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Iqaluit

IQALUIT WATER TREATMENT PLANT

OPERATION & MAINTENANCE MANUAL

IQALUIT, NU

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General Site Information and Guide
for the Iqaluit Water Treatment Plant
Iqaluit, Nunavut

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Iqaluit

March 2022

1 INTRODUCTION

Year of Completion:	2004
Original Scope:	Expand existing water treatment facility to meet city's requirements and Canadian Drinking Water Quality Guidelines.

This manual has been updated to include:

DATE	DESCRIPTION OF CHANGE
December, 2018	This section is a new addition to incorporate information regarding plant standards and procedures for site inspections, personnel training and emergency response plans.
March, 2022	Inclusion of supplemental text regarding updates and upgrades made to the water treatment plant as per WTP Project No. 211-12487-00.

Iqaluit Water Treatment Plant

Project History

The City of Iqaluit:	City of Iqaluit Public Works & Engineering P.O. Box 460 Iqaluit, NU X0A 0H0 Simon Doiron, Director of Public Works Phone: (867) 222-2966 S.Doiron@iqaluit.ca Sumon Ghosh, Director of Engineering Phone : (867) 979-5636 S.Ghosh@iqaluit.ca
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General Contractor:	2004 Upgrades 90 North Construction & Development Ltd. (No longer in operation) Suite 106, 6131-6th Street S.E. Calgary, AB T2H 1L9 2017 Upgrades Maxime Gaudreau, Project Manager Kudlik Construction Ltd. P.O. Box 727, 1519 Federal Road Iqaluit, NU X0A 0H0 P: (418) 802-8224 mgaudreau@kudlik.biz

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Electrical Subcontractor:	2004 Upgrades KRT Electric 1505 Federal Rd, Iqaluit, NU P.O. Box 1259 Iqaluit, NU X0A 0H0 Phone: (867) 979-2639 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, carl@sifec.ca Phone: (855) 437-4001
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3 USE O&M MANUAL GUIDE

3.1 USE OF THIS MANUAL

The intent of this Operations and Maintenance (O&M) manual is to provide the operations and maintenance personnel with a clear and concise understanding of how the City of Iqaluit Water Treatment Plant (WTP) operates, and the steps that must be followed to ensure that the facility is running safely and efficiently.

The primary goal of this manual and of all personnel operating in and around the WTP is loss prevention, the prevention of personnel injury and property damage. To meet this objective, the operation and maintenance program includes:

- General site information and purpose of the WTP.
- Specific operating instructions (divided into individual O&M Manual sections) pertaining to Architectural & Structural, Process, Mechanical and Electrical and Instrumentation components of the WTP to be learned and followed at all times to promote safe and efficient operation. These also include, but are not limited to information for the following:
  - Operational procedures for storage, treatment and distribution of potable water.
  - Waste streams generated as part of the water treatment process.
  - Hazardous substances found on site and their respective handling requirements.
  - Water quality sampling and monitoring.
- Site inspections and routine maintenance of all the facility's systems and structures.
- Detailed inspections of all equipment, facilities, system and structures as well as reporting and correction of deficiencies.
- Emergency procedures to be followed in the event of spills or accidents.
- Proper record keeping.
  - The appendices for each specific technical O&M section contain construction documents (record drawings, specifications and shop drawings).
- Maintaining a supply of parts, spare materials and equipment necessary to keep the facility running safely and efficiently.

Personnel must review and be familiar with all chapters of the manual to ensure that they have a thorough working knowledge of the Water Treatment Plant. This will enable them to turn directly to the correct chapter should a reference be required.

END OF CHAPTER 3

4 SITE INSPECTIONS

4.1 GENERAL SITE INSPECTIONS

The City of Iqaluit Water Treatment Plant (WTP) is located south of Geraldine Lake, which also provides the raw water source for potable water treatment at the WTP. With the exception of the occasional algal blooms during the summer, Geraldine Lake provides relatively good quality raw water. The WTP has a gross design capacity of 9,500 m3/day.

Site inspections are performed daily to ensure that all equipment and systems within the are operating and properly functioning, as well as ensure the housekeeping aspects are in place (such as tidiness and accessibility). On-shift operators perform daily rounds throughout the WTP in a 24-hour cycle. In the event an equipment is identified to be deficient, it is tagged and logged for maintenance, or where required, replacement. Refer to the Process, Mechanical, Electrical and Instrumentations Operations and Maintenance Manuals for further details on the maintenance schedule and requirements for operating equipment on site.

The observations for the daily site inspections are logged in the inspection’s logbook.

END OF CHAPTER 4

5 PERSONNEL TRAINING

5.1 PERSONNEL TRAINING REQUIREMENTS

Personnel training is done in-house by the City of Iqaluit. Topics that are covered as part of the training process include, but are not limited to the following:

- Site safety and orientation.
- Operating procedures for each of the process units on site.
- WHIMIS.
- Confined space.
- First Aid

New operating personnel are expected to shadow an experienced operator as part of the training process.

5.2 FIRE

For this section, details will be added at a later time to address the following information:

- *The designated muster points in the event of a fire.*
- *The primary responder during a fire event (e.g., apart from the local City fire department, operators may also be trained to address fires on site).*
- *Locations of all the manual fire alarm pull stations in the WTP.*

5.3 SPILLS

In the event of a chemical spill, all operators on shift must be notified, and action must be taken to contain the spill as soon as possible. Depending on the nature and location of the chemical spill, the local and territorial environmental agencies may need to be notified.

Proper PPE must be worn when addressing the spills. Depending on the degree of the chemical spill hazard, appropriate PPE would generally consist of the following:

- Suits (ranging from regular coveralls to Hazmat protection)
- Gloves
- Goggles or face shields
- Respirators
- Rubber Boots

Spills waste materials must be stored in a safe location until it can be safely disposed of through sea-lift services.

5.4 OPERATIONAL AND CONTROLS ALARMS

In 2018, the City of Iqaluit WTP commenced a project to carry out a water and wastewater facilities-wide PLC and SCADA radio communications upgrade to allow all the water and wastewater facilities to communicate directly with one other and allow for the control of the different communications systems City-wide. The main control center is located within the WTP. As part of the implementation of the new PLC and communications system, when PLC alarms are triggered, the Plant Superintendent will be notified, along with the designated operators. This is to allow for timely response to the alarm and for plant personnel to take appropriate action to rectify any process related emergencies.

END OF CHAPTER 5

6 EMERGENCY RESPONSE

6.1 GENERAL

During the event of an onsite emergency, the first point of contact would be the local dispatch emergency service. On-shift operators would be expected to take appropriate action and respond to emergencies on site. There are also back-up procedures that must be followed (the framework for which will be developed at a later time).

In the event of an emergency, there are muster points on site located throughout the exterior of the plant (details to be added at a later time).

The table below presents the strobe/beacon colour codes or alarm horns and their respective corresponding emergency scenarios (details to be added at a later time).

STROBE/BEACON LIGHT COLOUR / ALARM HORN	EMERGENCY SCENARIO
-	Fire
-	Chlorine Leak
-	Carbon Monoxide

END OF CHAPTER 6

Electrical Operation & Maintenance Manual
for the Iqaluit Water Treatment Plant
Iqaluit, Nunavut

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Iqaluit

March 2022

1 INTRODUCTION

Year of Completion: 2004

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This manual has been updated to include:

DATE	**DESCRIPTION OF CHANGE**
March, 2022	Inclusion of updates and upgrades made to the water treatment plant as per WTP Project No. 211-12487-00.

Iqaluit Water Treatment Plant

Project History

The City of Iqaluit:	City of Iqaluit Public Works & Engineering P.O. Box 460 Iqaluit, NU X0A 0H0 Simon Doiron, Director of Public Works Phone: (867) 222-2966 S.Doiron@iqaluit.ca Sumon Ghosh, Director of Engineering Phone : (867) 979-5636 S.Ghosh@iqaluit.ca
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Instrumentation Subcontractor:	2004 Upgrades Vector Electric & Controls 3524-78 Avenue Edmonton, AB X1A 2P4 Phone: (780) 469-7900 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, carl@sifec.ca Phone: (855) 437-4001

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3 BACKGROUND

3.1 2021-2022 UPGRADES AND IMPROVEMENT WORK

In 2021 and 2022, maintenance and upgrade work were carried out at the City of Iqaluit water treatment plant (WTP) as part of WSP Project No. 211-12487-00, in which the following modifications were made to the electrical systems:

- The installation of an Emergency Water Treatment Plant Bypass system including control and automation in a programmed *Bypass Mode*;
- The installation of the S::CAN online water quality monitoring devices at the WTP intake and on the treated water pipe between the WTP and the Reservoir measuring chlorine residual, pH, and petroleum hydrocarbon concentrations;
- Replacement of a permanent sump pump in the Void space beneath the WTP including audible and SCADA-integrated alarms;
- Removal of existing submersible service pumps P410 and P411 from the Pumping Chamber and the installation of two new inline Service Pumps in the utilidor tunnel below the Reservoir;
- The installation of two new ultraviolet disinfection systems in place of the existing system.

Refer to the Process and Mechanical Operation & Maintenance manuals for all other upgrades made during the 2021-2022 upgrades and improvement work.

3.2 ELECTRICAL SUPPLY

Electrical power is supplied to the WTP by the Quilliq Energy Corporation (QEC) and is configured to provide a continuous power source to the WTP.

3.3 POWER SOURCE

A 400A, 347/600 Volt overhead service is provided to the WTP from a utility pole mounted transformer. The WTP utility meter is located on the interior wall at the south corner of the building which is routed through the meter cabinet prior to the main electrical distribution panel.

3.4 FACILITY POWER DISTRIBUTION

3.4.1 MAIN DISTRIBUTION PANEL

A single 400 A main electrical distribution panel supplies all the WTP subpanels. The major subpanels are distribution panel 2A, 2B, 6A, and the motor control center (MCC). In addition, the main distribution panel supplies a 200A splitter which in turn feeds two UV control panels. Distribution subpanel 2A supplies the lower level of the WTP, while panels 2B and 6B supply the upper level.

3.4.2 DISTRIBUTION PANEL 2A

A 120/208 V, 60A circuit distribution panel supplies the lower-level loads, including the lower-level receptacles, unit heaters, sodium hypochlorite pumps, motorized valves, lower floor PLC panels, Clearwell level loads, battery packs, and tunnel lighting.

3.4.3 DISTRIBUTION PANEL 2B

A 120/208 V, 60 circuit distribution panel which supplies the majority of the power for the upper level, which includes the upper-level receptacles, unit heaters, exhaust fans, motorized valves, upper floor PLC panels, chlorinators, zinc orthophosphate dosing pumps, hydrofluorosilicic pumps, fire alarm panel, exit lighting, and battery packs.

3.4.4 DISTRIBUTION PANEL 6A

A 347/600 V, 24 circuit distribution panel supplies the 347/600 V loads, including the exterior and interior lighting and air handling unit AHU-2.

3.4.5 MOTOR CONTROL CENTER

The MCC is configured to operate various treatment process and mechanical equipment. Refer to Chapter 10 of this Manual for the water treatment process operating procedures.

3.5 WATER TREATMENT PROCESS CONTROLS AND ALARMS

The overall water treatment process is controlled utilizing a programmable logic controller (PLC) with multiple human-machine interfaces (HMI). The facility main control panels are the upper PLC cabinet, the lower PLC cabinet, and the MCC. Each PLC cabinet will control and operate the water treatment process instrumentation devices located on the same level as the PLC cabinet. The lower PLC module rack is interfaced with the upper PLC via a bus extension cable the PLC operates using a single processor module located in the Upper PLC cabinet. HMI interface terminals located in the upper and lower PLC cabinets are identical in the make and model and both allow complete access to all elements of the plant control system.

Refer to Chapter 4 of this Manual for the water treatment process operating procedures.

3.5.1 WATER TREATMENT PROCESS CONTROL

The water treatment process consists of UV disinfection, filtration, chlorination, fluoridation, and pH adjustment. The treatment system is automated and is able to operate on a continuous basis; however, can be switch to manual operation, if required. The production of treated water is controlled via a level sensor in the treated water storage reservoir. When in automatic mode, the PLC will initiate the production of water when the level in the reservoir reaches a lower threshold.

Refer to Drawings I-102 through I-108 at the end of Chapter 10 for the overall water treatment process instrumentation schematic.

3.5.2 WATER TREATMENT PROCESS ALARMS

The PLC continuously monitors the treatment process, as well as the mechanical, and electrical operating systems. System or equipment failure alarms are indicated on the Versaview HMI screen. Based on the severity of the alarm, the PLC may cease production or initiate backup systems.

Refer to Chapter 6 of this Manual for the water treatment process alarms.

3.6 CHLORINE DETECTION & MONITORING

The Chlorination Room is continuously monitored to detect the presence of a chlorine gas leak. Refer to Chapter 7 for the chlorine detection alarms.

3.7 TELECOMMUNICATIONS/ALARM DIALER

The WTP has a dedicated phone line for the facility alarm dialer. When the WTP is unoccupied alarms requiring operator intervention will be identified on the PLC and notify the operator via an auto dialer. Refer to Chapter 7 of this manual lists of major alarms and their associated annunciations.

3.8 FIRE ALARM

The WTP fire protection system consists of smoke detectors, thermal detectors, and alarm pull stations. All devices are wired back to distribution panel 2B.

3.9 ELECTRICAL WIRING

The plant electrical and controls system wiring is protected using either armoured cable (Teck cable) or contained in electrical conduit.

END OF CHAPTER 3

4 GENERAL OPERATING PROCEDURES

4.1 GENERAL

The operations portion of this manual should be read in conjunction with Chapter 4 of the Process and Mechanical Operations and Maintenance Manuals. The operating procedures described in this section will relate to the electrical and water treatment process controls systems.

4.2 FACILITY POWER AND STANDBY POWER SYSTEM

Electrical power for the WTP is supplied by a 400 Amp, 347/600 Volt utility service, which supplies all the water treatment process controls and alarm systems, auxiliary electrical systems, lighting, and mechanical systems.

Utility power availability is continuously monitored by the PLC. In the event of a utility power failure, the raw water intake control valve (FCV-1001) and the plant treated water outlet valve (FVC 2501) will be closed by a dedicated uninterrupted power supply, effectively shutting down the water treatment operation. All other facility valves will remain in their last position.

After the power is restored and all treatment system alarms are cleared, the water treatment plant will automatically restart.

4.3 WATER TREATMENT CONTROLS SYSTEMS

The water treatment plant can be operated in both manual and automatic mode. The production of water is controlled by the level of the treated water reservoir, which is monitored by the PLC system.

4.3.1 PRE-TREATMENT

(Refer to Drawing I-102 and I-301 at the end of Chapter 10)

Raw water entering the WTP is measured for turbidity, pH, and concentrations of petroleum hydrocarbons. AE-1001 is a continuous on-line turbidity meter. The continuous measurements are transmitted to the PLC via AIT-1001, recorded once per minute and stored for archive purposes. AI-1001 will display the raw water turbidity on the PLC. The raw water sample line leading to AE-1001 is equipped with an electric solenoid valve SV-1001. During plant operation SV-1001 will be energized open, during plant shut down SV-1001 will de-energize and the valve will close. AE-1002 provides continuous on-line pH monitoring of the raw water. The continuous measurements are transmitted to the PLC via AIT-1002, recorded once per 15 minutes and stored for archive purposes. AI-1002 displays the raw water pH on the PLC. The raw water sample line leading to AE-1002 is equipped with an electric solenoid valve SV-1002. During plant operation SV-1002 will be energized open, during plant shut down SV-1002 will de-energize and the valve will close. AE-1003 is a continuous on-line spectrophotometer calibrated to measure various water quality parameters, specifically concentrations of petroleum hydrocarbons. The continuous measurements are transmitted to the PLC via AIT-1001, recorded once every two minutes and stored for archive purposes. AI-1003 displays the raw water petroleum hydrocarbon concentrations on the PLC. AAH-1003 is a High-High alarm for petroleum hydrocarbon concentrations greater than or equal to 50 µg/L. Exceeding the High-High alarm setpoint causes shutdown of the Water Treatment Plant and an alarm on the PLC.

Raw water flow entering the water treatment plant is measured by FE-1001. FIT-1001 transmits the flow to the PLC. FIT-1001 has a calibrated range of 0-60 L/s corresponding to a 4-20 mA output signal. FI-1001 will display the raw water flow on the PLC. FAL-1001 is a low flow alarm for the raw water inlet. If the plant is called into operation and no raw water flow is detected FAL-1001 will alarm on the PLC.

The flow of raw water into the water treatment plant is controlled by FCV-1001. This valve is equipped with both REMOTE-OFF-LOCAL (ROL) and OPEN-STOP-CLOSE (OSC) hand switches labelled HS-1001A and HS-1001B respectively. When HS-1001A is in the LOCAL position, HS-1001B is used to open and close the valve as required. When HS-1001A is in the OFF position FCV-1001 will not operate. The position of FCV-1001 when HS-1001A is in the REMOTE position will be controlled based on the flow detected by FE-1001 and a desired plant production rate chosen by the plant operator. FCV-1001 is equipped with a position indicator ZI-1001 that detects the position of the valve. ZI-1001 is expressed on the PLC as a percentage open from 0-100% based on the 4-20 mA signal.

Upon loss of utility power FCV-1001 is closed by a dedicated uninterrupted power supply; therefore, shutting down the water treatment process. FCV-1001 is the only valve in the facility to be powered in this manner. All other valves fail to their last position upon a loss of utility power.

The UV disinfection reactors X-120 and X-121 disinfect the raw water. The plant PLC is connected to each of the reactors dedicated control panel via ethernet. Each of the reactors is controlled manually (at the UV control panel) or remotely at the PLC. During plant start up, the PLC will call for the duty UV reactor to start. the UV reactor controller determines tart-up, normal operation and shutdown of the UV reactor. In the event of a failure of the duty UV reactor, the PLC will switchover to the standby reactor.

Both X-120 and X-121 are associated with an influent valve, effluent valve and drain valve. Influent valves (V-1007 and V-1008) are manually operated to isolate the UV reactors. V-1007 and V-1008 remain fully open unless a UV reactor is out of service. Effluent control valves (FCV-1009 and FCV-1012) will be controlled (on/off) and monitored (open/closed) by the UV control panels based on the requirements established by Trojan Technologies. Drain valves (SV-1201 and SV-1211) provide cooling water to the UV reactors during start-up and shut down sequences. SV-1201 and SV-1211 are controlled by the UV control panels. Cooling water is monitored by FE-1001.

Valves X-120 and X-121 are continuously monitored by the dedicated control panels supplied with the equipment. The control panels monitor various parameters with minor, major, and critical common alarms being communicated to the plant PLC via Ethernet.

To facilitate even wear on the lamp assemblies a “reactor rotation” timer is provided in the PLC. Designation of the current standby reactor will alternate between each UV reactors. The PLC will designate of the reactor positions that will be regularly rotated into and out of service. The rotation timer was initially set to 168 hours (one week). This timer is fully adjustable to suit operator preferences but shall not exceed 4 rotations per day. It is possible for the operator to manually reset the timer.

4.3.2 FILTRATION

(Refer to Drawing I-103 and I-301 at the end of Chapter 10)

The filters operate in several different modes, including filtration (i.e., normal operation), backwash, and filter to waste mode. A description of each operation is included below for reference.

4.3.2.1 *FILTRATION MODE*

Filtration mode is where the filters are operating under normal conditions. The operator can select which filters will be in operation via the PLC based on the desired plant production rate. During filtration:

- Filter inlet valve (FCV-2101) will be fully open
- Backwash waste valve (FCV-2106) will be closed
- Air scour inlet valve (FCV-2107) will be closed
- Backwash supply valve (FCV-2105) will be closed
- Filter to waste valves (LCV-2103) will be closed
- The filtered water valve (LCV-2104) will modulate to maintain a constant level within the filter based on the level in the rapid gravity filter (LE-2101).

Filtration will continue until one of the following conditions occurs at which time the backwash mode will be started:

- Filtered water turbidity > 0.3 NTU
- Filtered water valve is fully open
- Filter media differential pressure
- Operator enables the backwash sequence on the PLC
- Elapsed time (variable set in the PLC)

4.3.2.2 *BACKWASH MODE*

Filtration will continue until one of the following conditions occurs at which time the backwash mode will be started:

- Filtered water turbidity > 0.3 NTU
- Filtered water valve is fully open
- Filter media differential pressure
- Operator enables the backwash sequence on the PLC
- Elapsed time (variable set in the PLC)

Backwash will begin when one of the above conditions occur, indicating that the filter media requires cleaning. Prior to the initiation of the backwash sequence, the PLC will confirm that the following conditions are met. If the reservoir level is calling for the plant to run the PLC confirms that the filter inlet valve, and the filter to clear well valve for at least one of the three other filters are proven as open. This ensures that a backwash cannot be initiated if the reservoir requires water. At least one filter must be available for normal use. Once a backwash has been triggered the following events will happen sequentially:

- Filter inlet control valve will close and prove as such, allowing the water level in the filter to decrease.
- The filtered water valve will close when the water level reaches 150 mm above the filter media as measured by LE-2101 and prove as such.
- The air scour valve will open, followed by the starting of one of the air scour blowers. Air will be delivered to the filter for approximately 5 minutes followed by the blower shutting down, then the air scour valve closing and proving as such.
- The backwash pump will be started with PRV-2501 fully open (pilot solenoid de-energized).
- The backwash waste valve and backwash supply valves will now be opened.
- After a delay of 3 minutes the PRV-2501 pilot solenoid will be energized allowing this valve to close slowly, thereby closing the pump bypass allowing backwash water to be introduced into the filter.

- The backwash pump will deliver water to the filter 10 minutes.
- PRV-2501 pilot solenoid will be de-energized allowing PRV-2501 to return to bypass mode.
- Backwash supply and backwash waste valves will be closed.
- The backwash pump will be shut down following 2 minutes after PRV-2501 is fully open and valve status is confirmed for all backwash related vales, the filter is ready to enter to waste mode.

4.3.2.3 *FILTER-TO-WASTE MODE*

This mode allows the filter to ripen following the backwash sequence and pass filtered water with excess turbidity to storage. This will be accomplished by the following:

- Filter influent valve will open.
- Filter to waste valve will be modulated to maintain the filter water level. This will require that the valve be closed for some time, so the filter has time to fill up.
- Filter to waste will continue for a pre-set time (~ 10-15 minutes) or until the turbidity of the filtered water is < 0.3 NTU.
- The filtered water valve will open and the filter to waste valve will close, thereby placing the filter into filtration mode.

Filtered water turbidity from the rapid gravity filter F-210 is measured by AE-2102. The continuous measurements are transmitted to the PLC via AIT-2102, recorded once per minute and stored for archive purposes. Alarm AE-2102 will display F-210 filtered water turbidity on the PLC. AAH-2102 will be used to notify the operations staff that the filtered water turbidity is high, and a backwash is required. The filtered water sample line leading to AE-2102 will be equipped with an electric solenoid valve (SV-2102). During filtration SV-2102 is energized open, when F-210 is in a backwash sequence, or the plant is not in operation, SV-2102 will de-energize and the valve will close.

The pressure drop across the filter media is monitored by PIT-2101. The reference leg of the transmitter is located above the filter media and represents a constant pressure value. The measuring leg of the transmitter is located at the under-drain piping outlet, and higher pressures will occur as the filter media reaches capacity.

The filter inlet valve on F-210, FCV-2101, is equipped with a HAND-OFF-AUTO (HOA) switch HS-2101A and an OPEN-CLOSE (OC) switch HS-2101B. FCV-2101 is equipped with position switches ZSO-2101 and ZSC-2101 to detect the valve open and closed position respectively. When HS-2101A is in the OFF position the valve will not operate. When HS-2101A is in the HAND position, the valve position can be opened or closed using HS-2101B. When HS-2101A is in the AUTO position, the PLC controls FCV-2101.

When the filter is in filtration mode FCV-2101 is signalled to open. When the filter is in backwash mode or is out of service (as determined by the operator on the PLC) FCV-2101 is signalled closed. ZSO-2101 and ZSC-2101 display the open/closed status of the filter inlet valve on the PLC. In the event that FCV-2101 is signalled to open and ZSO-2101 fails, a failure to open alarm annunciates. In the event that FCV-2101 is signalled to close and ZSC-2101 is not activated, the backwash sequence will be disabled for F-210, LCV-2103 and LCV-2104 will be closed and a failure-to-close alarm will be annunciated on the HMI.

Water level within F-210 is continuously measured by LE-2101. LIT-2101 provides local level indication and transmits the level within F-210 to the PLC. LI-2101 displays the level within F-210 on the PLC. LIT-2101 monitors the filter level and alarms on a high level (300mm above operating level). The occurrence of a high-level alarm indicates a downstream blockage or valve closure and results in the closure of FCV-2101.

The filter to waste valve (LCV-2103) is equipped with position indicator ZT-2103. Following the backwash sequence, LCV-2103 will open and modulate to maintain the water level within F-210 as detected by LE-2101. The filter to waste valve will continue to modulate until the turbidity (measured by AE-2102) is below 0.3 NTU. ZI-2103 provides display of the position status of the filter to waste valve on the PLC. The filter is disabled in the event that LCV-2103 is signalled to close and the valve fails to close or when LCV-2103 is signalled to open and the valve fails to open, FCV-2101 is closed and valve close/open failure alarm annunciates.

LCV-2103 will be equipped with a ROL switch HS-2103A and an OC switch HS-2103B. When HS-2103A is in the OFF position the valve will not operate. When HS-2103A is in the LOCAL position the valve position can be opened and closed using HS-2103B. When HS-2103A is in the REMOTE position, the PLC will control LCV-2103.

The filtered water valve (LCV-2104) is equipped with position indicator ZT-2104. Following the filer to waste sequence, the filter to waste valve will be closed and the filtered water valve will open. The filtered water valve will continue to modulate allowing filtered water to enter the clearwell. Once a condition is met that requires backwashing (see filtration mode description), the filtered water valve will close. ZI-2104 provides display of the position of the filtered water valve on the PLC. The filter is disabled in the event that LCV-2104 is signalled to close and the valve fails to close or when LCV-2104 is signalled to open the valve fails to open, FCV-2101 is closed and a valve close/open failure alarm annunciates. If ZI-2004 indicates that the valve is fully open in order to maintain the water level in the filter, a backwash is required.

LCV-2104 will be equipped with a ROL switch HS-2104A and an OC switch HS-2104B. When HS-2104A is in the OFF position the valve will not operate. When HS-2104A is in the LOCAL position the valve can be opened and closed using HS-2104B. When HS-2104A is in the REMOTE position, the PLC will control LCV-2104.

The backwash water supply to F-210 is controlled by FCV-2105. The valve is equipped with position switches ZSO-2105 and ZSC-2105 to detect the valve open and closed position respectively. During the backwash sequence, FCV-2105 will open and allow the backwash water to enter the filter following air scour. ZSO-2105 and ZSC-2105 provide display of the open/closed status of the filter to waste valve on the PLC. In the event that FCV-2105 is signalled to open and ZSO-2105 fails, a failure to open alarm annunciates. This results in a failure of the backwash sequence, that disables F-210 from coming back online. In the event that FCV-2105 is signalled to close and ZSC-2105 is not activated, the filter will be disabled, a failure to close alarm occurs.

FCV-2105 will be equipped with a HOA switch HS-2105A and an OC switch HS-2105B. When HS-2105A is in the OFF position the valve will not operate. When HS-2105A is in the HAND position the valve position can be opened and closed using HS-2105B. When HS-2105A is in the AUTO position, the PLC will control FCV-2105.

The backwash waste valve on F-210 is controlled by FCV-2106. The valve is equipped with position switches ZSO-2106 and ZSC-2106 to detect the valve open and closed position respectively. During the backwash sequence, FCV-2106 will open and allow the backwash waste to leave the filter. ZSO-2106 and ZSC-2106 provide display of the open/closed status of the filter to waste valve on the PLC. In the event that FCV-2106 is signalled to open and ZSO-2106 fails, a failure to open alarm occurs. This results in a failure of the backwash sequence, that disables F-210 from coming back online. If ZOA-2006 is active the backwash pumps, P-205/206 will be disabled. In the event that FCV-2106 is signalled to close and ZSC-2106 is not activated, the filter will be disabled, a failure to close alarm will occur.

FCV-2106 will be equipped with a HOA switch HS-2106A and an OC switch HS-2106B. When HS-2106A is in the OFF position the valve will not operate. When HS-2106A is in the HAND position the valve position can be opened and closed using HS-2106B. When HS-2106A is in the AUTO position, the PLC will control FCV-2106.

The air scour valve on F-210 is controlled by FCV-2107. The valve is equipped with position switches ZSO-2107 and ZSC-2107 to detect the valve open and closed position respectively. During the backwash sequence, FCV-2107 will open and prove as such, enabling the air scour blower start, which will allow the air to enter the filter. Upon completion of the air scour the operational sequence will shut down the blower prior to sending the FCV-2107 close signal. ZSO-2107 and ZSC-2107 provide display of the open/closed status of the air scour valve on the PLC.

In the event that FCV-2107 is signalled to open and ZSO-2107 fails, a failure to open alarm occurs. This results in a failure of the backwash sequence, that disables F-210 from coming back online. If ZOA-2007 is active the air scour blowers, C-200/C-201 will be disabled. In the event that FCV-2107 is signalled to close and ZSC-2107 is not activated, the filter will be disabled, initiating a failure to close alarm.

FCV-2107 will be equipped with a HOA switch HS-2107A and an OC switch HS-2107B. When HS-2107A is in the OFF position the valve will not operate. When HS-2107A is in the HAND position the valve position can be opened and closed using HS-2107B. When HS-2107A is in the AUTO position, the PLC will control FCV-2107.

HS-2001 and HS-2001 are HOA manual switches associated with air scour blowers C-200 and C-201 respectively. HS-2001 and HS-2001 are located in the MCC. When HS-2001 is in HAND position, blower C-200 starts and continues to run disregarding any other condition. In the OFF position, the blower is off disregarding any other condition. In the AUTO position the blower starts and stops as called for by the PLC. Running status of the blowers will be displayed on the PLC along with fault status and automatic operation. Running lights for each blower will be located on the plant MCC. C-200 and C-201 will be alternated automatically by the PLC once per month or in the case of fault with the duty blower. All controls are similar for both C-200 and C-201.

4.3.2.4 *BYPASS MODE*

This mode is used while operating the Emergency WTP Bypass System. The intent of the system is to convey piped water directly from Lake Geraldine, through the UV disinfection system, chlorinated, and conveyed to the Reservoir, effectively bypassing the below-ground tanks. In contrast to the Filtration Mode which is primarily controlled by the water elevation in the Pumping Chamber (via LIT-2501), Bypass Mode is controlled by the water elevation in the North Reservoir via LIT-5001.

When the WTP is operating in Bypass mode, the valves will be in the following position:

- Raw water inlet valve (FCV-1001) will be fully open
- Filter inlet valve (FCV-2101) will be fully closed
- Backwash waste valve (FCV-2106) will be closed
- Air scour inlet valve (FCV-2107) will be closed
- Backwash supply valve (FCV-2105) will be closed
- Filter to waste valves (LCV-2103) will be closed
- The filtered water valve (LCV-2104) will be closed
- Reservoir fill valve (FCV-2501) will be fully open

As there is no water passing through the filters, there is no signal to initiate Backwash Mode or Filter-to-Waste mode.

Conveyance of water to the Reservoir is controlled by the operator-defined low- and high-water elevation setpoints, respectively. These setpoints are normally set to:

- Low Water Elevation = 3.65 m
- High Water Elevation = 4.15 m

4.3.3 CLEARWELL AND BACKWASH SUPPLY

(Refer to Drawing I-104, I-105, and I-302 at the end of Chapter 10)

HS-2051 and HS-2061 are HOA switches associated with backwash pumps P-205 and P-206 respectively. HS-2051 and HS-2061 are located locally at P-205 and P-206. When HS-2051 is in HAND position, pump P-205 starts and continues to run disregarding other condition. In the OFF position, the pump will not operate. In the AUTO position the pump starts and stops as called for by the PLC. Running status, fault status and automatic operation of the pumps is displayed on the PLC. Running lights for each pump are located on the plant MCC. P-205 and P-206 will be alternated automatically by the PLC once per month or in the case a duty pump fault. P-205 and P-206 operate when required by the backwash mode. All controls are similar for both P-205 and P-206.

Water level within the backwash pumping chamber is continuously monitored by LE-2501. LIT-2501 provides local level indication and transmits the level within the pumping chamber to the PLC. LI-2501 displays the level within the clearwell on the PLC. LAL-2501 provides a low-level alarm, which disables the backwash pumps. LAL-2501 will also indicate that the water treatment plant needs to start, or the off-site reservoir is not receiving water from the WTP. LAH-250 will indicate a failure of the level control within the reservoir or a valve closure between the water treatment plant and the offsite reservoir.

The treated water supply to the storage reservoir is controlled by FCV-2501. FCV-2501 ensures that treated water exiting the plant meets the quality criteria dictated by AIT-2501. An alarm generated by AIT-2501 (for either chlorine residual via AE-2501A or concentrations of petroleum hydrocarbons via AE-2501C) will result in a plant stop condition closing FCV-1001 and FCV-2501. Once the plant conditions that initiated the AIT-2501 alarm are addressed the PLC allows the plant to restart and FCV-2501 to re-open. At this point, AIT-2501 alarms are bypassed for 10 minutes to allow a treated water sample to reach the analyzer. The valve will be equipped with position switches ZSO-2501 and ZSC-2501 to detect the valve open and closed position, respectively. During normal plant operations, FCV-2501 is open and allows the treated water to enter the storage reservoir. ZSO-2501 and ZSC-2501 provide display of the open/closed status of the plant outlet valve on the PLC. In the event that FCV-2501 is signalled to open and ZSO-2501 is not activated, a failure to close alarm annunciates. This results in a failure of the plant to produce water and a plant major alarm dial out occurs. In the event that FCV-2501 is signalled to close and ZSC-2501 is not activated, a failure to close alarm annunciates and a plant major alarm dial out occurs.

FCV-2501 will be equipped with a HOA switch HS-2501A and an OC switch HS-2501B. When HS-2501A is in the OFF position the valve will not operate. When HS-2501A is in the HAND position the valve position can be opened and closed using HS-2501B. When HS-2501A is in the AUTO position, the PLC will control FCV-2501.

4.3.4 CHLORINATION

(Refer to Drawing I-108 and I-301 at the end of Chapter 10)

The chlorination disinfection system uses chlorine gas (Cl_2), which is mixed with treated water to form hypochlorite (HOCl). The chlorine gas system is supplied by US Filter and comes complete with controls, refer to US Filter documentation. The plant PLC will feed gas chlorinators X-340 and X-341 and the chlorine feed water flow is measured by FE-1001.

The ambient chlorine gas detection sensor, AE-3401, alarms if chlorine gas is detected within the chlorination room. The chlorine alarm is displayed as AAH-3401 on the PLC. A chlorine audible alarm, HN-3401, and alarm beacon, BA-3401, are mounted outside of the chlorine room external to the water treatment plant and will both be activated if AAH-3401 alarms.

4.3.5 HYDROFLUOROSILICIC ACID, LIQUID SODIUM HYPOCHLORITE, AND CAUSTIC SODA

(Refer to Drawing I-106, I-107, I-301, and I-302 at the end of Chapter 10)

Each chemical dosing system consists of two dosing pumps (duty + standby), which are P-303 and P-304 for caustic soda, P-305 and P-306 for hydrofluorosilicic acid, and P-362 and P-363 sodium hypochlorite.

HS-3031 and HS-3041 are HOA switches located on the MCC control panel, associated with raw water pumps P-303 and P-304, respectively. When HS-3031 is in HAND position, pump P-303 starts and continues to run disregarding any other commands issued by the PLC. In the OFF position, the pump will not operate. In the AUTO position the pump starts and stops as called for by the PLC. The PLC provides a flow signal (raw water flow FE-1001) for flow pacing of each pump. P-303 is monitored for Auto status, operational status, and fault signals. The pump duty will be alternated automatically from the PLC every month. Similarly for HS-3041 and P-304.

4.3.6 WASTE TANKAGE

(Refer to Drawing I-105 and I-303 at the end of Chapter 10)

Water level in the Backwash Waste Tank is measured by LE-4001. LIT-4001 is the local level transmitter and will indicate the level in the tank on the PLC in meters (0-3.5m). LAH-4001 is the high-level alarm indicating a high backwash level that will disable any further backwashing of filters.

The flow of backwash water to the sewer is controlled my FCV-4001. This valve is equipped with both ROL and OSC switches, HS-4001A and HS-4001B respectively. When HS-4001A is in the LOCAL position, HS-4001B can be used to open and close the valve as required. When HS-4001A is in the OFF position the valve will not operate. When HS-4001A is in the REMOTE position the PLC controls the position of FCV-4001. The plant PLC indicates the position of HS-4001A.

The position of FCV-4001 when HS-4001A is in the REMOTE position is controlled based on the flow detected via FE-4001 and an operator input flow set point. FCV-4001 is equipped with a position indicator ZI-4001, to detect the position of the valve and therefore to detect fully open and fully closed positions. During operation of the WTP, the operator will input the desired outlet of backwash water rate via the PLC. ZI-4001 will be expressed on the PLC as a percentage open from 0-100% based on the 4-20 mA signal.

Water level in the Filter-to-Waste Tank is measured by LE-4011. LIT-4011 is the local level transmitter and the level in the tank on the PLC in meters (0-3.5m). LAH-4011 will be a high-level alarm indicating a high filter to waste level that will disable any filter to waste functions at the filters.

The flow of backwash water to the sewer is controlled by FCV-4011. This valve is equipped with both ROL and OSC switches, HS-4011A and HS-4011B respectively. When HS-4011A is in the LOCAL position, HS-4011B can be used to open and close the valve as required. When HS-4011A is in the OFF position the valve will not operate. When HS-4011A is in the REMOTE position the PLC controls the position of FCV-4011. The plant PLC will indicate the position of HS-4011A.

The position of FCV-4011 when HS-4011A is in the REMOTE position is controlled based on the flow detected via FE-4011 and an operator input flow set point. FCV-4011 is equipped with a position indicator ZI-4011, to detect the position of the valve and therefore to detect fully open and fully closed positions. During operation of the water treatment plant, the operator will input the desired outlet of backwash water rate via the PLC. ZI-4011 will be expressed on the PLC as a percentage open from 0-100% based on the 4-20 mA signal.

4.3.7 SERVICE WATER PUMPS

(Refer to Drawing I-107 and I-303 at the end of Chapter 10)

HS-4101 and HS-4111 are HOA switches located on the MCC control panel, associated with raw water pumps P-410 and P-411 respectively. When HS-4101 is in HAND position, pump P-410 starts and continues to run disregarding other condition. In the OFF position, the pump will not operate. In the AUTO position the pump starts and stops as called for by the PLC, either P-410 or P-411 will be in operation at all times. P-410 will be monitored for its Auto status, operational status, and fault signals. The pump duty is be alternated automatically by the PLC every month. Similarly for HS-4111 and P-411.

PSL-4112 is a pressure switch mounted in the service water header. This switch indicates low pressure in the supply, which feeds water to the chlorination system and the duty of the pumps.

END OF CHAPTER 4

5 SCHEMATICS AND FUNCTIONAL DATA

5.1 POWER DISTRIBUTION SCHEMATIC

(Refer to Drawings E-101, E-102, and E-301 at the end of this Section 10)

The following table identifies the components related to the power distribution.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Utility Transformer	South exterior power pole	Provide power to facility	
2	Weatherhead	South upper floor adjacent to new office	Overhead utility service entrance.	
3	Utility Meter Cabinet	South exterior wall	Utility billing is based on this meter.	
4	Customer Meter Cabinet	Interior wall, adjacent to new office	Customer check for utility billing.	
5	400A Main Distribution	Main Distribution Panel, adjacent to new office	Provides service to facility.	
6	Distribution Panel 6B	Upper Level	Provides distribution and overcurrent protection for exterior and upper floor lighting.	
7	75 kVA Transformer to Panel 2A	Lower Level	Provide power to panel 2A.	
8	Distribution Panel 2A	Lower Level	Provides distribution and overcurrent protection for lower-level loads.	
9	40 kVA Transformer to Panel 2B	Upper Level	Provide power to panel 2B.	
10	Distribution Panel 2B	Upper Level	Provides distribution and overcurrent protection for upper-level loads.	
11	Motor Control Center	Mechanical Mezzanine 201	Starts and controls facility motors.	
12	37.5 kVA Transformer to 200A Splitter	Upper Level	Provides power to UV control panels.	
13	200A Splitter	Upper Level	Provides service to UV control panels.	
14	100A Fused Disconnect	Upper Level, UV Control Panel	Disconnects UV Control Panel from utility power.	

15	UV Control Panel	Upper Level	Operates UV Package: SV-1201 & SV-1211 UV Reactors #1 & #2 X-120 & X-121 FCV-1009 & FCV-1012	
16	Ground Grid	Facility Exterior	Grounding of facility electrical system.	

5.2 PLC CONTROL SCHEMATIC

(Refer to Drawings I-102 to I-108 & E-101 to E-301 at the end of this Section 10)

The following table identifies the components related to the PLC controls.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Raw Water Turbidity (Inlet) AIT-1001	Pre-Treatment Process	Measure raw water turbidity into water treatment plant.	Recorded once every minute.
2	Raw Water PH (Inlet) AIT-1002	Pre-Treatment Process	Measure raw water pH into water treatment plant.	Recorded once every 15 minutes.
3	Raw Water Flow (Inlet) FIT-1001	Pre-Treatment Process	Measure raw water flow into water treatment plant.	
4	Raw Water Valve (Inlet) FCV-1001	Pre-Treatment Process	Control flow of raw water into water treatment plant.	Valve is driven closed by a dedicated UPS in the event of a utility power failure.
5	UV System CPP #1 & #2	Pre-Treatment Process	Control and monitoring of disinfection reactors X-120 & X-121.	UV control panels can be controlled manually or by the PLC. Even wear on lamp assemblies facilitated by reactor rotation. Rotation shall not exceed 4 per day.
6	Filter Inlet Valve FCV-2101 FCV-2111 FCV-2121 FCV-2131	Filtration Process	Control flow of pre-treated water into rapid gravity filters.	P&ID shows one of four filter assemblies.
7	Filter Water Level LIT-2101 LIT-2111 LIT-2121 LIT-2131	Filtration Process	Measure filtered water level in the rapid gravity filters.	P&ID shows one of four filter assemblies.

8	Pressure Drop Across Filter PIT-2101 PIT-2111 PIT-2121 PIT-2131	Filtration Process	Measures the pressure drop across the filter media.	P&ID shows one of four filter assemblies.
9	Filtered Water Turbidity AIT-2102 AIT-2112 AIT-2122 AIT-2132	Filtration Process	Measure filtered water turbidity.	P&ID shows one of four filter assemblies.
10	Air Scour Inlet Valve FCV-2107 FCV-2117 FCV-2127 FCV-2137	Filtration Process	Controls flow of air into rapid gravity filter.	P&ID shows one of four filter assemblies.
11	Filter to Waste Valve LCV-2103 LCV-2113 LCV-2123 LCV-2133	Filtration Process	After backwash sequence valve modulates to maintain level in rapid gravity filter.	P&ID shows one of four filter assemblies.
12	Filtered Water Valve LCV-2104 LCV-2114 LCV-2124 LCV-2134	Filtration Process	After filter to waste sequence valve modulates to maintain level in Clearwell.	P&ID shows one of four filter assemblies.
13	Backwash Supply Valve FCV-2105 FCV-2115 FCV-2125 FCV-2135	Filtration Process	Controls the backwash supply to the rapid gravity filter.	P&ID shows one of four filter assemblies.
14	Backwash Waste Valve FCV-2106 FCV-2116 FCV-2126 FCV-2136	Filtration Process	Allows backwash waste to leave the rapid gravity filter.	P&ID shows one of four filter assemblies.
15	Air Scour Blowers C-200 & C-201	Filtration Process	Used in backwash sequence to clear rapid gravity filters.	Pump duty switched every month by PLC.
16	Backwash Pumps P-205 & P-206	Clearwell & Backwash Supply Process	In backwash sequence pumps filtered water back through the rapid gravity filter.	Pump duty switched every month by PLC.
17	Backwash Pumping Chamber Level LIT-2501	Clearwell & Backwash Supply Process	Measurement of water level within backwash pumping chamber.	
18	Treated Water to Storage FCV-2501	Clearwell & Backwash Supply Process	Controls the flow of treated water to the storage reservoir.	

19	Treated Water Analysis AIT-2501	Clearwell & Backwash Supply Process	Measure treated water turbidity and pH.	
20	Chlorine Gas Monitor AIT-1001	Chlorination Room	Monitor chlorination room for chlorine gas leak.	
21	Facility Horn	Exterior of Chlorination Room	Warn facility of chlorine leak.	
22	Facility Beacon	Exterior of Chlorination Room	Warn facility of chlorine leak.	
23	Gas Chlorinators X-340 & X-341	Chlorine Supply Process	Chlorination of water.	Chlorination system comes complete with controls.
24	Caustic Soda Dosing Pumps P-303 & p-304	Caustic Soda Supply Process	pH adjustment to treated water.	Pump duty switched every month by PLC.
25	Hydrofluorosilicic Dosing Pumps P-305 & P-306	Hydrofluorosilicic Acid Supply Process	Fluoridation of post-filtration water.	Pump duty switched every month by PLC.
26	Sodium Hypochlorite Dosing Pumps P-362 & P-363	Sodium Hypochlorite Acid Supply Process	Chlorination of post-filtration water.	Pump duty switched every month by PLC.
27	Backwash to Sewer Tank Level LIT-4001	Fluoride & Orthophosphate Supply Process	Measure level in backwash storage tank.	Level indicated in meters.
28	Backwash to Sewer Flow FIT-4001	Fluoride & Orthophosphate Supply Process	Measure flow from backwash storage tank to sewer.	
29	Backwash to Sewer Valve FCV-4001	Fluoride & Orthophosphate Supply Process	Control flow of backwash water to sewer.	
30	Filter to Waste Tank Level LIT-4011	Fluoride & Orthophosphate Supply Process	Measure level in filter to waste storage tank.	Level indicated in meters.
31	Filter to Waste Flow FIT-4011	Fluoride & Orthophosphate Supply Process	Measure filtered water to waste storage tank flow.	
32	Filter to Waste Valve FCV-4011	Fluoride & Orthophosphate Supply Process	Control flow of filtered water to waste storage tank.	
33	Service Pumps P-410 & P-411	Service Water Pumps Process	Pump raw water.	Pump duty switched every month by PLC.
33	Service Water Pumps Switch PSL-4112	Service Water Pumps Process	Indicate low pressure in chlorination supply.	

5.3 LOWER PLC CABINET

(Refer to Drawing E-102 in Section 10)

The following table identifies the components related to the lower PLC cabinet.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Power Supply (Rack Mount)	Lower PLC Cabinet (Interior)	Provide power to rack mounted modules.	
2	PLC Rack (13 Slot)	Lower PLC Cabinet (Interior)	Provide location for module installation.	
3	Digital Input Module	Lower PLC Cabinet (Interior)	Provide connection for PLC discrete inputs.	
4	Digital Output Module	Lower PLC Cabinet (Interior)	Provide connection for PLC discrete outputs.	
5	Analog Input Module	Lower PLC Cabinet (Interior)	Provide connection for PLC analog inputs.	
6	Analog Output Module	Lower PLC Cabinet (Interior)	Provide connection for PLC analog outputs.	
7	Remote I/O Scanner	Lower PLC Cabinet (Interior)		
8	Power Supply (24VDC)	Lower PLC Cabinet (Interior)		
9	HMI	Lower PLC Cabinet (Exterior)	Interface between operator and PLC.	
10	Light Switch	Lower PLC Cabinet (Interior)	Turn on PLC enclosure light.	
11	Fluorescent Luminaire	Lower PLC Cabinet (Interior)	Illuminate PLC enclosure.	
12	120VAC Receptacle	Lower PLC Cabinet (Interior)	Provide receptacle power for operator at panel location.	
13	End Bracket	Lower PLC Cabinet (Interior)	Provide end point for din rail mounted devices.	
14	Fuse Holder (AC)	Lower PLC Cabinet (Interior)	Provide location for AC fuse.	
15	Fuse Holder (DC)	Lower PLC Cabinet (Interior)	Provide location for DC fuse.	
16	Ground Terminal	Lower PLC Cabinet (Interior)	Provide ground to rail mounted devices.	
17	Terminal Block	Lower PLC Cabinet (Interior)	Provide connection point to electrician.	
18	Wireway	Lower PLC Cabinet (Interior)	Provide space to store all PLC enclosure wiring.	

19	Vapor Corrosion Inhibiter	Lower PLC Cabinet (Interior)		
20	120VAC Interposing Relay	Lower PLC Cabinet (Interior)		
21	Relay Base	Lower PLC Cabinet (Interior)	Provide connection point for relay.	

5.4 UPPER PLC CABINET

(Refer to Drawing E-101 in Section 10)

The following table identifies the components related to the upper PLC cabinet.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Power Supply	Upper PLC Cabinet (Interior)	Provide power to rack mounted modules.	
2	PLC Rack (13 Slot)	Upper PLC Cabinet (Interior)	Provide location for module installation.	
3	SLC 5/05	Upper PLC Cabinet (Interior)		
4	Digital Input Module	Upper PLC Cabinet (Interior)	Provide connection for PLC discrete inputs.	
5	Digital Output Module	Upper PLC Cabinet (Interior)	Provide connection for PLC discrete outputs.	
6	Analog Input Module	Upper PLC Cabinet (Interior)	Provide connection for PLC analog inputs.	
7	Isolated Output Relay	Upper PLC Cabinet (Interior)		
8	Analog Output Module	Upper PLC Cabinet (Interior)	Provide connection for PLC analog outputs.	
9	Remote I/O Scanner	Upper PLC Cabinet (Interior)		
10	Power Supply (24VDC)	Upper PLC Cabinet (Interior)		
11	HMI	Upper PLC Cabinet (Exterior)	Interface between operator and PLC.	
12	8 Port EtherNET Switch	Upper PLC Cabinet (Interior)		
13	Modular Slot Filler	Upper PLC Cabinet (Interior)		
14	Fuse Holder (AC)	Upper PLC Cabinet (Interior)	Provide location for AC fuse.	

15	Fuse Holder (DC)	Upper PLC Cabinet (Interior)	Provide location for DC fuse.	
16	Ground Terminal	Upper PLC Cabinet (Interior)	Provide ground to rail mounted devices.	
17	Terminal Block	Upper PLC Cabinet (Interior)	Provide connection point to electrician.	
18	Wireway	Upper PLC Cabinet (Interior)	Provide space to store all PLC enclosure wiring.	
19	UPS	Upper PLC Cabinet (Interior)	Provide uninterruptible power supply.	
20	Light Switch	Upper PLC Cabinet (Interior)	Turn on PLC enclosure light.	
21	Fluorescent Luminaire	Upper PLC Cabinet (Interior)	Illuminate PLC enclosure.	
22	120VAC Receptacle	Upper PLC Cabinet (Interior)	Provide receptacle power for operator at panel location.	
23	End Bracket	Upper PLC Cabinet (Interior)	Provide end point for din rail mounted devices.	
24	Vapor Corrosion Inhibitor	Upper PLC Cabinet (Interior)		
25	Voice Dialer	Upper PLC Cabinet (Interior)	Dials pre-set number	
26	120VAC Interposing Relay	Upper PLC Cabinet (Interior)		
27	Relay Base	Upper PLC Cabinet (Interior)	Provide connection point for relay.	
28	EEPROM Memory Module	Upper PLC Cabinet (Interior)		

5.5 MOTOR CONTROL CENTRE

(Refer to Drawing E-102 in Section 10)

The following table identifies the components related to the motor control centre.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Incoming Lugs	MCC Cabinet	Connection to field devices.	
2	Spare	MCC Cabinet	Allows for future expansion.	
3	Air Handling Unit AHU-1	MCC Cabinet	Refer to Mechanical O&M Manual.	

4	Space for Future Expansion	MCC Cabinet	Allows for future expansion.	
5	Exhaust Fan EF-3	MCC Cabinet	Refer to Mechanical O&M Manual.	
6	Potable Water Pump P-1 & P-2	MCC Cabinet	Refer to Process O&M Manual.	
7	Glycol Heating Pump P-3 & P-4	MCC Cabinet	Refer to Mechanical O&M Manual.	
8	Air Scourer AS-1 & AS-2	MCC Cabinet	Refer to Process O&M Manual.	
9	Backwash Pump BP-1 & BP-2	MCC Cabinet	Refer to Process O&M Manual.	
10	Existing Boiler B-1 & B-2	MCC Cabinet	Refer to Mechanical O&M Manual.	
11	Terminal Control Section	MCC Cabinet	Connection to PLC and field devices.	

END OF CHAPTER 5

6 COMPONENT DETAILS

6.1 POWER DISTRIBUTION SCHEMATIC

(Refer to Drawing E-101, E-102, and E-301 in Section 10)

The following table identifies the components related to the power distribution.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Utility Transformer			
2	Weatherhead			
3	Utility Meter Cabinet			
4	Customer Meter Cabinet			
5	400A Main Distribution Panel	Cuttler Hammer PRL3000		1200A Main Bus Rating 347/600 Volts
6	Distribution Panel 6B	Cuttler Hammer PL3a		24 Circuits 250 Amperes 347/600 Volts
7	75 kVA Transformer to Panel 2A	Hammond MK075PBC		NEMA-3R Enclosure
8	Distribution Panel 2A	Cuttler Hammer PL3a		42 Circuits 225 Amperes 120/208 Volts
9	40 kVA Transformer to Panel 2B			
10	Distribution Panel 2B	Cuttler Hammer PL3a		42 Circuits 225 Amperes 120/208 Volts
11	Motor Control Center	Cuttler Hammer		
12	37.5 kVA Transformer to 200A Splitter	Hammond MF037PEC		NEMA-3R Enclosure
13	200A Splitter			
14	100A Fused Disconnect			
15	UV Control Panel			
16	Ground Grid			

6.2 PLC CONTROL SCHEMATIC

(Refer to Drawings I-102 to I-108 & E-101 to E-301 at the end of this Section 10)

The following table identifies the components related to PLC controls.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Raw Water Turbidity (Inlet) AIT-1001	c/w AE-1001 Hach 1720D Turbidimeter Cat# 52001-00	Scaled 0-100.0 NTU	w/ Aqua Trend Interface with SOM and 1720D Turbidimeter Power Supply
2	Raw Water PH (Inlet) AIT-1002	AIT-1002 Endress & Hauser Liquisys-M CPM253 CPM253-PS3105 AE-1002 Endress & Hauser Orbipac-W CPF81 CPF81-LH11C2	Scaled 0-14 pH	
3	Raw Water Flow (Inlet) FIT-1001	c/w FE 1001 Endress & Hauser PROMAG 50W DN 200/8”	Scaled 0-120 L/sec	
4	Raw Water Valve (Inlet) FCV-1001			
5	UV System CPP #1 & #2	Refer to Process O&M Manual		
6	Filter Inlet Valve FCV-2101 FCV-2111 FCV-2121 FCV-2131	14” Bray Series 30-111 c/w Bray S70-0501 electric actuator, 120VAC power supply	Valve operating time is 30 seconds	
7	Filter Water Level LIT-2101 LIT-2111 LIT-2121 LIT-2131	c/w LE-2101, LE-2111, LE-2121, LE-2131 Milltronics Level System XPS-10 Series		
8	Pressure Drop Across Filter PIT-2101 PIT-2111 PIT-2121 PIT-2131	Endress & Hauser Deltabar S PMD235 PMD235-2U4F9EH1B	Scaled 0-4.00 meters water	
9	Filtered Water Turbidity AIT-2102 AIT-2112 AIT-2122 AIT-2132	c/w AE-2101, AE-2111, AE-2121, AE-2131 Hach 1720D Turbiditimeters Cat# 52000-00	Scaled 0-2.00 NTU	w/ Aqua Trend Interface with SOM and 1720D Turbidimeter Power Supply

10	Air Scour Inlet Valve FCV-2107 FCV-2117 FCV-2127 FCV-2137	4” Bray Series 30-109 c/w Bray S70-0031 electric actuator, 120VAC power supply	Valve operating time 30 seconds	
11	Filter to Waste Valve LCV-2103 LCV-2113 LCV-2123 LCV-2133	8” Bray Series 30-109 c/w Bray S70-0121 electric actuator, 120 VAC power supply & 4-20mA input		
12	Filtered Water Valve LCV-2104 LCV-2114 LCV-2124 LCV-2134	8” Bray Series 30-109 c/w Bray S70-0121 electric actuator, 120 VAC power supply & 4-20mA input		
13	Backwash Supply Valve FCV-2105 FCV-2115 FCV-2125 FCV-2135	12” Bray Series 30-111 c/w Bray S70-0301 electric actuator, 120VAC power supply	Valve operating time is 30 seconds	
14	Backwash Waste Valve FCV-2106 FCV-2116 FCV-2126 FCV-2136	16” Bray Series 30-111 c/w Bray S70-0501 electric actuator, 120VAC power supply	Valve operating time is 30 seconds	
15	Air Scour Blowers C-200 & C-201	Refer to Process O&M Manual		
16	Backwash Pumps P-205 & P-206	Refer to Process O&M Manual		
17	Backwash Pumping Chamber Level LIT-2501	c/w LE-2501 Milltronics Level System XPS-10 Series		
18	Treated Water to Storage FCV-2501	12” Bray Series 30-111 c/w Bray S70-0301 electric actuator, 120VAC power supply	Valve operating time is 30 seconds	
19	Treated Water Analysis AIT-2501	c/w AE-2501 (Chlorine Cell) & AE-2502 (pH Sensor) Depolox 3 Plus	Free Chlorine Residual Scaled 0-5.0 mg/L pH Scaled 4.0-10	
20	Chlorine Gas Monitor AIT-1001	c/w AE-3401 Acutec 35	Scaled 0-10 ppm	
21	Facility Horn	Edwards		

22	Facility Beacon	Edwards		
23	Gas Chlorinators X-340 & X-341	Refer to Process O&M Manual		
24	Caustic Soda Dosing Pumps P-303 & p-304	Refer to Process O&M Manual		
25	Hydrofluorosilicic Dosing Pumps P-305 & P-306	Refer to Process O&M Manual		
26	Sodium Hypochlorite Dosing Pumps P-362 & P-363	Refer to Process O&M Manual		
27	Backwash to Sewer Tank Level LIT-4001	c/w LE-4001 Milltronics Level System XPS-10 Series		
28	Backwash to Sewer Flow FIT-4001	c/w FE-4001 Endress & Hauser Promag 50W DN 100/4” 50W1H-UL0A1RC1B4AA	Scaled 0-12 L/sec	
29	Backwash to Sewer Valve FCV-4001	4” Bray Series 30-109 c/w Bray S70-0031 electric actuator, 120VAC power supply, 4-20 mA input		
30	Filter to Waste Tank Level LIT-4011	LIT-4011 Endress & Hauser Process Transmitter RMA 421 RMA421-A11A4A LE-4011 Endress & Hauser Waterpilot FMX167 FMX167-F2AMC1C1	Scaled 0-4.00 meters	
31	Filter to Waste Flow FIT-4011	c/w FE-4011 Endress & Hauser Promag 50W DN 100/4” 50W1H-UL0A1RC1B4AA	Scaled 0-5 L/sec	
32	Filter to Waste Valve FCV-4011	4” Bray Series 30-109 c/w Bray S70-0031 electric actuator, 120VAC power supply, 4-20 mA input		
33	Service Pumps P-410 & P-411	Refer to Process O&M Manual		
34	Service Water Pumps Switch PSL-4112	Asco S-Series	SP = 206.85 kPa (30psi)	Contacts open on decreasing pressure

6.3 LOWER PLC CABINET

(Refer to Drawing E-102 in Section 10)

The following table identifies the components related to the lower PLC cabinet.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Power Supply (Rack Mount)	Allen Bradley 1746-P2		
2	PLC Rack (13 Slot)	Allen Bradley 1746-A13		
3	Digital Input Module	Allen Bradley 1746-IA16		
4	Digital Output Module	Allen Bradley 1746-OA16		
5	Analog Input Module	Allen Bradley 1746-NI8		
6	Analog Output Module	Allen Bradley 1746SC-NO8I		
7	Remote I/O Scanner	Allen Bradley 1747-ASB		
8	Power Supply (24VDC)	Weidmuller 9925340024		
9	HMI	Allen Bradley 6182H-15BEH4B		15” RAC6186 w/ Versaview
10	Light Switch	800T-J2		
11	Fluorescent Luminaire	Hammond FLK48 & FLK48MM		
12	120VAC Receptacle			
13	End Bracket	Weidmuller WEW 35/2		
14	Fuse Holder (AC)	Weidmuller 101440		c/w Indicator
15	Fuse Holder (DC)	Weidmuller 101470		c/w Indicator
16	Ground Terminal	Weidmuller		
17	Terminal Block	Weidmuller		
18	Wireway	Panduit G3x4WH6 & C3WH6 G2x4WH6 & C2WH6		c/w Cover
19	Vapor Corrosion Inhibiter	Hammond XC110		
20	120VAC Interposing Relay	Allen Bradley 700-HK32A1		

21	Relay Base	Allen Bradley 722-HN122		

6.4 UPPER PLC CABINET

(Refer to Drawing E-101 in Section 10)

The following table identifies the components related to the upper PLC cabinet.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Power Supply	Allen Bradley 1746-P2		
2	PLC Rack (13 Slot)	Allen Bradley 1746-A13		
3	SLC 5/05	Allen Bradley 1747-L552		
4	Digital Input Module	Allen Bradley 1746-IA16		
5	Digital Output Module	Allen Bradley 1746-OA16		
6	Analog Input Module	Allen Bradley 1746-NI8		
7	Isolated Output Relay	Allen Bradley 1746-OX8		
8	Analog Output Module	Allen Bradley 1746SC-NO8I		
9	Remote I/O Scanner	Allen Bradley 1747-SN		
10	Power Supply (24VDC)	Weidmuller 9925340024		
11	HMI	Allen Bradley 6182H-15BEH4B		c/w Versaview 6181P 15” Integrated Display
12	8 Port EtherNET Switch	Allen Bradley ENET Switch		
13	Modular Slot Filler	Allen Bradley 1746-N2		
14	Fuse Holder (AC)	Weidmuller 101440		c/w Indicator
15	Fuse Holder (DC)	Weidmuller 101470		c/w Indicator
16	Ground Terminal	Weidmuller		
17	Terminal Block	Weidmuller		

18	Wireway	Panduit G3x4WH6 & C3WH6 G2x4WH6 & C2WH6		c/w Cover
19	UPS	Always On GES-202L	1400W 2000VA	
20	Light Switch			
21	Fluorescent Luminaire	Hammond FUK48MM		2 x 48”
22	120VAC Receptacle			
23	End Bracket	Weidmuller WEW 35/2		
24	Vapor Corrosion Inhibitor	Hammond XC110		
25	Voice Dialer	Barnett B1290		
26	120VAC Interposing Relay	Allen Bradley 700-HK32A1		
27	Relay Base	Allen Bradley 722-HN122		
28	EEPROM Memory Module	Allen Bradley 1747-M13		

6.5 MOTOR CONTROL CENTRE

(Refer to Drawing E-102 in Section 10)

The following table identifies the components related to the motor control centre.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Incoming Lugs			
2	Spare	Cuttler Hammer E1A20612		
3	Air Handling Unit AHU-1	Cuttler Hammer E1A20612	2 HP 2.7 FLA	
4	Space for Future Expansion			
5	Exhaust Fan EF-3	Cuttler Hammer E1A20612	2 HP 2.7 FLA	
6	Potable Water Pump P-1 & P-2	Cuttler Hammer E1A20612	5 HP 6.1 FLA	
7	Glycol Heating Pump P-3 & P-4	Cuttler Hammer E1A20612	3 HP 3.9 FLA	
8	Air Scourer AS-1 & AS-2	Cuttler Hammer E2A20612	20 HP 22 FLA	

9	Backwash Pump BP-1 & BP-2	Cuttler Hammer E2A20612	25 HP 27 FLA	
10	Existing Boiler B-1 & B-2	Cuttler Hammer BFAHFD12		30A Trip
11	Terminal Control Section			

END OF CHAPTER 6

7 TROUBLESHOOTING & ALARMS

7.1 ALARMS IN GENERAL

The PLC continuously monitor the water treatment plant's process, mechanical and electrical operating systems. System or equipment failure alarms are indicated on the HMI screen. Various process and facility alarm conditions are detected by the PLC, some will shut the plant down and others will turn on backup equipment.

The following tables list the alarm tag #'s, the alarm function descriptions, and method the alarm is indicated to the operation staff. All alarms are stored in memory and are downloaded as a single file to HMI PC hard drive in the plant office once a week. The alarm log file uses a file name that includes the date upon which the file is written to disk. Information saved are the date, time, alarm descriptor No., Tripped by, and Acknowledgement date and time. Alarms are also printed on a dot matrix printer in the plant office to provide a continuous record of all PLC system alarms in chronological order.

Unless otherwise noted in the tables below, water treatment process alarms will be held out when equipment is selected as out of service, or the plant is offline due to a full level in the storage reservoir.

