float32	23c5	9157	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.Input1	Input 1 value	float32	23c7	9159	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.Input2	Input 2 value	float32	23c8	9160	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	23c4	9156	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.ModbusInput	Modbus input value	float32	23c6	9158	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.Operation	Specifies the operation of the virtual channel	uint8	23c1	9153	Not applicable
VirtualChannel.17.Main.Period	The time period over which the calculation is made	int32	23ca	9162	Not applicable
VirtualChannel.17.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	23cc	9164	Not applicable
VirtualChannel.17.Main.PresetValue	Specifies the preset value	float32	23cd	9165	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.PV	The virtual channel output value	float32	015e	350	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	23cb	9163	Not applicable
VirtualChannel.17.Main.Resolution	Specifies the resolution/number of decimal places	uint8	23c2	9154	Not applicable
VirtualChannel.17.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	23d1	9169	Not applicable
VirtualChannel.17.Main.RolloverValue	Rollover value	float32	23d2	9170	Set by VirtualChannel.17.Main.Resolution
VirtualChannel.17.Main.Status	As VirtualChannel1.Main.Status	uint8	015f	351	Not applicable
VirtualChannel.17.Main.TimeRemaining	Time remaining before the calculation is made	time_t	23c9	9161	Set by Network.Modbus.TimeFormat
VirtualChannel.17.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	23ce	9166	Not applicable
VirtualChannel.17.Main.Type	As VirtualChannel1.Main.Type	uint8	23c0	9152	Not applicable
VirtualChannel.17.Main.Units	Units descriptor	string_t	4cc6	19654	Not applicable
VirtualChannel.17.Main.UnitsScaler	Units scaler for totalisers	float32	23c3	9155	1dp
VirtualChannel.17.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	23e0	9184	Not applicable
VirtualChannel.17.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	23e2	9186	Same as VirtualChannel.17.Main.PV
VirtualChannel.17.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	23e1	9185	Same as VirtualChannel.17.Main.PV
VirtualChannel.18.Main.Descriptor	Virtual Channel descriptor	string_t	4ccc	19660	Not applicable
VirtualChannel.18.Main.Disable	1 = Virtual channel disabled	bool	2523	9507	Not applicable
VirtualChannel.18.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2405	9221	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.Input1	Input 1 value	float32	2407	9223	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.Input2	Input 2 value	float32	2408	9224	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2404	9220	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.ModbusInput	Modbus input value	float32	2406	9222	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.Operation	Specifies the operation of the virtual channel	uint8	2401	9217	Not applicable
VirtualChannel.18.Main.Period	The time period over which the calculation is made	int32	240a	9226	Not applicable
VirtualChannel.18.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	240c	9228	Not applicable
VirtualChannel.18.Main.PresetValue	Specifies the preset value	float32	240d	9229	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.PV	The virtual channel output value	float32	0160	352	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	240b	9227	Not applicable
VirtualChannel.18.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2402	9218	Not applicable
VirtualChannel.18.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2411	9233	Not applicable
VirtualChannel.18.Main.RolloverValue	Rollover value	float32	2412	9234	Set by VirtualChannel.18.Main.Resolution
VirtualChannel.18.Main.Status	As VirtualChannel1.Main.Status	uint8	0161	353	Not applicable
VirtualChannel.18.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2409	9225	Set by Network.Modbus.TimeFormat
VirtualChannel.18.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes)	bool	240e	9230	Not applicable
VirtualChannel.18.Main.Type	As VirtualChannel1.Main.Type	uint8	2400	9216	Not applicable
VirtualChannel.18.Main.Units	Units descriptor	string_t	4ce1	19681	Not applicable
VirtualChannel.18.Main.UnitsScaler	Units scaler for totalisers	float32	2403	9219	1dp
VirtualChannel.18.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2520	9504	Not applicable
VirtualChannel.18.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2522	9506	Same as VirtualChannel.18.Main.PV
VirtualChannel.18.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2521	9505	Same as VirtualChannel.18.Main.PV
VirtualChannel.19.Main.Descriptor	Virtual Channel descriptor	string_t	4ce7	19687	Not applicable
VirtualChannel.19.Main.Disable	1 = Virtual channel disabled	bool	2563	9571	Not applicable
VirtualChannel.19.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2445	9285	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.Input1	Input 1 value	float32	2447	9287	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.Input2	Input 2 value	float32	2448	9288	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2444	9284	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.ModbusInput	Modbus input value	float32	2446	9286	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.Operation	Specifies the operation of the virtual channel	uint8	2441	9281	Not applicable
VirtualChannel.19.Main.Period	The time period over which the calculation is made	int32	244a	9290	Not applicable
VirtualChannel.19.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	244c	9292	Not applicable
VirtualChannel.19.Main.PresetValue	Specifies the preset value	float32	244d	9293	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.PV	The virtual channel output value	float32	0162	354	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	244b	9291	Not applicable
VirtualChannel.19.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2442	9282	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.19.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2451	9297	Not applicable
VirtualChannel.19.Main.RolloverValue	Rollover value	float32	2452	9298	Set by VirtualChannel.19.Main.Resolution
VirtualChannel.19.Main.Status	TAs VirtualChannel1.Main.Statusv	uint8	0163	355	Not applicable
VirtualChannel.19.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2449	9289	Set by Network.Modbus.TimeFormat
VirtualChannel.19.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	244e	9294	Not applicable
VirtualChannel.19.Main.Type	As VirtualChannel1.Main.Type	uint8	2440	9280	Not applicable
VirtualChannel.19.Main.Units	Units descriptor	string_t	4cfc	19708	Not applicable
VirtualChannel.19.Main.UnitsScaler	Units scaler for totalisers	float32	2443	9283	1dp
VirtualChannel.19.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2560	9568	Not applicable
VirtualChannel.19.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2562	9570	Same as VirtualChannel.19.Main.PV
VirtualChannel.19.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2561	9569	Same as VirtualChannel.19.Main.PV
VirtualChannel.20.Main.Descriptor	Virtual Channel descriptor	string_t	4d02	19714	Not applicable
VirtualChannel.20.Main.Disable	1 = Virtual channel disabled	bool	25a3	9635	Not applicable
VirtualChannel.20.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2485	9349	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.Input1	Input 1 value	float32	2487	9351	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.Input2	Input 2 value	float32	2488	9352	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2484	9348	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.ModbusInput	Modbus input value	float32	2486	9350	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.Operation	Specifies the operation of the virtual channel	uint8	2481	9345	Not applicable
VirtualChannel.20.Main.Period	The time period over which the calculation is made	int32	248a	9354	Not applicable
VirtualChannel.20.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	248c	9356	Not applicable
VirtualChannel.20.Main.PresetValue	Specifies the preset value	float32	248d	9357	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.PV	The virtual channel output value	float32	0164	356	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	248b	9355	Not applicable
VirtualChannel.20.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2482	9346	Not applicable
VirtualChannel.20.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2491	9361	Not applicable
VirtualChannel.20.Main.RolloverValue	Rollover value	float32	2492	9362	Set by VirtualChannel.20.Main.Resolution
VirtualChannel.20.Main.Status	As VirtualChannel1.Main.Status	uint8	0165	357	Not applicable
VirtualChannel.20.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2489	9353	Set by Network.Modbus.TimeFormat
VirtualChannel.20.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	248e	9358	Not applicable
VirtualChannel.20.Main.Type	As VirtualChannel1.Main.Type	uint8	2480	9344	Not applicable
VirtualChannel.20.Main.Units	Units descriptor	string_t	4d17	19735	Not applicable
VirtualChannel.20.Main.UnitsScaler	Units scaler for totalisers	float32	2483	9347	1dp
VirtualChannel.20.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	25a0	9632	Not applicable
VirtualChannel.20.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	25a2	9634	Same as VirtualChannel.20.Main.PV
VirtualChannel.20.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	25a1	9633	Same as VirtualChannel.20.Main.PV
VirtualChannel.21.Main.Descriptor	Virtual Channel descriptor	string_t	4d1d	19741	Not applicable
VirtualChannel.21.Main.Disable	1 = Virtual channel disabled	bool	25e3	9699	Not applicable
VirtualChannel.21.Main.HighCutOff	The highest input value that will be totalised/counted	float32	24c5	9413	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.Input1	Input 1 value	float32	24c7	9415	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.Input2	Input 2 value	float32	24c8	9416	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	24c4	9412	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.ModbusInput	Modbus input value	float32	24c6	9414	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.Operation	Specifies the operation of the virtual channel	uint8	24c1	9409	Not applicable
VirtualChannel.21.Main.Period	The time period over which the calculation is made	int32	24ca	9418	Not applicable
VirtualChannel.21.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	24cc	9420	Not applicable
VirtualChannel.21.Main.PresetValue	Specifies the preset value	float32	24cd	9421	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.PV	The virtual channel output value	float32	0166	358	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	24cb	9419	Not applicable
VirtualChannel.21.Main.Resolution	Specifies the resolution/number of decimal places	uint8	24c2	9410	Not applicable
VirtualChannel.21.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	24d1	9425	Not applicable
VirtualChannel.21.Main.RolloverValue	Rollover value	float32	24d2	9426	Set by VirtualChannel.21.Main.Resolution
VirtualChannel.21.Main.Status	As VirtualChannel1.Main.Status	uint8	0167	359	Not applicable
VirtualChannel.21.Main.TimeRemaining	Time remaining before the calculation is made	time_t	24c9	9417	Set by Network.Modbus.TimeFormat
VirtualChannel.21.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	24ce	9422	Not applicable
VirtualChannel.21.Main.Type	As VirtualChannel1.Main.Type	uint8	24c0	9408	Not applicable
VirtualChannel.21.Main.Units	Units descriptor	string_t	4d32	19762	Not applicable
VirtualChannel.21.Main.UnitsScaler	Units scaler for totalisers	float32	24c3	9411	1dp
VirtualChannel.21.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	25e0	9696	Not applicable
VirtualChannel.21.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	25e2	9698	Same as VirtualChannel.21.Main.PV
VirtualChannel.21.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	25e1	9697	Same as VirtualChannel.21.Main.PV
VirtualChannel.22.Main.Descriptor	Virtual Channel descriptor	string_t	4d38	19768	Not applicable
VirtualChannel.22.Main.Disable	1 = Virtual channel disabled	bool	2623	9763	Not applicable
VirtualChannel.22.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2505	9477	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.Input1	Input 1 value	float32	2507	9479	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.Input2	Input 2 value	float32	2508	9480	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2504	9476	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.ModbusInput	Modbus input value	float32	2506	9478	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.Operation	Specifies the operation of the virtual channel	uint8	2501	9473	Not applicable
VirtualChannel.22.Main.Period	The time period over which the calculation is made	int32	250a	9482	Not applicable
VirtualChannel.22.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	250c	9484	Not applicable
VirtualChannel.22.Main.PresetValue	Specifies the preset value	float32	250d	9485	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.PV	The virtual channel output value	float32	0168	360	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	250b	9483	Not applicable
VirtualChannel.22.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2502	9474	Not applicable
VirtualChannel.22.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2511	9489	Not applicable
VirtualChannel.22.Main.RolloverValue	Rollover value	float32	2512	9490	Set by VirtualChannel.22.Main.Resolution
VirtualChannel.22.Main.Status	As VirtualChannel1.Main.Status	uint8	0169	361	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.22.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2509	9481	Set by Network.Modbus.TimeFormat
VirtualChannel.22.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	250e	9486	Not applicable
VirtualChannel.22.Main.Type	As VirtualChannel1.Main.Type	uint8	2500	9472	Not applicable
VirtualChannel.22.Main.Units	Units descriptor	string_t	4d4d	19789	Not applicable
VirtualChannel.22.Main.UnitsScaler	Units scaler for totalisers	float32	2503	9475	1dp
VirtualChannel.22.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2620	9760	Not applicable
VirtualChannel.22.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2622	9762	Same as VirtualChannel.22.Main.PV
VirtualChannel.22.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2621	9761	Same as VirtualChannel.22.Main.PV
VirtualChannel.23.Main.Descriptor	Virtual Channel descriptor	string_t	4d53	19795	Not applicable
VirtualChannel.23.Main.Disable	1 = Virtual channel disabled	bool	2663	9827	Not applicable
VirtualChannel.23.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2545	9541	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.Input1	Input 1 value	float32	2547	9543	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.Input2	Input 2 value	float32	2548	9544	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2544	9540	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.ModbusInput	Modbus input value	float32	2546	9542	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.Operation	Specifies the operation of the virtual channel	uint8	2541	9537	Not applicable
VirtualChannel.23.Main.Period	The time period over which the calculation is made	int32	254a	9546	Not applicable
VirtualChannel.23.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	254c	9548	Not applicable
VirtualChannel.23.Main.PresetValue	Specifies the preset value	float32	254d	9549	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.PV	The virtual channel output value	float32	016a	362	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	254b	9547	Not applicable
VirtualChannel.23.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2542	9538	Not applicable
VirtualChannel.23.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2551	9553	Not applicable
VirtualChannel.23.Main.RolloverValue	Rollover value	float32	2552	9554	Set by VirtualChannel.23.Main.Resolution
VirtualChannel.23.Main.Status	As VirtualChannel1.Main.Status	uint8	016b	363	Not applicable
VirtualChannel.23.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2549	9545	Set by Network.Modbus.TimeFormat
VirtualChannel.23.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	254e	9550	Not applicable
VirtualChannel.23.Main.Type	As VirtualChannel1.Main.Type	uint8	2540	9536	Not applicable
VirtualChannel.23.Main.Units	Units descriptor	string_t	4d68	19816	Not applicable
VirtualChannel.23.Main.UnitsScaler	Units scaler for totalisers	float32	2543	9539	1dp
VirtualChannel.23.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2660	9824	Not applicable
VirtualChannel.23.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2662	9826	Same as VirtualChannel.23.Main.PV
VirtualChannel.23.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2661	9825	Same as VirtualChannel.23.Main.PV
VirtualChannel.24.Main.Descriptor	Virtual Channel descriptor	string_t	4d6e	19822	Not applicable
VirtualChannel.24.Main.Disable	1 = Virtual channel disabled	bool	26a3	9891	Not applicable
VirtualChannel.24.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2585	9605	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.Input1	Input 1 value	float32	2587	9607	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.Input2	Input 2 value	float32	2588	9608	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2584	9604	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.ModbusInput	Modbus input value	float32	2586	9606	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.Operation	Specifies the operation of the virtual channel	uint8	2581	9601	Not applicable
VirtualChannel.24.Main.Period	The time period over which the calculation is made	int32	258a	9610	Not applicable
VirtualChannel.24.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	258c	9612	Not applicable
VirtualChannel.24.Main.PresetValue	Specifies the preset value	float32	258d	9613	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.PV	The virtual channel output value	float32	016c	364	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	258b	9611	Not applicable
VirtualChannel.24.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2582	9602	Not applicable
VirtualChannel.24.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2591	9617	Not applicable
VirtualChannel.24.Main.RolloverValue	Rollover value	float32	2592	9618	Set by VirtualChannel.24.Main.Resolution
VirtualChannel.24.Main.Status	As VirtualChannel1.Main.Status	uint8	016d	365	Not applicable
VirtualChannel.24.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2589	9609	Set by Network.Modbus.TimeFormat
VirtualChannel.24.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	258e	9614	Not applicable
VirtualChannel.24.Main.Type	As VirtualChannel1.Main.Type	uint8	2580	9600	Not applicable
VirtualChannel.24.Main.Units	Units descriptor	string_t	4d83	19843	Not applicable
VirtualChannel.24.Main.UnitsScaler	Units scaler for totalisers	float32	2583	9603	1dp
VirtualChannel.24.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	26a0	9888	Not applicable
VirtualChannel.24.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	26a2	9890	Same as VirtualChannel.24.Main.PV
VirtualChannel.24.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	26a1	9889	Same as VirtualChannel.24.Main.PV
VirtualChannel.25.Main.Descriptor	Virtual Channel descriptor	string_t	4d89	19849	Not applicable
VirtualChannel.25.Main.Disable	1 = Virtual channel disabled	bool	26e3	9955	Not applicable
VirtualChannel.25.Main.HighCutOff	The highest input value that will be totalised/counted	float32	25c5	9669	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.Input1	Input 1 value	float32	25c7	9671	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.Input2	Input 2 value	float32	25c8	9672	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	25c4	9668	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.ModbusInput	Modbus input value	float32	25c6	9670	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.Operation	Specifies the operation of the virtual channel	uint8	25c1	9665	Not applicable
VirtualChannel.25.Main.Period	The time period over which the calculation is made	int32	25ca	9674	Not applicable
VirtualChannel.25.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	25cc	9676	Not applicable
VirtualChannel.25.Main.PresetValue	Specifies the preset value	float32	25cd	9677	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.PV	The virtual channel output value	float32	016e	366	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	25cb	9675	Not applicable
VirtualChannel.25.Main.Resolution	Specifies the resolution/number of decimal places	uint8	25c2	9666	Not applicable
VirtualChannel.25.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	25d1	9681	Not applicable
VirtualChannel.25.Main.RolloverValue	Rollover value	float32	25d2	9682	Set by VirtualChannel.25.Main.Resolution
VirtualChannel.25.Main.Status	As VirtualChannel1.Main.Status	uint8	016f	367	Not applicable
VirtualChannel.25.Main.TimeRemaining	Time remaining before the calculation is made	time_t	25c9	9673	Set by Network.Modbus.TimeFormat
VirtualChannel.25.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	25ce	9678	Not applicable
VirtualChannel.25.Main.Type	As VirtualChannel1.Main.Type	uint8	25c0	9664	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.25.Main.Units	Units descriptor	string_t	4d9e	19870	Not applicable
VirtualChannel.25.Main.UnitsScaler	Units scaler for totalisers	float32	25c3	9667	1dp
VirtualChannel.25.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	26e0	9952	Not applicable
VirtualChannel.25.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	26e2	9954	Same as VirtualChannel.25.Main.PV
VirtualChannel.25.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	26e1	9953	Same as VirtualChannel.25.Main.PV
VirtualChannel.26.Main.Descriptor	Virtual Channel descriptor	string_t	4da4	19876	Not applicable
VirtualChannel.26.Main.Disable	1 = Virtual channel disabled	bool	2723	10019	Not applicable
VirtualChannel.26.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2605	9733	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.Input1	Input 1 value	float32	2607	9735	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.Input2	Input 2 value	float32	2608	9736	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2604	9732	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.ModbusInput	Modbus input value	float32	2606	9734	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.Operation	Specifies the operation of the virtual channel	uint8	2601	9729	Not applicable
VirtualChannel.26.Main.Period	The time period over which the calculation is made	int32	260a	9738	Not applicable
VirtualChannel.26.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	260c	9740	Not applicable
VirtualChannel.26.Main.PresetValue	Specifies the preset value	float32	260d	9741	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.PV	The virtual channel output value	float32	0170	368	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	260b	9739	Not applicable
VirtualChannel.26.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2602	9730	Not applicable
VirtualChannel.26.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2611	9745	Not applicable
VirtualChannel.26.Main.RolloverValue	Rollover value	float32	2612	9746	Set by VirtualChannel.26.Main.Resolution
VirtualChannel.26.Main.Status	As VirtualChannel1.Main.Status	uint8	0171	369	Not applicable
VirtualChannel.26.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2609	9737	Set by Network.Modbus.TimeFormat
VirtualChannel.26.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	260e	9742	Not applicable
VirtualChannel.26.Main.Type	As VirtualChannel1.Main.Type	uint8	2600	9728	Not applicable
VirtualChannel.26.Main.Units	Units descriptor	string_t	4db9	19897	Not applicable
VirtualChannel.26.Main.UnitsScaler	Units scaler for totalisers	float32	2603	9731	1dp
VirtualChannel.26.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2720	10016	Not applicable
VirtualChannel.26.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2722	10018	Same as VirtualChannel.26.Main.PV
VirtualChannel.26.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2721	10017	Same as VirtualChannel.26.Main.PV
VirtualChannel.27.Main.Descriptor	Virtual Channel descriptor	string_t	4dbf	19903	Not applicable
VirtualChannel.27.Main.Disable	1 = Virtual channel disabled	bool	2763	10083	Not applicable
VirtualChannel.27.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2645	9797	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.Input1	Input 1 value	float32	2647	9799	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.Input2	Input 2 value	float32	2648	9800	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2644	9796	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.ModbusInput	Modbus input value	float32	2646	9798	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.Operation	Specifies the operation of the virtual channel	uint8	2641	9793	Not applicable
VirtualChannel.27.Main.Period	The time period over which the calculation is made	int32	264a	9802	Not applicable
VirtualChannel.27.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	264c	9804	Not applicable
VirtualChannel.27.Main.PresetValue	Specifies the preset value	float32	264d	9805	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.PV	The virtual channel output value	float32	0172	370	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	264b	9803	Not applicable
VirtualChannel.27.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2642	9794	Not applicable
VirtualChannel.27.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2651	9809	Not applicable
VirtualChannel.27.Main.RolloverValue	Rollover value	float32	2652	9810	Set by VirtualChannel.27.Main.Resolution
VirtualChannel.27.Main.Status	As VirtualChannel1.Main.Status	uint8	0173	371	Not applicable
VirtualChannel.27.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2649	9801	Set by Network.Modbus.TimeFormat
VirtualChannel.27.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	264e	9806	Not applicable
VirtualChannel.27.Main.Type	As VirtualChannel1.Main.Type	uint8	2640	9792	Not applicable
VirtualChannel.27.Main.Units	Units descriptor	string_t	4dd4	19924	Not applicable
VirtualChannel.27.Main.UnitsScaler	Units scaler for totalisers	float32	2643	9795	1dp
VirtualChannel.27.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2760	10080	Not applicable
VirtualChannel.27.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2762	10082	Same as VirtualChannel.27.Main.PV
VirtualChannel.27.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2761	10081	Same as VirtualChannel.27.Main.PV
VirtualChannel.28.Main.Descriptor	Virtual Channel descriptor	string_t	4dda	19930	Not applicable
VirtualChannel.28.Main.Disable	1 = Virtual channel disabled	bool	27a3	10147	Not applicable
VirtualChannel.28.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2685	9861	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.Input1	Input 1 value	float32	2687	9863	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.Input2	Input 2 value	float32	2688	9864	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2684	9860	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.ModbusInput	Modbus input value	float32	2686	9862	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.Operation	Specifies the operation of the virtual channel	uint8	2681	9857	Not applicable
VirtualChannel.28.Main.Period	The time period over which the calculation is made	int32	268a	9866	Not applicable
VirtualChannel.28.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	268c	9868	Not applicable
VirtualChannel.28.Main.PresetValue	Specifies the preset value	float32	268d	9869	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.PV	The virtual channel output value	float32	0174	372	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	268b	9867	Not applicable
VirtualChannel.28.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2682	9858	Not applicable
VirtualChannel.28.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2691	9873	Not applicable
VirtualChannel.28.Main.RolloverValue	Rollover value	float32	2692	9874	Set by VirtualChannel.28.Main.Resolution
VirtualChannel.28.Main.Status	As VirtualChannel1.Main.Status	uint8	0175	373	Not applicable
VirtualChannel.28.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2689	9865	Set by Network.Modbus.TimeFormat
VirtualChannel.28.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	268e	9870	Not applicable
VirtualChannel.28.Main.Type	As VirtualChannel1.Main.Type	uint8	2680	9856	Not applicable
VirtualChannel.28.Main.Units	Units descriptor	string_t	4def	19951	Not applicable
VirtualChannel.28.Main.UnitsScaler	Units scaler for totalisers	float32	2683	9859	1dp
VirtualChannel.28.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	27a0	10144	Not applicable

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.28.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	27a2	10146	Same as VirtualChannel.28.Main.PV
VirtualChannel.28.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	27a1	10145	Same as VirtualChannel.28.Main.PV
VirtualChannel.29.Main.Descriptor	Virtual Channel descriptor	string_t	4df5	19957	Not applicable
VirtualChannel.29.Main.Disable	1 = Virtual channel disabled	bool	27e3	10211	Not applicable
VirtualChannel.29.Main.HighCutOff	The highest input value that will be totalised/counted	float32	26c5	9925	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.Input1	Input 1 value	float32	26c7	9927	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.Input2	Input 2 value	float32	26c8	9928	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	26c4	9924	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.ModbusInput	Modbus input value	float32	26c6	9926	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.Operation	Specifies the operation of the virtual channel	uint8	26c1	9921	Not applicable
VirtualChannel.29.Main.Period	The time period over which the calculation is made	int32	26ca	9930	Not applicable
VirtualChannel.29.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	26cc	9932	Not applicable
VirtualChannel.29.Main.PresetValue	Specifies the preset value	float32	26cd	9933	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.PV	The virtual channel output value	float32	0176	374	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	26cb	9931	Not applicable
VirtualChannel.29.Main.Resolution	Specifies the resolution/number of decimal places	uint8	26c2	9922	Not applicable
VirtualChannel.29.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	26d1	9937	Not applicable
VirtualChannel.29.Main.RolloverValue	Rollover value	float32	26d2	9938	Set by VirtualChannel.29.Main.Resolution
VirtualChannel.29.Main.Status	As VirtualChannel1.Main.Status	uint8	0177	375	Not applicable
VirtualChannel.29.Main.TimeRemaining	Time remaining before the calculation is made	time_t	26c9	9929	Set by Network.Modbus.TimeFormat
VirtualChannel.29.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	26ce	9934	Not applicable
VirtualChannel.29.Main.Type	As VirtualChannel1.Main.Type	uint8	26c0	9920	Not applicable
VirtualChannel.29.Main.Units	Units descriptor	string_t	4e0a	19978	Not applicable
VirtualChannel.29.Main.UnitsScaler	Units scaler for totalisers	float32	26c3	9923	1dp
VirtualChannel.29.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	27e0	10208	Not applicable
VirtualChannel.29.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	27e2	10210	Same as VirtualChannel.29.Main.PV
VirtualChannel.29.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	27e1	10209	Same as VirtualChannel.29.Main.PV
VirtualChannel.30.Main.Descriptor	Virtual Channel descriptor	string_t	4e10	19984	Not applicable
VirtualChannel.30.Main.Disable	1 = Virtual channel disabled	bool	2823	10275	Not applicable
VirtualChannel.30.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2705	9989	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.Input1	Input 1 value	float32	2707	9991	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.Input2	Input 2 value	float32	2708	9992	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2704	9988	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.ModbusInput	Modbus input value	float32	2706	9990	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.Operation	Specifies the operation of the virtual channel	uint8	2701	9985	Not applicable
VirtualChannel.30.Main.Period	The time period over which the calculation is made	int32	270a	9994	Not applicable
VirtualChannel.30.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	270c	9996	Not applicable
VirtualChannel.30.Main.PresetValue	Specifies the preset value	float32	270d	9997	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.PV	The virtual channel output value	float32	0178	376	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	270b	9995	Not applicable
VirtualChannel.30.Main.Resolution	Specifies the resolution/number of decimal places	uint8	2702	9986	Not applicable
VirtualChannel.30.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2711	10001	Not applicable
VirtualChannel.30.Main.RolloverValue	Rollover value	float32	2712	10002	Set by VirtualChannel.30.Main.Resolution
VirtualChannel.30.Main.Status	As VirtualChannel1.Main.Status	uint8	0179	377	Not applicable
VirtualChannel.30.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2709	9993	Set by Network.Modbus.TimeFormat
VirtualChannel.30.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	270e	9998	Not applicable
VirtualChannel.30.Main.Type	As VirtualChannel1.Main.Type	uint8	2700	9984	Not applicable
VirtualChannel.30.Main.Units	Units descriptor	string_t	4e25	20005	Not applicable
VirtualChannel.30.Main.UnitsScaler	Units scaler for totalisers	float32	2703	9987	1dp
VirtualChannel.30.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2820	10272	Not applicable
VirtualChannel.30.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2822	10274	Same as VirtualChannel.30.Main.PV
VirtualChannel.30.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2821	10273	Same as VirtualChannel.30.Main.PV
WebServer.Status	Status	uint8	3044	12356	Not applicable
WebServer.Enabled	Enabled	uint8	3045	12357	Not applicable
WebServer.Port	Port	uint8	3046	12358	Not applicable
WebServer.Security	Security	uint8	3047	12359	Not applicable
WebServer.Username	Username	string_t	776f	30575	Not applicable
WebServer.Password	Password	string_t	77d4	30676	Not applicable
Zirconia.aC_CO_O2	Carbon Activity Between CO and O2	float32	289e	10398	4dp
Zirconia.BalanceIntegral	Balance Integral	bool	289d	10397	Not applicable
Zirconia.CarbonPot	Calculated Carbon Potential	float32	2892	10386	Set by Zirconia.Resolution
Zirconia.Clean.AbortClean	1 = Abort cleaning process	bool	28b5	10421	Not applicable
Zirconia.Clean.CantClean	1 = can't clean	bool	28c3	10435	Not applicable
Zirconia.Clean.CleanAbort	1 = Cleaning cycle has been aborted	bool	28c4	10436	Not applicable
Zirconia.Clean.CleanEnable	1 = probe cleaning allowed	bool	28b2	10418	Not applicable
Zirconia.Clean.CleanFreq	Interval between probe cleaning cycles	time_t	28aa	10410	Set by Network.Modbus.TimeFormat
Zirconia.Clean.CleanMaxTemp	Maximum temperature for cleaning. If, during the cleaning cycle, the probe temperature exceeds this value, cleaning is aborted.	float32	28b4	10420	0dp
Zirconia.Clean.CleanMsgReset	1 = Clear cleaning related alarms	bool	28b3	10419	Not applicable
Zirconia.Clean.CleanProbe	1 = Initiate a probe cleaning cycle	bool	28b0	10416	Not applicable
Zirconia.Clean.CleanRecoveryTime	The time taken to recover from last clean. 0 = max. clean recovery time exceeded last time	time_t	28b6	10422	Set by Network.Modbus.TimeFormat
Zirconia.Clean.CleanTemp	1 = Clean cycle aborted because cleaning temperature was too high.	bool	28c5	10437	Not applicable
Zirconia.Clean.CleanTime	The time for which the probe is cleaned	time_t	28ab	10411	Set by Network.Modbus.TimeFormat
Zirconia.Clean.CleanValve	1 = Enable probe cleaning valve	bool	28af	10415	Not applicable
Zirconia.Clean.LastCleanMv	Probe output after last clean, in mV	float32	28b7	10423	0dp