7.2 PRE-TREATMENT ALARMS

The following table identifies the pre-treatment alarms.

NO.	ALARM TAG	ALARM DESCRIPTION	SET POINT	CONSEQUENCE
1	FAL-1001	Low flow in raw water supply header *Alarm held out or 5minutes on plant start sequence*	2 L/s	Plant Shut Down & Plant Dial Out
2	X-120 Minor Alarm	X-120 UV System #1 Control Panel	Various Conditions	None
3	X-120 Major Alarm	X-120 UV System #1 Control Panel	Various Conditions	Duty/Standby reactor change over
4	X-120 Critical Alarm	X-120 UV System #1 Control Panel	Various Conditions	Duty/Standby reactor change over & Plant Dial Out
5	X-121 Minor Alarm	X-120 UV System #2 Control Panel	Various Conditions	None

6	X-121 Major Alarm	X-120 UV System #2 Control Panel	Various Conditions	Duty/Standby reactor change over
7	X-121 Critical Alarm	X-120 UV System #2 Control Panel	Various Conditions	Duty/Standby reactor change over & Plant Dial Out
8	LAL-5001	Low level in the existing reservoir	(Operator Defined) ~ 3.65 m	WTP Start
9	LAH-5001	High level in the existing reservoir	(Operator Defined) ~ 4.15 m	WTP Stop
10	LAL-2501	Low level in the Pumping Chamber	(Operator Defined)	WTP Start
11	LAH-2501	High level in the Pumping Chamber	(Operator Defined)	WTP Stop
12	AAH-1003	High concentrations of PHCs in the raw water intake	50 µg/L	Plant Shutdown

7.3 FILTRATION ALARMS

The following table identifies the filtration alarms.

NO.	ALARM TAG	ALARM DESCRIPTION	SET POINT	CONSEQUENCE
1	AAH-2101	Filtration Mode – High filtered water turbidity Filter to Waste Mode – High filtered water turbidity	>0.3 NTU <0.3 NTU	Backwash sequence initiated. Change to filtration mode.
2	ZOA-2101	Failure of filter influent valve to open		Filter will not enter filtration or filter-to-waste mode.
3	ZCA-2101	Failure of filter influent valve to close		Filter will not enter backwash mode.
4	ZOA-2103	Filter to waste valve is fully open		Filter shutdown. Backwash was not effective.
5	ZCA-2103	Filter to waste valve has failed to open		Filter shutdown. Filter to waste cannot occur
6	ZOA-2104	Filtered water valve is fully open		Backwash required.
7	ZCA-2104	Filtered water valve has failed to open		Filtration cannot proceed.
8	ZOA-2105	Failure of backwash water supply valve to open		Backwash pumps (P-205/206) cannot start, backwash cannot proceed.

9	ZCA-2105	Failure of backwash water supply valve to close		Filter-to-waste cannot proceed.
10	ZOA-2106	Failure of backwash waste valve to open		Backwash pumps (P-205/P-206) cannot start, backwash cannot proceed.
11	ZCA-2106	Failure of backwash waste valve to close		Filter-to-waste cannot proceed, filter influent valve remains closed.
12	ZOA-2107	Failure of air scour valve to open		Air scour blowers (C-200/201) cannot start, backwash cannot proceed.
13	ZCA-2107	Failure of air scour valve to close		Backwash cannot proceed.
14	UA-2001*	Fault in Air Scour Blower C-200		If duty blower, set C-201 as duty pump. If UA-201 active, plant shut down & Plant Dial Out.
15	UA-2011*	Fault in Air Scour Blower C-201		If duty blower, set C-200 as duty pump. If UA-200 active, plant shut down & Plant Dial Out.
16	LAH 2101	High level in filter	300mm above normal operating level	FCV 2101 filter inlet valve closed.

7.4 CLEARWELL & BACKWASH SUPPLY ALARMS

The following table identifies the clearwell and backwash supply alarms.

NO.	ALARM TAG	ALARM DESCRIPTION	SET POINT	CONSEQUENCE
1	UA-2051	Fault with Backwash Pump P-205		If duty pump, set P-206 as duty pump. If UA-2061 active, plant shut down & Plant Dial Out.
2	UA-2061	Fault with Backwash Pump P-206		If duty pump, set P-205 as duty pump. If UA-2051 active, plant shut down & Plant Dial Out.
3	LAL-2501	Low level in backwash pumping chamber		Backwash sequence disabled.

4	LAH-2501	High level in backwash pumping chamber		Plant Shutdown
5	AAH-2501C	High concentrations of PHCs entering the Reservoir	50 µg/L	Plant Shutdown

7.5 CHLORINATION ALARMS

The following table identifies the chlorination alarms.

NO.	ALARM TAG	ALARM DESCRIPTION	SET POINT	CONSEQUENCE
1	AAH-3401 Chlorine alarms are always active	Chlorine Leak	2 ppm	Ventilation in chlorine room stops. HN-3401 starts BA-3401 starts & Plant Dial Out

7.6 FLUORIDE, ORTHOPHOSPHATE & HYPOCHLORITE ALARMS

The following table identifies the fluoride, orthophosphate, and hypochlorite alarms.

NO.	ALARM TAG	ALARM DESCRIPTION	SET POINT	CONSEQUENCE
1	UA-3031	Caustic Soda Dosing Pump Failure P-303		P-304 starts Plant Shutdown Plant Dial Out if UA-3041 is also active
2	UA-3041	Caustic Soda Dosing Pump Failure P-304		P-303 starts Plant Shutdown Plant Dial Out if UA-3031 is also active
3	UA-3051	Hydrofluorosilicic Pump failure P-305		P-306 starts Plant Shutdown Plant Dial Out if UA-3061 is also active
4	UA-3061	Hydrofluorosilicic Pump failure P-306		P-305 starts Plant Shutdown Plant Dial Out if UA-3051 is also active
5	UA-3051	Sodium Hypochlorite Pump Failure P-362		P-363 starts Plant Shutdown Plant Dial Out if UA-3061 is also active

6	UA-3061	Sodium Hypochlorite Pump Failure P-363		P-362 starts Plant Shutdown Plant Dial Out if UA-3051 is also active
7	UA-3621	Pump failure		P-363 starts Plant Shutdown
8	UA-3631	Pump failure		P-362 starts Plant Shutdown

7.7 WASTE TANKAGE ALARMS

The following table identifies the waste tankage alarms.

NO.	ALARM TAG	ALARM DESCRIPTION	SET POINT	CONSEQUENCE
1	LAH-4001	High level in the Backwash Waste Tank	3.1 m	Filters are locked out from backwashing and P-205 and P-206 shutdown & Plant Dial Out
2	LAH-4011	High level in the Filter-to-Waste tank	3.1 m	Filters are locked out from filter-to-waste mode & Plant Dial Out
3	FAH-4001	High flow out of Backwash Waste Tank	10 L/s	FCV-4001 closes
4	FAH-4011	High flow out of Filter-to-Waste Tank	5 L/s	FCV-4001 closes

7.8 SERVICE WATER PUMPS ALARMS

The following table identifies the service water pump alarms.

NO.	ALARM TAG	ALARM DESCRIPTION	SET POINT	CONSEQUENCE
1	UA-4101	Service Pump failure P-411		P-411 starts Plant Shutdown Plant Dial Out if UA-4011 is also active
2	UA-4111	Service Pump failure P-410		P-410 starts Plant Shutdown Plant Dial Out if UA-4101 is also active
3	PAL-4112	Low pressure in service water	245 kPag	Plant Shutdown & Plant Dial Out

END OF CHAPTER 7

8 MAINTENANCE PROCEDURES AND SERVICE INFORMATION

8.1 GENERAL MAINTENANCE

8.1.1 UNINTERUPTABLE POWER SUPPLIES

Each of the uninterruptable power supplies (total of 4 – PLC cabinet, Plant PC, FCV 1001, and FCV2501) contains sealed lead acid batteries. These batteries require annual inspection, and **replacement every 3 to 5 years**. Failure to do so will result in diminished or non-performance of these power supplies and a resulting loss of control over the treatment process in the event of a power failure.

Refer to the UPS system manufacturers data for testing and battery replacement information.

8.1.2 PETROLEUM HYDROCARBON ANALYZER (AIT 1003)

In order to ensure the accuracy of the petroleum hydrocarbon measurement, the analyzer must be regularly maintained. The manufacturers data outlines bi-monthly and semi-annual checks and calibrations. Performance of these routine maintenance intervals may require electrolytes and other consumable items. Ensure the required maintenance items are kept on hand. Testing and calibration should be performed in accordance with the manufacturers service manual.

8.1.3 pH ANALYZERS (AIT 1002)

pH analyzers require routine calibration and maintenance. As a minimum, once every 2 months the pH analyzer should be calibrated. During the calibration, the operator should preform maintenance on probe, as required. The pH probe has a fixed service life and requires regular replacement. If the measurement probe cannot be calibrated or the calibration of the probe drifts following calibrations, the probe requires replacement. The pH probe manufacturer specification provides both the calibration procedures and probe replacement procedures. It is recommended that no more than one spare pH probe is on hand due to the limited shelf life of these instruments.

8.1.4 TURBIDIMETERS (AIT-1001, 2101, 2111, 2121, 2131)

Turbidity analyzers require routine calibration and maintenance once every 6 months, at minimum. The turbidity measurement is performed using an optic technique, and therefore, the quality of the measurement is directly related to the clarity of the optics. Maintenance should include cleaning the analyzer optics and performing a calibration in accordance with the manufacturer’s instructions.

8.1.5 CHLORINE GAS DETECTION (AIT 3401)

In order to ensure the safety of plant personnel the chlorine gas detection system should be routinely tested to verify proper operation. As a minimum, the chlorine gas detection system should be tested and calibrated every six months. Testing should include the operation of the audible alarm, visual beacon, and the alarm dial out system. Testing and calibration should be performed in accordance with Section 4 of the manufacturers service manual.

8.1.6 RESIDUAL CHLORINE, pH, AND PETROLEUM HYDROCARBON ANALYZER (AIT 2501)

In order to ensure the accuracy of the residual chlorine, pH, and petroleum hydrocarbon measurement, the analyzers (chlorine::lyser, pH::lyser, spectro::lyser) must be regularly maintained. The manufacturers data outlines bi-monthly and semi-annual checks and calibrations. Performance of these routine maintenance intervals may require electrolytes and other consumable items. Ensure the required maintenance items are kept on hand. Testing and calibration should be performed in accordance with the manufacturers service manual.

END OF CHAPTER 8

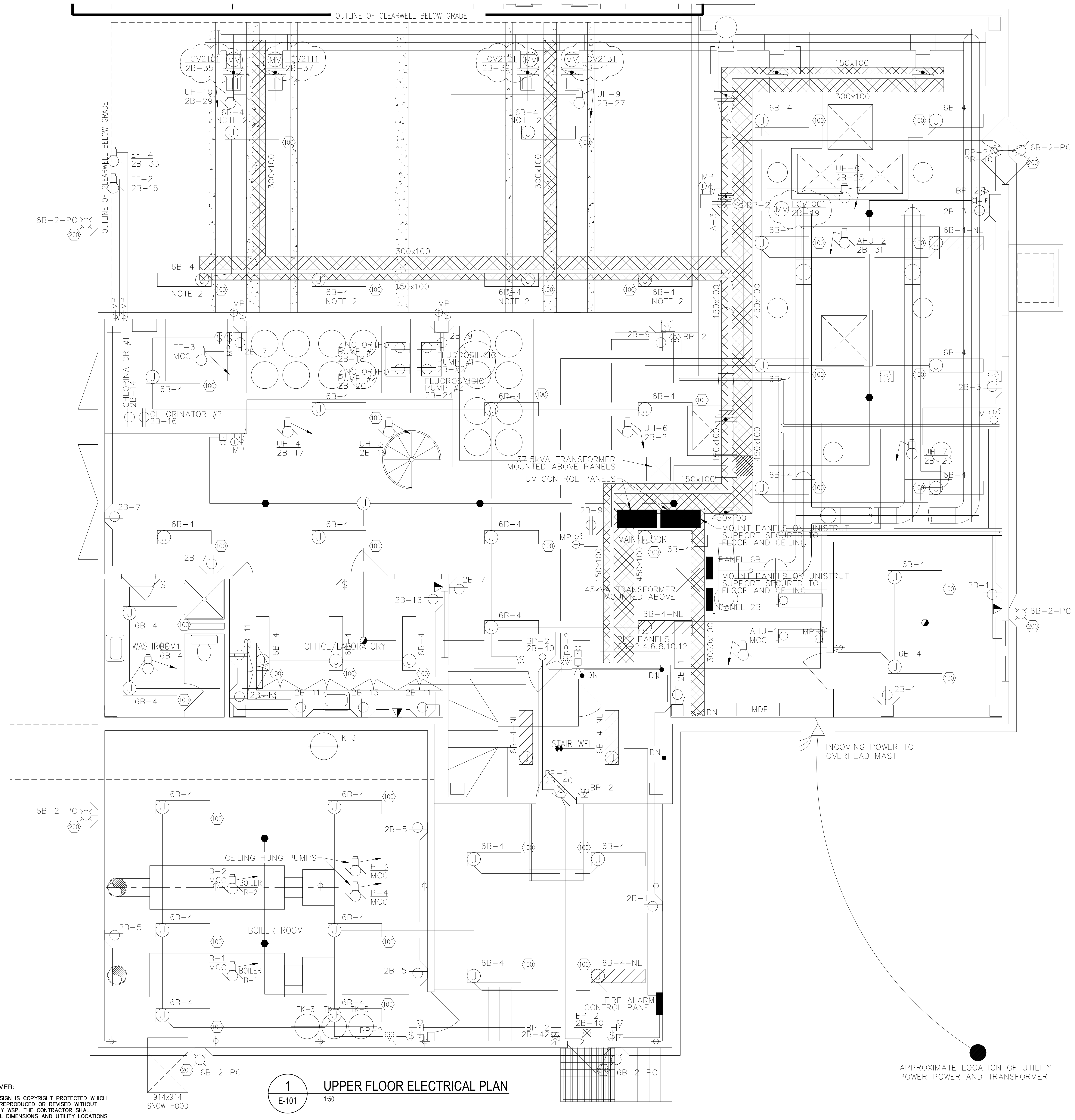
9 TESTING AND CERTIFICATION DATA

10 SKETCHES AND DRAWINGS

Sketches illustrating the general operating conditions at the WTP are provided at the end of this chapter and include the following:

E-101	**Upper Floor Electrical Plan and Schedules**
E-102	**Lower Floor Electrical Plan and Schedules**
E-301	**MCC Schedule and Details**
I-102	**P&ID – Pre-Treatment**
I-103	**P&ID – Filtration**
I-104	**P&ID – Backwash Supply**
I-105	**P&ID – Backwash & Filter-To-Waste**
I-106	**P&ID – Caustic Soda and Hydrofluorosilicic Acid Supply**
I-107	**P&ID – Sodium Hypochlorite and Domestic Supply System**
I-108	**P&ID – Chlorine Supply**
I-301	**Filters Floor Device Locations**
I-302	**Pumps Floor Device Locations**
I-303	**Clearwell Floor and WTP Underground Device Locations**

11 MANUFACTURER DATA AND SERVICE INFORMATION



1 E-101

UPPER FLOOR ELECTRICAL PLAN

1:50

ELECTRICAL LEGEND

	COMPACT FLUORESCENT OR H.I.D. LUMINAIRE – WALL MOUNTED
	WALL MOUNTED EXIT LIGHT – DIRECTIONAL ARROWS AS INDICATED
▭	FLUORESCENT LUMINAIRE – SURFACE MOUNTED OR SUSPENDED
NL	INDICATES NIGHT LIGHT
	PHOTO ELECTRIC CELL
	BATTERY PACK C/W HEADS AS INDICATED
	EMERGENCY REMOTE HEADS
$	SINGLE POLE SWITCH
#	LUMINAIRE TYPE
	DUPLEX RECEPTACLE
○	MOTOR
MV	MOTORIZED VALVE
	DISCONNECT SWITCH
$ M	MANUAL MOTOR STARTER C/W PILOT LIGHT
☒	MAGNETIC MOTOR STARTER
	THERMOSTAT
▬	PANELBOARD
F	MANUAL BREAKGLASS STATION
	FIRE ALARM HORN C/W VISUAL ALARM STROBE
	SMOKE DETECTOR
	THERMAL DETECTOR – RATE OF RISE
⬢	THERMAL DETECTOR – HIGH TEMPERATURE FIXED
	COMBINATION VOICE/DATA OUTLET BOX AND JACKS

NOTES

1. REFER TO MOTOR SCHEDULE FOR CONDUIT AND WIRE SIZES
2. CENTER LIGHT FIXTURE OVER CATWALK

PANEL 2B

DESCRIPTION	KW	BKR.	CIRCUIT NO.		BKR.	KW	DESCRIPTION
RECEPTACLES PLANT/FOYER		1P15A	1	2	1P15A		PLC PANELS
RECEPTACLES PLANT		1P15A	3	4	1P15A		PLC PANELS
RECEPTACLES MECH ROOM		1P15A	5	6	1P15A		PLC PANELS
RECEPTACLES PLANT		1P15A	7	8	1P15A		PLC PANELS
RECEPTACLES PLANT		1P15A	9	10	1P15A		PLC PANELS
RECEPTACLES OFFICE/LAB		1P15A	11	12	1P15A		PLC PANELS
RECEPTACLES OFFICE/LAB		1P15A	13	14	1P15A		CHLORINATOR #1
EXHAUST FAN EF-2		1P15A	15	16	1P15A		CHLORINATOR #2
UNIT HEATER UH-4		1P15A	17	18	1P15A		ZINC ORTHO PUMP #1
UNIT HEATER UH-5		1P15A	19	20	1P15A		ZINC ORTHO PUMP #2
UNIT HEATER UH-6		1P15A	21	22	1P15A		FLUOROSILICIC PUMP #1
UNIT HEATER UH-7		1P20A	23	24	1P15A		FLUOROSILICIC PUMP #2
UNIT HEATER UH-8		1P15A	25	26	1P15A		FIRE ALARM PANEL
UNIT HEATER UH-9		1P15A	27	28	1P15A		LIGHTING CONTACTOR
UNIT HEATER UH-10		1P15A	29	30	1P15A		SPARE
HVAC CONTROL		1P15A	31	32	1P15A		SPARE
EXHAUST FAN EF-4		1P15A	33	34	1P15A		SPARE
MOTORIZED VALVE FCV 2101		1P15A	35	36	1P15A		SPARE
MOTORIZED VALVE FCV 2111		1P15A	37	38	1P15A		SPARE
MOTORIZED VALVE FCV 2121		1P15A	39	40	1P15A		EXIT LIGHTING
MOTORIZED VALVE FCV 2131		1P15A	41	42	1P15A		BATTERY PACK BP-2
MOTORIZED VALVE FCV 4011		1P15A	43	44	1P15A		SPARE
MOTORIZED VALVE FCV 4001		1P15A	45	46	1P15A		SPARE
MOTORIZED VALVE FCV 2501		1P15A	47	48	1P15A		SPARE
MOTORIZED VALVE FCV 1001		1P15A	49	50	1P15A		SPARE
			51	52			
			53	54			
			55	56			
			57	58			
			59	60			
TOTAL							TOTAL

MAINS: 225A
MOUNTING: SURFACE
ENCLOSURE TO BE SINGLE TUB
VOLTS: 120/208 VOLTS
LOCATION: UPPER FLOOR
FED FROM: MDP
ENTER AT: TOP

PANEL 6B

DESCRIPTION	KW	BKR.	CIRCUIT NO.		BKR.	KW	DESCRIPTION
AIR HANDLING UNIT AHU-2		1P15A	1	2	1P15A		LIGHTING EXTERIOR/BASEMENT
AIR HANDLING UNIT AHU-2		1P15A	3	4	1P15A		LIGHTING UPPER FLOOR
AIR HANDLING UNIT AHU-2		1P15A	5	6	1P15A		SPARE
SPARE		1P15A	7	8	1P15A		SPARE
SPARE		1P15A	9	10			
			11	12			
			13	14			
			15	16			
			17	18			
			19	20			
			21	22			
			23	24			
TOTAL							TOTAL

MAINS: 225A
MOUNTING: SURFACE
VOLTS: 347/600 VOLTS
LOCATION: UPPER FLOOR
FED FROM: MDP
ENTER AT: TOP

COPYRIGHT DISCLAIMER:

IS	RE	DATE	DESCRIPTION
1	-	2022-03-28	FOR INFORMATION ONLY

SEAL:

FOR INFORMATION ONLY

CLIENT:
ᐃᖃᓗᐃᑦ
Iqaluit
CITY OF IQALUIT
CLIENT REF. #:

PROJECT:
IQALUIT
WATER TREATMENT PLANT
PROJECT NO: 211-12487-00
DATE: 2021/11/23

WSP
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
WWW.WSP.COM

ORIGINAL SCALE: AS NOTED

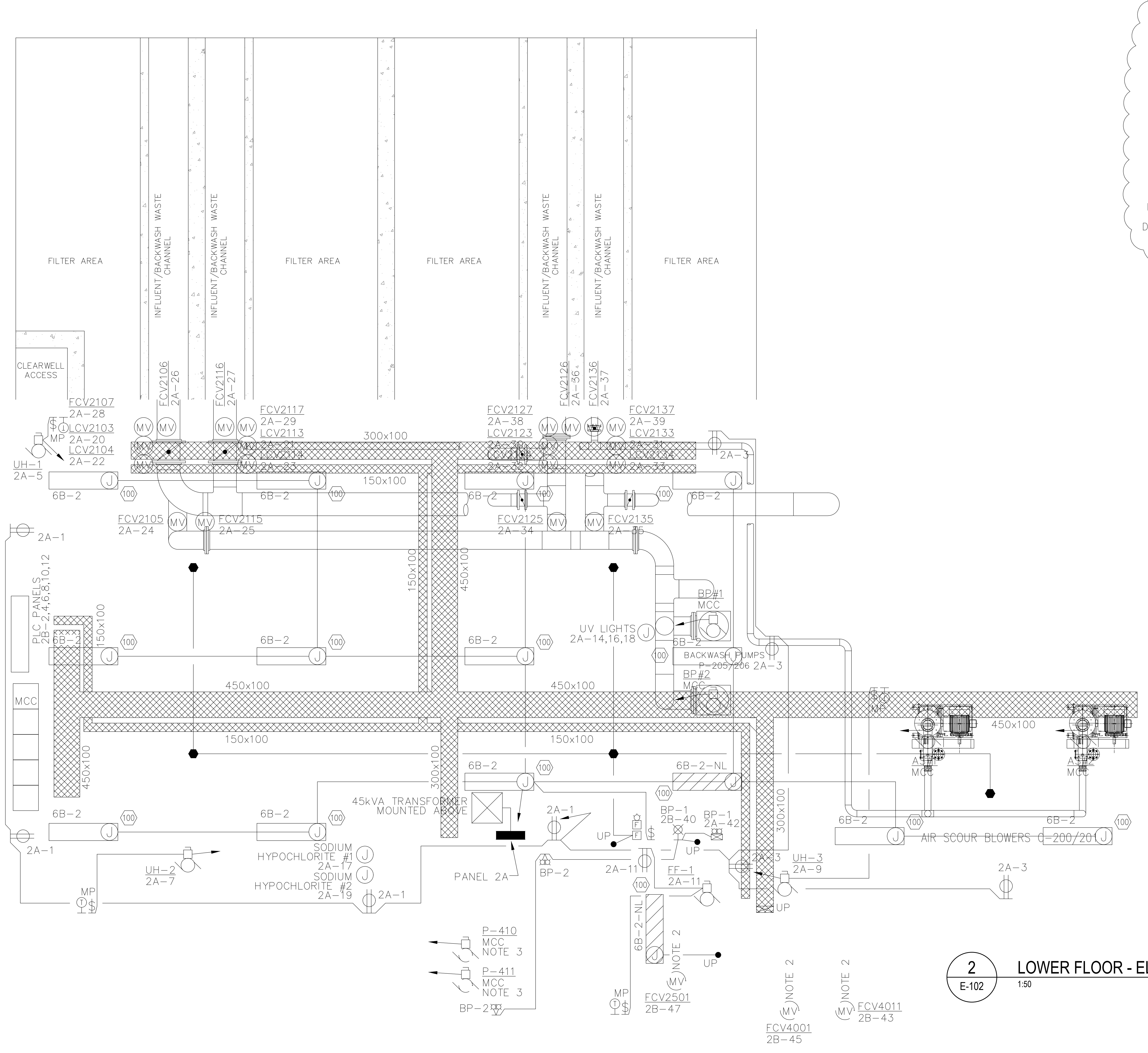
TITLE:
UPPER FLOOR ELECTRICAL
PLAN AND SCHEDULES

SHEET NUMBER: E-101

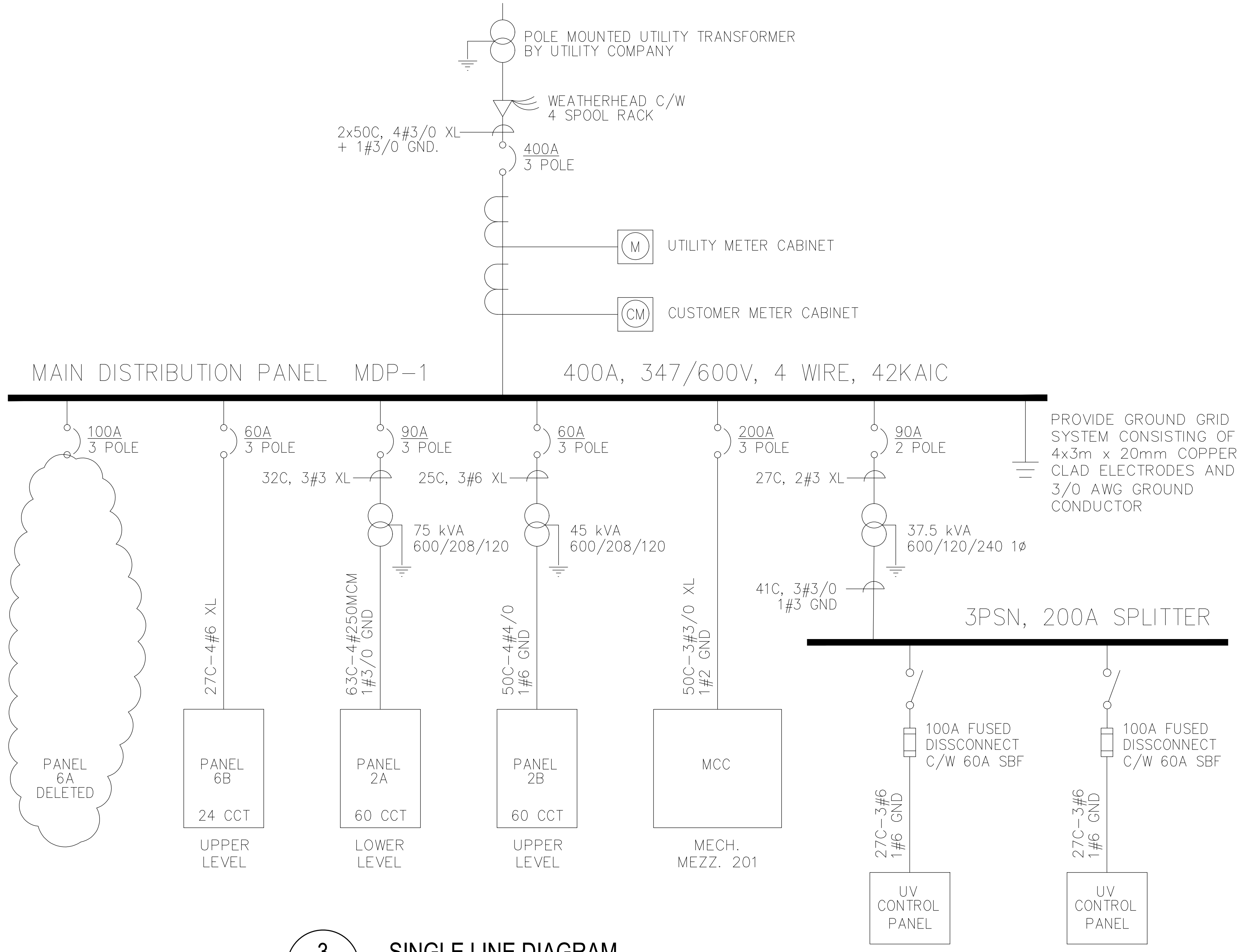
DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: ELECTRICAL
ISSUE: FOR INFORMATION ONLY
2022/03/28
REV #: -

NOTES

1. REFER TO MOTOR SCHEDULE FOR CONDUIT AND WIRE SIZES FOR ALL MOTORS.
2. MOTORIZED VALVE LOCATED ON CLEARWELL FLOOR LEVEL. CONFIRM EXACT LOCATION PRIOR TO ROUGHIN.
3. PUMPS LOCATED ON CLEARWELL FLOOR LEVEL. CONFIRM EXACT LOCATION PRIOR TO ROUGHIN.
4. SUPPLY CIRCUIT (2A-13 FOR LIGHTING AND 2A-15 FOR POWER AND FRACTIONAL MOTORS) TO EXISTING LIGHTING LOCATED ON CLEARWELL LEVEL. PROVIDE ALL REQUIREMENTS ASSOCIATED WITH MAKING POWER AND LIGHTING CONNECTIONS.



2 E-102 LOWER FLOOR - ELECTRICAL PLAN 1:50



3 E-102 SINGLE LINE DIAGRAM NTS

PANEL 2A

DESCRIPTION	KW	BKR.	CIRCUIT NO.		BKR.	KW	DESCRIPTION
RECEPTACLES LOWER LEVEL		1P15A	1	2	1P15A		PLC PANELS
RECEPTACLES LOWER LEVEL		1P15A	3	4	1P15A		PLC PANELS
UNIT HEATER UH-1		1P15A	5	6	1P15A		PLC PANELS
UNIT HEATER UH-2		1P15A	7	8	1P15A		PLC PANELS
UNIT HEATER UH-3		1P15A	9	10	1P15A		PLC PANELS
FORCE FLOW FF-1 RECEPTACLES-STAIRS		1P15A	11	12	1P15A		PLC PANELS
LIGHTING CLEARWELL LEVEL		1P15A	13	14	1P60A	14	PANEL
RECEPT./FRAC. MOTORS CLEARWELL LEVEL		1P15A	15	16	1P60A	16	MECHANICAL ROOM
SODIUM HYPOCHLORITE #1		1P15A	17	18	1P15A		SPARE
SODIUM HYPOCHLORITE #2		1P15A	19	20	1P15A		MOTORIZED VALVE LCV 2103
MOTORIZED VALVE LCV 2113		1P15A	21	22	1P15A		MOTORIZED VALVE LCV 2104
MOTORIZED VALVE LCV 2114		1P15A	23	24	1P15A		MOTORIZED VALVE FCV 2105
MOTORIZED VALVE FCV 2115		1P15A	25	26	1P15A		MOTORIZED VALVE FCV 2106
MOTORIZED VALVE FCV 2116		1P15A	27	28	1P15A		MOTORIZED VALVE FCV 2107
MOTORIZED VALVE FCV 2117		1P15A	29	30	1P15A		MOTORIZED VALVE FCV 2123
MOTORIZED VALVE FCV 2133		1P15A	31	32	1P15A		MOTORIZED VALVE FCV 2124
MOTORIZED VALVE FCV 2134		1P15A	33	34	1P15A		MOTORIZED VALVE FCV 2125
MOTORIZED VALVE FCV 2135		1P15A	35	36	1P15A		MOTORIZED VALVE FCV 2126
MOTORIZED VALVE FCV 2136		1P15A	37	38	1P15A		MOTORIZED VALVE FCV 2127
MOTORIZED VALVE FCV 2137		1P15A	39	40	1P15A		SPARE
EXISTING CCT 1 TUNNEL LIGHTS		1P15A	41	42	1P15A		BATTERY PACK BP-1
EXISTING CCT 6 TUNNEL LIGHTS		1P15A	43	44	2P		RECIRC PUMPS TO DAM
EXISTING CCT 8 TUNNEL RECEPTACLES		1P15A	45	46			
EXISTING CCT 10 EXT. LIGHTS RESERVOIR		1P15A	47	48	1P15A		SPARE
TEMPORARY BSMT. HEATER		2P	49	50			
			51	52	2P		TUNNEL HEATER
EXISTING CCT 2 TUNNEL LIGHTS		1P15A	53	54	30A		
			55	56			DAMPER MOTORS EF3
			57	58			
			59	60			
TOTAL							TOTAL

MAINS: 225A
MOUNTING: SURFACE
ENCLOSURE TO BE SINGLE TUB

VOLTS: 120/208 VOLTS
LOCATION: LOWER LEVEL
FED FROM: MDP
ENTER AT: TOP

IS	RE	DATE	DESCRIPTION
1	-	2022-03-28	FOR INFORMATION ONLY

SEAL:

FOR INFORMATION ONLY

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Iqaluit
CITY OF IQALUIT

CLIENT REF. #:

PROJECT:
IQALUIT
WATER TREATMENT PLANT

PROJECT NO: 211-12487-00
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wsp
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX: 204-474-2864
WWW.WSP.COM

ORIGINAL SCALE: AS NOTED

TITLE:
LOWER FLOOR ELECTRICAL
PLAN AND SCHEDULES

SHEET NUMBER: E-102

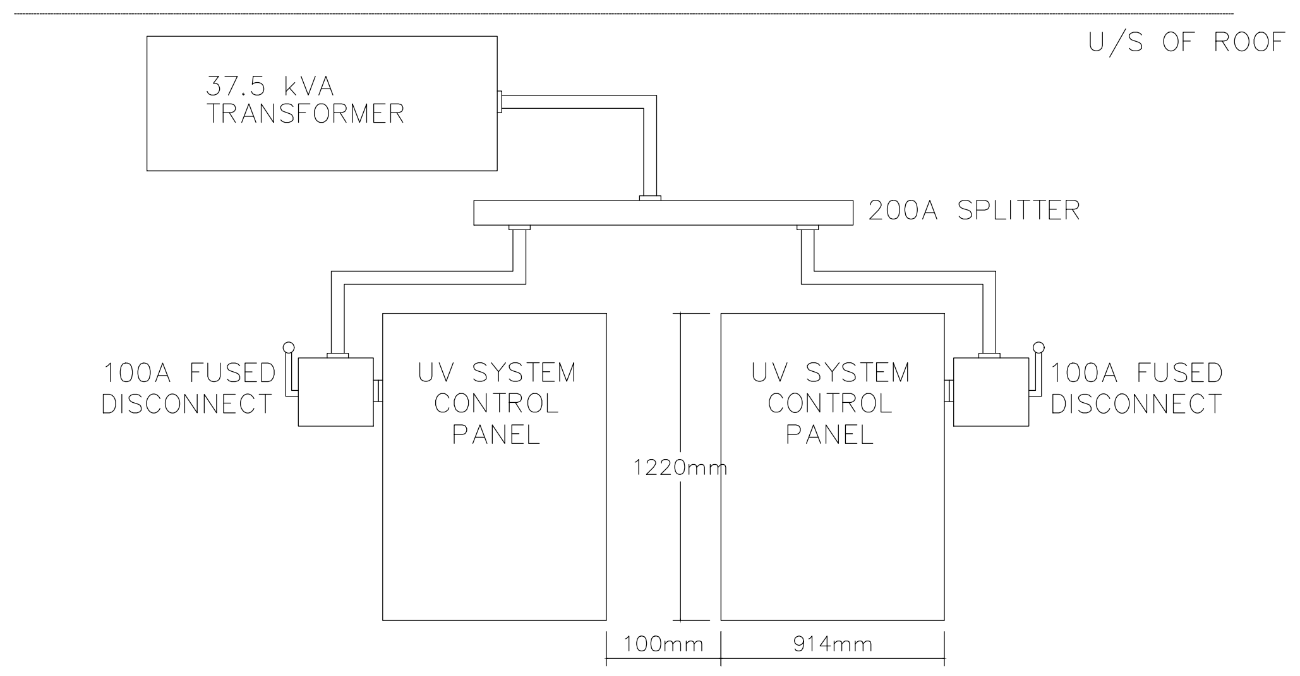
DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: ELECTRICAL
ISSUE: FOR INFORMATION ONLY 2022/03/28
REV #: -

M O T O R S T A R T E R A N D C O N T R O L S C H E D U L E

E – DIVISION 16
M – DIVISION 15
U – USERS EQUIPMENT
X – PROVIDE

1 - STOP-START
2 - ON-OFF
3 - HAND-OFF-AUTO
4 - PILOT LIGHT
5 - CONTROL RELAY
6 - TIMING RELAY
7 - DOUBLE VOLTAGE RELAY
8 - THERMISTORS
9 - ELECTRO PNEUMATIC SWITCH
10 - PNEUMATIC ELECTRO SWITCH
11 - SOLENOID
12 - MOTORIZED DAMPER
13 - FLOAT SWITCH
14 - PRESSURE SWITCH
15 - FLOW SWITCH
16 - SAIL SWITCH
17 - CONTROL TRANSFORMER
18 - THERMOSTAT
19 - INTEGRAL CONTROL PANEL
20 - FIRE ALARM SHUT DOWN
21 - FREEZE PROTECTION
22 - FIRE PROTECTION
23 - HIGH LIMIT
24 - LOW LIMIT
25 - CURRENT TRANSFORMER
26 - L.V. THERMOSTAT
27 - C.O. DETECTOR
28 - VARIABLE SPEED SW.
29 - LOW LIMIT
30 - CURRENT TRANSFORMER

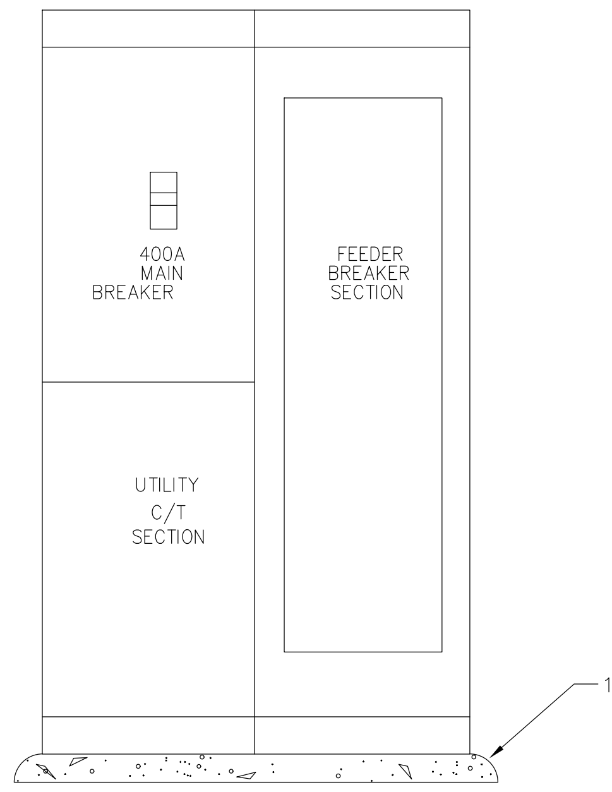
EQUIPMENT No.	LOCATION	EQUIPMENT				.56 EQUIP'T RATING		VOLTAGE	PHASE	PANEL AND CIRCUIT No.	MAGNETIC STARTER																										LOCATE AT MOTOR											REMOTE CONTROL														LINE DIAGRAM No.	INTERLOCK WITH EQUIP. NO.	FEEDER DETAILS
												IN COVER													IN COVER																																							
			SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	kW	HP				MANUAL	TOGGLE	KEY	PUSH BUTTON	PILOT LIGHT	MAGNETIC	COMBINATION	REDUCED VOLTAGE	TWO SPEED	BREAKER TYPE	FUSE TYPE	CONTROL TRANS.	AUXILIARY CONTACT		STOP-START	ON-OFF	HAND-OFF-AUTO	ON LIGHT - RED		CSA ENCLOSURE TYPE	LEGEND ABOVE	NOTES		SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	DISCONNECT SWITCH	TOGGLE SWITCH	JUNCTION BOX	RECEPTACLE	WEATHER PROOF	LEGEND ABOVE	LEGEND ABOVE	NOTES	SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	LEGEND ABOVE	LEGEND ABOVE	LEGEND ABOVE	NOTES	SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	LEGEND ABOVE	LEGEND ABOVE	LEGEND ABOVE	NOTES	SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER			
AS#1	LOWER LEVEL	AIR SCOURER #1	U	U	E	14.9	20	600	3	MCC						X	X			X		X	X				X	X						E	E	E	X																											19C, 3#8 +1#10 GND
AS#2	LOWER LEVEL	AIR SCOURER #2	U	U	E	14.9	20	600	3	MCC						X	X			X		X	X				X	X						E	E	E	X																											19C, 3#8 +1#10 GND
BP#1	LOWER LEVEL	BACHWASH PUMP #1	U	U	E	18.6	25	600	3	MCC						X	X			X		X	X				X	X						E	E	E	X																											19C, 3#8 +1#10 GND
BP#2	LOWER LEVEL	BACKWASH PUMP #2	U	U	E	18.6	25	600	3	MCC						X	X			X		X	X				X	X						E	E	E	X																											19C, 3#8 +1#10 GND
P-330	UPPER LEVEL	ZINC ORTHO PUMP #1	U	U	E		.05	120	1	2B-18	X	X																																																					19C, 2#12 +1#12 GND
P-331	UPPER LEVEL	ZINC ORTHO PUMP #2	U	U	E		.05	120	1	2B-20	X	X																																																				19C, 2#12 +1#12 GND
	UPPER LEVEL	CHLORINATOR #1	U	U	E			120	1	2B-14	X	X																																																				19C, 2#12 +1#12 GND
	UPPER LEVEL	CHLORINATOR #2	U	U	E			120	1	2B-16	X	X																																																				19C, 2#12 +1#12 GND
P-360	UPPER LEVEL	FLOUROSILICIC METERING PUMP #1	U	U	E		.05	120	1	2B-22	X	X																																																				19C, 2#12 +1#12 GND
P-361	UPPER LEVEL	FLOUROSILICIC METERING PUMP #2	U	U	E		.05	120	1	2B-24	X	X																																																				19C, 2#12 +1#12 GND
P-362	UPPER LEVEL	SODIUM HYPOCLORITE #1	U	U	E			120	1	2A-17	X	X																																																				19C, 2#12 +1#12 GND
P-363	UPPER LEVEL	SODIUM HYPOCLORITE #1	U	U	E		.05	120	1	2A-19	X	X																																																				19C, 2#12 +1#12 GND
	LOWER LEVEL	UV LIGHTS	U	U	E	26		208	3	NOTE #1	X	X																																																				19C, 3#8 +1#10 GND
*	NOTE #1	REFER TO SINGLE LINE DIAGRAM AND DETAIL THIS DRAWING.																																																														



1
E-301

UV POWER SUPPLY ELEVATION

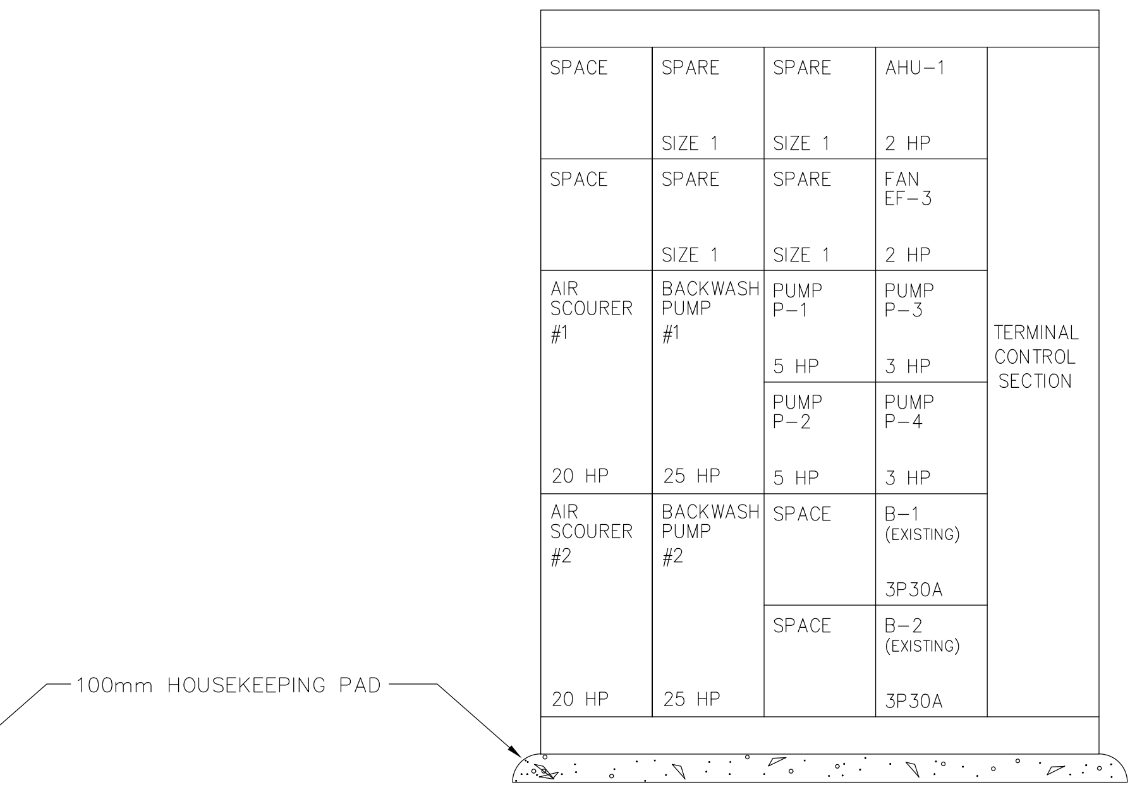
NTS



4
E-301

MDP ELEVATION

NTS

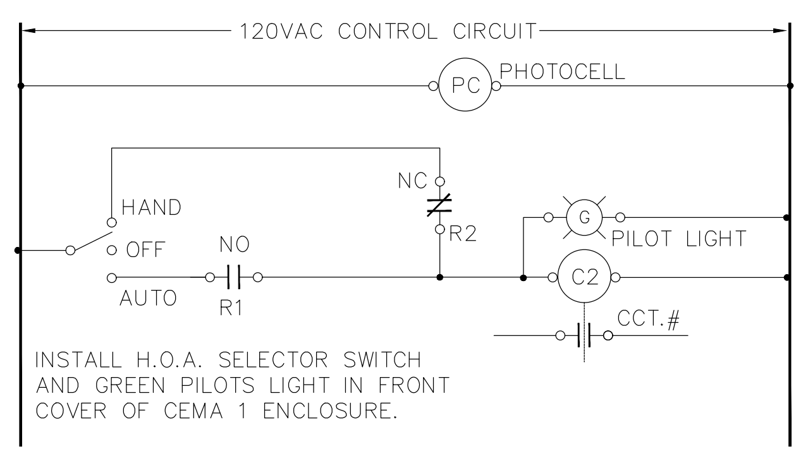


SPACE	SPARE SIZE 1	SPARE SIZE 1	AHU-1 2 HP	TERMINAL CONTROL SECTION
SPACE	SPARE SIZE 1	SPARE SIZE 1	FAN EF-3 2 HP	
AIR SCOURER #1 20 HP	BACKWASH PUMP #1 25 HP	PUMP P-1 5 HP	PUMP P-3 3 HP	
		PUMP P-2 5 HP	PUMP P-4 3 HP	
AIR SCOURER #2 20 HP	BACKWASH PUMP #2 25 HP	SPACE	B-1 (EXISTING) 3P30A	
		SPACE	B-2 (EXISTING) 3P30A	

5
E-301

MCC ELEVATION

NTS



INSTALL H.O.A. SELECTOR SWITCH AND GREEN PILOTS LIGHT IN FRONT COVER OF CEMA 1 ENCLOSURE.

6
E-301

PEC LIGHTING CONTROL SCHEMATIC

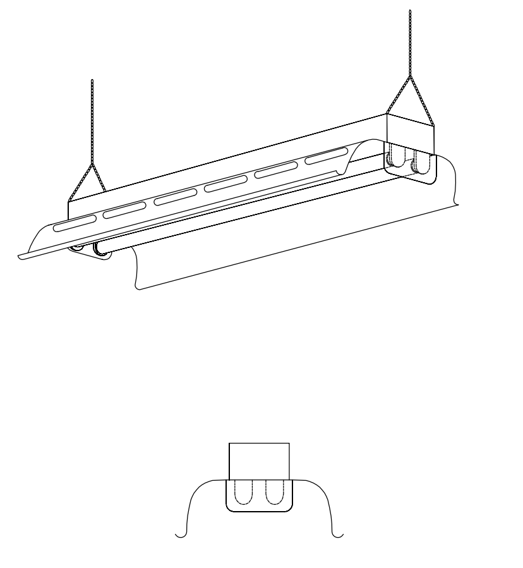
NTS

M O T O R S T A R T E R A N D C O N T R O L S C H E D U L E

E – DIVISION 16
M – DIVISION 15
U – USERS EQUIPMENT
X – PROVIDE

1 - STOP-START
2 - ON-OFF
3 - HAND-OFF-AUTO
4 - PILOT LIGHT
5 - CONTROL RELAY
6 - TIMING RELAY
7 - DOUBLE VOLTAGE RELAY
8 - THERMISTORS
9 - ELECTRO PNEUMATIC SWITCH
10 - PNEUMATIC ELECTRO SWITCH
11 - SOLENOID
12 - MOTORIZED DAMPER
13 - FLOAT SWITCH
14 - PRESSURE SWITCH
15 - FLOW SWITCH
16 - SAIL SWITCH
17 - CONTROL TRANSFORMER
18 - THERMOSTAT
19 - INTEGRAL CONTROL PANEL
20 - FIRE ALARM SHUT DOWN
21 - FREEZE PROTECTION
22 - FIRE PROTECTION
23 - HIGH LIMIT
24 - LOW LIMIT
25 - CURRENT TRANSFORMER
26 - L.V. THERMOSTAT
27 - C.O. DETECTOR
28 - VARIABLE SPEED SW.
29 - LOW LIMIT
30 - CURRENT TRANSFORMER

EQUIPMENT No.	LOCATION	EQUIPMENT				EQUIP'T RATING		VOLTAGE	PHASE	PANEL AND CIRCUIT No.	MAGNETIC STARTER																										LOCATE AT MOTOR											REMOTE CONTROL														LINE DIAGRAM No.	INTERLOCK WITH EQUIP. NO.	FEEDER DETAILS
												IN COVER													IN COVER																																							
			SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	kW	HP				MANUAL	TOGGLE	KEY	PUSH BUTTON	PILOT LIGHT	MAGNETIC	COMBINATION	REDUCED VOLTAGE	TWO SPEED	BREAKER TYPE	FUSE TYPE	CONTROL TRANS.	AUXILIARY CONTACT		STOP-START	ON-OFF	HAND-OFF-AUTO	ON LIGHT - RED		CSA ENCLOSURE TYPE	LEGEND ABOVE	NOTES		SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	DISCONNECT SWITCH	TOGGLE SWITCH	JUNCTION BOX	RECEPTACLE	WEATHER PROOF	LEGEND ABOVE	LEGEND ABOVE	NOTES	SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	LEGEND ABOVE	LEGEND ABOVE	LEGEND ABOVE	NOTES	SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER	LEGEND ABOVE	LEGEND ABOVE	LEGEND ABOVE	NOTES	SUPPLIED UNDER	INSTALLED UNDER	WIRED UNDER			
AHU-1	PUMP ROOM	AIR HANDLING UNIT	M	M	E	1.5	2	600	3	MCC						X											X	X						E	E	E																												19C, 3#12 +1#12 GND
AHU-2	FILTER ROOM	AIR HANDLING UNIT	M	M	E	.37		120	1	2B-31	X	X							X																																													19C, 2#12 +1#12 GND
EF-1	WASHROOM	EXHAUST FAN	M	M	E	.083		120	1	2B-6	X	X																																																						19C, 2#12 +1#12 GND
EF-2	FILTER ROOM	EXHAUST FAN	M	M	E	.25		120	1	2B-15	X	X							X																																													19C, 2#12 +1#12 GND
EF-3	CHLORINE ROOM	EXHAUST FAN	M	M	E	1.5	2	600	3	MCC						X									X		X							E	E	E																												19C, 3#12 +1#12 GND
EF-4	FILTER ROOM	EXHAUST FAN	M	M	E	.25		120	1	2B-15	X	X							X																																													19C, 2#12 +1#12 GND
P-110	CLEARWELL FLOOR LEVEL	NEW POTABLE WATER PUMP			E	3.37	5	600	3	MCC						X									X		X							E	E	E																												19C, 3#12 +1#12 GND
P-111	CLEARWELL FLOOR LEVEL	NEW POTABLE WATER PUMP			E	3.37	5	600	3	MCC						X									X		X							E	E	E																												19C, 3#12 +1#12 GND
P-3	BOILER ROOM	GLYCOL HEATING PUMP	M	M	E	2.23	3	600	3	MCC						X									X		X							E	E	E																												19C, 3#12 +1#12 GND
P-4	BOILER ROOM	GLYCOL HEATING PUMP	M	M	E	2.23	3	600	3	MCC						X									X		X							E	E	E																												19C, 3#12 +1#12 GND
UH-1	EAST ROOM	UNIT HEATER	M	M	E	.187		120	1	2A-5	X	X																																																						19C, 2#12 +1#12 GND
UH-2	FILTER ROOM	UNIT HEATER	M	M	E	.187		120	1	2A-7	X	X																																																						19C, 2#12 +1#12 GND
UH-3	PUMP ROOM	UNIT HEATER	M	M	E	.187		120	1	2A-9	X	X																																																						19C, 2#12 +1#12 GND
UH-4	PUMP ROOM	UNIT HEATER	M	M	E	.187		120	1	2B-17	X	X																																																						19C, 2#12 +1#12 GND
UH-5	PUMP ROOM	UNIT HEATER	M	M	E	.187		120	1	2B-19	X	X																																																						19C, 2#12 +1#12 GND
UH-6	PUMP ROOM	UNIT HEATER	M	M	E	.187		120	1	2B-21	X	X																																																						19C, 2#12 +1#12 GND
UH-7	PUMP ROOM	UNIT HEATER	M	M	E	.187		120	1	2B-23	X	X																																																						19C, 2#12 +1#12 GND
UH-8	LOWER FLOOR	UNIT HEATER	M	M	E	.187		120	1	2B-25	X	X																																																						19C, 2#12 +1#12 GND
UH-9	LOWER FLOOR	UNIT HEATER	M	M	E	.187		120	1	2B-27	X	X																																																						19C, 2#12 +1#12 GND
UH-10	LOWER FLOOR	UNIT HEATER	M	M	E	.187		120	1	2B-29	X	X																																																						19C, 2#12 +1#12 GND
FF-1	LOWER FLOOR	FORCE FLOW HEATER	M	M	E	FRAC.		120	1	2A-11	X	X																																																						19C, 2#12 +1#12 GND
B-1	BOILER ROOM	BOILER (EXISTING)	U	U	E			600	3	MCC																																																						19C, 3#12 +1#12 GND
B-2	BOILER ROOM	BOILER (EXISTING)	U	U	E			600	3	MCC																																																						19C, 3#12 +1#12 GND



LAMP TYPE: 32 WATT, T-8, FLUORESCENT
LAMP QTY: 2
MOUNTING: SUSPENDED CEILING
HOUSING: COLD ROLLED STEEL
REFLECTOR: SLOTTED – WHITE POWDER PAINT
LENS: NONE

SPECIAL REQUIREMENT:

Products are listed to establish reference standards. For approval of equivalents refer to General Conditions of specification.

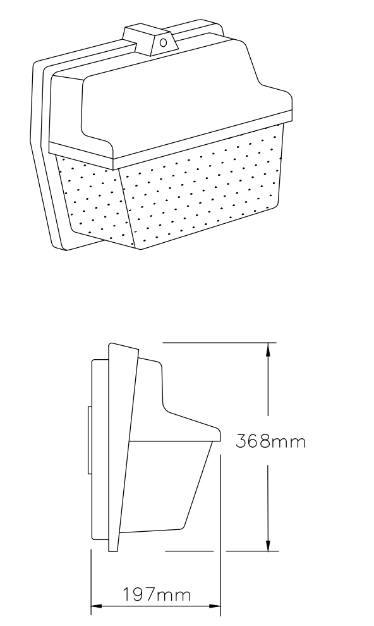
ACCEPTABLE PRODUCTS:

MANUFACTURER	PART No.
CFI	
METALUX	
LITHONIA	

LUMINAIRE SCHEDULE

TYPE No. 100

File: FLST4-2C



LAMP TYPE: 150 WATT, HIGH PRESSURE SODIUM
LAMP QTY: 1
MOUNTING: SURFACE, WALL
HOUSING: WEATHER RESISTANT DIE CAST ALUMINUM
REFLECTOR: SPECULAR ALZAK ALUMINUM
LENS: MOLDED PRISMATIC SHOCK RESISTANT GLASS

SPECIAL REQUIREMENT:

Products are listed to establish reference standards. For approval of equivalents refer to General Conditions of specification.

ACCEPTABLE PRODUCTS:

MANUFACTURER	PART No.
COOPER	
HOLOPHANE	
LITHONIA	
KEENE	

LUMINAIRE SCHEDULE

TYPE No. 200

File: HPSWP-1A

IS	RE	DATE	DESCRIPTION
1	-	2022-03-28	FOR INFORMATION ONLY

SEAL:

FOR INFORMATION ONLY

CLIENT:
ᐃᖃᓗᐃᑦ
Iqaluit
CITY OF IQALUIT

CLIENT REF. #:

PROJECT:
IQALUIT
WATER TREATMENT PLANT

PROJECT NO: 211-12487-00
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ORIGINAL SCALE: AS NOTED

TITLE:
MCC
SCHEDULE AND DETAILS

SHEET NUMBER: E-301

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: ELECTRICAL
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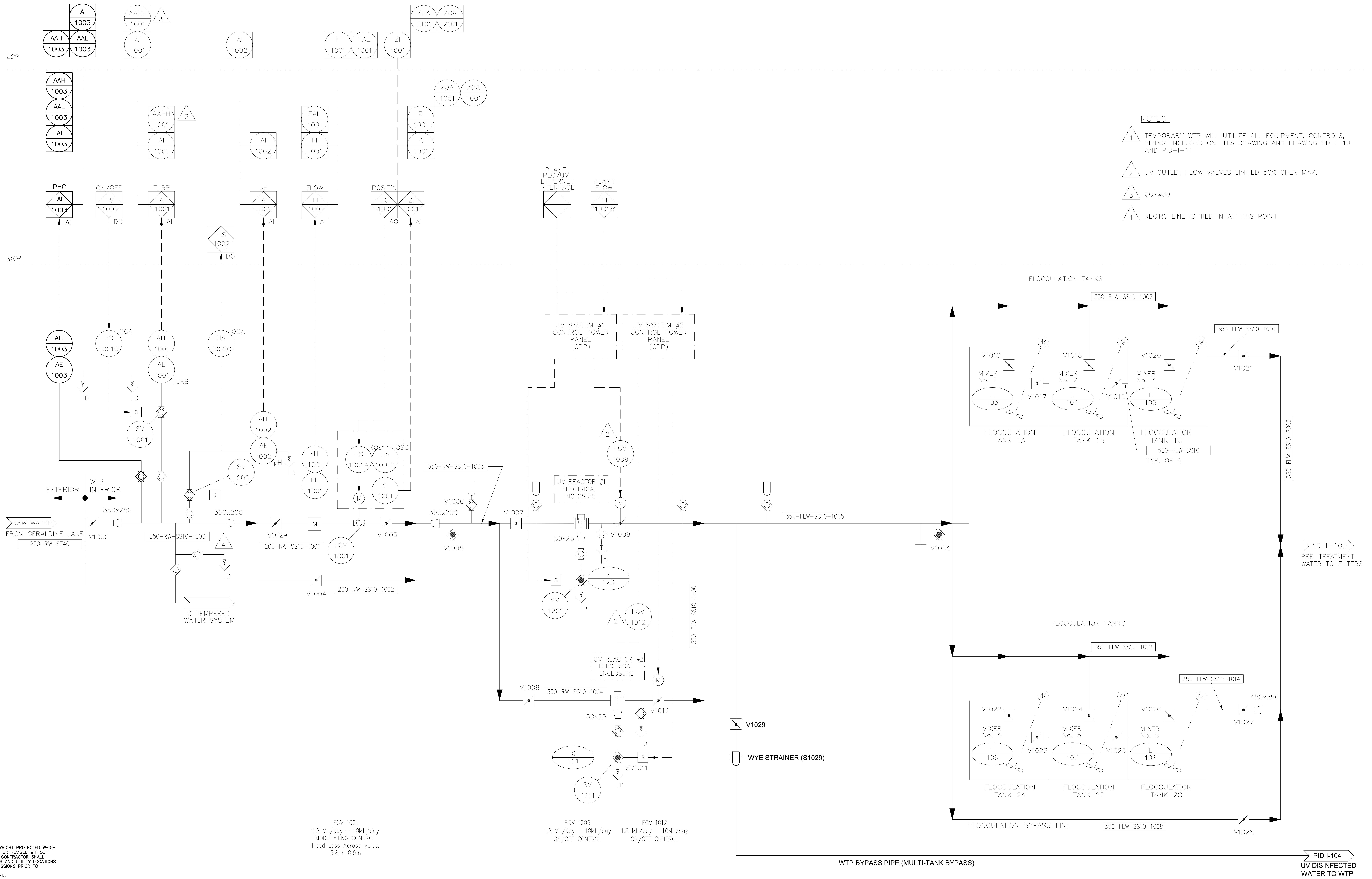
2022/03/28
REV #: -



NOTES:

1. TEMPORARY WTP WILL UTILIZE ALL EQUIPMENT, CONTROLS, PIPING INCLUDED ON THIS DRAWING AND FRAWING PD-I-10 AND PID-I-11
2. UV OUTLET FLOW VALVES LIMITED 50% OPEN MAX.
3. CCN#30
4. RECIRC LINE IS TIED IN AT THIS POINT.

IS	RE	DATE	DESCRIPTION
1	-	2022-03-28	FOR INFORMATION ONLY

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Iqaluit
CITY OF IQALUIT
CLIENT REF. #:

PROJECT:
IQALUIT
WATER TREATMENT PLANT

PROJECT NO: 211-12487-00
DATE: 2021/11/23

wsp
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
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ORIGINAL SCALE: AS NOTED

TITLE: P&ID - PRETREATMENT

SHEET NUMBER: I-102

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
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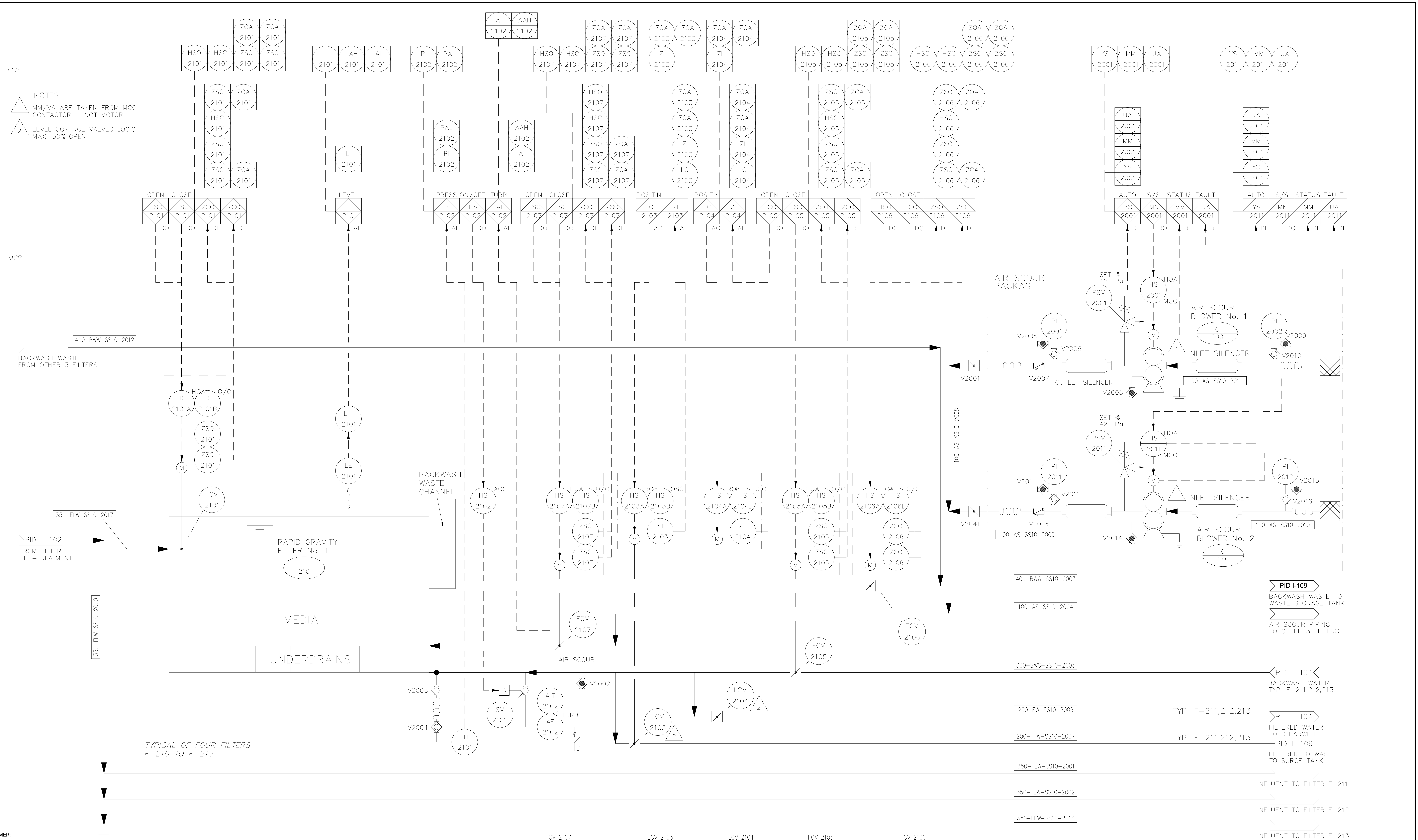

NOTES:

1. MM/VA ARE TAKEN FROM MCC CONTACTOR - NOT MOTOR.
2. LEVEL CONTROL VALVES LOGIC MAX. 50% OPEN.

FCV 2101
0.0 ML/day - 2.5ML/day
ON/OFF CONTROL

FCV 2107
0.0 - 840 M^3/hour (nominal)
ON/OFF CONTROL

LCV 2103
0.0 - 2.5ML/day
MODULATING CONTROL
Head Loss Across Valve, 0.3m to 3.0m

LCV 2104
0.0 - 2.5ML/day
MODULATING CONTROL
Head Loss Across Valve, 0.3m to 3.0m

FCV 2105
0.0 - 167.0 L/s
ON/OFF CONTROL

FCV 2106
0.0 - 167.0 L/s
ON/OFF CONTROL

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ORIGINAL SCALE: AS NOTED

TITLE: P&ID - FILTRATION SYSTEM

SHEET NUMBER: I-103

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
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DISCIPLINE: INSTRUMENTATION
ISSUE: FOR INFORMATION ONLY
2022/03/28
REV #: -

NOTES:
1 MM/VA ARE TAKEN FROM MCC CONTACTOR - NOT MOTOR.
2 LEVEL CONTROL VALVES LOGIC MAX. 50% OPEN.
LCP
MCP
PID I-107
CAUSTIC SODA
25-OPS-PP-3015
PID I-102
UV DISINFECTED WATER FROM WTP BYPASS PIPE
V3054
PID I-103
BACKWASH WATER TYP. F-211,212,213
300-BWS-SS10-2005
V2034
V2033
PID I-106
SODIUM HYPOCHLORITE
V2032
V3053
PID I-108
CHLORINE SOLUTION TYP. F-211,212,213
25-CLS-PP-3011
V3050
V3051
V3052
PID I-103
FILTERED WATER TYP. F-211,212,213
200-FW-SS10-2006
PID I-108
HYDROFLUOROSILIC ACID TYP. F-211,212,213
25-FAS-PP-3023
V3052
V3053
200-FW-SS10-2006
25-FAS-PP-3023
MANUAL OPERATION TYP. IN CLEARWELL
OPEN/CLOSE
ZSO 2051
HS 2051
DI
DO
HS 2051 OCA
ZSO 2501
SV 2501
PRV 2501
SET @ 100 kPag
300-BWS-SS10-2005
300-BWS-SS10-2013
200-BWS-SS10-2014
N.O. V2022
V2023
N.O. V2025
V2024
PI 2061
V2029
V2028
PI 2051
V2027
V2026
YS 2051
MM 2051
UA 2051
YS 2061
MM 2061
UA 2061
AUTO
S/S
STATUS
FAULT
YS 2051
MN 2051
MM 2051
UA 2051
YS 2061
MN 2061
MM 2061
UA 2061
HS 2051 HOA MCC
HS 2061 HOA MCC
M
TWL
BWL
V2039
V2038
V2037
300-BWS-SS10-2016
V2035
V2033
V2034
BACKWASH PUMP No. 1
P 205
BACKWASH PUMP No. 2
P 206
NORTH CLEARWELL
MIXING CHAMBER
SOUTH CLEARWELL
PUMPING CHAMBER
LALL 2501
LAL 2501
LAH 2501
LI 2501
LEVEL
LI 2501
AI
LIT 2501
LE 2501
AI 2501A
AAL 2501A
AAH 2501A
AI 2501B
AAH 2501B
AAL 2501B
AI 2501C
AAH 2501C
AAL 2501C
CL2
AI 2501A
pH
AI 2501B
PHC
AI 2501C
AIT 2501
300-TW-PVC-2015
ZSC 2501
ZSO 2501
HSC 2501
HSO 2501
OPEN
CLOSE
HSO 2501
HSC 2501
ZSO 2501
ZSC 2501
DO
DI
HS 2501A
HS 2501B
HOA
O/C
ZSO 2501
ZSC 2501
M
FCV 2501
V2036
V2031
V2032
75-TW-PVC-1013
V2040
PID I-111
TREATED WATER TO RESERVOIR
V2042
V2040
V2041
PID I-107
PRE-RESERVOIR SAMPLE WATER
V2044
V2043
PID I-107
POST-RESERVOIR SAMPLE WATER
P 310
PI 2045
V2045
V2046
V2047
V2048
AE 2501 CL2
AE 2502 pH
AE 2503 PHCs
D
FCV 2501
0.0 - 10.0ML/day
ON/OFF CONTROL

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PROJECT NO: 211-12487-00
DATE: 2021/11/23

wsp
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WINNIPEG, MANITOBA
CANADA R3T 6B8
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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - BACKWASH SUPPLY

SHEET NUMBER: I-104

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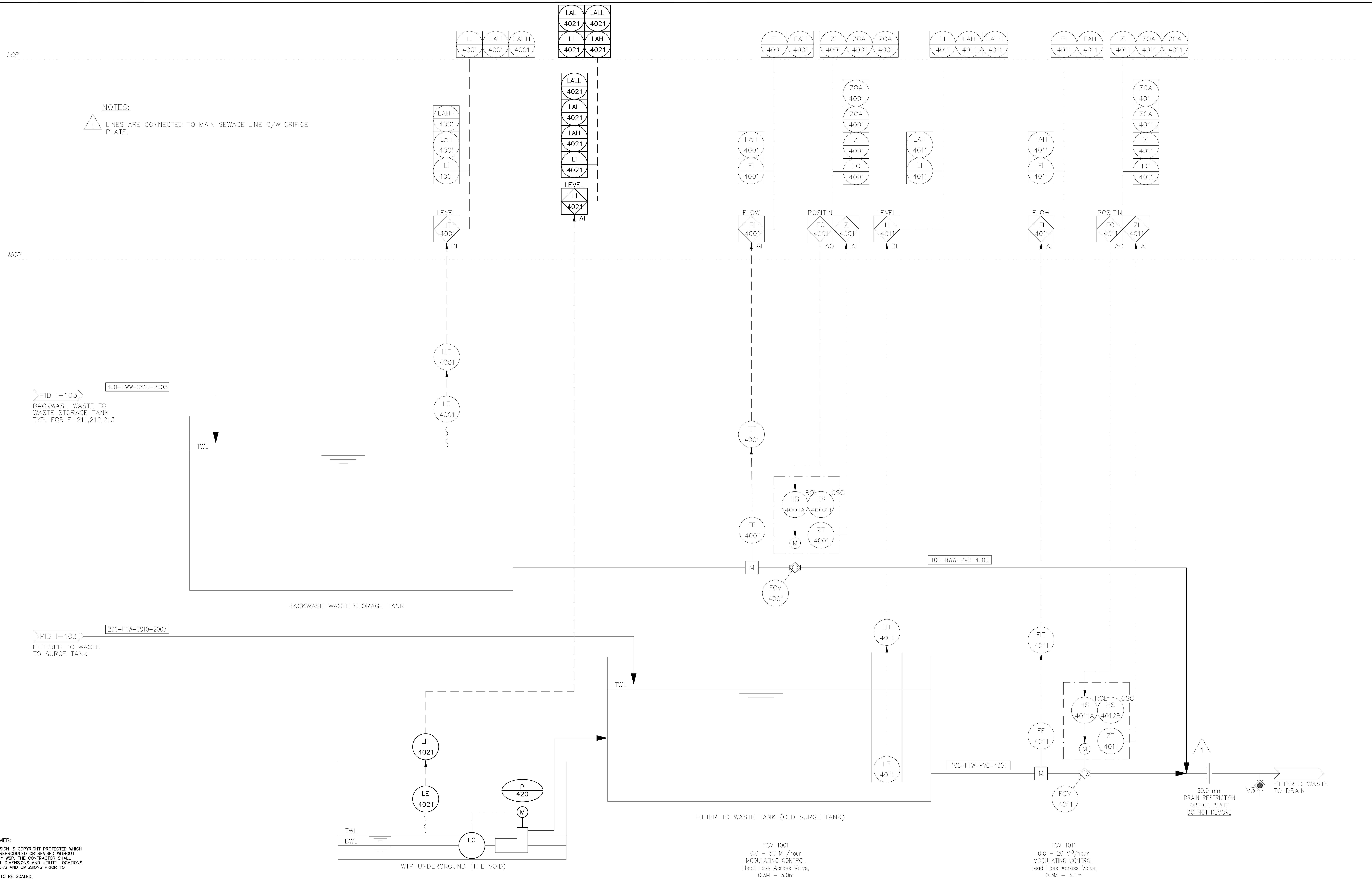

NOTES:

1. LINES ARE CONNECTED TO MAIN SEWAGE LINE C/W ORIFICE PLATE.

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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - BACKWASH AND
FILTER-TO-WASTE SYSTEMS

SHEET NUMBER: I-105

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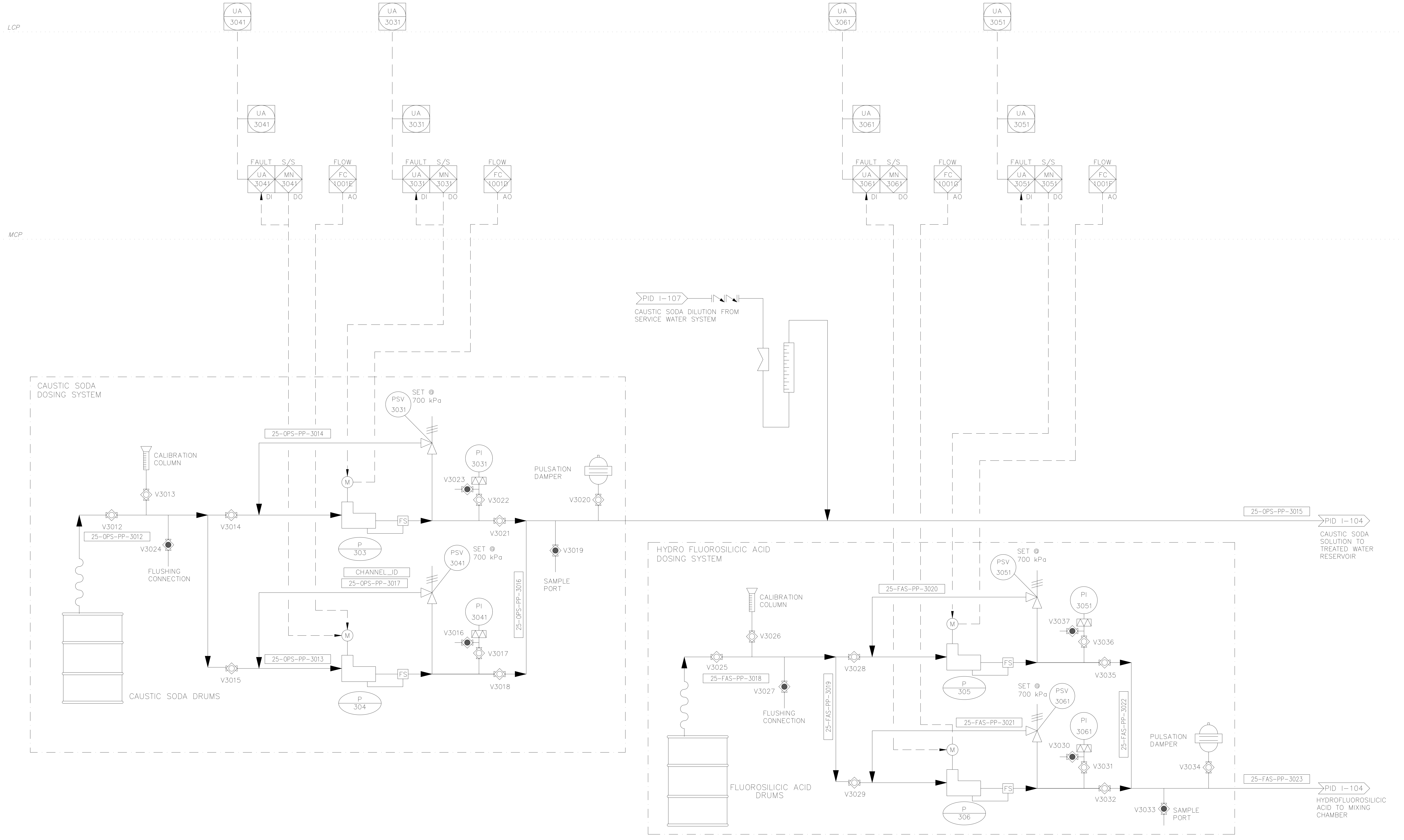

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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - CAUSTIC SODA AND
HYDROFLOUOROSILICIC SUPPLY

SHEET NUMBER: I-106

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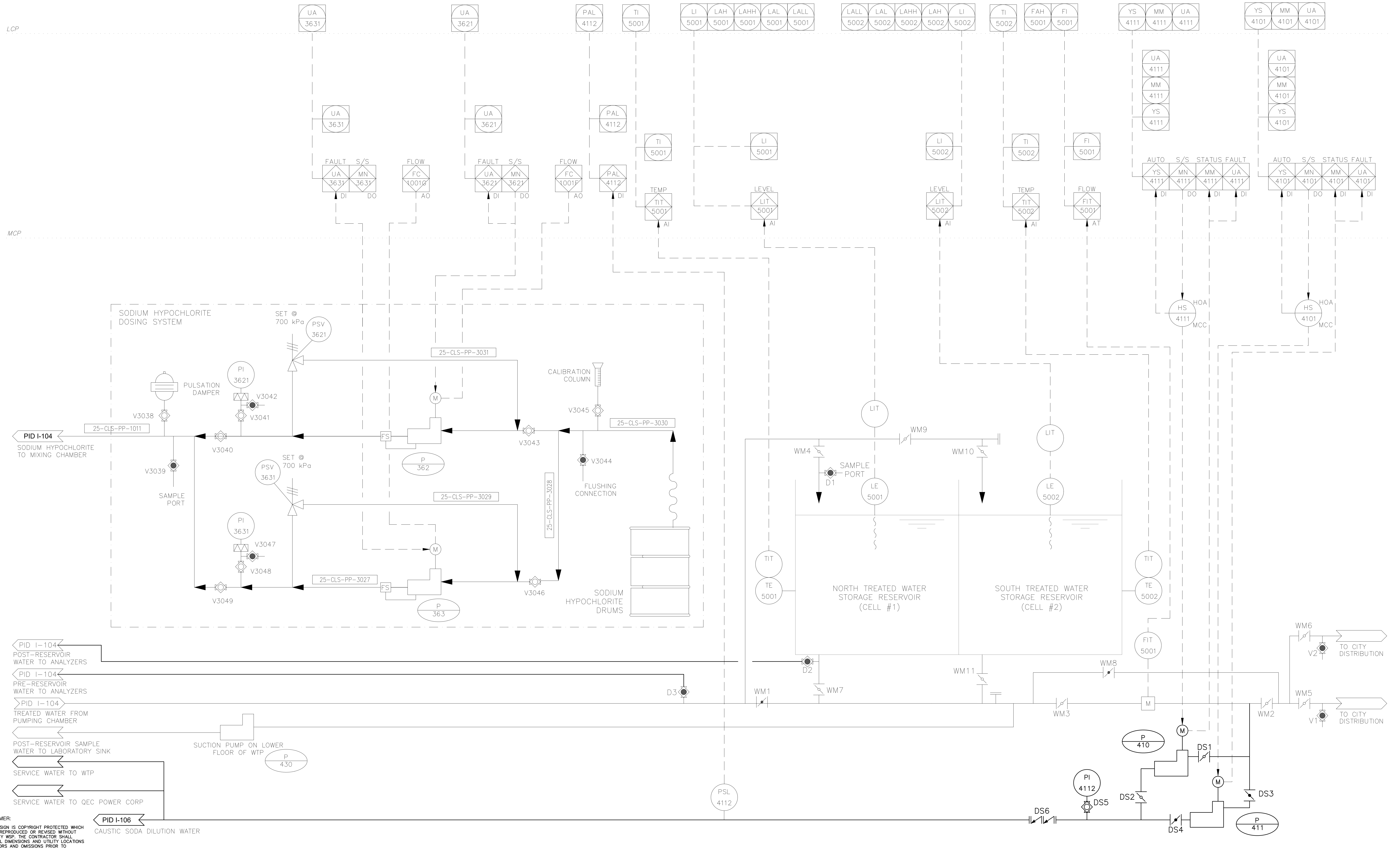

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ORIGINAL SCALE:
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TITLE:
P&ID - SODIUM HYPOCHLORITE
AND DOMESTIC WATER SYSTEM

SHEET NUMBER:
I-107

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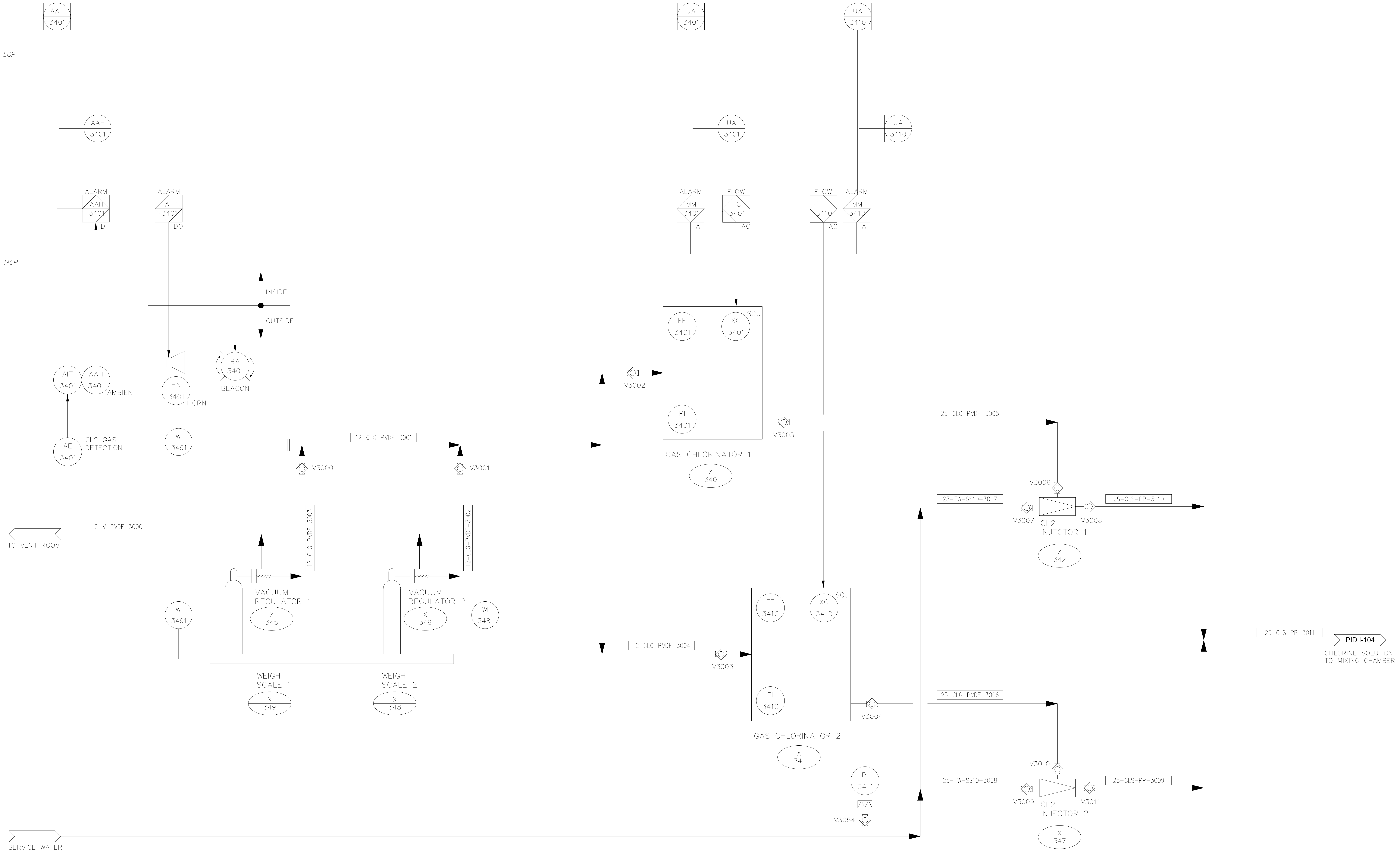

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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - CHLORINE SOLUTION SUPPLY

SHEET NUMBER: I-108

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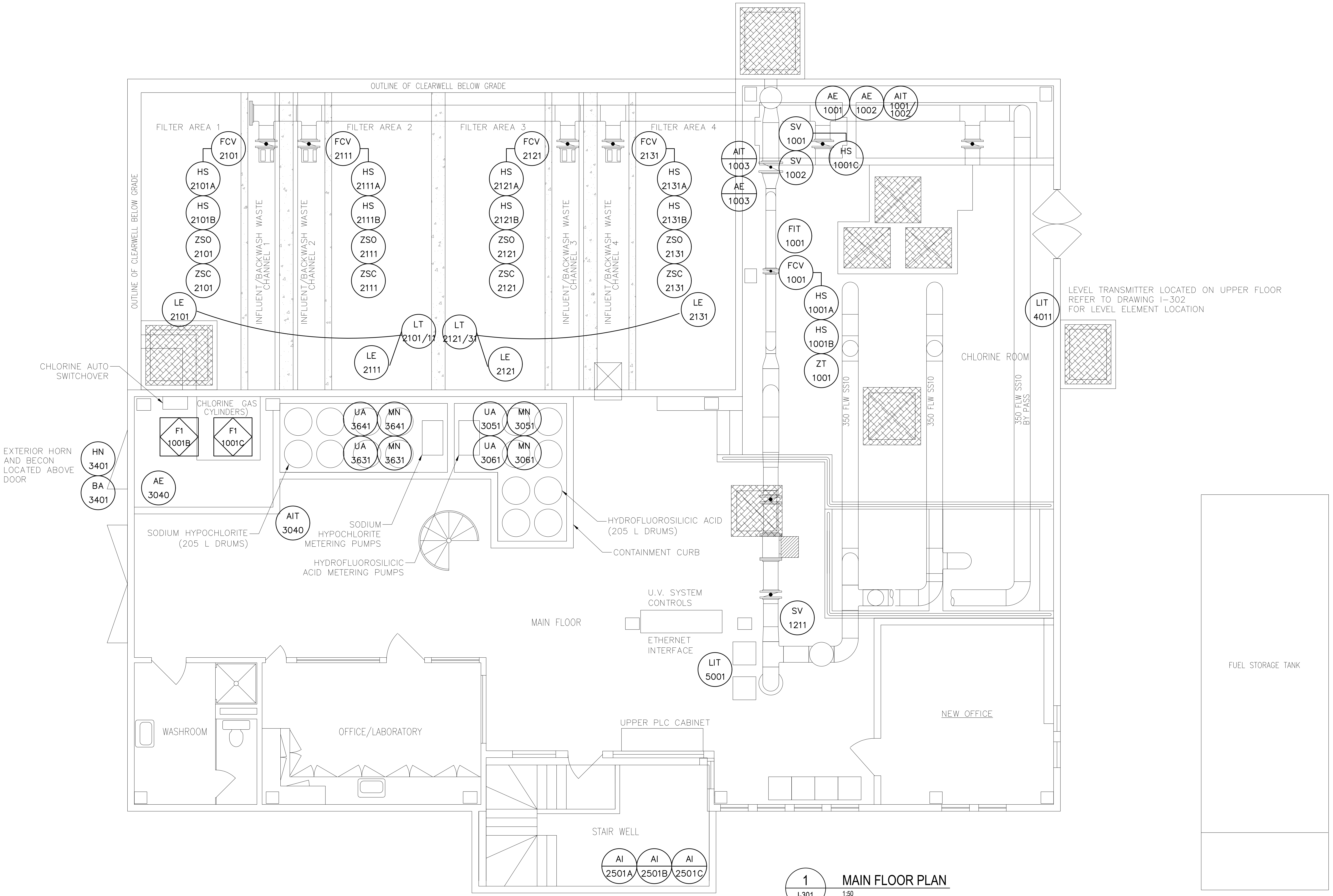

1
I-301
MAIN FLOOR PLAN
1:50

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PROJECT NO: 211-12487-00
DATE: 2021/11/23

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ORIGINAL SCALE: AS NOTED

TITLE:
FILTERS FLOOR
DEVICE LOCATIONS

SHEET NUMBER: I-301

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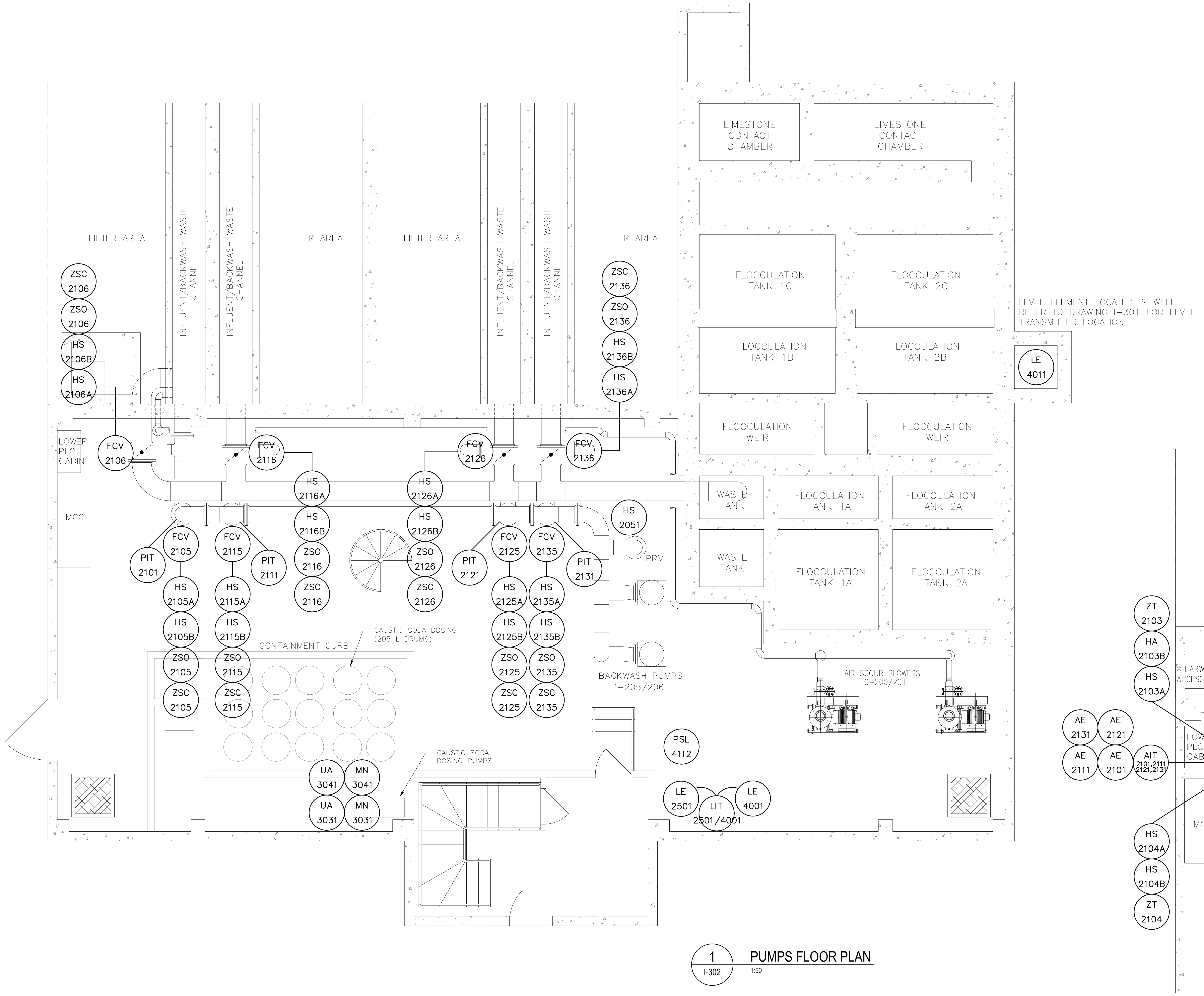
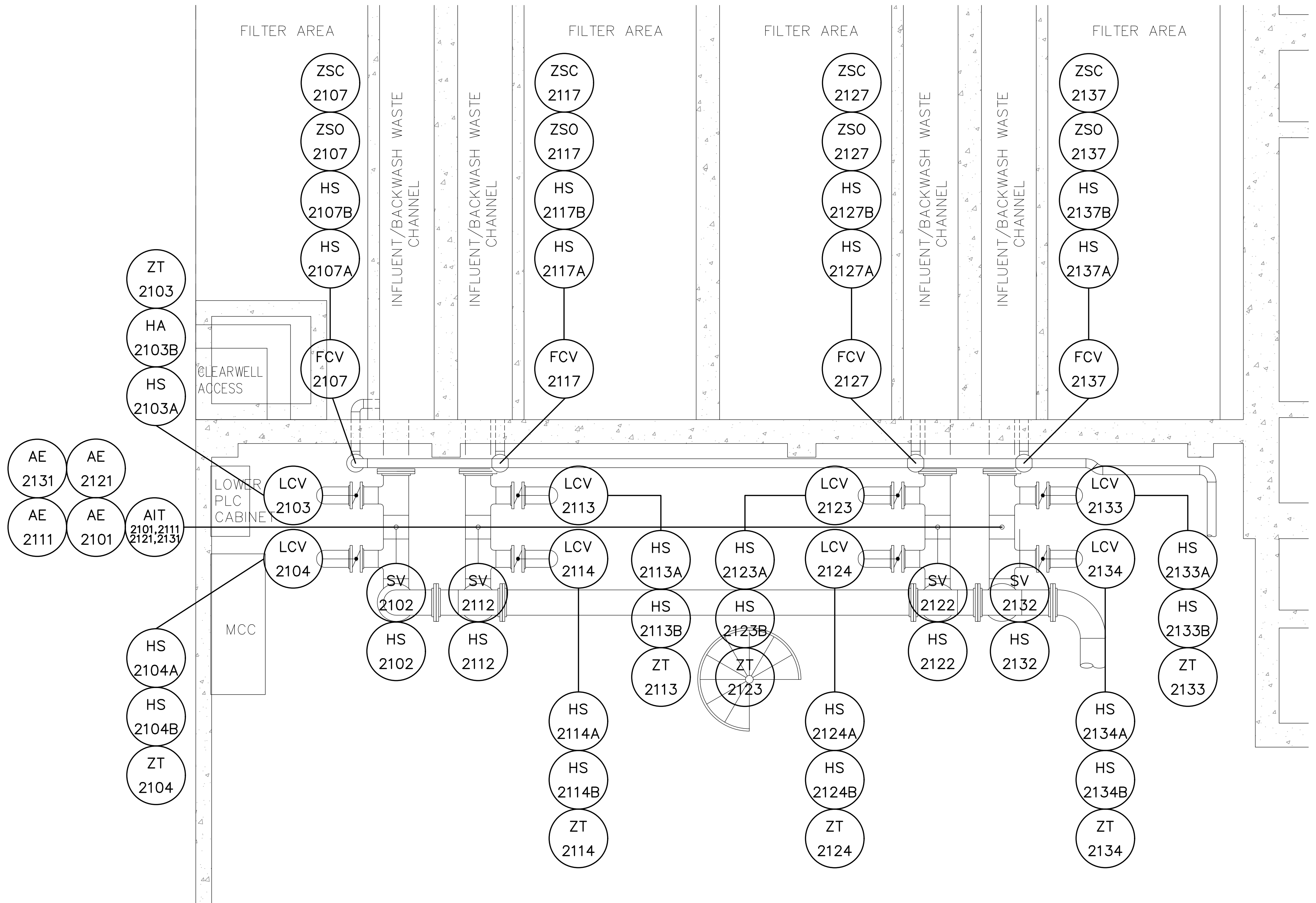


LEVEL ELEMENT LOCATED IN WELL REFER TO DRAWING I-301 FOR LEVEL TRANSMITTER LOCATION

1 PUMPS FLOOR PLAN
I-302
1:50



2 PARTIAL PUMPS FLOOR PLAN
I-302
1:50

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ORIGINAL SCALE: AS NOTED

TITLE:
PUMPS FLOOR
DEVICE LOCATION

SHEET NUMBER: I-302

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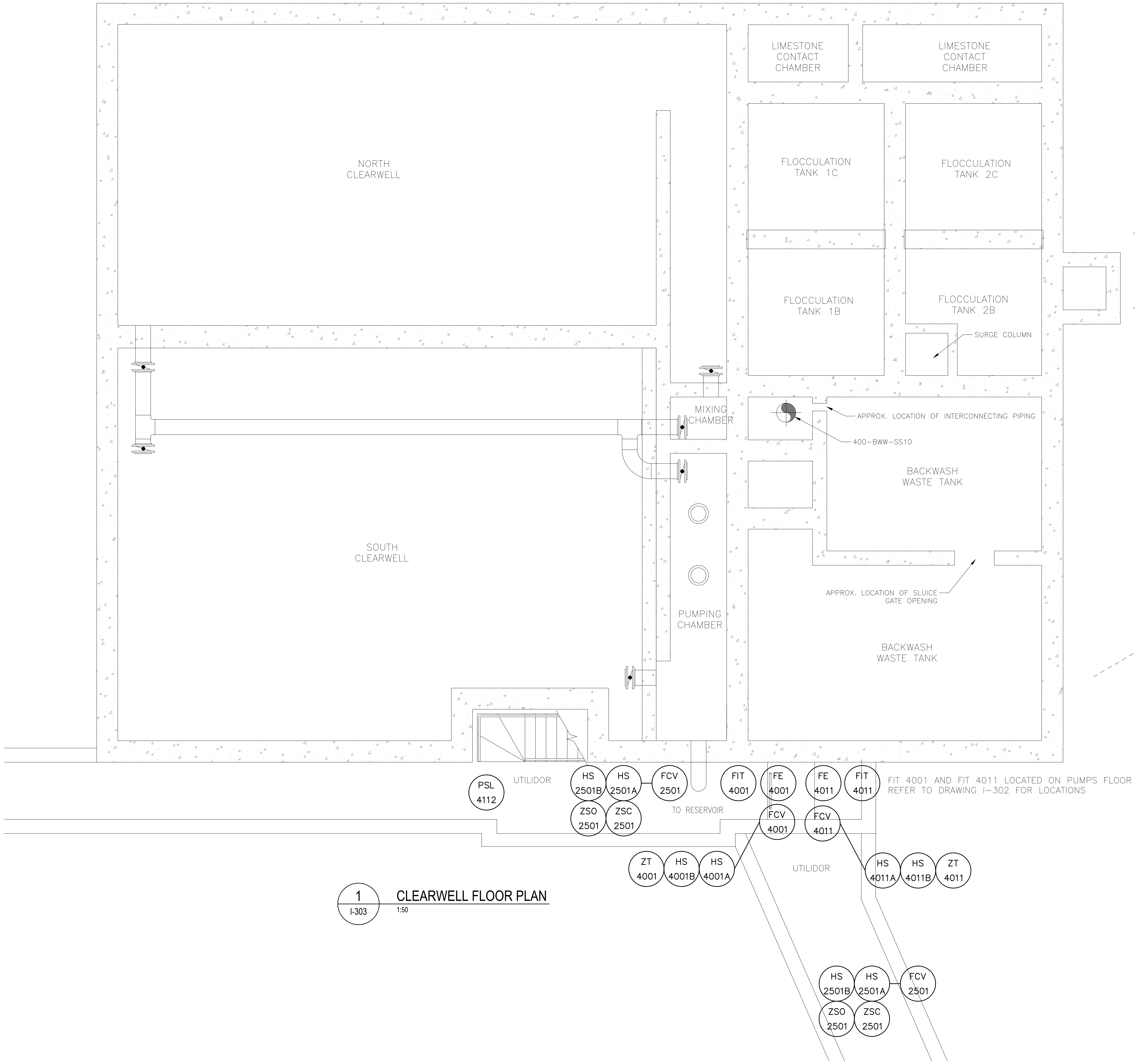
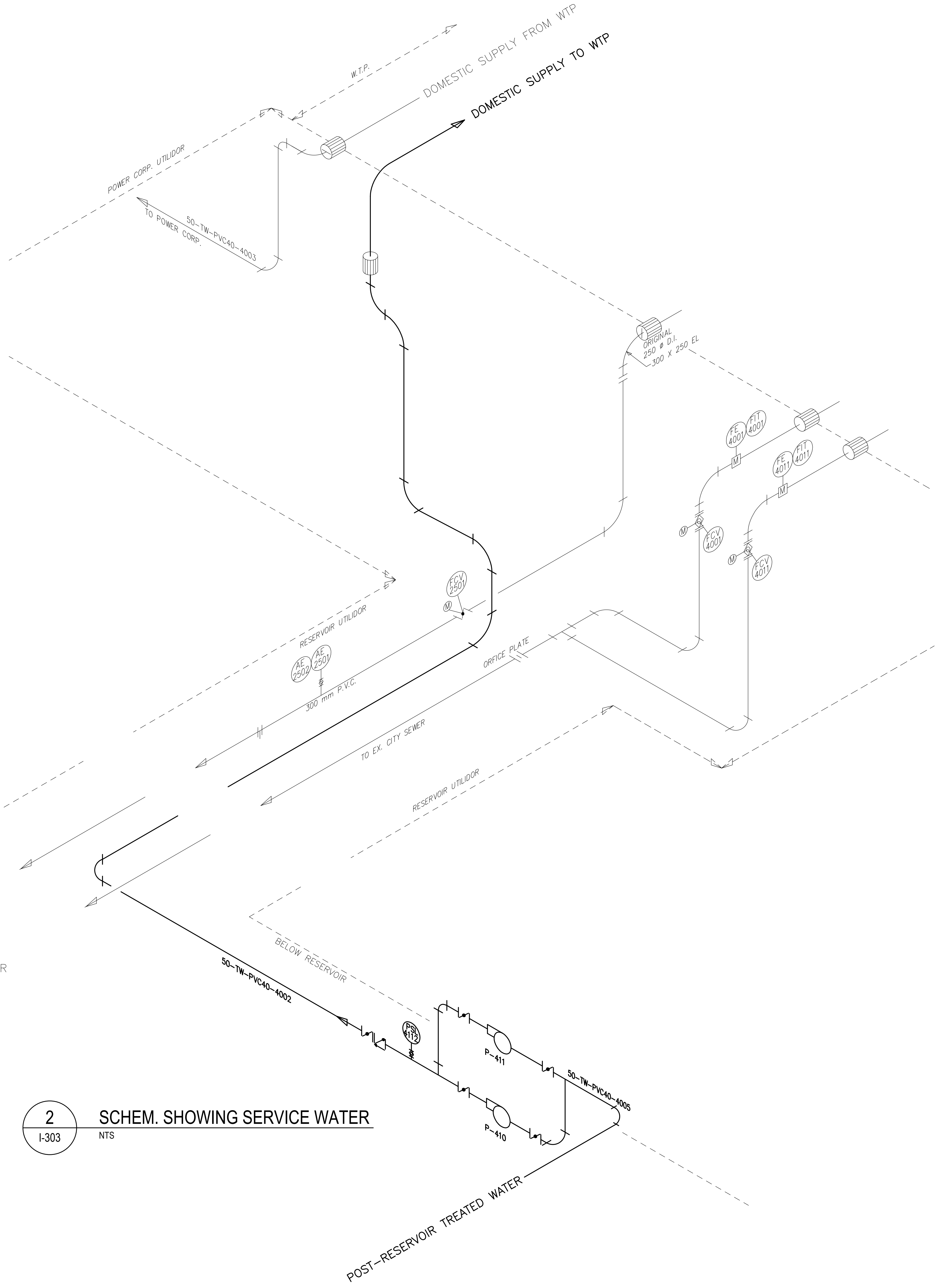


FIT 4001 AND FIT 4011 LOCATED ON PUMPS FLOOR
REFER TO DRAWING I–302 FOR LOCATIONS

1
I-303

CLEARWELL FLOOR PLAN

1:50



2
I-303

SCHEM. SHOWING SERVICE WATER

NTS

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ORIGINAL SCALE: AS NOTED

TITLE:
CLEARWELL FLOOR AND WTP
UNDERGROUND DEVICE LOCATIONS

SHEET NUMBER: I-303

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Mechanical Operation & Maintenance Manual
for the Iqaluit Water Treatment Plant
Iqaluit, Nunavut

March 2022

1 INTRODUCTION

Year of Completion:	2004
Original Scope:	Design and upgrade existing Water Treatment Plant to meet current and future demands.

This manual has been updated to include:

DATE	DESCRIPTION OF CHANGE
March, 2022	Inclusion of updates and upgrades made to the water treatment plant as per WTP Project No. 211-12487-00.

Iqaluit Water Treatment Plant

Project History

The City of Iqaluit:	City of Iqaluit Public Works & Engineering P.O. Box 460 Iqaluit, NU X0A 0H0 Simon Doiron, Director of Public Works Phone: (867) 222-2966 S.Doiron@iqaluit.ca Sumon Ghosh, Director of Engineering Phone: (867) 979-5636 S.Ghosh@iqaluit.ca
Project Engineer:	2004 Upgrades Earth Tech Canada Inc. (Currently AECOM) 4916 47th Street P.O. Box 1259 Yellowknife, NT X1A 2N9 Phone: 1 (867) 873-6316 2017 Upgrades Glenn Prosko, Project Manager Nunami-Stantec 10160 112 Street Edmonton AB T5K 2L6 P: (780) 969-3258 Glenn.Prosko@stantec.com 2021-2022 Upgrades Justin Rak-Banville, Project Manager WSP Canada Inc. 1600 Buffalo Place, Winnipeg, MB, R3T 6B8
General Contractor:	2004 Upgrades 90 North Construction & Development Ltd. (No longer in operation) Suite 106, 6131-6th Street S.E. Calgary, AB T2H 1L9 2017 Upgrades Maxime Gaudreau, Project Manager Kudlik Construction Ltd. P.O. Box 727, 1519 Federal Road Iqaluit, NU X0A 0H0 P: (418) 802-8224 mgaudreau@kudlik.biz

Mechanical Subcontractor:	2004 Upgrades Schendel Mechanical Contracting Ltd. 20310-107 Avenue Edmonton, AB T5T 3L7 Phone: (780) 447-3400 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, P: (855) 437-4001 carl@sifec.ca
Electrical Subcontractor:	2004 Upgrades KRT Electric 1505 Federal Rd, Iqaluit, NU P.O. Box 1259 Iqaluit, NU X0A 0H0 Phone: 1 (867) 979-2639 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, P: (855) 437-4001 carl@sifec.ca
Instrumentation Subcontractor:	2004 Upgrades Vector Electric & Controls 3524-78 Avenue Edmonton, AB X1A 2P4 Phone: (780) 469-7900 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, P: (855) 437-4001 carl@sifec.ca

INDEX

INDEX OF DRAWINGS

M-001	**Legend**
M-101	**Upper Floor Mechanical Layout**
M-102	**Lower Floor Mechanical Layout**
M-301	**Schematics and Details**

3 BACKGROUND AND DESIGN DATA

3.1 PRE-2003 EXISTING MECHANICAL SYSTEMS

Prior to 2004, the facility mechanical systems consisted of several types including a hydronic (glycol) heating system, ventilation system, and fuel oil system.

The heating system consisted of two fuel oil (diesel) fired boilers servicing a hydronic system using glycol. Heating for the Water Treatment Plant (WTP) areas is accomplished by distribution of glycol through a direct piping system to terminal heating units (unit heaters, force flow heaters, baseboard radiation). The terminal heating units exhibited corrosion and was near end of average life expectancy. The heating boilers were replaced in 1993.

The ventilation system provided minimal ventilation for the Water Treatment Plant areas which consisted of an exhaust fan and natural vent opening to service the filter floor level. No ventilation had been provided to service the pump floor level. The plant operating equipment exhibited excessive corrosion due to the lack of ventilation to remove the humidity build-up within the plant.

The fuel oil system consisted of an outdoor storage tank, indoor day tank, and fuel oil transfer system provides fuel for the heating boilers. The existing day tank was not equipped with a containment dike to meet code requirements at the time. The day tank steel support structure also did not meet minimum fire code requirements.

3.2 2003-2004 WTP UPGRADES PROJECT

In 2003-2004, the existing Water Treatment Plant in the City of Iqaluit was approaching its design demand. To meet the increasing and future demands, the existing water treatment plant was upgraded to increase both capacity and operational control of the system. The upgrades to the system also required an upgrade in the mechanical systems to properly support plant operation.

Along with the plant upgrade, the mechanical systems will be upgraded to meet heating, ventilation, safety, miscellaneous mechanical and applicable code requirements.

3.2.1 HYDRONIC (GLYCOL) HEATING SYSTEM UPGRADES

Two existing diesel-fired, glycol heating boilers located in the Mechanical Room serves as the primary heating source for the building via hydronic system utilizing glycol. Each boiler provides 100 % of system capacity at 88˚C glycol supply temperature ensuring full heating capacity at all times. The boilers provide hot glycol to the air handling units heating coils, reheat coils, unit heaters, force flow heaters and wall radiation located throughout the building. Two primary glycol pumps circulate the glycol to the heating equipment as required.

Heating systems upgrades included the removal of three existing unit heaters and associated piping located in the reservoir, the replacement of four existing unit heaters with three-unit heaters on the Pumps Floor Level, the replacement of the existing force flow heater in the stairwell, the replacement of six existing unit heaters with five at the Filter Floor Level, and the addition of two new unit heaters to service the new Filter Room. The new unit heaters were be provided with stainless steel components where possible for corrosion resistance. Each unit heater has a heating capacity of 14.3 kW (49,000 Btu/hr). The force flow heater has a heating capacity of 15.0 kW (51,000 Btu/hr).

Other heating upgrades included the replacement of the wall radiation in the Laboratory and Washroom and addition of wall radiation for the Office. The wall radiation has a heating capacity range of 1.13 to 1.44 kW/m (1,200 Btu/hr/ft to 1,500 Btu/hr/ft) depending on the location of the radiation.

Two reheat coils were added to the ductwork of the new air handling units to service the Laboratory and Office. Each reheat coil has a heating capacity of 1.7 kW (5,800 Btu/hr).

The direct heating piping distribution system will be revised to a reverse return system to provide more efficient heating fluid flow control, prevent short cycling of system, and to limit the lack of hot heating fluid at the farthest terminal heating unit.

Two existing heating re-circulation pumps were be replaced and upgraded to meet the requirements of the upgraded heating system with addition of an air separator to remove air from the heating system. The flow capacity of each pump is 6.0 L/s (79 Imp. gpm) with each pump providing 100% of system flow requirements.

3.2.2 VENTILATION SYSTEM UPGRADES

Ventilation system upgrades included the addition of one air handling unit to service the Pump and Filter Floor Levels, and the addition of one air handling unit and two exhaust fans to service the Filter Room. The existing washroom exhaust fan was replaced, and an exhaust fan was added to service the Chlorine Room. Ventilation for the Pump/Filter Level is provided by an air handling unit complete with a heating coil interlocked with an exhaust damper. Ventilation for the Filter Level is provided by an air handling unit complete with pre-heat and heating coils interlocked with an exhaust fan. Additional Filter Level ventilation is provided by a second exhaust fan interlocked with the process aeration (air scour) blowers.

3.2.3 FUEL OIL SYSTEM UPGRADES

Fuel oil system upgrades included the replacement of the day tank with ULC approved self-contained storage tank. Other fuel oil system upgrades included replacement of the existing day tank steel support structure with a new support structure capable of maintaining its integrity for a minimum of two hours during a fire. The replacement day tank is a Durex double wall tank with a storage capacity of 1136 litres (250 Imp. gal.).

3.3 2021-2022 UPGRADES AND IMPROVEMENT WORK

In 2021 and 2022, maintenance and upgrade work were carried out at the WTP as part of WSP Project No. 211-12487-00, in which the following modifications were made to the Fuel Oil system to improve system reliability, improve safety, and to mitigate the risk of spills and contamination of the treated water supply. These upgrades included:

- Replacement of both boilers
- Replacement of the day tank, steel structure, and associated fuel oil piping
- Modifications to the exterior fuel storage tank piping (pending)
- Installation of a spill containment barrier around the exterior fuel storage tank complete with oil-water separation system (pending)

Refer to the Process and Mechanical Operation & Maintenance manuals for all other upgrades made during the 2021-2022 upgrades and improvement work.

END OF CHAPTER 3

4 GENERAL OPERATING PROCEDURES

4.1 GENERAL

Two existing diesel fuel oil, glycol heating boilers located in the Mechanical Room serves as the primary source of heating in the building with each boiler providing 100% of the system capacity. The use of glycol as a heating agent helps to prevent freeze-up in the system.

Two air handling units, two exhaust fan and relief air openings located in the plant provides ventilation for the Pump and Filter Floor Levels with additional exhaust fans servicing the Washroom and Chlorine Room.

Since the equipment is only heating and ventilation source for the building, it is important to ensure proper operation and maintenance is performed.

4.2 GLYCOL HEATING SYSTEM OPERATION

4.2.1 UNIT HEATERS AND FORCE FLOW HEATERS

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

Unit heaters and force flow heaters are located in the plant providing heat to various areas. Each heater fan circuit is energized from a local disconnect switch with a local wall mounted electric thermostat cycling the heater fan motor to maintain the desired space temperature.

4.2.2 REHEAT COIL

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

Two reheat coils located in Air Handling Unit AHU-1 distribution ductwork provides further tempering of the supply air as required for the Office/Laboratory and New Office. Each office has a local wall mounted thermostat controlling both reheat coil and wall radiation zone valves to provide room heating to the desired room temperature.

4.2.3 AIR HANDLING UNIT PREHEAT & HEATING COILS

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

Refer to Air Handling Units AHU-1 & AHU-2 in this section.

4.2.4 HEATING PUMPS P-3 AND P-4

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

Two glycol circulation pumps located in the Mechanical Room have been provided to handle the heating glycol circulation for the building with each pump providing 100% of the required glycol flow for the heating system. A manual switch on the Pump Control Panel will allow selection of either Pump P-3 or P-4 to operate. Only one pump is allowed to operate at a time and runs continuously once a pump is selected. Failure of the duty pump will activate the standby pump and sound alarm horn at the Pump Control Panel. The audible alarm is silenced when the duty pump is manually switched over at the Pump Control Panel.

Additional equipment has been installed to protect the heating system includes an air separator complete with strainer, flow switches, and check valves. Check valves located at the discharge of the pumps will prevent backflow of the system and flow switches to ensure there is system flow before the boilers are allowed to start. A strainer located within the air separator will filter out any solid material circulating in the heating system. The air separator with automatic air vent (AAV) will automatically remove entrapped air from the system reducing possibility of corrosion within the system.

4.3 VENTILATION SYSTEM OPERATION

4.3.1 AIR HANDLING UNIT AHU-1 SYSTEM

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

Air Handling Unit AHU-1 and two relief dampers provides ventilation for the Pump and Filters Level. The system is initially started by a local wall mounted thermostat to maintain the desired space temperature. When the supply fan status is proven, the mixed air dampers (outside & return dampers) will modulate to provide 20% (operator adjustable) minimum fresh air. The mixed air temperature sensor will modulate the mixed air dampers as required to maintain the mixed air set point which is limited to 9˚C (48˚F). The supply air discharge sensor will modulate the 3-way heating coil valve to maintain the supply air set point based on the space temperature reset schedule. The supply air set point of 23˚C (73˚F) is scheduled when the space temperature is below -1˚C (30˚F) or set point of 13˚C (55˚F) when the space temperature is above 1˚C (34˚F). When the supply fan is off, the mixed air dampers will close, and the heating coil valve will modulate to maintain a mixed air temperature of 13˚C (55˚F).

The motorized relief damper will open and modulate in conjunction with the mixing dampers to provide proper building pressurization. The barometric relief damper will open as required to relieve excess building pressure.

If the heating coil discharge temperature falls below 4˚C (39˚F), the low temperature thermostat will stop the supply fan to prevent cold air from being supplied. The thermostat must be manually reset before the system can resume normal operation after inspection of low temperature problem.

An AHU-1 thermostat/controller user guide is provided in the following pages for operational reference.

4.3.2 AIR HANDLING UNIT AHU-2 SYSTEM

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

Air Handling Unit AHU-2 and Exhaust Fans EF-2 and EF-4 provides ventilation for the Filters Area Level. The system is initiated by switching the fan control to Auto Mode on the local wall mounted thermostat to open EF-2 exhaust dampers and start exhaust fan in low speed. When EF-2 fan status is proven, AHU-2 outside air dampers will modulate open and start supply fan in low speed. The supply air discharge sensor will modulate the 3-way preheat and heating coil valves in sequence to maintain the supply air set point of 12˚C (54˚F) which is adjustable at the thermostat. When the system is off, the preheat and heating coil valves will modulate 100% open.

When the supply fan status is proven and after a 15-minute delay, the humidity controls will be enabled. Both the supply and exhaust fans will switch to high speed if the exhaust air humidity rises above 40% RH. When the exhaust air humidity falls below 30%, both the supply and exhaust fans will be stopped for 30 seconds and then restarted in low speed.

If the preheat coil discharge temperature falls below 4˚C (39˚F), the low temperature thermostat will stop the supply and exhaust fans. The thermostat must be manually reset before the system can resume normal operation after inspection of low temperature problem.

Exhaust Fan EF-4 interlocked with the Scour Blowers to start when either Scour Blower is started. When the system is activated, EF-4 normally closed discharge dampers will open to allow discharge damper end switch to make allowing EF-4 to start.

An AHU-2 thermostat/controller user guide is provided in the following pages for operational reference.

4.3.3 EXHAUST FAN EF-3

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

Exhaust Fan EF-3 provides ventilation for the Chlorine Storage Room. The system is initiated by a manual switch located in the Entrance Lobby. When the system is activated, EF-3 normally closed inlet and discharge dampers will open to allow discharge damper end switch to make allowing EF-3 to start.

4.4 FUEL OIL SYSTEM OPERATION

4.4.1 FUEL OIL SYSTEM

(Refer to Drawing M-101 and M-301 at the end of Chapter 10)

The fuel oil required to operate the boilers is diesel fuel. The diesel fuel is stored in an outside above ground storage tank located adjacent to the building with a 1100 litre (250 Imp. Gal.) double walled day tank located inside the building. The fuel oil is pumped from the outside tank to the day tank and gravity supplied to the boilers. The existing four level switches have been reinstalled on the new day tank and set at 10%, 20%, 80% and 90% tank full levels.