Parameter path	Description	Type	Hex	Dec	Resolution
Zirconia.Clean.MaxRcovTime	Max. recovery time after a purge	time_t	28ad	10413	Set by Network.Modbus.TimeFormat
Zirconia.Clean.MinRcovTime	Min. recovery time after a purge	time_t	28ac	10412	Set by Network.Modbus.TimeFormat
Zirconia.Clean.ProbeFault	1 = Probe failed to recover following the clean cycle	bool	28ae	10414	Not applicable
Zirconia.Clean.Time2Clean	Time to next cleaning cycle	time_t	28b1	10417	Set by Network.Modbus.TimeFormat
Zirconia.CleanFreq	Interval between cleaning cycles	time_t	2889	10377	Set by Network.Modbus.TimeFormat
Zirconia.CleanProbe	Initiates a demand cleaning cycle	bool	289a	10394	Not applicable
Zirconia.CleanState	Cleaning State (0 = Waiting, 1 = Cleaning, 2 = Recovering)	uint8	2899	10393	Not applicable
Zirconia.CleanTime	The time for which the probe is cleaned	time_t	288a	10378	Set by Network.Modbus.TimeFormat
Zirconia.CleanValve	1 = Enable probe cleaning valve	bool	2898	10392	Not applicable
Zirconia.DewPoint	Calculated Dewpoint	float32	2893	10387	Set by Zirconia.Resolution
Zirconia.GasRef	Reference value for hydrogen concentration	float32	2882	10370	1dp
Zirconia.GasRefs.CO_Ideal	Gas ref value when Oxygen Type = Nernst	float32	28a9	10409	1dp
Zirconia.GasRefs.CO_InUse	The CO gas measurement value being used	float32	28a4	10404	1dp
Zirconia.GasRefs.CO_Local	Reference value for CO concentration	float32	28a1	10401	1dp
Zirconia.GasRefs.CO_Remote	CO concentration from remote source	float32	28a2	10402	1dp
Zirconia.GasRefs.CO_RemoteEn	1 = Allow remote gas measurement	bool	28a3	10403	Not applicable
Zirconia.GasRefs.H2_InUse	The hydrogen gas measurement value being used	float32	28a8	10408	1dp
Zirconia.GasRefs.H2_Local	Reference value for hydrogen concentration	float32	28a5	10405	1dp
Zirconia.GasRefs.H2_Remote	Hydrogen concentration from remote source	float32	28a6	10406	1dp
Zirconia.GasRefs.H2_RemoteEn	1 = Allow remote gas measurement	bool	28a7	10407	Not applicable
Zirconia.MaxRcovTime	Maximum recovery time after a purge	time_t	288c	10380	Set by Network.Modbus.TimeFormat
Zirconia.MinCalTemp	Min. temp at which the calculation is valid	float32	2886	10374	Same as Zirconia.TempInput
Zirconia.MinRcovTime	Minimum recovery time after a purge	time_t	288b	10379	Set by Network.Modbus.TimeFormat
Zirconia.NumResolution	Number of decimal places	uint8	2881	10369	Not applicable
Zirconia.Oxygen	Calculated Oxygen value	float32	2894	10388	Set by Zirconia.Resolution
Zirconia.OxygenExp	Exponent used by log oxygen calculations	int16	288d	10381	Not applicable
Zirconia.OxygenType	The oxygen equation being used. 0 = Nernst 1=Nernst Bosch 2 = Nernst CP 3= Ferronova	uint8	28a0	10400	Not applicable
Zirconia.ProbeFault	Probe Clean Recovery Warning	bool	2896	10390	Not applicable
Zirconia.ProbeInput	Probe input in mV	float32	2890	10384	0dp
Zirconia.ProbeOffset	Probe offset in mV	float32	2891	10385	Set by Zirconia.Resolution
Zirconia.ProbeState	State of the probe measurement system 0 = Measuring 1 = Cleaning 2 = Clean Recovery 3 = Test impedance 4 = Impedance recovery 5 = Not ready	uint8	289f	10399	Not applicable
Zirconia.ProbeStatus	Status of Probe 0 = OK 1 = mVSbr 2 = TempSbr 3 = MincalcT	uint8	289c	10396	Not applicable
Zirconia.ProbeType	Type of Probe 25 = MMI 26 = AACC 27 = Dray 28 = Accu 29 = SSI 30 = MacD 31 = Bosch 32 = Barber 33 = ferono 34 = PrbmV 35 = Eurotherm	uint8	2880	10368	Not applicable
Zirconia.ProcFactor	Process Factor (Value defined by probe manufacturer)	float32	2888	10376	1dp
Zirconia.PVFrozen	1 = PV frozen	bool	2897	10391	Not applicable
Zirconia.RemGasEn	1 = Enable use of remote gas reference	bool	2884	10372	Not applicable
Zirconia.RemGasRef	Remote Gas Reference Value	float32	2883	10371	1dp
Zirconia.SootAlm	1 = Soot alarm active	bool	2895	10389	Not applicable
Zirconia.TempInput	Probe temperature Input	float32	288e	10382	0dp
Zirconia.TempOffset	Temperature Offset	float32	288f	10383	Set by Zirconia.Resolution
Zirconia.Time2Clean	Time To Next Clean	time_t	289b	10395	Set by Network.Modbus.TimeFormat
Zirconia.Tolerance	Sooting Tolerance	float32	2887	10375	1dp
Zirconia.WrkGas	Working Reference Gas Value	float32	2885	10373	1dp

6 iTOOLS

iTools software running on a pc allows quick and easy access to the configuration of the unit. The parameters used are generally the same as those described in section 4 above, with the addition of various diagnostic parameters.

iTools also gives the user the ability to create software wiring between function blocks, such wiring being carried out using the Graphical wiring Editor feature.

A further feature - the display mode 'Promote List', is populated using iTools - see section 3.4.11 for details.

In addition to the guidance given here, there are two on-line Help systems available within iTools: Parameter help and iTools help. Parameter help is accessed by clicking on 'Help' in the toolbar (opens the complete parameter help system), by right-clicking on a parameter and selecting 'Parameter Help' from the resulting context menu, or by clicking on the Help menu and selecting 'Device Help'. iTools help is accessed by clicking on the Help menu, and selecting 'Contents'. iTools help is also available in manual format under part number HA028838, either as a physical manual or as a pdf file.

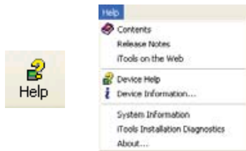


Figure 6 Help access

6.1 iTools CONNECTION

The following descriptions assume that iTools software has been correctly installed on the pc.

6.1.1 Ethernet (Modbus TCP) communications

Note: the following description is based on windows XP. Windows 'Vista' is similar.

It is first necessary to determine the IP address of the unit, as described under 'Network.Interface' in section 4.2.1.

Once the Ethernet link has been correctly installed, carry out the following actions at the pc:

1. Click on 'Start'
2. Click on 'Control Panel'. (If Control Panel opens in 'Category View' select 'Classic View' instead.)
3. Double-click on 'iTools'.
4. Click on the TCP/IP tab in the Registry settings configuration.
5. Click on 'Add...' The 'New TCP/IP Port' dialogue box opens.
6. Type-in a name for the port, then click 'Add...' again
7. Type the IP address of the unit in the 'Edit Host' box which appears. Click OK.
8. Check the details in the 'New TCP/IP Port' box, then click on 'OK'.
9. Click on 'OK' in the 'Registry settings' box to confirm the new port.

(Continued)

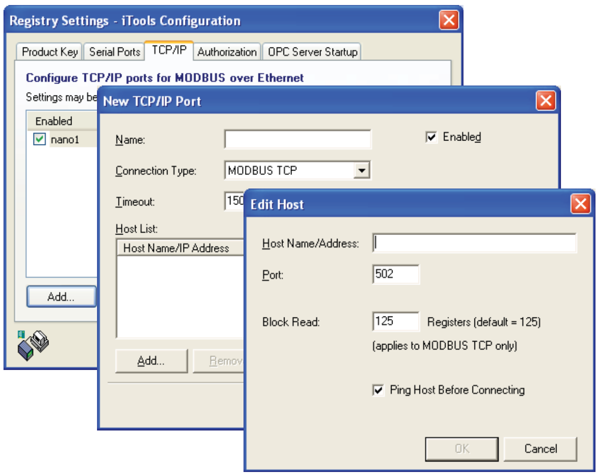


Figure 6.1.1a Adding a new Ethernet port

6.1.1 Ethernet (TCP/IP) Communications (Cont.)

To check that the pc can now communicate with the instrument, Click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'

when the Command Prompt box appears, type in: Ping<Space>IP1.IP2.IP3.IP4<Enter> (where IP1 to IP4 are the IP address of the instrument).

If the Ethernet link to the instrument is operating correctly, the 'successful' reply arrives. Otherwise, the 'failed' reply arrives, in which case, the Ethernet link, IP address, and pc port details should be verified.

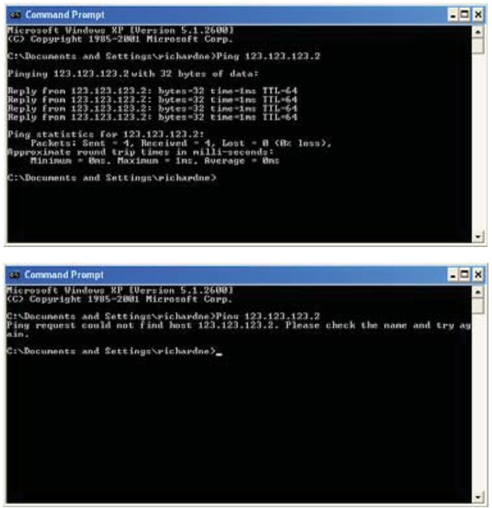


Figure 6.1.1b Command prompt 'Ping' screens (typical)

Once the Ethernet link to the instrument has been verified, iTools can be started (or shut down and restarted), and the Scan toolbar icon used, to 'find' the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time.

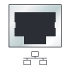
See section 6.2 for more details of the scan procedure.

6.1.2 Direct Connection

This section describes how to connect a pc directly to the instrument.

WIRING

Connection is made from the Ethernet connector at the rear of the Instrument to an Ethernet RJ45 connector, usually located at the rear of the pc. The cable can be either a 'cross-over' or 'straight through' type.



PC Ethernet connector.

Once wired correctly, and powered up, it is necessary to enter a suitable IP address and subnet mask into the Comms configuration of the Driver Module. This information can be found as follows:

1. At the pc, click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'
2. When the Command Prompt box appears, type IPConfig<Enter>

   The response is a display, such as that shown below, giving the IP address and Subnet mask of the pc. Choose an address in the range covered by these two values.

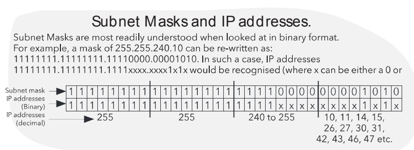
   A subnet mask element of 255 means that the equivalent element of the IP address must be used unchanged. A subnet mask element of 0 means that the equivalent element of the IP address may take any value between 1 and 255 (0 is not allowed). In the example below, the range of IP addresses which may be chosen for the Driver Module is 123.123.123.2 to 123.123.123.255. (123.123.123.0 is not allowed and 123.123.123.1 is the same as the pc's address, and may therefore not be used.)

Figure 6.1.2b IP Config command

3. In Network.Interface configuration (section 4.2.1) enter the selected IP address and the subnet mask (as it appears in the command prompt window) in the relevant parts of the menu.
4. Check communications by 'pinging' as described in section 6.1.1, above.

Once the link to the instrument has been verified, iTools can be started (or shut down and re-started), and the Scan toolbar icon used, to 'find' the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time.

See section 6.2 for more details of the scan procedure.



6.2 SCANNING FOR INSTRUMENTS

Clicking on the ‘Scan’ toolbar icon causes a dialogue box (shown below) to appear. This allows the user to define a search range of addresses.

Notes:

1. The relevant instrument address is that entered in the Network.Modbus configuration item (section 4.2.4, and it can take any value between 1 and 254 inclusive, as long as it is unique to the comms link.
2. The default selection (Scan all device addresses...) will detect any instrument on the serial link, which has a valid address.

As the search progresses, any instruments detected by the scan appear as thumbnails (faceplates) in the ‘Panel Views’ area, normally located at the bottom of the iTools screen. (options/Panel Views position allows this area to be moved to the top of the window, or the Close icon can be used to close it. Once closed it can be re-opened by clicking on ‘Panel Views’ in the ‘View’ menu.)

Figure 6.2a Scan range enable

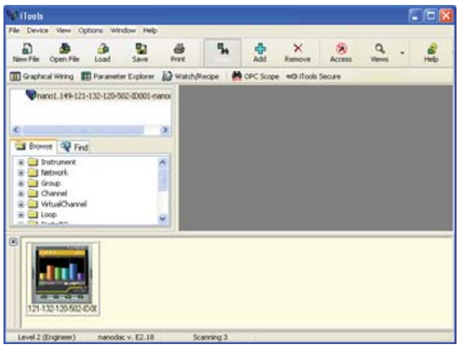


Figure 6.2b iTools initial window with one instrument detected

Once the instrument has been detected stop the scan. When the instrument has synchronised, click on the ‘Access’ button to enter configuration mode (a password might be required). Once the editing session is complete, click on the Access button again to quit configuration mode.

6.3 GRAPHICAL WIRING EDITOR Graphical Wiring

Clicking on the Graphical wiring Editor tool bar icon causes the Graphical wiring window for the current instrument configuration to open.

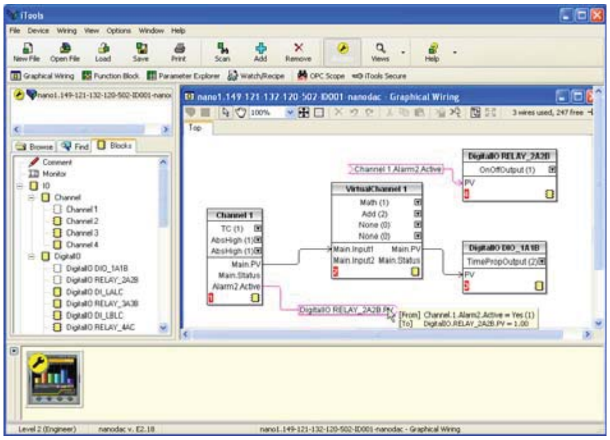
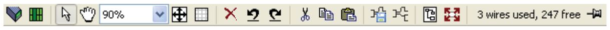


Figure 6.3 Graphical wiring Editor

The graphical wiring editor allows:

1. Function blocks, notes, comments etc. to be 'drag and dropped' into the wiring diagram from the tree list (left pane).
2. Parameters to be wired to one another by clicking on the output, the clicking on the required input.
3. Viewing and/or editing of parameter values by right-clicking on a function block and selecting 'Function Block View'.
4. The user to select parameter lists and to switch between parameter and wiring editors.
5. Completed wiring to be downloaded to the instrument (function blocks and wiring items with dashed outlines are new, or have been edited since the last download).

6.3.1 Tool bar



Download wiring to instrument.

Mouse select. Select normal mouse operation. Mutually exclusive with 'Mouse Pan' below.

Mouse Pan. When active, this causes the mouse cursor to change to a hand-shaped icon. Allows the graphical wiring diagram to be click-dragged within the GWE window aperture.

Zoom. Allows the magnification factor of the wiring diagram to be selected.

Pan tool. Whilst left clicked, the cursor appears as a rectangle showing which part of the wiring diagram is currently displayed. Click dragging allows the rectangle to be moved freely about the diagram. The size of the rectangle depends on the zoom setting.

Show/Hide grid. This toggles an alignment grid on and off.

Undo, redo.Allows the user to undo the last action, or, once an undo action has taken place, to undo the undo. Short cuts are <Ctrl>+<Z. for undo; <Ctrl>+<V, for undo.

Cut, Copy, Paste. Normal Cut (copy and delete), Copy (copy without delete) and Paste (insert into) functions. Shortcuts are: <Ctrl> + <X> for 'Cut'; <Ctrl> + <C> for copy and <Ctrl> + <V> for Paste.

Copy diagram fragment; Paste diagram fragment. Allows a part of the wiring diagram to be selected, named and be saved to file. The fragment may then be pasted into any wiring diagram, including the source diagram.

Create compound; Flatten compound. These two icons allow compounds to be created and 'un created' (flattened).

6.3.2 Wiring editor operating details

COMPONENT SELECTION

Single wires are shown with boxes at 'corners' when selected. When more than one wire is selected, as part of a group, the wire colour changes to magenta. All other items have a dashed line drawn round them when selected.

Clicking on a single item selects it. An Item can be added to the selection by holding down the control key (ctrl) whilst clicking on the item. (A selected item can be deselected in the same way.) If a block is selected, then all its associated wires are also selected.

Alternatively, the mouse can be click-dragged on the background to create a 'rubber band' round the relevant area; anything within this area being selected when the mouse is released.

<Ctrl>+<A> selects all items on the active diagram.

BLOCK EXECUTION ORDER

The order in which the blocks are executed by the instrument depends on the way in which they are wired. Each block displays its place in its sequence in a coloured block in the bottom left-hand corner (figure 6.3.2a).

6.3.2 Wiring Editor Operating Details (Cont.)

FUNCTION BLOCKS

A Function Block is an algorithm which may be wired to and from other function blocks to make a control strategy. Each function block has inputs and outputs. Any parameter may be wired from, but only parameters that are alterable in Operator Mode may we wired to. A function block includes any parameters that are needed to configure or operate the algorithm. The inputs and outputs which are considered to be of most use are always shown. In most cases all of these need to be wired before the block can perform a useful task.

If a function block is not faded in the tree (left hand pane) it can be dragged onto the diagram. The block can be dragged around the diagram using the mouse.

A Channel block is shown below as an example. When block type information is alterable (as in this case) click on the box with the down arrow in it to display a dialogue box allowing the value to be edited.

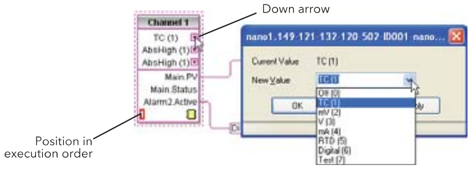


Figure 6.3.2a Function block example

If it is required to wire from a parameter, which is not shown as a recommended output, click on the 'Click to Select Output' icon in the bottom right hand corner to display a full list of parameters in the block (figure 6.3.2c, below). Click on one of these to start a wire.

FUNCTION BLOCK CONTEXT MENU

Right click in the function block to display the context menu.

Function block view Displays a list of parameters associated with the function block. 'Hidden' parameters can be displayed by de-selecting 'Hide Parameters and Lists when not Relevant in the options menu 'Parameter availability setting...' item

Re-Route wires Redraws all wiring associated with the function block.

Re-route input wires Redraws all input wiring associated with the function block

Re-route output wires Redraws all output wiring associated with the function block.

Show wiring using tags

Wires are not drawn, but their start and end destinations are indicated by tags instead. Reduces wire clutter in diagrams where source and destination are widely separated.

Hovering the cursor over the tag shows both its source and destination parameters and their values

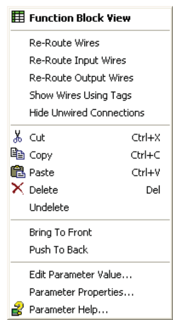
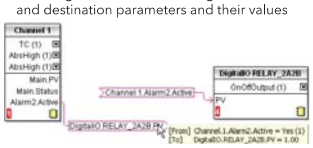


Figure 6.3.2b Function block context menu



6.3.2 Wiring Editor Operating Details (Cont.)

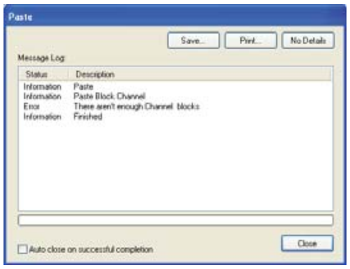
FUNCTION BLOCK CONTEXT MENU (Cont.)

Hide unwanted connections
: Causes the display to include only wired items.

Cut
: Allows one or more selected items to be moved to the Clipboard ready for pasting into another diagram or compound, or for use in a Watch window, or OPC scope. The original items are greyed out, and function blocks and wires are shown dashed until next download, after which they are removed from the diagram. Short cut = <Ctrl>+<X>. Cut operations carried out since the last download can be 'undone' by using the 'Undo' tool bar icon, by selecting 'Undelete' or by using the short cut <Ctrl>+<Z>.

Copy
: Allows one or more selected items to be copied to the Clipboard ready for pasting into another diagram or compound, or for use in a Watch window, or OPC scope. The original items remain in the current wiring diagram. Short cut = <Ctrl>+<C>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, an error display appears showing details of which items couldn't be copied.

Paste
: Copies items from the Clipboard to the current wiring diagram. Short cut = <Ctrl>+<V>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, a Paste error display appears showing details of those items which could not be copied.



Delete
: Marks all selected items for deletion. Such items are shown dashed until next download, after which they are removed from the diagram. Short cut = <Del>.

Undelete
: Reverses 'Delete' and 'Cut' operations carried out on selected item(s) since the last download.

Bring to Front
: Brings selected items to the front of the diagram.

Push to Back
: Sends the selected items to the back of the diagram.

Edit Parameter Value...
: This menu item is active if the cursor is hovering over an editable parameter. Selecting this menu item causes a pop-up window to appear, which allows the user to edit the parameter value.

Parameter Properties
: This menu item is active if the cursor is hovering over an editable parameter. Selecting this menu item causes a pop-up window to appear, which allows the user to view the parameter properties, and also, to view the parameter Help (by clicking on the 'Help' tab).

Parameter Help
: Produces Parameter Properties and Help information for the selected function block or parameter, depending on the hover position of the cursor, when the right-click occurs.

6.3.2 Wiring Editor Operating Details (Cont.)

WIRES

To make a wire

1. Drag two (or more) blocks onto the diagram from the function block tree.
2. Start a wire by either clicking on a recommended output or clicking on the 'Click to Select output' icon at the bottom right corner of the block to bring up the connection dialogue, and clicking on the required parameter. Recommended connections are shown with a green plug symbol; other parameters which are available being shown in yellow. Clicking on the red button causes all parameters to be shown. To dismiss the connection dialogue either press the escape key on the keyboard, or click the cross at the bottom left of the dialogue box.
3. Once the wire has started a dashed wire is drawn from the output to the current mouse position. To complete the wire click on the required destination parameter.
4. Wires remain dashed until they are downloaded

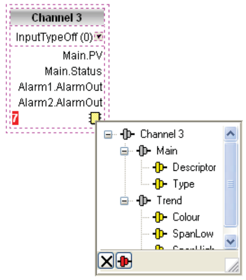


Figure 6.3.2c Output selection dialogue box.

Routing wires

When a wire is placed it is auto-routed. The auto routing algorithm searches for a clear path between the two blocks. A wire can be auto-routed again using the context menus or by double clicking the wire. A wire segment can be edited manually by click-dragging. If the block to which it is connected is moved, the end of the wire moves with it, retaining as much of the path as possible.

If a wire is selected by clicking on it, it is drawn with small boxes on its corners.

Wire Context Menu

Right click on a wire to display the wire block context menu:

Force Exec Break	When wires form a loop, a break point must be introduced, where the value written to the block comes from a source which was last executed during the previous cycle. A break is automatically placed by iTools, and appears in red. Force Exec Break allows the user to define where a break must be placed. Surplus breaks appear in black.
Task Break	Not used in this product
Re-Route wire	Replaces the current wire route with a new route generated from scratch.
Use Tags	Toggles between wire and tag mode between parameters. Tag mode is useful for sources and destinations which are widely separated.
Find Start	Goes to the source of the wire.
Find End	Goes to the destination of the wire.
Cut, Copy, Paste	Not used in this context.
Delete	Marks the wire for deletion. The wire is redrawn as a dashed line (or dashed tags) until next download. Operation can be reversed until after next download.
Undelete	Reverses the effect of the Delete operation up until the next download, after which, Undelete is disabled.
Bring to Front	Brings the wire to the front of the diagram.
Push to Back	Sends the wire to the back of the diagram.

6.3.2 Wiring Editor Operating Details (Cont.)

Wire Colours

Black	Normal functioning wire
Red	The wire is connected to a non-changeable parameter. Values are rejected by the destination block.
Magenta	A normal functioning wire is being hovered-over by the mouse cursor.
Purple	A red wire is being hovered-over by the mouse cursor.
Green	New Wire (dashed green wire changes to solid black after being downloaded.)

COMMENTS

Comments are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. As soon as the mouse is released, a dialogue box opens to allow the comment text to be entered.

Carriage returns are used to control the width of the comment. Once text entry is complete, 'OK' causes the comment to appear on the diagram. There are no restrictions on the size of a comment. Comments are saved to the instrument along with the diagram layout information.

Comments can be linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the comment box and then clicking again on the required block or wire. A dashed line is drawn to the top of the block or to the selected wire segment (figure 6.3.2f).

> Note: Once the comment has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the comment box.

Comment Context Menu

Edit	Opens the Comment dialogue box to allow the comment text to be edited.
Unlink	Deletes the current link from the comment.
Cut	Moves the comment to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<X>.
Copy	Copies the comment from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<C>.
Paste	Copies a comment from the Clipboard to the wiring diagram. Short cut = <Ctrl>+<V>.
Delete	Marks the comment for deletion at next download.
Undelete	Undoes the Delete command if download has not taken place since.

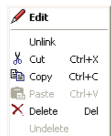


Figure 6.3.2e
Comment context menu

6.3.2 Wiring Editor Operating Details (Cont.)

MONITORS

Monitor points are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. A monitor shows the current value (updated at the iTools parameter list update rate) of the parameter to which it is linked. By default the name of the parameter is shown. To hide the parameter name either double click on the monitor box or 'Show Names' in the context (right-click) menu can be used to toggle the parameter name on and off.

Monitors are linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the box and then clicking again on the required parameter. A dashed line is drawn to the top of the block or the selected wire segment.

> Note: Once the monitor has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the monitor box.

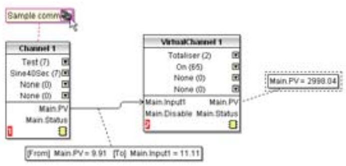


Figure 6.3.2f Comment and Monitor appearance

Monitor Context Menu

Show names	Toggles parameter names on and off in the monitor box.
Unlink	Deletes the current link from the monitor.
Cut	Moves the monitor to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<X>.
Copy	Copies the monitor from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<C>.
Paste	Copies a monitor from the Clipboard to the wiring diagram. Short cut = <Ctrl>+<V>.
Delete	Marks the monitor for deletion at next download.
Undelete	Undoes the Delete command if download has not taken place since.
Bring to Front	Moves the item to the 'top' layer of the diagram.
Push to Back	Moves the item to the 'bottom' layer of the diagram.
Parameter Help	Shows parameter help for the item.

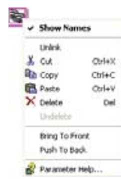


Figure 6.3.2g
Monitor context menu

DOWNLOADING

When the wiring editor is opened the current wiring and diagram layout is read from the instrument. No changes are made to the instrument function block execution or wiring until the download button is pressed. Any changes made using the operator interface after the editor is opened are lost on download.

When a block is dropped onto the diagram, instrument parameters are changed to make the parameters for that block available. If changes are made and the editor is closed without saving them there is a delay while the editor clears these parameters.

During download, the wiring is written to the instrument which then calculates the block execution order and starts executing the blocks. The diagram layout including comments and monitors is then written into instrument flash memory along with the current editor settings. When the editor is reopened, the diagram is shown positioned as it was when it was last downloaded.

6.3.2 Wiring Editor Operating Details (Cont.)

COLOURS

Items on the diagram are coloured as follows:

Red	Items which totally or partially obscure other items and items which are totally or partially obscured by other items. Wires that are connected to unalterable or non-available parameters. Execution breaks.
Blue	Non-available parameters in function blocks.
Green	Items added to the diagram since last download are shown as green dashed lines.
Magenta	All selected items, or any item over which the cursor is hovering.
Purple	Red wires when being hovered over by the mouse cursor.
Black	All items added to the diagram before the last download. Redundant execution breaks. Monitor and comment text.

DIAGRAM CONTEXT MENU

Cut	Active only when the right click occurs within the bounding rectangle which appears when more than one item is selected. Moves the selection off the diagram to the Clipboard. Short cut = <Ctrl>+<X>.
Copy	As for 'Cut', but the selection is copied, leaving the original on the diagram. Short cut = <Ctrl>+<C>.
Paste	Copies the contents of the Clipboard to the diagram. Short cut = <Ctrl>+<V>.
Re-Route wires	Reroutes all selected wires. If no wires are selected, all wires are re-routed.
Align Tops	Aligns the tops of all blocks in the selected area.
Align Lefts	Aligns the left edges of all blocks in the selected area.
Space Evenly	Spaces selected items such that their top left corners are spaced evenly across the width of the diagram. Click on the item which is to be the left-most item, then <Ctrl>+<left click> the remaining items in the order in which they are to appear.
Delete	Marks the item for deletion at next download time. Can be 'Undeleted' up until download occurs.
Undelete	Reverses the action of 'Delete' on the selected item.
Select All	Selects all items on the current diagram.
Create Compound	Active only when the right click occurs, in the top level diagram, within the bounding rectangle which appears when more than one item is selected. Creates a new wiring diagram as described in 'Compound', below.
Rename	Allows a new name to entered for the current wiring diagram. This name appears in the relevant tab.
Copy Graphic	Copies the selected items (or the whole diagram if no items are selected) to the clipboard as a Windows metafile, suitable for pasting into a documentation application. Wiring entering/leaving the selection (if any) are drawn in tag mode.
Save Graphic...	As for 'Copy Graphic' above, but saves to a user-specified file location instead of the clipboard.
Copy Fragment To File...	Copies selected items to a user-named file in folder 'My iTools Wiring Fragments' located in 'My Documents'.
Paste Fragment From File	Allows the user to select a stored fragment for inclusion in the wiring diagram.
Centre	Places the display window at the centre of the selected items. If 'Select All' has previously been clicked-on, then the display widow is placed over the centre of the diagram.

Figure 6.3.2h
Diagram context menu

6.3.2 Wiring Editor Operating Details (Cont.)

COMPOUNDS

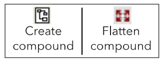
Compounds are used to simplify the top level wiring diagram, by allowing the placing of any number of function blocks within one 'box', the inputs and outputs of which operate in the same way as those of a normal function block.

Each time a compound is created, a new tab appears at the top of the wiring diagram. Initially compounds and their tabs are named 'Compound 1', 'Compound 2', etc. but they can be renamed by right clicking either on the compound in the top level diagram, or anywhere within an open Compound, selecting 'Rename' and typing in the required text string (16 characters max.).

Compounds cannot contain other compounds (i.e. they can be created only in the top level diagram).

Compound creation

1. Empty compounds are created within the top level diagram by clicking on the 'Create Compound' tool bar icon.
2. Compounds can also be created by highlighting one or more function blocks in the top level diagram and then clicking on the 'Create Compound' tool bar icon. The highlighted items are moved from the top level diagram into a new compound.



3. Compounds are 'uncreated' (flattened), by highlighting the relevant item in the top level menu and then clicking on the 'Flatten Compound' tool bar icon. All the items previously contained within the compound appear on the top level diagram.
4. Wiring between top level and compound parameters is carried out by clicking on the source parameter, then clicking on the compound (or the compound tab) and then clicking on the destination parameter. Wiring from a compound parameter to a top level parameter or from compound to compound is carried out in similar manner.
5. Unused function blocks can be moved into compounds by dragging from the tree view. Existing blocks can be dragged from the top level diagram, or from another compound, onto the tab associated with the destination compound. Blocks are moved out of compounds to the top level diagram or to another compound in a similar way. Function blocks can also be 'cut and pasted'.
6. Default compound names (e.g. 'Compound 2') are used only once, so that if, for example, Compounds 1 and 2 have been created, and Compound 2 is subsequently deleted, then the next compound to be created will be named 'Compound 3'.
7. Top level elements can be click-dragged into compounds.