END OF CHAPTER 4

5 SCHEMATICS AND FUNCTIONAL DATA

5.1 TYPICAL UNIT HEATER & FORCE FLOW HEATER FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical unit heater and force flow schematics.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Unit Heaters & Force Flow Heaters	Pump & Filter Levels	Provides heating for Pump & Filter Levels	
2	Room Thermostat	Pump & Filter Levels	Temperature control for Unit Heater or Force Flow Heater	Room temperature to be maintained at set point.
3	Manual Air Vent	Unit Heater & Force Flow Heater Return Piping	Allows for venting/removal of trapped air from heating system	
4	Drain Valve	Unit Heater & Force Flow Heater Supply Piping	Allows for draining of glycol from Unit Heater or Force Flow Heater	Normally Closed & Capped
5	Union	Unit Heater & Force Flow Heater Supply Piping	Allows for removal of Unit Heater or Force Flow Heater from heating system.	
6	Union	Unit Heater & Force Flow Heater Return Piping	Allows for removal of Unit Heater or Force Flow Heater from heating system	
7	Isolation Valve	Unit Heater & Force Flow Heater Supply Piping	Valve used for isolation of Unit Heater or Force Flow Heater	Normally Open
8	Balancing/Isolation Valve	Unit Heater & Force Flow Heater Return Piping	Valve used for balancing/isolation of Unit Heater or Force Flow Heater	Normally Open Valve to be reset to balanced position if used for isolation

5.2 TYPICAL REHEAT COIL FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical reheat coil flow.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Reheat Coils	Air Handling Unit-1 Ductwork	Provides heating for Office/Laboratory & New Office	
2	Room Thermostat	Office/Laboratory & New Office	Temperature control for Reheat Coil	Room temperature to be maintained at set point.
3	Control Valve (2-way)	Reheat Coil Supply Piping	Regulates glycol flow to Reheat Coil	
4	Manual Air Vent	Reheat Coil Return Piping	Allows for venting/removal of trapped air from heating system	
5	Drain Valve	Reheat Coil Supply Piping	Allows for draining of glycol from Reheat Coil	Normally Closed & Capped
6	Union	Reheat Coil Supply Piping	Allows for removal of Reheat Coil from heating system	
7	Union	Reheat Coil Return Piping	Allows for removal of Reheat Coil from heating system	
8	Isolation Valve	Reheat Coil Supply Piping	Valve used for isolation of Reheat Coil	Normally Open
9	Balancing/Isolation Valve	Reheat Coil Return Piping	Valve used for balancing/isolation of Reheat Coil	Normally Open Valve to be reset to balanced position if used for isolation

5.3 TYPICAL AIR HANDLING UNIT PREHEAT & HEATING COILS FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical air handling unit preheat and heating coils.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS

1	Preheat & Heating Coils	Pump & Filter Levels	Provides heating for Pump & Filter Levels	
2	Temperature Control Valve (3-way)	Preheat & Heating Coil Supply & Return Piping	Regulates glycol flow Preheat or Heating coil provide desired AHU discharge supply air temperature	
3	Duct Mounted Thermostat	AHU Supply Air Discharge Ductwork	Measures AHU Supply Air Discharge Temperature & regulates 3-way control valve	AHU Supply Air Discharge temperature to be maintained at set point
4	Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for isolation of Preheat or Heating Coil	Normally Open
5	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for isolation of Preheat or Heating Coil	Normally Open
6	Union	Preheat & Heating Coil Supply Piping	Allows for removal of Preheat or Heating Coil from AHUs	
7	Union	Preheat & Heating Coil Return Piping	Allows for removal of Preheat or Heating Coil from AHUs	
8	Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
9	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
10	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
11	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for bypass of Preheat or Heating Coil Temperature Control Valve	Normally Close
12	Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
13	Balancing/Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for balancing/isolation of Preheat or Heating Coil	Normally Open Valve to be reset to balanced position if used for isolation

5.4 HEATING PUMPS FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical heating pump.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Primary Heating Pump P-3	Mechanical Room	Circulates glycol throughout heating system	
2	Check Valve	Pump P-3 Discharge Piping	Prevents backflow of glycol	
3	Balancing/Isolation Valve	Pump P-3 Discharge Piping	Valve used for balancing/isolation of Pump P-3	Normally Open Valve to be reset to balanced position if used for isolation
4	Strainer	Strainer provided within Air Separator (No.15)	Provides for removal of solid material from glycol heating system	Strainer to be cleaned if plugged
5	FS – Flow Switch	Pump P-3 Discharge Piping	Indication of glycol flow for Pump P-3	
6	Isolation Valve	Pump P-3 Suction Piping	Valve used for isolation of Pump P-3	Normally Open
7	PI – Pressure Indicator	Pump P-3 Suction & Discharge Piping	Visual indication of Pump P-3 operating pressures and strainer condition	
8	Primary Heating Pump P-4	Mechanical Room	Circulates glycol throughout heating system	
9	Check Valve	Pump P-4 Discharge Piping	Prevents backflow of glycol	
10	Balancing/Isolation Valve	Pump P-4 Discharge Piping	Valve used for balancing/isolation of Pump P-4	Normally Open Valve to be reset to balanced position if used for isolation
11	Strainer	Strainer provided within Air Separator (No.15)	Provides for removal of solid material from heating system	Strainer to be cleaned if plugged
12	FS – Flow Switch	Pump P-4 Discharge Piping	Indication of glycol flow for Pump P-4	
13	Isolation Valve	Pump P-4 Suction Piping	Valve used for isolation of Pump P-4	Normally Open

14	PI – Pressure Indicator	Pump P-4 Suction & Discharge Piping	Visual indication of Pump P-4 operating pressures and strainer condition	
15	Air Separator c/w Strainer	Mechanical Room	Automatic separation of trapped air from glycol heating system	
16	AAV – Automatic Air Vent	Air Separator	Automatic removal of trapped air from glycol heating system	
17	Drain Valve	Air Separator	Allows for draining of glycol from Air Separator	Normally Closed & Capped
18	Isolation Valve	Air Separator Outlet Piping	Valve used for isolation of Air Separator	Normally Open
19	Isolation Valve	Supply Header Supply Piping	Valve used for isolation of Heating System from Main Supply	Normally Open
20	TI – Temperature Indicator	Pumps P-3 & P-4 Common Supply Piping	Visual indication of heating system glycol supply temperature	
21	TI – Temperature Indicator	Heating System Common Return Piping	Visual indication of heating system glycol return temperature	
22	Isolation Valve	Return Header Return Piping	Valve used for isolation of Heating System from Main Return	Normally Open

5.5 AIR HANDLING UNIT AHU-1 FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical air handling unit AHU 1.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Air Handling Unit AHU-1	Filter Floor Level	Provides ventilation for Pump & Filter Floor Level	
2	Supply Fan	AHU-1	Provides flow of air	
3	Intake Hood	Outside Wall	Allows outside air to be supplied to AHU-1	

4	Outside Air Damper Motor & Outside Air Dampers	AHU-1	Dampers opens to provide outside air for AHU-1	Dampers Normally Closed
5	Return Air Damper Motor & Return Air Dampers	AHU-1	Dampers opens to provide return air for AHU-1	Dampers Normally Open
6	30% Filter – Summer Position	AHU-1	Removal of dust & dirt 30% Filters to be installed at this location during summer time	
7	PD-1 – Pressure Differential Indicator	AHU-1	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
8	TS-1 – Temperature Sensor – Mixed Air	AHU-1	Measures and modulates outside & return air dampers to maintain mixed air set point	
9	30% Filter – Winter Position	AHU-1	Removal of dust & dirt 30% Filters to be installed at this location during winter time	
10	PD-2 – Pressure Differential Indicator	AHU-1	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
11	Heating Coil	AHU-1	Provides tempering of outside/return air to maintain supply air set point	
12	65% Final Filter	AHU-1	Removal of dust & dirt	Filters to be replaced if plugged
13	LTA – Low Temperature Alarm	AHU-1	Low supply air temperature protection Shutdown of AHU-1 if low limit is exceeded	

14	TS-2 – Temperature Sensor – Supply Air	AHU-1	Measures and modulates heating coil control valve to maintain supply air set point	
15	Room Thermostat	Filter Floor Level	Measures and controls AHU-1 to maintain room temperature set point	
16	Exhaust Hood	Outside Wall	Allows air to be relieved	
17	Relief Air Damper Motor & Relief Air Dampers	Filter Floor Level	Dampers opens to relieve air	Dampers Normally Closed
18	Exhaust Hood	Outside Wall	Allows air to be relieved	
19	Barometric Relief Air Dampers	Filter Floor Level	Dampers opens to relieve air	Dampers Normally Closed

5.6 AIR HANDLING UNIT AHU-2 FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical air handing unit AHU 2.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Air Handling Unit AHU-2	Filter Floor Level	Provides ventilation for Filters Area	Interlocked with EF-2
2	Supply Fan	AHU-2	Provides flow of air	
3	Intake Hood	Outside Wall	Allows outside air to be supplied to AHU-2	
4	Outside Air Damper Motor & Outside Air Dampers	AHU-2	Dampers opens to provide outside air for AHU-2	Dampers Normally Closed
5	30% Filter – Summer Position	AHU-2	Removal of dust & dirt 30% Filters to be installed at this location during summer time	

6	PD- – Pressure Differential Indicator	AHU-2	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
7	Preheat Coil	AHU-2	Provides tempering of outside air to maintain supply air set point	
8	LTA – Low Temperature Alarm	AHU-2	Low supply air temperature protection Shutdown of AHU-2 if low limit is exceeded	
9	30% Filter – Winter Position	AHU-2	Removal of dust & dirt 30% Filters to be installed at this location during winter time	
10	PD – Pressure Differential Indicator	AHU-2	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
11	Heating Coil	AHU-2	Provides tempering of outside air to maintain supply air set point	
12	65% Final Filter	AHU-2	Removal of dust & dirt	Filters to be replaced if plugged
13	TS-1 – Temperature Sensor – Supply Air	AHU-2	Measures and modulates preheat & heating coil control valves to maintain supply air set point	
14	Room Thermostat	Filters Area	Measures and controls AHU-2 to maintain room temperature set point	
15	Exhaust Fan EF-2	Filters Area	Provides exhaust for filters area	Interlocked with AHU-2
16	Exhaust Fan EF-2 Damper motor & Dampers	Filters Area	Dampers open to exhaust air	Dampers Normally Closed

17	HS-1 – Humidity Sensor Exhaust Air	EF-2 Ductwork	Measures humidity of the exhaust air	
18	Exhaust Fan EF-4	Filters Area	Provides exhaust for Air Scour Blowers	Interlocked with Air Scour Blowers
19	Exhaust Fan EF-4 Damper motor & Dampers	Filters Area	Dampers open to exhaust air	Dampers Normally Closed

5.7 EXHAUST FAN EF-3 FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical exhaust fan EF 3.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Exhaust Fan EF-3	Chlorine Storage Room	Provides exhaust for Chlorine Storage Room	
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	Chlorine Storage Room	Dampers opens to exhaust air	Dampers Normally Closed
3	Manual Push Button	Entrance Lobby	Allows start-up & shutdown of EF-3	

5.8 FUEL OIL (DIESEL) FLOW SCHEMATIC

(Refer to Drawing M-101, M102, and M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of the fuel oil(diesel)

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Exhaust Fan EF-3	Chlorine Storage Room	Provides exhaust for Chlorine Storage Room	
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	Chlorine Storage Room	Dampers opens to exhaust air	Dampers Normally Closed

END OF CHAPTER 5

6 COMPONENT DETAILS

6.1 TYPICAL UNIT HEATER & FORCE FLOW HEATER FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical unit heater and force flow heater.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Unit Heaters & Force Flow Heaters	Engineered Air Unit Heaters: H Series: M/N: H-3 Force Flow: CUH Series: M/N: CUH-7		Supplier: Engineered Air Edmonton, AB
2	Room Thermostat	Robertshaw M/N: 501-501C		Supplier: Automatic Controls Edmonton, AB
3	Manual Air Vent			Supplier: Bartle & Gibson Edmonton, AB
4	Drain Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
5	Union			Supplier: Bartle & Gibson Edmonton
6	Union			Supplier: Bartle & Gibson Edmonton
7	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
8	Balancing/Isolation Valve	Dahl Brothers Canada Ltd. M/N: 13013		Supplier: Bartle & Gibson Edmonton

6.2 TYPICAL REHEAT COIL FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to the flow a typical reheat coil.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Reheat Coils	Engineered Air Custom Built for Project		Supplier: Engineered Air Edmonton, AB

2	Room Thermostat	Invensys M/N: TA168-001		Supplier: Automatic Controls Edmonton, AB
3	Control Valve (2-way)	Invensys Reheat Coil: M/N: VS-2213-536-9-02 Wall Radiation: M/N: VM2233P23A000		Supplier: Automatic Controls Edmonton, AB
4	Manual Air Vent			Supplier: Bartle & Gibson Edmonton
5	Drain Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
6	Union			Supplier: Bartle & Gibson Edmonton
7	Union			Supplier: Bartle & Gibson Edmonton
8	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
9	Balancing/Isolation Valve	Dahl Brothers Canada Ltd. M/N: 13013		Supplier: Bartle & Gibson Edmonton

6.3 TYPICAL AIR HANDLING UNIT PREHEAT & HEATING COILS FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a typical air handling unit preheat and heating coils.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Preheat & Heating Coils	Engineered Air Custom Built for Project Inclusive of Air Handling Units		Supplier: Engineered Air Edmonton, AB
2	Temperature Control Valve (3-way)	Invensys M/N: VS-2313-536-9-03 or 05		Supplier: Automatic Controls Edmonton, AB
3	Duct Mounted Thermostat	Invensys M/N: TS-8201		Supplier: Automatic Controls Edmonton, AB
4	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton

5	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
6	Union			Supplier: Bartle & Gibson Edmonton
7	Union			Supplier: Bartle & Gibson Edmonton
8	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
9	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
10	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
11	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
12	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
13	Balancing/Isolation Valve	Dahl Brothers Canada Ltd. M/N: 13013		Supplier: Bartle & Gibson Edmonton

6.4 HEATING PUMPS FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of a heating pump.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Primary Heating Pump P-3	Armstrong M/N: Series 4360 3D		Supplier: Wolsely Mechanical Group Edmonton, AB
2	Check Valve	Val-Matic M/N: Series 1400		Supplier: Robins Flow Tech Edmonton, AB
3	Balancing/Isolation Valve	Armstrong M/N: CBV-G Straight		Supplier: Bartle & Gibson Edmonton, AB
4	Strainer/Air Separator	Armstrong M/N: VAS-3		Supplier: Wolsely Mechanical Group Edmonton, AB
5	FS – Flow Switch	MacDonnell M/N: Series FS4-3		Supplier: Emco Edmonton, AB

6	Isolation Valve	Apollo M/N: Series 143		Supplier: M.A. Steward & Sons Edmonton, AB
7	PI – Pressure Indicator	H.O. Trerice Co. M/N: 620B		Supplier: Ener-tech Mechanical Sales Edmonton, AB
8	Primary Heating Pump P-4	Armstrong M/N: Series 4360 3D		Supplier: Wolsely Mechanical Group Edmonton, AB
9	Check Valve	Val-Matic M/N: Series 1400		Supplier: Robins Flow Tech Edmonton, AB
10	Balancing/Isolation Valve	Armstrong M/N: CBV-G Straight		Supplier: Bartle & Gibson Edmonton, AB
11	Strainer/Air Separator	Armstrong M/N: VAS-3		Supplier: Wolsely Mechanical Group Edmonton, AB
12	FS – Flow Switch	MacDonnell M/N: Series FS4-3		Supplier: Emco Edmonton, AB
13	Isolation Valve	Apollo M/N: Series 143		Supplier: M.A. Steward & Sons Edmonton, AB
14	PI – Pressure Indicator	H.O. Trerice Co. M/N: 620B		Supplier: Ener-tech Mechanical Sales Edmonton, AB
15	Air Separator/Strainer	Armstrong M/N: VAS-3		Supplier: Wolsely Mechanical Group Edmonton, AB
16	AAV – Automatic Air Vent			Supplier: Bartle & Gibson Edmonton, AB
17	Drain Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB
18	Isolation Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB
19	Isolation Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB
20	TI – Temperature Indicator	H.O. Trerice Co. M/N: BX-9		Supplier: Ener-tech Mechanical Sales Edmonton, AB
21	TI – Temperature Indicator	H.O. Trerice Co. M/N: BX-9		Supplier: Ener-tech Mechanical Sales Edmonton, AB
22	Isolation Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB

6.5 AIR HANDLING UNIT AHU-1 FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to an air handling unit AHU 1.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Air Handling Unit AHU-1	Engineered Air Custom Built for Project M/N: LM-3-C		Supplier: Engineered Air Edmonton, AB
2	Supply Fan	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
3	Intake Hood			
4	Outside Air Damper Motor & Outside Air Dampers	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
5	Return Air Damper Motor & Return Air Dampers	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
6	30% Filter – Summer Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
7	PD-1 – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
8	TS-1 – Temperature Sensor – Mixed Air	Invensys M/N: TS-8405		Supplier: Automatic Controls Edmonton, AB
9	30% Filter – Winter Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
10	PD-2 – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
11	Heating Coil	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
12	65% Final Filter	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
13	LTA – Low Temperature Alarm	Johnson Controls M/N: A70BA		Supplier: Automatic Controls Edmonton, AB

14	TS-2 – Temperature Sensor – Supply Air	Invensys M/N: TS-8201		Supplier: Automatic Controls Edmonton, AB
15	Room Thermostat	Invensys M/N: MN-S4		Supplier: Automatic Controls Edmonton, AB
16	Exhaust Hood			
17	Relief Air Damper Motor & Relief Air Dampers	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB
18	Exhaust Hood			
19	Barometric Relief Air Dampers	Ruskin M/N: MD35		Supplier: Aqua Air Systems Ltd Edmonton, AB

6.6 AIR HANDLING UNIT AHU-2 FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to an air handling unit AHU 2.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Air Handling Unit AHU-2	Engineered Air Custom Built for Project M/N: LM-3-C-MV		Supplier: Engineered Air Edmonton, AB
2	Supply Fan	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
3	Intake Hood			
4	Outside Air Damper Motor & Outside Air Dampers	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
5	30% Filter – Summer Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
6	PD- – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
7	Preheat Coil	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB

8	LTA – Low Temperature Alarm	Johnson Controls M/N: A70BA		Supplier: Automatic Controls Edmonton, AB
9	30% Filter – Winter Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
10	PD – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
11	Heating Coil	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
12	65% Final Filter	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
13	TS-1 – Temperature Sensor – Supply Air	Invensys M/N: TS-8201		Supplier: Automatic Controls Edmonton, AB
14	Room Thermostat	Invensys M/N: MN-S4		Supplier: Automatic Controls Edmonton, AB
15	Exhaust Fan EF-2	Penn Ventilation M/N: WFX10B		Supplier: Aqua Air Systems Ltd Edmonton, AB
16	Exhaust Fan EF-2 Damper motor & Dampers	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB
17	HS-1 – Humidity Sensor – Exhaust Air	Invensys M/N: RH200A03		Supplier: Automatic Controls Edmonton, AB
18	Exhaust Fan EF-4	Penn Ventilation M/N: WFX08B		Supplier: Aqua Air Systems Ltd Edmonton, AB
19	Exhaust Fan EF-4 Damper motor & Dampers	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB

6.7 EXHAUST FAN EF-3 FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to an exhaust fan EF 3.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Exhaust Fan EF-3	Twin City Fan & Blower M/N: 909 RBA		Supplier: Aqua Air Systems Ltd Edmonton, AB
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB
3	Manual Push Button	Allen Bradley M/N: Series 800H		Supplier: Westburne Edmonton, AB

6.8 FUEL OIL (DIESEL) FLOW SCHEMATIC

(Refer to Drawing M-301 at the end of Chapter 10)

The following table identifies the components related to the flow of fuel oil (diesel).

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Exhaust Fan EF-3	Watts M/N: V.A.G.S.T. Capacity: 250 Gallons		Supplier: Durex Steel & Alloy Industries Edmonton, AB
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB

END OF CHAPTER 6

7 TROUBLESHOOTING

7.1 ALARMS

The Water Treatment Plant process, mechanical and electrical operating systems and equipment is continuously monitored with the appropriate alarms indicated if there is a system or equipment failure.

Alarms with dial out to plant operator have been previously provided for the existing boiler system in event of a primary heating system failure.

The heating pumps system have been provided with a local alarm in event of a heating pump failure.

A fuel oil low level alarm is provided for the fuel oil system day tank.

7.2 HEATING OPERATION FAILURE

7.2.1 UNIT HEATERS NOT OPERATIONAL

- Check for power to unit heater motor.
- Check unit heater thermostat control and setting.
- Check for possible obstructions in the heating piping including closed isolation valves.
- Check for air lock in heating system.
- Correct fault as required.

7.2.2 REHEAT COILS NOT OPERATIONAL

- Check 2-way valve operation.
- Check 2-way valve thermostat control and settings.
- Check for possible obstructions in the heating piping including closed isolation valves.
- Check for air lock in heating system.
- Correct fault as required.

7.2.3 AIR HANDLING UNITS PREHEAT & HEATING COILS NOT OPERATIONAL

- Check 3-way valve operation.
- Check 3-way valve control system operating parameters and settings.
- Check for possible obstructions in the heating piping including closed isolation valves.

- Check for air lock in heating system.
- Correct fault as required.

7.2.4 HEATING PUMPS WILL NOT START UP

- Check for power to heating pump.
- Check heating pump control system operating parameters and settings.
- Correct fault as required.

7.2.5 BOILERS LOCKED OUT ON LOW FLOW

- Check flow switch operation.
- Check heating pump operation.
- Check for possible obstructions in the heating piping including closed isolation valves.
- Check strainers.
- Correct fault as required.

7.3 AIR HANDLING UNIT OPERATION FAILURE

7.3.1 AIR HANDLING UNIT WILL NOT START UP

- Check low discharge temperature lockout controller.
- Check AHU control system operating parameters and settings.
- Check dampers, damper motors, linkages, and end switches
- Correct fault as required.

7.3.2 AIR HANDLING UNIT SUPPLY FAN WILL NOT START UP

- Check for power to motor.
- Check for broken belts.
- Check blower wheel bearings and binding of blower wheel.
- Correct fault as required.

7.3.3 AIR HANDLING UNIT LOW SUPPLY AIR DISCHARGE TEMPERATURE

- Check AHU heating control system operating parameters and settings.
- Refer to Item 7.2.3 in this chapter

- Correct fault as required.

7.3.4 AIR HANDLING UNIT LOW DISCHARGE AIR VOLUME

- Check for dirty/plugged filters.
- Check for dirty/plugged preheat/heating coils.
- Correct fault as required.

7.4 EXHAUST FAN OPERATION FAILURE

7.4.1 EXHAUST FAN WILL NOT START UP

- Check control system operating parameters, settings, and interlocks.
- Check dampers, damper motors, linkages, and end switches
- Check for power to exhaust fan motor.
- Check for broken belts.
- Check blower wheel bearings and binding of blower wheel.
- Correct fault as required.

7.5 RELIEF DAMPER OPERATION FAILURE

7.5.1 RELIEF DAMPER WILL NOT OPEN UP

- Check control system operating parameters, settings, and interlocks.
- Check dampers, damper motors, linkages, and end switches

END OF CHAPTER 7

8 MAINTENANCE PROCEDURES AND SERVICE INFORMATION

8.1 GENERAL

To ensure uninterrupted use, equipment should be regularly inspected, tested, and proper repairs made and recorded. The objective is to minimize equipment operating problems and prevent failures by making minor or necessary repairs before major difficulties occur. The importance of record keeping cannot be over-emphasized. Good maintenance protects the owner’s interest with manufacturer warranties, continuity, or maintenance despite staff turnovers and equipment reliability track record.

Environmental and operating conditions are key elements affecting proper and reliable operation of equipment. Costly repairs can be minimized if the following items are attended to:

KEEP IT CLEAN

KEEP IT TIGHT

8.1.1 KEEP IT CLEAN

Day-to day accumulation of normal atmospheric particles, lint, metallic particles form mechanical equipment cause problems with equipment over a long period of time. An accumulation affects equipment reliability and operating life. ALL equipment should be regularly cleaned.

8.1.2 KEEP IT TIGHT

All contactors and control devices operate with high-speed movement. This motion creates vibration that can loosen hardware and other parts. External vibration from equipment may cause the loosening of hardware and connections in any equipment. All hardware and connections should be tightened regularly. This simple procedure takes only a small amount of time and can save hours of searching for intermittent problems. All rotating equipment such as motors are affected by vibrations. This can cause alignment problems which can result in bearing failures.

8.2 RENEWAL PARTS

Availability of parts can be a major problem these days as distributors are keeping very low inventories in a move to economize. This may make any part a long delivery item. For this reason, local distributors should be contacted to assess the availability of parts. Any critical part affecting the reliability of the system should be ordered, recorded, and stored by the maintenance department.

8.3 PARTS AND EQUIPMENT ORDERING PROCEDURE

During the first year of operation, the Contractor should be contacted for any replacement parts required. This will ensure that parts covered by warranty will be replaced under warranty. Failure to contact the Contractor may result in difficulties in obtaining warranty replacement.

Following the first year of operation, it is recommended that the Contractor also be contacted as many of the suppliers have a wholesale only policy. If it is necessary to purchase parts directly from the original supplier, the following information is required.

- Make
- Model No.
- Year of Installation
- Installing Contractor
- Description of Part Required (ie. Fan Bearing)
- Part No. if Available

When quoting a part number contained in manufacturer’s catalogue, always provide the date of the catalogue you are referring to, as these numbers are often subject to change. The equipment supplier will have the latest edition of the manufacturer’s catalogue.

If the original supplier is no longer in business, contact the contractor who will be able to suggest an alternate source of supply.

8.4 SCHEDULED PREVENTIVE MAINTENANCE PROGRAM

Scheduled preventive maintenance is an effective means to improve services from systems and equipment. Where failure of equipment can result in shutdown, scheduled preventive maintenance is an economical alternative.

8.4.1 CAUSES OF EQUIPMENT FAILURE

An effective maintenance program will attempt to remove or reduce causes of equipment failure. Common failure initiating causes are:

- Loose and broken belts
- Misaligned pulleys
- Dirty or plugged filters
- Dirty or plugged coils

- Worn bearings
- Improper lubrication and oiling or lack of
- Persistent overloading
- Above normal temperatures
- Below normal temperatures
- Obstruction of ventilation by foreign objects or material (blockage of air, dirt on components etc.)
- Normal deterioration from age
- Severe weather conditions

The scheduled preventive maintenance suggestions presented will be applicable to most equipment, but all of the suggestions given in any one section may not be applicable to the particular mechanical component being maintained. When equipment repair is necessary, refer to the Manufacturer Data section provided in this manual.

Most maintenance can be done by general WTP staff, with a minimum need for specialized service. Refer to the maintenance legend provided below.

D	Daily
W	Weekly
M	Monthly
SA	Semi-Annually
A	Annually
PMI	As per Manufacturer’s Instructions
AN	As Necessary

8.5 HEATING SYSTEM

8.5.1 UNIT HEATERS AND FORCE FLOW HEATERS

Refer to Unit Heater and Force Flow Heater Operation and Maintenance Data.

Check controls and thermostat	M
Clean unit heating coil	M
Visually inspect fan operation and electrical connections	M
Replace or clean force flow heater filters	M

8.5.2 HEATING PUMPS

Refer to Heating Pump Operation and Maintenance Data.

Record voltage and amperage	A
Check terminals for corrosion or loose leads	A
Blow out motor windings with compressed air	A
Check and clean strainers	AN

8.5.3 REMOVAL OF HEATING PUMP FOR SERVICE

If the duty pump will not start, it may be necessary to remove the duty pump for servicing.

- Switch over to the Backup Heating Pump for duty service and open isolation valves.
- Close the pump isolation valves to isolate the pump and have an electrician disconnect the pump.
- After repair of the pump is completed, reinstall the pump in reverse order.
- Start-up pump to verify operation.
- The Heating pumps can be left as is, making the Backup Heating Pump as the duty pump or returning the heating pumps back to normal operating condition.

8.6 VENTILATION SYSTEM

8.6.1 AIR HANDLING UNITS AND EXHAUST FANS

Refer to Air Handling Units and Exhaust Fans Operation and Maintenance Data.

Check for unusual noise or vibration and if observed, check bearings and belt	M
Check for belt slipping and wear	M
Check pulley sheaves for wear	A
Lubricate bearings	PMI
Check fan blades/wheel for grease and dirt and clean as required	A
Check all bolts and fasteners	M
Check filters and clean or replace as required	M
Check and clean preheat and heating coil fins	M
Check that outside air intake screens are clean	M
Check that all dampers operate without binding	M
Ensure spring tension is adequate to close dampers	M
Check motor amperage draw	A
Record voltage and amperage	A
Check terminals for corrosion or loose leads	A
Blow out motor windings with compressed air	A

8.6.2 CONTROLS

Check safety controls and ensure shut down is activated	D
Check temperature sensor calibration	M
Clean all points and contacts on control system	M
Check control valves for positive shut off	M

END OF CHAPTER 8

9 TESTING AND CERTIFICATION DATA

10 SKETCHES AND DRAWINGS

Sketches illustrating the general operating conditions at the WTP are provided at the end of this chapter and include the following:

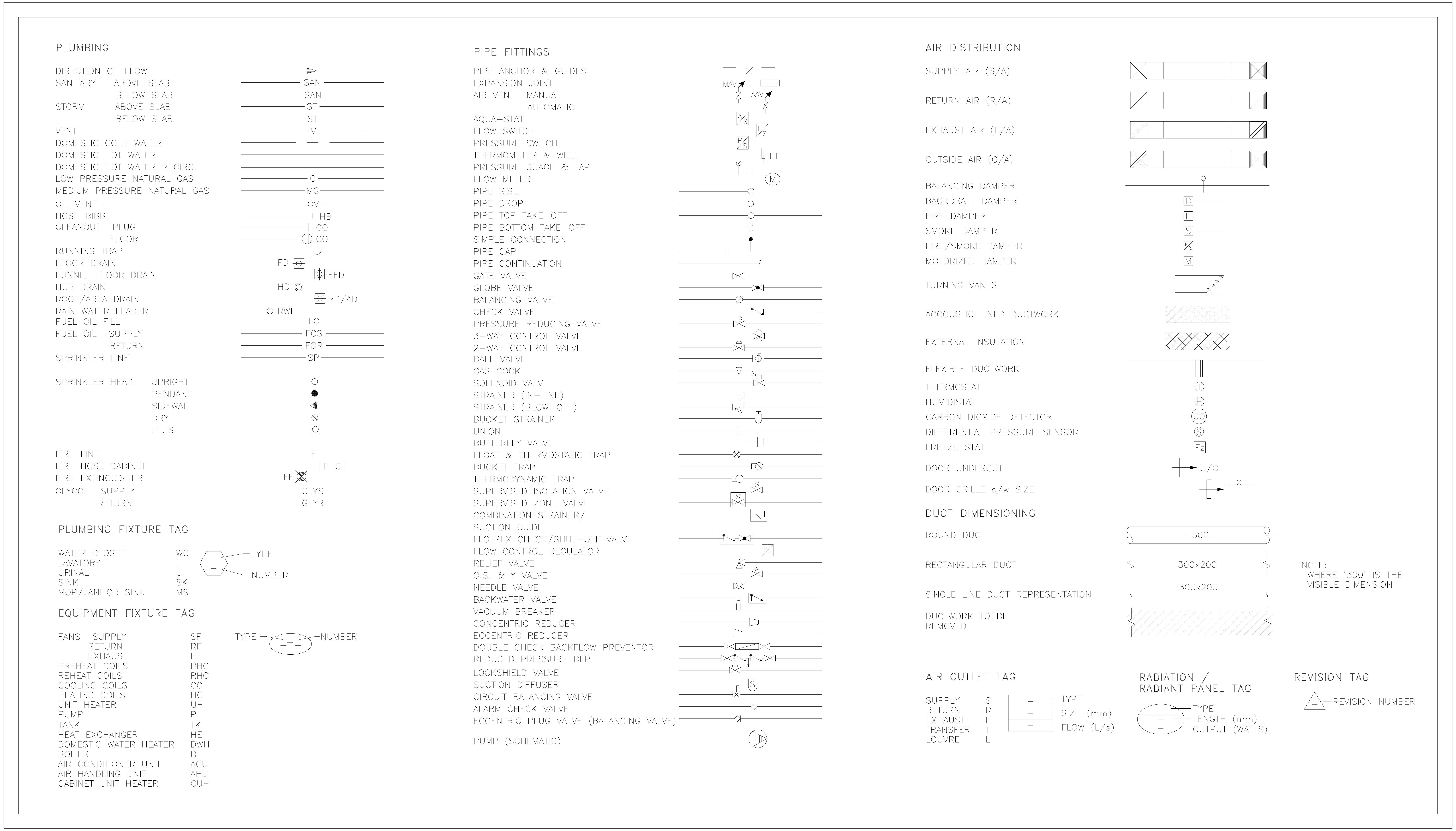
M-001	**Legend**
M-101	**Upper Floor Mechanical Layout**
M-102	**Lower Floor Mechanical Layout**
M-301	**Schematics and Details**

11 MANUFACTURER’S DATA

Manufacturer data for the equipment installed/replaced as part of the 2021-2022 WTP Upgrades Project (WSP No. 211-12487-00) are appended to this Chapter.

A: Mechanical Room Boiler Replacement (Pending Installation)

B: Mechanical Room Heat Exchangers Replacement (Pending Installation)



PLUMBING

DIRECTION OF FLOW	
SANITARY ABOVE SLAB	SAN
BELOW SLAB	SAN
STORM ABOVE SLAB	ST
BELOW SLAB	ST
VENT	V
DOMESTIC COLD WATER	
DOMESTIC HOT WATER	
DOMESTIC HOT WATER RECIRC.	
LOW PRESSURE NATURAL GAS	G
MEDIUM PRESSURE NATURAL GAS	MG
OIL VENT	OV
HOSE BIBB	HB
CLEANOUT PLUG	CO
FLOOR	CO
RUNNING TRAP	
FLOOR DRAIN	FD
FUNNEL FLOOR DRAIN	FFD
HUB DRAIN	HD
ROOF/AREA DRAIN	RD/AD
RAIN WATER LEADER	RWL
FUEL OIL FILL	FO
FUEL OIL SUPPLY	FOS
RETURN	FOR
SPRINKLER LINE	SP
SPRINKLER HEAD UPRIGHT	○
PENDANT	●
SIDEWALL	◀
DRY	⊗
FLUSH	⧇
FIRE LINE	F
FIRE HOSE CABINET	FHC
FIRE EXTINGUISHER	FE
GLYCOL SUPPLY	GLYS
RETURN	GLYR

PLUMBING FIXTURE TAG

WATER CLOSET	WC
LAVATORY	L
URINAL	U
SINK	SK
MOP/JANITOR SINK	MS

TYPE
NUMBER

EQUIPMENT FIXTURE TAG

FANS SUPPLY	SF
RETURN	RF
EXHAUST	EF
PREHEAT COILS	PHC
REHEAT COILS	RHC
COOLING COILS	CC
HEATING COILS	HC
UNIT HEATER	UH
PUMP	P
TANK	TK
HEAT EXCHANGER	HE
DOMESTIC WATER HEATER	DWH
BOILER	B
AIR CONDITIONER UNIT	ACU
AIR HANDLING UNIT	AHU
CABINET UNIT HEATER	CUH

TYPE
NUMBER

PIPE FITTINGS

PIPE ANCHOR & GUIDES	
EXPANSION JOINT	
AIR VENT MANUAL	MAV
AUTOMATIC	AAV
AQUA-STAT	A/S
FLOW SWITCH	F/S
PRESSURE SWITCH	P/S
THERMOMETER & WELL	
PRESSURE GUAGE & TAP	
FLOW METER	M
PIPE RISE	
PIPE DROP	
PIPE TOP TAKE-OFF	
PIPE BOTTOM TAKE-OFF	
SIMPLE CONNECTION	
PIPE CAP	
PIPE CONTINUATION	
GATE VALVE	
GLOBE VALVE	
BALANCING VALVE	
CHECK VALVE	
PRESSURE REDUCING VALVE	
3-WAY CONTROL VALVE	
2-WAY CONTROL VALVE	
BALL VALVE	
GAS COCK	
SOLENOID VALVE	S
STRAINER (IN-LINE)	
STRAINER (BLOW-OFF)	
BUCKET STRAINER	
UNION	
BUTTERFLY VALVE	
FLOAT & THERMOSTATIC TRAP	
BUCKET TRAP	
THERMODYNAMIC TRAP	
SUPERVISED ISOLATION VALVE	S
SUPERVISED ZONE VALVE	S
COMBINATION STRAINER/ SUCTION GUIDE	
FLOTREX CHECK/SHUT-OFF VALVE	
FLOW CONTROL REGULATOR	
RELIEF VALVE	
O.S. & Y VALVE	
NEEDLE VALVE	
BACKWATER VALVE	
VACUUM BREAKER	
CONCENTRIC REDUCER	
ECCENTRIC REDUCER	
DOUBLE CHECK BACKFLOW PREVENTOR	
REDUCED PRESSURE BFP	
LOCKSHIELD VALVE	
SUCTION DIFFUSER	S
CIRCUIT BALANCING VALVE	
ALARM CHECK VALVE	
ECCENTRIC PLUG VALVE (BALANCING VALVE)	
PUMP (SCHEMATIC)	

AIR DISTRIBUTION

SUPPLY AIR (S/A)	
RETURN AIR (R/A)	
EXHAUST AIR (E/A)	
OUTSIDE AIR (O/A)	
BALANCING DAMPER	
BACKDRAFT DAMPER	B
FIRE DAMPER	F
SMOKE DAMPER	S
FIRE/SMOKE DAMPER	F/S
MOTORIZED DAMPER	M
TURNING VANES	
ACCOUSTIC LINED DUCTWORK	
EXTERNAL INSULATION	
FLEXIBLE DUCTWORK	
THERMOSTAT	T
HUMIDISTAT	H
CARBON DIOXIDE DETECTOR	CO
DIFFERENTIAL PRESSURE SENSOR	S
FREEZE STAT	Fz
DOOR UNDERCUT	U/C
DOOR GRILLE c/w SIZE	__x__

DUCT DIMENSIONING

ROUND DUCT	300
RECTANGULAR DUCT	300x200
SINGLE LINE DUCT REPRESENTATION	300x200
DUCTWORK TO BE REMOVED	

NOTE:
WHERE '300' IS THE VISIBLE DIMENSION

AIR OUTLET TAG

SUPPLY	S
RETURN	R
EXHAUST	E
TRANSFER	T
LOUVRE	L

TYPE
SIZE (mm)
FLOW (L/s)

RADIATION / RADIANT PANEL TAG

TYPE
LENGTH (mm)
OUTPUT (WATTS)

REVISION TAG

REVISION NUMBER

1
M-001
MECHANICAL LEGEND
NTS

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CLIENT:
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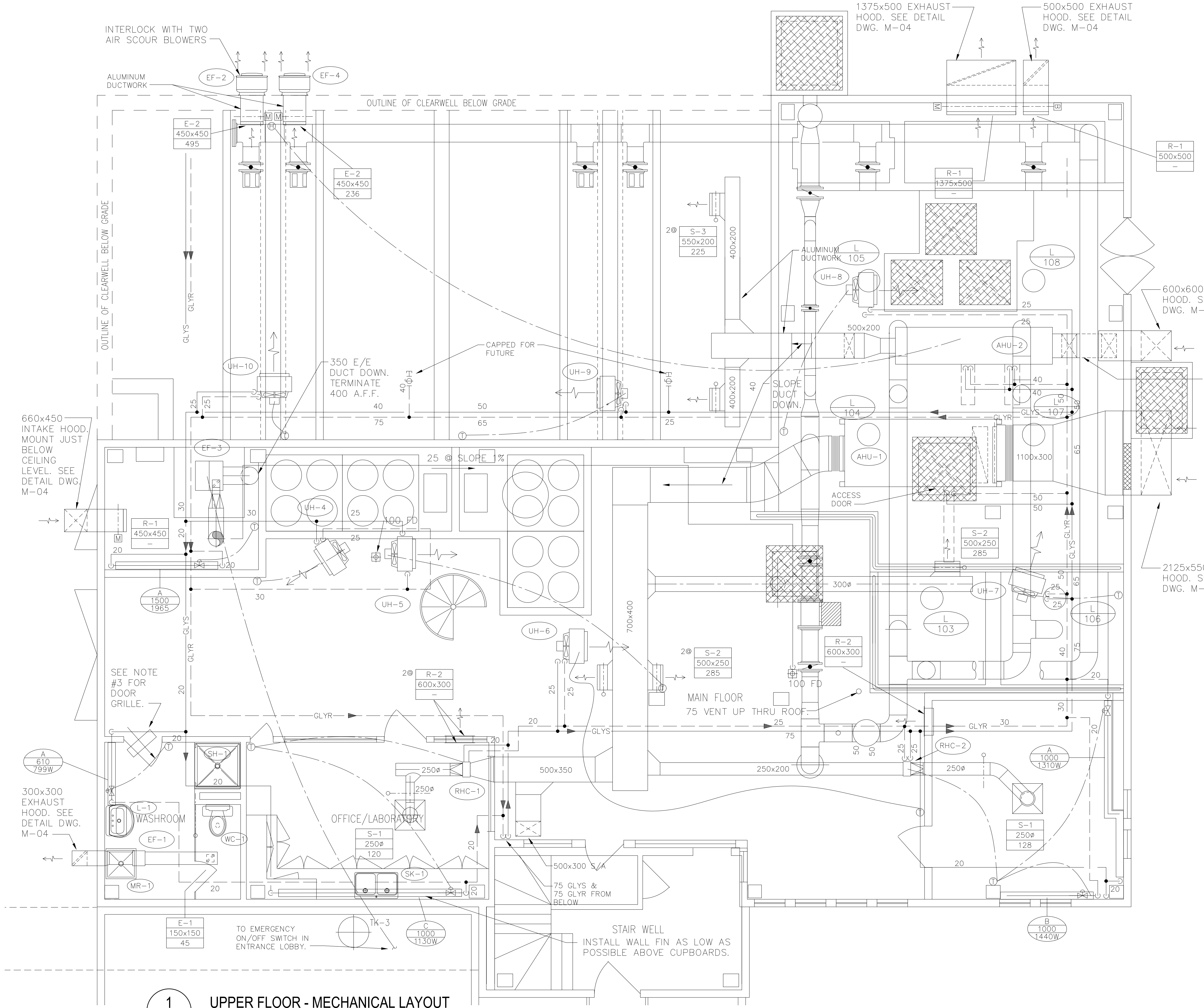
Iqaluit
CITY OF IQALUIT
CLIENT REF. #:

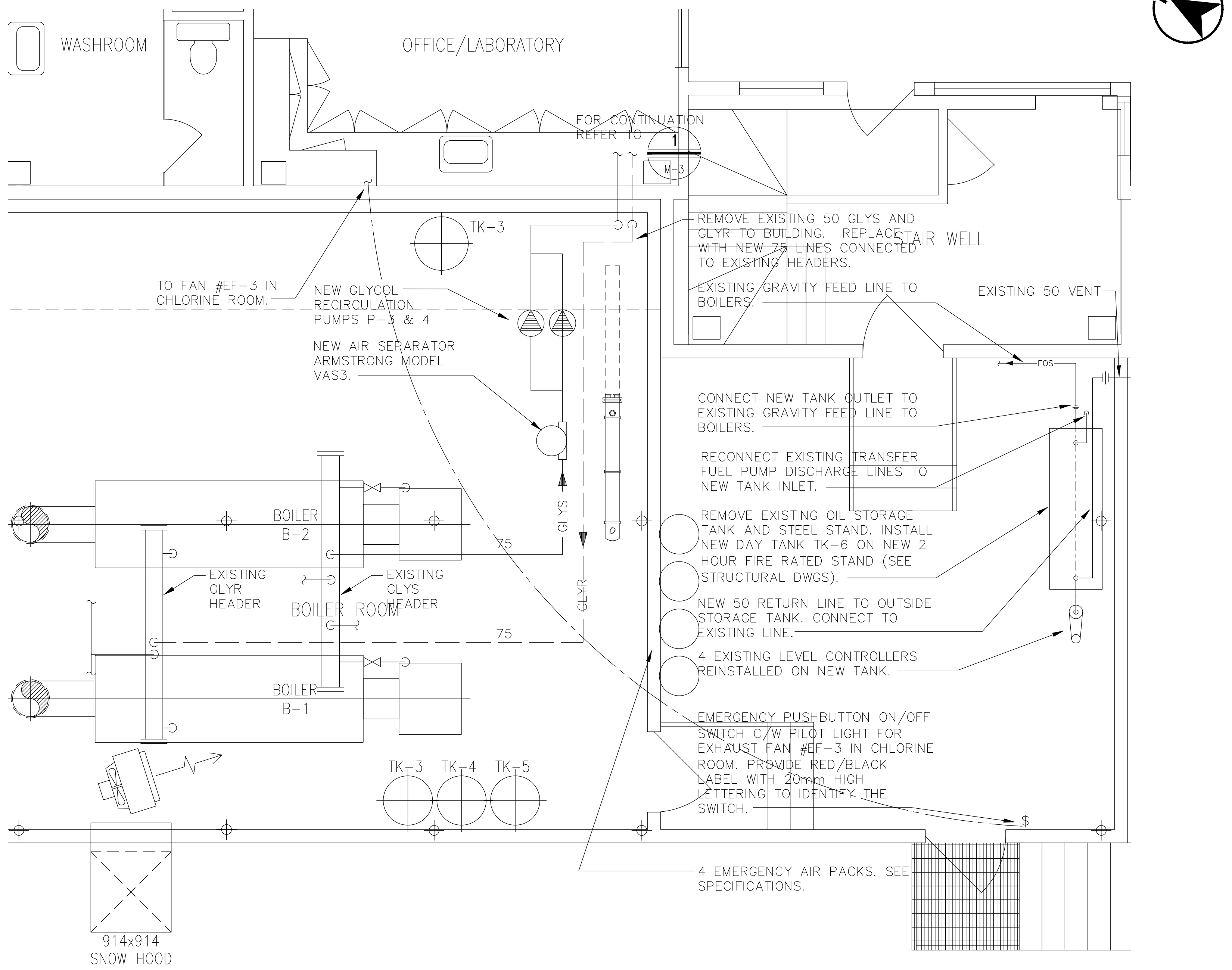
PROJECT:
IQALUIT
WATER TREATMENT PLANT
PROJECT NO: 211-12487-00
DATE: 2021/11/23

WSP
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
WWW.WSP.COM

ORIGINAL SCALE: AS NOTED
TITLE: LEGEND
SHEET NUMBER: M-001
DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: MECHANICAL
ISSUE: FOR INFORMATION ONLY
2022/03/28
REV #: -


INTERLOCK WITH TWO AIR SCOUR BLOWERS
ALUMINUM DUCTWORK
EF-2
EF-4
OUTLINE OF CLEARWELL BELOW GRADE
E-2 450x450 495
E-2 450x450 236
1375x500 EXHAUST HOOD. SEE DETAIL DWG. M-04
500x500 EXHAUST HOOD. SEE DETAIL DWG. M-04
R-1 500x500 –
R-1 1375x500 –
S-3 550x200 225
400x200
ALUMINUM DUCTWORK
L 105
L 108
UH-8
600x600 INTAKE HOOD. SEE DETAIL DWG. M-04
500x200
AHU-2
475x300
350 E/E DUCT DOWN. TERMINATE 400 A.F.F.
CAPPED FOR FUTURE
UH-10
UH-9
SLOPE DUCT DOWN.
L 104
L 107
GLYS
GLYR
660x450 INTAKE HOOD. MOUNT JUST BELOW CEILING LEVEL. SEE DETAIL DWG. M-04
EF-3
25 @ SLOPE 1%
AHU-1
1100x300
ACCESS DOOR
R-1 450x450 –
UH-4
100 FD
S-2 500x250 285
UH-5
300ø
UH-7
2125x550 INTAKE HOOD. SEE DETAIL DWG. M-04
A 1500 1965
UH-6
700x400
L 103
L 106
SEE NOTE #3 FOR DOOR GRILLE.
2@ R-2 600x300 –
2@ S-2 500x250 285
R-2 600x300 –
100 FD
MAIN FLOOR 75 VENT UP THRU ROOF.
GLYR
GLYS
GLYR
A 610 799W
SH-1
500x350
250x200
RHC-2
250ø
A 1000 1310W
300x300 EXHAUST HOOD. SEE DETAIL DWG. M-04
L-1
WASHROOM
EF-1
WC-1
OFFICE/LABORATORY
RHC-1
S-1 250ø 120
S-1 250ø 128
SK-1
MR-1
500x300 S/A
75 GLYS & 75 GLYR FROM BELOW
STAIR WELL INSTALL WALL FIN AS LOW AS POSSIBLE ABOVE CUPBOARDS.
B 1000 1440W
E-1 150x150 45
TO EMERGENCY ON/OFF SWITCH IN ENTRANCE LOBBY.
TK-3
C 1000 1130W

1 M-101 **UPPER FLOOR - MECHANICAL LAYOUT**
1:50


WASHROOM
OFFICE/LABORATORY
FOR CONTINUATION REFER TO 1 M-3
TK-3
STAIR WELL
REMOVE EXISTING 50 GLYS AND GLYR TO BUILDING. REPLACE WITH NEW 75 LINES CONNECTED TO EXISTING HEADERS.
TO FAN #EF-3 IN CHLORINE ROOM.
NEW GLYCOL RECIRCULATION PUMPS P-3 & 4
EXISTING GRAVITY FEED LINE TO BOILERS.
EXISTING 50 VENT
FOS
NEW AIR SEPARATOR ARMSTRONG MODEL VAS3.
CONNECT NEW TANK OUTLET TO EXISTING GRAVITY FEED LINE TO BOILERS.
RECONNECT EXISTING TRANSFER FUEL PUMP DISCHARGE LINES TO NEW TANK INLET.
BOILER B-2
GLYS
75
REMOVE EXISTING OIL STORAGE TANK AND STEEL STAND. INSTALL NEW DAY TANK TK-6 ON NEW 2 HOUR FIRE RATED STAND (SEE STRUCTURAL DWGS).
EXISTING GLYR HEADER
BOILER ROOM
EXISTING GLYS HEADER
GLYR
NEW 50 RETURN LINE TO OUTSIDE STORAGE TANK. CONNECT TO EXISTING LINE.
75
4 EXISTING LEVEL CONTROLLERS REINSTALLED ON NEW TANK.
BOILER B-1
EMERGENCY PUSHBUTTON ON/OFF SWITCH C/W PILOT LIGHT FOR EXHAUST FAN #EF-3 IN CHLORINE ROOM. PROVIDE RED/BLACK LABEL WITH 20mm HIGH LETTERING TO IDENTIFY THE SWITCH.
TK-3
TK-4
TK-5
4 EMERGENCY AIR PACKS. SEE SPECIFICATIONS.
914x914 SNOW HOOD

2 M-101 **BOILER ROOM MECHANICAL**
1:50

NOTE:

1. FIELD RUN NEW HEATING PIPES TO PREVENT INTERFERENCE WITH NEW PROCESS PIPING.
2. INSTALL ALL THERMOSTATS ON BRACKETS MIN. 50 CLEAR OF THE WALL.
3. 400x250 DOOR GRILLE. E.H. PRICE SERIES "ATGH", BORDER STYLE "BF", FINISH "B15".

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CLIENT:
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Iqaluit
CITY OF IQALUIT
CLIENT REF. #:

PROJECT:
IQALUIT
WATER TREATMENT PLANT
PROJECT NO: 211-12487-00
DATE: 2021/11/23

WSP
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
WWW.WSP.COM

ORIGINAL SCALE: AS NOTED

TITLE:
UPPER FLOOR
MECHANICAL LAYOUT

SHEET NUMBER: M-101

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DISCIPLINE: MECHANICAL
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2022/03/28
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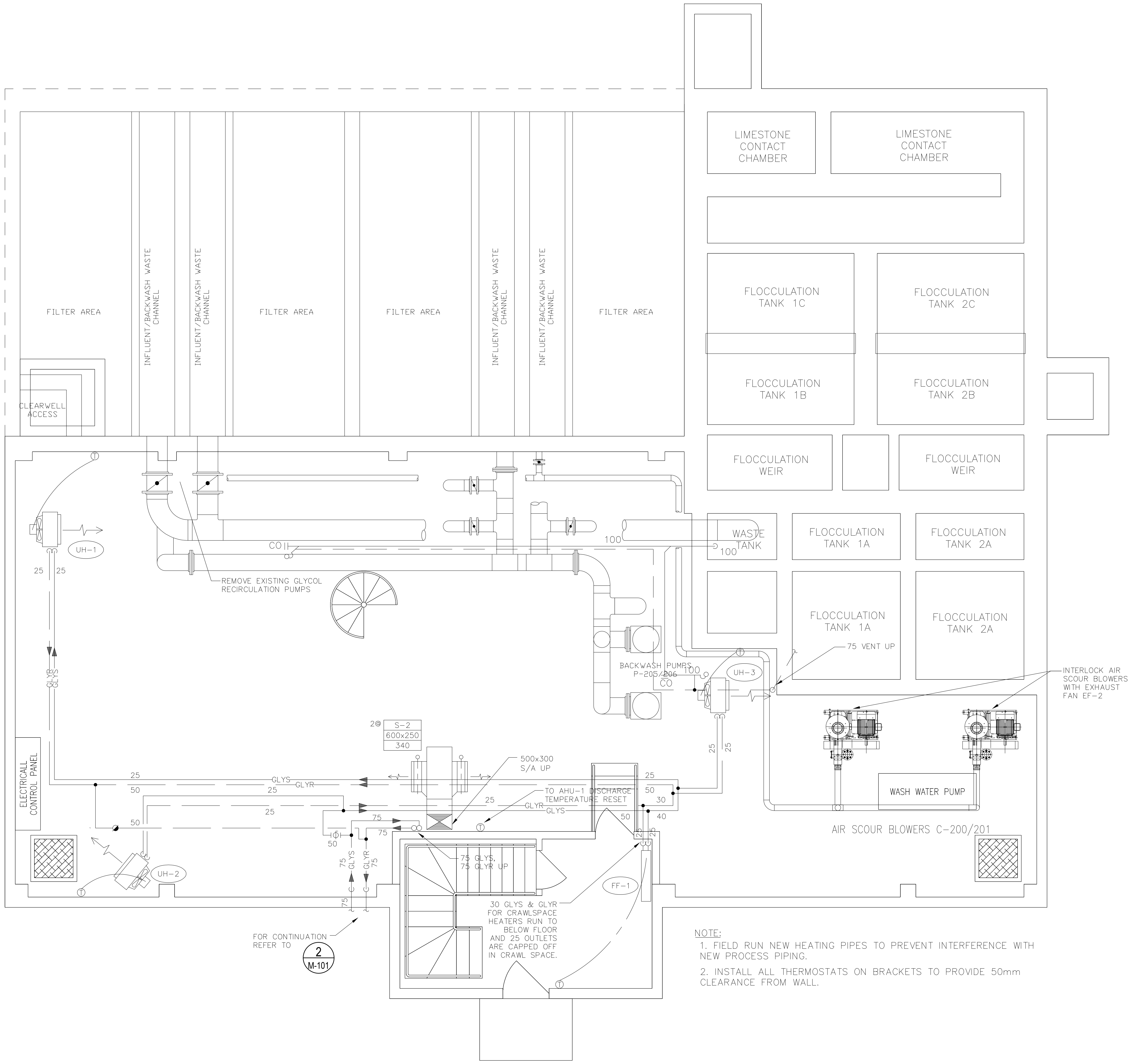

LIMESTONE CONTACT CHAMBER
LIMESTONE CONTACT CHAMBER
FLOCCULATION TANK 1C
FLOCCULATION TANK 2C
FLOCCULATION TANK 1B
FLOCCULATION TANK 2B
FLOCCULATION WEIR
FLOCCULATION WEIR
WASTE TANK
FLOCCULATION TANK 1A
FLOCCULATION TANK 2A
FLOCCULATION TANK 1A
FLOCCULATION TANK 2A
FILTER AREA
INFLUENT/BACKWASH WASTE CHANNEL
INFLUENT/BACKWASH WASTE CHANNEL
FILTER AREA
FILTER AREA
INFLUENT/BACKWASH WASTE CHANNEL
INFLUENT/BACKWASH WASTE CHANNEL
FILTER AREA
CLEARWELL ACCESS
UH-1
25
25
CO
100
100
REMOVE EXISTING GLYCOL RECIRCULATION PUMPS
BACKWASH PUMPS P-205/206
100
CO
UH-3
75 VENT UP
INTERLOCK AIR SCOUR BLOWERS WITH EXHAUST FAN EF-2
GLYR
GLYS
2@ S-2 600x250 340
500x300 S/A UP
ELECTRICALL CONTROL PANEL
25
GLYS
GLYR
50
25
25
TO AHU-1 DISCHARGE TEMPERATURE RESET
GLYR
GLYS
25
50
30
40
50
25
25
25
WASH WATER PUMP
AIR SCOUR BLOWERS C-200/201
50
75
75
50
75 GLYS
GLYR 75
75 GLYS, 75 GLYR UP
UH-2
FF-1
75
30 GLYS & GLYR FOR CRAWLSPACE HEATERS RUN TO BELOW FLOOR AND 25 OUTLETS ARE CAPPED OFF IN CRAWL SPACE.
FOR CONTINUATION REFER TO
2
M-101

NOTE:

1. FIELD RUN NEW HEATING PIPES TO PREVENT INTERFERENCE WITH NEW PROCESS PIPING.
2. INSTALL ALL THERMOSTATS ON BRACKETS TO PROVIDE 50mm CLEARANCE FROM WALL.

1 M-102 LOWER FLOOR - MECHANICAL PLAN

1:50

IS	RE	DATE	DESCRIPTION
1	-	2022-03-28	FOR INFORMATION ONLY

SEAL:

FOR INFORMATION ONLY

CLIENT:
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Iqaluit
CITY OF IQALUIT
CLIENT REF. #:

PROJECT:
IQALUIT
WATER TREATMENT PLANT
PROJECT NO: 211-12487-00
DATE: 2021/11/23

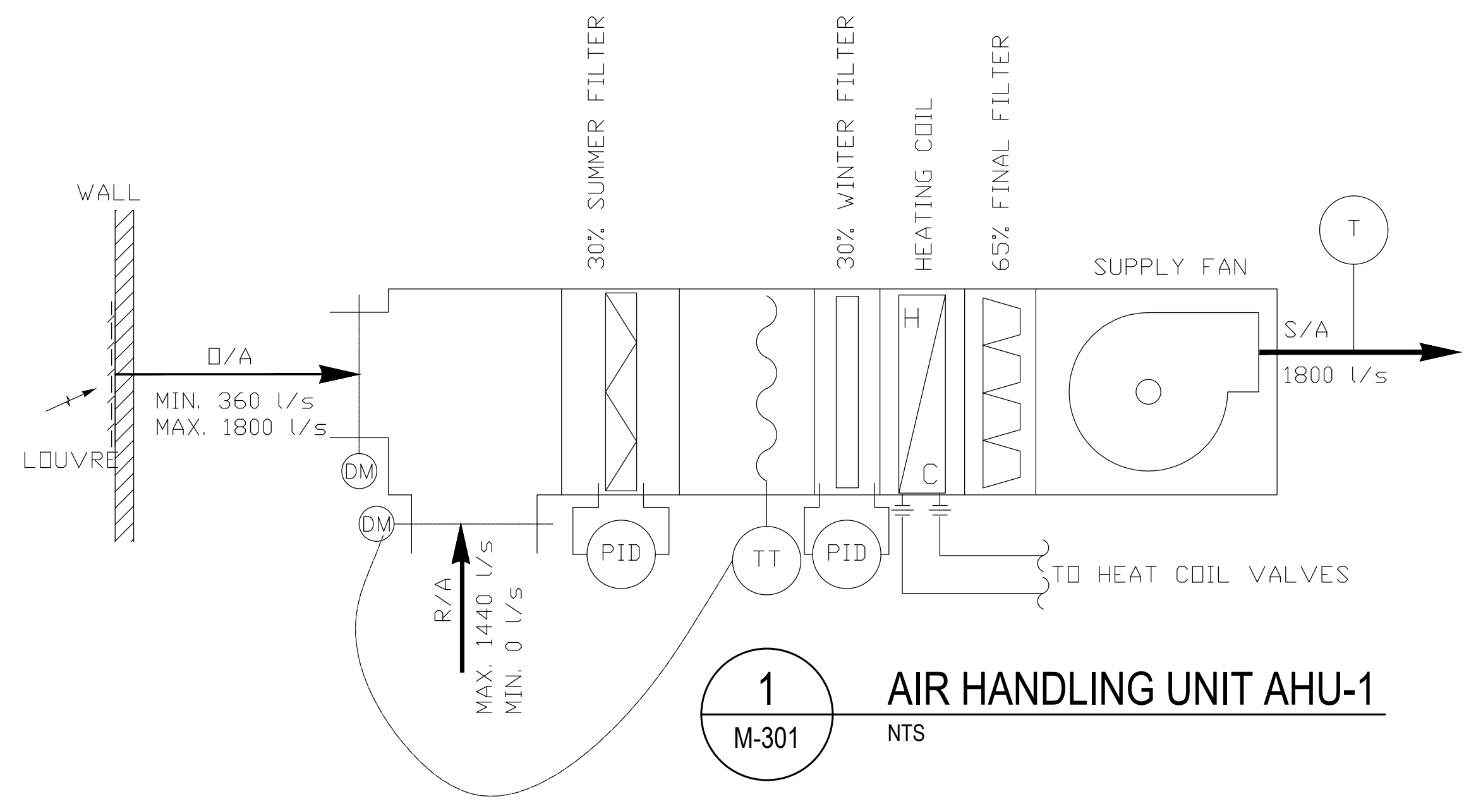
wsp
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
WWW.WSP.COM

ORIGINAL SCALE: AS NOTED

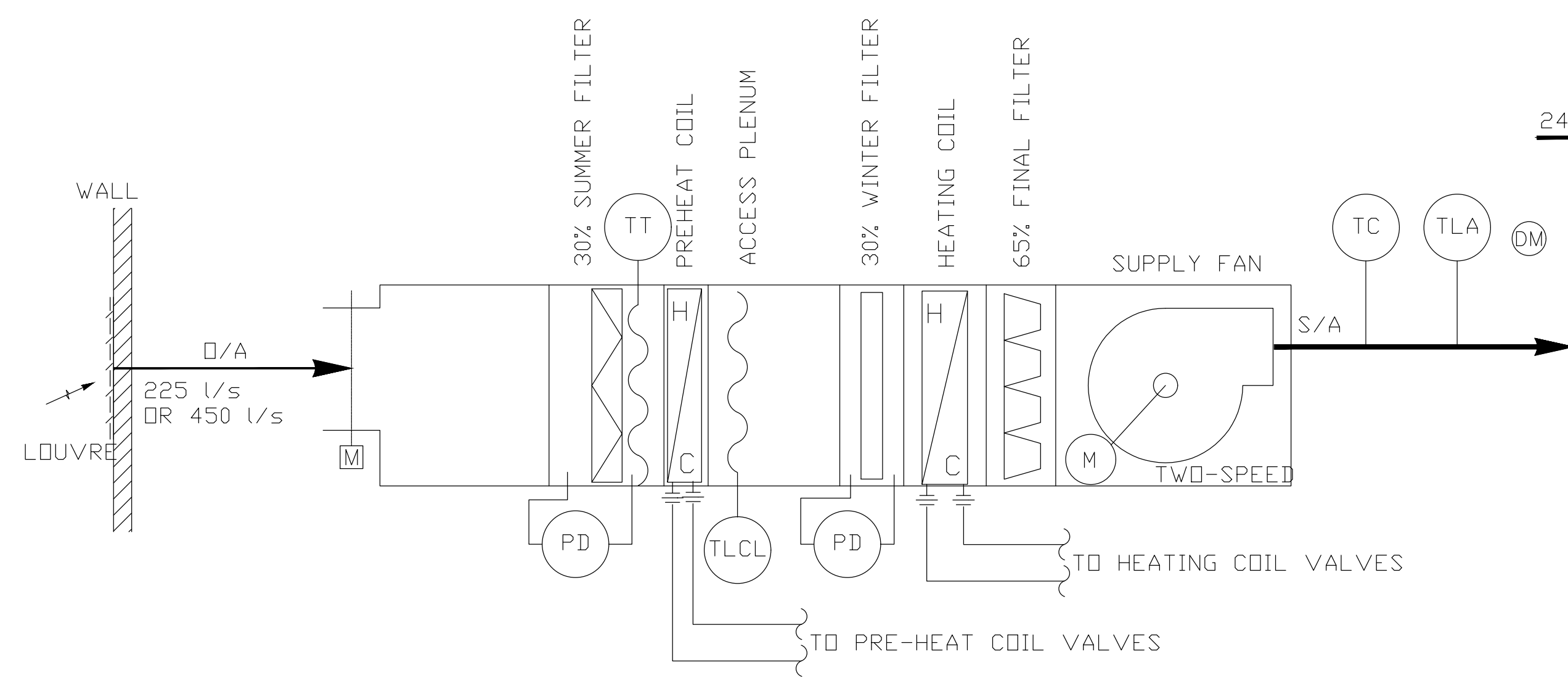
TITLE:
LOWER FLOOR
MECHANICAL LAYOUT

SHEET NUMBER: M-102

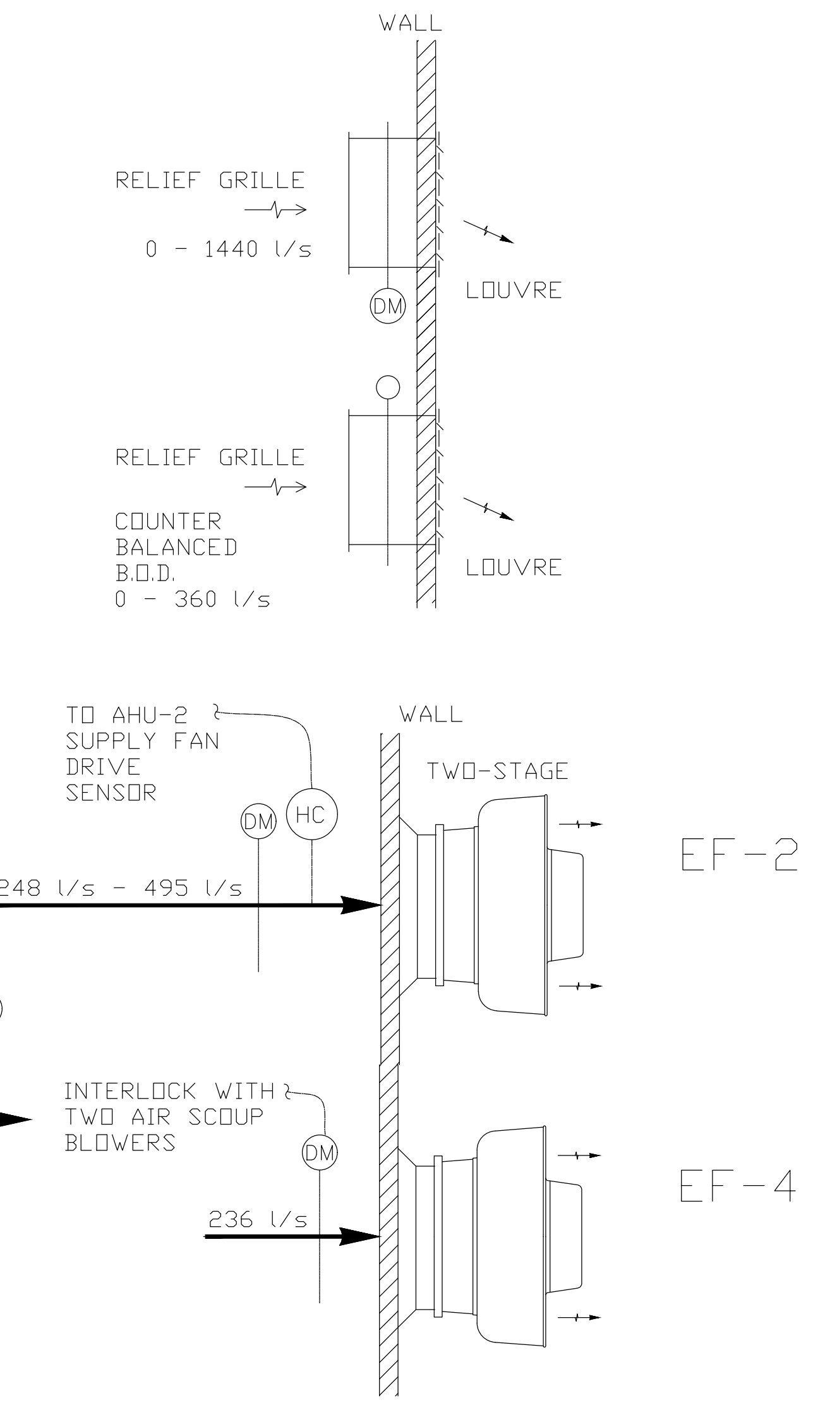
DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: MECHANICAL
ISSUE: FOR INFORMATION ONLY
2022/03/28
REV #: -



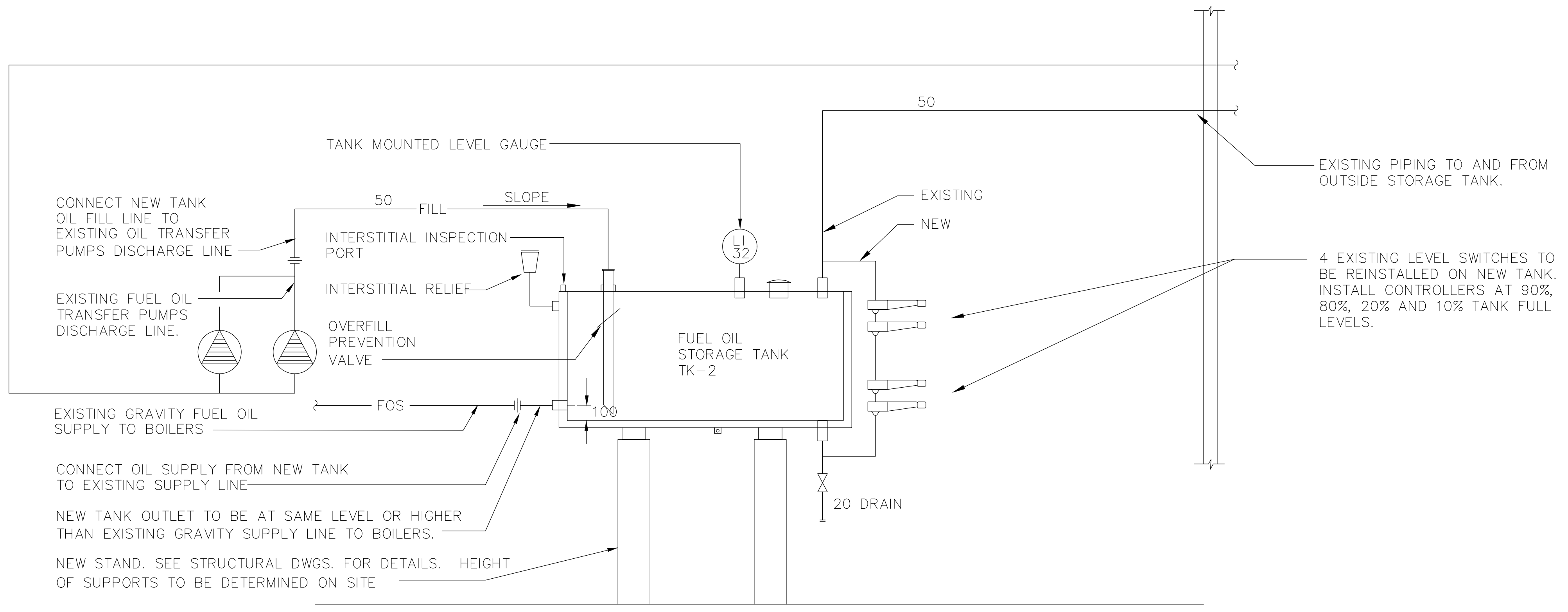
1 M-301 AIR HANDLING UNIT AHU-1
NTS



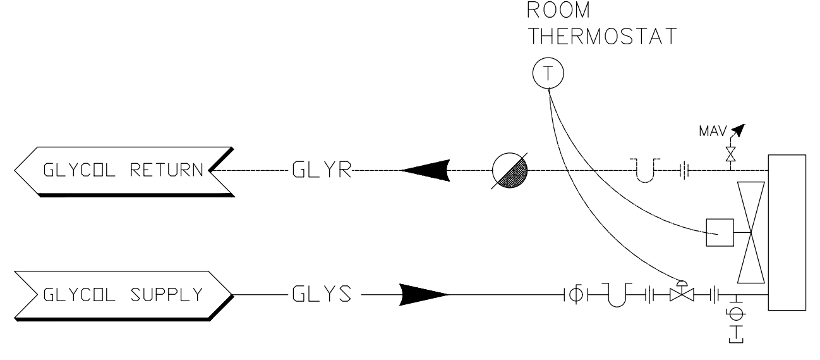
2 M-301 AIR HANDLING UNIT AHU-2
NTS



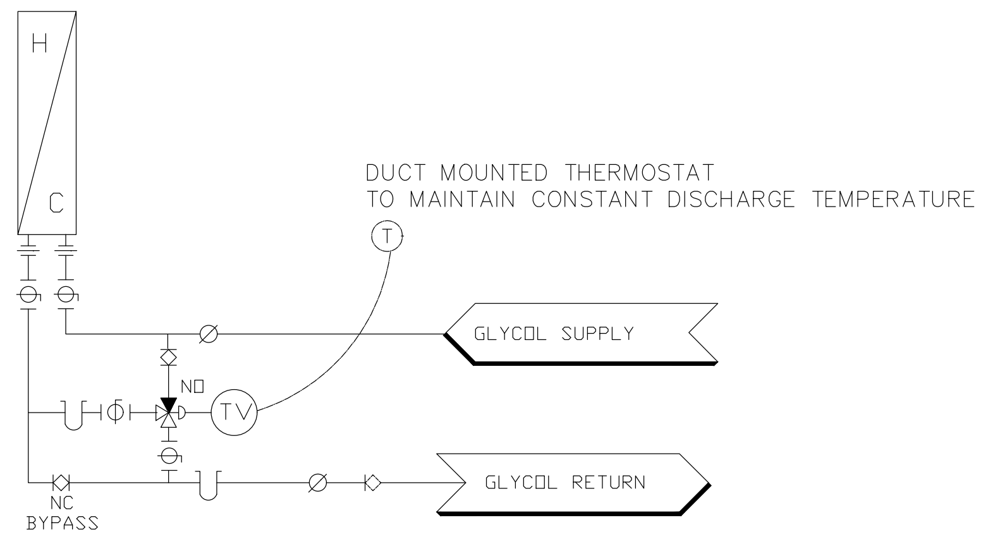
5 M-301 EXHAUST FANS EF-2/4
NTS


TANK MOUNTED LEVEL GAUGE
50
CONNECT NEW TANK
OIL FILL LINE TO
EXISTING OIL TRANSFER
PUMPS DISCHARGE LINE
50
FILL
SLOPE
INTERSTITIAL INSPECTION
PORT
INTERSTITIAL RELIEF
EXISTING FUEL OIL
TRANSFER PUMPS
DISCHARGE LINE.
OVERFILL
PREVENTION
VALVE
LI
32
FUEL OIL
STORAGE TANK
TK-2
EXISTING
NEW
EXISTING PIPING TO AND FROM
OUTSIDE STORAGE TANK.
4 EXISTING LEVEL SWITCHES TO
BE REINSTALLED ON NEW TANK.
INSTALL CONTROLLERS AT 90%,
80%, 20% AND 10% TANK FULL
LEVELS.
EXISTING GRAVITY FUEL OIL
SUPPLY TO BOILERS
FOS
100
CONNECT OIL SUPPLY FROM NEW TANK
TO EXISTING SUPPLY LINE
NEW TANK OUTLET TO BE AT SAME LEVEL OR HIGHER
THAN EXISTING GRAVITY SUPPLY LINE TO BOILERS.
NEW STAND. SEE STRUCTURAL DWGS. FOR DETAILS. HEIGHT
OF SUPPORTS TO BE DETERMINED ON SITE
20 DRAIN