TOOL TIPS

Hovering the cursor over the block displays 'tooltips' describing that part of the block beneath the cursor. For function block parameters the tooltip shows the parameter description, its OPC name, and, if downloaded, its value. Similar tooltips are shown when hovering over inputs, outputs and over many other items on the iTools screen.

A Function Block is enabled by dragging the block onto the diagram, wiring it, and finally downloading it to the instrument. Initially blocks and associated wires are drawn with dashed lines, and when in this state the parameter list for the block is enabled but the block is not executed by the instrument.

The block is added to the instrument function block execution list when the 'Download' icon is operated and the items are redrawn using solid lines.

If a block which has been downloaded is deleted, it is shown on the diagram in a ghosted form until the download button is pressed. (This is because it and any wires to/from it are still being executed in the instrument. On download it will be removed from the instrument execution list and the diagram.) A ghosted block can be 'undeleted' as described in 'Context menu', above.

When a dashed block is deleted it is removed immediately.

6.4 PARAMETER EXPLORER Parameter Explorer

This view can be displayed:

1. by clicking on the 'Parameter Explorer' toolbar icon,
2. by double clicking on the relevant block in the tree pane or in the graphical wiring editor
3. by selecting 'Function Block View' from the Function block context menu in the Graphical wiring Editor.
4. by selecting 'parameter Explorer from the 'View' menu
5. by using the short cut <Alt>+<Enter>

In each case the function block parameters appear in the iTools window in tabular form, such as the example in figure 6.4a, below.

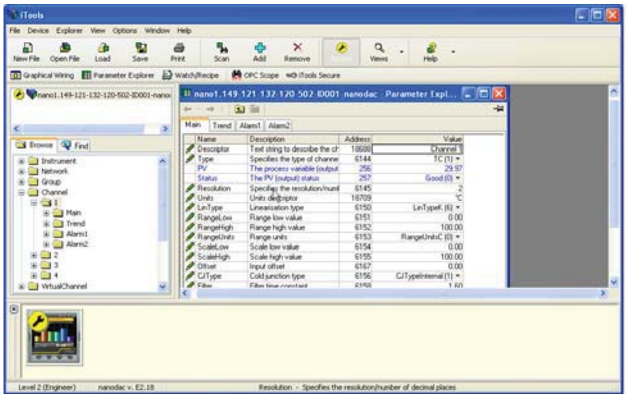


Figure 6.4a Parameter table example

The figure above shows the default table layout. Columns can be added/deleted from the view using the 'Columns' item of the Explorer or context menus (figure 6.4b).

6.4 Parameter Explorer (Cont.)

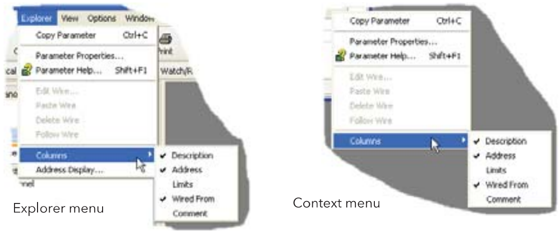


Figure 6.4b Column enable/disable

6.4.1 Parameter explorer detail

Figure 6.4.1a shows a typical parameter table. This particular parameter has a number of subfolders associated with it, and each of these is represented by a 'tab' across the top of the table.

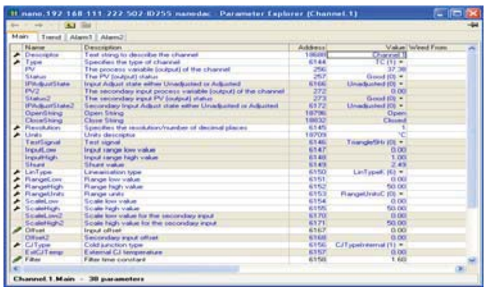


Figure 6.4.1a Typical parameter table

Notes:

1. Parameters in blue are non-editable (Read only). In the example above all the parameters are read only. Read/write parameters are in black and have a 'pencil' symbol in the 'read/Write access column at the left edge of the table. A number of such items are shown in figure 6.4.1a, above.
2. Columns. The default explorer window (figure 6.4a) contains the columns 'Name', 'Description', 'Address', 'Value', and 'Wired From'. As can be seen from figure 6.4b, the columns to be displayed can be selected, to a certain extent, using either the 'Explorer' menu or the context menu.
3. Hidden Parameters. By default, iTools hides parameters which are considered irrelevant in the current context. Such hidden parameters can be shown in the table using the 'Parameter availability' settings item of the options menu (figure 6.4.1b). Such items are displayed with a shaded background.
4. The full pathname for the displayed parameter list is shown at the bottom left hand corner of the window.

6.4.1 Parameter Explorer Detail (Cont.)

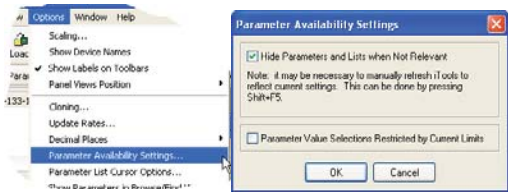


Figure 6.4.1b Show/Hide parameters

6.4.2 Explorer tools

A number of tool icons appear above the parameter list:

Back to: and Forward to:. The parameter explorer contains a history buffer of up to 10 lists that have been browsed in the current instance of the window. The 'Back to: (list name)' and 'Forward to: (list name)' icons allow easy retracing or repeating of the parameter list view sequence.
If the mouse cursor is hovered over the tool icon, the name of the parameter list which will appear if the icon is clicked-on appears. Clicking on the arrow head displays a pick list of up to 10 previously visited lists which the user can select. Short cut = <Ctrl>+<B> for 'Back to' or <Ctrl>+<F> for 'Forward to'.

Go Up a Level, Go Down a Level. For nested parameters, these buttons allow the user to navigate 'vertically' between levels. Short cut = <Ctrl>+<U> for 'Go Up a Level' or <Ctrl>+<D> for 'Go Down a Level'.

Push pin to give the window global scope. Clicking on this icon causes the current parameter list to be permanently displayed, even if another instrument becomes the 'current device'.

6.4.3 Context Menu

Copy Parameter Copies the clicked-on parameter to the clipboard
Parameter properties
Displays parameter properties for the clicked-on parameter
Parameter Help... Displays help information for the clicked-on parameter
Edit/Paste/Delete/Follow Wire
Not used in this application
Columns Allows the user to enable/disable a number of parameter table columns (figure 6.1.4b).

6.5 WATCH/RECIPE EDITOR Watch/Recipe

The watch/recipe editor is opened by clicking on the Watch/Recipe tool icon, by selecting 'Watch/Recipe' in the 'Views' menu or by using the short cut <Ctrl>+<A>. The window is in two parts: the left part containing the watch list; the right-hand part containing one or more data sets, initially empty and unnamed.

The Watch/Recipe window is used:

1. To monitor a list of parameters. This list can contain parameters from many different, and otherwise unrelated parameter lists within the same device. It cannot contain parameters from different devices.
2. To create 'data sets' of parameter values which can be selected and downloaded to the device in the sequence defined in the recipe. The same parameter may be used more than once in a recipe.

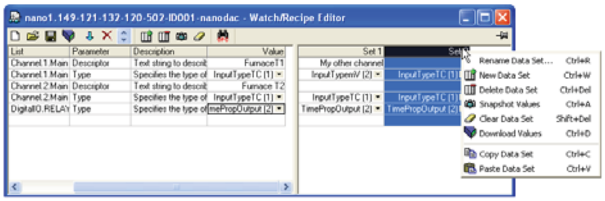


Figure 6.5 Watch/Recipe Editor window (with context menu)

6.5.1 Creating a Watch List

After opening the window, parameters can be added to it as described below. The values of the parameters update in real-time, allowing the user to monitor a number of values simultaneously.

ADDING PARAMETERS TO THE WATCH LIST

1. Parameters can be click-dragged into the watch list from another area of the iTools window (for example, the parameter explorer window, the graphical wiring editor, the browse tree). The parameter is placed either in an empty row at the bottom of the list, or if it is dragged on top of an already existing parameter, it is inserted above this parameter, with the remaining parameters being moved down one place.
2. Parameters can be dragged from one position in the list to another. In such a case, a copy of the parameter is produced, the source parameter remaining in its original position.
3. Parameters can be copied <Ctrl>+<C> and pasted <Ctrl>+<V> either within the list, or from a source external to it, for example the parameter browse window or the graphical wiring editor.
4. The 'Insert item...' tool button the 'Insert Parameter' item in the Recipe or context menu or the short cut <Insert> can be used to open a browse window from which a parameter is selected for insertion above the currently selected parameter.

DATA SET CREATION

Once all the required parameters have been added to the list, select the empty data set by clicking on the column header. Fill the data set with current values using one of the following methods:

1. Clicking on the 'Capture current values into a data set' tool icon (also known as the 'Snapshot Values' tool).
2. Selecting 'Snapshot Values' from the Recipe or Context (right-click) menu.
3. Using the short cut <Ctrl>+<A>.

6.5.1 Creating A Watch List (Cont.)

DATA SET CREATION (Cont.)

Individual data values can now be edited by typing directly into the grid cells. Data values can be left blank or cleared, in which case, no values will be written for those parameters at download. Data values are cleared by deleting all the characters in the cell then either moving to a different cell or typing <Enter>.

The set is called 'Set 1' by default, but it can be renamed by either by using the 'Rename data set...' item in the Recipe or context menus, or by using the short cut <Ctrl>+<R>.

New, empty data sets can be added using one of the following:

1. Clicking on the 'Create a new empty data set' toolbar icon.
2. Selecting 'New Data Set' in the Recipe or context menus
3. Using the short cut <Ctrl>+<W>

Once created, the data sets are edited as described above.

Finally, once all the required data sets have been created, edited and saved, they can be downloaded the instrument, one at a time, using the Download tool, the 'Download Values' item in the Recipe or context menus, or the short cut <Ctrl>+<D>.

6.5.2 Watch Recipe toolbar icons

Create a new watch/recipe list. Creates a new list by clearing out all parameters and data sets from an open window. If the current list has not been saved, confirmation is requested. Short cut <ctrl>+<N>

Open an existing watch/recipe file. If the current list or data set has not been saved, confirmation is requested. A file dialogue box then opens allowing the user to select a file to be opened. Short cut <ctrl>+<O>

Save the current watch/recipe list. Allows the current set to be saved to a user specified location. Short cut <ctrl>+<S>.

Download the selected data set to the device. Short cut <ctrl>+<D>

Insert item ahead of selected item. Short cut <Insert>.

Remove recipe parameter. Short cut <ctrl>+<Delete>.

Move selected item. Up arrow moves selected parameter up the list; down arrow move the selected parameter down the list.

Create a new empty data set. Short cut <ctrl>+<w>.

Delete an empty data set. Short cut <ctrl>+<Delete>

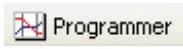
Capture current values into a data set. Fills the selected data set with values. Short cut <ctrl>+<A>.

Clear the selected data set. Removes values from the selected data set. Short cut <Shift>+<Delete>.

Open OPC Scope. Opens a separate utility that allows trending, data logging and Dynamic Data Exchange

6.5.3 Watch/Recipe Context Menu

The Watch/Recipe Context menu items have the same functions as described above for toolbar items.

6.6 PROGRAMMER OPTION 

Clicking on the Programmer tool bar icon opens the programmer configuration window, displaying the program currently loaded in the instrument, in Segment Parameter view. If no program is loaded, the programmer display opens with just one segment, defined as an 'End' Segment.

Figure 6.6 shows a simple program for example purposes. Parameters are defined in section 3.4.9 and section 4.8.

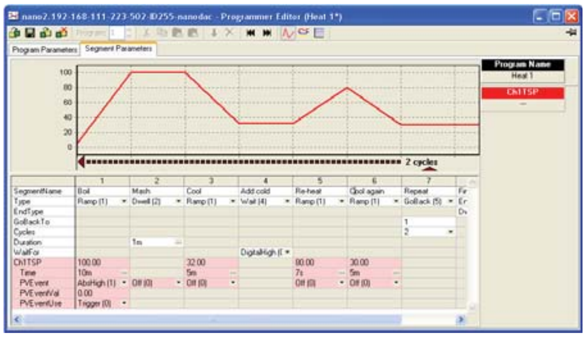


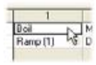
Figure 6.6 Programmer display

As can be seen from the example, the segments appear below a graphical representation of the program.

6.6.1 Segment parameter editing

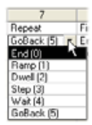
SEGMENT NAME

To edit the segment name, click in the segment name field (as shown), and type in the required text, of up to 20 characters. Alternatively, double click on the existing name and edit it as desired.



SEGMENT TYPE

Clicking on the down arrow symbol to the right of the existing segment type field, produces a pick list from which a segment type can be selected. The type of segment selected defines which configuration fields appear for that segment.



END TYPE

Allows the selection of 'Dwell' or 'Reset' as the action to be taken by the End segment.

6.6.1 Segment Editing (Cont.)

GO BACK TO

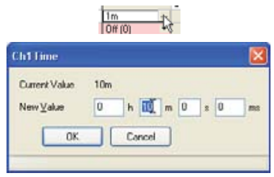
For GoBack segments only, this allows the user to enter a segment number for the program to return to.

CYCLES

For GoBack segments only, this allows the number of times the program returns to the 'Go Back To' segment, before continuing.

DURATION

Sets the amount of time for which Dwell segments are to operate. Times are entered using a hours/minutes/seconds/milliseconds display which appears when the ellipsis button to the right of the duration field is clicked on.



WAIT FOR

Select an analogue or digital input as the wait criterion. For single channel programs only one analogue input is available; for two-channel programmers one digital and two analoge inputs are available, as shown.

CH1 (2) TSP

The channel 1 (2) target setpoint, editable by the user in a similar way as that used for segment name editing, described above. Ch2 TSP appears only for two channel programmers.

TIME

For programs where 'Ramp Style' = 'Time', this allows the user to enter time periods for ramp segments, in a similar way, as described for 'Duration', above. For two channel programmers, two times can be entered, and if the two times are different, the channel with the shorter time waits at its setpoint value until the other channel's time has elapsed.

RATE

For programs where 'Ramp Style' = 'Rate', this allows the user to eneter a rate value for Ramp segments. This value is entered in the same way as that used for segment name editing, described above. For two channel programmers, two rates can be entered.

OTHER PARAMETERS

Holdback, PV Event etc. parameters may or may not appear depending on the programmer features enabled, and they are all edited in the ways described above.

6.6.2 Digital Event display

Clicking on the 'Digital Events Output' tool bar icon produces a segment display, allowing the user to select the events on or off as required, for each segment. Figure 6.6.2 shows a programmer where the number of events is four.

The number of events which appear (maximum eight) is configured in the Programmer Setup menu as described in section 4.8.3

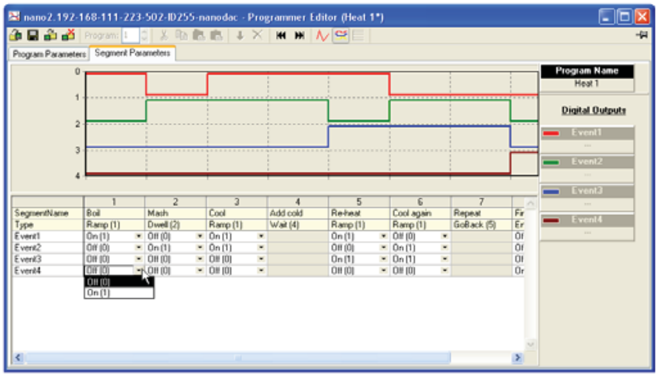


Figure 6.6.2 Event on/off configuration

6.6.3 Program parameters

The number of parameters which appear in this display depends on which program features are enabled. Figure 6.6.3 shows a basic set of parameters which allows the user to select Rate or Time as the Ramp style, and to select a value for Rate units.

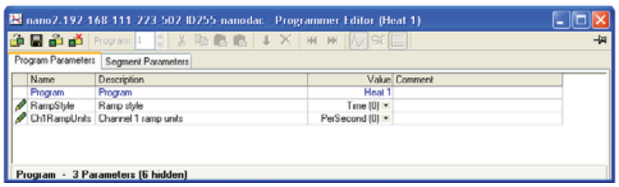


Figure 6.6.3 Program parameter display

6.6.4 Adding and deleting segments.

INSERT SEGMENT

As shown in figure 6.6.4, to insert a segment, click in the segment number field of the segment to the right of where the new segment is to be located. This causes the whole segment to highlight. Click on the blue down arrow tool icon to insert the new segment. The new segment name is the segment number, and the segment configuration is that of the segment to the right, unless that segment is a Goback or End segment, in which case the new segment is a ramp segment.

To insert more than one segment, operate the shift key whilst clicking on the range of contiguous segments to be copied.

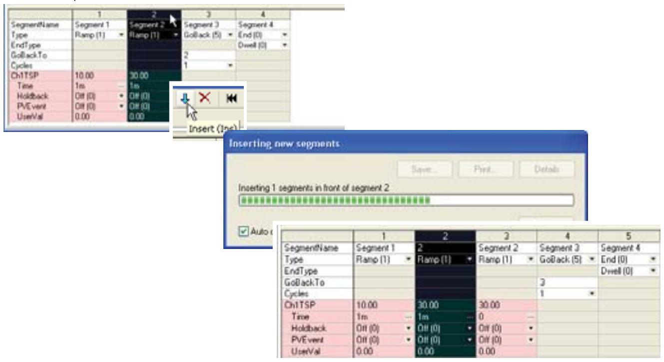


Figure 6.6.4 Insert a segment

Alternatively the mouse can be right-clicked anywhere in a segment, and the 'Insert segment' item selected, or one or more segment can be highlighted and the 'Insert' key on the pc keyboard used to initiate the process. See section 6.6.7 for more details of the right-click (context) menu.

CUTTING, COPYING AND PASTING SEGMENTS

The process of highlighting one or more segments causes the cut and copy toolbar icons to become active.

The cut tool removes the highlighted segments from the program and stores them on the pasteboard ready for re-use.

The copy tool copies the selected segment(s) to the paste board, leaving the original segment(s) in place.

Once one or more segments have been cut or copied, the 'Paste insert' and 'Paste over' icons become active allowing the user to paste the contents of the pasteboard in front of a selected segment (Paste insert), or to overwrite the existing highlighted segment(s) (Paste over). When using the Paste over tool, the number of segments being pasted over must match the number of segments on the paste board.

DELETING SEGMENTS

Once one or more segments have been highlighted, the highlighted segments can be removed using the Delete toolbar icon, by using the Delete Segment item in the right-click (context) menu, or by operating the pc keyboard 'Ctrl' and Delete' keys simultaneously.

6.6.5 Loading and Saving programs

The four program operation keys at the top left of the programmer window allow the user to load a program from or save a program to either the currently connected instrument or to a pc.

The fourth icon allows the user to select a program to be deleted from the connected instrument.

See section 6.6.6 for more details.

6.6.6 Toolbar icons

The toolbar icons appearing at the top of the programmer window have the following properties:

- Load Program. Opens a browser window allowing the user to select a program on the pc, or a program stored in the connected instrument to load. Short cut: <Ctrl> + <L>.
- Save current program to file. Opens a browser window allowing the user to select a location on the pc in which to save the current program. This file is saved with a '.upiz' extension and can be saved to a USB memory stick for downloading to an instrument, or it can be transferred to the instrument via an ftp server. Short cut: <Ctrl> + <S>.
- Store current program on device. Allows the user to save the program to the program store on the instrument. Short cut: <Shift key> + <Ctrl> + <S>.
- Delete Programs from Device. Allows the user to delete programs from the program store on the connected instrument. Short cut: <Ctrl> + <F>.
- Cut. Removes the highlighted segment(s) from the program and places them on the pasteboard. Short cut: <Ctrl> + <X>.
- Copy. Copies the selected segment(s) to the pasteboard, leaving the original segments in place. Short cut: <Ctrl> + <C>.
- Paste insert. Inserts the segments on the pasteboard into a location to the left of the highlighted segment. Short cut: <Ctrl> + <V>.
- Paste over. Overwrites the highlighted segment(s) with the segment(s) on the pasteboard. The number of segments on the pasteboard must match the number of segments being overwritten. Short cut: <Shift key> + <Ctrl> + <V>.
- Insert. Inserts a new segment to the left of the highlighted segment. If more than one segment is highlighted, then the same number of segments are inserted as are highlighted. Copies the segment type of the segment to the right of the insertion point except if that segment is an 'End' or 'GoBack' segment, when newly inserted segments are of type 'Ramp'. Short cut: <Insert>.
- Delete. Deletes the highlighted segment(s). Short cut: <Ctrl> + <Delete>.
- Go to first. Moves the user to the first segment. Useful in very long programs. Short cut: <Ctrl> + <Left arrow>.
- Go to last. Moves the user to the end segment. Useful in very long programs. Short cut: <Ctrl> + <Right arrow>.
- Analog. Selects the analogue trace chart for display and segment configuration. Short cut: <Ctrl> + <G>.
- Digital Event Outputs. Selects the Event output chart for display and configuration.Short cut: <Ctrl> + <D>.
- Logarithmic. Switches the vertical scale to logarithmic. Short cut: <Ctrl> + <M> (figure 6.6.6)

6.6.6 Toolbar Icons (Cont.)

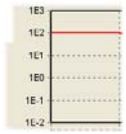
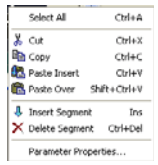


Figure 6.6.6 Logarithmic scale example

6.6.7 Context menus

SEGMENT CONTEXT MENU



Right-clicking when the mouse cursor is hovering over a segment in the analogue segment parameters view produces the segment context menu shown. The various items copy the relevant tool bar icons described above, with the following additions:

Select All Selects all parameters

Parameter properties Displays the properties window for the parameter right-clicked on, including a 'Help' tag for that parameter.

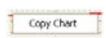
PROGRAM CONTEXT MENU

Right-clicking when the mouse cursor is hovering in the program parameters view produces the program context menu shown.

Parameter properties Displays the properties window for the parameter right-clicked on, including a 'Help' tag for that parameter.

Columns Allows the user to enable/disable columns in the program parameters display.

CHART CONTEXT MENU



Right-clicking when the mouse cursor is hovering over the analogue chart or the digital event chart produces the segment context menu shown. This allows the user to copy the chart to the pasteboard, from where it can be pasted into (for example) a standard word procesing document.

6.6.8 Programmer menu

Clicking on the 'Programmer' menu item near the top of the iTools window causes the Programmer menu (figure 6.6.8) to appear. The items contained within this menu are described in the 'Toolbar icons' and 'Context menu' sections (sections 6.6.6 and 6.6.7 respectively) above.

Figure 6.6.8 Programmer menu

6.6.9 Two channel programs

The display and editing of segment and program parameters for two-channel programmers is carried out in the same way as described above, for single channel programs. The major difference in apearance is that there are two sets of parameters for each segment, instead of one. The background colour for channel 1 parameters is pink; that for channel 2 parameters is green.

The number of channels and the program features enabled are set up at the instrument as desribed in section 3.4.9 and section 4.8.

Figure 6.6.9 Two channel program display

6.6.10 To Set Up OEM Security

This will be illustrated by the following two examples:

EXAMPLE 1:

Make the parameter Network.Modbus.TimeFormat read/write when OEM security is enabled and the instrument is in Engineer access level and leave the remaining parameters in this list as read only.

Select Engineer (Configuration) access level

With OEM status unlocked set 'OEMParamsLists' to On.

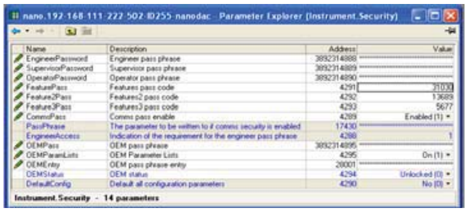


Figure 6.6.10a

Open 'Network.Modbus list

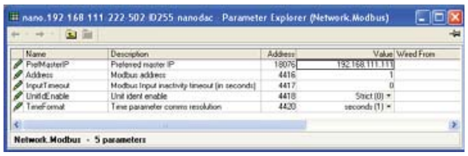


Figure 6.6.10b

Open 'Instrument.OEM-ConfigList'

Drag and drop the parameter(s) which are required to be read/write in Engineer level when OEM security is enabled.

In this example the parameter 'TimeFormat'.

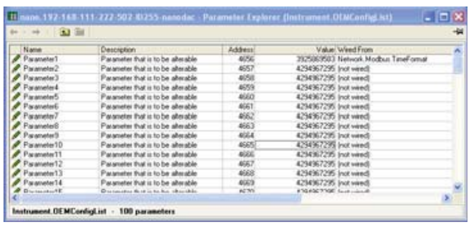


Figure 6.6.10c

EXAMPLE 2:

Make the parameter 'Loop1.PID.ProportionalBand' read only when OEM security is enabled and the instrument is in Supervisor access level and leave the remaining parameters in this list as read/write.

Open 'Loop1.PID list.

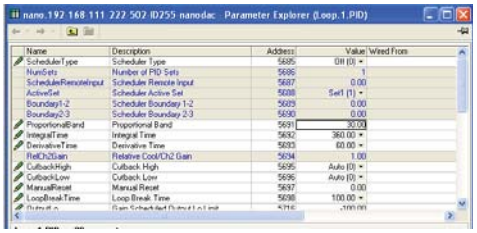


Figure 6.6.10d

Open Instrument.OEMSupervisorList

Drag and drop the parameter(s) which are required to be read only in Supervisor level when OEM security is enabled.

In this example the parameter Loop1 Proportional band.

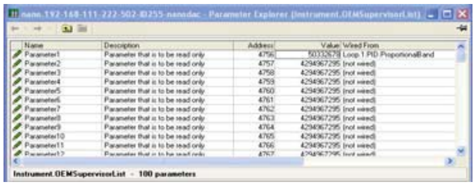


Figure 6.6.10e

TO ENABLE OEM SECURITY

In 'OEMEntry' enter the security code. This is the same code as entered in Engineer level in 'OEMPass', Section 4.1.6.

The 'OEMStatus' parameter will change to 'Locked'.

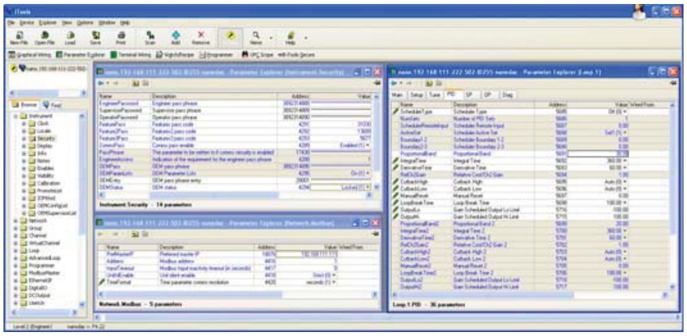


Figure 6.6.10f

As in Figure 6.6.10f above, the parameter 'TimeFormat' is alterable in Engineer level and the parameter 'Loop1 Proportional Band' is locked when OEM security is enabled.

7 USER WIRING

User wiring, created from the instrument front panel, allows parameters to be wired together so that, for example, a counter can be configured to be incremented when an alarm goes active. This can be used as an alternative to iTools.

This section is presented as two examples that show the general techniques used to create and delete wires from the instrument user interface.

Notes:
1. These examples refer to Channel Configuration and to Virtual Channel configuration, descriptions of which are to be found in sections 4.4 and 4.5 respectively.
2. The destination parameter field has a small green triangle at the top left corner to indicate that it has a wire routed to it. 

7.1 DRIVE RELAY EXAMPLE

To drive the relay whose terminal contacts are 3A/3B, whilst the temperature being measured by Channel 2 exceeds 30°C. For this example Channel 2 alarm 1 and a hysteresis of 4°C will be used.

1. In channel 2, Alarm 1 page (see note), set the following parameters:
   Type: Abs. High
   Threshold: 30
   Hysteresis: 4
   Latch: None
   Block: Off
   Dwell:00:00:00
   Acknowledge: No

Figure 7.1a Channel 2, Alarm 1 set up

Note: the channel alarm areas of configuration become accessible only once the channel with which they are associated has been configured with a suitable 'Type' (section 4.4.1).

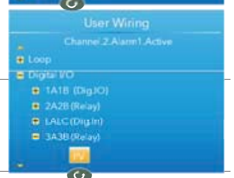
7.1 Drive Relay Example (Cont.)

2. Highlight the 'Active' field, and press and hold the scroll button for a few seconds, until the top level User Wiring page appears.
   The name of the selected parameter appears at the top of the page. Any already existing wires from this parameter would appear below the 'Add new wire' area.

3. With 'Add new wire' highlighted operate the Scroll button.

4. Use the down arrow to highlight 'Digital I/O' and press the scroll button.

5. Use the down arrow to highlight '3A3B (Relay)' and press the scroll button.

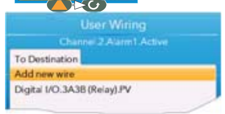


6. Use the down arrow to highlight 'PV' and press the scroll button.

   Note: If this parameter is already wired-to, the 'wired' symbol appears to the left of the parameter.

7. When the confirmation window appears, use the up or down arrow to highlight 'Ok', then operate the scroll button again.

8. The top level user wiring page reappears, showing the destination parameter.



7.1.1 Wire removal

At the top level user wiring page, use the up and down arrow buttons to highlight the wire to be deleted, and operate the scroll key. In the 'Delete Wire' confirmation window, highlight 'Ok' and operate the scroll key again. The wire is deleted without further confirmation.

7.2 COUNTER EXAMPLE

This example shows how to set up a counter to be incremented each time Channel 1 Alarm 1 becomes active, and reset each time channel 2, alarm 1 is acknowledged. For this example, Virtual Channel 3 will be configured as the counter, with a preset value of 0.

1. At Channel.1.Main, set:

   Type = test
   Test Signal = Sine 4 min.
   Scale Low = 0
   Scale High = 100
2. At Channel.1.Alarm1, set:

   Type = Abs Hi
   Threshold = 50
   Latch = None
3. At Channel.2.Main, set:

   Type = Test
   Test Signal = Sine 40 min.
   Scale Low = 0
   Scale High = 100
4. At Channel.2.Alarm 1, set:

   Type = Abs Hi
   Threshold = 90
   Latch = Manual
5. At Virtual Channel.3.Main, set:

   Type = Counter
   Operation = On
   Input = 1

All the other parameters can be left at their defaults.

6. Still at Virtual Channel 3 (Main), use the up/down arrow buttons to highlight 'Trigger'. Press and hold the scroll key. The top level User Wiring page appears, this time with a 'From Source' tab as well as the 'To Destination' tab of example 1. This is because this parameter is read/write, whereas Alarm Active is read only (i.e. its value may be read but not changed).
7. Use the up (or down) arrow button to select the 'From Source' tab.