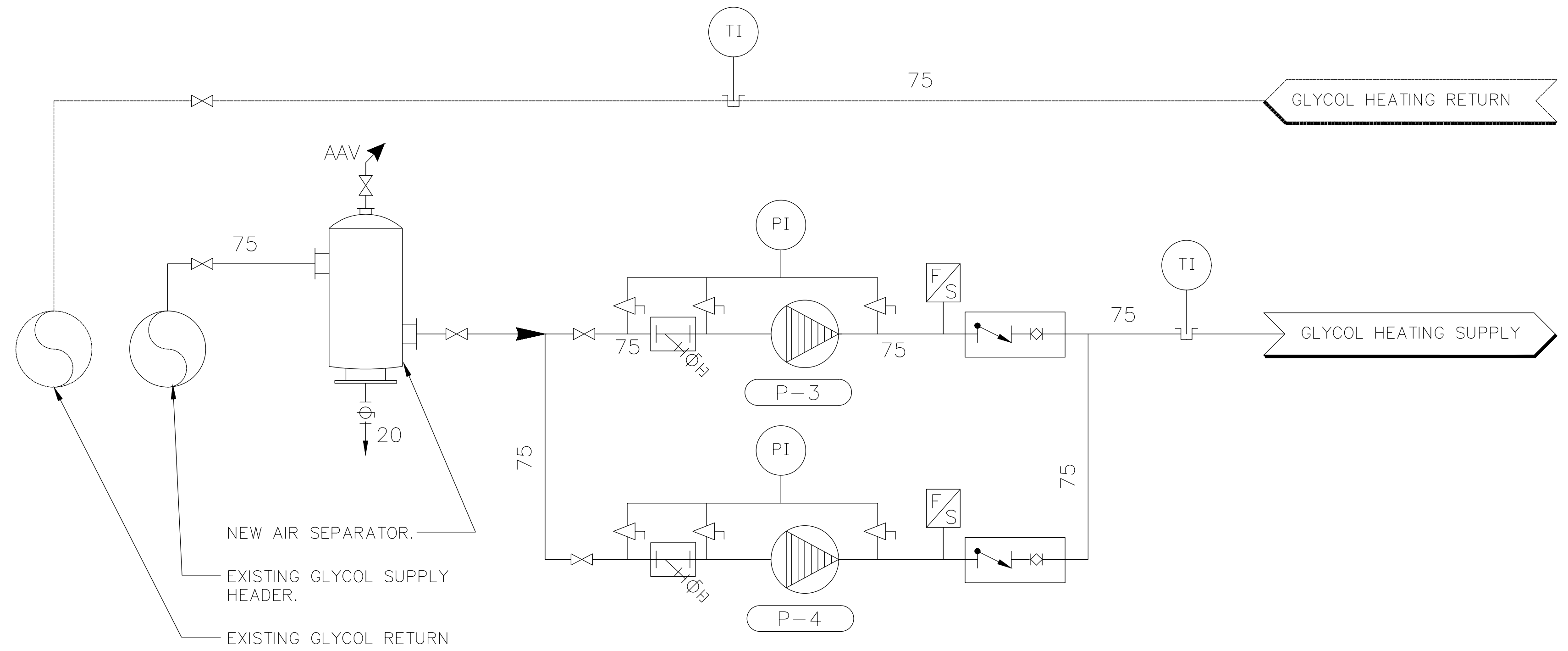
8 M-301 NEW FUEL OIL DAY TANK
NTS



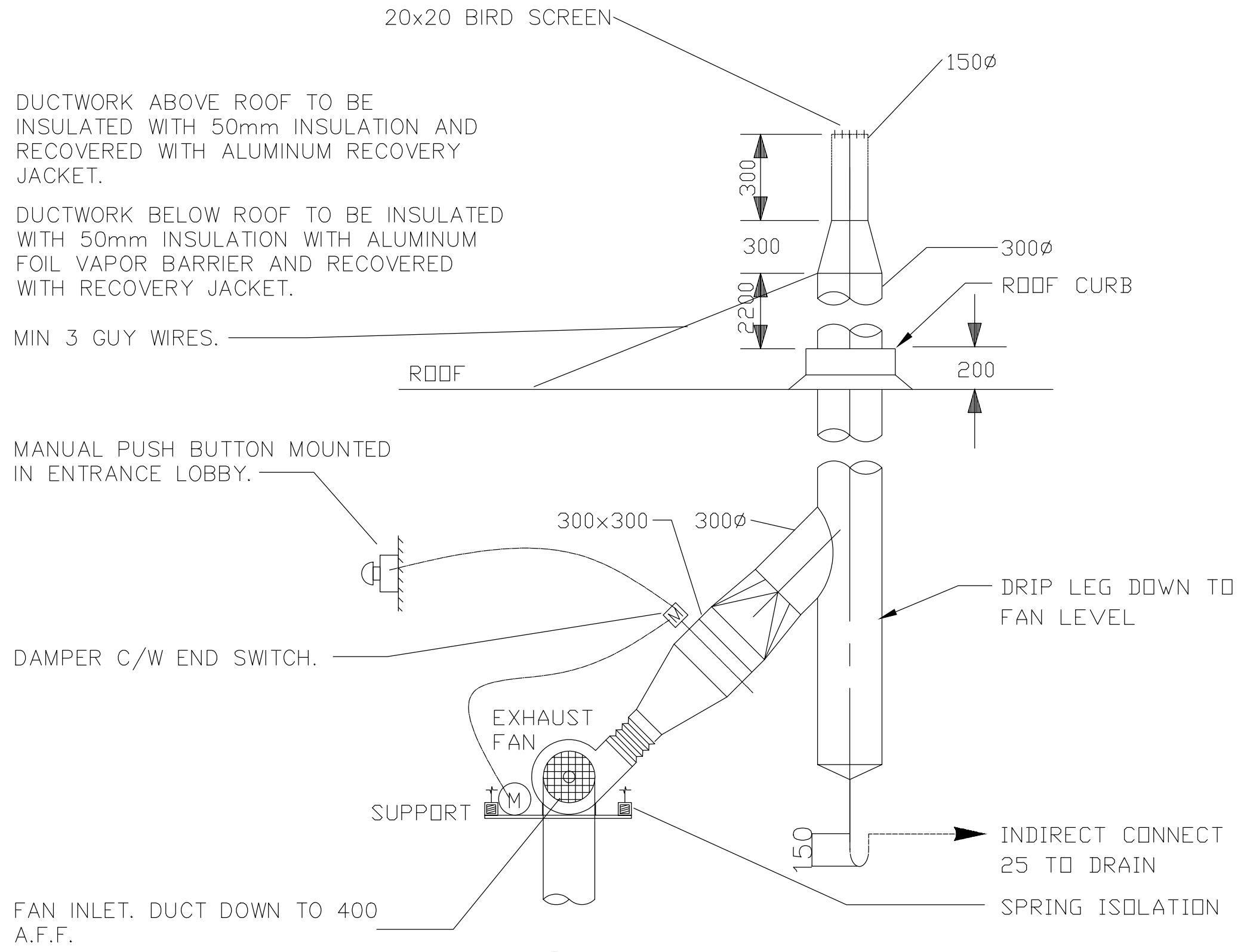
3 M-301 TYPICAL UNIT HEATER & FORCE FLOW SCHEMATIC
NTS



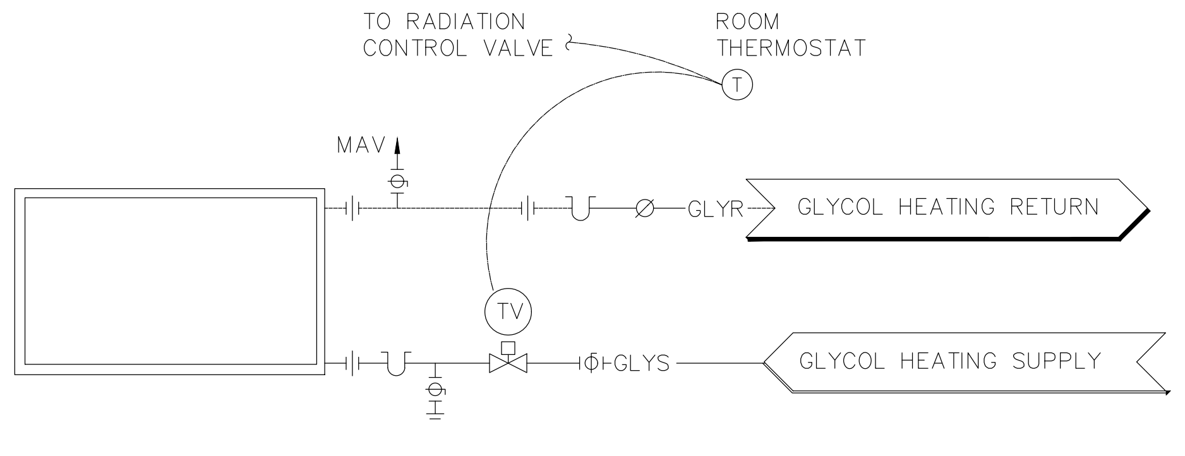
6 M-301 TYPICAL AHU HEATING AND PREHEAT COILS SCHEMATIC
NTS



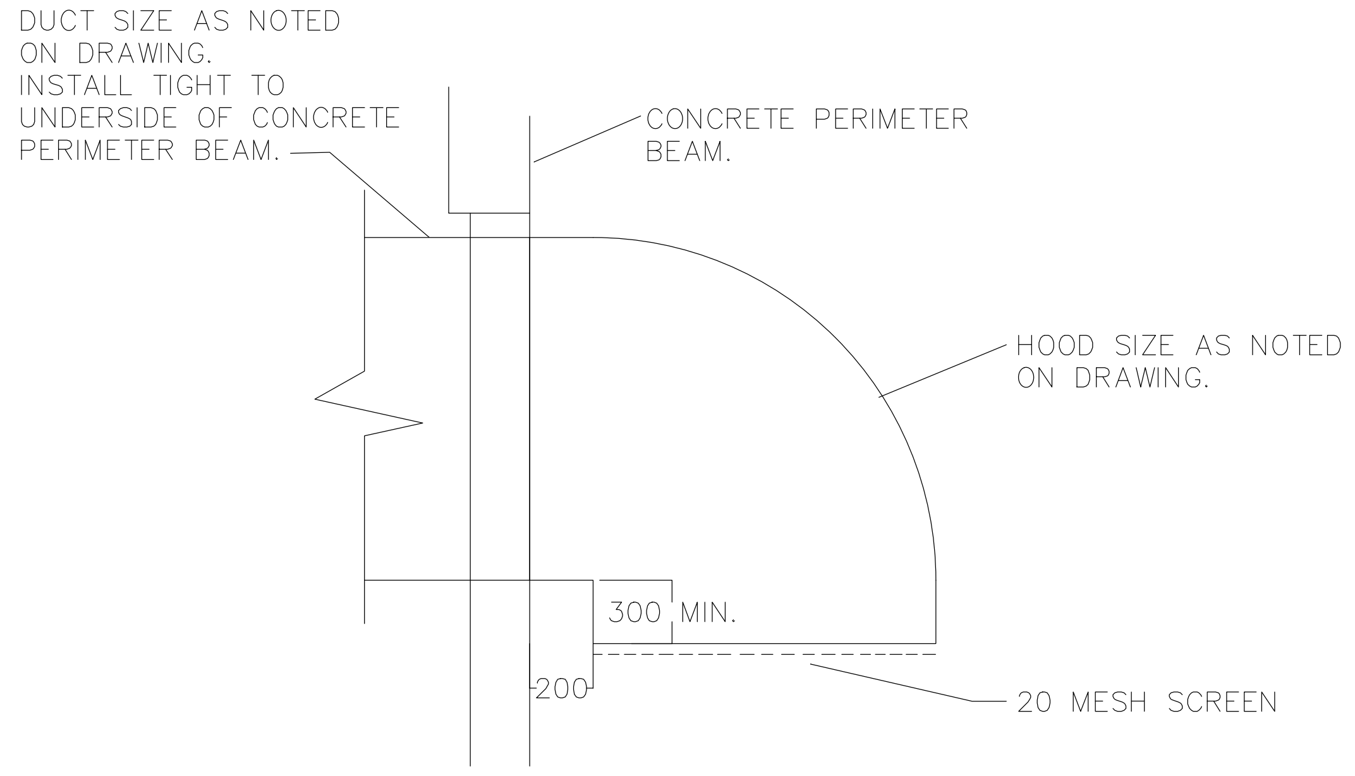
9 M-301 NEW HEATING PUMP SCHEMATIC
NTS


20x20 BIRD SCREEN
150ø
DUCTWORK ABOVE ROOF TO BE
INSULATED WITH 50mm INSULATION AND
RECOVERED WITH ALUMINUM RECOVERY
JACKET.
DUCTWORK BELOW ROOF TO BE INSULATED
WITH 50mm INSULATION WITH ALUMINUM
FOIL VAPOR BARRIER AND RECOVERED
WITH RECOVERY JACKET.
300
300
300ø
2200
ROOF CURB
MIN 3 GUY WIRES.
ROOF
200
MANUAL PUSH BUTTON MOUNTED
IN ENTRANCE LOBBY.
300x300
300ø
DRIP LEG DOWN TO
FAN LEVEL
DAMPER C/W END SWITCH.
EXHAUST
FAN
M
SUPPORT
150
INDIRECT CONNECT
25 TO DRAIN
SPRING ISOLATION
FAN INLET. DUCT DOWN TO 400
A.F.F.

4 M-301 EXHAUST FAN EF-3
NTS



7 M-301 REHEAT COIL
NTS



10 M-301 TYPICAL INLET HOOD
NTS

IS	RE	DATE	DESCRIPTION
1	-	2022-03-28	FOR INFORMATION ONLY

SEAL:

FOR INFORMATION ONLY

CLIENT:
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Iqaluit
CITY OF IQALUIT
CLIENT REF. #:

PROJECT:
IQALUIT
WATER TREATMENT PLANT
PROJECT NO: 211-12487-00
DATE: 2021/11/23

wsp
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
WWW.WSP.COM

ORIGINAL SCALE: AS NOTED

TITLE: SCHEMATICS AND DETAILS

SHEET NUMBER: M-301

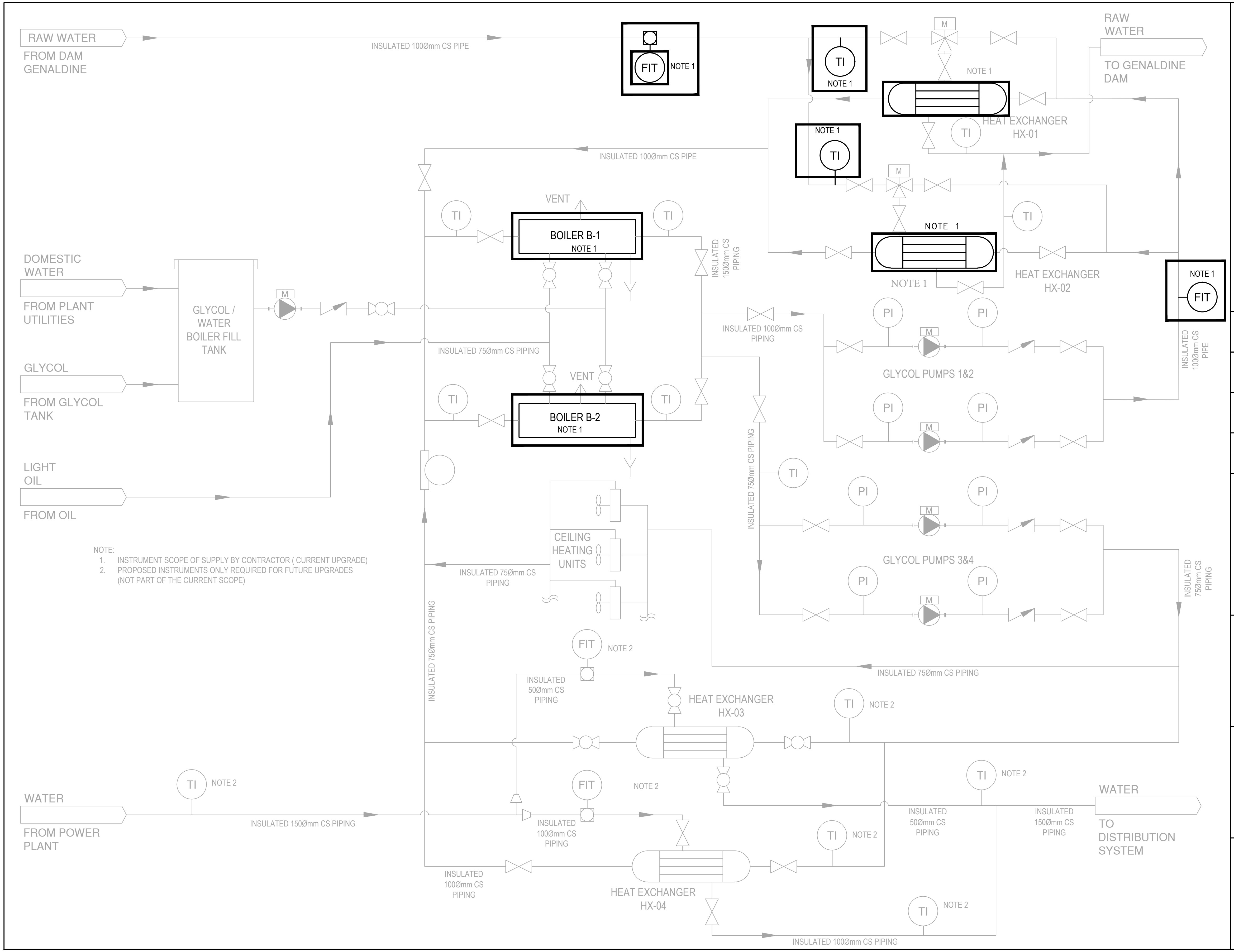
DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: MECHANICAL
ISSUE: FOR INFORMATION ONLY
2022/03/28
REV #: -

Appendix A

Heating System P&ID and Boiler Room Layout

CITY OF IQALUIT – WATER
TREATMENT PLANT - HEATING
SYSTEMS UPGRADE
Project No. 201-09487-01 – PCR 001
City of Iqaluit

WSP
June 2021

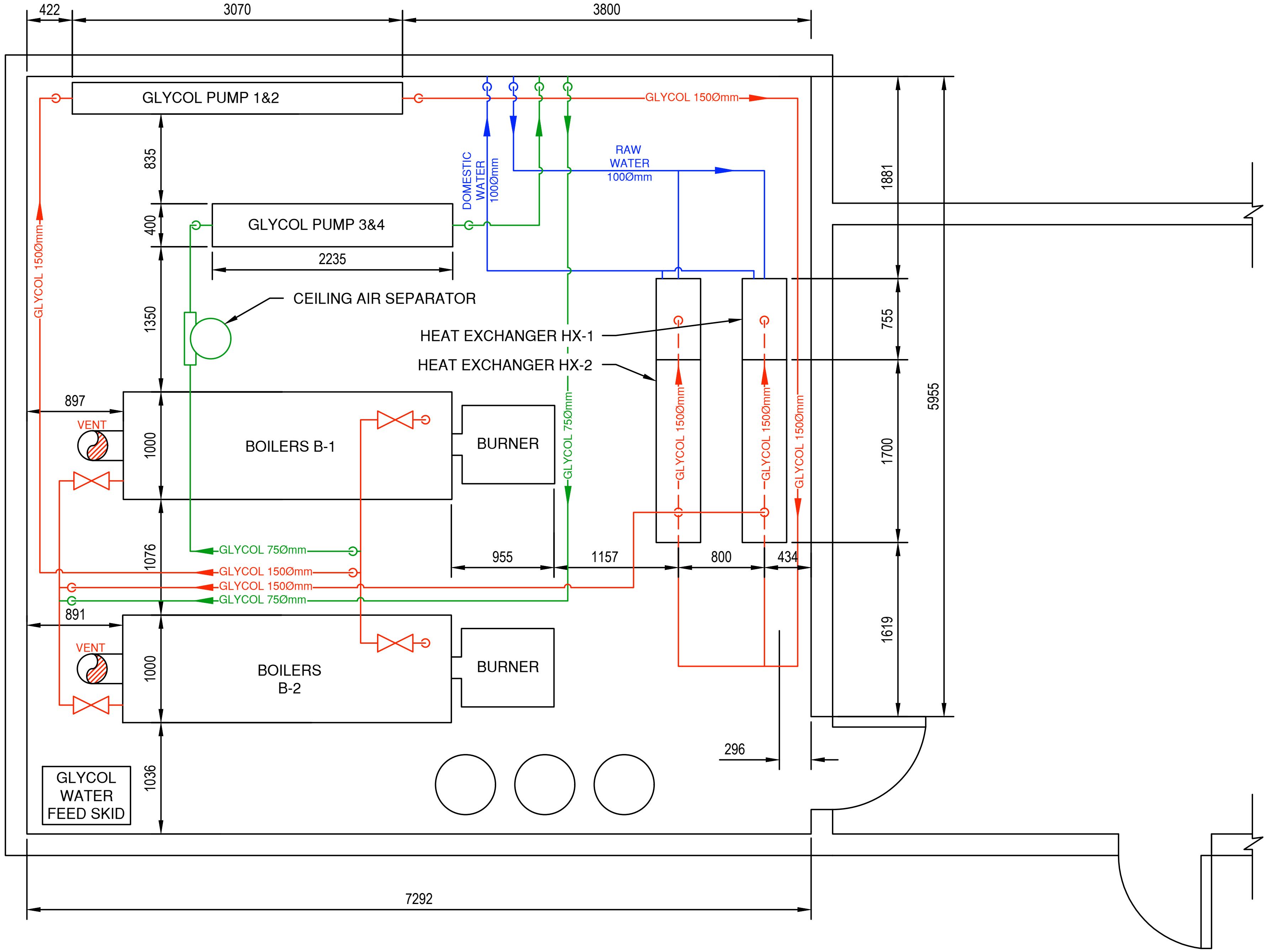


NOTE:
1. INSTRUMENT SCOPE OF SUPPLY BY CONTRACTOR (CURRENT UPGRADE)
2. PROPOSED INSTRUMENTS ONLY REQUIRED FOR FUTURE UPGRADES (NOT PART OF THE CURRENT SCOPE)

PROJECT NO: 201-09487-00
DATE: 2021/07/27
ORIGINAL SCALE: NTS
IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.
25mm
DESIGNED BY: H.A.
DRAWN BY: V.A.A.
CHECKED BY: H.A.
APPROVED BY: H.A.

1600 BUFFALO PLACE
WINNIPEG, MANITOBA CANADA R3T 6B8
TEL: 204-477-6650 | FAX: 204-474-2864
| WWW.WSP.COM

CLIENT:
CITY OF IQALUIT
CLIENT REF. #:
PROJECT:
WATER TREATMENT PLANT
BOILER ROOM
TITLE:
P & ID-R1



PROJECT NO: 201-09487-00	DATE: 2021/07/05
ORIGINAL SCALE: NTS	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE. 25mm
DESIGNED BY: H.A.	DRAWN BY: V.A.A.
CHECKED BY: H.A.	APPROVED BY: H.A.

1600 BUFFALO PLACE
WINNIPEG, MANITOBA CANADA R3T 6B8
TEL: 204-477-6650 | FAX: 204-474-2864
| WWW.WSP.COM

CLIENT:
CITY OF IQALUIT

CLIENT REF. #:

PROJECT:
WATER TREATMENT PLANT
BOILER ROOM

TITLE:
EQUIPMENT LAYOUT

Appendix B

Water Boiler Specifications

BOILER CUTSHEET
& SPECIFICATIONS

Boilers

Specifications summary for the required boilers and burners are provided in **Table 1** and **Table 2**, respectively.

Table 1 – Boiler Specifications

Boiler Manufacturer	**Weil McLain - Burlington, Ontario**
Model	BL-1588-WF SERIES # 2 – Oil
Quantity	2
Capacity	3,996 MBH
Thermal Efficiency	85.7 %
Water Volume	372 Gallons
Options	Low water cutoff, dual switched for cut-off with alarm & auto reset

Table 2 – Burner Specifications

Burner Manufacturer	**Power Flame – Burlington, Ontario**
Model	WCR3-OB
Quantity	2
Capacity	3,996 MBH
Max Oil Consumption	33 Gallons / hour
Burner Voltage	575/3/60
Control	Control Panel with Power on Light & Switch and Light for Main-Fuel, Load-Demand & Flame-Safeguard.

88™ Series 2 Commercial Boiler
Weil-McLain®

Gas, Oil & Gas/Oil
Water or Steam
MBH: 996-5,845
Combustion Eff.: Up to 87.5%

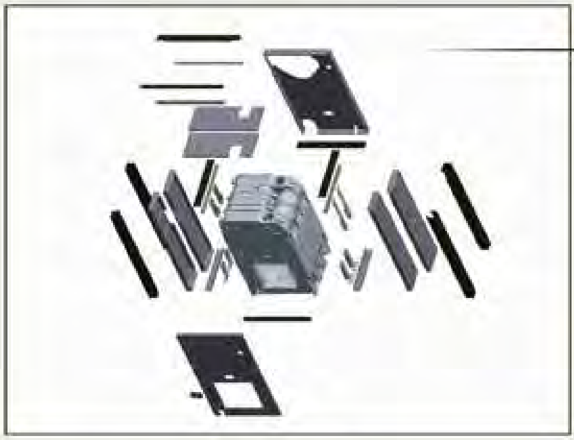
88™
SERIES 2 BOILER

- Up to 85.7% Thermal Efficiency
- Water or Steam
- Gas, Oil or Gas/Oil
- Complies to LEED
- Packaged or Knock-down

WEIL-McLAIN®
www.weil-mclain.com

MADE IN THE USA

RECYCLED CAST IRON



NEW Jacket design:

- Modular jacketing and toolless jacket panels for easy access
- 3 inches of insulation to minimize jacket losses, maximizing thermal efficiencies
- Modular side panels for ease of assembly
- High temperature site glass grommets
- Part number labels on all components for easy assembly

NEW Efficiencies!

- 85.7% Thermal Efficiencies (see ratings)
- HXT-bars optimize heat transfer

NEW clean-out plates:

- ¼ inch thick solid steel plates
- Coated Woven Fiberglass reusable gasket
- Reusable - cleaning after cleaning

Backwards Compatible:

- Can use up to 50% Series 2 iron on a Series 1 block without consulting Weil-McLain® – no need to stock both!

Standard Equipment

All Boilers:

- ASME 80 PSI rated cast iron sections
- Insulated steel jacket
- Power burner for light oil, gas or gas/light oil (except H-XX88)
- Burner mounting plate with refractory (except H-XX88)
- Cast iron flue collar with built-in breaching damper
- Observation ports on front and back sections
- Cleanout plates with reusable gaskets
- Flue brush
- HXT-bars
- 3 inches of insulation (except front panel)

Water Boilers

- 30 PSI ASME relief valve
- Combination high limit and low limit with manual reset control
- Combination pressure/temperature gauge
- Nipple and 5" x 6" reducing coupling (1288 – 1888 boilers only)
- Built-in air eliminator

Steam Boilers

- 15 PSI ASME safety valve side outlet
- Low limit and high limit pressure controls
- Steam pressure gauge siphon
- Gauge cocks, glass and guards

Optional Equipment

- Factory assembled sections
- Burner mounting plate with refractory for "H" units
- Intermediates with tankless heater opening
- Tankless heaters for domestic hot water (water or steam boilers)
- Tankless heater opening cover plates
- Low water cutoffs
- Barometric dampers
- Side inspection tappings with plugs – 2 per section
- Dual-range manometer
- Optional burners and burner controls

Ratings

	I=B=R			I=B=R Net Rating				Flue Outlet	Combustion Efficiency		Thermal Efficiency	
Model	Oil Input GPH	Gas Input MBH	Gross Output MBH	Steam MBH	Steam Sq. Ft.	Water MBH	Boiler H.P.	(Dia)	OIL	GAS	OIL	GAS
488R®	6.9	996	827	620	2,583	719	24.7	10 in.	87.5	84.8	85.6	83.1
488®	7.0	1,010	839	629	2,621	730	25.1	10 in.	87.5	84.8	85.6	83.1
588®	9.4	1,356	1,126	845	3,521	979	33.6	10 in.	87.0	84.4	85.6	83.1
688®	11.8	1,701	1,413	1,072	4,469	1,229	42.2	10 in.	86.7	84.1	85.6	83.1
788®	14.2	2,046	1,700	1,311	5,463	1,478	50.8	12 in.	86.5	83.9	85.6	83.1
888®	16.6	2,382	1,987	1,543	6,427	1,728	59.4	12 in.	86.3	83.7	85.6	83.1
988R®	17.2	2,482	2,062	1,601	6,671	1,793	61.6	14 in.	86.2	83.7	85.6	83.1
988®	18.8	2,737	2,274	1,766	7,358	1,977	67.9	14 in.	86.2	83.7	85.6	83.1
1088R®	20.0	2,887	2,399	1,863	7,763	2,086	71.7	14 in.	86.2	83.6	85.6	83.1
1088®	21.5	3,082	2,561	1,988	8,283	2,227	76.5	14 in.	86.2	83.6	85.6	83.1
1188®	23.5	3,428	2,848	2,211	9,213	2,477	85.1	14 in.	86.1	83.5	85.7	83.1
1288®	26.0	3,773	3,135	2,434	10,147	2,726	93.7	14 in.	86.0	83.5	85.7	83.1
1388®	28.5	4,119	3,422	2,657	11,071	2,976	102.2	14 in.	86.0	84.4	85.7	83.1
1488®	31.0	4,464	3,709	2,880	12,000	3,225	110.8	16 in.	86.0	83.4	85.7	83.1
1588	33.0	4,809	3,996	3,102	12,925	3,475	119.4	16 in.	85.9	83.3	85.7	83.1
1688R	34.5	4,979	4,137	3,212	13,383	3,597	123.6	16 in.	85.9	83.3	85.7	83.1
1688®	35.5	5,155	4,283	3,325	13,854	3,724	127.9	16 in.	85.9	83.3	85.7	83.1
1788®	38.0	5,494	4,570	3,548	14,783	3,974	136.5	18 in.*	85.9	83.3	85.7	83.1
1888®	40.5	5,845	4,857	3,771	15,713	4,123	145.1	18 in.*	85.9	83.3	85.7	83.1

- Burner input based on maximum of 2,000 ft. altitude - for higher altitudes consult Weil-McLain® representative.
- No.2 Fuel oil - Commercial Standard Spec. CS75-56. Heat value of oil - 140,000 BTU/G.
- Stack gas volume at outlet temperature
- With 0.10" WC positive pressure at flue collar.
- Consult Burner Specification Sheets for gas pressure required.
- Gross I=B=R ratings have been determined under the I=B=R provision governing forced draft boiler-burner units
- Net I-B-Ratings are based on net installed radiation of sufficient quantity for the requirements of the building and nothing need be added for normal piping and pick.up. Water ratings are based on a piping and pick-up allowance of 1.15. Steam ratings are based on the following allowances: 488 and 588 - 1.333; 688 - 1.323; 788 - 1.300; 888 - 1.289; and 988 through 1888 - 1.288. An additional allowance should be made for gravity hot water systems or for unusual piping and pick.up loads. Consult Weil-McLain® representative.

*Flue collar connection is oval, 16 1/8" x 19 7/8"

MADE IN THE USA

Model 88™
-Est. 1985-
Weil-McLain

RECYCLED CAST IRON

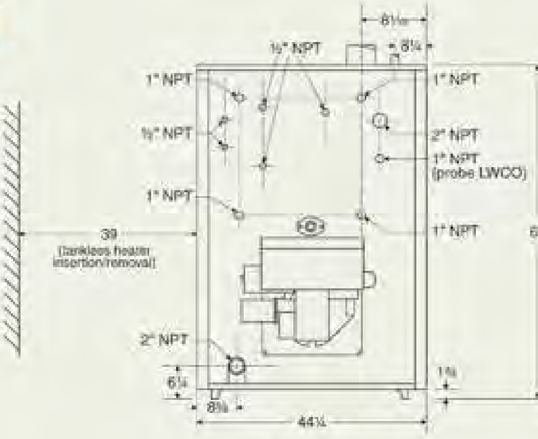
Dimensions

Dimensions (inches)								
Model	A	B	C	D	E	L	W	H
488®	23	–	–	10	54 ¾	34 ¾	30	23 ⅜
588®	31	–	–	10	54 ¾	42 ¾	38	31 ⅜
688®	39	–	–	10	54 ¾	50 ¾	46	39 ⅜
788®	47	–	–	12	53 ¾	58 ¾	54	47 ⅜
888®	55	–	–	12	53 ¾	66 ¾	62	55 ⅜
988®	63	–	–	14	52 ¾	74 ¾	70	63 ⅜
1088®	71	–	–	14	52 ¾	82 ¾	78	71 ⅜
1188®	79	–	–	14	52 ¾	90 ¾	86	79 ⅜
1288®	87	39 ½	–	14	52 ¾	98 ¾	94	87 ⅜
1388®	95	47 ½	–	14	52 ¾	106 ¾	102	95 ⅜
1488®	103	55 ½	–	16	51 ¾	114 ¾	110	103 ⅜
1588®	111	63 ½	–	16	51 ¾	122 ¾	118	111 ⅜
1688®	119	47 ½	–	16	51 ¾	130 ¾	126	119 ⅜
1788®	127	31 ½	79 ½	18†	51 ¾	138 ¾	134	127 ⅜
1888®	135	39 ½	87 ½	18†	51 ¾	146 ¾	142	135 ⅜

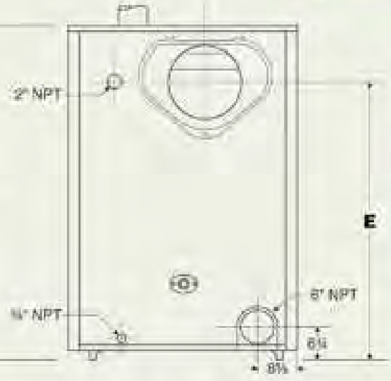
†For 18" diameter breaching, flue collar is oval (19 7/8" x 16 1/8")

	Supply & return tappings				Dimension F
	Supply tappings (No. & size)*		Return tappings (No. & size)*		
Model	Steam	Water	Steam	Water	
488R®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	See Burner Specification & Data Sheets
488®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
588®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
688®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
788®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
888®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
988R®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
988®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
1088R®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
1088®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
1188®	2 – 5"	2 – 5"	1 – 6"	1 – 6"	
1288®	3 – 5"	2 – 5"	1 – 6"	1 – 6"	
1388®	3 – 5"	2 – 5"	1 – 6"	1 – 6"	
1488®	3 – 5"	2 – 5"	1 – 6"	1 – 6"	
1588®	3 – 5"	2 – 5"	1 – 6"	1 – 6"	
1688R®	3 – 5"	2 – 5"	1 – 6"	1 – 6"	
1688®	3 – 5"	2 – 5"	1 – 6"	1 – 6"	
1788®	4 – 5"	2 – 5"	1 – 6"	1 – 6"	
1888®	4 – 5"	2 – 5"	1 – 6"	1 – 6"	

*Use recommended piping connections.
†For 18" diameter breaching, flue collar is oval (19 7/8" x 16 1/8")

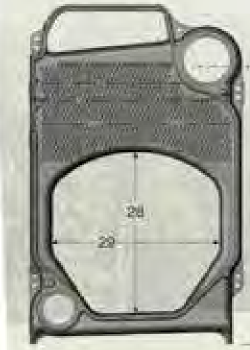


FRONT

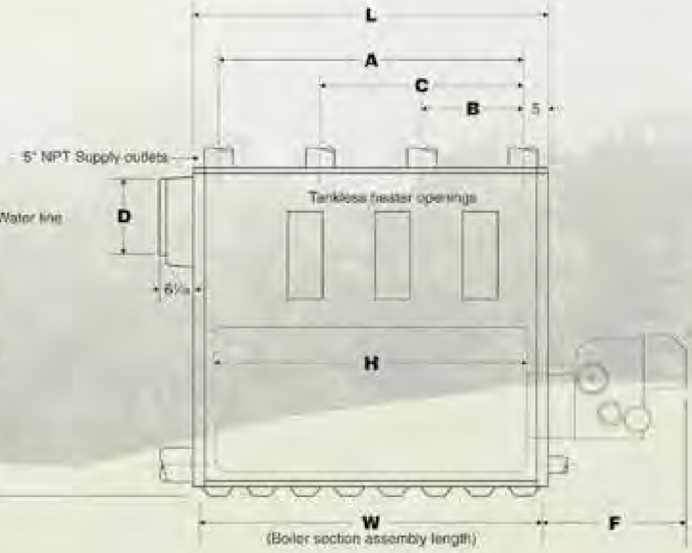


REAR

Model	I=B=R Vent or Liner Dia (in)		Boiler Flue Collar Dimensions (in)
	Forced Draft	Balanced Draft	
488®	10	12	10 round
588®	10	15	10 round
688®	12	15	10 round
788®	12	18	12 round
888®	14	18	12 round
988®	14	18	14 round
1088®	14	21	14 round
1188®	16	21	14 round
1288®	16	21	14 round
1388®	16	24	14 round
1488®	18	24	16 round
1588®	18	24	16 round
1688®	18	24	16 round
1788®	18	24	16 1/8 x 19 7/8 oval
1888®	20	27	16 1/8 x 19 7/8 oval



INTERMEDIATE SECTION



LEFT SIDE

C-645 (0813)

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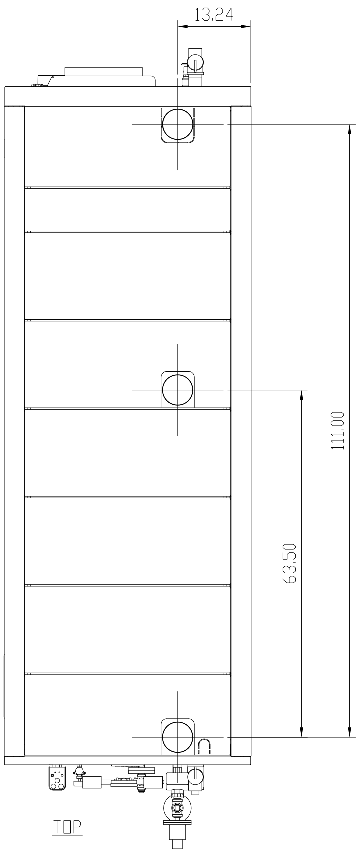
BOILER DRAWING

NOT TO SCALE



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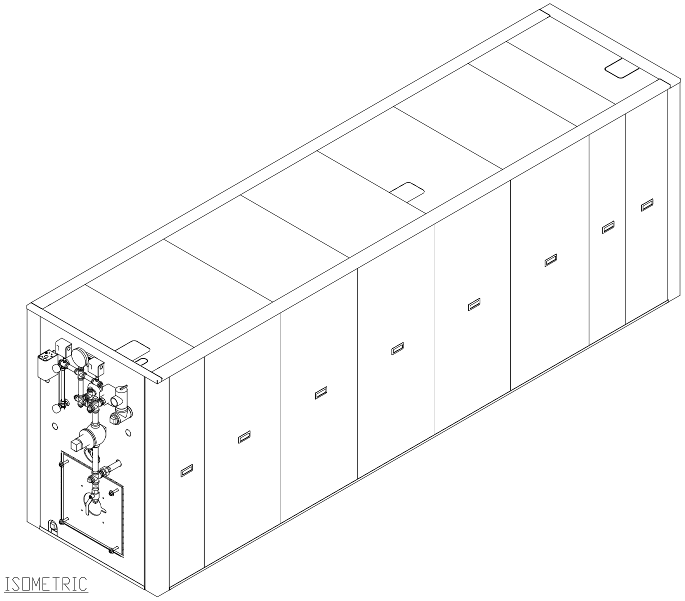

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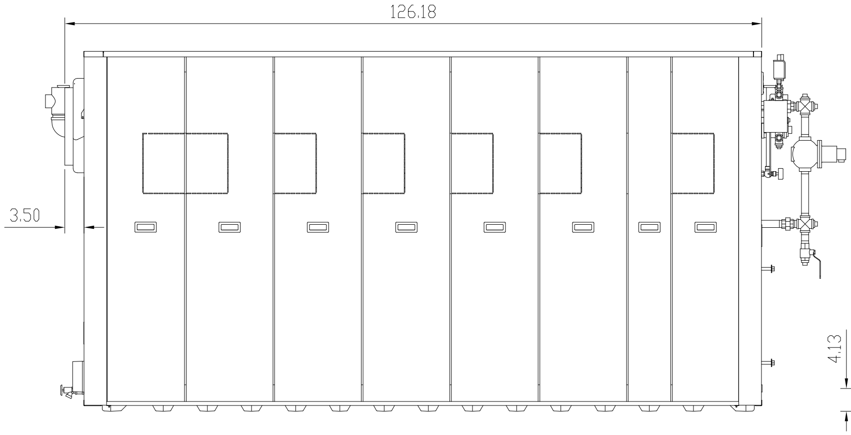

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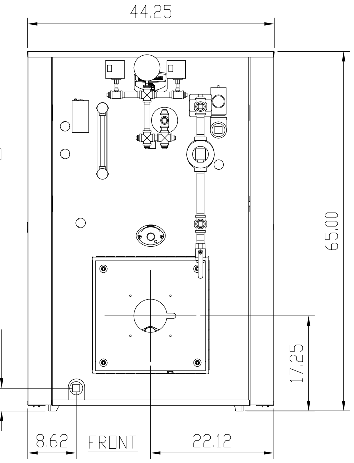
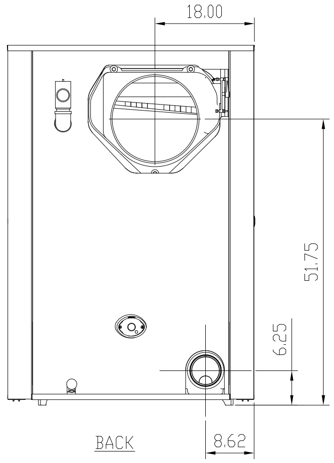


FRONT



BACK

REFERENCE OF FLOW RATES (GPM) AT VARIOUS SYSTEM TEMPERATURE DIFFERENTIALS (F)

FLOW RATES FOR WEIL-McLAIN BOILERS

BOILER SIZE	INPUTS BTU/HR.	D.O.E* HEATING CAPACITY	I=B=R RATING BTU/HR.	10 °ΔT	15 °ΔT	20 °ΔT	25 °ΔT	30 °ΔT	35 °ΔT	40 °ΔT	45 °ΔT	50 °ΔT
BL-1288	3,640,000	3,000,000	2,609,000	600.2	400.2	300.1	240.1	200.1	171.5	150.1	133.4	120.0
BL-1388	3,990,000	3,270,000	2,843,000	654.3	436.2	327.1	261.7	218.1	186.9	163.6	145.4	130.9
BL-1488	4,340,000	3,550,000	3,087,000	710.3	473.5	355.1	284.1	236.8	202.9	177.6	157.8	142.1
BL-1588	4,620,000	3,820,000	3,322,000	764.3	509.5	382.2	305.7	254.8	218.4	191.1	169.8	152.9
BL-1688	4,970,000	4,090,000	3,557,000	818.3	545.6	409.2	327.3	272.8	233.8	204.6	181.9	163.7
BL-1788	5,320,000	4,370,000	3,800,000	874.3	582.9	437.2	349.7	291.4	249.8	218.6	194.3	174.9
BL-1888	5,670,000	4,640,000	4,035,000	928.4	618.9	464.2	371.3	309.5	265.2	232.1	206.3	185.7
BG-894	2,540,000	2,028,000	1,763,000	405.8	270.5	202.9	162.3	135.3	115.9	101.4	90.2	81.2
BG-994	2,887,000	2,320,000	2,017,000	464.2	309.5	232.1	185.7	154.7	132.6	116.0	103.2	92.8
BG-1094	3,247,000	2,612,000	2,271,000	522.6	348.4	261.3	209.0	174.2	149.3	130.7	116.1	104.5
BG-1194	3,608,000	2,904,000	2,525,000	581.0	387.4	290.5	232.4	193.7	166.0	145.3	129.1	116.2
BG-1294	3,969,000	3,190,000	2,774,000	638.3	425.5	319.1	255.3	212.8	182.4	159.6	141.8	127.7
BG-1394	4,330,000	3,480,000	3,026,000	696.3	464.2	348.1	278.5	232.1	198.9	174.1	154.7	139.3
BG-1494	4,691,000	3,770,000	3,278,000	754.3	502.9	377.2	301.7	251.4	215.5	188.6	167.6	150.9
BG-1594	5,052,000	4,070,000	3,539,000	814.3	542.9	407.2	325.7	271.4	232.7	203.6	181.0	162.9
BG-1694	5,412,000	4,360,000	3,791,000	872.3	581.6	436.2	348.9	290.8	249.2	218.1	193.9	174.5
BG-1794	5,773,000	4,650,000	4,043,000	930.4	620.2	465.2	372.1	310.1	265.8	232.6	206.7	186.1
BG-1894	6,134,000	4,940,000	4,296,000	988.4	658.9	494.2	395.4	329.5	282.4	247.1	219.6	197.7
BG-1994	6,495,000	5,230,000	4,548,000	1046.4	697.6	523.2	418.6	348.8	299.0	261.6	232.5	209.3
BG-2094	6,856,000	5,520,000	4,800,000	1104.4	736.3	552.2	441.8	368.1	315.6	276.1	245.4	220.9
BG-2194	7,216,000	5,810,000	5,052,000	1162.5	775.0	581.2	465.0	387.5	332.1	290.6	258.3	232.5
BG-2294	7,577,000	6,400,000	5,304,000	1280.5	853.7	640.3	512.2	426.8	365.9	320.1	284.6	256.1
BG-2394	7,938,000	6,390,000	5,557,000	1278.5	852.3	639.3	511.4	426.2	365.3	319.6	284.1	255.7
BG-2494	8,299,000	6,680,000	5,809,000	1336.5	891.0	668.3	534.6	445.5	381.9	334.1	297.0	267.3
BG-2594	8,660,000	6,970,000	6,061,000	1394.6	929.7	697.3	557.8	464.9	398.4	348.6	309.9	278.9
BL-894	2,464,000	2,028,000	1,763,000	405.8	270.5	202.9	162.3	135.3	115.9	101.4	90.2	81.2
BL-994	2,800,000	2,320,000	2,017,000	464.2	309.5	232.1	185.7	154.7	132.6	116.0	103.2	92.8
BL-1094	3,150,000	2,612,000	2,271,000	522.6	348.4	261.3	209.0	174.2	149.3	130.7	116.1	104.5
BL-1194	3,500,00	2,904,000	2,525,000	581.0	387.4	290.5	232.4	193.7	166.0	145.3	129.1	116.2
BL-1294	3,850,000	3,190,000	2,774,000	638.3	425.5	319.1	255.3	212.8	182.4	159.6	141.8	127.7
BL-1394	4,200,000	3,480,000	3,026,000	696.3	464.2	348.1	278.5	232.1	198.9	174.1	154.7	139.3
BL-1494	4,550,000	3,770,000	3,278,000	754.3	502.9	377.2	301.7	251.4	215.5	188.6	167.6	150.9
BL-1594	4,900,000	4,070,000	3,539,000	814.3	542.9	407.2	325.7	271.4	232.7	203.6	181.0	162.9
BL-1694	5,250,000	4,360,000	3,791,000	872.3	581.6	436.2	348.9	290.8	249.2	218.1	193.9	174.5
BL-1794	5,600,000	4,650,000	4,043,000	930.4	620.2	465.2	372.1	310.1	265.8	232.6	206.7	186.1
BL-1894	5,950,000	4,940,000	4,296,000	988.4	658.9	494.2	395.4	329.5	282.4	247.1	219.6	197.7
BL-1994	6,300,000	5,230,000	4,548,000	1046.4	697.6	523.2	418.6	348.8	299.0	261.6	232.5	209.3
BL-2094	6,650,000	5,520,000	4,800,000	1104.4	736.3	552.2	441.8	368.1	315.6	276.1	245.4	220.9
BL-2194	7,000,000	5,810,000	5,052,000	1162.5	775.0	581.2	465.0	387.5	332.1	290.6	258.3	232.5
BL-2294	7,420,000	6,400,000	5,304,000	1280.5	853.7	640.3	512.2	426.8	365.9	320.1	284.6	256.1
BL-2394	7,700,000	6,390,000	5,557,000	1278.5	852.3	639.3	511.4	426.2	365.3	319.6	284.1	255.7
BL-2494	8,120,000	6,680,000	5,809,000	1336.5	891.0	668.3	534.6	445.5	381.9	334.1	297.0	267.3
BL-2594	8,400,000	6,970,000	5,809,000	1394.6	929.7	697.3	557.8	464.9	398.4	348.6	309.9	278.9

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*Delta "T" Based on DOE Output Rating

BOILER HEAD LOSS CALCULATIONS

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Boiler Size	Boiler Gross Output (Btu)	GPM for 20° ΔT	Recommended Pipe Size (in)	Equivalent Length (ft)	Friction Loss (Ft/100 Ft)	First 90 Elbow	Third 90 Elbow
488	839,000	83.9	4	5.90	0.45	2.655	**7.97**
588	1,126,000	112.6	4	5.90	0.78	4.602	**13.81**
688	1,413,000	141.3	4	5.90	1.18	6.962	**20.89**
788	1,700,000	170	5	7.30	0.55	4.015	**12.05**
888	1,987,000	198.7	5	7.30	0.73	5.329	**15.99**
988	2,274,000	227.4	5	7.30	0.94	6.862	**20.59**
1088	2,561,000	256.1	6	8.90	0.47	4.183	**12.55**
1188	2,848,000	284.8	6	8.90	0.57	5.073	**15.22**
1288	3,135,000	313.5	6	8.90	0.69	6.141	**18.42**
1388	3,422,000	342.2	6	8.90	0.81	7.209	**21.63**
1488	3,709,000	370.9	6	8.90	0.94	8.366	**25.10**
1588	3,996,000	399.6	6	8.90	1.08	9.612	**28.84**
1688	4,283,000	428.3	8	12.00	0.32	3.84	**11.52**
1788	4,570,000	457	8	12.00	0.36	4.32	**12.96**
1888	4,857,000	485.7	8	12.00	0.40	4.8	**14.40**

BOILER WATER CONTENT

Technical Services Bulletin No: SB0208 *(Page 2 of 2)*

Subject: Boiler Water Capacities for Weil-McLain Boilers

Date: December 16, 2002

Boiler Model & Size	Steam Boilers (To Water Line)		Water Boilers (Entire Boiler)	
	Pounds	Gals.	Pounds	Gals.
LGB-4	193.3	23.2	304.0	36.5
LGB-5	240.7	28.9	379.8	45.6
LGB-6	288.2	34.6	455.7	54.7
LGB-7	335.7	40.3	532.3	63.9
LGB-8	383.2	46.0	608.1	73.0
LGB-9	432.3	51.9	683.9	82.1
LGB-10	479.8	57.6	759.7	91.2
LGB-11	528.1	63.4	836.3	100.4
LGB-12	575.6	69.1	912.1	109.5
LGB-13	623.9	74.9	987.9	118.6
LGB-14	672.2	80.7	1063.7	127.7
LGB-15	719.7	86.4	1140.4	136.9
LGB-16	768.0	92.2	1216.2	146.0
LGB-17	816.3	98.0	1292.0	155.1
LGB-18	863.0	103.6	1367.8	164.2
LGB-19	912.1	109.5	1444.4	173.4
LGB-20	960.4	115.3	1520.2	182.5
LGB-21	1007.9	121.0	1596.0	191.6
LGB-22	1056.2	126.8	1676.0	201.2
LGB-23	1103.7	132.5	1747.6	209.8
380	229.1	27.5	312.4	37.5
480	299.9	36.0	408.2	49.0
580	370.7	44.5	504.0	60.5
680	441.5	53.0	599.8	72.0
780	512.3	61.5	695.6	83.5
880	583.1	70.0	791.4	95.0
980	653.9	78.5	887.1	106.5
1080	724.7	87.0	982.9	118.0
1180	795.5	95.5	1078.7	129.5
1280	866.3	104.0	1174.5	141.0

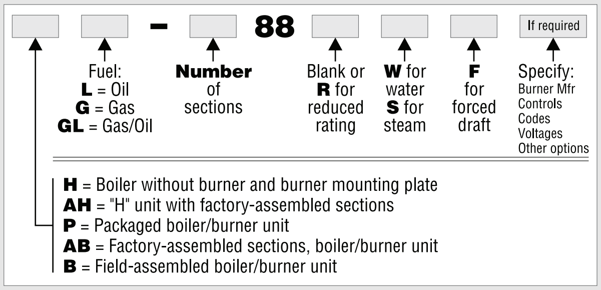
Boiler Model & Size	Steam Boilers (To Water Line)		Water Boilers (Entire Boiler)	
	Pounds	Gals.	Pounds	Gals.
488 (R)	758.0	91.0	908.0	109.0
588	916.3	110.0	1099.6	132.0
688	1074.6	129.0	1291.2	155.0
788	1232.8	148.0	1482.7	178.0
888	1391.1	167.0	1674.3	201.0
988 (R)	1549.4	186.0	1865.9	224.0
1088 (R)	1707.7	205.0	2057.5	247.0
1188	1865.9	224.0	2249.1	270.0
1288	2024.2	243.0	2440.7	293.0
1388	2182.5	262.0	2632.3	316.0
1488	2340.7	281.0	2823.9	339.0
1588	2499.0	300.0	3015.5	362.0
1688 (R)	2657.3	319.0	3207.1	385.0
1788	2815.5	338.0	3398.6	408.0
1888	2973.8	357.0	3590.2	431.0
894	1929.2	231.6	2284.9	274.3
994	2125.0	255.1	2515.7	302.0
1094	2320.7	278.6	2747.2	329.8
1194	2517.3	302.2	2978.0	357.5
1294	2713.1	325.7	3208.7	385.2
1394	2908.8	349.2	3440.3	413.0
1494	3104.6	372.7	3671.0	440.7
1594	3301.2	396.3	3901.8	468.4
1694	3496.9	419.8	4133.3	496.2
1794	3692.7	443.3	4364.1	523.9
1894	3889.3	466.9	4594.8	551.6
1994	4085.0	490.4	4826.4	579.4
2094	4280.8	513.9	5057.1	607.1
2194	4476.5	537.4	5287.9	634.8
2294	4673.1	561.0	5519.5	662.6
2394	4868.9	584.5	5750.2	690.3
2494	5064.6	608.0	5980.9	718.0
2594	5261.2	631.6	6212.5	745.8

BOILER CERTIFICATION
& RATINGS

Ratings

Boiler model number	AHRI burner capacity		Gross AHRI output		Net AHRI ratings			AHRI Certified Ratings				Boiler H.P.	Net firebox volume	Flue gas volume	Flue outlet dia.	Boiler water content	Packaged boiler weight
								Combustion efficiency		Thermal efficiency							
	Light oil GPH	Gas MBH	Steam MBH	Water MBH	Steam Sq. Ft	Steam MBH	Water MBH	Oil	Gas	Oil	Gas		Cubic feet	CFM	Inches	Gallons	Pounds
Notes: 1, 10	2, 3	2, 4	5, 6	5, 6	8	8	8	%	%	%	%	—	—	7	—	—	—
488R	6.9	996	827	833	2,583	620	719	87.5	84.8	85.6	83.1	24.7	11.02	376	10	109	2,860
488	7.0	1,010	839	844	2,621	629	730	87.5	84.8	85.6	83.1	25.1	11.02	370	10	109	2,860
588	9.4	1,356	1,126	1,135	3,521	845	979	87.0	84.4	85.6	83.1	33.6	14.45	507	10	132	3,340
688	11.8	1,701	1,413	1,424	4,469	1,072	1,229	86.7	84.1	85.6	83.1	42.2	18.08	639	10	155	3,820
788	14.2	2,046	1,700	1,713	5,463	1,311	1,478	86.5	83.9	85.6	83.1	50.8	21.61	772	12	178	4,345
788R	--	1999	1661	1673	5,463	1279	1,444	--	84.0	--	83.1	50.8	21.61	772	12	178	4,345
888	16.6	2,382	1,987	1,994	6,427	1,543	1,728	86.3	83.7	85.6	83.1	59.4	25.14	906	12	201	4,925
988R	17.2	2,482	2,062	2,080	6,671	1,601	1,793	86.2	83.7	85.6	83.1	61.6	28.67	1,031	14	224	5,600
988	18.8	2,737	2,274	2,294	7,358	1,766	1,977	86.2	83.7	85.6	83.1	67.9	28.67	954	14	224	5,600
1088R	20.0	2,887	2,399	2,419	7,763	1,863	2,086	86.2	83.6	85.6	83.1	71.7	32.20	1,184	14	247	6,130
1088	21.5	3,082	2,561	2,583	8,283	1,988	2,227	86.2	83.6	85.6	83.1	76.5	32.20	1,101	14	247	6,130
1188	23.5	3,428	2,848	2,873	9,213	2,211	2,477	86.1	83.5	85.7	83.1	85.1	35.76	1,299	14	270	6,695
1288	26.0	3,773	3,135	3,162	10,147	2,434	2,726	86.0	83.5	85.7	83.1	93.7	39.26	1,443	14	293	7,260
1388	28.5	4,119	3,422	3,456	11,071	2,657	2,976	86.0	84.4	85.7	83.1	102.2	42.79	1,588	14	316	7,890
1488	31.0	4,464	3,709	3,745	12,000	2,880	3,225	86.0	83.4	85.7	83.1	110.8	46.32	1,735	16	339	8,410
1588	33.0	4,809	3,996	4,035	12,925	3,102	3,475	85.9	83.3	85.7	83.1	119.4	49.85	1,854	16	362	9,005
1688R	34.5	4,979	4,137	4,182	13,383	3,212	3,597	85.9	83.3	85.7	83.1	123.6	53.38	2,003	16	385	9,525
1688	35.5	5,155	4,283	4,330	13,854	3,325	3,724	85.9	83.3	85.7	83.1	127.9	53.38	1,945	16	385	9,525
1788	38.0	5,494	4,570	4,615	14,783	3,548	3,974	85.9	83.3	85.7	83.1	136.5	56.91	2,152	18 *	408	9,780
1888	40.5	5,845	4,857	4,910	15,713	3,771	4,223	85.9	83.3	85.7	83.1	145.1	60.44	2,303	18 *	431	10,775

1. See below to specify complete model number.


- 88
If required
Fuel: **L** = Oil **G** = Gas **GL** = Gas/Oil
Number of sections
Blank or **R** for reduced rating
W for water **S** for steam
F for forced draft
Specify: Burner Mfr Controls Codes Voltages Other options
H = Boiler without burner and burner mounting plate
AH = "H" unit with factory-assembled sections
P = Packaged boiler/burner unit
AB = Factory-assembled sections, boiler/burner unit
B = Field-assembled boiler/burner unit

2. Burner input based on maximum of 2,000 feet altitude. For other altitudes, consult Weil-McLain distributor/agent or sales office.
3. No. 2 fuel oil — Commercial Standard Spec CS75-56. Heating value of oil = 140,000 Btu per gallon.
4. Gas pressure required at burner gas train inlet for rated burner input; based on 1,000 Btu per cubic foot natural gas, specific gravity of 0.60. Refer to burner manual for required pressure.
5. Gross AHRI ratings have been determined under the AHRI provision governing forced draft boiler-burner units.
6. Flue gas volume at outlet temperature.
7. Net AHRI ratings are based on net installed radiation of sufficient quantity for the requirements of the building. Nothing need be added for normal piping and pick-up. Water ratings are based on a piping and pick-up allowance of 1.15. Steam ratings are based on the following allowances: 488 – 588 = 1.333; 688 = 1.323; 788 = 1.301; 888 = 1.289; 988 – 1888 = 1.288. An additional allowance should be made for gravity hot water systems or for unusual piping and pick-up loads. Consult local Weil-McLain distributor/agent or sales office.
8. With 0.10" W.C. positive pressure at flue collar.
9. Water boilers tested for 80 PSIG, ASME water working pressure. Steam boilers tested for 15 PSIG, ASME steam working pressure.

* Flue collar connection is oval, 16⅛" x 19⅞"

BURNER SPECIFICATIONS AND DATA SHEETS

WEIL-McLAIN

88

Water & Steam Boilers – Series 2

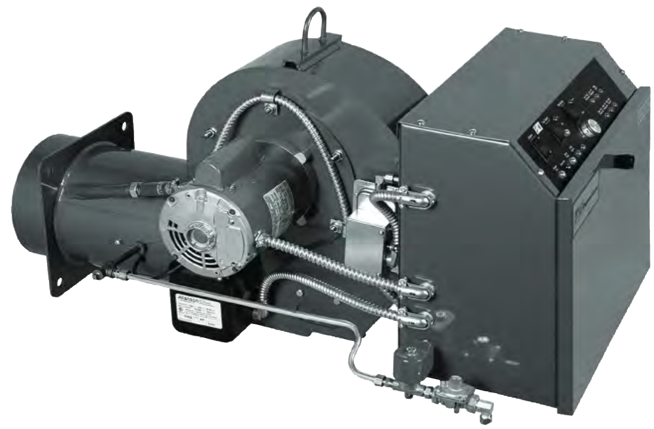
For Gas, Light Oil, & Gas/Light Oil – Fired Burners

Burner Specification & Data Sheet

Power Flame

Gas/Oil Burners

Model WCR



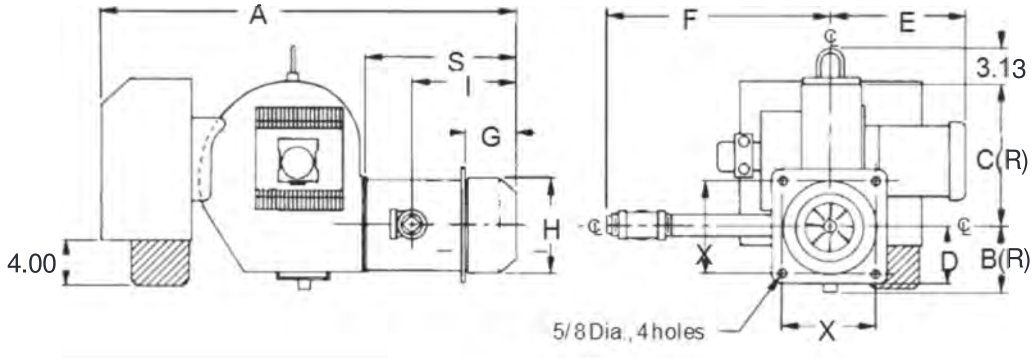


Figure 1 Model WCR

Note: Add .38 to "H" dim for size of opening in boiler front plate.

Burner Model Number	A	B(R)	C(R)	D	E	F*	G	H	I	S	X	Approximate Weight
WCR1	34.13	5.56	14.50	4.63	12.25	20.00	3.25	7.25	7.38	12.63	7.25	175-200
WCR2	39.13	6.13	14.00	5.25	14.00	20.00	4.00	8.75	8.50	13.38	8.50	220-300
WCR3	44.00	7.00	15.25	6.00	16.00	22.38	5.00	10.13	11.50	15.50	10.00	360-400
WCR4	50.00	7.31	17.69	7.00	18.50	28.00	6.00	12.13	14.25	19.13	12.00	500-550

* Required for installation of standard control components

Burner specifications and settings

Table 1 Burner data

Boiler Model Number	Burner Input		Positive Pressure In Firebox In. W.C.	Standard Burner Model Designation			Standard Combustion Control			Standard Control System			Burner Motor 3450 Rpm			Standard Motor Voltage
	No. 2 Oil Gph	Gas Mbh		Gas	Light Oil	Gas/Light Oil	Gas	Light Oil	Gas/Light Oil	Gas	Light Oil	Gas/Light Oil	Gas	Light Oil	Gas/ Light Oil	
488R	6.9	996	0.80	WCR1-G-12	WCR1-OS	WCR1-GO-12	RM7897A	R7184P	RM7897C	OO	FALFS	OO/FALFS	Zx	Zx	Zx	120/60/1
488	7.0	1,010	0.80	WCR1-G-12	WCR1-OS	WCR1-GO-12	RM7897A	R7184P	RM7897C	OO	FALFS	OO/FALFS	Zx	Zx	Zx	120/60/1
588	9.4	1,356	0.58	WCR1-G-12	WCR1-OS	WCR1-GO-12	RM7897A	R7184P	RM7897C	OO	FALFS	OO/FALFS	Zx	Zx	Zx	120/60/1
688	11.8	1,701	0.46	WCR2-G-15	WCR2-OAS	WCR2-GO-15	RM7897A	R7184P	RM7897C	LHO	LHO	LHO/LHO	Zx	Qv	Qv	120/60/1
788	14.2	2,046	0.47	WCR2-G-15	WCR2-OAS	WCR2-GO-15	RM7897A	R7184P	RM7897C	LHO	LHO	LHO/LHO	Zx	Qv	Qv	120/60/1
888	16.6	2,382	0.49	WCR2-G-20A	WCR2-OBS	WCR2-GO-20A	RM7897A	R7184P	RM7897C	LHO	LHO	LHO/LHO	Qv	1	1	240/60/1
988R	17.2	2,482	0.50	WCR2-G-20B	WCR2-OBS	WCR2-GO-20B	RM7897A	R7184P	RM7897C	LHO	LHO	LHO/LHO	1	1	1	240/60/1
988	18.8	2,737	0.50	WCR2-G-20B	WCR2-OBS	WCR2-GO-20B	RM7897C	R7184P	RM7897C	LHO	LHO	LHO/LHO	1	1Zx	1Zx	240/60/1
1088R	20.0	2,887	0.52	WCR2-G-20B	WCR2-OBS	WCR2-GO-20B	RM7897C	RM7897A	RM7897C	LHO	LHO	LHO/LHO	1	1Zx	1Zx	240/60/1
1088	21.5	3,082	0.73	WCR3-G-20	WCR3-O	WCR3-GO-20	RM7897C	RM7897A	RM7897C	LHO	LHO	LHO/LHO	1Zx	2	2	240/60/1
1188	23.5	3,428	0.53	WCR3-G-20	WCR3-O	WCR3-GO-20	RM7897C	RM7897A	RM7897C	LHO	LHO	LHO/LHO	1Zx	2	2	3-Phase*
1288	26.0	3,773	0.48	WCR3-G-20	WCR3-O	WCR3-GO-20	RM7897C	RM7897A	RM7897C	LHO	LHO	LHO/LHO	1Zx	2	2	3-Phase*
1388	28.5	4,119	0.56	WCR3-G-25	WCR3-O	WCR3-GO-25	RM7897C	RM7840L	RM7840L	LHO	LHO	LHO/LHO	1Zx	2	2	3-Phase*
1488	31.0	4,464	0.58	WCR3-G-25B	WCR3-OB	WCR3-GO-25B	RM7840L	RM7840L	RM7840L	LHO	LHO	LHO/LHO	3	3	3	3-Phase*
1588	33.0	4,809	0.59	WCR3-G-25B	WCR3-OB	WCR3-GO-25B	RM7840L	RM7840L	RM7840L	LHO	LHO	LHO/LHO	3	3	3	3-Phase*
1688R	34.5	4,979	0.80	WCR3-G-25B	WCR3-OB	WCR3-GO-25B	RM7840L	RM7840L	RM7840L	LHO	LHO	LHO/LHO	3	3	3	3-Phase*
1688	35.5	5,155	0.80	WCR3-G-25B	WCR3-OB	WCR3-GO-25B	RM7840L	RM7840L	RM7840L	LHO	LHO	LHO/LHO	3	3	3	3-Phase*
1788	38.0	5,494	0.62	WCR4-G-25	WCR4-OA	WCR4-GO-25	RM7840L	RM7840L	RM7840L	LHO	LHO	LHO/LHO	3	5	5	3-Phase*
1888	40.5	5,845	0.69	WCR4-G-25	WCR4-OA	WCR4-GO-25	RM7840L	RM7840L	RM7840L	LHO	LHO	LHO/LHO	3	5	5	3-Phase*

* 208/60/3, 240/60/3, 480/60/3 burner motor voltage must be specified.

Notes for Table 1 and Table 2

1. Burner capacities listed for elevations up to 2,000 feet. For higher elevations, consult local Weil-McLain distributor/agent or sales office.
2. Light oil ratings based on No. 2 fuel oil with heating value of 140,000 Btu per gallon.
3. Gas ratings based on natural gas with heating value of 1,000 Btu per cubic foot and specific gravity of 0.60. Gas burners for other gases are available. Consult local Weil-McLain distributor/agent or sales office.
4. Boiler-burner unit to be adjusted to achieve +0.10 inches W.C. pressure at the flue collar, resulting in positive pressure in firebox as listed.
5. Minimum gas pressures listed are subject to variations due to job conditions. Gas burners for other gas pressures are available. Consult local Weil-McLain distributor/agent or sales office.
6. Tee pressures shown are for initial start-up. Final pressure should be determined after checking actual gas flow and combustion readings.
7. 120/60/1 control circuit is used for all burners.
8. Control circuit transformer is available as an option.
9. Motor relay or contactor will be furnished for all units, except 488R and 488.
10. Airflow safety switch is standard for all gas and combination gas/light oil units.
11. Burners will be completely assembled and wired (except gas train) and factory test-fired.
12. Burners listed by Underwriters Laboratories, Inc., state of Connecticut, Fire Marshal state of Massachusetts, city of New York MEA, and others.
13. Special controls can be provided to meet other code requirements not listed. Consult your local Weil-McLain distributor/agent or sales office.
14. Electric gas pilot will be furnished as standard equipment on all gas and combination gas/light oil units.
15. Direct spark ignition is standard for light oil units. Direct spark ignition is available as an option for combination gas/light oil units. Consult your local Weil-McLain distributor/agent or sales office.
16. Gas Control Systems:

OO	On-off operation, low fire start, high fire run. Single-position air, adjustable opening gas valve.
LHO	On-off operation, low fire start, high fire run. 488-1388: two-position air controlled by damper arm on motorized gas valve, fixed damper pre-purge. 1488-1888: two-position air controlled by separate motor, open damper pre-purge.
LHL	Low-high-low-off firing conditions. 488-1388: two-position air controlled by damper arm on motorized gas valve, fixed damper pre-purge. 1488-1888: two-position air controlled by separate motor, open damper pre-purge.
MOD	On-off operation, with proven low fire start and full modulating firing conditions with combustion air control. Proportional motor drives fuel metering valve and combustion air damper according to the firing conditions. Fixed damper pre-purge on 488-1388, open damper pre-purge on 1488-1888.

Burner specifications and settings (continued)

Table 2 Gas train components and flame safeguards

Boiler Model Number	Pressure Drop Thru Gas Train Inches W.C.	Manifold Pressure Inches W.C.*	Gas Pressure Required At Gas Control Inlet Inches W.C.*		Initial Low Fire Damper Setting Inches		Oil Nozzle (One Per Unit)					Oil Pressures Psig				Fuel Unit Data Burner-Motor Driven 3450 Rpm	
			Min	Max	Top	Bottom	Gph @ 100 Psig	Bypass Oil System	Brand**	Type	Spray Angle	Pump Capacity Psig	High Fire Pump Pressure	Approximate Return Psig		Type	Gear Gph
														High Fire	Low Fire		
488R	2.20	2.10	4.10	14.00	M̸	M̸	4.50	No	Delavan	Solid	80°	300	295	—	100-150	B2TA-8850-4	37
488	2.20	2.10	4.30	14.00	M̸	M̸	4.50	No	Delavan	Solid	80°	300	300	—	100-150	B2TA-8850-4	37
588	1.80	2.60	4.40	14.00	1	1	5.50	No	Delavan	Solid	80°	300	300	—	100-150	B2TA-8850-4	37
688	2.70	1.70	4.40	14.00	C̸	C̸	7.00	No	Delavan	Solid	80°	300	300	183	100-150	B2TA-8851-4	43
788	2.50	2.30	4.80	14.00	C̸	C̸	8.50	No	Delavan	Solid	70°	300	300	195	100-150	B2TA-8851-4	43
888	3.90	1.20	5.10	14.00	C̸	C̸	9.50	No	Delavan	Solid	70°***	300	300	210	100-150	B2GA-8852	43
988R	4.60	1.60	6.20	14.00	C̸	C̸	10.00	No	Monarch	PLP	60°	300	300	110	80-100	B2GA-8852	47
988	4.50	1.90	6.40	14.00	C̸	C̸	11.00	No	Delavan	Solid	70°***	300	280	135	80-100	B2GA-8852	47
1088R	4.90	2.00	6.90	14.00	C̸	C̸	12.00	No	Monarch	PLP	60°	300	290	140	80-100	B2GA-8852	47
1088	4.00	2.30	6.30	14.00	C̸	C̸	16.00	Yes	Del. Variflo	BPS	80°	300	225	150	100-150	22R322D	105
1188	3.30	2.10	5.40	14.00	C̸	C̸ (fixed)	14.00	Yes	Del. Variflo	BPS	80°	300	295	140	50-108	22R322D	105
1288	4.10	2.50	6.50	14.00	C̸	C̸ (fixed)	16.00	Yes	Del. Variflo	BPS	80°	300	290	133	50-110	22R322D	105
1388	3.50	2.70	6.20	27.70	C̸	C̸	18.00	Yes	Del. Variflo	BPS	80°	300	244	166	60-108	22R322D	105
1488	4.70	3.60	8.20	27.70	Z̸v	Z̸v	20.00	Yes	Del. Variflo	BPS	80°	300	280	180	100-150	22R623D	105
1588	5.30	3.90	9.20	27.70	Z̸v	Z̸v	22.00	Yes	Del. Variflo	BPS	60°	300	290	165	100-150	22R623D	105
1688R	5.80	4.10	10.50	27.70	Z̸v	Z̸v	22.00	Yes	Del. Variflo	BPS	60°	300	295	175	100-150	22R623D	135
1688	6.20	4.40	10.50	27.70	Z̸v	Z̸v	22.00	Yes	Del. Variflo	BPS	60°	300	295	155	100-150	22R623D	135
1788	6.50	2.80	9.30	27.70	Z̸v	Z̸v	24.00	Yes	Hago	BPS	60°	300	300	165	100-150	22R623D	135
1888	7.10	3.20	10.30	27.70	Z̸v	Z̸v	26.00	Yes	Hago	BPS	60°	300	300	175	100-150	22R623D	135

* Gas pressure shown are for standard gas train arrangement ** Primary manufacturer. For alternate nozzles, contact Power-Flame

*** 70° spray angle standard, 60° or 80° approved and available upon request

Standard Gas Control Components And Sizes In Inches

Boiler Model Number	Manual Hand Valve	Low Gas Pressure Switch	Gas Pressure Regulator	Combination Gas Valve And Regulator	Motorized Operating Gas Valve	Motorized Operating Gas Valve (With Proof Of Closure)	Safety Gas Valve	Manual Checking Gas Valve	High Gas Pressure Switch
488R-488	1Z̸v	Optional	Optional	1Z̸v	Optional	Optional	1Z̸v	1Z̸v	Optional
588	1Z̸v	Optional	Optional	1Z̸v	Optional	Optional	1Z̸v	1Z̸v	Optional
688	1Z̸v	Optional	Optional	1Z̸v	1Z̸v	Optional	*	1Z̸v	Optional
788	1Z̸x	Optional	Optional	1Z̸x	1Z̸x	Optional	*	1Z̸x	Optional
888	2	Optional	Optional	1Z̸x	1Z̸x	Optional	*	1Z̸x	Optional
988R	2	Optional	2	—	1Z̸x	Optional	1Z̸x	1Z̸x	Optional
988-1088R	2	Standard	2	—	2	Optional	1Z̸x	1Z̸x	Standard
1088	2	Standard	2	—	2	Optional	2	2	Standard
1188-1588	2	Standard	2	—	2	Optional	2	2	Standard
1688R-1888	2	Standard	2	—	—	2	2	2	Standard

* Combination operating gas valve and regulator also serves as safety gas valve.

17. Light Oil Control Systems:

FALFS	On-off operation, fixed air, reduced fuel low fire start, high fire run. Single-position air, two-position oil.
OO	On-off operation, low fire start, high fire run. Single-position air, single-position oil.
LHO	On-off operation, low fire start, high fire run. Two-position air, two-position oil. Fixed damper pre-purge on 488-1288, open damper pre-purge on 1388-1888.
LHL	Low-high-low-off firing conditions. Two-position air, two-position oil. Fixed damper pre-purge on 488-1288. Open damper pre-purge on 1388-1888.
MOD	On-off operation, with proven low fire start and full modulating firing conditions. Proportional motor drives fuel metering valve and combustion air damper according to the firing conditions. Fixed damper pre-purge on 488-1088R, open damper pre-purge on 1088-1888.

18. Gas/Light Oil Control Systems:

OO/FALFS	Combines gas and light oil characteristics listed above.
OO/OO	Combines gas and light oil characteristics listed above.
LHO/LHO	Combines gas and light oil characteristics listed above. Open damper pre-purge on 1388-1888.
LHL/LHL	Combines gas and light oil characteristics listed above. Open damper pre-purge on 1388-1888.
MOD/MOD	Combines gas and light oil characteristics listed above. Open damper pre-purge on 1388-1888.

Burner specifications and settings (continued)

Table 3 Flame safeguards

Flame Safeguards Provided with Listed Control Systems by Code

GAS BURNERS

Boiler Model Number	UL				FM				CSD-1				IRI			
	CO	LHO	LHL	MOD	CO	LHO	LHL	MOD	CO	LHO	LHL	MOD	CO	LHO	LHL	MOD
488R-588	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897C	RM7897C	RM7897C	RM7840L
688-988R	—	RM7897A	RM7897A	RM7897A	—	RM7897A	RM7897A	RM7897A	—	RM7897A	RM7897A	RM7897A	—	RM7897C	RM7897C	RM7840L
988-1388	—	RM7897C	RM7897C	RM7840L	—	RM7897C	RM7897C	RM7840L	—	RM7897C	RM7897C	RM7840L	—	RM7897C	RM7897C	RM7840L
1488-1888	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L

LIGHT OIL BURNERS

Boiler Model Number	UL				FM				CSD-1				IRI			
	FALFS	LHO	LHL	MOD	FALFS	LHO	LHL	MOD	FALFS	LHO	LHL	MOD	FALFS	LHO	LHL	MOD
488R	R7184P	R7184P	R7184P	R7184P	R7184P	R7184P	R7184P	R7184P	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7840L
488-588	R7184P	R7184P	R7184P	R7184P	R7184P	R7184P	R7184P	R7184P	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7897A	RM7840L
688-1088R	—	R7184P	R7184P	R7184P	—	R7184P	R7184P	R7184P	—	RM7897A	RM7897A	RM7897A	—	RM7897A	RM7897A	RM7840L
1088-1288	—	RM7897A	RM7897A	RM7840L	—	RM7897A	RM7897A	RM7840L	—	RM7897A	RM7897A	RM7840L	—	RM7897A	RM7897A	RM7840L
1388-1888	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L

COMBINATION GAS/OIL BURNERS

Boiler Model Number	UL				FM				CSD-1				IRI			
	CO/FALFS	LHO	LHL	MOD	CO/FALFS	LHO	LHL	MOD	CO/FALFS	LHO	LHL	MOD	CO/FALFS	LHO	LHL	MOD
488R-588	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7897C	RM7840L
688-988R	—	RM7897C	RM7897C	RM7897C	—	RM7897C	RM7897C	RM7897C	—	RM7897C	RM7897C	RM7897C	—	RM7897C	RM7897C	RM7840L
988-1288	—	RM7897C	RM7897C	RM7840L	—	RM7897C	RM7897C	RM7840L	—	RM7897C	RM7897C	RM7840L	—	RM7897C	RM7897C	RM7840L
1388-1888	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L	—	RM7840L	RM7840L	RM7840L

Notes for Table 3

1. Combustion Controls:

R7184P	Uses cadmium cell for flame detector to monitor oil burner flame, also furnishes intermittent ignition.
RM7897A, RM7897C	Uses ultraviolet electronic flame detector to monitor gas or oil burner flame and provides pre-purge programming. "A" models provide intermittent pilot; "C" models provide interrupted pilot and RUN/TEST switch. RM7897 provides same as above with post-purge.
RM7840L, E110/EPD170	Monitors the oil or gas burner flame, provides pre-purge and post-purge programming, provides switching necessary to allow firing rate motor to be driven to both low fire and high fire positions, prevents start-up if pre-ignition interlocks are open and has low fire start proving circuit. In the event pre-ignition interlock circuit or running interlock circuit does not "prove", system will lock out on safety. Ultraviolet sensitive electronic flame detector is standard with infrared detector available.
RM7800L, E110/EP160	Monitors the oil or gas burner flame with digital readout control system, provides pre-purge and post-purge programming, provides switching necessary to allow firing rate motor to be driven to both low fire and high fire position, prevents start-up if pre-ignition interlocks are open and has low fire start proving circuit. In the event pre-ignition interlock circuit or running interlock circuit does not "prove", system will lock out on safety. Ultraviolet sensitive electronic flame detector is standard with infrared detector available.

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APPENDIX - PROCEDURE TO REFER BURNER OPERATING CONDITION IN HIGH ALTITUDE PLANTS

- Find the **corrected burner capacity** for the plant's altitude in chart **1** and the **corrected pressure** in chart **2**.
- Check in the firing rate graph of the burner (page 7), if the working point defined by the values above is within the range limits. If not, higher burner size is needed.

Note
Charts are based only on altitude variation (reference temperature = 68°F , 20°C)

To get the combined correction in case of different air temperature, a compensation of **1000 ft each 20°F (305 m each 11°C)** is applicable.

Example
Rated capacity = 3000 MBtu/hr - Rated air pressure = 1.5"w.c.
Real altitude = 5000 ft - Real temperature = 108°F
Δ = 108°F - 68°F (reference temp.) = 40°F (equivalent 2000 ft variation)
Proceeding as descripted above and considering a "virtual altitude" of (5000 + 2000) ft:
- the corrected capacity is 3847 MBtu/hr;
- the corrected burner air pressure is 1.92. ➡ **Burner RL 100/M is OK**

1 CORRECTED BURNER CAPACITY ACCORDING TO ALTITUDE

S8369

		Altitude									
Rated Capacity	**m. a.s.l.**	**0**	**100**	**305**	**610**	**915**	**1220**	**1525**	**1830**	**2135**	**2440**
	ft a.s.l	**0**	**328**	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**
500		494	500	512	530	551	571	593	616	641	669
1000		987	1000	1023	1061	1101	1142	1186	1232	1282	1337
1500		1481	1500	1535	1591	1652	1713	1778	1848	1924	2006
2000		1974	2000	2046	2121	2202	2284	2371	2464	2565	2675
2500		2468	2500	2558	2652	2753	2855	2964	3079	3206	3343
3000		2962	3000	3069	3182	3303	3425	3557	3695	3847	4012
3500		3455	3500	3581	3712	3854	3996	4149	4311	4488	4680
4000		3949	4000	4092	4243	4404	4567	4742	4927	5130	5349
4500		4442	4500	4604	4773	4955	5138	5335	5543	5771	6018
5000		4936	5000	5116	5303	5505	5709	5928	6159	6412	6686
5500		5429	5500	5627	5834	6056	6280	6520	6775	7053	7355
6000		5923	6000	6139	6364	6606	6851	7113	7391	7694	8024
6500		6417	6500	6650	6894	7157	7422	7706	8006	8335	8692
7000		6910	7000	7162	7425	7708	7993	8299	8622	8977	9361
7500		7404	7500	7673	7955	8258	8564	8892	9238	9618	10029
8000		7897	8000	8185	8485	8809	9135	9484	9854	10259	10698
8500		8391	8500	8697	9016	9359	9705	10077	10470	10900	11367
9000		8885	9000	9208	9546	9910	10276	10670	11086	11541	12035
9500		9378	9500	9720	10076	10460	10847	11263	11702	12183	12704
10000		9872	10000	10231	10607	11011	11418	11855	12318	12824	13373
Average barometric Pressure (20°C)	**mbar**	**1013**	**1000**	**977,4**	**942,8**	**908,2**	**875,8**	**843,5**	**811,85**	**779,8**	**747,8**
Average barometric Pressure (68°F)	**"w.c.**	**399**	**394**	**385**	**371**	**358**	**345**	**332**	**320**	**307**	**294**

2 CORRECTED BURNER AIR PRESSURE ACCORDING TO ALTITUDE

		Altitude									
Rated Pressure	**m. a.s.l.**	**0**	**100**	**305**	**610**	**915**	**1220**	**1525**	**1830**	**2135**	**2440**
	ft a.s.l	**0**	**328**	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**
0,50		0,49	0,50	0,51	0,53	0,55	0,57	0,59	0,62	0,64	0,67
1,00		0,99	1,00	1,02	1,06	1,10	1,14	1,19	1,23	1,28	1,34
1,50		1,48	1,50	1,53	1,59	1,65	1,71	1,78	1,85	1,92	2,01
2,00		1,97	2,00	2,05	2,12	2,20	2,28	2,37	2,46	2,56	2,67
2,50		2,47	2,50	2,56	2,65	2,75	2,85	2,96	3,08	3,21	3,34
3,00		2,96	3,00	3,07	3,18	3,30	3,43	3,56	3,70	3,85	4,01
3,50		3,46	3,50	3,58	3,71	3,85	4,00	4,15	4,31	4,49	4,68
4,00		3,95	4,00	4,09	4,24	4,40	4,57	4,74	4,93	5,13	5,35
4,50		4,44	4,50	4,60	4,77	4,95	5,14	5,33	5,54	5,77	6,02
5,00		4,94	5,00	5,12	5,30	5,51	5,71	5,93	6,16	6,41	6,69
5,50		5,43	5,50	5,63	5,83	6,06	6,28	6,52	6,77	7,05	7,35
6,00		5,92	6,00	6,14	6,36	6,61	6,85	7,11	7,39	7,69	8,02
6,50		6,42	6,50	6,65	6,89	7,16	7,42	7,71	8,01	8,34	8,69
7,00		6,91	7,00	7,16	7,42	7,71	7,99	8,30	8,62	8,98	9,36
7,50		7,40	7,50	7,67	7,96	8,26	8,56	8,89	9,24	9,62	10,03
8,00		7,90	8,00	8,18	8,49	8,81	9,13	9,48	9,85	10,26	10,70
8,50		8,39	8,50	8,70	9,02	9,36	9,71	10,08	10,47	10,90	11,37
9,00		8,88	9,00	9,21	9,55	9,91	10,28	10,67	11,09	11,54	12,04
9,50		9,38	9,50	9,72	10,08	10,46	10,85	11,26	11,70	12,18	12,70
10,00		9,87	10,00	10,23	10,61	11,01	11,42	11,86	12,32	12,82	13,37
Average barometric Pressure (20°C)	**mbar**	**1013**	**1000**	**977,4**	**942,8**	**908,2**	**875,8**	**843,5**	**811,85**	**779,8**	**747,8**
Average barometric Pressure (68°F)	**"w.c.**	**399**	**394**	**385**	**371**	**358**	**345**	**332**	**320**	**307**	**294**

Reference conditions (Charts 1-2): Ambient temperature 68 °F (20 °C) - Barometric pressure 394" WC (1000 mbar) - Altitude 328 ft a.s.l. (100 m a.s.l.)

BOILER MANUAL
INSTALLATION & MAINTENANCE

88

Water & steam boilers – Series 2

for use with Gas, Light Oil, & Gas/Light Oil – Fired Burners

Boiler Manual

- **Installation**
- **Startup**
- **Maintenance**
- **Parts**

For additional information, refer to . .

Burner specification and data sheets

for burners pre-tested with model 88 boilers

WARNING This manual must only be used by a qualified heating installer/service technician. Read all instructions before installing. Follow all instructions in proper order. Failure to comply could result in severe personal injury, death or substantial property damage.

NOTICE When calling or writing about the boiler— Please have the boiler model number from the boiler rating label and the CP number from the boiler jacket.

INSTALLER Consider piping and installation when determining boiler location.
Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

USER . . . . This manual is for use only by your qualified heating installer/service technician. Boiler and burner must be installed by a qualified service technician. We recommend regular service by a qualified service technician, at least annually.

Part No. 550-100-068/0215

Read before proceeding

Hazard Definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.

⚠DANGER Indicates presence of hazards that **will cause severe** personal injury, death or substantial property damage if ignored.

⚠WARNING Indicates presence of hazards that **can cause severe** personal injury, death or substantial property damage if ignored.

⚠CAUTION Indicates presence of hazards that **will or can cause minor** personal injury, death or substantial property damage if ignored.

NOTICE Indicates special instructions on installation, operation or maintenance that are important but not related to personal injury.

Read before proceeding:

⚠WARNING Read all instructions before installing. Failure to follow all instructions in proper order can cause severe personal injury, death or substantial property damage.

⚠WARNING Do not use petroleum-based cleaning or sealing components in boiler system. Severe damage to system components can result, causing substantial property damage.

⚠WARNING **Propane boilers only** — Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade and the gas may no longer have an odor.

- Propane gas can accumulate at floor level. Smell near the floor for the gas odorant or any unusual odor. If you suspect a leak, do not attempt to light the burner.
- Use caution when attempting to light a propane burner (or pilot burner). This should be done by a qualified service technician, particularly if flame outages (or pilot outages) are common.
- Periodically check the odorant level of your gas.
- Inspect boiler and system at least yearly to make sure all gas piping is leak-tight.
- Consult your propane supplier regarding installation of a gas leak detector. There are some products on the market intended for this purpose. Your supplier may be able to suggest an appropriate device.

Contents

Before installing boiler

Installation must comply with —

1. State, provincial and local plumbing, heating and electrical codes.
2. Regulations of servicing utilities.
3. ASME Section IV, Low Pressure Boiler and Pressure Vessel Code.
4. National Fuel Gas Code, ANSI/NFPA 54, when applicable.
5. National codes where applicable.

Before selecting boiler location

1. Check for nearby connections to:
   a. Fuel supply.
   b. Electrical power.
   c. System water or steam piping.
   d. Venting systems - see page 29.
   e. Combustion and ventilation air supply — see page 5.
2. Check area around boiler. Remove any combustible materials, gasoline and other flammable vapors and liquids.

⚠WARNING Failure to keep boiler area clear and free of combustible materials, gasoline and other flammable liquids and vapors can result in severe personal injury, death and substantial property damage.

Provide clearance around boiler

1. Provide minimum clearances to combustible materials:
   - **Boiler top** — 24 inches.
   - **Boiler front** — 48 inches.
   - **Boiler flue** — 9 inches.
   - **Boiler rear** — 9 inches.
   - **Boiler sides** — 6 inches.
   - **Single-wall vent pipe** – 18 inches.
   - **Double-wall vent pipe** – refer to vent pipe manufacturer's recommendations for vent pipe clearances.
2. Boiler may be installed on combustible flooring.
3. See page 36 for boiler dimensions.

NOTICE Flue pipe/breeching clearances take precedence over jacket clearances.

4. Provide minimum clearances for servicing:
   - **Left side** — for cleaning and tankless heater removal – 39 inches.
   - **Rear** — for breeching — 36 inches.
   - Allow sufficient space on remaining sides for cleaning, servicing and burner installation. See burner literature for length and recommended service clearances.

Lay a foundation, if needed

1. Floor construction and condition must be suitable for weight of boiler when filled with water. See page 35 for approximate boiler operating weight.
2. A level concrete or brick foundation, constructed per Figure 1 and Figure 2 is required when:
   a. A floor could possibly become flooded.
   b. Non-level conditions exist.

Figure 1 Boiler foundation, when required

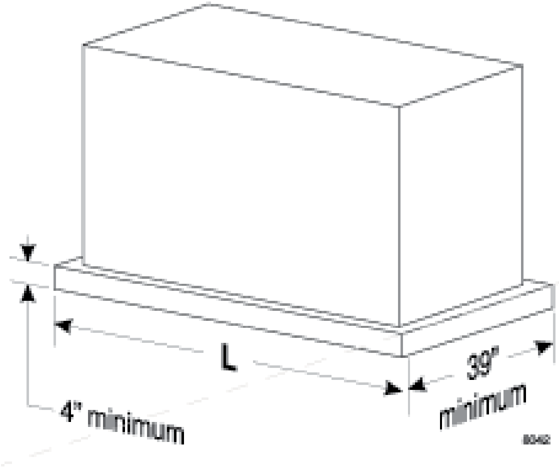


Figure 2 Boiler foundation (see Figure 1)

Boiler model number	Length, L, minimum (inches)
488	33
588	41
688	49
788	57
888	65
988	73
1088	81
1188	89
1288	97
1388	105
1488	113
1588	121
1688	129
1788	137
1888	145

Before installing boiler *(continued)*

Combustion and ventilation air openings

⚠WARNING Adequate combustion and ventilation air must be provided to assure proper combustion and prevent possibility of flue gas leakage and carbon monoxide emissions, causing severe personal injury or death.

Do not install an exhaust fan in boiler room. Incorrect burner operation can result.

When combustion and ventilation air enters through side wall openings, ensure that the openings comply with the requirements of Figure 3 and Figure 4.

Opening sizes must comply with state, provincial or local codes. In the absence of local requirements, use the National Fuel Gas Code, ANSI/NFPA 54). The following information is taken from ANSI/NFPA 54. For details and information not addressed below, refer to the standard.

Combustion air openings to inside

Required volume of interior spaces

ANSI/NFPA 54 allows combustion air to be supplied through openings to interior spaces **if the volume of the connected interior spaces meets the minimum volume required by the standard**.

The minimum volume of interior spaces can be taken as 50 cubic feet per 1,000 Btuh of all appliances in the spaces, or the minimum volume can be calculated using the formulas given in ANSI/NFPA 54. Exception: If the air infiltration rate for the spaces is known to be less than 0.40 air changes per hour, the minimum volume must be calculated as specified in the standard.

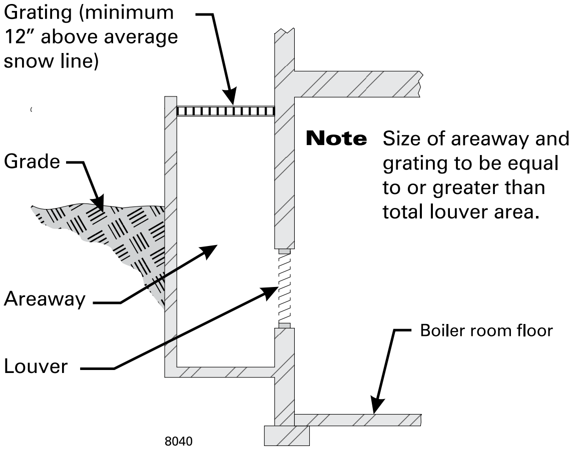
Inside air opening sizes and locations

For spaces that provide the minimum volume required by ANSI/NFPA 54, the air openings must be sized per the following:

Combining spaces on the same story — Each opening shall have a minimum free area of 1 in^2/1000 Btuh (2200 mm^2/kW) of the total input rating of all appliances in the space but not less than 100 in^2 (0.06 m^2). One opening shall commence within 12 inches (300 mm) of the top, and one opening shall commence within 12 inches (300 mm) of the bottom, of the enclosure. The minimum dimension of air openings shall be not less than 3 inches (80 mm).

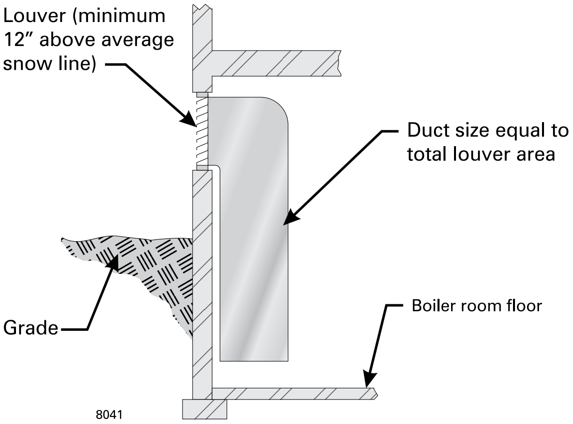
Combining spaces in different stories — The volumes of spaces in different stories shall be considered as communicating spaces where such spaces are connected by one or more openings in doors or floors having a total minimum free area of 2 in^2/1000 Btuh (4400 mm^2/kW) of total input rating of all appliances.

Figure 3 Combustion and ventilation air openings — Boiler room below grade



Note Size of areaway and grating to be equal to or greater than total louver area.

Figure 4 Combustion and ventilation air openings — Boiler room partially or completely above grade


Louver (minimum 12″ above average snow line)
Duct size equal to total louver area
Boiler room floor
Grade
8041

Combustion air openings to outside

Outdoor combustion air can be taken through permanent openings (TWO or ONE), as described in the following. The minimum dimension of air openings shall not be less than 3 inches (80 mm).

Outside openings: TWO permanent openings method

Two permanent openings, one commencing within 12 inches (300 mm) of the top and one commencing within 12 inches (300 mm) of the bottom of the enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that

Before installing boiler *(continued)*

freely communicate with the outdoors, as follows:

- Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 in^2/4000 Btuh (550 mm^2/kW) of total input rating of all appliances in the enclosure.
- Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 in^2/2000 Btuh (1100 mm^2/kW) of total input rating of all appliances in the enclosure.

Outside openings: ONE permanent opening method

One permanent opening, commencing within 12 inches (300 mm) of the top of the enclosure, shall be provided. The appliance shall have clearances of at least 1 in. (25 mm) from the sides and back and 6 inches (150 mm) from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of the following:

(1) 1 in^2/3000 Btu/hr (700 mm^2 per kW) of the total input rating of all appliances located in the enclosure, and . . .

(2) Not less than the sum of the areas of all vent connectors in the space.

Combustion air — combination indoor and outdoor openings

ANSI/NFPA 54 allows combustion air to be taken from a combination of openings to outside and to interior spaces. Follow all requirements of the standard to determine the minimum volume of interior spaces and to calculate minimum sizes of openings.

Engineered Installations

Engineered combustion air installations shall provide an adequate supply of combustion, ventilation, and dilution air and shall he approved by the authority having jurisdiction.

Mechanical Combustion Air Supply

Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 ft^3/minute per 1000 Btuh (0.034 m^3/min per kW) for all appliances located within the space.

- Where exhaust fans are installed in the building, additional air shall be provided to replace the exhausted air.
- Each of the appliances served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation.
- Where combustion air is provided by the building's mechanical ventilation system, the system shall provide the specified combustion air rate in addition to the required ventilation air.

Louvers, Grilles, and Screens.

The required size of openings for combustion, ventilation, and dilution air shall be based on the **net free area** of each opening.

Where the free area through a design of louver or grille or screen is known, it shall be used in calculating the size opening required to provide the free area specified.

Where the louver and grille design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area, and metal louvers and grilles will have 75 percent free area.

Non-motorized louvers and grilles shall be fixed in the open position.

Minimum screen mesh size

Screens shall not be smaller than ¼ inch mesh.

Motorized louvers

Motorized louvers shall be interlocked with the appliance so they are proven in the full open position prior to main burner ignition and during main burner operation. Means shall be proved to prevent the main burner from igniting should the louver fail to open during burner startup, and to shut down the main burner if the louvers close during burner operation.

Set boiler in place

⚠WARNING Ensure the equipment and cables used for lifting are designed to handle the load. See Figure 5 for approximate weights of model 88 section assemblies. Failure to comply can result in severe personal injury, death or substantial property damage.

NOTICE Cables used for lifting are NOT provided by Weil-McLain.

For packaged boiler:

1. Remove top jacket panels. Set aside until after boiler is piped.

⚠WARNING The boiler contains ceramic fiber and fiberglass materials. Use care when handling these materials per instructions on "Handling ceramic fiber and fiberglass materials," page 34 of this manual. Failure to comply could result in severe personal injury.

2. Remove lag screws (2 in front, 2 in rear) from shipping rails.
3. Remove boiler from skid. See Figure 5 for lifting weight.
   - Using crane — hook middle of each cable to eye of crane.
   - Using hoist — hook middle of each cable to hoist. Raise boiler off skid. Use pipe rollers under skid angles to roll boiler.
4. Place boiler in final position. Center boiler on foundation, if used.
5. Level boiler. Shim under skid angles, if necessary.
6. Cut off cables.

⚠WARNING Cables are not intended for long-term usage. Cables may corrode inside boiler, weakening their lifting strength. Failure to remove cables can result in severe personal injury, death or substantial property damage.

7. Proceed to "Perform hydrostatic pressure test," page 11.

For block assembly:

1. Remove lag screws (2 in front, 2 in rear) from shipping rails.
2. Remove boiler from skid. See Figure 5 for lifting weight.
   - Using crane – attach free end of cables to eye of crane.
   - Using hoist – attach free end of cables to hoist. Raise boiler off skid. Use pipe rollers under steel skid angles to roll boiler.
3. Place boiler in final position. Center boiler on foundation, if used.
4. Level boiler. Shim under skid angles, if necessary.
5. Cut off cables.

⚠WARNING Cables are not intended for long-term usage. Cables may corrode inside boiler, weakening their lifting strength. Failure to remove cables can result in severe personal injury, death or substantial property damage.

6. Inspect block assembly for disjointed sections. Check gas-tight seal of flue collector hood and cleanout plates.

⚠WARNING Gas tight seal must be maintained to prevent possible flue gas leakage and carbon monoxide emissions, resulting in severe personal injury or death.

   a. Check inside section assembly for any light passing through unsealed areas.
   b. Mark all unsealed areas.
   c. At unsealed areas, check for:
      - Damaged gaskets.
      - Sealing rope not in place.
      - Loose bolts or nuts.
   d. Correct all conditions and repeat step b. If unsealed areas still exist, contact your Weil-McLain distributor or sales office before continuing installation.

7. Proceed to "Perform hydrostatic pressure test," page 11.

Figure 5 Section assembly lifting weights

Boiler model number	Approximate lifting weight (pounds)	Minimum sling length — (from crane hook to boiler lifting lugs)
488	2928	2' 6"
588	3490	3' 0"
688	4152	4' 0"
788	4714	4' 6"
888	5276	5' 0"
988	5838	6' 0"
1088	6400	6' 6"
1188	7062	7' 0"
1288	7624	8' 0"
1388	8186	8' 6"
1488	8748	9' 0"
1588	9310	10' 0"
1688	9872	10' 6"
1788	10,584	11' 0"
1888	11,146	12' 0"

Assembling the block

⚠WARNING Sections are top heavy. Unbolted sections may fall if not supported, resulting in severe personal injury or death.

Prepare and position back section

1. Apply ⅛" continuous bead of sealing rope adhesive in sealing rope grooves. See Figure 6. **Do not get any adhesive on machined port surfaces**.
2. Place ½" sealing rope in groove. Around curves, grasp at 1" intervals and push together. Do not stretch.

⚠WARNING Do not pre-cut rope. Gas tight seal must be maintained to prevent possibility of flue gas leakage and carbon monoxide emissions, causing severe personal injury or death. Cut rope as each section is completed.

3. Remove any grit from port machined surfaces with clean rag.

⚠WARNING Do not use petroleum-based cleaning or sealing compounds in boiler system. Severe damage to system components can result, causing substantial property damage.

4. Place 9" and 6" sealing rings in appropriate port openings. See Figure 6. If sealing ring slips out of groove, stretch ring gently for several seconds, then reposition in groove.
5. Apply continuous bead of silicone sealant no larger than 1/16" around entire outside edge of **outer** machined surface of port. Refer to Figure 7. **Do not apply silicone sealant on, next to or under sealing ring**.

⚠WARNING Silicone sealant applied as specified above prevents unburned oil vapors from coming in contact with sealing ring. Vapor contact can damage rings, resulting in severe damage to boiler and substantial property damage.

6. Hoist back section upright. Then temporarily screw a 6-inch threaded pipe at least 36 inches long into the lower (return) tapping.
7. Hoist the section and put into position.
8. Place a block under the 6-inch pipe to hold the back section upright and plumb.

⚠CAUTION The back section must be plumb before installing other sections to ensure the block will assemble correctly.

9. The 6-inch support pipe and block can be removed after several sections have been installed, and the assembly is stable.
10. Install intermediate sections as described on the following page.

Figure 6 Sealing rope installation

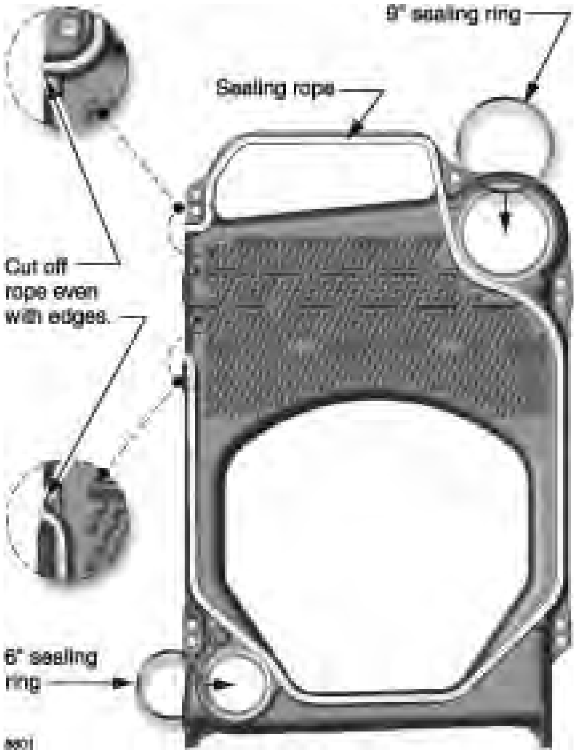
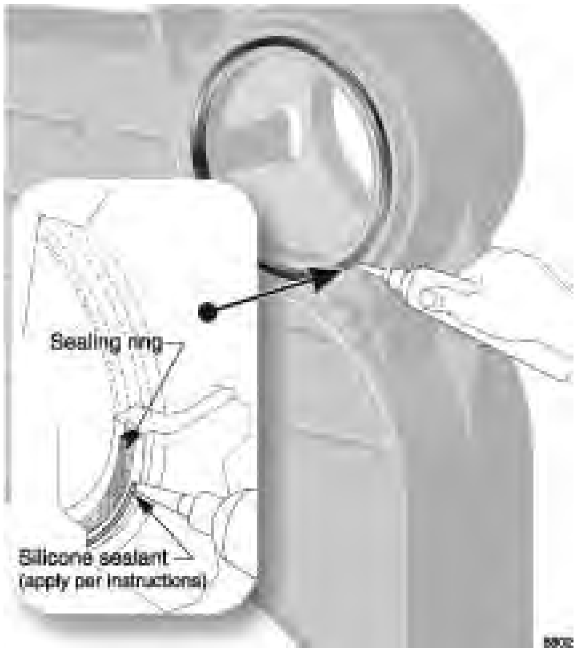


Figure 7 Silicone sealant



Assembling the block

⚠WARNING Sections are top heavy. Unbolted sections may fall if not supported, resulting in severe personal injury or death.

Install intermediate sections

1. Remove and discard ³⁄₈" diameter shipping tie rods.
2. Remove grit from port machined surfaces with clean rag.

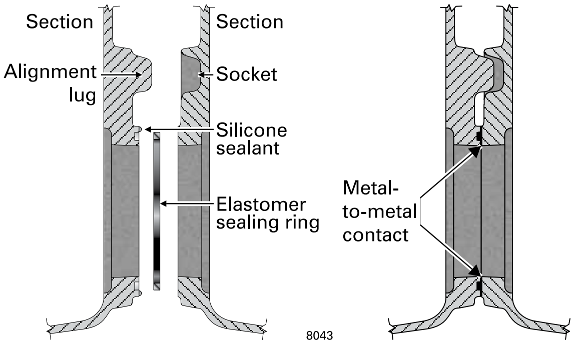
⚠WARNING Do not use petroleum-based cleaning or sealing compounds in boiler system. Severe damage to system components can result, causing substantial property damage.

3. Position intermediate section so aligning lugs fit into sockets of next section. See Figure 8.
4. Install TI (tankless intermediate) and SI (supply intermediate) sections (when used) in order shown in Figure 9, page 10.
5. Draw sections together until metal-to-metal contact is made around machined port openings (see Figure 8):
    a. Oil threads on 4 draw rods. Install washer and nut on end to be tightened. Use nut only on other end.
    b. Uniformly draw sections together, starting at washer/nut end.

NOTICE Important — Leave an equal amount of thread on each end of the draw rod. This is needed to allow securing the jacket support brackets in place.

    c. Draw rods should be torqued to a range of 100 to 120 ft-lbs. Do not back off draw rods.
    d. Metal-to-metal contact will be achieved around port openings. See Figure 8. If gap occurs, it should be no greater than .032". Check with feeler gauge.
    e. If, for any reason, gap around machined port opening exceeds .032", check for rope extending from rope grooves, dirt on port openings or sockets, or misaligned lugs. If corrections are made and gap still exists, contact your Weil-McLain distributor or sales office before continuing installation.

Figure 8 Sealing ring installation and port alignment



⚠CAUTION After erecting first intermediate section, check both sections for plumb. Failure to plumb sections can cause misaligned piping and breeching, possibly resulting in property damage.

6. Repeat steps 1-5.
7. Check each section for proper sealing rope position before proceeding to next section.

⚠WARNING Failure to position sealing rope properly can cause boiler to not seal gas-tight. Gas tight seal prevents possible flue gas leakage and carbon monoxide emissions, resulting in severe personal injury or death.

8. Install remaining intermediate sections and front section using the same procedure.

If using tankless heater (TI) sections

- Install tankless heaters and gaskets or heater cover plates and gaskets. Use ³⁄₈" x ³⁄₄" studs, washers and nuts.

Assembling the block *(continued)*

Figure 9 Section arrangement

Boiler model number **W** = water **S** = steam	**Max. number of tankless heaters**	**Section arrangement** (all heaters must be on left side of boiler) **F** = front / **B** = back / **I** = Intermediate **TI** = tankless intermediate **SI** = supply intermediate (steam only) **"I"** can be substituted for **"TI"** sections
488 W&S	1	**F • TI • I • B**
588 W&S	2	**F • TI • I • TI • B**
688 W&S	2	**F • TI • I • TI • I • B**
788 W&S	3	**F • TI • I • TI • I • TI • B**
888 W&S	3	**F • TI • I • TI • I • TI • I • B**
988 W&S	4	**F • TI • I • TI • I • TI • I • TI • B**
1088 W&S	4	**F • TI • I • TI • I • TI • I • TI • I • B**
1188 W&S	5	**F • TI • I • TI • I • TI • I • TI • I • TI • B**
1288 W	5	**F • TI • I • TI • I • TI • I • TI • I • TI • I • B**
1288 S	4	**F • TI • I • TI • I • SI • I • TI • I • TI • I • B**
1388 W	6	**F • TI • I • TI • I • TI • I • TI • I • TI • I • TI • B**
1388 S	6	**F • TI • I • TI • I • TI • SI • TI • I • TI • I • TI • B**
1488 W	6	**F • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • B**
1488 S	5	**F • TI • I • TI • I • TI • I • SI • I • TI • I • TI • I • B**
1588 W	7	**F • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • TI • B**
1588 S	7	**F • TI • I • TI • I • TI • I • TI • SI • TI • I • TI • I • TI • B**
1688 W	7	**F • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • B**
1688 S	7	**F • TI • I • TI • I • TI • SI • TI • I • TI • I • TI • I • TI • I • B**
1788 W	8	**F • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • TI • B**
1788 S	8	**F • TI • I • TI • SI • TI • I • TI • I • TI • SI • TI • I • TI • I • TI • B**
1888 W	8	**F • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • TI • I • B**
1888 S	6	**F • TI • I • TI • I • SI • I • TI • I • TI • I • SI • I • TI • I • TI • I • B**

Perform hydrostatic pressure test

Prepare boiler and test:

1. See Figure 10 and Figure 11 for tapping locations. Install:
    a. Boiler drain (not furnished).
    b. Water pressure gauge — for test only. Be sure gauge can handle test pressure — see step 3.
    c. Air vent in upper tapping (K).
2. Plug remaining tappings.

⚠CAUTION Do not pressure test with any control installed. Damage to control can occur due to overpressure.

3. Fill boiler. Vent all air. Pressure test at least 10 minutes at a pressure not less than the following:
    a. **Steam** boiler: **Between 45 and 55 psig**.
    b. **Water** boiler: **1½ times maximum allowable working pressure** (MAWP) stamped on the boiler nameplate, located on boiler jacket front panel.

NOTICE Do not exceed above test pressures by more than 10 psig.

⚠WARNING Do not leave boiler unattended. Cold water fill could expand and cause excessive pressure, resulting in severe personal injury, death or substantial property damage.

4. Check for maintained gauge pressure and leaks. Repair if found.

⚠WARNING Leaks must be repaired at once. Failure to do so can damage boiler, resulting in substantial property damage.

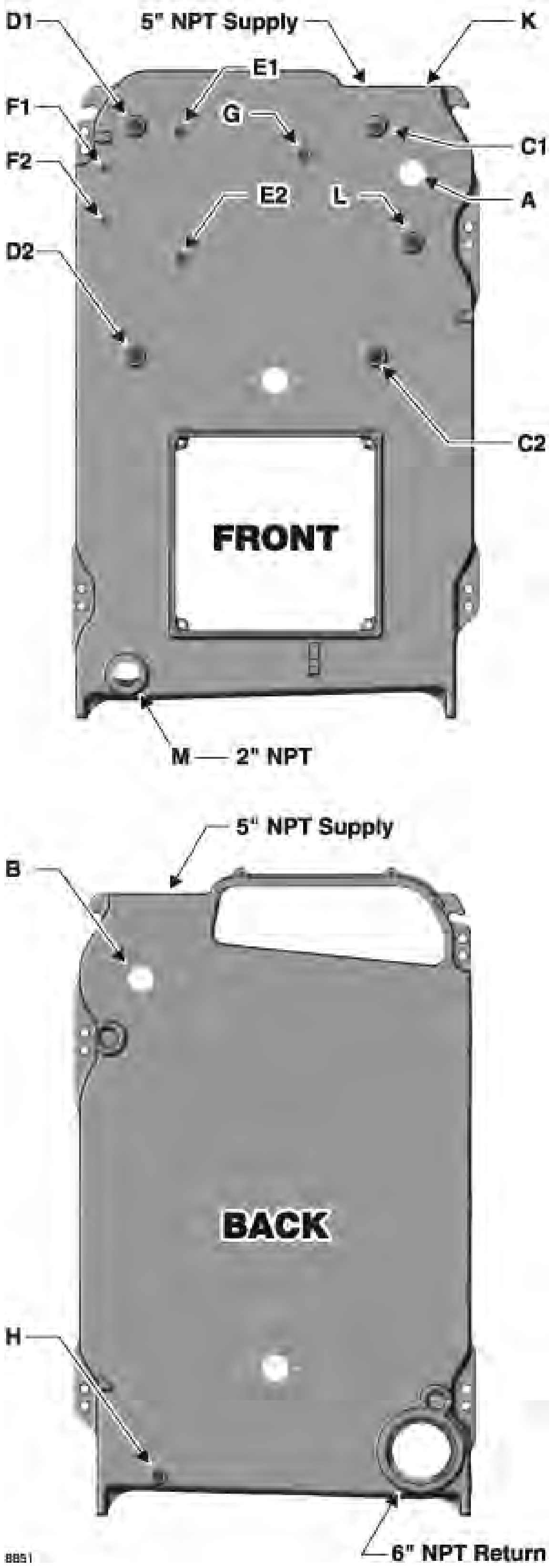
⚠WARNING Do not use petroleum-based cleaning or sealing compounds in boiler system. Severe damage to system components can result, causing substantial property damage.

5. Drain boiler and remove air vent, boiler drain and gauge. Remove plugs from tappings that will be used for controls and accessories.

Figure 10 Boiler tapping locations and sizes (see Figure 11)

Location	Size	Steam	Water
A	2"	Steam relief valve and/or Skim tapping	High limit Manual reset limit
B	2"	Steam relief valve	Water relief valve
L	1"	Secondary probe LWCO	Not used — Plug
C1 & C2	1"	Low water cut-offs	Alternate low water cut-offs
C1		—	Combination high and low limit control
D1 & D2	1"	Alternate low water cut-offs	Firing rate temperature control (when used) Low water cut-offs
E1 & E2	½"	Gauge glass	—
F1 & F2	⅜"	Try cock tappings	—
G	¾"	Pressure limit control, Pressure operating control and pressure gauge, Firing rate pressure control (when used)	Combination pressure–temperature gauge
H	¾"	Boiler drain (see Figure 17, page 15, for system blow-off (drain) valve locations and sizes	Boiler drain
K	1"	—	Piping to compression tank or automatic air vent
M	2"	Blowdown/drain	—

Figure 11 Boiler tappings



Complete block assembly

Install burner mounting plate on front section

1. Install four ½" x 3½" studs to secure burner mounting plate to section:
    a. Thread and lock together two nuts on rounded end of stud. Thread flat end of stud into one of four holes located around opening.
    b. Remove nuts.
    c. Repeat steps a and b for remaining studs.
2. Install burner mounting plate:
    a. Apply ⅛" continuous bead of sealing rope adhesive in groove around opening in section.
    b. Position ½" sealing rope in groove. Overlap ends at least one inch.
    c. Install burner mounting plate with part number and the word, "**UP,**" positioned at top. Use ½" washers and nuts.

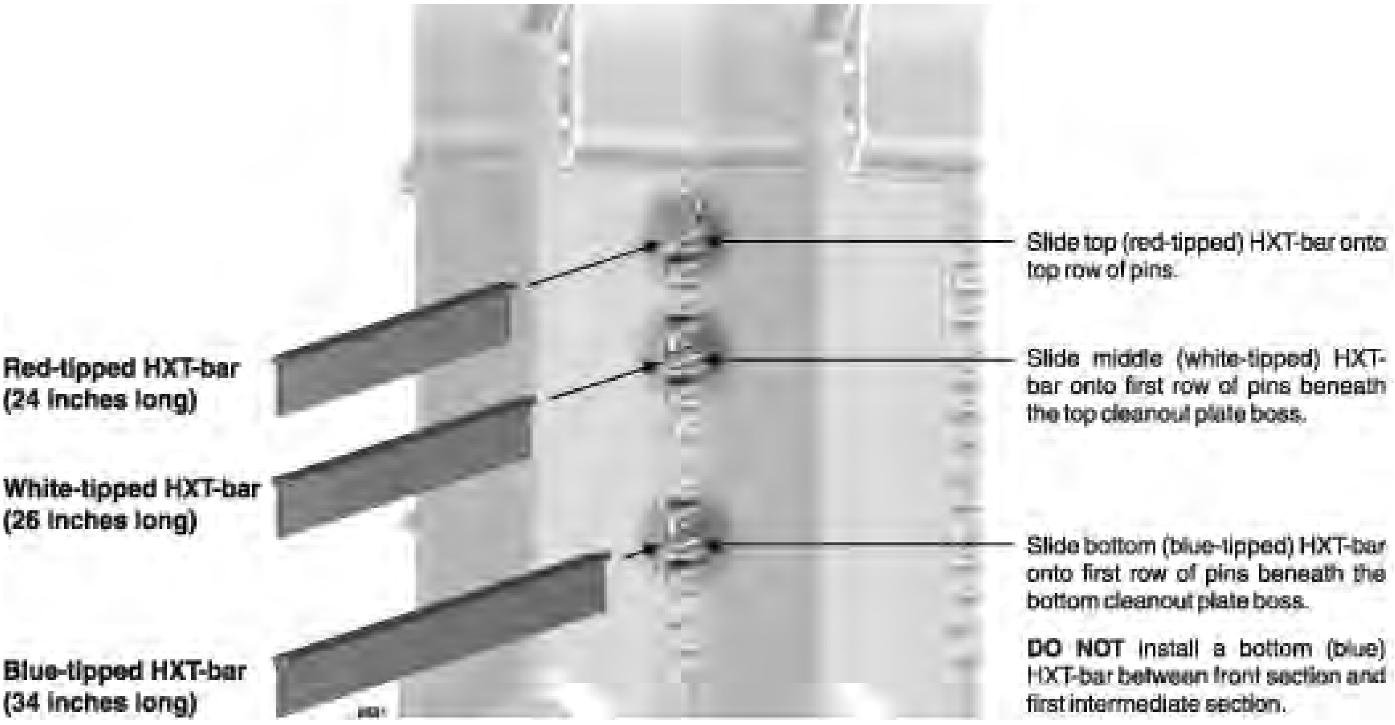
Install observation port assemblies on front and back sections

1. Install front observation port assembly:
    a. Apply ⅛" continuous bead of sealing rope adhesive in groove on observation port.
    b. Position ⅜" sealing rope in groove.
    c. Secure assembly to section. Use 10-32 x ¾" truss-head screws.
2. Repeat above steps for back observation port assembly.

Insert HXT-bars

1. See Figure 12, page 12.
2. Flue HXT-bars are identified by painted ends. They must be inserted as shown, with the HXT-bars in the sequence:
    - **Top** position
        - **red**-tipped, HXT-bar 24 inches long — place on the top row of pins.
    - **Middle** position
        - **white**-tipped HXT-bar, 26 inches long — place on the first row of pins below the top clean-out plate boss.
    - **Bottom** position
        - **blue**-tipped HXT-bar, 34 inches long — place on the first row of pins below the bottom cleanout plate boss.

Figure 12 Insert HXT-bars through cleanout openings as shown below (omit the bottom, blue-tipped, HXT-bar in the opening between the front section and the first intermediate section)


Red-tipped HXT-bar
(24 inches long)
White-tipped HXT-bar
(26 inches long)
Blue-tipped HXT-bar
(34 inches long)
Slide top (red-tipped) HXT-bar onto top row of pins.
Slide middle (white-tipped) HXT-bar onto first row of pins beneath the top cleanout plate boss.
Slide bottom (blue-tipped) HXT-bar onto first row of pins beneath the bottom cleanout plate boss.
DO NOT install a bottom (blue) HXT-bar between front section and first intermediate section.

Complete block assembly *(continued)*

NOTICE **DO NOT** insert a bottom HXT-bar into the opening between the FRONT section and the first intermediate section.

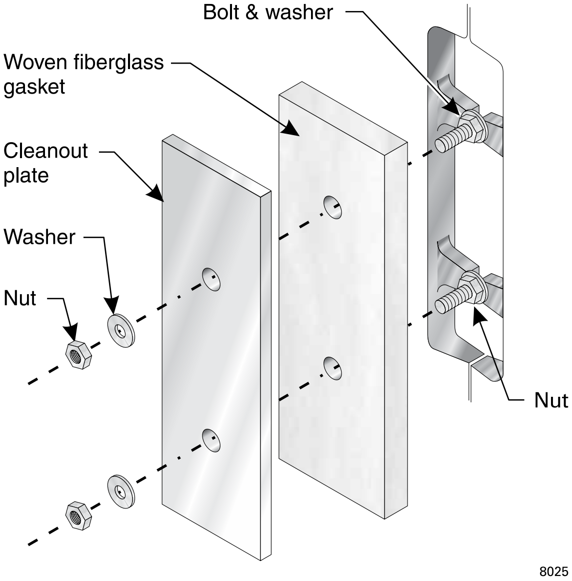
3. To remove flue HXT-bars when required to clean the boiler flueways, grab the end of each HXT-bar with pliers and pull straight out. Clean HXT-bars and replace as shown in Figure 12, page 12.

Install cleanout plates

⚠WARNING Cleanout plates must be installed gas-tight to prevent possibility of flue gas leakage and carbon monoxide emissions, resulting in severe personal injury or death.

1. See Figure 13.
2. Position two ¼" x 1¾" carriage bolts in cleanout opening, between the cleanout plate bosses, as shown. Secure with washers and nuts.
3. Place woven fiberglass gasket over carriage bolts.
4. Mount cleanout plate over opening. Secure with nuts and washers.
5. Repeat steps 1 through 3 for remaining cleanout plates.

Figure 13 Cleanout plate assembly



Install draft hood collar

1. Install ⅛" continuous bead of sealing rope adhesive in groove on draft hood collar.
2. Position ½" sealing rope in groove. Overlap ends of rope at least 1 inch.
3. Mount collar over flueway outlet on back section. Secure with ½ x 1½" hex head cap screws and washers.

⚠WARNING The boiler contains ceramic fiber and fiberglass materials. Use care when handling these materials per instructions on page 34 of this manual. Failure to comply could result in severe personal injury.

Connect water boiler piping

General water piping information

1. System water supply and return piping should be installed and piping connections attached to boiler before erecting jacket or installing controls.
2. Do not pipe in through supply and out through return. This creates reverse water flow through boiler that must not be used.
3. When installing in a system in which return water temperature can drop below 140°F, apply the by-pass piping with by-pass pump as shown in .

Install piping

Install piping as shown in Figure 14, page 14 and Figure 18, page 15 (if applicable) for single boilers. For multiple boilers, see Figure 19, page 15.

⚠CAUTION Improperly piped systems or undersized piping can contribute to erratic boiler operation and possible boiler or system damage.

1. Connect supply and return piping:
    a. Size according to tables below.
        - For **known flow rates or higher flow rate** (less than 20°F temperature rise) through boiler, see Figure 15.
        - For **unknown flow rates**, size piping per Figure 17, page 15, using 20°F temperature rise through boiler.

⚠WARNING Flow at higher rates than shown in the tables in this manual for given pipe sizes can damage the boiler, causing substantial property damage.

    b. Locate circulator in supply piping.
    c. For return piping, use full diameter pipe for 10 times that diameter before making any reduction. For example, a 4-inch return should not be reduced any closer to boiler return tapping than 40 inches.
    d. Install system blow-off (drain) valve in lowest part of return piping close to boiler. ASME minimum size requirements are given in Figure 17, page 15.
2. Install expansion tank:
    a. **Closed type** – connect to 1" tapping "K" (see page 11). Use 1" NPT piping. Any horizontal piping must pitch up toward tank at least 1 inch per each 5 feet of piping.
    b. **Diaphragm type** – Refer to tank manufacturer's literature for location. Install automatic air vent in "K" tapping.
    c. Connect cold water fill to expansion tank piping. Figure 14 shows typical piping when using a closed type tank. Connect to the same location as the expansion tank connects to the system when using a diaphragm type tank.
    d. Also shown are recommended valves and water meter, when used. Water meter will detect added make-up water, indicating leaks in system.

Figure 14 Water boiler piping, typical

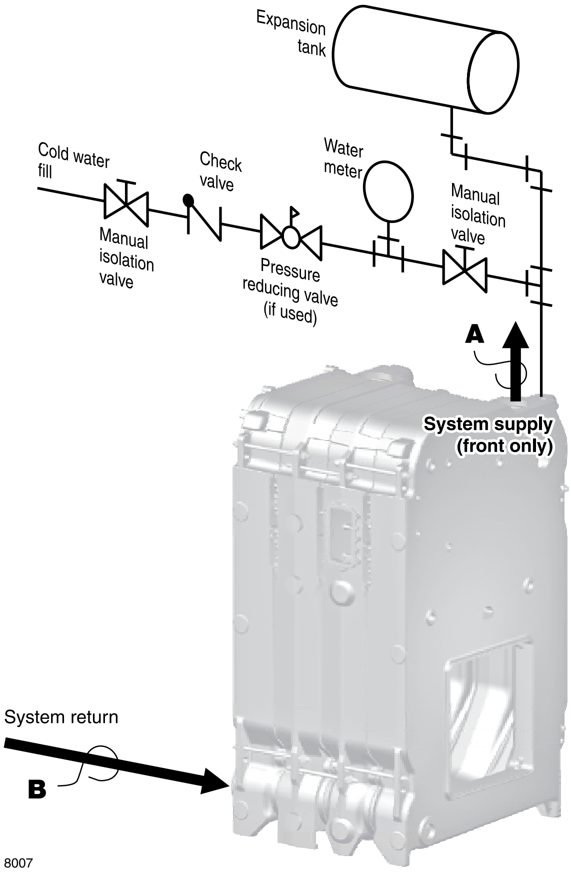


Figure 15 Recommended minimum pipe sizes for known flow rates (note 1)

Water flow rate GPM	Supply pipe size A	Return pipe size B
Up to 35	2"	2"
36–50	2½"	2½"
51–77	3"	3"
78–142	4"	4"
143–237	5"	5"
238–404	6" (note 2)	6"

Note 1 High temperature rise through boiler is permissible when boiler piping connections are sized per this table. **Intermittent** flow at **high** velocities may damage any boiler.

Note 2 6-inch piping requires nipples and 5" x 6" reducing couplings (provided with 1288 through 1888 boilers only). The total pressure drop through the 1888 boiler using the nipple and reducing coupling will not exceed ¼ PSI. For smaller boilers, the pressure drop will be less.