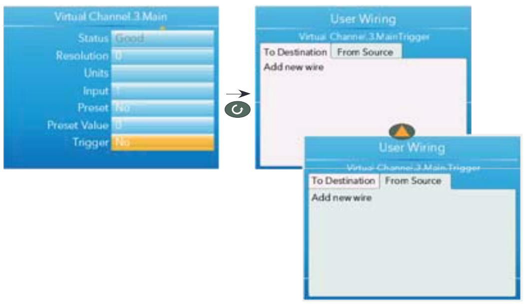


Figure 7.2a Wiring a counter: part 1

7.2 Counter Example (Cont.)

8. Operate the Scroll key to highlight 'Add new wire', then again to display the top level parameter list.
9. Use the down arrow button to highlight 'Channel' and operate the scroll button.
10. Operate the scroll button to select '1'.
11. Highlight 'Alarm 1' and operate the scroll button.
12. Use the down arrow button to highlight 'Active'. Operate the Scroll button again, and create the new wire.
13. Use the Page button twice to return to the Virtual Channel 3 menu.

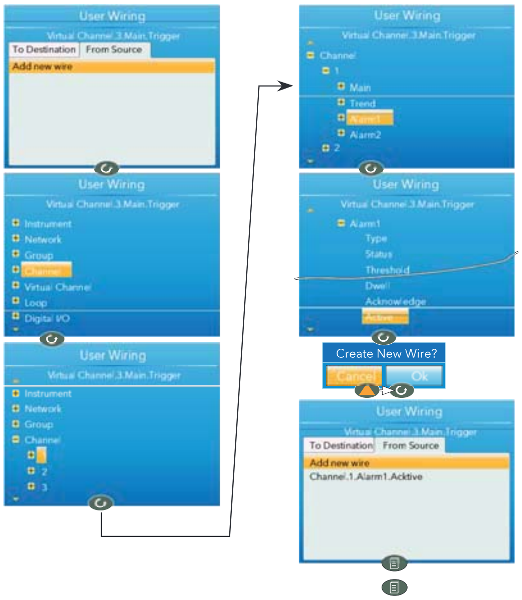


Figure 7.2b Wiring a counter: part 2

7.2 Counter Example (Cont.)

14. At Virtual Channel.3.Main, use the down arrow to select 'Preset'. Press and hold the scroll key. The top level User Wiring page appears.
15. Use the up (or down) arrow button to select the 'From Source' tab, if not already selected.
16. Operate the Scroll key to highlight 'Add new wire', then again to display the top level parameter list.
17. Use the down arrow button to highlight 'Channel' and operate the scroll button.
18. Use the down arrow button to highlight '2' and operate the scroll button.
19. Highlight 'Alarm 1' and operate the scroll button.
20. Use the down arrow button to highlight 'Acknowledgement' (not 'Acknowledge'). Operate the Scroll button again, and create the new wire.

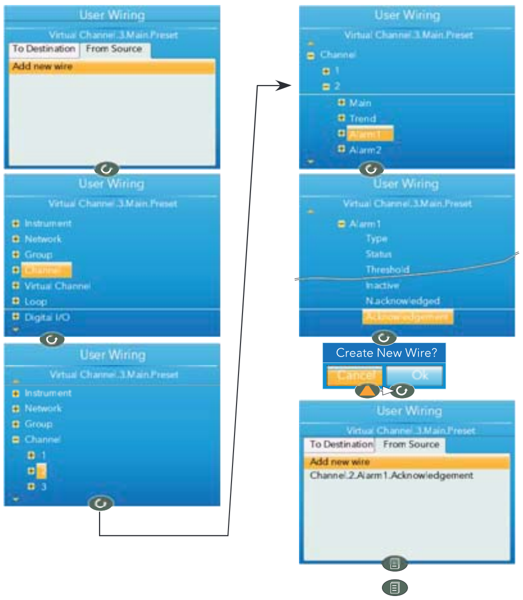


Figure 7.2c Wiring a counter: part 3

8 USB DEVICES

The devices listed below can be plugged into the USB connector at the back of the instrument, providing that the maximum current required is less than 100 mA.

1. Memory Stick
2 Bar code reader
3. Keyboard

Notes:
1. See 'USB device precautions' in the Safety Notes preamble section of the manual.
2. See Section A2 for the USB port specification
3. The use of USB hubs is not supported by this instrument.

8.1 MEMORY STICK

The use of the memory stick as an archiving device, or to facilitate software upgrades is well documented in the relevant sections of this manual.

8.2 BAR CODE READER

If 'USB Auto Scan is set to 'Yes' in Display Configuration (section 4.1.3) then, with the bar code reader plugged into the USB port, the scanned data input stream is packaged into a general message displayed on the trend page and included in the .uhh history file. The format of the message is: DD/MM/YY HH:MM:SS 123--13 (where 123--13 represents the ASCII data read from the bar code.

If 'USB auto Scan' is set to 'No, the ASCII data read from the bar code is displayed as a message ready for editing prior to being sent to the display etc. Figure 8.2 shows an example.

Note: the bar code reader must be configured to use a carriage return (decimal 13) terminating character.

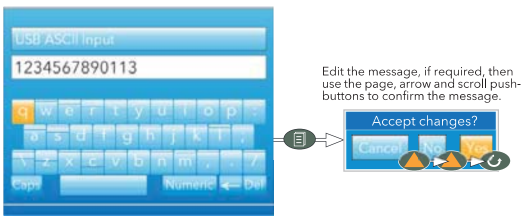


Figure 8.2 Bar Code reader display

8.3 USB KEYBOARD

A QWERTY keyboard may be plugged into the rear USB port to act in parallel with the virtual keyboard. The editing keys listed below are supported in addition to the standard alpha-numeric characters.

Left arrow	Moves the cursor left-wards through the text string (stops at the start of the string).
Right arrow	Moves the cursor right-wards through the text string (stops at the end of the string).
Backspace	Deletes the character immediately to the left of the cursor.
Delete	Removes the character immediately to the right of the cursor.
End	Moves the cursor to the end of the string
Home	Moves the cursor to the start of the string
Insert	Highlights the entire string, for overwriting
Esc	Exit without saving changes.

Appendix A: TECHNICAL SPECIFICATION

A1 INSTALLATION CATEGORY AND POLLUTION DEGREE

This product has been designed to conform to BS EN61010 installation category II and pollution degree 2, defined as follows:

Installation category II

The rated impulse voltage for equipment on nominal 230V mains is 2500V.

Pollution degree 2

Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

A2 RECORDER SPECIFICATION

I/O types

Analogue i/p: Four (eight if dual input option fitted)
Digital i/p: Two
Digital (logic) o/p: See table A2 for options
Relay o/p: See table A2 for options
DC output: See table A2 for options

Features:
CSV archive format
EtherNet/IP (Option)
File transfer protocol (FTP)
Messages
Modbus Master (Option)
Modbus TCP slave
Set point programmer (option)
uhh (history file) archiving
USB port at rear of instrument
User linearisation tables (four)
Two control loops (optional)
Advanced Loop (optional)
Zirconia probe support (optional)
15 Virtual channels (each configurable as maths, totaliser or counter).
30 Virtual channels if Modbus Master or EtherNet/IPoptions fitted (no alarms on virtual channels 16 to 30)

IO1	OP2	OP3	OP4	OP5	
L	R	R	R	R	Default
L	R	D	R	R	Options
L	L	R	R	R	
R	D	D	R	R	
D	D	D	R	R	

L = Logic output; R = Relay; D = DC output
OP4 and OP5 share Common terminals.

Table A2 Output options

Environmental performance

Ambient temperature range
Operating: 0 to 55°C
Storage: -20 to +70°C
Humidity range Operating: 5% to 85% RH non condensing
storage: 5% to 85% RH non condensing
Protection Front panel (Standard): IP65
Front panel (Wash down): IP66, NEMA12
Behind panel: IP10 (International)
Shock/Vibration: To BS EN61131-2 (5 to 150 Hz. at 1g; 1 octave per min.)
Altitude: <2000 metres
Atmosphere: Not suitable for use in explosive or corrosive atmospheres.
Electrical safety: BS EN61010-1 (Installation category II; Pollution degree 2)
Electromagnetic compatibility
Emissions (standard units): BS EN61326 Class B - Light industrial.
Emissions (Low voltage option): BS EN61326 Class A - Heavy industrial
Immunity: BS EN61326 Industrial

Other approvals and compliance details

General: CE and cUL, EN61010
PV input: AMS2750D compliant
RoHS: EU; China
Packaging: BS EN61131-2 section 2.1.3.3.

Physical

Panel mounting: 1/4 DIN
Weight: 0.44kg (15.52 oz.)
Panel cutout dimension: 92 mm x 92 mm (both -0.0 +0.8) or 3.62 in x 3.62 in (both -0.00 +0.03 in) (figure 2.1)
Depth behind panel: 90 mm (3.54 in) (figure 2.1) excluding wiring.

Operator interface

Display: 3.5" TFT colour display (320 pixels wide x 240 pixels high)
Controls: Four navigation pushbuttons below the display screen (Page, Scroll, Lower and Raise)

Power requirements

Supply voltage Standard: 100 to 230Vac ± 15% at 48 to 62Hz.
Low voltage option: 24Vac (+10% - 15%), at 48 to 62 Hz, or 24Vdc (+20% -15%)
Power dissipation: 9 W
Fuse type: None
Interrupt protection Standard: Holdup >10ms at 85V RMS supply voltage.
Low voltage option: Holdup >10ms at 20.4V RMS supply voltage.

Battery backup

Stored data: Time, date.
Support time (for real-time clock): Minimum of 1 year with unit unpowered.
Replacement period: Three years typical
Type: poly-carbonmonofluoride / lithium (BR2330) (PA260195)

Ethernet communications

Type: 10/100baseT Ethernet (IEEE802.3)
Protocols: Modbus TCP/IP slave, FTP, DHCP
Cable type: Category 5
Maximum length: 100metres (110 yards)
Termination: RJ45. Green LED illuminated = link connected; Amber LED flashing shows link activity.

A2 RECORDER SPECIFICATION (Cont.)

USB port

Number of ports		One at rear of instrument
Standard		USB1.1
Transmission speeds		1.5Mbits/sec (low speed device)
Maximum current		<100mA
Peripherals supported		Memory stick (8GB max), Bar code reader, QWERTY keyboard

Update/Archive rates

Sample rate (input/output)		8Hz (4Hz for digital inputs) (4Hz for dual input channels)
Trend update		8 Hz max
Archive sample value		Latest value at archive time
Display value		Latest value at display update time.

A3 ANALOGUE INPUT SPECIFICATION

General

Number of anaologue inputs		Four
Input types	Standard:	dc Volts, dc mV, dc mA (external shunt required), thermocouple, RTD (2-wire and 3-wire), digital (contact closure).
	Optional:	dual mA, dual mV, dual thermocouple.
Input type mix		Freely configurable
Sample rate		8Hz (125ms)
Conversion method		16 bit delta sigma.
Input ranges		See below.
Mains rejection (48 to 62Hz)		
	Series mode:	>95dB
	Common mode:	>179dB
Common mode voltage		250Vac max.
Series mode voltage		280mV at lowest range; 5V peak-to-peak, at highest range.
Input impedance		See relevant Range specification, below.
Overvoltage protection	Continuous:	± 30V RMS
	Transient (<1ms):	±200V pk-pk between terminals.
Sensor break detection	Type	ac sensor break on each input giving quick response with no associated dc errors.
	Recognition time:	<3 secs.
	Minimum break resistance:	40mV, 80mV ranges: 5kΩ; other ranges: 12.5kΩ
Shunt (mA inputs only)	Values	1Ω to 1kΩ, mounted externally.
	additional error due to shunt:	0.1% input
Isolation	Channel to channel:	300V RMS or dc (double insulation)
	Channel to common electronics:	300V RMS or dc (double insulation)
	Channel to ground:	300V RMS or dc (double insulation)
Dielectric strength	Test:	BS EN61010, 1 minute type test
	Channel to channel:	2500 Vac
	Channel to ground:	1500 Vac

DC input ranges

Ranges		40mv, 80mV, 2V; 10V (-4.0 to +10V)
40mV Range	Range:	-40mV to + 40mV
	Resolution	1.9μV (unfiltered)
	Measurement noise:	1.0μV peak-to-peak with 1.6s input filter
	Linearity error:	0.003% (best fit straight line)
	Calibration error:	±4.6μV ±0.053% of measurement at 25°C ambient
	Temperature coefficient:	±0.2μV/°C ± 13ppm/°C of measurement from 25°C ambient
	Input leakage current:	±14nA
	Input resistance:	100MΩ
80mV Range	Range:	-80mV to + 80mV
	Resolution	3.2μV (unfiltered)
	Measurement noise:	3.3μV peak-to-peak with 1.6s input filter
	Linearity error:	0.003% (best fit straight line)
	Calibration error:	±7.5μV ±0.052% of measurement at 25°C ambient
	Temperature coefficient:	±0.2μV/°C ± 13ppm/°C of measurement from 25°C ambient
	Input leakage current:	±14nA
	Input resistance:	100MΩ
2V Range	Range:	±2V
	Resolution	82μV
	Measurement noise:	90μV peak-to-peak with 1.6s input filter
	Linearity error:	0.003% (best fit straight line)
	Calibration error:	±420μV ±0.044% of measurement at 25°C ambient
	Temperature coefficient:	±125μV/°C ± 13ppm/°C of measurement from 25°C ambient
	Input leakage current:	±14nA
	Input resistance:	100MΩ

A3 ANALOGUE INPUT SPECIFICATION (Cont.)

DC Input ranges (Cont.)

10V Range	Range:	-3V to +10V
	Resolution	500μV
	Measurement noise:	550μV peak-to-peak with 1.6s input filter
	Linearity error:	0.007% (best fit straight line) for zero source resistance. Add 0.003% for each 10Ω source and lead resistance
	Calibration error:	±1.5mV ±0.063% measurement at 25°C ambient
	Temperature coefficient:	±66μV/°C ± 45ppm/°C of measurement from 25°C ambient
	Input resistance:	62.5kΩ for input voltages > 5.6V. 667kΩ for input ranges < 5.6V.

Note: 10V range not available for dual input channels

Resistance input ranges

Temperature scale	ITS90
RTD Types, ranges and accuracies	See table
Maximum source current	200μA

Resistance input figures

Range:	0 to 400Ω (-200 to +850°C)
Resolution:	0.05°C
Measurement noise:	0.05°C peak-peak with 1.6s input filter
Linearity error:	0.0033% (best fit straight line)
Calibration error:	±0.31°C ±0.023% of measurement in °C at 25°C ambient
Temperature coefficient:	±0.01°C/°C ±25ppm/°C measurement in °C from 25°C ambient
Lead resistance	0 to 22Ω matched lead resistances
Bulb current:	200μA nominal

RTD type	Overall range °C	Standard	Max. linearisation error
Cu10	-20 to + 400	General electric Co.	0.02°C
Cu53	-70 to + 200	RC21-4-1966	<0.01°C
JPT100	-220 to + 630	JIS C1604:1989	0.01°C
Ni100	-60 to + 250	DIN43760:1987	0.01°C
Ni120	-50 to + 170	DIN43760:1987	0.01°C
Pt100	-200 to + 850	IEC751	0.01°C
Pt100A	-200 to + 600	Eurotherm Recorders SA	0.09°C

Table A3a RTD type details

Thermocouple data

Temperature scale		ITS90
CJC	Types:	Off, internal, external, remote.
	Remote CJC source	Any input channel
	Internal CJC error	<1 °C max, with instrument at 25 °C
	Internal CJC rejection ratio:	40:1 from 25°C
Upscale/downscale drive		High, low or none independently configurable for each channel's sensor break detection.
Types, ranges and accuracies		See table A3b

T/C type	Overall range (°C)	Standard	Max. linearisation error
B	0 to + 1820	IEC584.1	0 to 400°C = 1.7°C 400 to 1820°C = 0.03°C
C	0 to + 2300	Hoskins	0.12°C
D	0 to + 2495	Hoskins	0.08°C
E	-270 to + 1000	IEC584.1	0.03°C
G2	0 to + 2315	Hoskins	0.07°C
J	-210 to + 1200	IEC584.1	0.02°C
K	-270 to + 1372	IEC584.1	0.04°C
L	-200 to + 900	DIN43710:1985 (to IPTS68)	0.02°C
N	-270 to + 1300	IEC584.1	0.04°C
R	-50 to + 1768	IEC584.1	0.04°C
S	-50 to + 1768	IEC584.1	0.04°C
T	-270 to + 400	IEC584.1	0.02°C
U	-200 to + 600	DIN43710:1985	0.08°C
NiMo/NiCo	-50 to + 1410	ASTM E1751-95	0.06°C
Platinel	0 to + 1370	Engelhard	0.02°C
Mi/NiMo	0 to + 1406	Ipsen	0.14°C
Pt20%Rh/Pt40%/Rh	0 to + 1888	ASTM E1751-95	0.07°C

Table A3b Thermocouple types, ranges and accuracies

A4 RELAY AND LOGIC I/O SPECIFICATION

OP1, OP2, OP3 logic input, logic output and relay specification.

Active (current on) current sourcing logic output		
Voltage output across terminals		+11V min; +13V max.
Short circuit output current		6mA min. (steady state); 44mA max. (switch current)
Inactive (current off) current sourcing logic output (OP1 or OP2 only)		
Voltage output across terminals		0V (min.); 300mV (max)
Output source leakage current	into short circuit	0μA (min.); 100μA max
Active (current on) contact closure sourcing logic input (OP1 only)		
Input current	Input at 12V:	0mA (min.); 44mA (max.)
	inout at 0V:	6mA min. (steady state); 44mA max. (switch current)
Open circuit input voltage		11V (min.); 13V (max.)
Open circuit (inactve) resistance		500Ω (min.); □ (max.)
Closed circuit (active) resistance		0Ω (min.); 150Ω (max.)
Relay contacts		
Contact switching power (resistive)		Max: 2A at 230V RMS ±15%; Min: 100mA @ 12V.
Maximum current through terminals		2A

A5 DIGITAL INPUTS

DigInA, DigInB, contact closure logic input

Contact closure	
Short circuit sensing current (source)	5.5mA (min.); 6.5mA (max.)
Open circuit (inactive) resistance	600 Ω (min.); □ (max.)
Closed circuit (active) resistance	0Ω (min.); 300Ω (max.)
Maximum frequency	8 Hz
Minimum pulse width	62.5 ms

A6 DC OUTPUTS

OP1, OP2, OP3 DC analogue outputs

Current outputs (OP1, OP2 and OP3)	
Output ranges	Configurable within 0 to 20mA
Load resistance	500Ω Max.
Calibration accuracy	<±100μA ±1% of reading
Voltage outputs (OP3 only)	
Output range	Configurable within 0 to 10V
Output impedance	500Ω Min.
Calibration accuracy	<±50mV ±1% of reading
General	
Isolation	300Vac double insulated from instrument and other I/O
Resolution	>11 bits
Thermal drift	<100ppm/°C

A7 BLOCKS SUPPORTED

A7.1 ‘TOOLKIT’ BLOCKS

BCD input
Eight-input logic
Eight input multiplexer
Timers
Two-input logic
Two-input maths
User values

A7.2 APPLICATION BLOCKS

Humidity
Steriliser
Zirconia

Appendix B CONTROL LOOPS

Note: See section 4.6 for Loop configuration details

B.1 INTRODUCTION

With this recorder, two control loops are available, each loop containing two outputs (Channel 1 and Channel 2) which can be individually configured for PID, On/Off or valve position. For temperature control, channel 1 is normally configured for heating and channel 2 for cooling.

B1.1 EXAMPLE (HEAT ONLY)

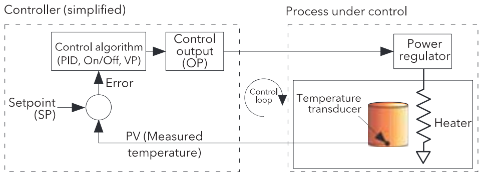


Figure B1.1 Control loop example

The measured temperature (process variable, or 'PV') is connected to the input of the controller, where it is compared with the 'Setpoint' (SP) (the target temperature). If there is a difference between the PV and the SP, the controller calculates and outputs a heating demand. This output is applied to the process heating device, which in turn causes a change in the PV in a direction intended to result in a zero error.

B2 CONTROL LOOP DEFINITIONS

B2.1 AUTO/MANUAL

In manual mode, if 'On/Off' control is configured, the output power may be edited by the user but the only power values allowed are: +100% (heat on; cool off) for positive user entries, 0% (heat off; cool off) for zero entry or -100%. (heat off; cool on) for negative entries.

In manual mode, for 'PID' control the output may be edited between +100% and (if 'cool' is configured), -100%. The actual output value is subject to limiting and output rate limit.

In manual mode, for valve position control, the up and down arrow buttons directly control (nudge) the raise and lower relay outputs respectively. It is also possible to control the valve by sending nudge commands over a serial link, or by software wiring from a suitable parameter. A single nudge command moves the valve by 1 minimum on time; longer nudge demands produce longer valve movements. See section B2.6.10 for more details.

If sensor break occurs while the controller is in automatic the controller outputs the sensor break output power. In such a case the user can switch to manual control and edit the output power. On returning to automatic control, the controller checks again for sensor break.

If autotune is enabled while in manual mode, the autotune remains in a reset state such that when the user puts the controller into automatic control the autotune starts.

B2.2 TYPES OF CONTROL LOOP

B2.2.1 On/Off control

This form of control turns heating power on when the process value is below the setpoint, and turns it off when it is above the setpoint (see also figure B2.6.9a). If cooling is configured, it has its own relay which operates in a similar way. In Direct Acting mode, the behaviour is inverted. On/off is suitable for controlling switching devices such as relays.

Because of the thermal inertia of the load, a certain amount of oscillation will take place, and this can affect the quality of the product. For this reason, On/Off control is not recommended for critical applications.

Depending on the nature of the process being controlled, some hysteresis may have to be included to prevent continuous operation or chatter in the controlling device.

B2.2.2 PID Control

Also known as 'three term control', this type of control continuously adjusts the output demand, according to a set of rules, in order to control the process as closely as possible to requirements. PID provides more stable control than On/Off control but is more complex to set up as the parameters must match the characteristics of the process under control.

The three major parameters are: Proportional band (PB), Integral time (Ti) and Derivative time (Td) and the output from the controller is the sum of these three terms. This output is a function of the size and duration of the error value and the rate-of-change of the process value.

It is possible to disable the integral and/or derivative terms and control on proportional only, on proportional plus integral (PI) or proportional plus derivative (PD).

PI control is often used when the PV is noisy and/or subject to rapid variations, where derivative action would cause the output power to fluctuate wildly.

PROPORTIONAL BAND

The proportional band (PB) delivers an output which is proportional to the size of the error signal. It is the range over which the output power is continuously adjustable in a linear fashion from 0% to 100% (for a heat only controller). Below the proportional band the output is full on (100%), above the proportional band the output is full off (0%) as shown in figure B2.2.2a.

The width of the proportional band determines the magnitude of the response to the error. If PB is too narrow (high gain) the system oscillates; if it is too wide (low gain) control is sluggish. The ideal situation is when the proportional band is as narrow as possible without causing oscillation.

Figure B2.2.2a also shows the effect of narrowing proportional band to the point of oscillation. A wide proportional band results in straight line control but with an appreciable initial error between setpoint and actual temperature. As the band is narrowed the temperature gets closer to setpoint until eventually, it becomes unstable.

The proportional band may be set in engineering units or as a percentage of the controller range.

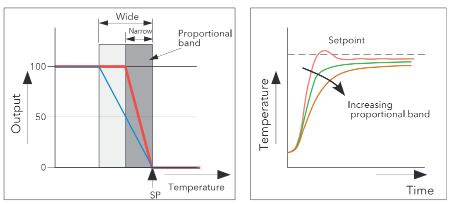


Figure B2.2.2a Proportional band action (reverse acting)

B2.2 TYPES OF CONTROL LOOP (Cont.)

INTEGRAL TERM

In a proportional only controller, as seen in the previous section, an error must exist between setpoint and PV in order for the controller to deliver power. Integral is used to achieve zero steady state control error.

The integral term slowly modifies the output level as a result of any error between setpoint and measured value. If the measured value is below setpoint the integral action gradually increases the output in an attempt to correct the error. If it is above setpoint integral action gradually decreases the output or increases the cooling power to correct the error.

Figure B2.2.2b shows proportional plus integral action.

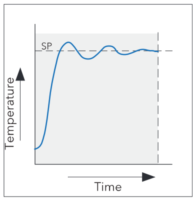


Figure B2.2.2b: Proportional + Integral Control

The integral term is set in seconds. The longer the integral time constant, the more slowly the output is modified and the more sluggish the response. Too small an integral time causes the process to overshoot, and perhaps to start oscillating. The integral action may be disabled by setting its value to Off.

DERIVATIVE TERM

Derivative (or rate) action provides a sudden change in output linked to the rate of change in error, whether this is caused by PV alone (derivative on PV) or by a change in the SP as well (derivative on error selection). If the measured value falls quickly, derivative provides a large change in output in an attempt to correct the perturbation before it goes too far. It is most beneficial in recovering from small perturbations.

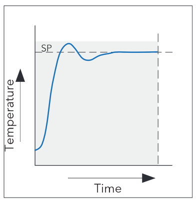


Figure B2.2.2c Proportional + Integral + Derivative Action

Derivative is used to improve the performance of the loop. There are, however, situations where derivative may be the cause of instability. For example, if the PV is noisy, then derivative can amplify that noise and cause excessive output changes, in these situations it is often better to disable the derivative and re-tune the loop.

B2.2 TYPES OF CONTROL LOOP (Cont.)

Derivative should not be used to curb overshoot in situations when the output is saturated at Op High or Op Low for extended periods, such as process start up, since to do so degrades the steady state performance of the system. Overshoot inhibition is best left to the approach control parameters, High and Low Cutback.

If Derivative is set to Off, no derivative action will be applied.

Derivative can be calculated on change of PV or change of Error. If configured on error, then changes in the setpoint will be transmitted to the output. For applications such as furnace temperature control, it is common practice to select Derivative on PV to prevent thermal shock caused by a sudden change of output as a result of a change in setpoint.

B2.2.3 Motorised valve control

Designed specifically for driving motorised valves this type of control can operate in 'Unbounded' mode (VPU) or 'Bounded' mode (VPB). Relay outputs are used to drive the valve motor.

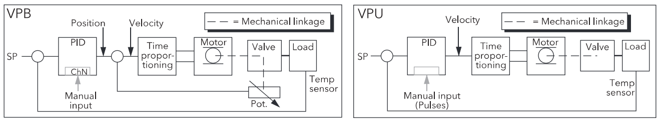


Figure B2.2.3 VPB and VPU comparison

Unbounded valve positioning (VPU) does not require a position feedback potentiometer in order to operate because it controls directly the direction and velocity of the movement of the valve in order to minimise the error between the setpoint (SP) and the process variable (PV). Control is performed by delivering a 'raise' or 'lower' pulse to control the velocity of the valve in response to the control demand signal.

Bounded VP (VPB) control uses PID (or any other combination of the three terms) to set a required valve position. A feedback potentiometer linked to the valve provides a signal giving actual valve position. This allows the control loop to calculate the difference between required and actual position dynamically, and adjust control output accordingly. Control is performed by delivering a 'raise' or 'lower' pulse to adjust the valve position.

MANUAL MODE

Bounded VP controls in manual mode because the inner positional loop is still running against the potentiometer feedback, so it is operating as a position loop.

In boundless mode the algorithm is a velocity mode positioner. When manual is selected then the up and down arrow produce +100% or –100% velocity respectively for the duration of the key press.

In boundless mode it is essential that the motor travel time is set accurately in order to allow the integral time to calculate correctly. Motor travel time is defined as (valve fully open – valve fully closed). This is not necessarily the time printed on the motor since, if mechanical stops have been set on the motor, the travel time of the valve may be different.

Every time the valve is driven to its end stops the algorithm is reset to 0% or 100% to compensate for any changes which may occur due to wear in linkages or other mechanical parts.

This technique makes boundless VP look like a positional loop in manual even though it is not. This enables combinations of heating and cooling e.g. PID heat, VPU cool with manual mode working as expected.

MOTORISED VALVE OUTPUT CONNECTIONS

The loop output which has been configured as valve position can be wired to the PV input of one of the pairs of relays 2A2B/3A3B or 4AC/5AC which has been configured as Type = 'Valve Raise'. Only one relay input needs to be wired as the other relay of the pair will be automatically set to 'Valve Lower'. For example, if Loop 1 Channel 1 output is wired to Relay 2A2B and the 'Type' is configured as 'Valve Raise' then the Type for Relay 3A3B will be 'Valve Lower'.

B2.3 LOOP PARAMETERS

B2.3.1 Relative cool gain (R2G)

This is the gain of channel 2 control output, relative to the channel 1 control output and is used to compensate for the different quantities of power available to heat and to cool a process. For example, water cooling applications might require a relative cool gain of 0.25 because cooling is 4 times greater than the heating process at the operating temperature.

By default, this parameter is set automatically when an Autotune is performed, but setting the Tune menu parameter 'AT.R2G' to 'No' causes the R2G value(s) entered in the PID menu to be used instead.

B2.3.2 High and Low cutback

Cutback high 'CBH' and Cutback low 'CBL' are values that modify the amount of overshoot, or undershoot, that occurs during large step changes in PV under start-up conditions, for example. They are independent of the PID terms which means that the PID terms can be set for optimal steady state response and the cutback parameters used to modify any overshoot which may be present.

Cutback involves moving the proportional band towards the cutback point nearest the measured value whenever the latter is outside the proportional band and the power is saturated (at 0 or 100% for a heat only controller). The proportional band moves downscale to the lower cutback point and waits for the measured value to enter it. It then escorts the measured value with full PID control to the setpoint. In some cases it can cause a 'dip' in the measured value as it approaches setpoint as shown in figure B2.3.2 but generally decreases the time to needed to bring the process into operation.

The action described above is reversed for falling temperature.

If cutback is set to Auto the cutback values are automatically configured to 3 □PB.

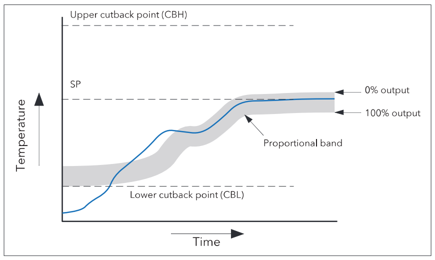


Figure B2.3.2 Cutback operation

Briefly, if PV < CBL then the output is set to its maximum.

If PV > CBH, then the output is set to its minimum

If PV lies within the range CBH-CBL, then PID calculations take control.

B2.3.3 Manual Reset

With PID control, the integral term automatically removes the steady state error from the setpoint. With PD control, the integral term is set to 'OFF', and the measured value will not settle precisely at the setpoint. The Manual Reset parameter (MR in the PID menu) represents the value of the power output that will be delivered when the error is zero. This value must be set manually in order to remove the steady state error.

B2.3 LOOP PARAMETERS (Cont.)

B2.3.4 Integral Hold

If 'Integral Hold' (Main menu) is set to 'Yes', the integral component of the PID calculation is frozen, that is, it holds its current value but does not integrate any disturbances in the plant. This is equivalent to switching into PD control with a manual reset value preconfigured.

Integral Hold may be used, in a situation where the loop is expected to open. For example, it may be necessary to turn heaters off for a short period or to switch into manual at low power. In this case it may be advantageous to wire Integral Hold to a digital input which activates when the heaters are turned off. When the heaters are switched on again, because the integral is at its previous value, overshoot is minimised.