Connect water boiler piping *(continued)*

Figure 16 Recommended minimum pipe sizes when flow rate is not known (see Figure 14, page 14) (note 1)

Boiler model	Supply pipe size A	Return pipe size B
488	3"	3"
588 – 788	4"	4"
888 – 1188	5"	5"
1288 – 1888	6" (note 2)	6" (note 2)

Note 1 Pipe sizes are based on a 20°F temperature rise through the boiler. For applications with higher flow rates (lower temperature rise), determine the flow rate and use Figure 15, page 14 to size the piping.

Note 2 6-inch piping requires nipples and 5" x 6" reducing couplings (provided with 1288 through 1888 boilers only). The total pressure drop through the 1888 boiler using the nipple and reducing coupling will not exceed ¼ PSI. For smaller boilers, the pressure drop will be less.

Figure 17 ASME blowoff/drain valve size

Boiler model	Minimum blow-off valve size
488 – 588	1"
688 – 1088	1¼"
1188 – 1888	1½"

Piping multiple boilers

1. See Figure 18. (Expansion tanks, relief valves and other accessories are required, but omitted from the illustration for simplicity.)
2. The boiler piping circuits are referred to as the secondary circuits in the following.
3. The legend for Figure 18 and boiler pump sizing recommendations follow:

A Size boiler pump GPM based on the following:

a. **Temp rise = Operating limit temp – Return water temp**

b. $$\text{GPM} = \frac{\text{Boiler Gross Output, Btuh}}{\text{Temperature rise x 500}}$$

c. Calculate only secondary (boiler) piping circuit resistance. Allow for head loss through the boiler equal to three 90 degree elbows of secondary pipe size.

d. Operate each boiler and its pump with a Weil-McLain boiler control panel.

e. Size secondary (boiler) circuit piping using the flow rate ranges given in Figure 17, page 15.

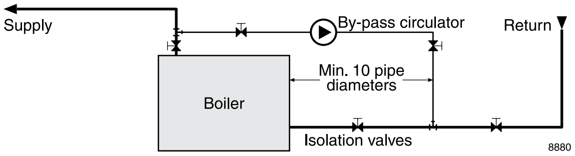
B Primary pump GPM and head calculation should not include secondary boiler circuits. Primary pump can operate continuously during heating season.

C Connection to primary circuit — Space 12" maximum or as close as practical.

D Check valve.

E Hand valve.

Figure 18 By-pass piping for return water less than 140°F

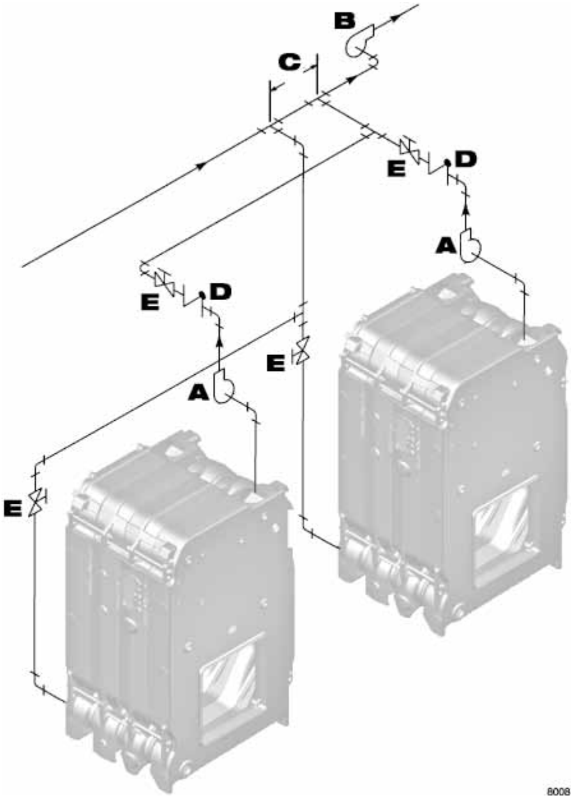


By-pass circulator sizing:

1. Size system circulator as required. Determine GPM and head requirements.
2. Provide a by-pass circulator for EACH boiler. The flow rate for each by-pass circulator will be:

   Flow = ¼ x (System circulator GPM) ÷ (# of boilers)
3. All circulators must run at the same time.
4. Example: For a 1,000,000 Btuh single boiler, with system temperature drop of 20°F:
   - System GPM = 1,000,000 ÷ 20 ÷ 500 = 100 GPM
   - By-pass GPM = ¼ x 100 GPM = 25 GPM
   - Determine by-pass circuit head loss for pipe size and fittings used.
5. In most applications, a standard booster pump should be adequate.

Figure 19 Multiple water boiler piping



Connect steam boiler piping

General steam piping information:

1. Hartford loop piping arrangement and wet return are required for steam boilers. Use the Hartford loop for both pumped-return and gravity-return systems.
2. Maintain 24-inch minimum from waterline to bottom of header (63" from bottom of section).
3. When using condensate receiver, feed pump must be energized by boiler-mounted pump controller.
4. Install piping:
    a. Install piping as shown on page 17 through page 18 for single boilers. See page 19 for additional requirements when piping multiple boilers.
    b. Return pipe sizing.
        - Pumped return — Size return piping by pump.
        - Gravity return — Size gravity return same as Hartford loop equalizer pipe size.
    c. Drain valve — Install system drain valve in lowest part of return piping close to boiler. See Figure 17, page 15, for sizing.
    d. Cold water fill piping — Connect cold water fill piping as shown in Figure 20. Also shown are recommended valves and water meter, if used. Water meter will detect added makeup water, indicating leaks in system.
    e. Condensate return piping:
        - Satisfactory operation of any steam heating system depends on adequate return of condensate to maintain steady water level.
        - Avoid adding excessive amounts of raw make-up water.
        - Where condensate return is not adequate, a low water cutoff with pump control, condensate receiver, and condensate boiler feed pump should be installed.
        - See Figure 21 for piping and Figure 22 for sizing.

Figure 20 Cold water fill piping

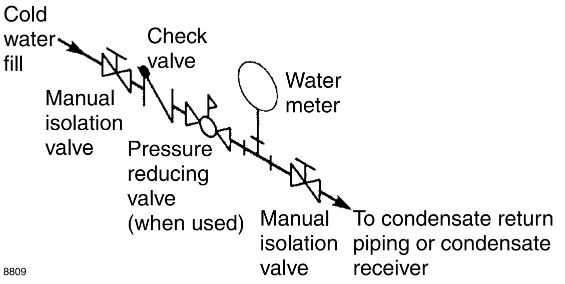

Cold water fill
Check valve
Water meter
Manual isolation valve
Pressure reducing valve (when used)
Manual isolation valve
To condensate return piping or condensate receiver
8809

Figure 21 Condensate piping to boiler

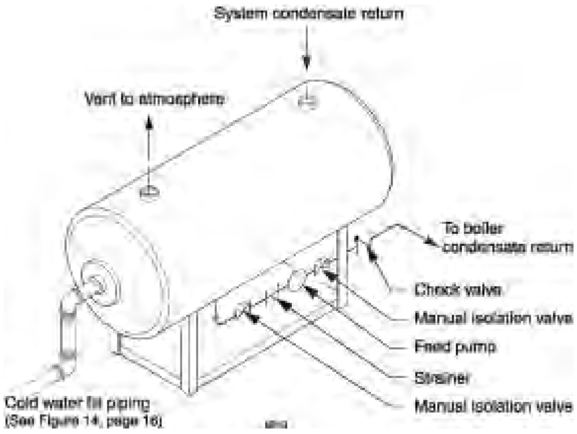


Figure 22 Condensate receiver capacity required

Boiler model number	AHRI gross output (lbs steam per hour)	Gallons condensate per hour	Minimum condensate receiver capacity (gallons) (Note 1)				Recommended condensate feed pump capacity GPM at 15 PSI
			15-minute boiler operation	30-minute boiler operation	45-minute boiler operation	60-minute boiler operation	
488	810	97	29	58	87	116	3.2
488R	794	95	28	57	85	114	3.1
588	1084	130	39	78	117	156	4.3
688	1358	163	49	98	147	196	5.4
788	1632	195	59	117	176	234	6.5
888	1904	228	68	137	205	273	7.6
988	2170	261	78	157	235	313	8.7
988R	1991	239	72	145	217	289	8.0
1088	2452	294	88	176	265	353	9.8
1088R	2304	277	83	166	249	332	9.2
1188	2724	327	98	196	294	392	10.9
1288	3000	360	108	216	324	432	12.0
1388	3270	392	117	235	353	470	13.1
1488	3550	426	127	255	383	511	14.2
1588	3820	458	137	274	412	550	15.3
1688	4090	490	147	294	441	588	16.4
1688R	3980	478	143	287	430	574	15.9
1788	4370	524	157	314	471	629	14.5
1888	4640	557	167	334	501	668	18.6
Note 1 — Maximum time to when condensate returns to boiler — the longer the time for condensate to return, the larger the receiver must be.							

Connect steam boiler piping *(continued)*

⚠CAUTION Improperly piped systems or undersized piping can contribute to erratic boiler operation and possible boiler or system damage. Piping system must be installed as shown, using pipe sizes shown. Pipe sizes shown are for two-pipe, pumped-return systems. Adjust pipe sizing as needed when connecting to gravity-return systems. Consult local Weil-McLain distributor or sales office before installing alternate piping.

Steam boiler piping guidelines

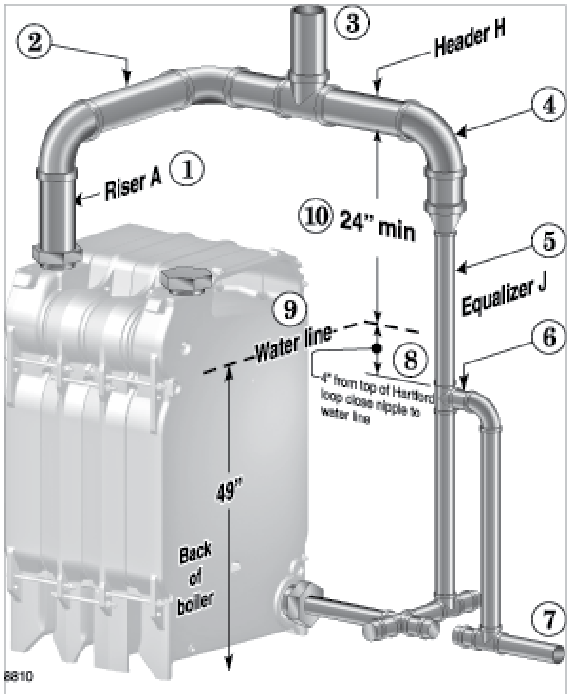
Minimum height of header above water line must be 24 inches

⚠WARNING The boiler header must always be at least **24 inches** above the water line, as shown in all steam boiler piping diagrams. Installing the pipe lower will result in increased water carryover to the system, resulting in potential serious damage to system components and oxygen corrosion due to excess make-up water.

Hartford loop piping for all steam boilers

1. You must install the system supply pipe between the equalizer elbow and the last boiler riser pipe connection to the header. This assists in separating water from the steam as it turns upward into the steam supply pipe.
2. Locate the top of the Hartford loop return nipple at least 4 inches below the water line, as shown.

Figure 23 Model 488 through 688 steam (1 riser)



Pipe Dimensions	Model	Riser A	Header H	Equalizer J
	488	4"	4"	2½"
	588 & 688	5"	5"	2½"

Drawing legend & notes

(Figure 23 through Figure 26)

1 Riser pipes (one for each supply intermediate section)

2 Horizontal pipes needed to offset the header to allow for expansion and contraction of the header

3 Steam supply must be located between last riser connection and equalizer elbow

4 Equalizer elbow — full size or reducing

5 Equalizer pipe

6 Close nipple at Hartford loop tee to reduce water hammer potential

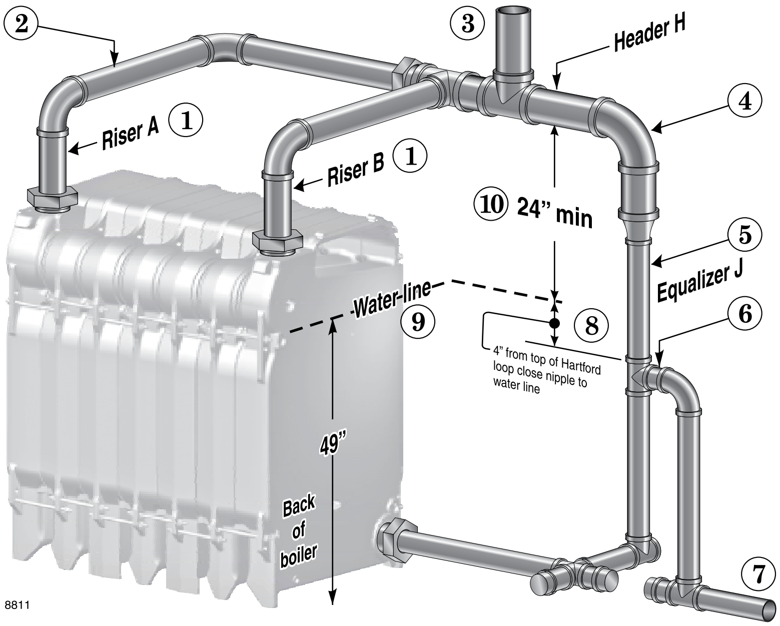
7 Condensate return line (gravity or pumped)

8 Minimum 4 inches between water line and top of Hartford loop return nipple

9 Boiler water line — all automatic water level controls must be set to maintain this level

10 Minimum 24 inches between water line and bottom of header

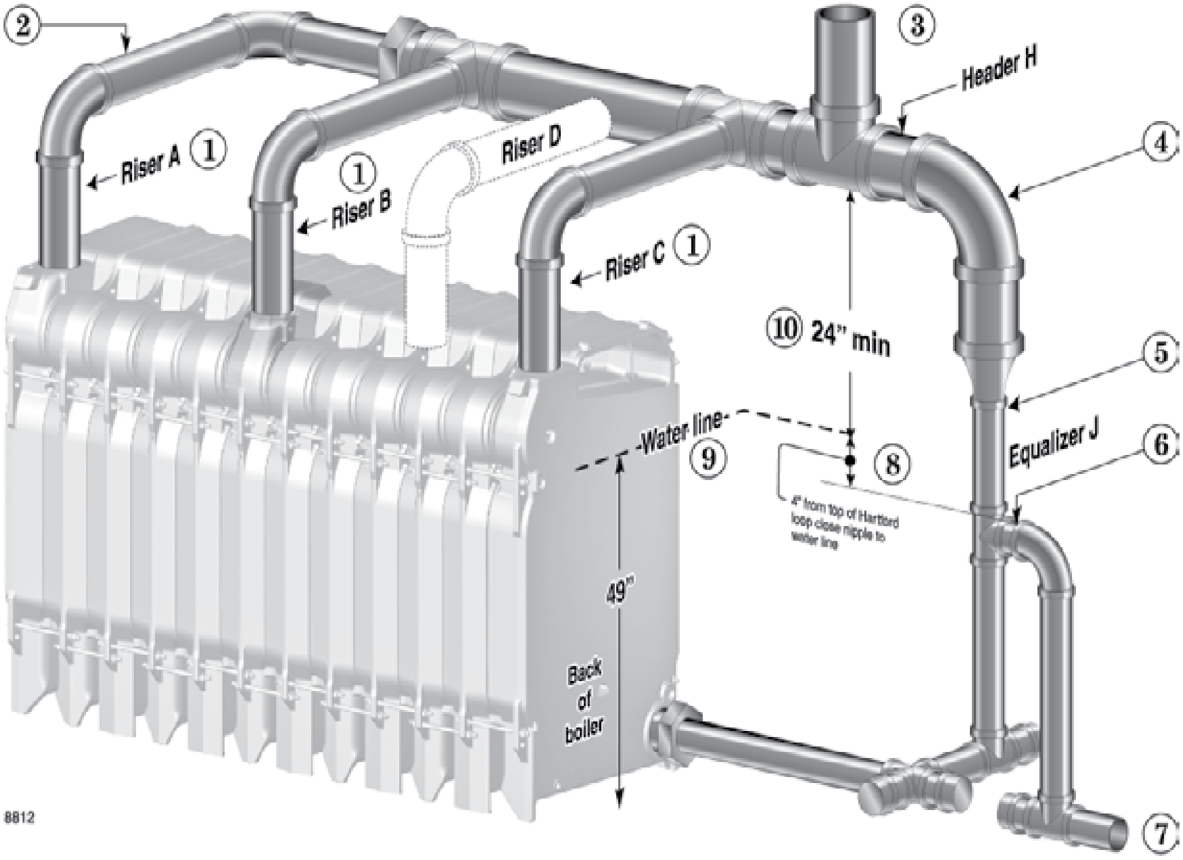
Figure 24 Model 788 through 1188 steam (2 risers required)



Pipe Dimensions	Model	Riser A	Riser B	Header H	Equalizer J
	788	4"	4"	6"	2½"
	888	5"	5"	6"	2½"
	988 & 1088	5"	5"	8"	2½"
	1188	5"	5"	8"	4"

Connect steam boiler piping *(continued)*

Figure 25 Model 1288 through 1888 steam (3 or 4 risers required)



	Model	Riser A	Riser B	Riser C	Riser D	Header H	Equalizer J
Pipe Dimensions	1288 – 1488	5"	5"	5"	NA	8"	4"
	1588 – 1688	5"	5"	5"	NA	10"	4"
	1788 – 1888	5"	5"	5"	5"	10"	4"

Drawing legend & notes

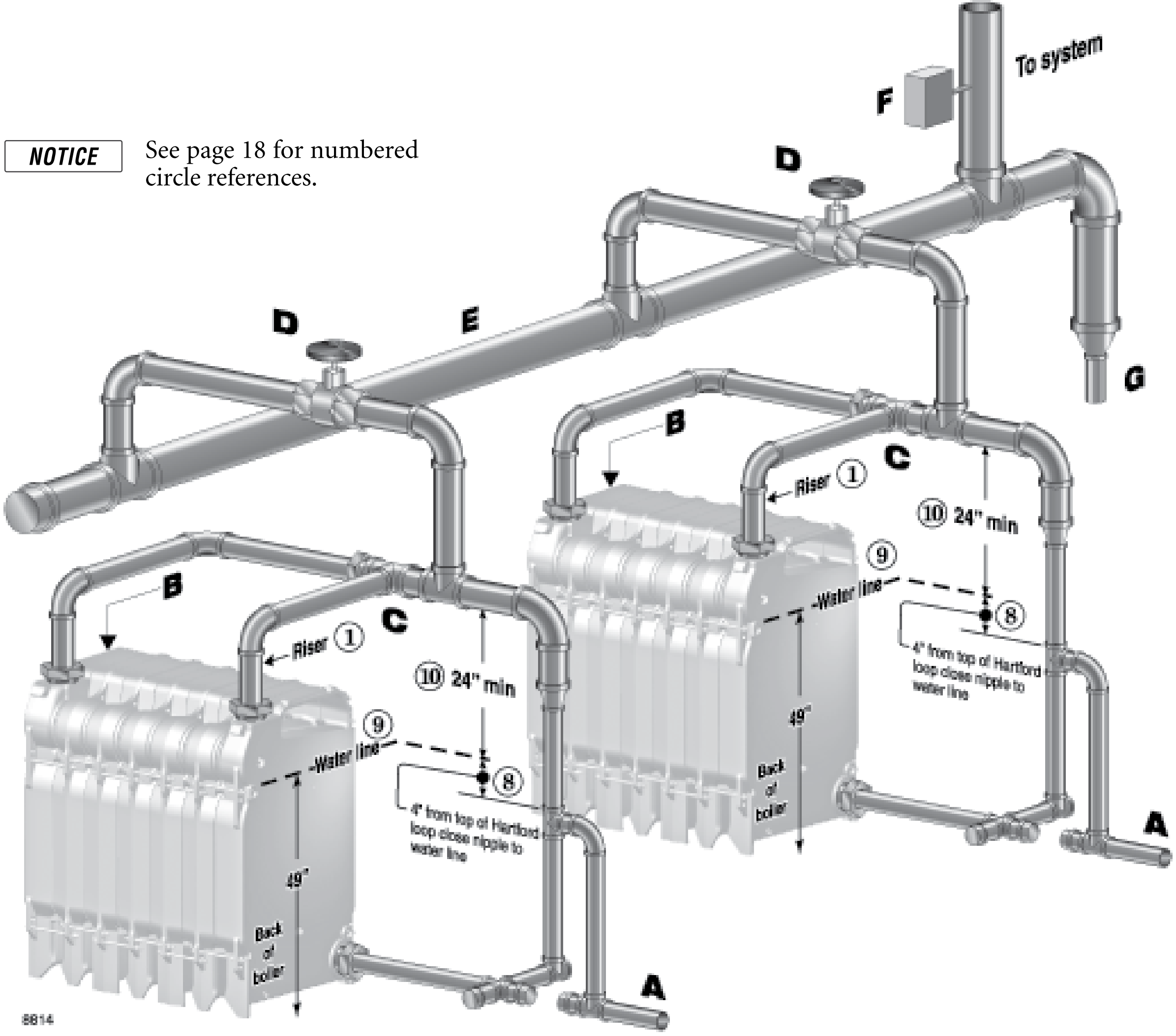
(Figure 23 through Figure 26)

1 Riser pipes (one for each supply intermediate section)
2 Horizontal pipes needed to offset the header to allow for expansion and contraction of the header
3 Steam supply must be located between last riser connection and equalizer elbow
4 Equalizer elbow — full size or reducing
5 Equalizer pipe
6 Close nipple at Hartford loop tee to reduce water hammer potential
7 Condensate return line (gravity or pumped)
8 Minimum 4 inches between water line and top of Hartford loop return nipple
9 Boiler water line — all automatic water level controls must be set to maintain this level
10 Minimum 24 inches between water line and bottom of header

Connect steam boiler piping *(continued)*

Figure 26 Multiple Steam Boiler Piping Gravity Condensate Return

NOTICE See page 18 for numbered circle references.



A Pipe as shown for gravity return systems, connecting point **A** to the wet gravity return.

- For pumped-return systems, install boiler water level control on each boiler with body mark at level indicated in Figure 42, page 28. Provide at point **A** either:
- Separate feed pumps and check valves for each boiler, or . . .
- Single feed pump, with separate solenoid valve for each boiler.

B For pumped-return systems, install a combination float and thermostatic trap on each boiler to prevent flooding of one boiler while other boiler is firing. Install trap in skim tapping (see Figure 39, page 27). Connect traps to condensate receiver.

Gravity-return systems are self-levelling if the wet returns are piped to the common system wet return.

C Install boiler piping as shown in the preceding pages of this manual.

D Install stop valves per ASME code requirements.

- For pump-return systems, if using automatic steam valves, use only slow-opening automatic valves. Use a Weil-McLain Boiler Control System (such as a BCP panel) to open each steam valve automatically before firing burner.

E Construct common supply drop header with pipe size at least same size as largest boiler header size.

F Use:

- A Weil-McLain Boiler Control System (such as a BCP panel) with header-mounted pressure control(s) to sequence boilers, or . . .
- A steam pressure controller.

G Install drip line in common supply drop header.

- Gravity-return: Pipe drip line to wet return.
- Pumped-return: Use combination float and thermostatic trap and drain to condensate receiver.

Install jacket

Before installing jacket

⚠WARNING The boiler contains ceramic fiber and fiberglass materials. Use care when handling these materials per instructions on page 34 of this manual. Failure to comply could result in severe personal injury.

1. These parts **must be on boiler**:
   a. Plugs for unused tappings
   b. Supply and return piping and steam supply header
   c. Cleanout plates
   d. Tankless heaters (when used), tankless heater cover plates (when used), tankless heater piping (when used)
   e. Flue damper assembly
   f. Observation port assemblies
2. These parts **may be on boiler**:
   a. Burner mounting plate
3. These parts **must be off boiler**:
   a. Water or steam gauge
   b. Limit control and low water cutoff
   c. Gauge glass and gauge glass cocks, tri-cocks
   d. Drain cock

Remove jacket parts from cartons

1. Locate jacket cartons.
2. Remove jacket parts from cartons as needed. Leave in cartons as long as possible to avoid damage.
3. Jacket parts are in the boxes listed below:

Part	Box label descriptions
Jacket screws (in jacket corner boxes)	included in **CRNR** boxes
Jacket support brackets & hex nuts	**BKT**
Jacket side support channels, upper & lower	included in **TRM/CHNL** boxes
Jacket front/rear support channels, upper & lower	**COM**
Jacket front panel	**PNL-F**
Jacket back panel	**PNL-B**
Jacket side and top panels	**L / R / T**
Jacket corners	**CRNR**
Jacket trim	**TRM/CHNL**

Install support brackets/channels

1. Place upper and lower support brackets over draw rods as shown in Figure 29, page 21. Place the brackets on the sections as given in Figure 27. Sections are numbered from front to back.
2. Fasten each bracket loosely using two 5/8" nuts screwed onto the ends of the tie rods as shown.

NOTICE Models 488 through 988 do not require lower support brackets. Only upper brackets are required.

Fasten all nuts and screws loosely during assembly to allow adjustment after all jacket frame parts are installed.

Figure 27 Place support brackets as listed below

Boiler	Upper brackets on sections:	Lower brackets on sections:
488	2, 3	None
588	2, 4	None
688	2, 5	None
788	2, 6	None
888	3, 6	None
988	2, 5, 8	None
1088	3, 6, 9	6
1188	3, 6, 9	6
1288	3, 7, 10	7
1388	3, 7, 11	7
1488	3, 7, 10, 13	7
1588	2, 5, 8, 11, 14	8
1688	2, 5, 9, 12, 15	9
1788	2, 5, 9, 13, 16	9
1888	2, 6, 10, 14, 17	10

3. Attach the upper channels to the upper supports as shown in callouts ①, ② and ⑥, Figure 29, page 21. Use two #10 x ½" screws at each bracket. Models 988 and larger have two-piece channels.
   - The side channels are labelled **A** and **B** in Figure 29. Figure 28 gives the lengths of the side channel parts for each model.
   - The channels at the boiler front and rear are part numbers 426400030 & 426400031, respectively.

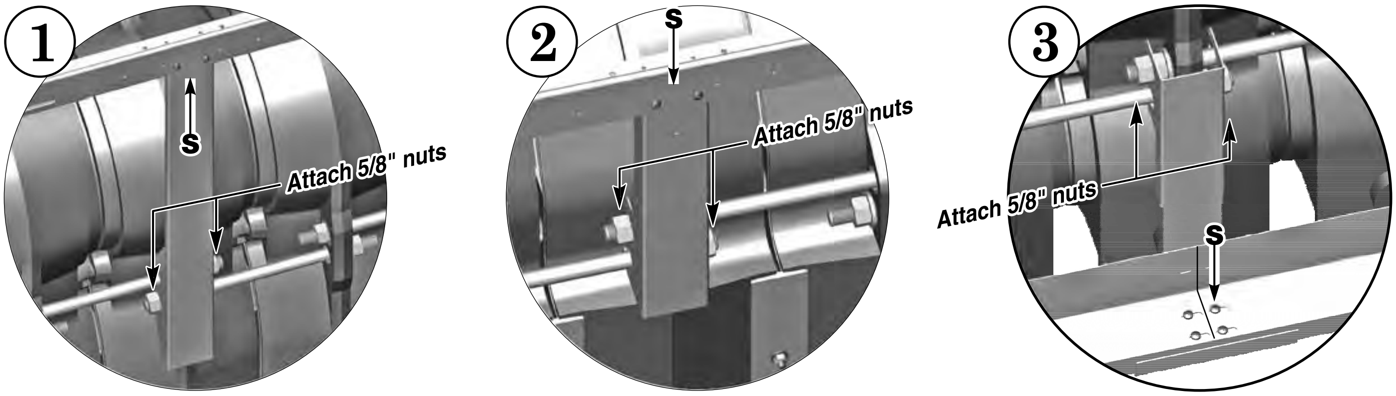
Figure 28 Upper and lower side channel lengths

Boiler	Upper channel lengths (inches)		Lower channel lengths (inches)	
	A	B	A	B
488	30	NA	26	NA
588	38	NA	34	NA
688	46	NA	42	NA
788	54	NA	50	NA
888	62	NA	58	NA
988	35	35	66	NA
1088	43	35	40	34
1188	43	43	40	42
1288	51	43	48	42
1388	51	51	48	50
1488	51	59	48	58
1588	59	59	56	58
1688	67	59	64	58
1788	67	67	64	66
1888	71	71	72	66

4. Attach the four jacket corners to the upper channels as shown in callout ⑥, Figure 29, page 21. Corner part numbers are: 426400054 (front left), 055 (front right), 056 (back left), and 057 (back right).
5. Attach the lower side, front and rear channels to the jacket corners as shown in callouts ④ and ⑤ of Figure 29, page 21. Models 1088 and larger have two-piece side channels. The channels are labelled **A** and **B** in Figure 29. Figure 28 gives the lengths of these parts for each model. Front and rear lower channels are part numbers 426400032 and 426400033.

Install jacket *(continued)*

Figure 29 Installing jacket support brackets, support channels and corners *(piping and other components omitted for clarity)*



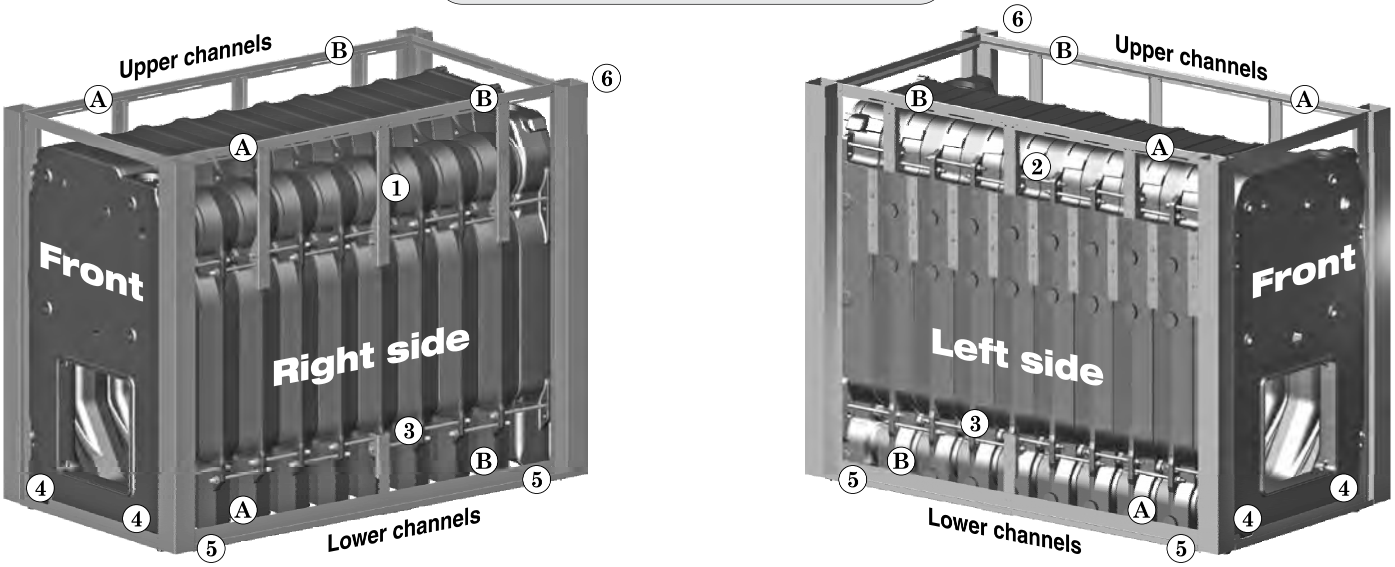
Upper right support bracket

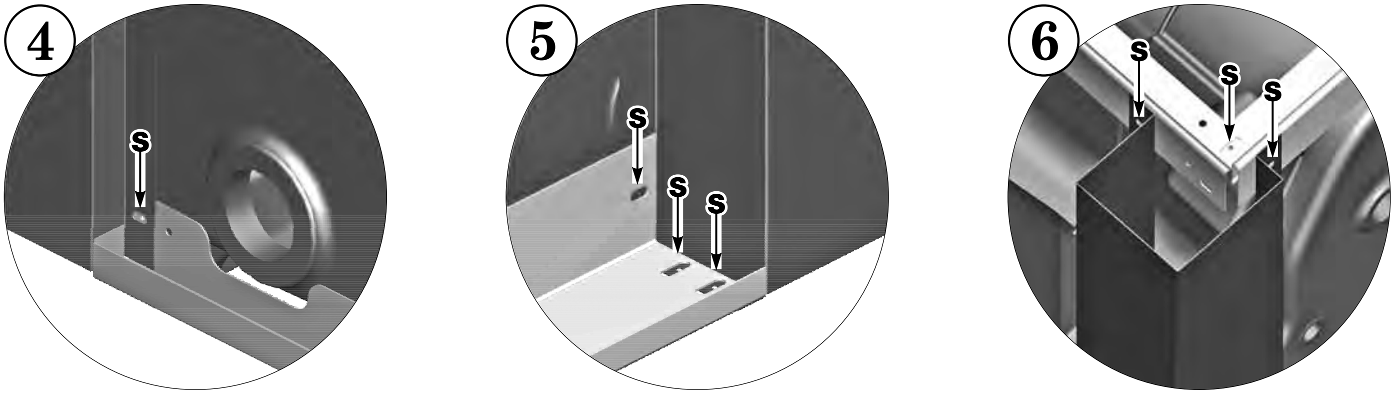
Upper left support bracket

Lower support brackets

S = Insert #10 x ½" Phillips pan head screws

A, B = Side channel pieces, front and rear





Corner attachments to lower front and rear channels

Corner attachments to lower channels

Corner attachments to upper channels

Install jacket *(continued)*

Install jacket front and back panels

1. Slide the jacket front and back panels down over the top channels and into the bottom channels as shown in Figure 30.
2. Slide the upper and lower channels as needed to square up the fit.

Install jacket side panels

1. Remove jacket side panels from cartons.
2. Before installing side panels, square up the jacket support rails.
   - Place any of the jacket side panels on the rails as shown in Figure 30.
   - Butt the side panel against the jacket corner panel.
   - Push/pull on the upper and lower channels until the fit-up of the side panel, corner panel and channels is square.
   - Place a jacket top panel in position against the jacket front panel to ensure the top alignment is square. Adjust the jacket support rails forward or backward if needed for square alignment.
   - Tighten the 5/8-inch nuts on the upper (and lower) support brackets.
   - Tighten the screws securing the upper and lower rails to the support brackets.
   - Tighten the screws securing the front and back panels to the rails.
3. Apply all jacket side panels in the order shown in Figure 32.
   - Remove jacket knockouts as required for tankless heaters and tankless heater openings.
   - Note that panel sequence is not important for boilers not equipped with tankless heater intermediate sections.

Install jacket top panels

1. Place jacket top panels as shown in Figure 33, page 24.
   - Remove knockouts for riser pipes and air bleed piping (front section) using tin snips.

Install jacket trim

2. Press jacket trim down over the front and side jacket panels as shown in Figure 31.

Figure 30 Installing (removing) jacket front, rear and side panels

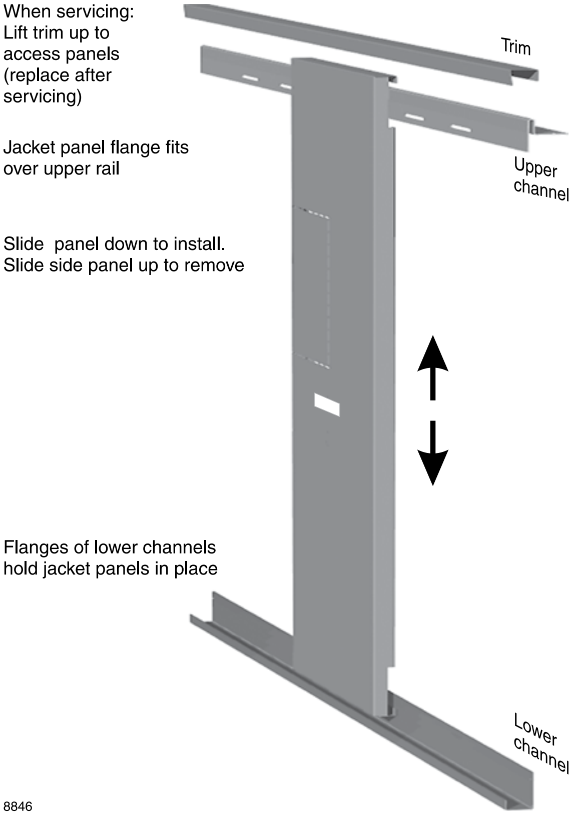
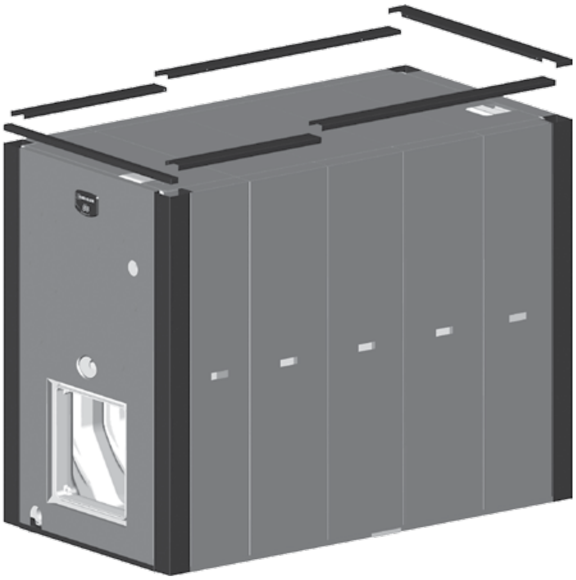
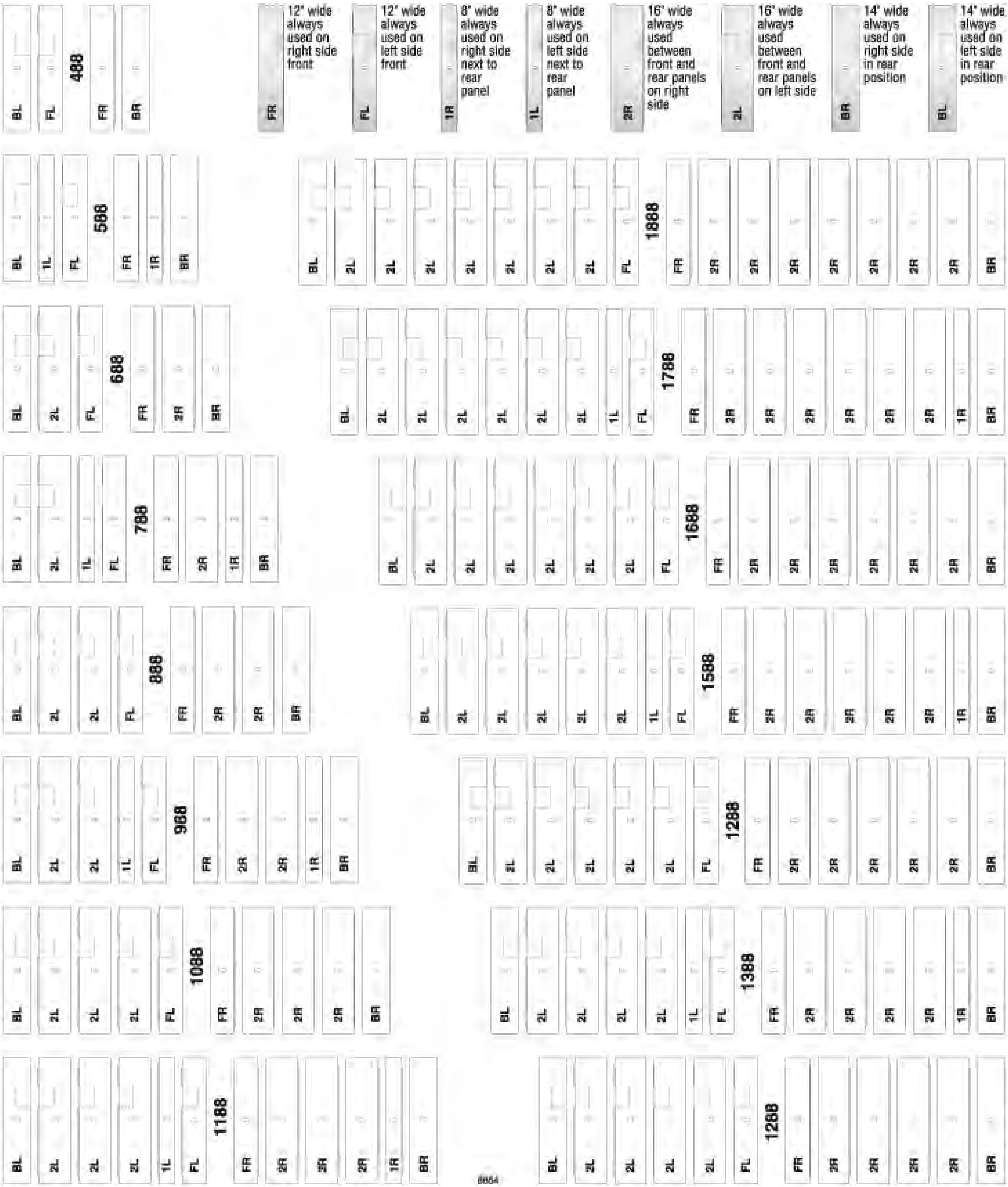

When servicing: Lift trim up to access panels (replace after servicing)
Trim
Jacket panel flange fits over upper rail
Upper channel
Slide panel down to install. Slide side panel up to remove
Flanges of lower channels hold jacket panels in place
Lower channel
8846

Figure 31 Press jacket trim down over jacket front, rear and side panels



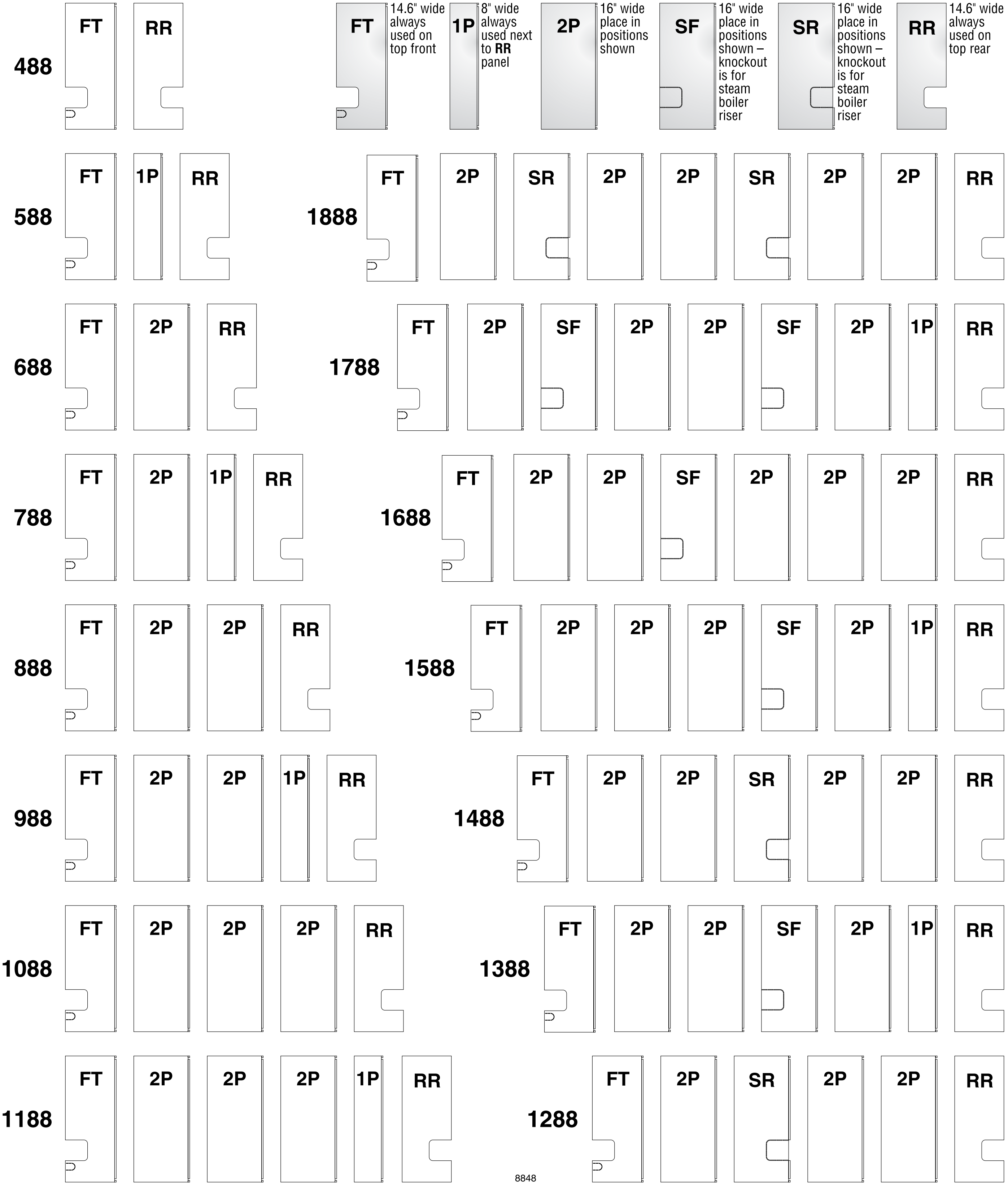
Install jacket *(continued)*

Figure 32 Jacket side panel placement


FR 12" wide always used on right side front
FL 12" wide always used on left side front
1R 8" wide always used on right side next to rear panel
1L 8" wide always used on left side next to rear panel
2R 16" wide always used between front and rear panels on right side
2L 16" wide always used between front and rear panels on left side
BR 14" wide always used on right side in rear position
BL 14" wide always used on left side in rear position
488
BL FL FR BR
588
BL 1L FL FR 1R BR
1888
BL 2L 2L 2L 2L 2L 2L 2L FL FR 2R 2R 2R 2R 2R 2R 2R BR
688
BL 2L FL FR 2R BR
1788
BL 2L 2L 2L 2L 2L 2L 1L FL FR 2R 2R 2R 2R 2R 2R 1R BR
788
BL 2L 1L FL FR 2R 1R BR
1688
BL 2L 2L 2L 2L 2L 2L FL FR 2R 2R 2R 2R 2R 2R BR
888
BL 2L 2L FL FR 2R 2R BR
1588
BL 2L 2L 2L 2L 2L 1L FL FR 2R 2R 2R 2R 2R 1R BR
988
BL 2L 2L 1L FL FR 2R 2R 1R BR
1288
BL 2L 2L 2L 2L 2L FL FR 2R 2R 2R 2R 2R BR
1088
BL 2L 2L 2L FL FR 2R 2R 2R BR
1388
BL 2L 2L 2L 2L 1L FL FR 2R 2R 2R 2R 1R BR
1188
BL 2L 2L 2L 1L FL FR 2R 2R 2R 1R BR
1288
BL 2L 2L 2L 2L FL FR 2R 2R 2R 2R BR
8854

Install jacket *(continued)*

Figure 33 Jacket top panel placement


FT 14.6" wide always used on top front

1P 8" wide always used next to **RR** panel

2P 16" wide place in positions shown

SF 16" wide place in positions shown – knockout is for steam boiler riser

SR 16" wide place in positions shown – knockout is for steam boiler riser

RR 14.6" wide always used on top rear

488 FT RR
588 FT 1P RR
688 FT 2P RR
788 FT 2P 1P RR
888 FT 2P 2P RR
988 FT 2P 2P 1P RR
1088 FT 2P 2P 2P RR
1188 FT 2P 2P 2P 1P RR
1888 FT 2P SR 2P 2P SR 2P 2P RR
1788 FT 2P SF 2P 2P SF 2P 1P RR
1688 FT 2P 2P SF 2P 2P 2P RR
1588 FT 2P 2P 2P SF 2P 1P RR
1488 FT 2P 2P SR 2P 2P RR
1388 FT 2P 2P SF 2P 1P RR
1288 FT 2P SR 2P 2P RR
8848

Pipe tankless heaters

⚠ DANGER **Hot water can scald!**

Consumer Product Safety Commission and some states recommend domestic hot water temperature of 130°F or less.

When installing an automatic mixing valve, selection and installation **must** comply with valve manufacturer's recommendations and instructions.

Water heated to a temperature suitable for clothes washing, dish washing and other sanitizing needs will scald and cause injury.

Children, elderly, infirm or physically handicapped persons are more likely to be injured by hot water. Never leave them unattended in or near a bathtub, shower or sink. Never allow small children to use a hot water faucet or draw their own bath. If anyone using hot water in the building fits this description, or if state laws or local codes require certain water temperatures at hot water faucets, take special precautions:

— Install automatic mixing valve set according to those standards.

— Use lowest practical temperature setting.

— Check water temperature immediately after first heating cycle and after any adjustment.

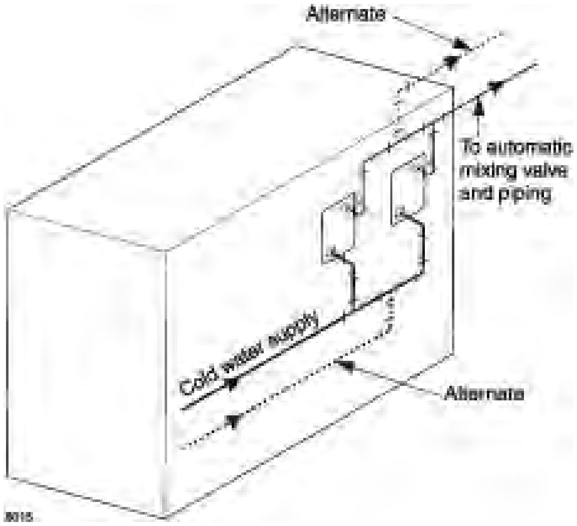
To pipe tankless heaters:

1. See Figure 35.
2. Size piping no smaller than heater inlet and outlet.
3. Automatic mixing valve must be installed. See Figure 35. Follow manufacturer's instructions to install.
4. Flow regulating valve must be installed. Size according to continuous draw of heater. See Figure 34. Follow manufacturer's instructions to install.
5. Operating control with small adjustable differential scale is recommended. Install in temperature control tapping in heater plate.
6. Multiple tankless heaters (see Figure 35):
   a. Use cold water supply header with individual risers to each heater. Size header by increasing one pipe size for each additional heater.
   b. Use hot water outlet header with individual risers to each heater. Size header by increasing one pipe size for each additional heater.
   c. Do not pipe multiple heaters in series.
7. In hard water areas, soften cold domestic water supply to heaters to prevent lime build-up.

Figure 34 Tankless heater ratings (Weil-McLain ratings)

Heater number	Intermittent draw – GPM (note 2)	Continuous draw GPM (notes 1, 2)	Inlet and outlet tappings
820	8.5	8.0	¾"
Note 1	GPM based on 40–140°F DHW with boiler water at 200°F		
Note 2	Based on continuous draw with no recovery period		

Figure 35 Tankless Heater Piping



Install water boiler controls

Install controls:

1. Install furnished controls per Figure 37 and Figure 36.

⚠WARNING Failure to properly install, pipe and wire boiler controls can result in severe damage to boiler, building and personnel; and is not covered by boiler warranty.

2. Relief valve must be installed with spindle in vertical position. Use fittings provided with boiler. Do not make any other connection in that piping.

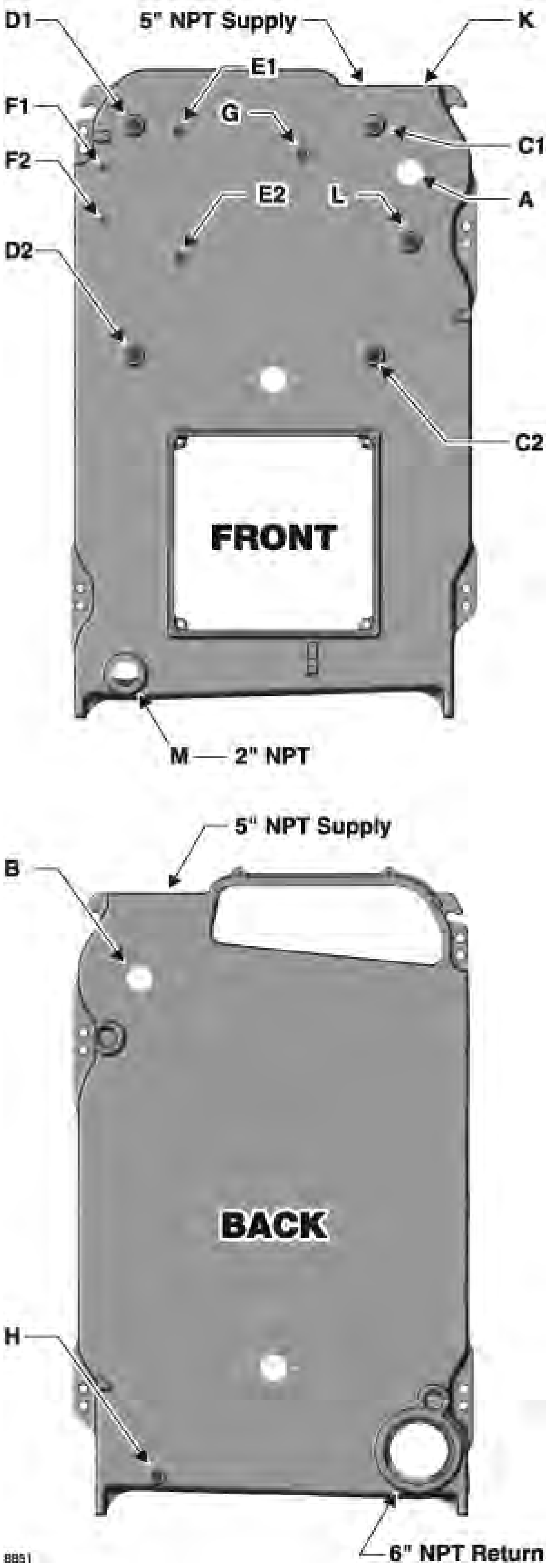
⚠WARNING Relief valve discharge line must be piped using rigid material suitable for 375°F, threaded one end, near floor close to drain to eliminate potential of severe burns. Do not pipe to any area where freezing could occur. Do not plug, valve or place any obstruction in discharge line.

3. When installing low water cut-off
   - a. Must be installed if boiler is located above radiation level.
   - b. May be required on water boilers by certain state, local or territorial codes or insurance companies.
   - c. Install low water cutoff designed for water installations where shown in Figure 37 and Figure 36.
4. If installation is to comply with ASME installation requirements, an additional high temperature limit is needed. Purchase and install in supply line between boiler and isolation valve or in tapping "**A**."
5. Dual limit control settings:
   - **a. Low** – set according to design requirements.
   - **b. High** – at least 20° higher than low limit, 240°F maximum.
6. Install optional controls per control manufacturer's instructions.

Figure 37 Water control tappings (see Figure 36)

Location	Size	Function
A	2"	High limit Manual reset limit
B	2"	Water relief valve
L	1"	Not used — plug
C1 & C2	1"	Alternate low water cut-offs
C1		Combination high and low limit control
D1 & D2	1"	Firing rate temperature control (when used) Low water cut-offs
E1 & E2	½"	—
F1 & F2	⅜"	—
G	¾"	Combination pressure–temperature gauge
H	¾"	Boiler drain
K	1"	Piping to compression tank or automatic air vent
M	2"	Drain

Figure 36 Water control locations



Install steam boiler controls

Install controls:

1. Install controls where shown in Figure 38 and Figure 39.

⚠**WARNING** Failure to properly install, pipe and wire boiler controls can result in severe damage to boiler, building and personnel; and is not covered by boiler warranty.

   a. Install steam pressure operating and high limit controls and pressure gauge. See Figure 38, Figure 39 and Figure 40, page 28. Pressure limit control settings:
      - **Low** – set according to design requirements.
      - **High** – set at least 2 psi higher than low limit, 15 psi maximum.

   b. Relief valve must be installed with spindle in vertical position. Use fittings provided with boiler. Do not make any other connection in that piping.

⚠**WARNING** Pipe relief valve discharge through vertical piping to atmosphere. Use rigid material suitable for 375°F, threaded one end only. Install drain pan elbow to drain condensate. Pipe near floor close to floor drain to eliminate potential of severe burns. Do not pipe to any area where freezing could occur. Do not plug, valve or place any obstruction in discharge line.

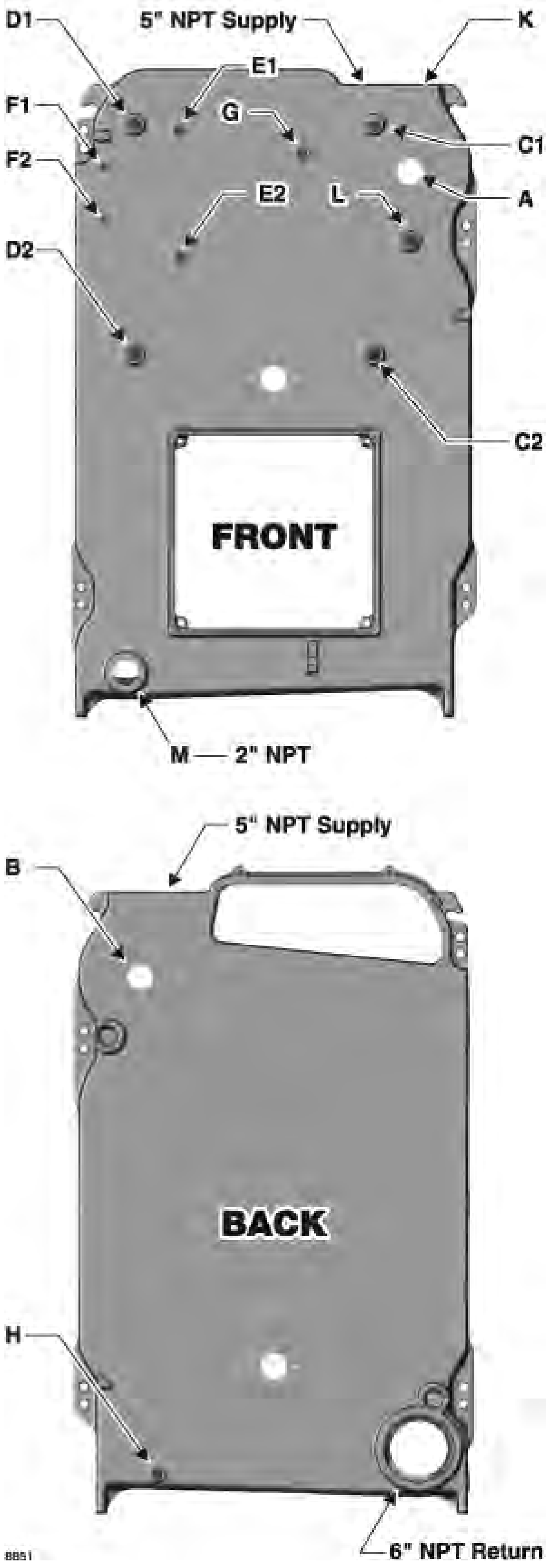
   c. Install water level controls and gauge glass per Figure 38, Figure 39 and Figure 42, page 28.
      - Fittings for controls to be furnished by others.
      - If water level control is not shown in Figure 41, page 28, locate casting mark on control and install per manufacturer's instructions.

NOTICE Do not use water level controls with quick hook-up fittings. Nuisance shutdowns will occur.

Figure 38 Steam control tappings (see Figure 39)

Location	Size	Function
A	2"	Steam relief valve and/or Skim tapping
B	2"	Steam relief valve
L	1"	Secondary probe low water cut-off
C1 & C2	1"	Low water cut-offs (see Figure 42, page 28)
C1		—
D1 & D2	1"	Alternate low water cut-offs (see Figure 42, page 28)
E1 & E2	½"	Gauge glass
F1 & F2	⅜"	Try cock tappings
G	¾"	Pressure limit control, Pressure operating control and pressure gauge, Firing rate pressure control (when used)
H	¾"	Boiler drain (see Figure 17, page 15, for system blow-off (drain) valve locations and sizes
K	1"	—
M	2"	Blowdown/drain

Figure 39 Steam control locations



Install steam boiler controls *(continued)*

Figure 40 Steam control siphon and fittings

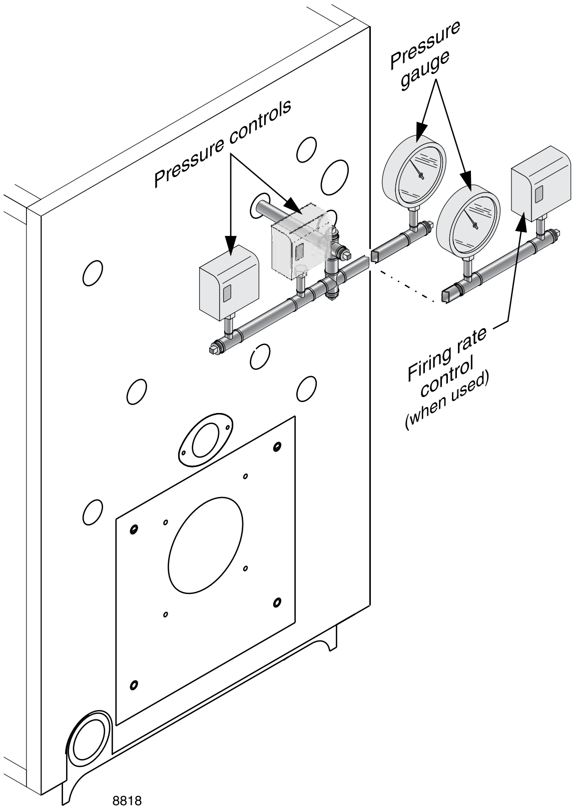


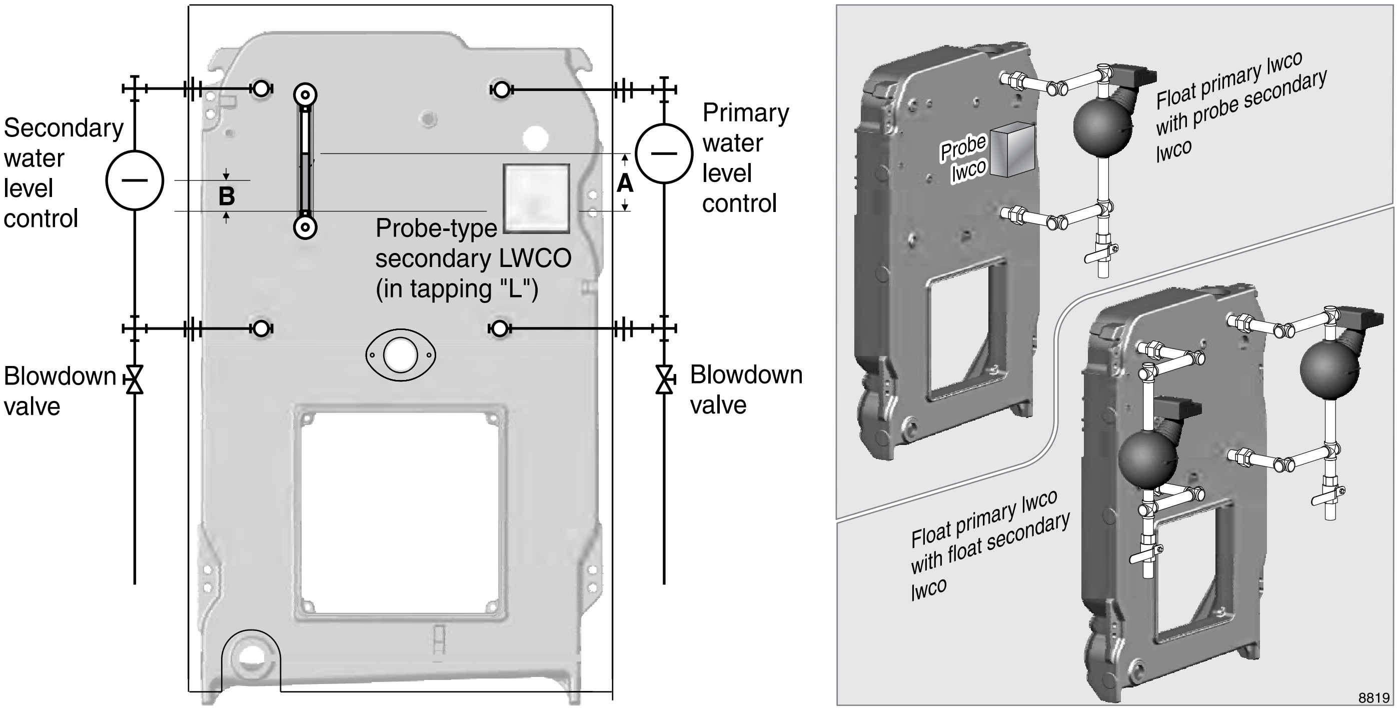
Figure 41 Float-type water level control locations

Primary water level control	Casting line height above bottom of gauge glass	Back-up water level control	Casting line height above bottom of gauge glass
Note 1	**"A"**	Notes 1, 2	**"B"**
61, 63	¼"	**None**	—
	1½"	**61, 63**	½"
150MD, 157MD (see Note 3)	2⅜"	**None**	—
	2"	**150**	¼"
	2⅜"	**61, 63**	¼"
	2⅜"	**51-2 & 51-S-2**	¼"
93, 193, 94 (see Note 3)	2"	**None**	—
	2"	**93, 193, 94**	¼"
	2"	**61, 63**	¼"
	2"	**51-2 & 51-S-2**	¼"
51-2 & 51-S-2 (see Note 3)	1"to 1¼"	**None**	—

Notes:

1. Other manufacturer's controls providing similar function may be used, if properly located and selected.
2. Use low water cut-off function only. Pump controller function must only be handled by the primary control.
3. When pump control is used with feedwater tank, install pump control on boiler and make-up water feeder on tank. Use separate low water cutoff on boiler when back-up is needed. Do not install combination low water cutoff and feeder as back-up control on boiler. Feeder will operate before pump control operates.