B2.3.5 Integral De-bump

This feature is not accessible to the user. When changing from Manual to Auto control. the integral component is forced to: (out put value – proportional component – derivative component) (I = OP – P – D).

This ensures that no change occurs in output at the point of switch over, ('Bumpless Transfer'). The output power then gradually changes in accordance with the demand from the PID algorithm.

If manual mode = 'Track', bumpless transfer also occurs when changing from Auto to Manual control. At the point of changeover the output power remains the same as the demand in the auto state. The value can then be altered by the operator. For other modes, the output steps to the 'Forced output' or 'Last MOP' value as appropriate. See 'Manual Mode in the Output menu for further details

B2.3.6 Loop Break

Loop Break attempts to detect loss of restoring action in the control loop by checking the control output, the process value and its rate of change. Since response times vary from process to process, the Loop Break Time (LBT) parameter (PID menu) allows a time to be set before a Loop Break Alarm (Loop Break - Diagnostics menu) becomes active. LBT is set automatically in Autotune.

The Loop Break Alarm parameter has no direct effect on control. In order to define behaviour under Loop Break conditions, the parameter must be wired, for example, to a relay, which can then activate an external indicator.

It is assumed that, so long as the requested output power is within the output power limits of a control loop, the loop is operating in linear control and is therefore not in a loop break condition. If, however, the output becomes saturated then the loop is operating outside its linear control region. If the output remains saturated at the same output power for a significant duration, then this might be symptomatic of a fault in the control loop. The source of the loop break is not important, but the loss of control could be catastrophic.

Since the worst case time constant for a given load is usually known, a worst case time can be calculated over which the load should have responded with a minimum movement in temperature. By performing this calculation the corresponding rate of approach towards setpoint can be used to determine if the loop can no longer control at the chosen setpoint. If the PV was drifting away from the setpoint or approaching the setpoint at a rate less than that calculated, the loop break condition would be met.

If an autotune is performed the loop break time is automatically set to Ti □2 for a PI or PID loop, or to 12 □ Td for a PD loop. For an On/Off controller loop break detection is based on loop range settings as 0.1 □ Span where Span = Range High – Range Low. Therefore, if the output is at limit and the PV has not moved by 0.1Span in the loop break time a loop break will occur.

If the loop break time is 0 (off) the loop break time can be set manually. Then, if the output is in saturation and the PV has not moved by >0.5 □Pb in the loop break time, a loop break condition is considered to have occurred.

B2.3.7 Gain Scheduling

In some processes the tuned PID set may be different at low temperatures from that at high temperatures particularly in control systems where the response to the cooling power is significantly different from that of the heating power, or when changes in the process have occurred. Gain scheduling allows a number of PID sets to be stored and provides automatic transfer of control between one set of PID values and another. For this instrument, the maximum number of sets is three which means that two boundaries are provided to select when the next PID set is used. When a boundary is exceeded the next PID set is selected bumplessly. Hysteresis is used to stop scheduling oscillation at the boundaries.

Gain scheduling is basically a look up table which can be selected using different strategies or types. Auto tune tunes to the active scheduled PID set.

The following Gain Scheduled types are offered using the PID menu parameter 'Sched Type':

Set	Required set selected by the user. Alternatively soft wiring may be used to control the PID set selection
Setpoint	Transfer between sets is dependent on the setpoint value
PV	Transfer between sets is dependent on the process value
Error	Transfer between sets is dependent on the Error value
Output	Transfer between sets is dependent on the output demand value
Remote	A remote parameter may be wired into the scheduler. The PID set is then selected according to the value of this input.

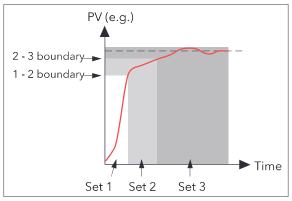


Figure B2.3.7 gain scheduling

B2.4 TUNING

B2.4.1 Introduction

The balancing of the P, I and D terms varies from process to process. In a plastics extruder, for example, there are different responses to a die, casting roll, drive loop, thickness control loop or pressure loop. In order to achieve the best performance from an extrusion line all loop tuning parameters must be set to their optimum values.

Tuning involves setting the following PID menu parameters:

Proportional Band (PB), Integral Time (Ti), Derivative Time (Td), Cutback High (CBH), Cutback Low (CBL), and Relative Cool Gain (R2G - applicable to heat/cool systems only).

The recorder/controller is shipped with these parameters set to default values. In many cases the default values give adequate, stable, straight-line control, but the response of the loop may not be ideal. Because process characteristics vary it is often necessary to adjust the control parameters to achieve best control. To determine the optimum values for any particular loop or process it is necessary to carry out a procedure called loop tuning. If significant changes are later made to the process which affect the way in which it responds it may be necessary to retune the loop.

Users have the choice of tuning the loop automatically or manually. Both procedures require the loop to oscillate and both are described in the following sections.

B2.4.2 Loop Response

Ignoring loop oscillation, there are three categories of loop performance viz Under damped, Critically damped and Over damped:

UNDER DAMPED

In this situation the parameters are set to prevent oscillation but lead to an overshoot of the Process Value (PV) followed by decaying oscillation until the PV finally settles at the Setpoint. This type of response can give a minimum time to Setpoint but overshoot may cause problems in certain situations and the loop may be sensitive to sudden changes in PV, resulting in further decaying oscillations before settling once again.

CRITICALLY DAMPED

This represents an ideal situation where noticeable overshoot to small step changes does not occur and the process responds to changes in a controlled, non oscillatory manner.

OVER DAMPED

In this situation the loop responds in a controlled but sluggish manner which results in a non-ideal and unnecessarily slow loop performance.

B2.4.3 Initial Settings

In addition to the tuning parameters listed above, there are a number of other parameters which can affect loop response. These parameters must be correctly configured before tuning is initiated. Parameters include, but are not limited to:-

SETPOINT

Before tuning, the loop conditions should be set as closely as practicable to the actual conditions which will be met in normal operation. For example, in a furnace or oven application a representative load should be included, an extruder should be running, etc.

OUTPUT HIGH, OUTPUT LOW

These Output menu heat and cool limits define the overall maximum and minimum power which may be delivered to the process by the control loop. For a heat only controller the default values are 0 and 100%. For a heat/cool controller the defaults are -100 and 100%. Although most processes are designed to work between these limits there may be instances where it is desirable to limit the power delivered to the process.

REM. OUTPUT LOW, REM. OUTPUT HIGH

If these Remote Output Limits parameters (Output menu) are used, they are effective only if they lie within the Heat/Cool Limits above.

CH2 DEADBAND

Heat/Cool Dead band If a second (cool) channel is configured, a parameter 'Ch2 Deadband' is also available in the Output menu which sets the distance between the heat and cool proportional bands. The default value is 0% which means that heating will cease to be available at the same time as cooling becomes available. The dead band may be set to ensure that there is no possibility of the heat and cool channels operating together, particularly when cycling output stages are installed.

MINIMUM ON TIME

If either or both of the output channels is fitted with a relay or logic output, the parameter 'Min On Time' appears in the output menu. This is the cycling time for a time proportioning output and should be set correctly before tuning is started.

FILTER

The 'Filter' parameter is found in the Channel 'Main' menu (section 4.4). It is used to remove noise from slowly changing signals so that the underlying trend can be seen more clearly.

B2.4.3 INITIAL SETTINGS (Cont.)

RATE

Sets the maximum PID rate-of-change. The output rate limit is active during tuning and can affect the tuning results. Rate is useful in preventing rapid changes in output from damaging the process or heater elements. The parameter 'Rate' is found in the 'Setpoint' menu.

CH1 TRAVEL TIME, CH2 TRAVEL TIME

Valve Travel Time. If the output is a motor valve positioner the 'Ch1 Travel Time' and Ch2 Travel Time' Output menu parameters must be set correctly. The valve travel time is the time taken for the valve to travel from 0% (closed) to 100% (open). This may be different from the motor travel time limits because the mechanical linkage between the motor and the valve, setting of limit switches etc. can modify behaviour. In a valve positioner application, the channel output is wired to the 'PV' input of relay 2A2B or 4AC. Configuring this relay as Type = Valve Raise causes the associated relay (3A3C or 5AC respectively) to be configured automatically as Type = Valve Lower, and the action of the relay pair is controlled by the single wire. In a heat/cool application, channel one is the heat valve and channel two is the cool valve.

B2.4.4 Other tuning considerations

If a process includes adjacent interactive zones, each zone should be tuned independently with the adjacent zones at operating temperature.

It is recommended that a tuning process be initiated when the PV and setpoint are far apart. This allows start up conditions to be measured and cutback values to be calculated more accurately. Cutback is not set for 'Tune at setpoint'.

In a programmer/controller tuning should only be attempted during dwell periods and not during ramp stages. If a programmer/controller is tuned automatically the controller should be placed in 'Hold' during each dwell period whilst autotune is active.

> Note: Tuning, carried out in dwell periods which are at different extremes of temperature may give different results owing to non linearity of heating (or cooling). This may provide a convenient way to establish values for Gain Scheduling.

If an auto tune is initiated there are two further parameters (High Output' and 'Low Output') which need to be set. These are found in the 'Tune' menu.

High Output	Sets a high output limit to be imposed during autotune. Must be ≤ Output High, set in the Output menu.
Low Output	Sets a low output limit to be imposed during autotune. Must be ≥ Output Low, set in the Output menu.

The above values must be set correctly, otherwise sufficient power to achieve SP might not be available during tuning, and the tune will eventually fail.

B2.4.5 Autotune

Autotune automatically sets the following PID menu parameters:

PB	Proportional band.
Ti	Integral time. If previously set to 'Off' Ti will remain off after an autotune.
Td	Derivative time. If previously set to 'Off' Td will remain off after an autotune.
CBH, CBL	Cutback high and low values. If either is set to 'Auto', it will remain so after auto tuning. In order that Autotune set the cutback values for the user, a value other than 'Auto' must be selected before Autotune is initiated. Autotune never returns cutback values less than 1.6 × PB
R2G	Calculated only if the unit is configured as Heat/Cool. Following an Autotune, R2G lies between 0.1 and 10. If the calculated value lies outside this range, a 'Tune Fail' alarm is set.
LBT	Loop break time. Following an autotune, LBT is set to 2 × Ti (if Ti was not previously set 'Off'), or to 12 × Td (if Ti was previously set to 'Off').

B2.4.5 AUTOTUNE (Cont.)

Autotune can be performed at any time, but normally it is performed only once, during the initial commissioning of the process. However, if the process under control subsequently becomes unsatisfactory (because its characteristics have changed), it may be necessary to tune again for the new conditions.

The auto tune algorithm reacts in different ways depending on the initial conditions of the plant. The explanations given later in this section are for the following example conditions:-

1. Initial PV is below the setpoint and, therefore, approaches the setpoint from below for a heat/cool control loop
2. As above, but for a heat only control loop
3. Initial PV is at the same value as the setpoint (tune at setpoint). That is, within 0.3% of the range of the controller if 'PB Units' (Setup menu) is set to 'Percent', or ±1 engineering unit (1 in 1000) if the 'PB Units' is set to 'Eng'. Range is defined as 'Range High' – 'Range Low' for process inputs or the thermocouple or RTD range defined in section A3 for temperature inputs. If the PV is just outside the range stated above the autotune will attempt a tune from above or below SP.

AUTOTUNE AND SENSOR BREAK

When the controller is autotuning and sensor break occurs, the autotune aborts and the controller outputs the sensor break output power 'Sbrk OP' set up in the Output menu. Autotune must be re-started when the sensor break condition is no longer present.

AUTOTUNE AND INHIBIT OR MANUAL

If the Loop Inhibit is asserted or the controller is put into Manual Mode, any tune in progress will be aborted and will need to be restart once the condition has been removed. Note that it is not possible to start an autotune sequence if the loop is inhibited or in Manual control.

AUTOTUNE AND GAIN SCHEDULING

When gain scheduling is enabled and an autotune is performed, the calculated PID values are written into the PID set that is active, on completion of the tune. Therefore, the user may tune within the boundaries of a set and the values will be written into the appropriate PID set. However, if the boundaries are close (because the range of the loop is not large), then, at the completion of the tune, it cannot be guaranteed that the PID values will be written to the correct set particularly if the schedule type is PV or OP. In this situation the scheduler ('Sched Type') should be switched to 'Set' and the 'active set' chosen manually.

INITIAL CONDITIONS

Configure the parameters described in sections B2.4.3 and B2.4.4, above.

Notes:
1. The 'tighter' power limit applies. For example, if 'High Output' is set to 80% and 'Output High' is set to 70% then the output power will be limited to 70%
2. The PV must oscillate to some degree to allow the tuner to calculate the relevant values. The limits must be set so as to allow oscillation about the setpoint.

INITIATING THE AUTOTUNE

In the Loop Tune menu for the relevant loop, set 'TuneEn' to 'On'.

B2.4.5 AUTOTUNE (Cont.)

EXAMPLE 1: AUTOTUNE FROM BELOW SP (HEAT/COOL)

The point at which Automatic tuning is performed (Tune Control Point) lies just below the setpoint at which the process is normally expected to operate (Target Setpoint). This ensures that the process is not significantly overheated or overcooled. The Tune Control Point is calculated as follows:-

Tune Control Point = Initial PV + 0.75(Target Setpoint – Initial PV).

The Initial PV is the PV measured after a 1 minute settling period (point 'B' in the figure below).

Examples:

If Target Setpoint = 500°C and Initial PV = 20°C, then the Tune Control Point is 380°C.

If Target Setpoint = 500°C and Initial PV = 400°C, then the Tune Control Point is 475°C.

This is because the overshoot is likely to be less as the process temperature approaches the target setpoint.

Figure B2.4.5a shows the auto tune sequence.

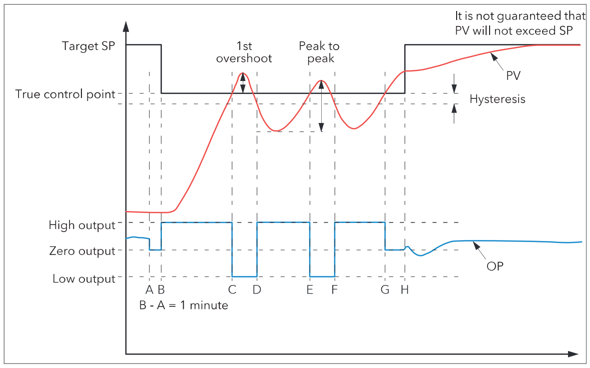


Figure B2.4.5a Autotune heat/cool process

KEY

A	Start of Autotune
A to B	Heating and Cooling off for one minute allows steady state conditions to be established.
B to D	First heat/cool cycle to establish first overshoot. Cutback low (CBL) value calculated from the overshoot magnitude (unless CBL set to 'Auto').
B to F	Two cycles of oscillation allow peak-to-peak value and oscillation period to be determined. PID terms are calculated.
F	Heating is switched on.
G	Heating (and cooling) are switched off allowing the plant to respond naturally. Measurements over the period F to G are used to calculate the Relative Cool Gain (R2G). Cutback High is calculated from the equation (CBH = CBL □R2G).
H	Autotune is turned off and the process is allowed to control at the target setpoint using the new control terms.

Note: Autotuning from above SP is identical except that heating and cooling are reversed.

B2.4.5 AUTOTUNE (Cont.)

EXAMPLE 2: AUTOTUNE FROM BELOW SP (HEAT ONLY)

The sequence of operation for a heat only loop is the same as that described above for a heat/cool loop, except that the sequence ends at 'F' since there is no need to calculate 'R2G' (R2G is set to 1.0 for heat only processes). At 'F' autotune is turned off and the process is allowed to control using the new control terms.

For a tune from below setpoint 'CBL' is calculated on the basis of the size of the overshoot (assuming it was not set to Auto in the initial conditions). CBH is then set to the same value as CBL.

Note: Autotune can also occur when the initial PV is above SP. The sequence is the same as tuning from below setpoint except that the sequence starts with natural cooling applied at 'B' after the first one minute settling time. In this case CBH is calculated and CBL is then set to the same value as CBH.

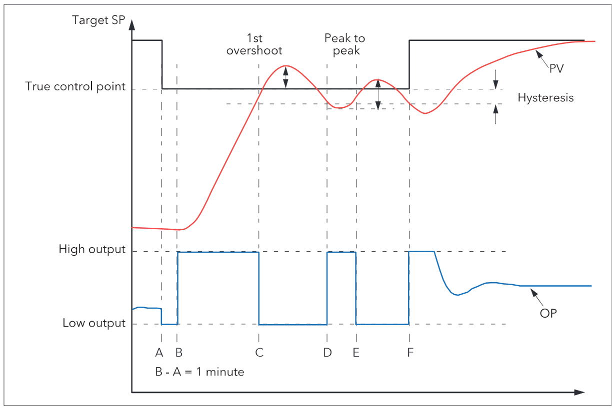


Figure B2.4.5b Autotune heat only process (from below SP)

A	Start of Autotune
A to B	Heating off for one minute to allow steady state conditions to be established.
B to D	First heat cycle to establish first overshoot. Cutback low (CBL) value calculated from the overshoot magnitude (unless CBL set to 'Auto').
D to F	Calculate PID terms.
F	Autotune is turned off and the process is allowed to control at the target setpoint using the new control terms.

B2.4.5 AUTOTUNE (Cont.)

EXAMPLE 3: AUTOTUNE AT SP (HEAT / COOL)

It is sometimes necessary to tune at the actual setpoint being used as shown below.

For a tune at setpoint, autotune does not calculate cutback since there was no initial start up response to the application of heating or cooling. Cutback values of less than 1.6 □PB will not be returned.

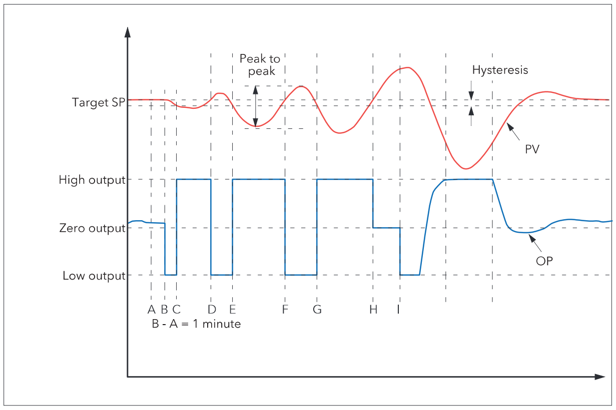


Figure B2.4.5c Autotune at setpoint

A	Start of Autotune. A test is done at the start of autotune to establish conditions for a tune at setpoint. Conditions are that SP must remain within 0.3% of the range of the controller if 'PB Units' (Setup menu) is set to 'Percent', or ±1 engineering unit (1 in 1000) if the 'PB Units' is set to 'Eng'. Range is defined as 'Range High' – 'Range Low' for process inputs or the thermocouple or RTD range defined in section A3 for temperature inputs.
A to B	The output is frozen at he current value for one minute, and the conditions are continuously monitored during this period. If the conditions specified above are met, then an autotune at setpoint is initiated at 'B'. If PV drifts outside the condition limits at any time during this period, tuning at SP is abandoned, and tuning resumes as a 'tune from above' or 'tune from below', depending on the direction of drift. Since the loop is already at setpoint, a Tune Control setpoint is not calculated; the loop is forced to oscillate about the Target SP.
C to G	The process is forced to oscillate by switching the output between the output limits. The oscillation period and the peak-to-peak response are determined, and the PID terms calculated.
G to H	An extra heating stage is initiated, then all heating and cooling are switched off at H, allowing the plant to respond naturally. The relative cool gain (R2G) is calculated.
I	Autotune is switched off and the process is allowed to control at the target setpoint using the newly calculated terms.

B2.4.5 AUTOTUNE (Cont.)

AT.R2G

Some load types and process conditions can cause autotune to set an incorrect value for R2G resulting in an instability in the system after an autotune has completed, In such circumstances, the value of R2G should be checked, and if it is low (approaching 0.1) a manual entry should be made as follows:

1. In the Tune menu, set the AT.R2G parameter to 'No'.
2. In the PID menu, enter the new R2G value (calculated as described below)
3. In the Tune menu, enter a value for Low Output, calculated from: Low Output = -High Output x R2G
4. In the Tune menu, set 'TuneEn' On.

R2G CALCULATION

1. In the Main menu, set the controller to Manual mode
2. Turn heating on (limited by the value of 'Output High' in the Output menu) and measure the heating rate ('H' °C/minute).
3. Allow the process to heat to, say, 10% above the setpoint value then turn the heating off and allow the temperature to settle.
4. Turn cooling power on (limited by the value of 'Output Low' in the Output menu) and measure the cooling rate ('C' °C/minute) whilst allowing the temperature to fall below the setpoint value.
5. Calculate the value of R2G from the equation R2G = (H/C) x (Output Low/output High)

Example:

For a measured heating rate (H) of 10°C per min and a measured cooling rate (C) of 25° per minute and with, Output High = 80% and Output Low = 40%, then R2G = (10/25) x (40/80) = 0.4 x 0.5 = 0.2.

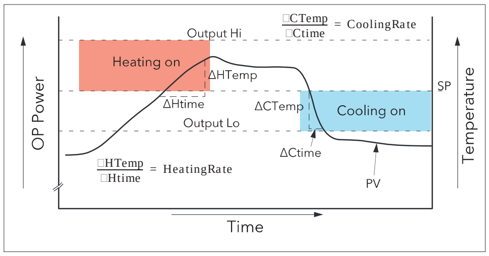


Figure 2.4.5d R2G calculation

Note: This is not a very accurate method as it does not take natural cooling into account. Its main advantage is that it is simple to achieve.

B2.4.5 AUTOTUNE (Cont.)

FAILURE MODES

The conditions for performing an autotune are monitored by the Tune menu parameter 'State'. If autotune is not successful error conditions are read by this parameter as follows:

Timeout	Set if any one stage is not completed within an hour. Possible causes are the loop being open circuit, or not responding to the controller demands. Some heavily lagged systems may produce a timeout if the cooling rate is very slow.
TI Limit	This is set if Autotune calculates a value for the integral term which is greater than the maximum allowable (99999 seconds). This indicates that the loop is not responding or that the tune is taking too long.
R2G Limit	Error occurs if the calculate value of R2G is outside the range 0.1 to 10.0. R2G limit can occur if the gain difference between heating and cooling is too large, or if the controller is configured for heat/cool, but the heating and/or cooling device is turned off or not working correctly.

B2.4.6 Relative Cool Gain in Well Lagged Processes

In the majority of processes Relative Cool Gain R2G is calculated by the autotune algorithm as described in the previous sections.

There are occasions, however, where an alternative algorithm may be preferred. These are processes which are heavily lagged, where the heat loss to ambient is very small so that natural cooling is extremely slow, and certain high order plants, those that need derivative, Td. This algorithm is known as R2GPD and has been added to controllers from firmware version V4.10.

The type of algorithm is selected using the parameter 'Tune R2G' found in the Auto-Tune list, sections 4.6.3 and 4.7.3. The choices are:-

Standard	This is the default as described in example 2 in section B2.4.5. and is suitable for use on most processes. The benefit of this algorithm is that it is relatively quick. However, in the type of process described in the previous paragraph, it can produce values which are not ideal. These values are generally identified by R2G equal to or very close to 0.1.
R2GPD	If the process is known to be heavily lagged or produces values such as those above then R2GPD should be selected. This algorithm extends the autotune period by putting the controller into proportional plus derivative mode (PD) and uses the output power demand value during this period to determine the Relative Cool Gain.
Off	The automatic calculation of Relative Cool Gain can be turned off and the value entered manually as described in section B2.4.6.

EXAMPLE 4: WHEN TUNE R2G = R2GPD, AUTOTUNE FROM BELOW SETPOINT

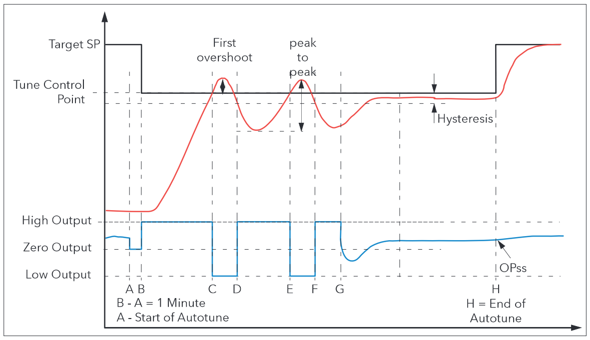


Figure B2.4.6 Autotune from below setpoint

Periods A-F are largely unchanged from the 'Standard' algorithm, example 2 in section B2.4.5 Autotune, with the following exception:

- Changing the Target Setpoint during period A-B will not change the tuning setpoint.

Period F-H is replaced as follows:

F to G	Heat is applied for a period (F-G) of half the first heat cycle (D-E) to compensate for the last cool cycle.
G to H	This is a period in which the controller is put into PD control. The values of proportional term and derivative time for this period of PD control are determined by the algorithm.
H	OPss is the output demand value at the end of this period and is used in the determination of R2G.

B2.4.7 Manual tuning

If, for any reason, automatic tuning gives unsatisfactory results the controller can be tuned manually. There are a number of standard methods for manual tuning, the Zeigler-Nichols method being described here:

1. Adjust the setpoint to its normal running conditions (assumed to be above the PV so that 'heat only' is applied.
2. Set the integral and derivative times (Ti and Td) to 'Off'
3. Set High and Low cutback (CBH and CBL) to 'Auto'.
4. If the PV is stable (not necessarily at the setpoint), reduce the proportional band (PB) such that the PV just starts to oscillate, leaving time between adjustments to allow the loop to stabilise. Make a note of the PB at this point (PB′), and also note the oscillation period ('T').
   If the PV is already oscillating measure the oscillation period ('T') and then gradually increase PB to the point at which oscillation just ceases. Make a note of the PB (PB′) at this point.
5. If the controller is fitted with a cooling channel, enable this now.
6. Observe the oscillation waveform and adjust 'R2G' until a symmetrical wave form is observed (Figure B2.4.7).
7. Set PB, Ti and Td according to table B2.4.7

.

Control type	PB	Ti	Td
Proportional only	2 ×PB′	Off	Off
P + I	2.2 ×PB′	0.8 ×T	Off
P + I + D	1.7 ×PB′	0.5 ×T	0.12 ×T

Table B2.4.7 Calculate parameter values

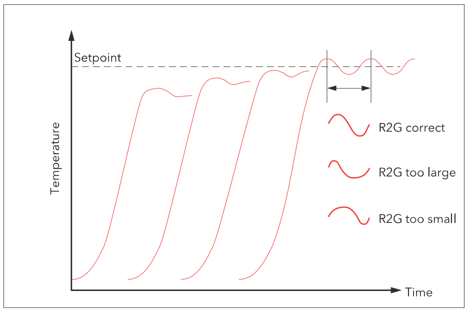


Figure B2.4.6a Relative Cool Gain

CUTBACK VALUES

The PID terms calculated from Table 2.4.7, above, should be entered before the cutback values are set.

The above procedure sets up the parameters for optimum steady state control. If unacceptable levels of overshoot or undershoot occur during start-up, or for large step changes in PV, then the cutback parameters should be set manually, as follows:

1. Initially set the cutback values to one proportional bandwidth converted into display units. This can be calculated by taking the value in percent that has been installed into the parameter 'PB' and entering it into the following formula:

   PB/100 ×Span of controller = Cutback High and Cutback Low
   For example, if PB = 10% and the span of the controller is 0 to 1200°C, then
   Cutback High = Cutback Low = 10/100 ×1200 = 120

B2.4.7 MANUAL TUNING (Cont.)

2. If overshoot is observed following the correct settings of the PID terms increase the value of 'CBL' by the value of the overshoot in display units. If undershoot is observed increase the value of the parameter 'CBH' by the value of the undershoot in display units.

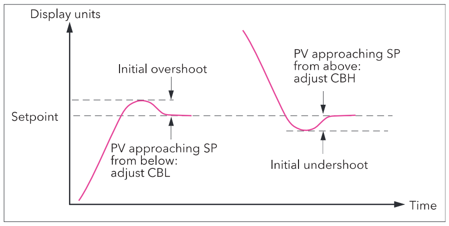


Figure B2.4.6b Manual Cutback setting

B2.5 SETPOINT

The controller setpoint is the Working Setpoint which can be derived from:-

1. SP1 or SP2, both of which are manually set by the user and can be switched into use by an external signal or via the user interface.
2. From an external (remote) analogue source
3. The output of a programmer function block.

B2.5.1 Setpoint function block

As well as providing a setpoint, the function block also provides:

1. The ability to limit the rate of change of the setpoint before it is applied to the control algorithm.
2. Upper and lower limits. These are defined as setpoint limits, 'SP High Limit' and 'SP Low Limit', for the local setpoints and instrument range high and low for other setpoint sources.

Note: All setpoints are limited by 'Range High' and 'Range Low' so that if 'SP High Limit', for example, is set higher than 'Range High', then 'SP High Limit' is ignored and the setpoint is limited at the 'Range High' value.

User configurable methods for tracking are available, such that the transfers between setpoints and between operating modes do not cause 'bumps' in the setpoint.

B2.5.1 Setpoint function block (Cont.)

Figure B2.5.1, below, shows the function block schematic.

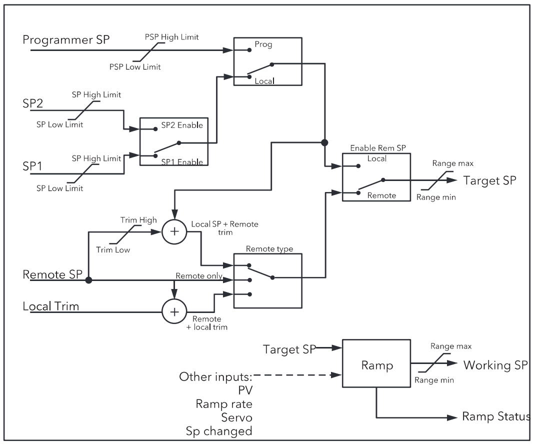


Figure 2.5.1 Setpoint Function block

B2.5.2 Setpoint Limits

The setpoint generator provides limits for each of the setpoint sources as well as an overall set of limits for the loop. These are summarised in figure 2.5.2, below.

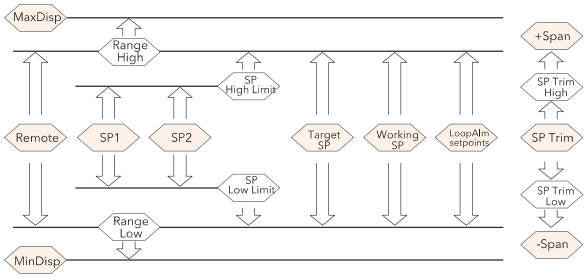


Figure 2.5.2 Setpoint Limits

'Range High' and 'Range Low' provide the range information for the control loop. They are used in control calculations to generate proportional bands. Span = Range High – Range Low.

B2.5.3 Setpoint Rate Limit

This symmetrical rate limiter allows the rate of change of setpoint to be controlled, preventing step changes in the setpoint. The limit is applied to the working setpoint which includes setpoint trim.

Rate limiting is enabled using the 'Rate' parameter. If this is set to '0' then any change made to the setpoint will be effective immediately. If it is set to any other value, then a change in the setpoint will be have rate limiting applied at the value set, in units per minute. Rate limit applies to SP1, SP2 and Remote SP.

When rate limit is active 'Rate Done' displays 'No'. When the setpoint has been reached the value changes to 'Yes'.

When 'Rate' is set to a value (other than 'Off') an additional parameter 'SP Rate Disable' is displayed which allows the setpoint rate limit to be turned off and on without the need to adjust the 'Rate' parameter between Off and a working value.

If the PV is in sensor break, the rate limit is suspended and the working setpoint takes the value of 0. On sensor break being released the working setpoint goes from 0 to the selected setpoint value at the rate limit.

B2.5.4 Setpoint Tracking

The setpoint used by the controller may be derived from a number of sources. For example:-

1. Local setpoints SP1 and SP2. These may be selected through the front panel using the parameter 'SP Select', through digital communications or by configuring a digital input which selects either SP1 or SP2. This might be used, for example, to switch between normal running conditions and standby conditions. If Rate Limit is switched off the new setpoint value is adopted immediately when the switch is changed.
2. A programmer generating a setpoint which varies over time. When the programmer is running, the 'Track SP' and 'Track PV' parameters update continuously so that the programmer can perform its own servo. This is sometimes referred to as 'Program Tracking'.
3. From a Remote analogue source. The source could be an external analogue input into an analogue input module wired to the 'Alt SP' parameter or a User Value wired to the 'Alt SP' parameter. The remote setpoint is used when the parameter 'Alt SP Enable' is set to 'Yes'.

Setpoint tracking (sometimes referred to as Remote Tracking) ensures that the Local setpoint adopts the Remote setpoint value when switching from Local to Remote to maintain bumpless transfer from Remote to Local. Bumpless transfer does not take place when changing from Local to Remote.

Note: If Rate Limit is applied, the setpoint will change at the set rate, when changing from Local to Remote.

B2.5.5 Manual Tracking

When the controller is operating in manual mode the currently selected SP (SP1 or SP2) tracks the PV. When the controller resumes automatic control there will be no step change in the resolved SP. Manual tracking does not apply to the remote setpoint or programmer setpoint.

B2.6 OUTPUT

B2.6.1 Introduction

The output function block selects the correct output sources to be used, determines whether to heat or cool and then applies limits. Power feed forward and non-linear cooling are also applied.

It is this block that manages the output in exception conditions such as start up and sensor break.

The outputs, 'Ch1 Output' and 'Ch2 Output', are normally wired to a digital I/O where they are converted into analogue or time proportioned signals for electrical heating, cooling or valve movement.

B2.6.2 Output Limits

Figure B2.6.2 shows where output limits are applied.

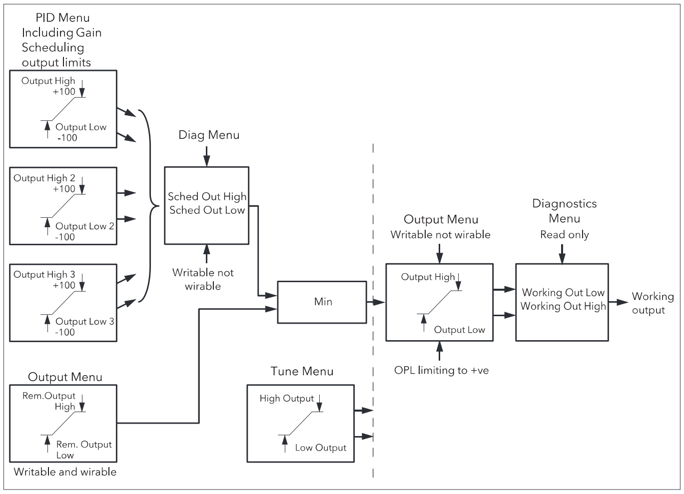


Figure B2.6.2 Output Limits

Notes:

1. Individual output limits may be set in the PID list for each set of PID parameters when gain scheduling is in use.
2. Limits may also be applied from an external source. These are 'Rem.Output High' and 'Rem. Output Low' found in the Output menu. These parameters are wireable; for example they may be wired to an analogue input module so that a limit may applied through some external strategy. If these parameters are not wired ±100% limit is applied every time the instrument is powered up.

(Continued)

B2.6.2 OUTPUT LIMITS (Cont.)

Notes (Continued)

3. The tightest limits (between Remote and PID) are connected to the output where an overall limit is applied using parameters 'Output High' and 'Output Low'.
4. 'Working Out High' and 'Working Out low' found in the Diagnostics list are read only parameters showing the overall working output limits.
5. The tune limits are a separate part of the algorithm and are applied to the output during the tuning process. The overall limits 'Output Hi' and 'Output Lo' always have priority.

B2.6.3 Output Rate Limit

The output rate limiter is a rate-of-change limiter, set in (%/sec) which prevents step changes in output power being demanded. Rate limiting is performed by determining the direction in which the output is changing, and then incrementing or decrementing the Working Output (Main menu) until it equals the required output (Target OP).

The amount to increment or decrement is calculated using the sampling rate of the algorithm (125ms) and the selected rate limit. If the change in output is less than the rate limit increment the change takes effect immediately.

The rate limit direction and increment is calculated on every execution of the rate limit. Therefore, if the rate limit is changed during execution, the new rate of change takes immediate effect. If the output is changed whilst rate limiting is taking place, the new value takes immediate effect on the direction of the rate limit and in determining whether the rate limit has completed.

The rate limiter is self-correcting such that if the increment is small it is accumulated until it takes effect.

The output rate limit is active when the loop is in both auto and manual modes, and during autotune.

B2.6.4 Sensor Break Mode

If a Sensor break is detected by the measurement system the loop reacts in one of two ways, according to the configuration of 'Sbrk Mode' ('Safe' or 'Hold'). On exit from sensor break the transfer is bumpless – the power output starts controlling again from the current operating setpoint and moves, under PID closed-loop control, from its pre-set value to the control value.

SAFE

If set to 'Safe', the output adopts a pre-set level (Sbrk OP). If rate limit is not configured, the output steps to the Sbrk OP value, otherwise it ramps to this value at the rate limit.

HOLD

If set to 'Hold' the output remains at its current value. If Output Rate Limit (Rate) has been configured a small step may be seen as the working output will limit to the value existing two iterations ago.

B2.6.5 Forced Output

This feature enables the user to specify what the output of the loop should do when moving from automatic control to manual control. The default is that the output power is maintained but it is then adjustable by the user.

If Manual Mode is set to 'Step', the user can set a manual output power value and on transition to manual the output will be forced to that value.

If Manual Mode is set to 'Track' the output steps to the forced manual output and then subsequent edits to the output power are tracked back into the manual output value.

If Manual Mode is set to 'Last Man. Out' then when moving from automatic to manual mode, the output adopts the last manual output value.

B2.6.6 Power Feed Forward

Power feed forward is used when driving an electrical heating element. It monitors the line voltage and compensates for fluctuations before they affect the process temperature. The use of this will give better steady state performance when the line voltage is not stable.

It is mainly used for digital type outputs which drive contactors or solid state relays. Because it only has value in this type of application it can be switched off using the parameter 'Pff En'. It should also be disabled for any non-electric heating process. It is not necessary when Eurotherm analogue thyristor control is used since compensation for power changes is included in the thyristor driver.

Consider a process running at 25% power, with zero error and then the line voltage falls by 20%. The heater power would drop by 36% because of the square law dependence of power on voltage. A drop in temperature would result. After a time, the thermocouple and controller would sense this fall and increase the ON-TIME of the contactor just enough to bring the temperature back to set point. Meanwhile the process would be running a bit cooler than optimum which may cause some imperfection in the product.

With power feed forward enabled the line voltage is monitored continuously and ON-TIME increased or decreased to compensate immediately. In this way the process need never suffer a temperature disturbance caused by a line voltage change.

'Power Feed forward' should not be confused with 'Feed forward' which is described in section B2.6.8.

B2.6.7 Cool Type

Cooling methods vary from application to application. For example, an extruder barrel may be cooled by forced air (from a fan), or by circulating water or oil around a jacket. The cooling effect will be different depending on the method. 'Cool Type' (appears only if the 'setup' parameter 'Ch2 Control' is set to 'PID') is used to accommodate different types of cooling methods as follows:

LINEAR

The cooling algorithm may be set to linear where the controller output changes linearly with the PID demand signal.

OIL COOLING

'Cool Type' = 'Oil'. As oil is, to all intents and purposes, non-evaporative, oil cooling is pulsed in a linear manner.

WATER COOLING

If the area being cooled is running well above 100°C, then the first few pulses of water flash into steam giving greatly increased cooling due to the latent heat of evaporation. When the area cools, less (or even no) evaporation takes place and the cooling is less effective.

Setting 'Cool Type' to 'Water' delivers much shortened pulses of water for the first few percent of the cooling range, when the water is likely to be flashing into steam. This compensates for the transition out of the initial strong evaporative cooling.

FAN COOLING

'Cool Type = 'Fan'. Fan cooling is much gentler than water cooling and not so immediate or decisive (because of the long heat transfer path through the process mechanics). With fan cooling, a cool gain setting of three upwards is typical. Delivery of pulses to the blower is non linear, this non-linearity being caused by a combination of forced air movement and fan efficiency as a function of air velocity (e. g. the efficiency of a fan when producing a low speed (laminar) air flow is different from its efficiency when producing a high-speed, turbulent flow.

B2.6.8 Feed forward

Feed forward is a method of adding an extra scalable component to the PID output, before any limiting. It can be used, for example, in the implementation of cascade loops and constant head control or it can be used to pre-load the control signal with a value close to that which is required to achieve the setpoint, thus improving system response. Feed forward (FF) is applied such that the PID output is limited by trim limits and acts as a trim on a FF value. The FF value is derived either from the PV or setpoint by scaling the PV or SP by the 'FF Gain' and 'FF Offset'. Alternatively, a remote value may be used for the FF value, but this is not subject to any scaling. The resultant FF value is added to the limited PID OP and becomes the PID output as far as the output algorithm is concerned. The feedback value then generated must then have the FF contribution removed before being used again by the PID algorithm. The diagram below shows how feed forward is implemented.

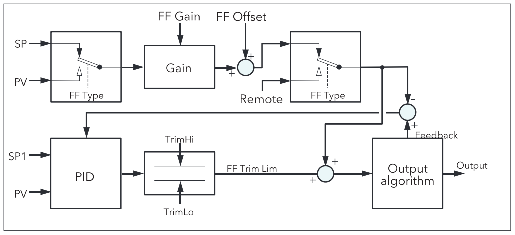


Figure B2.6.8 Implementation of Feed forward

B2.6.9 Effect of Control Action, Hysteresis and Deadband

CONTROL ACTION

For temperature control 'Control Act' should be set to 'Rev'. For a PID controller this means that the heater power decreases as the PV increases. For an on/off controller, output 1 (usually heat) will be on (100%) when PV is below the setpoint and output 2 (usually cool) will be on when PV is above the setpoint.

HYSTERESIS

Hysteresis applies to on/off control only and is set in the units of the PV. In heating applications the output will turn off when the PV is at setpoint. It will turn on again when the PV falls below SP by the hysteresis value. This shown in Figures B2.6.9a and B2.6.9b below for a heat and cool controller.

Hysteresis is intended to prevent the output from repeated switching on and off 'chattering' at the control setpoint. If the hysteresis is set to 0 then even the smallest change in the PV when at setpoint will cause the output to switch. Hysteresis should be set to a value which provides an acceptable life for the output contacts, but which does not cause unacceptable oscillations in the PV.

If this performance is unacceptable, it is recommended that PID control be used instead.

DEADBAND

Deadband 'Ch2 Deadband' can operate on both on/off control or PID control where it has the effect of extending the period when no heating or cooling is applied. In PID control the effect is modified by both the integral and derivative terms. Deadband might be used in PID control, for example, where actuators take time to complete their cycle thus ensuring that heating and cooling are not being applied at the same time. Deadband is likely to be used, therefore, in on/off control only. Figure B2.6.9b, below, adds a deadband of 20 to the first example in figure B2.6.9a.

B2.6.9 EFFECT OF CONTROL ACTION, HYSTERESIS AND DEADBAND (Cont.)

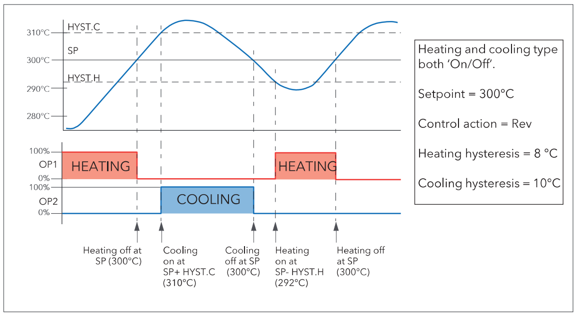


Figure B2.6.9a Deadband OFF

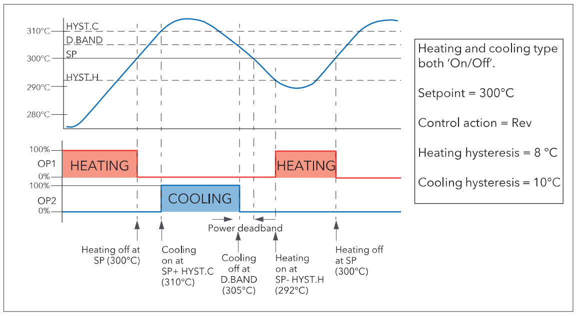


Figure B2.6.9b Deadband ON set at 50% of Cooling.

B2.6.10 Valve nudge

For systems configured as Unbounded Valve Positioning (VPU) - set up in Loop Setup configuration Ch1(2) control), it is possible to move the valve in small increments towards the open position (Nudge Raise) or towards the closed position (Nudge Lower). The trigger for such nudging can be a digital input (e.g. contact closure) 'wired' to the nudge raise or lower parameter, the up or down arrow keys or a command received over the serial link.

The nudge command causes the valve drive output to drive the valve for either the minimum on time, or for as long as the command is 'true', whichever is the longer (note 2). The default minimum on time is 125ms, but this can be edited in the configuration for the relevant output relay (section 4.11.2).

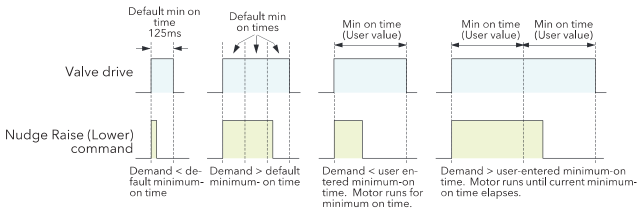


Figure B2.6.10 Valve nudge examples

Notes:
1. If Ch1 is set to VPU, Nudge operates the channel 1 valve, no matter what Ch2 is set to. If Ch1 is not set to VPU, and Ch2 is set to VPU then the nudge operates on channel 2 valve.
2. The minimum on time is continuously retriggered. This means that if a minimum on time of (say) 10 seconds has been configured, then the valve may continue to move for up to 10 seconds after the command has been removed. That is, it continues until the current minimum on time period has expired.

B2.6.11 Time Proportioning

PID controllers somtimes use Time Proportioning to control the average power to the load. This is done by repeatedly switching the output on for a period (T_{on}) and then off for a period (T_{off}). The total period (T_{on} + T_{off}) is called the 'cycle time'. During each cycle, the average power delivered to the load is:

$P_{Avg} = P_{Heater}$ x Duty cycle,

where 'P_{Heater}' is the actual transferred heater (or cooler) power and Duty cycle = $T_{on}/(T_{on} + T_{off})$, normally represented as a percentage value.

The PID controller calculates the Duty Cycle (the PID output control signal from 0 to 100%) and provides a Minimum on time between 100ms to 150 seconds.

Figure B2.6.11 shows how T_{on}, T_{off} and cycle time vary with demand %.

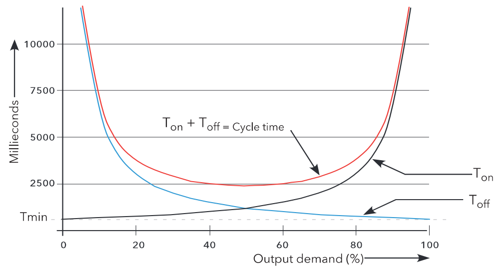


Figure B2.6.11 Time proportioning curves (Minimum on time = 625ms)

Note: For this instrument, only 'Min on time' is configurable

B2.7 DIAGNOSTICS

See section 4.6.7 for definitions of these parameters

Appendix C: REFERENCE

C1 BATTERY

This instrument is fitted with a battery which has a minimum life of 1 year unpowered and when stored in an ambient temperature of around 25°C. The battery life may be reduced if it is consistently operated in an elevated ambient temperature environment. The battery is designed to retain configuration and other settings in the event of a failure of the instrument power supply.

The battery is not user serviceable and any instrument displaying the symptoms of a battery fail should be returned to your supplier for battery replacement at the earliest opportunity.

WARNING

It is strongly recommended that, with the instrument working normally, a clone file* is made and stored in a known safe location so that the settings can be uploaded to a spare instrument or restored to the instrument following replacement of the battery. Alternatively maintain a record of the instrument configuration and other important settings.

* A clone file is made using iTools, a proprietary package which may be downloaded from www.eurotherm.co.uk.

C2 SETTING UP AN FTP SERVER USING FILEZILLA

C2.1 DOWNLOADING

'FileZilla' is a free download from the internet (search for 'FileZilla server download').

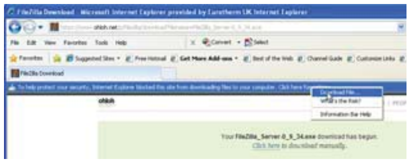
1. Download the latest version, following the instructions on the screen.

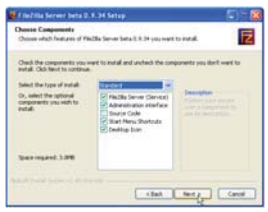
2. Answer 'No' to the question 'Do you want to view only the webpage content that was delivered securely'.

3. If necessary enable file download.

4. In the 'Do you want to run or save this file' Security Warning window- click on 'Run'

5. In the 'The Publisher could not be verified..., Security Warning win- dow, click on 'Run'



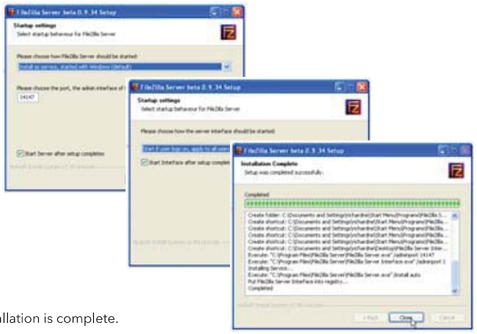


6. Agree or cancel the License agreement. If 'Agree', choose 'Standard' as the type of install.

C2.1 DOWNLOADING (Cont.)

7. Choose the destination for the file

8. Select startup settings



9. Click on Close when Installation is complete.

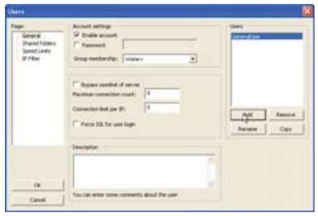
10. Click 'OK' in the 'Connect to Server' window.

C2.2 SERVER SETUP

1. Create a new folder (directory) called, for this example, 'Archive' in a suitable location such as the C drive, or the desktop.

2. In the Filezilla server window, click on 'File' and select 'Connect to Server'.

   The 'Logged on' message appears



3 In the Edit menu, select 'Users' and in the 'General' page, click on 'Add' and enter a name for the user, then click 'OK'. For this example, 'GeneralUser' has been used, but it may be more advantageous to use 'Anonymous' because this is the default name in the recorder/controller. Click on 'OK'.

4 In the Edit menu, select 'Users' and in the 'Shared Folders' page, click on 'Add'

   A browse window opens allowing the user to select the new folder ('Archive') created in step 1, above.

   When OK has been clicked to confirm the selection, the new folder appears in the centre window (with an 'h' next to it to indicate that this is the home folder for this ftp user setup.

5. Click on the relevant folder to enable the tick boxes. Click on all the 'File' and 'Directory' enable tick boxes, then click OK

C2.3 PC SETUP

1. Operate the ‘Start’ button, and select ‘Control Panel’ from the window that appears. Double click on ‘Windows Firewall’

2. Click on the ‘Exceptions’ tab in the window that appears, and check that both ‘FTPControl’ and ‘FTPData’ are enabled (ticked). If not, the user’s IT department should be contacted for advice.

3. Click on ‘Add Program...’ and browse to the Filezilla destination defined in step 7 of the download section (C2.1). Select ‘FileZilla server.exe’ and click on ‘Open’

‘FileZilla server.exe’ appears in the Exceptions list.

Click on ‘OK’

C2.4 RECORDER/CONTROLLER SET UP

In Network Archiving (section 4.2.2):

1. Enter the IP address of the pc in which the FTP server has been enabled in the ‘Primary Server’ field.
2. Enter the Primary User name, as entered in step three of the Server setup procedure (section C2.2) above (GeneralUser in this example).
3. Enter the IP address of another suitable pc which has been configured as an ftp server in the ‘Sec. Server’ field, and enter the relevant ‘Sec. User’ name.
4. Configure the other unattended archive parameters as required (section 4.2.2).

Note: For the example above, ‘Password’ was not enabled in the User Accounts setup page (section C2.2), so for this example any Primary (Sec.) password entry is ignored. If a password had been entered in the User Accounts setup, then the Primary (Sec.) Password field would have to contain this password.

C2.5 ARCHIVE ACTIVITY

Once a demand or unattended archive is initiated, the FileZilla Server page shows the activity status as the archive progresses. Figure C2.5 shows a typical page. The top of the page shows the transaction details between the server and any clients to which it is connected. The bottom portion shows details of the files currently being transferred. These files are archived to the 'Archive' folder.

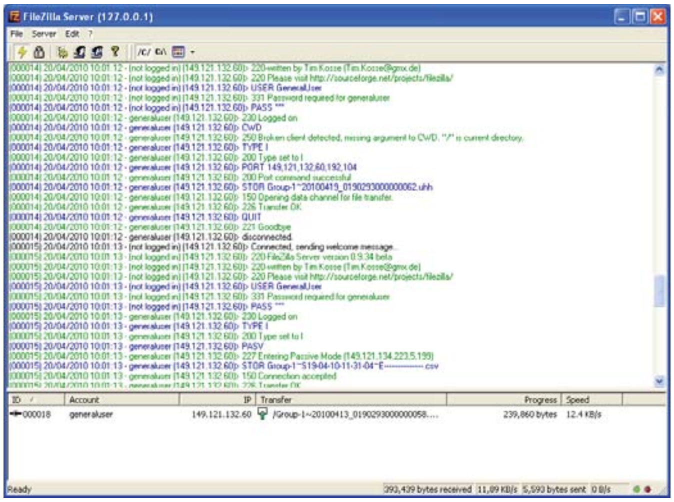


Figure C2.5 FileZilla Server archive activity page

C3 FUNCTION BLOCK DETAILS

C3.1 EIGHT INPUT OR BLOCK

An eight input logical OR block whose output is high (1, On) if any one or more inputs is high (1, On). If more than eight inputs are required, a second block is automatically introduced, as shown in figure C3.1a. The blocks in the figure are given the names 'A' and 'B', where 'A' and 'B' can be any of the 12 available instances.

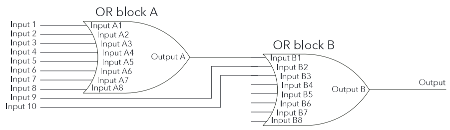


Figure C3.1a Eight input OR block

OR blocks are used automatically by the 'user wiring' when more than one source is wired to the same destination parameter. For example, it may be required that Relay (Digital I/O 2A2B) is to operate if channel 1 alarm 1 and/or channel 2 alarm 1 channels goes active. In such a case, the 'Active' parameter for the two channel alarms would be wired to the same relay's 'PV' parameter.

OR blocks are invisible to the user interface, but the iTools graphical wiring page for this configuration (figure C3.1b), shows that an OR block has been introduced to OR the two alarm outputs together.

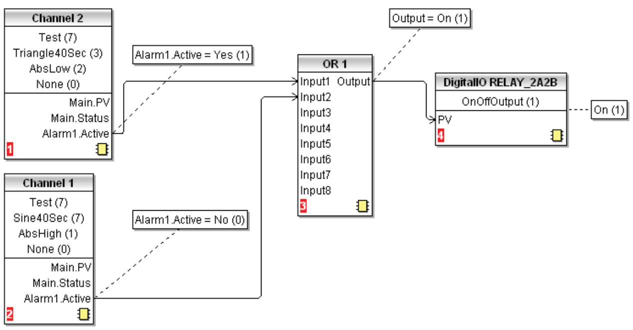


Figure C3.1b iTools representation of OR block usage

C4 TCP PORT NUMBERS

The following TCP ports are made use of by the instrument.

Port	Usage
20	File Transfer protocol (FTP) data
21	FTP control
502	Modbus TCP communications

C5 ISOLATION DIAGRAM

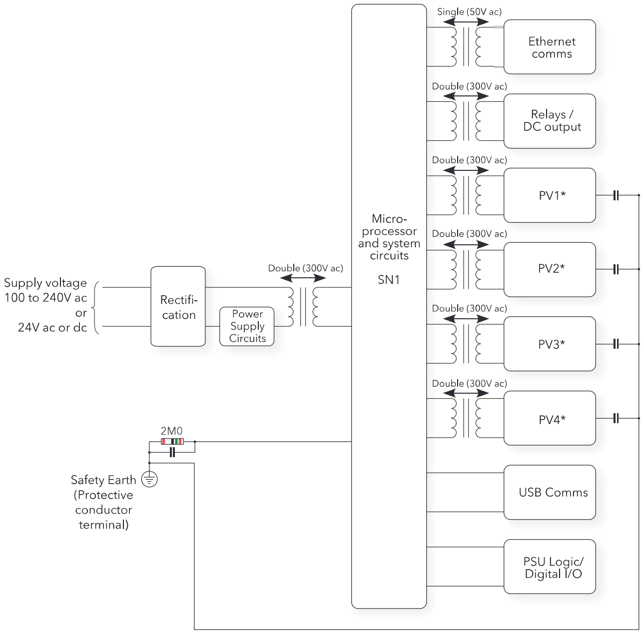


Figure C5 Isolation diagram

* Note: Each 'PV' is double isolated (300VRMS) from all other 'PV's.

Appendix D: CONFIGURATION MENU OVERVIEW

This appendix contains an overview of the configuration menus for the instrument, including all options as follows:

D1 INSTRUMENT CONFIGURATION MENUS

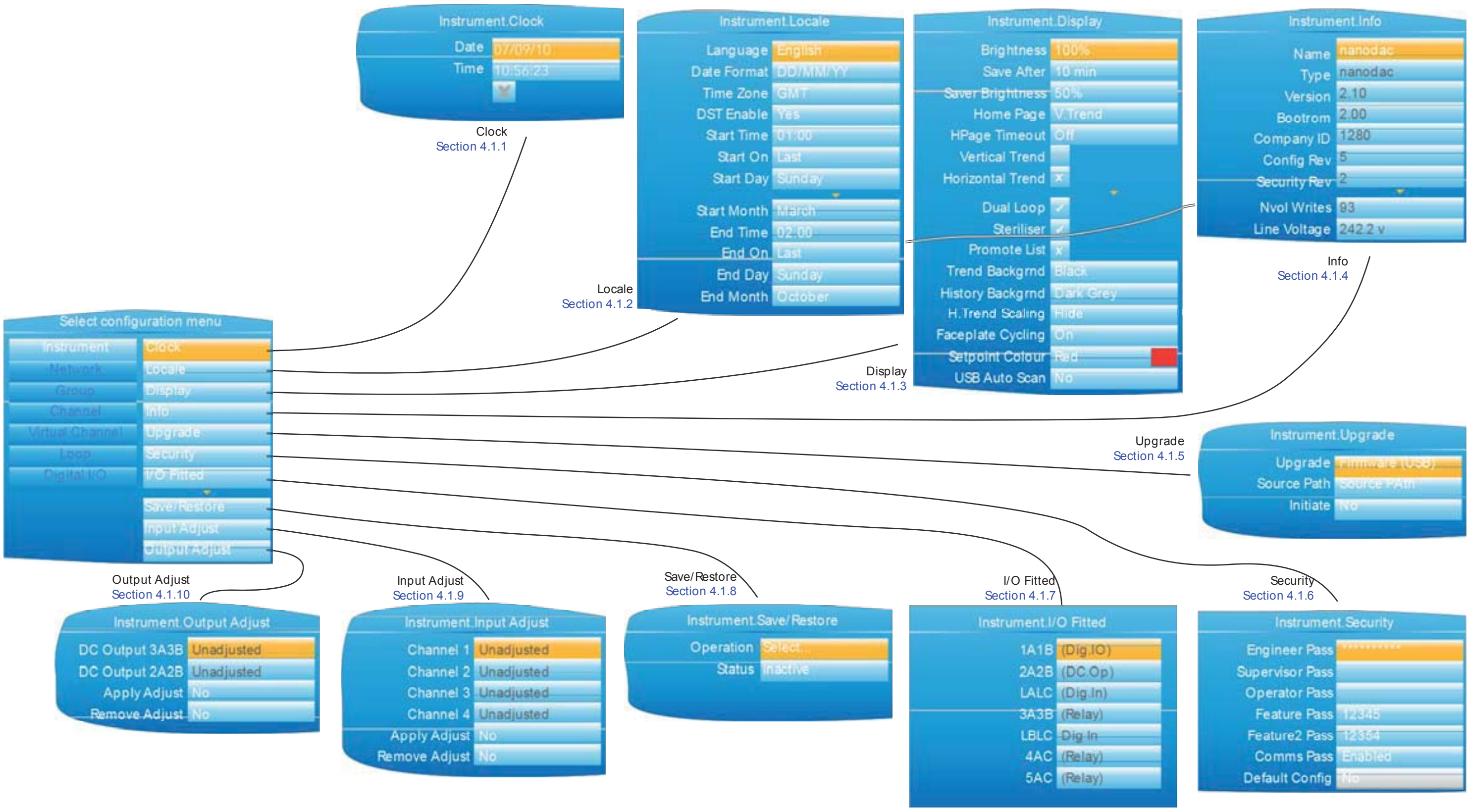


Figure D1 Instrument configuration menus

D2 NETWORK CONFIGURATION MENUS

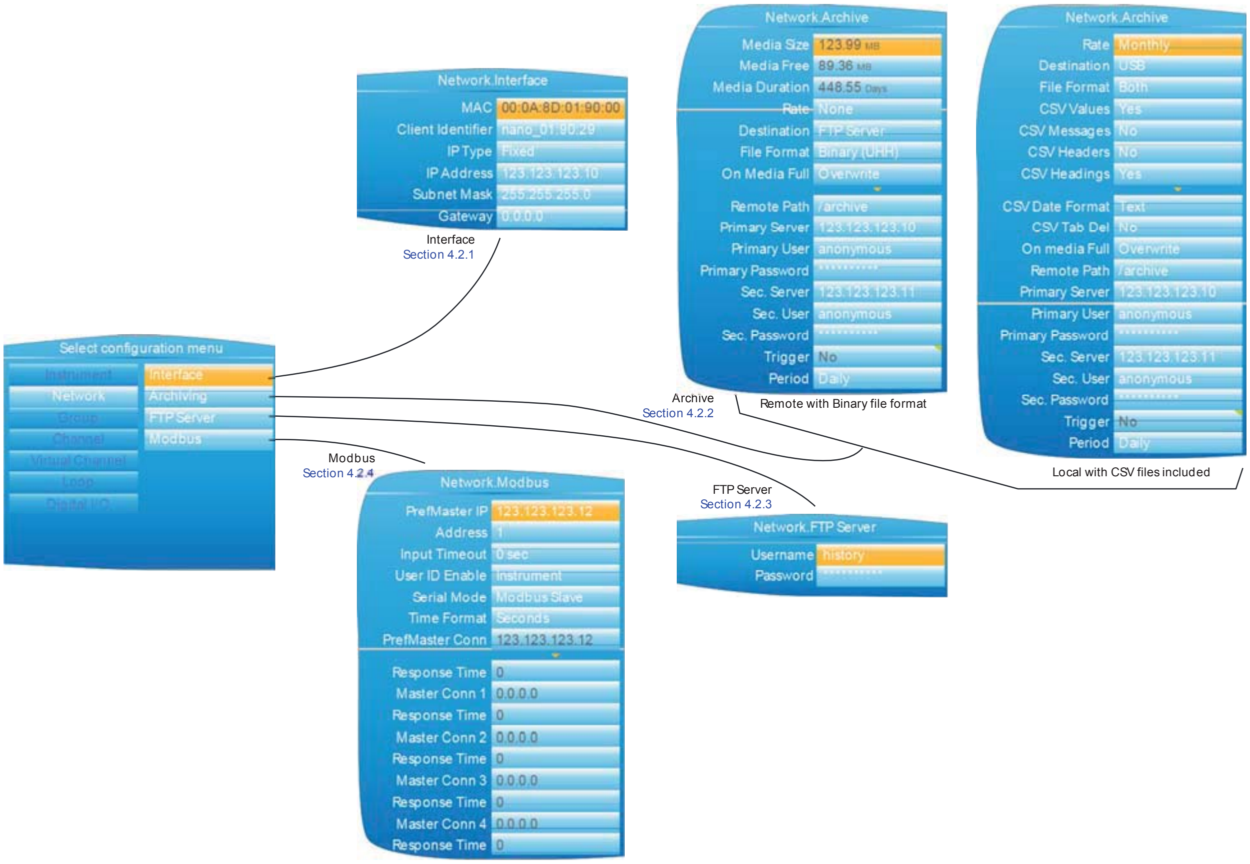


Figure D2 Network configuration menus

D3 GROUP CONFIGURATION MENU

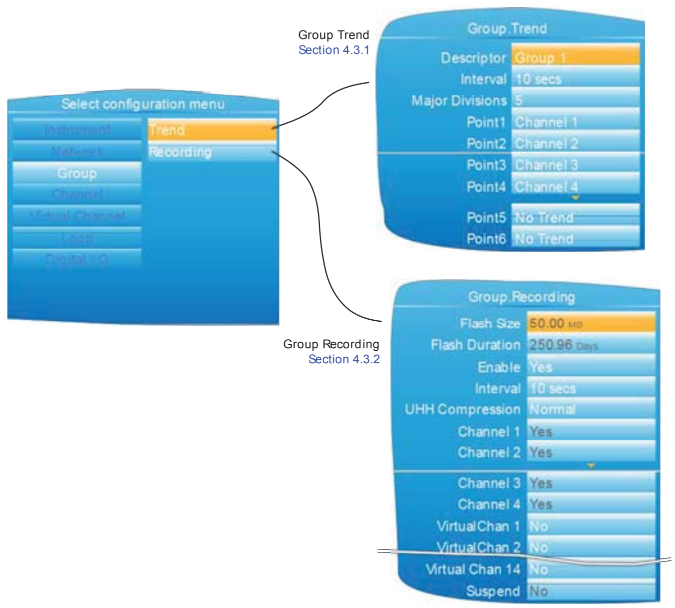


Figure D3 Group configuration menus

D4 CHANNEL CONFIGURATION MENU

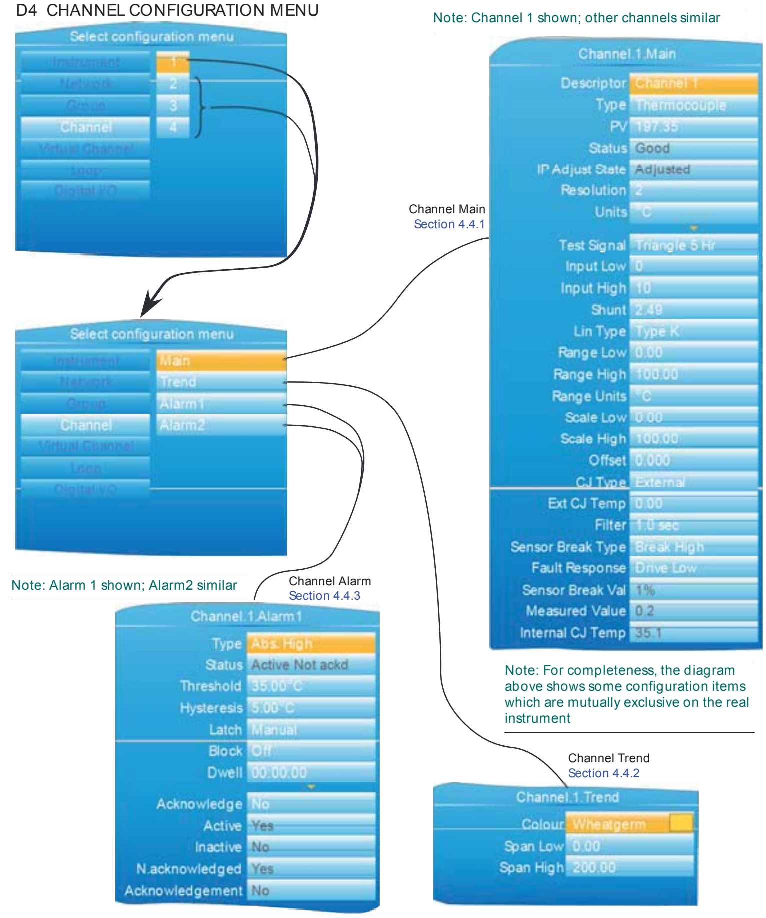
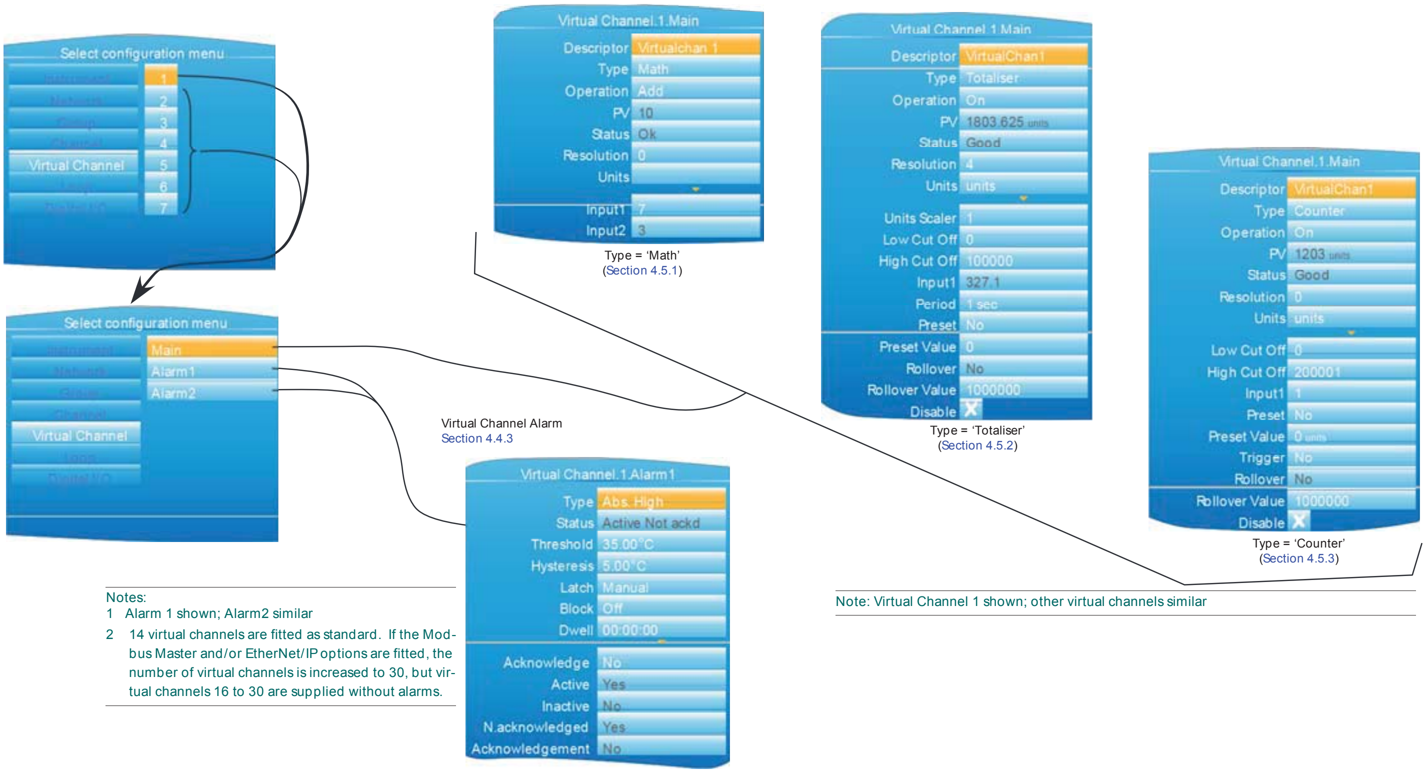


Figure D4 Channel configuration menus

D5 VIRTUAL CHANNEL CONFIGURATION MENU



Notes:
1 Alarm 1 shown; Alarm2 similar
2 14 virtual channels are fitted as standard. If the Modbus Master and/or EtherNet/IP options are fitted, the number of virtual channels is increased to 30, but virtual channels 16 to 30 are supplied without alarms.

Note: Virtual Channel 1 shown; other virtual channels similar

Figure D5 Virtual channel configuration menus

D6 LOOP CONFIGURATION MENUS

D7 ADVANCED LOOP CONFIGURATION MENUS

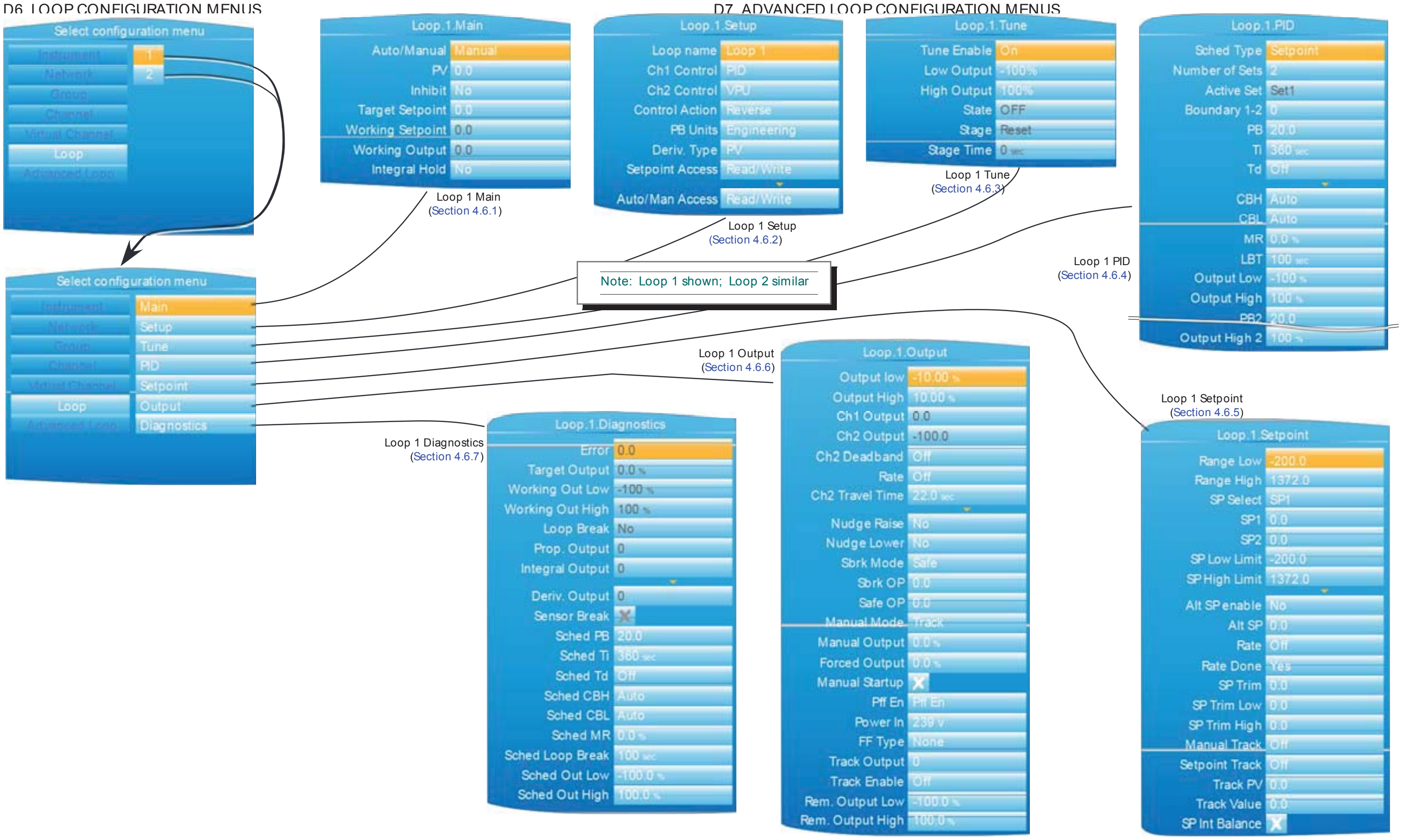


Figure D6 Loop Configuration menus

D7 ADVANCED LOOP CONFIGURATION (Cont.)

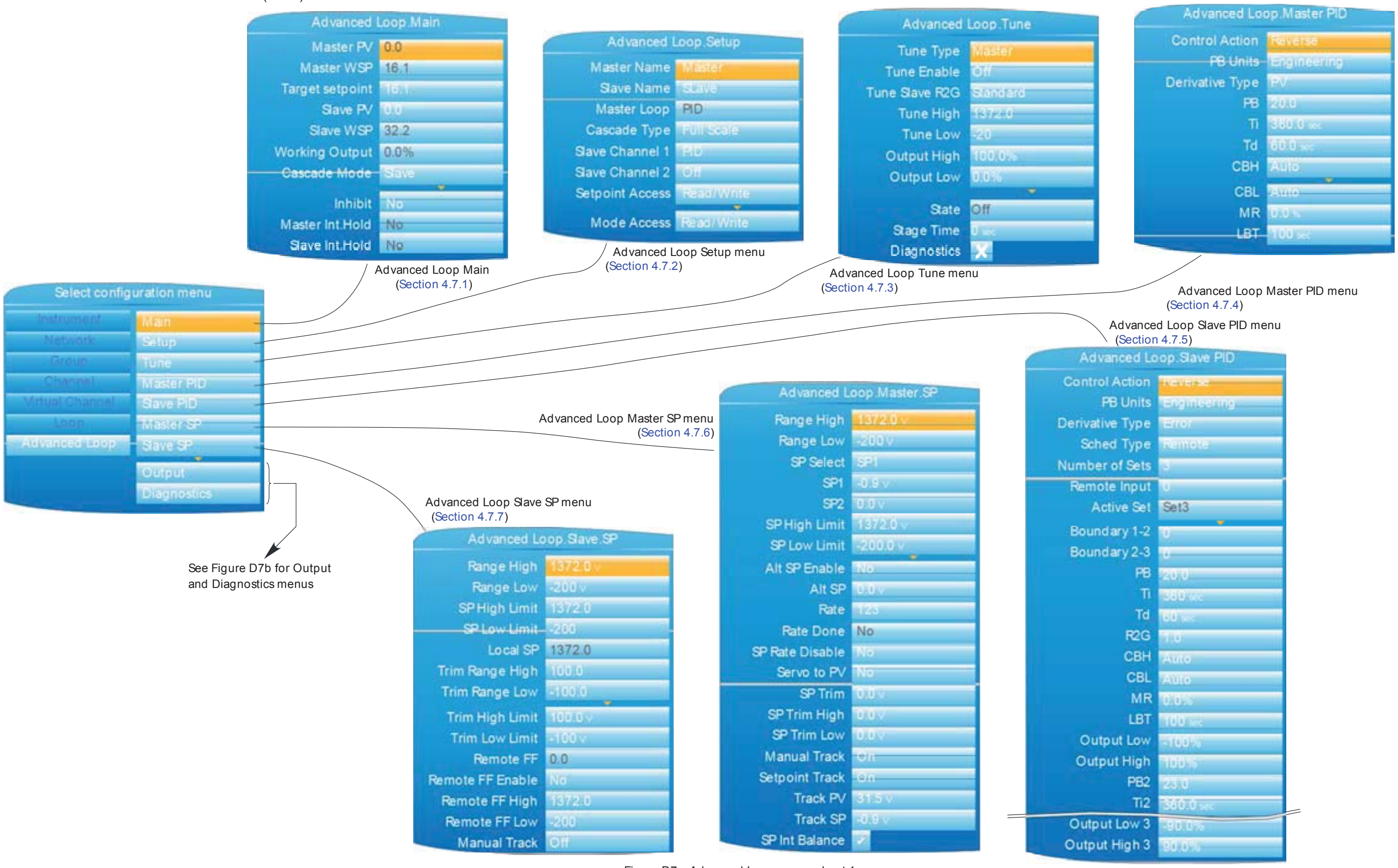


Figure D7a Advanced Loop menus sheet 1

D8 PROGRAMMER CONFIGURATION

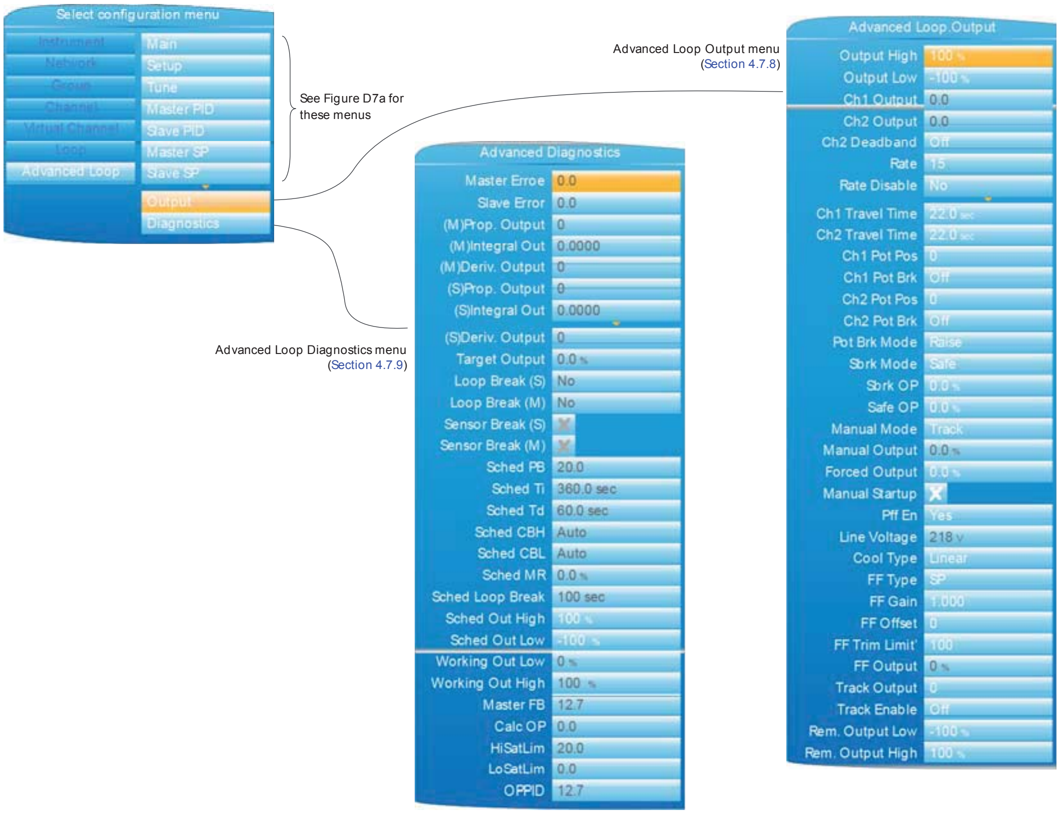


Figure D7b Advanced Loop menus sheet 2

D9 MODBUS MASTER CONFIGURATION

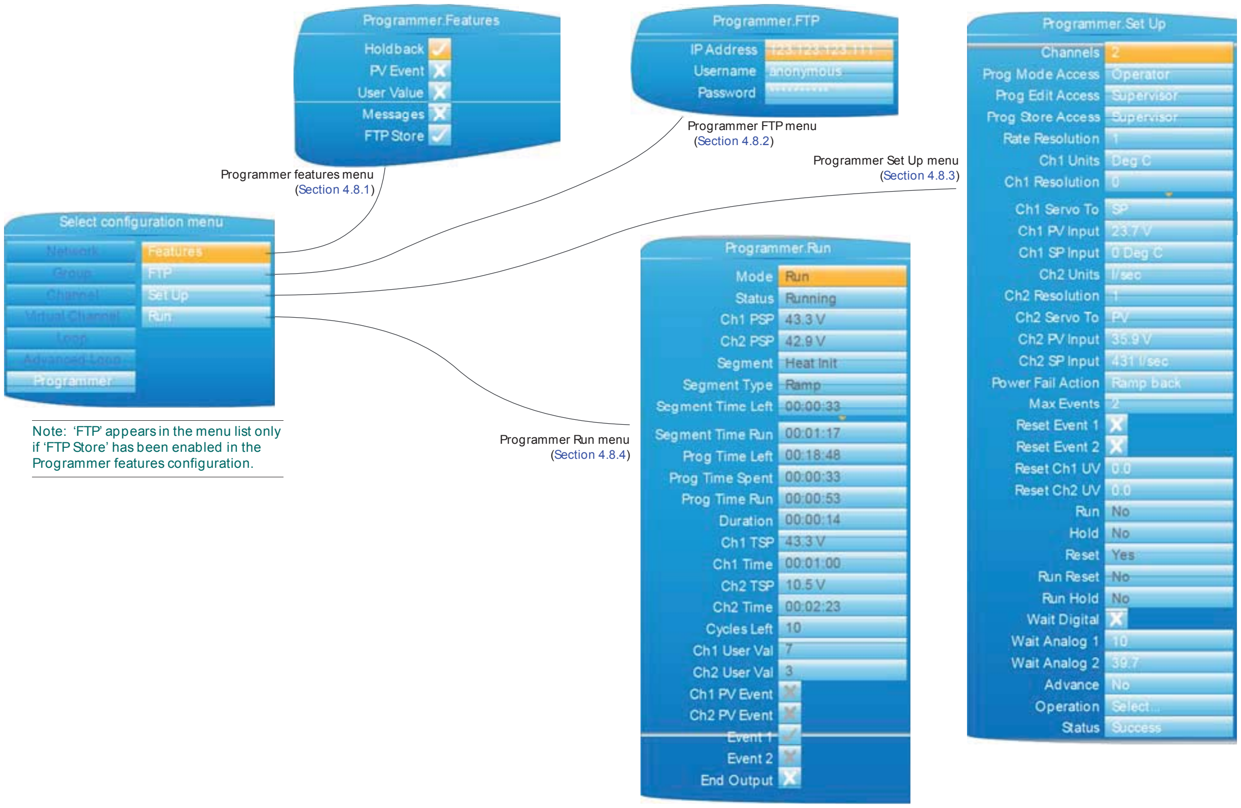


Figure D8 Programmer menus

D10 ETHERNET/IP CONFIGURATION

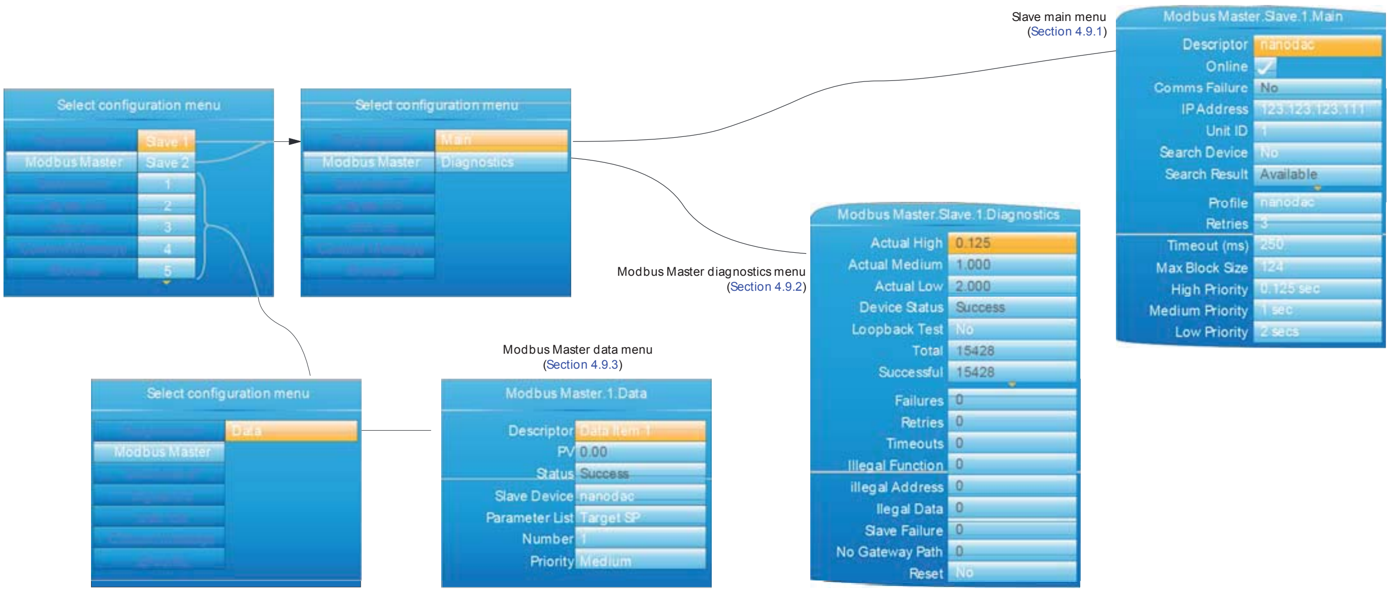


Figure D9 Modbus Master menus

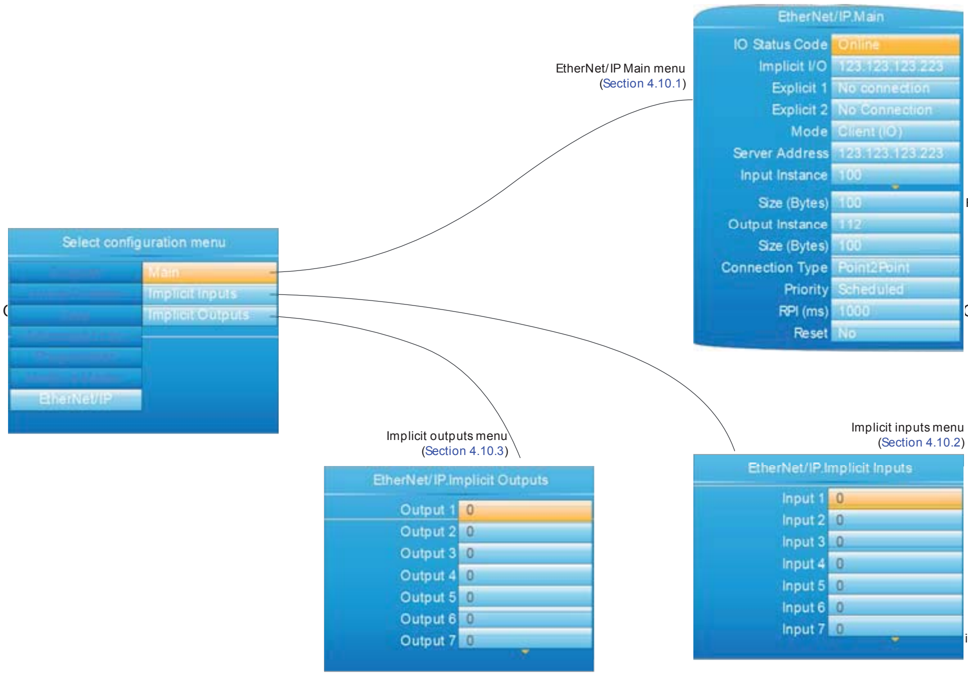
D11 DIGITAL I/O CONFIGURATION MENUS

D13 USER LINEARISATION TABLE CONFIGURATION MENU

Figure D13 User Linearisation tble menus

D12 DC C

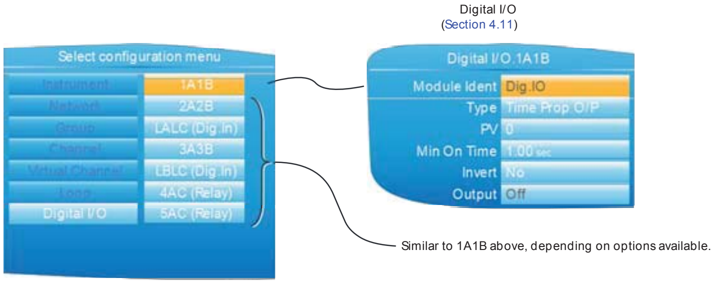
GURATION MENU

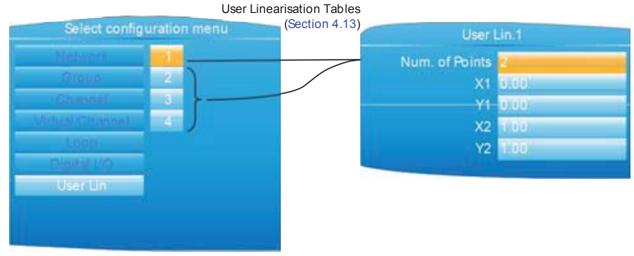


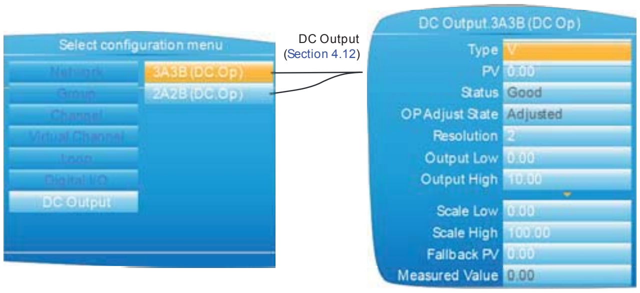
igure D14 Custom messages configuration

Figure D10 EtherNet/IP menus

D15 ZIRCONIA BLOCK CONFIGURATION







D16 STERILISER BLOCK CONFIGURATION MENU

D17 HUMIDITY BLOCK CONFIGURATION MENU

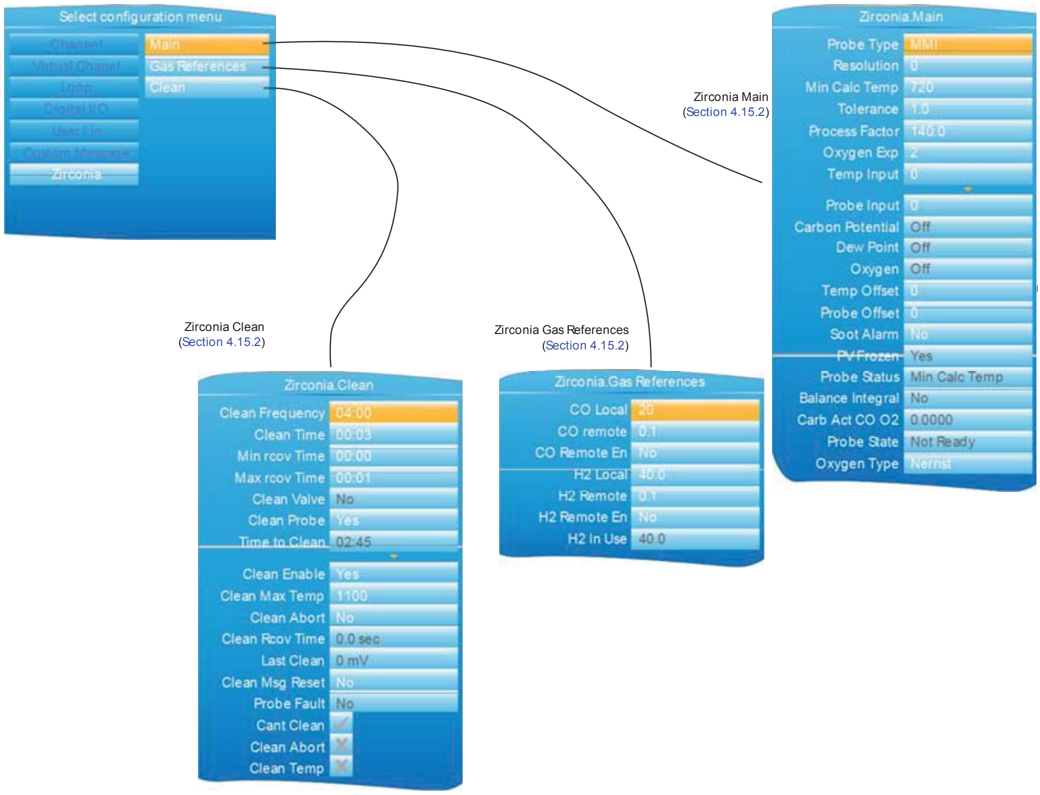


Figure D15 Zirconia block configuration menus

D19 LOGIC (2 INPUT) CONFIGURATION MENU

Steriliser
(Section 4.16)

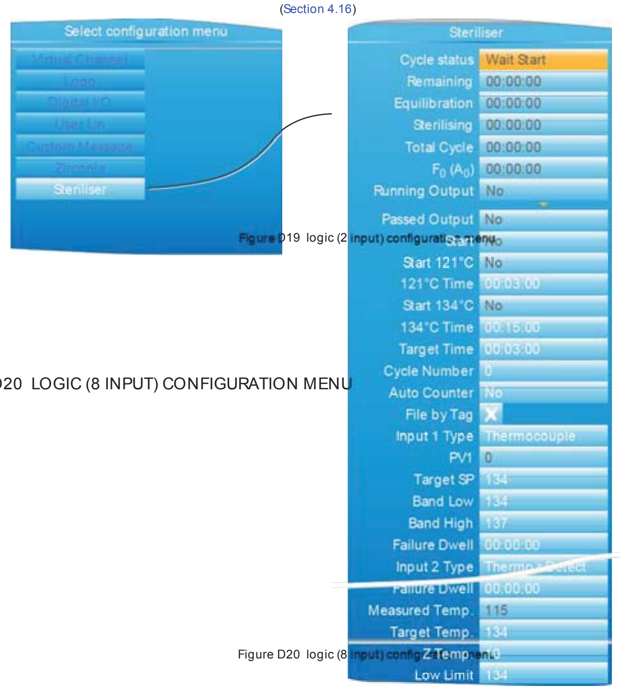


Figure D19 logic (2 input) configuration menu

D20 LOGIC (8 INPUT) CONFIGURATION MENU

Figure D20 logic (8 input) configuration menu

D21 MULTIPLEXER BLOCK CONFIGURATION MENU

Humidity block
(Section 4.17)

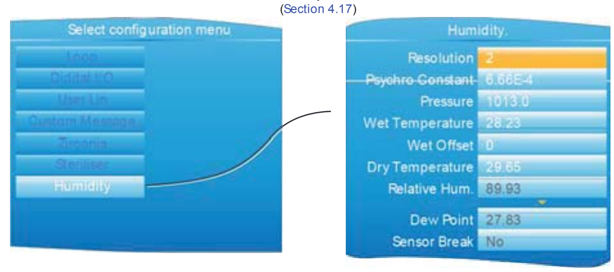


Figure D21 Logic (2 input) configuration menu

D22 MATH (2 INPUT) CONFIGURATION MENU

BCD Input Block
(Section 4.18)

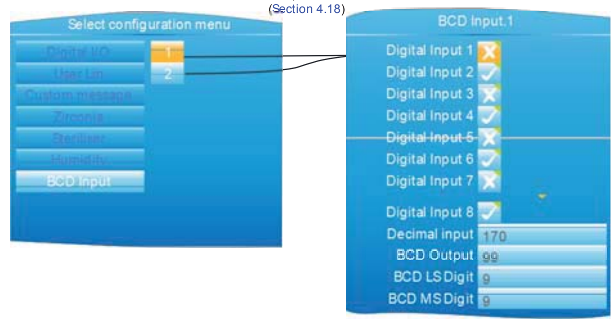


Figure D22 Math (2 Input) configuration menu

D23 TIMER CONFIGURATION MENU

Logic (2 Input) block
(Section 4.19)

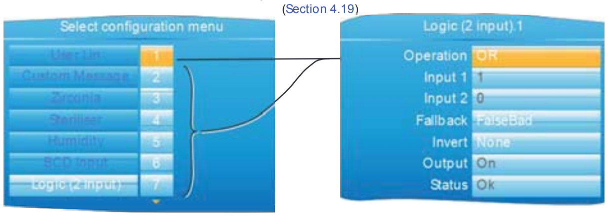


Figure D23 Timer configuration menu

D24 USER VALUES CONFIGURATION MENU

Logic (8 Input) block
(Section 4.20)

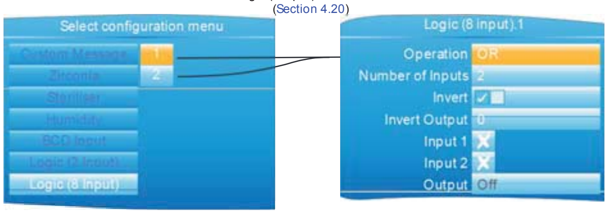
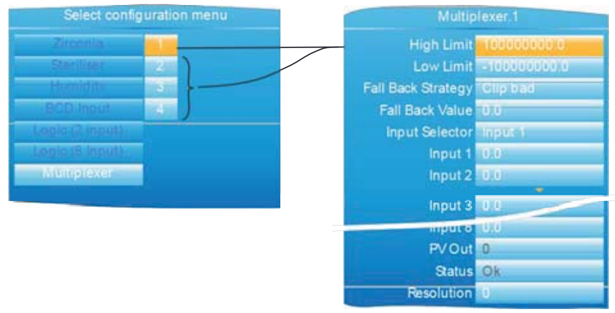


Figure D24 User Values configuration menu

D25 REAL TIME EVENTS CONFIGURATION MENU

Multiplexer block
(Section 4.21)



Math (2 Input)
(Section 4.22)

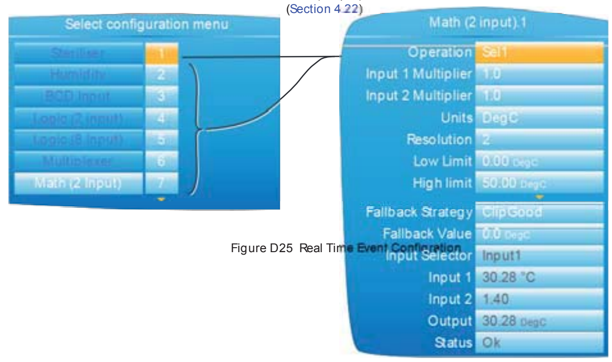
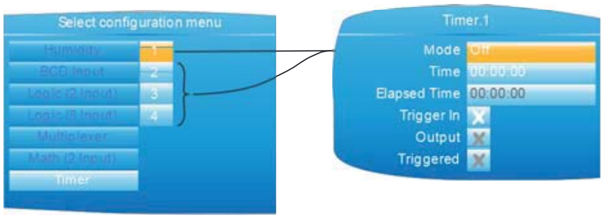
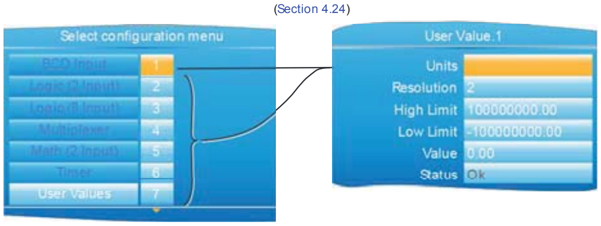


Figure D25 Real Time Event Configuration

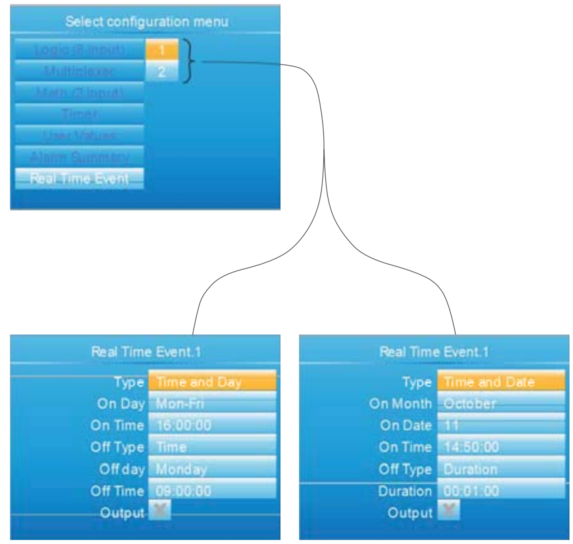
Timer block
(Section 4.23)



User Values block
(Section 4.24)



Real Time Events
(Section 4.26)



E Appendix E: WEB SERVER

The Web Browser has been added from firmware release V5.00.

E.1 Browsers

The following browsers are supported in the above firmware release:

- Google Chrome V22.0 or greater
- Google Mobile Chrome (Android Mobile technology running 'Ice cream sandwich' or greater
- Internet Explorer V9.0 or greater
- Mobile Safari (Apple Mobile technology running IOS 5.0 or greater)

All files are uploaded from the nanodac device to the browser, where all JS and JQuery files are executed locally.

Browsers should be configured to allow cookies, and support for file caching should also be enabled.

If cookies are not enabled this will have the following detrimental effects:

- Any web page configuration changes 'saved' by the user in the client browser will not be retained when navigating between web pages
- For the most efficient browsing make sure that caching is enabled in the browser being used.
- Web server supports standard ASCII character set. Any non displayable characters will, therefore, be replaced by an asterisk '*'.

E.1.1 Connecting to the Internet

Open the desired web browser.

Enter the ethernet address or other configured name of the instrument.

Note: the webserver requires up to 15 seconds before it becomes fully operational after it has been enabled.

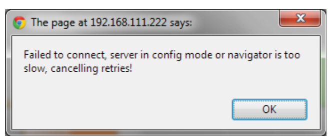
E.1.2 Denied Page

This page will be displayed when there are no more available connections to the server. It does not use the same CSS theme as all other pages, so that this page does not rely on any other files being transferred up to the client browser, since to do this would require access to the server, which has just been denied.

E.1.3 Error Message

An error message can be displayed at any time if the following three conditions occur:

- A page fails to connect to the server. A retry will usually be sufficient to correct this condition
- The server is in configuration mode. To correct this put the instrument into run mode.
- A page stops trying to connect. A refresh is usually sufficient to correct this condition.



E.1.4 Home Page

The Home Page is the first page the user is directed to on completion of a successful log in.

If Security has been set to Yes in the instrument (page 146) it will be necessary to enter a User name and a Password.

The defaults are:

Username: admin

Password: admin

These may be customised by the user up to 50 alpha/numeric characters.

E.1.5 About Page

This page contains the following target information:

- Instrument descriptor
- MAC address
- Application software version
- Bootrom software version
- Legal disclaimer

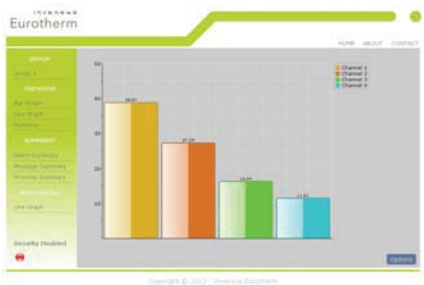
E.1.6 Contact Page

This page contains links to the following Eurotherm sites:

- Accredited Service
- Customer First & Technical Support
- Installation & Commisioning
- Repair & Support Services

Note: Links are only active if the browser has internet access.

E.1.7 Bar Graph Page



The channels that have been configured to be trended on the nanodac instrument will automatically be displayed on this page. The current configuration data for those channels will be used to render the values on the graph.

The graph will always use the largest scale high and the lowest scale low of all the channels being rendered.

Click on a channel on the graph to display the current channel status. To remove this, click out of the graph again. The channel status will either be 'Ok' or 'Error' for all other error conditions.

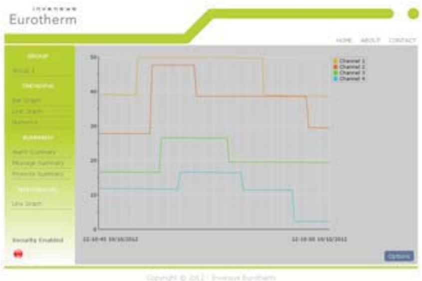
All channels will be represented in their configured RGB colours. Colour matching will very much depend on the display the browser is running on.

Options

The Options button allows the user some control over how the Bar Graph page is displayed.
All data is stored as cookies.

Graph Type	Gradient (as shown in the above display) Flat 3D
Legend	Show or Hide the Channel numbering legend in the top right hand corner
Background Type	Transparent or White
Gridlines	Show or Hide
Decimal Places	0 to 4
Value Alignement	Horizontal or Vertical
Plot Point	All (shows all available channels) Channel 1 only Channel 2 only Channel 3 only Channel 4 only

E.1.8 Line Graph Page



The channels that have been configured to be trended on the nanodac will automatically be displayed on this page. The current configuration data for those channels will be used to render the values on the graph.

The graph will always use the largest scale high and the lowest scale low of all the channels being rendered.

This graph is currently fixed at 100 samples. The first time that this page is opened it may take a little more time as the page will need to interrogate the web server for UHH history and render 100 samples of backfill.

As each new sample arrives the oldest historical sample is removed.

All channels will be represented in their configured RGB colours. Colour matching will very much depend on the display the browser is running on.

Options

The Options button allows the user some control over how Line Graph page is displayed.

All data is stored as cookies.

Plot Thickness	Narrow, Normal, Wide.
Legend	Show, Hide.
Background Type	Transparent, White.
Gridlines	Show, Hide.
Sample Period	1 second - 1 hour.
Plot Point	All, (shows all available channels)
	Channel 1 only
	Channel 2 only
	Channel 3 only
	Channel 4 only

E.1.9 Numeric Page

This page displays the process value and channel descriptor.

The process value (PV) will not be displayed if the channel is not in a good status. Instead the text for the channel status is displayed as one of the following

OFF	Channel is turned off
>RANGE	Over range
<RANGE	Under range
HW_ERROR	Hardware error
RANGING	Automatic range configuration (may appear briefly)
OVERFLOW	Value out of limits e.g. a maths channel may have returned a bad value
ERROR	Error, e.g. a maths channel divided by zero
NO_DATA	No data, e.g. nothing has been written to a Modbus input channel.

All channels will be represented in their configured RGB colours. Colour matching will very much depend on the display the browser is running on.

Options

The Options button allows the user some control over how Numerics page is displayed.

All data is stored as cookies.

Channel Font Size	Small, Normal, Large
PV Font Size	Small, Normal, Large

E.1.10 Alarm Summary Page

This page indicates if any process alarms are currently active

Status:

Red = unacknowledged alarm.

Green = Acknowledged alarm

E.1.11 Message Summary Page

This page provides the last 30 messages in chronological order

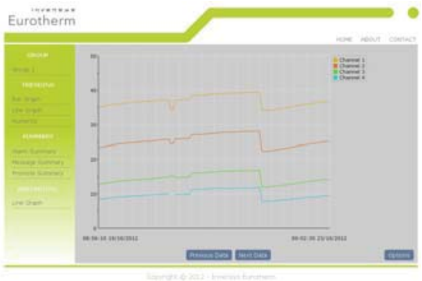
This page does not auto-refresh.

To refresh this page press or go to another page and re-open the Message Summary page.

E.1.12 Promote Page

This page will show up to the 10 data items that have been configured by the user in the Promote page in the instrument display - see “Promote list” on page 45.

E.1.13 Historical Line Page



The channels that have been configured to be trended in the nanodac instrument will automatically be displayed on this page. The current configuration data for those channels will be used to render the values on the graph.

The graph will always use the largest scale high and the lowest scale low of all the channels being rendered

All channels will be represented in their configured RGB colours. Colour matching will very much depend on the display the browser is running on.

This graph is currently fixed at 100 samples, and the first time this page is accessed it may take a short time to load as the page will need to interrogate the web server for UHH history and render 100 samples of backfill.

Use the 'Previous Data' button to navigate back in time for up to a maximum of five time periods of history. If there is an end to the history event or a configuration change event, then the request to navigate back may result in only part of the trend being populated up to that event time.

Use the 'Next Data' button to navigate back to the point in time when the web page was entered.

Options

The Options button allows the user some control over how the Historical Line page is displayed.

All data is stored as cookies.

Plot Thickness	Narrow, Normal, Wide.
Legend	Show, Hide.
Background Type	Transparent, White.
Gridlines	Show, Hide.
Sample Period	1 second - 1 hour.
Plot Point	All (shows all available channels)
	Channel 1 only
	Channel 2 only
	Channel 3 only
	Channel 4 only

E.1.14 Status Icons

The Status icons are shown in the lower left of those pages that are automatically updated (i.e. not the Message Summary page).

They indicate the following:

Security Enabled or Disabled in the nanodac instrument.


Recording Status
Green shows recording enabled e.g. when the instrument is not in configuration mode.
Red shows recording disabled e.g. when the instrument is in configuration mode.


Any Channel Alarm Status. This flashes when any alarm is present, whether acknowledged or not.


Any new messages. Go to the Message Summary page to view any new messages. This icon is then removed from the other pages.


Any system alarm

Note: the update rate for the status icons is inherited from the current page.

E.1.15 DHCP Support

DHCP is managed in the web server in as much as the web server will not be allowed to come online until the nanodac has received a valid IP address. The server will continually monitor the IP address and, if at any point an invalid address is found, the server will shut down and re-start.

E.1.16 Network Protocols

The web server is in no way mutually exclusive with all other network protocols on the nanodac, however, to achieve the best results from the web server it is recommended that no other communication protocols are active at the same time.

E.1.17 Languages

The web server will only support English for all static text. Any channel descriptors or units that have been configured at the target in another language will be displayed in that language on all web pages where they are visible.

This page has been deliberately left blank.

F Appendix F: Labview Driver

The purpose of this section is to describe how to download, install and configure examples of LabVIEW driver for nanodac instruments.

The driver is designed to integrate with Labview, a graphical programming Environment developed by National Instruments. Labview allows users to create applications by wiring VI's from pre-existing libraries. VI's stands for Virtual Instruments and these are similar to function blocks found in Invensys Eurotherm products such as iTools or Lintools.

The user can also create their own VI's, save them and reuse them on future projects.

For more information on Labview go to http://www.ni.com/labview/whatis/.

Four working examples are available as free downloads by going to http://www.eurotherm.co.uk/labview/. They are intended to show users how to use the nanodac driver to build applications.

Each example is a collection of Virtual Instruments (VI's) that perform specific tasks and use Ethernet TCP for communications.

It is not intended to describe how to configure a LabVIEW application as it is assumed that the reader is generally familiar with this process.

To find the examples select the Help menu and 'Find Examples' to open the 'Example Finder' page. In the search field, enter any of the following keywords nanodac, InvensysEurotherm, Eurotherm, Steriliser, Environmental, Chambers, Controller, Instrument or Driver and the corresponding examples will appear in the search results. Just select and Double click to open an example.

F.1 Application Example 1 - Heat/Cool Control

The "HeatCoolControl.vi" is an application example for Environmental chambers. The user can change the target setpoint, monitor temperature and instrument alarms.

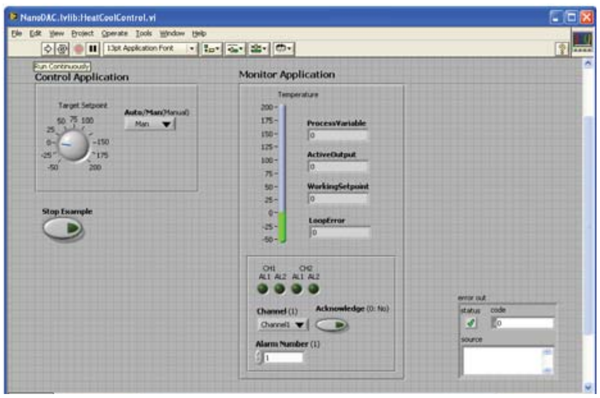


Figure F1 Heat/Cool Control Opening View

From the opening view, Figure F1;

press Run 

Enter the IP address of the nanodac instrument.

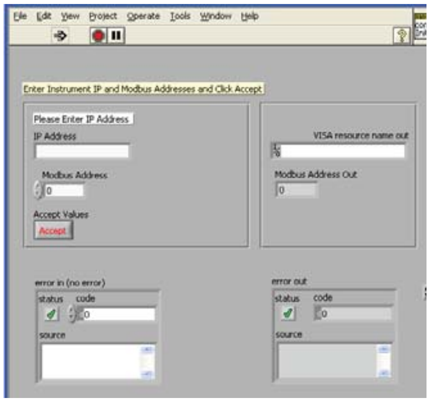
Enter the Modbus address of the nanodac instrument. This depends on the setting of the Unit ident enable in the instrument;

If this is 'Strict' enter 255.

If this is 'Instrument' enter the modbus address as set in the instrument from 1 to 99.

If this is 'Loose' then the ModbusTCP Unit Identity field does not have to match the instrument address. The instrument will respond to ANY value in the Unit Identity field.

Press 'Accept'.



Note: further information is available from the Help menu.

Figure F1a   Enter Instrument Address

It is then necessary to select the firmware version which is supported for the instrument in use. Certain functions will not be available if the firmware version of the instrument is not in this list.

Press 'Current Folder'.

If a password has been entered in the instrument it will be necessary to enter this.

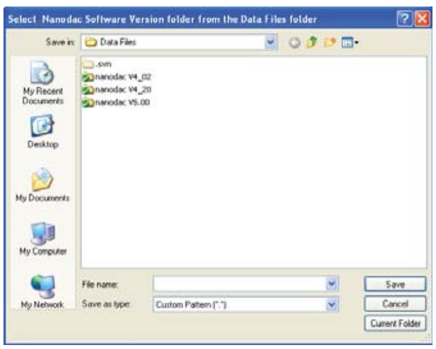


Figure F1b   Data Files Folder

The application view then becomes live

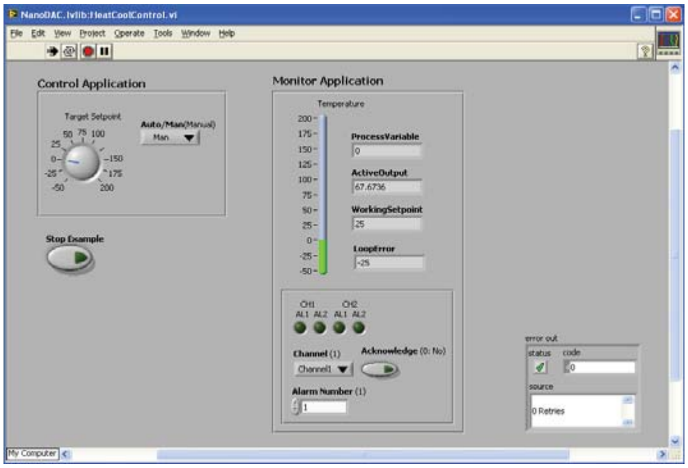


Figure F1c Heat Cool Live Application

The following parameters may be monitored/adjusted:

- Target setpoint
- Select Auto/Manual and adjust the output power manually if in Manual.
- Monitor the current Process Variable, Active Output demand, Working Setpoint and Error.
- Monitor alarms. The alarm beacon turns red when an alarm occurs.
- Acknowledge alarms. Pressing the Acknowledge button acknowledges the selected alarm in the nanodac instrument. If the alarm is still active the alarm beacon remains red. If the alarm is no longer active the beacon reverts to its dark colour.

F.2 Application Example 2 - Program Load by Program Number

The "Program_LoadControl.vi" is an Application example which allows the user to load a program stored in the instrument using numbers, and to Run/Hold or Reset a preloaded Program.

This feature has been added in the nanodac instrument from firmware versions 5.00 and above.

To open and load this file, repeat the steps listed in Example 1.

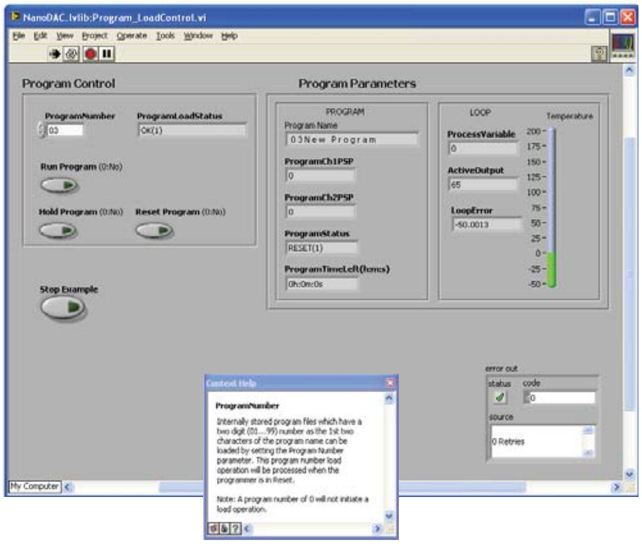


Figure F2 Program Load by Program Number (showing Context Help)

The following parameters may be monitored/adjusted:

- Select the Program Number. If the number entered is not available in the instrument it will not be recognised and an error message shown in the Program Load Status box
- Run/Hold/Reset the program
- Monitor the running program

F.3 Application Example 3 Steriliser

The "Steriliser_Monitor.vi" is a Steriliser Application example allowing the user to control and monitor Sterilisation process parameters.

To open and load this file, repeat the steps listed in Example 1.

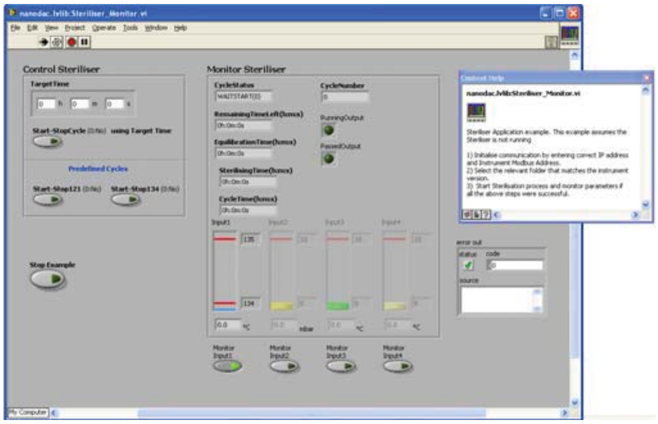


Figure F3 Steriliser Application (showing Context Help)

The following parameters may be monitored/adjusted:

- Start - Stop Predefined Cycles or Cycles using a target time
- Monitor the running steriliser cycle
- Monitor up to four input conditions. Any input can be selected by pressing the 'Monitor Input' button otherwise they are greyed out. Sterliser process limits are displayed for each input.

F.4 Application Example 4 Configurable Steriliser

This application is the same as Example 3 but some configuration is allowable by the user such as input types and ranges.

F.5 Full driver capabilities list

As a general summary, with the nanodac Ethernet Labview Driver the user can:

Configure SensorBreakType and Fault Response
Configure Instrument Alarm Types
Configure Alarm Parameters e.g. (Threshold, Hysteresis, Latching Mode, Blocking)
Configure Channel Filter Time
Configure Humidity parameters
Configure Cool Type
Configure FeedForward Parameters
Configure Control Action
Configure Control Loop Type
Configure ServoToPV and Tracking
Configure Range Low and High Limits
Change Instrument Modes e.g. Operator, Configuration, Auto, Manual
Configure Setpoints (Setpoint1, Setpoint2, Remote Setpoint, Target Setpoint)
Configure Dead Band
Configure hysteresis
Configure Safe Output, Manual Output and ManStartUp
Configure Control Output Limits.
Configure Valve Operation
Configure Proportional Band Integral Time and Derivate Time
Configure Cutback Low and High Limits
Configure Setpoint Low and High Limits
Configure Setpoint Ramp Rate Value
Configure Tuning parameters
Configure PID Loop Break Time
Configure Virtual Channel Timer Parameters
Configure Virtual Channel Totaliser Parameters
Configure Virtual Channel Counter Parameters
Configure Steriliser parameters
Read Working Setpoint and Working Output
Read Alarm Output status
Read Manual Output Value
Read Process Variable and Measured Values
Read Timer Status
Read PID parameters
Enable/Disable the Alternative Setpoint
Start an Autotune
Global Acknowledge Alarms
Set Active Setpoint (Setpoint1, Setpoint2)
Set Controller Mode (Auto, Manual, OFF)
Start Program (Reset, Run, Hold)
Read Steriliser Parameters
Read Program parameters

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International sales and support
Eurotherm: www.eurotherm.com

Contact Information
Eurotherm Head Office
Faraday Close,
Durrington,
Worthing, West Sussex,
BN13 3PL

Sales Enquiries
T +44 (01903) 695888
F 0845 130 9936

General Enquiries
T +39 031 975 111
F +39 031 977 512

Worldwide Offices
www.eurotherm.com/global

Scan for local contacts

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