Figure 42 Water level control locations (see Figure 41)


Secondary water level control
B
A
Probe-type secondary LWCO (in tapping "L")
Primary water level control
Blowdown valve
Blowdown valve
Probe lwco
Float primary lwco with probe secondary lwco
Float primary lwco with float secondary lwco
8819

Connect breeching and venting systems

General venting information

1. Model 88 boilers operate with positive overfire pressure. Adjust damper assembly (see Figure 49, page 33) during burner start-up to achieve 0.1" W.C. positive pressure at damper sample hole.

Select type of venting system

Forced draft

- Boiler, breeching and stub vent operate at positive pressure. Entire system must be gas-tight to prevent leaks. Stub vent height must be limited to prevent negative draft with 3-foot minimum stub vent height above roof. See Figure 44 and Figure 46.

Balanced draft

- Boiler operates with positive pressure overfire. Chimney **may** provide excess draft which may require a barometric draft control installed and set to provide minimum draft to maintain 0.1" positive pressure at flue collar. Minimum chimney height above roof is 3 feet. See Figure 45 and Figure 47.

Construct metal breeching:

1. See Figure 43 for minimum breeching diameter.
2. Select material type and thickness in compliance with local codes.

⚠WARNING Conventional flue pipe should not be used as it could leak flue gases and carbon monoxide emissions through seams and joints, resulting in severe personal injury or death.

3. Refer to ASHRAE Guide for chimney and breeching calculations and construction and lining.

⚠WARNING Long horizontal breechings, excessive number of tees and elbows or other obstructions restricting combustion gas flow can result in possibility of condensation, flue gas leakage and carbon monoxide emissions, causing severe personal injury or death.

Figure 43 Minimum breeching diameter

Boiler model	AHRI vent or liner diameter (inches)		Boiler flue collar dimensions (inches)
	Forced draft	Balanced draft	
488	10	12	10 round
588	10	15	10 round
688	12	15	10 round
788	12	18	12 round
888	14	18	12 round
988	14	18	14 round
1088	14	21	14 round
1188	16	21	14 round
1288	16	21	14 round
1388	16	24	14 round
1488	18	24	16 round
1588	18	24	16 round
1688	18	24	16 round
1788	18	24	16⅛ x 19⅞ oval
1888	20	27	16⅛ x 19⅞ oval

Connect breeching and venting systems

Figure 44 Stub vent – forced draft — single boiler

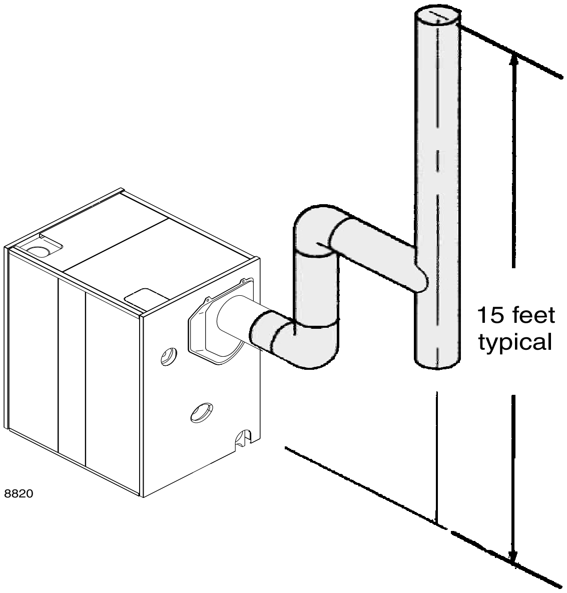


Figure 46 Stub vent – forced draft — multiple boilers

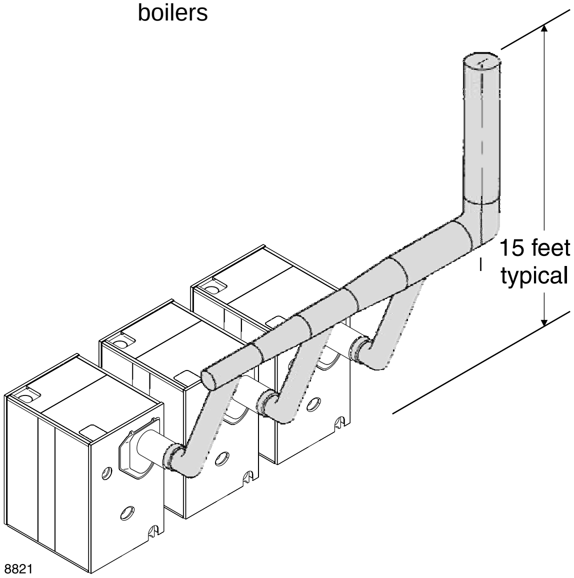


Figure 45 Conventional chimney – balanced draft with barometric draft control when required — single boiler

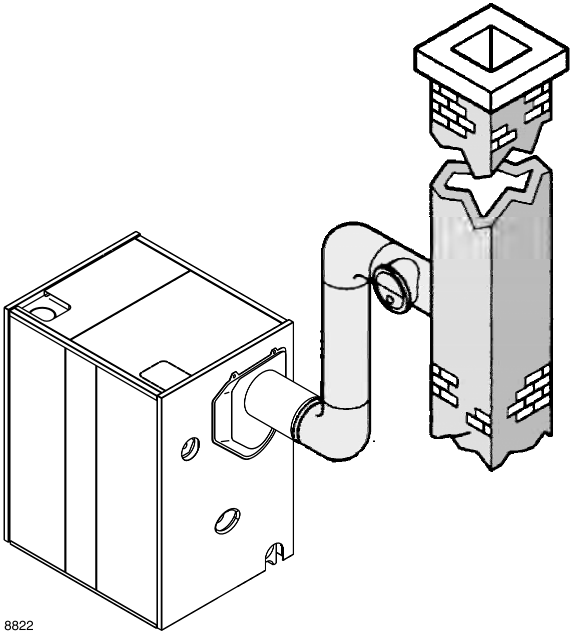
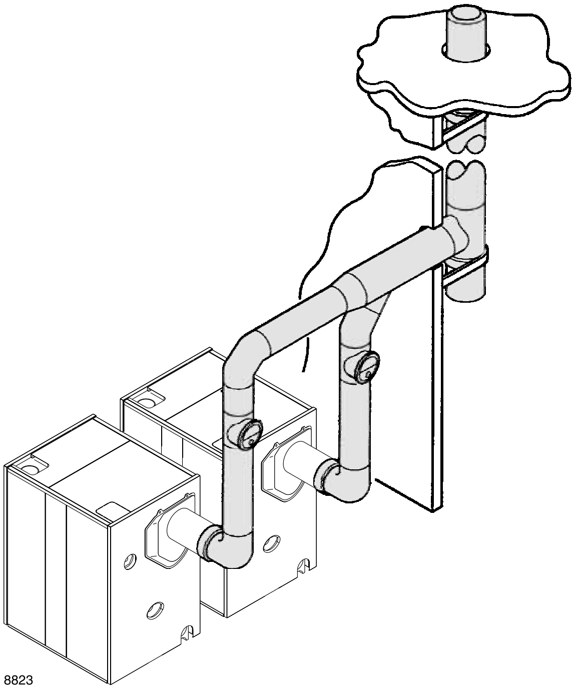


Figure 47 Conventional chimney – balanced draft with barometric draft control when required — multiple boilers



Install burner & wiring and fill system

To install burner

1. Unpack burner.
2. Place gasket around air tube and against burner mounting flange. If sealing rope is used, apply $^1/_8$" continuous bead of rope adhesive around burner mounting flange and apply sealing rope to make gas-tight seal.
3. Mount burner into opening in burner mounting plate.

⚠CAUTION Maintain gas-tight seal between burner mounting flange and plate to prevent damage to air tube.

4. Level burner using burner support brackets where required.
5. Secure with furnished bolts.
6. Retain burner information packet. Keep with boiler.

To wire burner and boiler controls

⚠WARNING Electric shock hazard. Can cause severe personal injury or death if power source is not disconnected before installing or servicing boiler and burner.

1. Install all wiring in compliance with:
   - National Electrical Code ANSI/NFPA 70.
   - Any additional national, state, or local codes.
2. Follow burner manual and wiring diagram found in burner information packet.
3. Use #14 AWG wire for operating and safety circuit wiring.
4. Where burner motor voltage differs from control voltage, supply proper voltage to each. Size fused disconnects and conductors per National Electrical Code ANSI/NFPA 70.

Determine if water treatment is needed (water boilers only)

⚠WARNING Do not use petroleum-based cleaning or sealing compounds in boiler system. Severe damage to system components can result, causing substantial property damage.

Continual make-up water will reduce boiler life. Minerals can build up in sections, reducing heat transfer, overheating cast iron and causing section failure.

For unusually hard water areas or low pH conditions (less than 7.0) consult local water treatment company. Provide a water softener for make-up water if hardness exceeds 7 grains.

Freeze protection (when used) (water boilers only)

1. Use antifreeze especially made for hydronic systems. Inhibited propylene glycol is recommended.

⚠WARNING Do not use automotive, ethylene glycol or undiluted antifreeze. Severe personal injury or death can result.

2. 50% solution provides protection to about -30°F.
3. Local codes may require back-flow preventer or actual disconnect from city water supply.
4. Determine quantity according to system water content. Boiler water content is listed in "Ratings," page 35. Percent of solution will affect sizing of heat distribution units, circulator and expansion tank.
5. Follow antifreeze manufacturer's instructions.

To fill water boilers

1. Close manual air vents and drain cocks.
2. Fill to correct system pressure. Correct pressure will vary with each installation.
3. Starting on lowest floor, open air vents one at a time until water squirts out. Close vent. Repeat with remaining vents.
4. Refill boiler to correct pressure.

To fill steam boilers

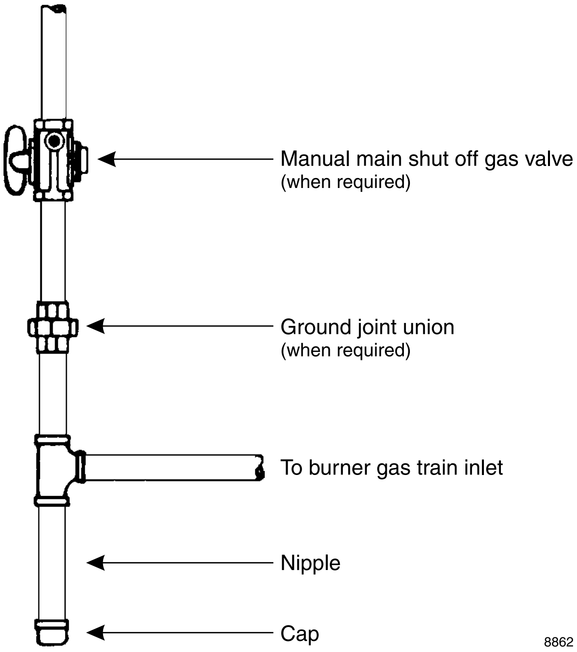
1. Do not fill (except for leakage test) until boiler is ready to be fired.
2. Fill to normal waterline, halfway up gauge glass.
3. Recommend boiler water pH 7.0 to 8.5.

Install fuel piping

Gas piping

1. In sizing the gas piping, the following factors should be considered:
   a. Diameter and length of the gas supply piping.
   b. Number of fittings.
   c. Maximum gas consumption (including any possible future expansion).
   d. Allowable loss in gas pressure from the gas meter outlet to the boiler.
2. Minimum inlet natural gas pressure required at manual main shut-off valve — see the burner manual and material list.
3. Follow good piping practices.
4. Pipe joint compound (pipe dope) must be resistant to the corrosive action of liquefied petroleum gases and applied sparingly only to the male threads of pipe joints.
5. A ground joint union must be installed in the piping to provide for servicing. The supply piping must include a manual shut-off valve and sediment trap. See Figure 48.
6. Piping must be supported by hangers, not by the burner or its accessories.
7. Purge all air from the supply piping.
8. All gas piping must be tested for leaks after installation. Use soap suds mixture only.

Figure 48 Gas supply piping



Fuel oil piping

⚠ DANGER To prevent oil flow in case of oil line breakage:

- Use anti-syphon device when any part of the oil tank is above burner level.
- Use check valve in suction line on burner side of manual shut-off valve nearest tank when top of fuel oil tank is below burner level.

Failure to comply could result in fuel leakage or fire, causing potential severe personal injury, death or substantial property damage.

1. A two-pipe fuel oil piping system is required for all installations.
2. Supply and return lines must enter tank from top, extending to within 4 to 6 inches from bottom of tank.
3. Use oil filter sized for fuel pump suction gear capacity.
4. Install oil filter.

⚠ CAUTION Do not install filter outside or close to an outside wall.

5. Use continuous copper tubing to reduce possible piping leaks and to ensure reliable seal when oil piping is buried.
6. Use flare fittings, not compression fittings.

⚠ DANGER **Fire hazard** — DO NOT USE soldered fittings. No safe repair can be made.

7. Follow good piping practices.
8. Pipe joint compound (pipe dope) must be resistant to corrosive action of fuel oil. Apply sparingly only to male threads of pipe joints.
9. Supply and return piping should be sized to design conditions, but not less than ½" O.D. continuous copper tubing.
10. Auxiliary fuel oil pump is recommended when suction line lift exceeds 12 feet.
11. Install swing joints so they will tighten as buried tank settles to prevent fuel line breakage.
12. Where iron pipe is required by local codes, make swing joints with nipples and elbows several inches long on both suction and return line. Locate close to tank.
13. Install manual shut-off valve in suction line piping near burner and where piping enters building from outside tank.
14. Pitch suction line piping toward fuel tank.
15. Provide tee and plug at highest point in suction line to release air from suction line and aid in priming.

Make final adjustments

Adjust burner and damper assembly:

1. Lock flue damper OPEN (Figure 49).

WARNING Make final burner adjustments using combustion test equipment to assure proper operation. Do not fire boiler without water. Sections will overheat, damaging boiler and resulting in severe property damage.

2. Refer to burner manual for start-up and service.
3. Let burner advance to high fire. Heat boiler to design conditions.
4. Using combustion test equipment, adjust burner for:
   a. 12% (± ¼%) CO_2 for No. 2 fuel oil, 0 smoke.
   b. 9 – 10% CO_2 natural gas; CO in flue gas not to exceed 50 ppm (0.01%).
   c. **Flue gas temperature no lower than 330°F.**

NOTICE On some applications, if draft conditions or burner characteristics cause the burner flame pattern to impinge on the combustion chamber wall, you may notice pinging sounds from the boiler. Adjust the burner if possible to redirect the flame. If this does not work, contact your boiler supplier or Weil-McLain to obtain an optional combustion chamber kit (see page 38 for contents).

5. Adjust flue collar damper (Figure 49) to ensure 0.1" W.C. positive pressure at test opening.
6. Tighten screws to secure in position.
7. Plug test opening with 1/8" plug provided with flue collar/damper assembly.
8. Adjust barometric draft control, when used, to design conditions.
9. Repeat steps 4 through 6. Adjust as required.

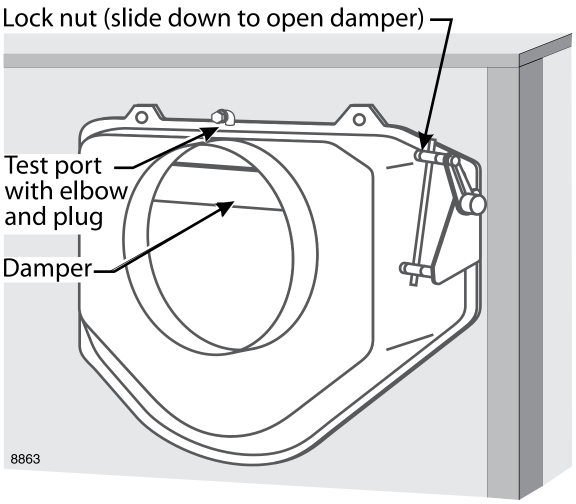
Skim steam boilers:

NOTICE Clean all newly installed steam boilers to remove oil. Failure to properly clean can result in violent water level fluctuations, water passing into steam mains, or high maintenance costs on strainers, traps and vents. Skim boiler only. Do not clean old piping or leaks can occur.

WARNING Do not use petroleum-based cleaning or sealing compounds in boiler system. Severe damage to system components can result, causing substantial property damage.

1. Remove 2" plug from skim tapping "**A**" (see Figure 38, page 27).
2. Provide 2" skim piping from tapping to floor drain.
3. Raise waterline to midpoint of skim piping.
4. Fire burner to maintain temperature below steaming rate during skimming process.
5. Feed in water to maintain water level.
6. Cycle burner ON/OFF as needed to prevent rise in steam pressure.
7. Continue skimming until discharge is clear. This may take several hours.

Figure 49 Flue collar/damper assembly


Lock nut (slide down to open damper)
Test port with elbow and plug
Damper
8863

8. Drain boiler.
9. While boiler is warm, **but not hot**, flush all interior surfaces under full pressure until drain water runs clear.
10. Remove skim piping.
11. Re-insert plug at boiler skim tapping.
12. Close drain cock.
13. Fill with fresh water to normal water line.
14. Start burner and steam for 15 minutes to remove dissolved gases.
15. Stop burner.
16. Check traps and air vents for proper operation.

Check boiler for gas-tight seal:

WARNING Boiler must be sealed gas-tight to prevent possible flue gas leakage and carbon monoxide emissions, resulting in severe personal injury or death.

1. Remove boiler jacket side and top panels.

WARNING The boiler contains ceramic fiber and fiberglass materials. Use care when handling these materials per instructions on **page 34** of this manual. Failure to comply could result in severe personal injury.

2. Start burner. Observe all sealing points and chalk mark any not gas-tight.
3. To seal all chalk-marked areas:
   a. Use silicone sealant on section flueways.
   b. Check gaskets and sealing rope placement.
4. Reinstall all jacket panels.

Handling ceramic fiber and fiberglass materials

REMOVAL OF FRONT PLATE OR CLEANOUT PLATE MATERIALS

⚠WARNING The burner front plate and cleanout plate gaskets contain ceramic fiber materials. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).":

- Avoid breathing dust and contact with skin and eyes.
    - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.
    - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining or base insulation to prevent airborne dust.
- Remove combustion chamber lining or base insulation from the boiler and place it in a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

REMOVAL OR INSTALLATION OF FIBERGLASS WOOL:

⚠WARNING This product contains fiberglass jacket insulation and ceramic fiber materials in jacket insulation, burner front plate insulation and cleanout plate gaskets. Airborne fibers from these materials have been listed by the State of California as a possible cause of cancer through inhalation.

- Avoid breathing dust and contact with skin and eyes.
    - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for fiberglass wool at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.
    - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Operations such as sawing, blowing, tear out, and spraying may generate airborne fiber concentration requiring additional protection.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

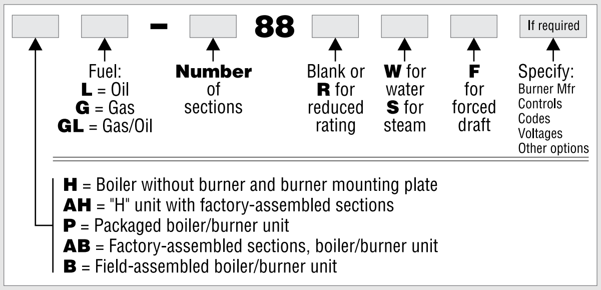
NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

Ratings

								AHRI Certified Ratings									
Boiler model number	AHRI burner capacity		Gross AHRI output		Net AHRI ratings			Combustion efficiency		Thermal efficiency		Boiler H.P.	Net firebox volume	Flue gas volume	Flue outlet dia.	Boiler water content	Packaged boiler weight
	Light oil GPH	Gas MBH	Steam MBH	Water MBH	Steam Sq. Ft	Steam MBH	Water MBH	Oil	Gas	Oil	Gas		Cubic feet	CFM	Inches	Gallons	Pounds
Notes: 1, 10	2, 3	2, 4	5, 6	5, 6	8	8	8	%	%	%	%	—	—	7	—	—	—
488R	6.9	996	827	833	2,583	620	719	87.5	84.8	85.6	83.1	24.7	11.02	376	10	109	2,860
488	7.0	1,010	839	844	2,621	629	730	87.5	84.8	85.6	83.1	25.1	11.02	370	10	109	2,860
588	9.4	1,356	1,126	1,135	3,521	845	979	87.0	84.4	85.6	83.1	33.6	14.45	507	10	132	3,340
688	11.8	1,701	1,413	1,424	4,469	1,072	1,229	86.7	84.1	85.6	83.1	42.2	18.08	639	10	155	3,820
788	14.2	2,046	1,700	1,713	5,463	1,311	1,478	86.5	83.9	85.6	83.1	50.8	21.61	772	12	178	4,345
788R	--	1999	1661	1673	5,463	1279	1,444	--	84.0	--	83.1	50.8	21.61	772	12	178	4,345
888	16.6	2,382	1,987	1,994	6,427	1,543	1,728	86.3	83.7	85.6	83.1	59.4	25.14	906	12	201	4,925
988R	17.2	2,482	2,062	2,080	6,671	1,601	1,793	86.2	83.7	85.6	83.1	61.6	28.67	1,031	14	224	5,600
988	18.8	2,737	2,274	2,294	7,358	1,766	1,977	86.2	83.7	85.6	83.1	67.9	28.67	954	14	224	5,600
1088R	20.0	2,887	2,399	2,419	7,763	1,863	2,086	86.2	83.6	85.6	83.1	71.7	32.20	1,184	14	247	6,130
1088	21.5	3,082	2,561	2,583	8,283	1,988	2,227	86.2	83.6	85.6	83.1	76.5	32.20	1,101	14	247	6,130
1188	23.5	3,428	2,848	2,873	9,213	2,211	2,477	86.1	83.5	85.7	83.1	85.1	35.76	1,299	14	270	6,695
1288	26.0	3,773	3,135	3,162	10,147	2,434	2,726	86.0	83.5	85.7	83.1	93.7	39.26	1,443	14	293	7,260
1388	28.5	4,119	3,422	3,456	11,071	2,657	2,976	86.0	84.4	85.7	83.1	102.2	42.79	1,588	14	316	7,890
1488	31.0	4,464	3,709	3,745	12,000	2,880	3,225	86.0	83.4	85.7	83.1	110.8	46.32	1,735	16	339	8,410
1588	33.0	4,809	3,996	4,035	12,925	3,102	3,475	85.9	83.3	85.7	83.1	119.4	49.85	1,854	16	362	9,005
1688R	34.5	4,979	4,137	4,182	13,383	3,212	3,597	85.9	83.3	85.7	83.1	123.6	53.38	2,003	16	385	9,525
1688	35.5	5,155	4,283	4,330	13,854	3,325	3,724	85.9	83.3	85.7	83.1	127.9	53.38	1,945	16	385	9,525
1788	38.0	5,494	4,570	4,615	14,783	3,548	3,974	85.9	83.3	85.7	83.1	136.5	56.91	2,152	18 *	408	9,780
1888	40.5	5,845	4,857	4,910	15,713	3,771	4,223	85.9	83.3	85.7	83.1	145.1	60.44	2,303	18 *	431	10,775

1. See below to specify complete model number.


– 88
If required
Fuel: **L** = Oil **G** = Gas **GL** = Gas/Oil
Number of sections
Blank or **R** for reduced rating
W for water **S** for steam
F for forced draft
Specify: Burner Mfr Controls Codes Voltages Other options

H = Boiler without burner and burner mounting plate
AH = "H" unit with factory-assembled sections
P = Packaged boiler/burner unit
AB = Factory-assembled sections, boiler/burner unit
B = Field-assembled boiler/burner unit

2. Burner input based on maximum of 2,000 feet altitude. For other altitudes, consult Weil-McLain distributor/agent or sales office.
3. No. 2 fuel oil — Commercial Standard Spec CS75-56. Heating value of oil = 140,000 Btu per gallon.
4. Gas pressure required at burner gas train inlet for rated burner input; based on 1,000 Btu per cubic foot natural gas, specific gravity of 0.60. Refer to burner manual for required pressure.
5. Gross AHRI ratings have been determined under the AHRI provision governing forced draft boiler-burner units.
6. Flue gas volume at outlet temperature.
7. Net AHRI ratings are based on net installed radiation of sufficient quantity for the requirements of the building. Nothing need be added for normal piping and pick-up.
   Water ratings are based on a piping and pick-up allowance of 1.15.
   Steam ratings are based on the following allowances: 488 – 588 = 1.333; 688 = 1.323; 788 = 1.301; 888 = 1.289; 988 – 1888 = 1.288.
   An additional allowance should be made for gravity hot water systems or for unusual piping and pick-up loads.
   Consult local Weil-McLain distributor/agent or sales office.
8. With 0.10" W.C. positive pressure at flue collar.
9. Water boilers tested for 80 PSIG, ASME water working pressure. Steam boilers tested for 15 PSIG, ASME steam working pressure.

* Flue collar connection is oval, 16⅛" x 19⅞"

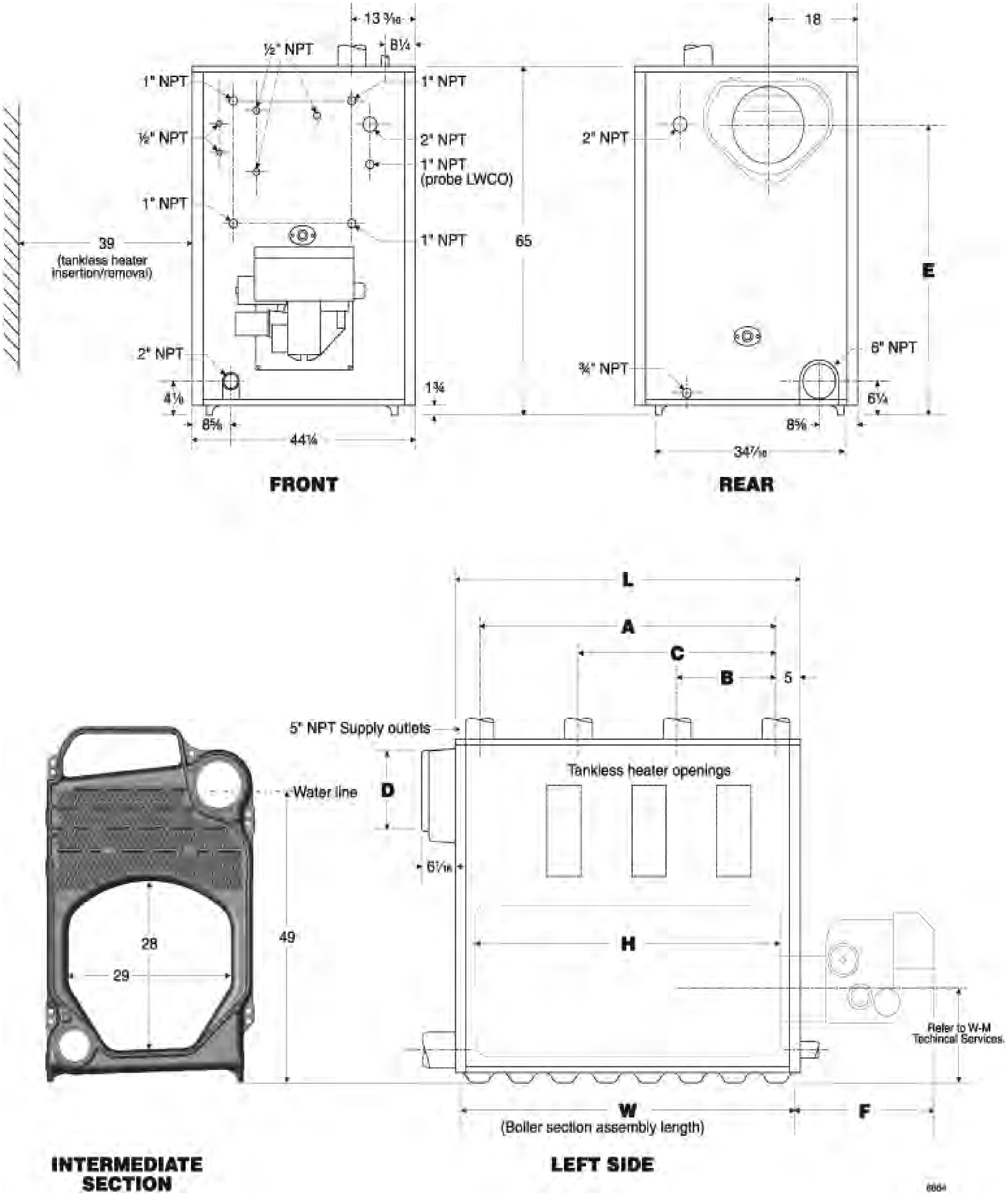
Dimensions

Dimensions (inches)								
Model	**A**	**B**	**C**	**D**	**E**	**L**	**W**	**H**
488	23	—	—	10	54¾	34¾	30	23⅜
588	31	—	—	10	54¾	42¾	38	31⅜
688	39	—	—	10	54¾	50¾	46	39⅜
788	47	—	—	12	53¾	58¾	54	47⅜
888	55	—	—	12	53¾	66¾	62	55⅜
988	63	—	—	14	52¾	74¾	70	63⅜
1088	71	—	—	14	52¾	82¾	78	71⅜
1188	79	—	—	14	52¾	90¾	86	79⅜
1288	87	39½	—	14	52¾	98¾	94	87⅜
1388	95	47½	—	14	52¾	106¾	102	95⅜
1488	103	55½	—	16	51¾	114¾	110	103⅜
1588	111	63½	—	16	51¾	122¾	118	111⅜
1688	119	47½	—	16	51¾	130¾	126	119⅜
1788	127	31½	79½	16⅛" x 19⅞" oval	51¾	138¾	134	127⅜
1888	135	39½	87½		51¾	146¾	142	135⅜

Model	**Supply & return tappings**				**Burner lengths (Dimension F)**				
	Supply tappings (No. & size)		**Return tappings (No. & size)**		**Carlin**	**Riello**	**Power-Flame**	**Beckett Oil**	**Beckett Gas**
	Steam	**Water**	**Steam**	**Water**					
488R	2 – 5"	2 – 5"	1 – 6"	1 – 6"	21	33	31	21	29
488	2 – 5"	2 – 5"	1 – 6"	1 – 6"	21	33	31	21	30
588	2 – 5"	2 – 5"	1 – 6"	1 – 6"	21	33	31	21	30
688	2 – 5"	2 – 5"	1 – 6"	1 – 6"	21	33	34	22	30
788	2 – 5"	2 – 5"	1 – 6"	1 – 6"	21	33	34	22	30
888	2 – 5"	2 – 5"	1 – 6"	1 – 6"	21	49	34	22	30
988R	2 – 5"	2 – 5"	1 – 6"	1 – 6"	21	49	34	22	30
988	2 – 5"	2 – 5"	1 – 6"	1 – 6"	26	49	34	22	30
1088R	2 – 5"	2 – 5"	1 – 6"	1 – 6"	26	49	34	22	30
1088	2 – 5"	2 – 5"	1 – 6"	1 – 6"	26	49	34	22	30
1188	2 – 5"	2 – 5"	1 – 6"	1 – 6"	26	49	39	23	30
1288	3 – 5"	2 – 5"	1 – 6"	1 – 6"	26	49	39	23	30
1388	3 – 5"	2 – 5"	1 – 6"	1 – 6"	26	49	39	23	30
1488	3 – 5"	2 – 5"	1 – 6"	1 – 6"	26	49	39	—	30
1588	3 – 5"	2 – 5"	1 – 6"	1 – 6"	—	49	39	—	—
1688R	3 – 5"	2 – 5"	1 – 6"	1 – 6"	—	49	39	—	—
1688	3 – 5"	2 – 5"	1 – 6"	1 – 6"	—	49	39	—	—
1788	4 – 5"	2 – 5"	1 – 6"	1 – 6"	—	49	44	—	—
1888	4 – 5"	2 – 5"	1 – 6"	1 – 6"	—	56	44	—	—

Dimensions *(continued)*

Figure 50 Dimensions (see lettered dimensions on opposite page)

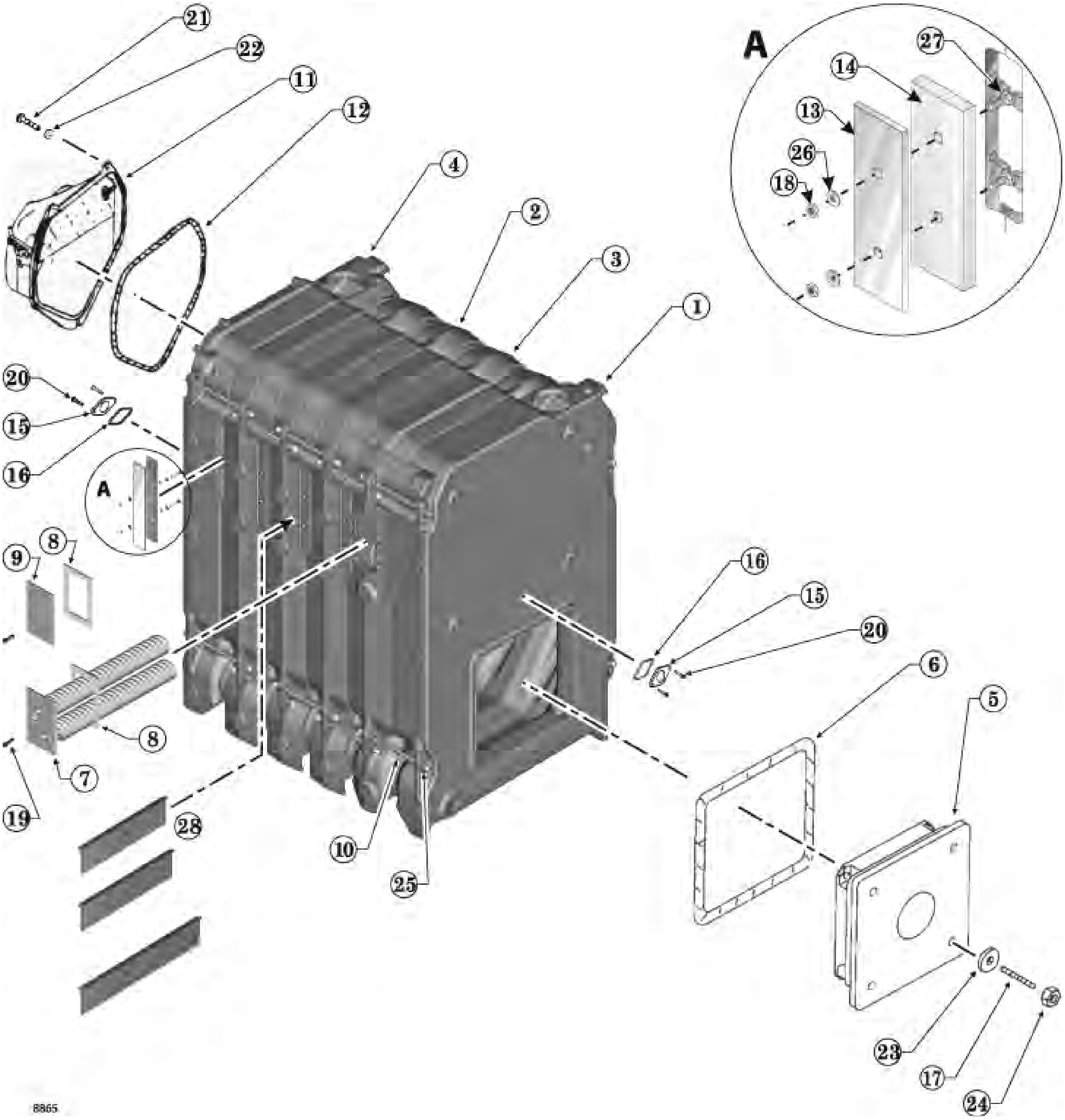


Parts

Item	Description	Part number
1	Front sections (8823)	316-301-210
2	Regular intermediate section (8825)	316-301-212
3	Tankless intermediate section (8826)	316-301-214
4	Back section (8828)	316-301-211
—	Supply intermediate section (8824) (not shown)	316-301-213
—	Section replacement kit (includes rope seals, rope adhesive and sealant for one joint)	386-300-213
5	Burner mounting plate	Order for specific burner
6	Sealing rope — ½" (7 feet per burner plate)	590-735-140
7	Tankless heater, when used, number 820	590-291-909
8	Heater gasket	590-317-579
9	Heater cover plate	450-030-934
10	Draw rod 5/8"-11UNC-2A x 13" (apply to front and rear sections)	560-134-505
11	Draft hood collar assembly (includes damper collar, damper, damper quadrant, locking plate, swivel, brackets and rope)	
	a. 10-inch — 488 through 688	340-004-606
	b. 12-inch — 788 and 888	340-004-607
	c. 14-inch — 988 through 1388	340-004-608
	d. 16-inch — 1488 through 1688	340-004-609
	e. 18-inch — 1788 and 1888	340-004-612
	f. Quadrant for flue collar	330-056-634
	g. Damper blade	460-003-646
	h. Damper locking plate	563-530-784
12	Sealing rope ½" (6 feet for flue collar)	590-735-140
13	Cleanout plate	450-030-965
14	Woven fiberglass gasket for cleanout plate	590-317-305
15	Observation port assembly (includes frame, rope, gasket, plugs and sight glass) (2 per boiler)	
	a. Assembly	383-600-099
	b. Sight glass only	591-419-199
	c. Washer gasket for sight glass (2⅛ x 1¼ x ⅛ inches)	590-317-580
16	Sealing rope, ⅜" (1 foot per observation port)	590-317-150
17	Burner mounting plate studs (½ x 3½ inches)	Obtain locally
18	Cleanout plate nut, ¼"	Obtain locally
19	Cap screw, ½–13 x ¾"	Obtain locally
20	Observation port screw, 10–32 x 1½"	Obtain locally
21	Flue collar cap screw, ½" x 1½"	Obtain locally
22	Flue collar washer, ¹¹⁄₁₆"	Obtain locally
23	Burner mounting plate washer, ½"	Obtain locally
24	Burner mounting plate nut, ½"	Obtain locally
25	Draw rod nut, ⅝"	Obtain locally
26	Cleanout plate washer, ¼"	Obtain locally
27	Cleanout plate carriage bolt, ¼" x 1¾"	Obtain locally
28	HXT-bars (see Figure 12, page 12, for installation and placement details for HXT-bars)	
	d. 3-flueway kit (includes 3 sets of bars)	416-400-130
	e. 2-flueway kit (includes 2 sets of bars)	416-400-131
Not shown	Combustion chamber liner kit (optional) — includes ceramic fiber blanket for left side wall plus water glass adhesive — see page 33. Consult your local Weil-McLain sales office for details.	Contact local Weil-McLain sales office

Parts *(continued)*

Figure 51 Parts



Appendix C

Heat Exchanger (Boiler Room) Specifications

HEAT EXCHANGER (BOILER ROOM)
DRAWING & SPECIFICATIONS

Heat Exchangers

Specifications summary for the required shell & tube heat exchangers in the boiler room are provided in **Table 3**. The full specification sheets for the boiler room heat exchangers are given in **Appendix C**.

Table 3 – Heat Exchanger Specifications

Heat Exchanger Manufacturer	**Armstrong**
Model	WX-1005-208-3-CBBSSNN-12
Quantity	2
Nozzle size (inlet & outlet)	4”
Shell Side Specifications	Carbon Steel, 316 SS tube sheet & front head
Tube side specifications	Copper Double Wall Piping
Hot Side	Glycol @ 225 gpm, 80 C inlet, 70 C Outlet
Cold Side	Raw Water @ 175 gpm, 2 C inlet, 56 C Outlet

Submittal

Ref. #: SQO036018_5

Product: Shell & Tube

Model: WX-1005-208-3-C66SSNN-12

Project name:		**Representative:**	Michael Gasior
Location:		**Phone number:**	
Date submitted:	7/8/2021 6:47 PM	**e-mail:**	mgasior@armstrongfluidtechnology.com
Engineer:		**Submitted by:**	Gasior, Michael

Process Conditions		
	Shell Side	**Tube Side**
Fluid	ethylene glycol 40%	water
Flow Rate	225 USgpm	111.7 USgpm
Inlet Temperature	80 ˚C	2 ˚C
Outlet Temperature	70 ˚C	30 ˚C
Operating Pressure	150.000 psi	125.00 psi
Density	63.58 lb/ft³	62.41 lb/ft³
Viscosity	0.86 SSU	1.25 SSU
Specific Heat	0.89 Btu/lb▪˚F	1.00 Btu/lb▪˚F
Thermal Conductivity	0.30 Btu/hr▪ft▪˚F	0.40 Btu/hr▪ft▪˚F
Specified Limits		
Maximum Velocity	4.00 ft/s	7.50 ft/s
Maximum Pressure Drop	Not Specified	Not Specified
Fouling Requested	None	0.0005 hr*ft²*˚F/Btu
Maximum Exchanger Length	Not Specified	
Required Tube Passes	Not Specified	
Shell Design Pressure	N/A	N/A
Performance		
Total Surface Area	73.7 ft²	
Velocity	3.20 ft/s	4.05 ft/s
Pressure Drop	2.30 psi	0.80 psi
Heat Transfer Coeff.	1,499.00 Btu/hr.ft².˚F	1,079.00 Btu/hr.ft².˚F
Heat Load	1819269.1 Btu/hr	
Corrected LMTD	114.00 ˚F	
Overall Heat Transfer Coeff.	503.40 Btu/hr.ft².˚F	
Total Fouling Used	0.002637422 hr.ft².˚F/Btu	
Required Heating Surface	31.6ft² dirty and31.6ft² clean	

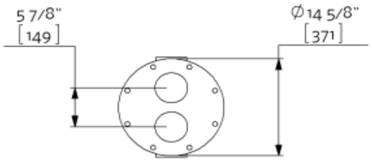
Design Details		
	Shell Side	**Tube Side**
Design Rating	150 psi at 375 ˚F	125 psi at 375 ˚F
Passes	1	2
Inlet Nozzle	4 inch ANSI RF	4 inch NPT F
Outlet Nozzle	4 inch ANSI RF	4 inch NPT F
Materials - Tubes		copper -dbl wall
Materials - Tubesheets	Carbon Steel	Stainless Steel (316SS)

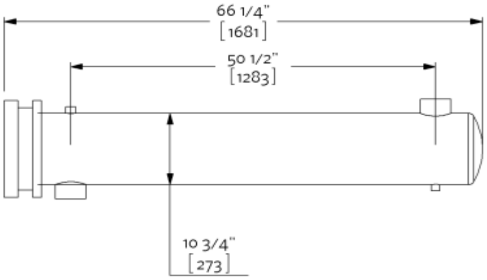
Materials - Head		Stainless Steel (316SS)
Materials - Shell	Carbon Steel	
Materials - Baffles	Carbon Steel	
Materials - Gasket	Non-Asbestos	Non-Asbestos
Materials - Studs/Nuts	Carbon Steel	
Shipping/Dry Weight (not including adjustable supports): 760 lb [344.73 kg]		
Drawing Number: No Submittal Available. Contact Technical Support		
Exchanger Size: Not Appicable		

Design, test, and fabrication in accordance with ASME Code Sect. VIII, Div. 1

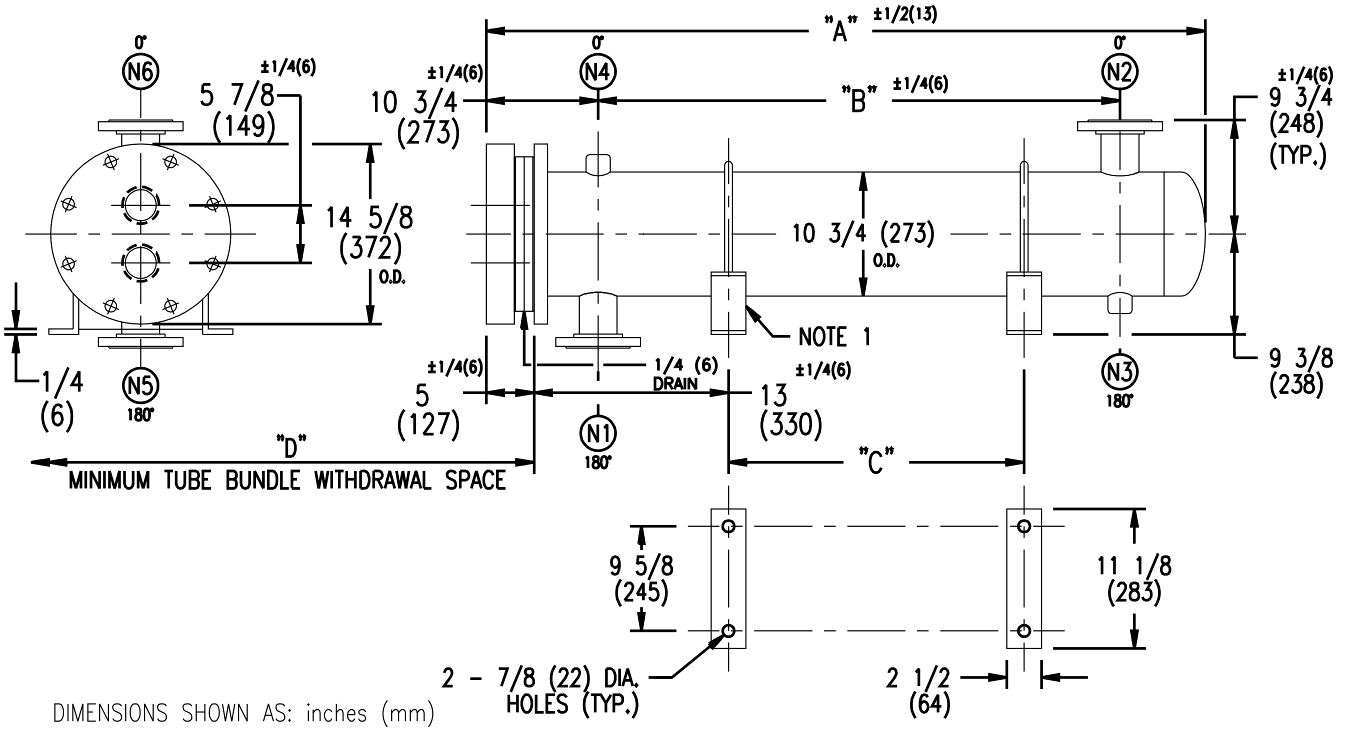
Note: When the Manual Select mode for pricing shell & tube heat exchangers and bundles is chosen; the thermal performance is not inputted nor verified and therefore cannot be guaranteed by Armstrong.

Drawing





Note:- Standard model as shown. For models with Adjustable Supports contact factory.



DIMENSIONS SHOWN AS: inches (mm)

EXCHANGER SIZE *-BAFFLE SPACING	DIMENSIONS											
	A		B		C		D		N1		N2	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
WX-103-2*-3	43 1/4	1099	25 1/2	648	14 1/2	368	42	1067	4	102	4	102
WX-104-2*-3	55 1/4	1403	37 1/2	953	26 1/2	673	54	1372	4	102	4	102
WX-105-2*-3	67 1/4	1708	49 1/2	1257	38 1/2	978	66	1676	4	102	4	102
WX-106-2*-3	79 1/4	2013	61 1/2	1562	50 1/2	1283	78	1981	4	102	4	102
WX-107-2*-3	91 1/4	2318	73 1/2	1867	62 1/2	1588	90	2286	4	102	4	102
WX-108-2*-3	103 1/4	2623	85 1/2	2172	74 1/2	1892	102	2591	4	102	4	102
WX-109-2*-3	115 1/4	2927	97 1/2	2477	86 1/2	2197	114	2896	4	102	4	102
WX-1010-2*-3	127 1/4	3232	109 1/2	2781	98 1/2	2502	126	3200	4	102	4	102
WX-1011-2*-3	139 1/4	3537	121 1/2	3086	110 1/2	2807	138	3505	4	102	4	102
WX-1012-2*-3	151 1/4	3842	133 1/2	3391	122 1/2	3112	150	3810	4	102	4	102
WX-1013-2*-3	163 1/4	4147	145 1/2	3696	134 1/2	3416	162	4115	4	102	4	102
WX-1014-2*-3	175 1/4	4451	157 1/2	4001	146 1/2	3721	174	4420	4	102	4	102
WX-1015-2*-3	187 1/4	4756	169 1/2	4305	158 1/2	4026	186	4724	4	102	4	102

NOZZLE SCHEDULE

SERVICE	MARK	SHELL SIDE	MARK	TUBE SIDE
INLET	N1	AS PER TABLE	N5	4 (102) NPT
OUTLET	N2	AS PER TABLE	N6	4 (102) NPT
DRAIN	N3	1/2 (13) NPT		
VENT	N4	3/4 (19) NPT		

NOTES:
1. SUPPORTS SUPPLIED ONLY IF SPECIFIED ON ORDER.
2. NOZZLE SIZES SHOWN ARE RECOMMENDED FOR MAXIMUM EXCHANGER LIFE.
3. FABRICATED TO ASME CODE SECTION VIII DIVISION 1 AND LATEST ADDENDA.
4. DRAWING IS NOT TO SCALE.
5. ALL DIMN'S ±1/8 (3) UNLESS OTHERWISE SHOWN.

DESIGN CONDITIONS

	SHELL		TUBES	
DESIGN PRESSURE	150 PSIG	1034 KPa	125 PSIG	862 KPa
DESIGN TEMPERATURE	375 °F	191 °C	375 °F	191 °C
MIN. DESIGN METAL TEMP.	40 °F	1.7 °C	40 °F	1.7 °C
HYDRO. TEST PRESSURE	225 PSIG	1551 KPa	200 PSIG	1379 KPa
CONTENTS	WATER		WATER	

CUSTOMER:
LOCATION:

ENGINEER:
ORDER No.:
PROJECT/JOB:
LOCATION:
TAG: (QUOTE #)

TITLE		NUMBER	REV.
G.A. 150 LB. WX SERIES HEAT EXCHANGERS	ARMSTRONG TORONTO - CANADA TEL : (416) 755-2291 MONTREAL - CANADA TEL ; (514) 421-2424 BUFFALO - N. Y. TEL: (716) 693-8813 COLCHESTER - U.K. TEL: (44) 120-657-9491	WX-10-2P-3(4)	
DATE: 12/01/94 BY: D.C.R.			

Typical Specifications

Project #: SQO036018_2
Specification

Product: Shell & Tube Heat Exchanger
Model: WX-1005-208-1-CBBSSNN-12

Armstrong WX Heat Exchanger Engineering Specification: WX-1005-208-1-CBBSSNN-12

Tag No:	Service:	Location:

Supply and install approximately where shown on plans and with the manufacturer's recommendations heat exchanger(s) as follows:

1.TYPE

Shell and tube, single wall tubes, u-bend removable bundle.

2. MATERIALS

Tubes	copper -dbl wall	**Shell**	Carbon Steel
Tubesheet	Brass	**Baffles**	Carbon Steel
Front Head	Bronze	**Studs and Nuts**	Carbon Steel
Head Gasket	Non-Asbestos	**Shell Gasket**	Non-Asbestos
		Shell side Tubesheet	Carbon Steel

3. CONSTRUCTION

Each heat exchanger is to be designed, built, and tested in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 and certified with ASME UM certification designator. A manufacturer's data report for pressure vessels, form number U-1 or a manufacturer's certificate of compliance form number U-3 as required by the provisions of the ASME Code rules is to be furnished to the user or designated agent upon request. This form must be signed by a qualified inspector, holding a National Board Commission when required, certifying that construction conforms to the latest ASME Code for pressure vessels for a minimum design metal temperature of 35 F, a tube side working pressure of 125 psi at 375 ˚F and a shell side working pressure of 150 psi at 375 ˚F.

4. MANUFACTURER and MODEL

The heat exchanger(s) shall be the Armstrong liquid to liquid model WX-1005-208-1-CBBSSNN-12.

5. DOCUMENTATION

Each heat exchanger shall be shipped complete with one copy each of the ASME U-1 or U-3 form and the manufacturer's installation and operating instructions.

6. SHIPPING

Each heat exchanger shall be prepared for shipping firmly mounted on a wooden skid. The skid shall be designed so as to prevent damage to the vessel during transport. All vessel connections shall be capped so as to prevent contamination of the tube surfaces.

7. INSTALLATION

Each heat exchanger shall be connected to the proper relief valves, vent and/or vacuum breaker as required.

Typical Specifications

Project #: SQO036018_2
Specification

Product: Shell & Tube Heat Exchanger
Model: WX-1005-208-3-C66SSNN-12

Armstrong WX Heat Exchanger Engineering Specification: WX-1005-208-3-C66SSNN-12

Tag No:	Service:	Location:

Supply and install approximately where shown on plans and with the manufacturer's recommendations heat exchanger(s) as follows:

1.TYPE

Shell and tube, single wall tubes, u-bend removable bundle.

2. MATERIALS

Tubes	copper -dbl wall	**Shell**	Carbon Steel
Tubesheet	Stainless Steel (316SS)	**Baffles**	Carbon Steel
Front Head	Stainless Steel (316SS)	**Studs and Nuts**	Carbon Steel
Head Gasket	Non-Asbestos	**Shell Gasket**	Non-Asbestos
		Shell side Tubesheet	Carbon Steel

3. CONSTRUCTION

Each heat exchanger is to be designed, built, and tested in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 and certified with ASME UM certification designator. A manufacturer's data report for pressure vessels, form number U-1 or a manufacturer's certificate of compliance form number U-3 as required by the provisions of the ASME Code rules is to be furnished to the user or designated agent upon request. This form must be signed by a qualified inspector, holding a National Board Commission when required, certifying that construction conforms to the latest ASME Code for pressure vessels for a minimum design metal temperature of 35 F, a tube side working pressure of 125 psi at 375 ˚F and a shell side working pressure of 150 psi at 375 ˚F.

4. MANUFACTURER and MODEL

The heat exchanger(s) shall be the Armstrong liquid to liquid model WX-1005-208-3-C66SSNN-12.

5. DOCUMENTATION

Each heat exchanger shall be shipped complete with one copy each of the ASME U-1 or U-3 form and the manufacturer's installation and operating instructions.

6. SHIPPING

Each heat exchanger shall be prepared for shipping firmly mounted on a wooden skid. The skid shall be designed so as to prevent damage to the vessel during transport. All vessel connections shall be capped so as to prevent contamination of the tube surfaces.

7. INSTALLATION

Each heat exchanger shall be connected to the proper relief valves, vent and/or vacuum breaker as required.

Rev:	**Lead Content**	**Technical Data**
Date:		
Approved:		**Sheet No. 1 of 1**

1.0 Scope

1.1 This Technical Data sheet outlines the chemical composition of shell & tube heat exchanger components used in W,WS and TH type tubular exchangers with special attention paid to lead content.

1.2 Table

Component	Material	ASTM#	Main Component / %	Max Lead Pb %
Tubes	Copper	SB-111-C12200	Cu 99.9% min	--
	9010 CuNi	SB-111-C70600	Cu 90%	0.05% Max
	316SS	SA-249 316L Wld		--
	Carbon Steel	SA-214		--
Head	Cast Iron	SA-278 Cl.30		--
	Cast Bronze	SB-61	Cu 90% max.	1.0% to 2.0%
	Carbon Steel	SA-516-70		--
	316SS	SA-240 316L		--
Baffles	Steel	A1008 CS Type B		--
	Brass	B36 C26000	68.5% to 71.5% Cu	0.07% Max
	316SS	SA-240 316L		--
Tank Collar	Carbon Steel	SA-106B / SA-516-70		--
	316SS	SA-312 TP 316L / SA- 240 316L		--
Tubesheet	Carbon Steel	SA-516 70		--
	Brass	SB-171 C46400	59% to 62% Cu	0.2% Max
	316SS	SA-240 316L		--
Tie Rods / Spacers	Brass	B16 C36000 /SB-111 C44300	60% to 63% Cu / 70% to 73% Cu	2.5% to 3.7% / 0.07% Max
	Steel	ASTM C1018 / SA-214		--
	316SS	A 484 316 / SA-249 316L		--
Studs and Nuts	Carbon Steel	SA-193 B7 & SA - 194 2H		--
Gaskets	Non-Asbestos	Klinger Sil C4430 Compress Fiber		--

HEAT EXCHANGER (BOILER ROOM) INSTALLATION & OPERATION INSTRUCTIONS

ARMSTRONG

Shell and Tube Heat Exchangers

Installation and operating instructions

File No: 138.65
Date: MAY 25, 2017
Supersedes: 138.65
Date: MAY 29, 2007

INTRODUCTION

Armstrong Heat Exchangers are designed for highest efficiency and trouble-free service, based on many years of technical and operational research. Careful supervision and inspection of materials and workmanship are important factors in the manufacturing of each unit.

In any correspondence relating to Armstrong units, please refer to the serial number which is stamped on the nameplate.

CONSTRUCTION

A shell and tube heat exchanger consists of a shell with inlet and outlet connections which carries one fluid, and a tube bundle with inlet and outlet connections for the handling of another fluid. The wall of the tubes is the boundary between the two fluids and is known as the heat transfer surface.

When the temperatures of the two fluids are such as to cause difference in linear expansion of the shell and tubes, means are provided to prevent this expansion damaging the unit. These means vary with the type of exchanger. A U-tube bundle can move independently of the shell and no other precautions in design need to be taken to take care of expansion. Straight tube bundles requiring consideration for expansion are usually provided with a floating rear head. In lieu of this, the shell may be fitted with a suitable expansion joint. The various uses to which heat exchangers are put, and the economics of each particular application dictate the method most suitable.

For heating of oils and other liquids of low specific heat and low thermal conductivity, exchangers with fixed tube sheets and no expansion joints are often used. In these cases, the tube wall temperature and the shell temperatures are relatively close, so that it is not considered essential to allow for difference in expansion of these parts when the heating medium is in the shell. If the heating medium were in the tubes, of course, means to take care of expansion would be necessary.

Every care is taken in design to provide a heat exchanger most suitable to meet each situation, consistent with reasonable cost. Various industries and processes have special preferences and requirements which S. A. Armstrong Limited is most anxious to provide. Standard designs may be modified to embody special features and materials as required. All Armstrong heat exchangers are built to ASME Code.

INSTALLATION

1. In selecting a location for the heat exchanger, provide sufficient clearance at the head end of the exchanger to permit removal of the tube bundle from the shell. In the case of straight tubes with fixed tube sheets, allow room to remove the heads for inspection and cleaning tubes, if and when it should become necessary.
2. Provide valves and bypasses in the piping system so that both the shell side and the tube side may be by-passed to permit isolating the unit for inspection and repairs.
3. Provide, as considered necessary, means for cleaning the unit periodically. See also information under Maintenance.
4. Provide thermometer wells and pressure gauge connections in all piping to and from the unit and located as near the unit as practicable.
5. Provide necessary air vent cocks so that gas vapor may be purged to prevent binding. A vacuum breaker in a steam spacer or in piping close to the steam spacer is desirable to minimize the effect of water-hammer.
6. Foundations must be adequate so that the exchanger will not settle and cause piping strains. In concrete footings, foundation bolts set in pipe sleeves of larger size than the bolt size will allow for adjustment after the foundation has set.
7. Loosen foundation bolts at one end of unit to allow free expansion and contraction of the heat exchanger shell.
8. Set the exchanger level and square so that piping connections may be made without forcing and also so that the tube bundle and shell of the exchanger do not trap gas, vapor or condensate. Steam to water heat exchangers should be installed at a 3 to 4 deg incline (towards the shell outlet), in order to facilitate the drainage of the condensate.
9. Before piping up, inspect all openings in exchanger for foreign material. Remove all shipping plugs and flange covers just before installing, and do not expose the unit to the weather with openings uncovered, since water may freeze and cause damage.
10. Be sure entire system is clean before starting operation, to prevent plugging of tubes with sand or foreign material. The use of a strainer or a settling tank in pipe line leading to the exchanger is recommended.
11. Drain connections should not be piped to a common closed manifold.

12 A gauge glass should be installed in a vapor or gas space to indicate possible flooding due to faulty trap operation.

13 To guard against pulsation of fluid due to reciprocating pumps or other equipment, a surge drum is recommended.

14 Quick-opening and closing valves controlling fluids to or from an exchanger may cause water-hammer, and care should be taken for proper selection of such equipment. Water-hammer can cause serious damage to heat exchanger tubes.

OPERATION OF HEAT EXCHANGERS

1 **Start-Up:** When placing a unit in operation, open the vent connections and start to circulate the cold medium only. Be sure the passages in the exchanger are entirely filled with cold fluid before closing the vents. The hot medium should then be introduced gradually until all passages are filled with the liquid or vapor, as the case may be. Then close the vents and slowly bring the units up to temperature.

2 **Bolted Joints:** Heat exchangers are hydrostatically tested in accordance with Code requirements and are certified as satisfactory by inspection agencies agreed upon by the manufacturer and the purchaser. However, normal yielding of gaskets will occur in the interval between hydrostatic testing in the manufacturer's shop and installation at the job site. Therefore, all external bolted joints should be properly re-tightened after installation and again after the exchanger has been heated, to prevent leaks and blowing out of gaskets.

3 **Design and Operating Conditions:** Do not operate equipment under pressure and temperature conditions in excess of those indicated on the nameplate.

4 **Shutting Down:** In shutting down, flow of hot fluid should be shut off first. If it is necessary to stop circulation of cooling medium, the circulation of the hot medium should be stopped also, through bypassing or other means.

When shutting the system, all fluids should be completely drained to minimize the possibility of freezing and corrosion. To guard against water-hammer, condensate should be drained from steam heaters and similar units when starting up, as well as when shutting down.

To minimize water retention after drainage, the tube side of water-cooled exchangers may require blowing out with air.

5 **Water Hammer:** In the case of steam as the heating medium, the steam trap should be manually by-passed until the exchanger is switched to automatic control. Costly damage can result if care is not exercised in the start-up of a heat exchanger. Water-hammer often results when a large quantity of steam is allowed to condense rapidly in an enclosure. Thin-walled tubes are very vulnerable. Copper tubing is used extensively and is relatively soft metal.

Water-hammer is a type of implosion effect particularly pronounced when low pressure steam is used, one reason being the high volume ratio of steam and water at low pressure. For instance: Volume of 1 lb. of steam at 5 psig is about 20 Cu. ft. Volume of 1 lb. of water (condensate) is 0.0168 cu. ft.

This volume ratio of 1200 to 1 gives us some idea of how the tremendous hammer effect may be produced when there is enough transfer surface present to remove the latent heat of vaporization rapidly. Slugs of water are hurled about in the vacuum created by condensation, and one can visualize the damage possible to fragile tubes.

When this hammer effect has occurred in the shell of an exchanger, the damage pattern is quite regular. Tubes are crushed in on top of the tube bundle, usually at about two-thirds of the distance from the steam entry nozzle toward the other end of the tube bundle. So far, there seems to be no technical explanation for this phenomenon. From study and examination of damaged exchangers, and investigation of their operation, we have come to the conclusion the following is roughly what happens: In a water heater using steam in the shell, when the demand for hot water ends the steam control valve closes, but there is a good supply of steam left in the shell of the exchanger. As this steam condenses, the pressure drops, often below atmospheric or even practically to full vacuum. This prevents condensate from leaving the shell and sometimes even siphons in condensate from the line beyond the trap. Now, when the steam valve opens again and admits steam to the shell, the rapid condensation, as it strikes the cold condensate, causes streams of water to rise, hitting the top of the shell and bouncing onto the top tubes. Sometimes the breaks in the tubes look as though a 4" spike had been driven through the topside. Other times the tubes may be crushed as if with a blunt chisel over lengths of a few inches or up to two feet.

MAINTENANCE OF HEAT EXCHANGERS

1 **Important:** Follow carefully the procedure recommended for operation. Quick start-up and shut-down without proper condensate removal is a major cause of heat exchanger damage.

2 Frequently, and at regular intervals, observe the interior and exterior condition of all tubes and keep them clean. Neglect in keeping all tubes clean may result in complete stoppage of flow through some tubes, causing over-heating of these tubes. This overheating may result in severe expansion strains and leaking tube joints.

3 When removing tube bundles from exchangers for inspection or cleaning, care should be taken to see that improper handling does not damage them. Tube bundles are often of great weight, yet the tubes are small and of relatively thin metal. The tube bundle should therefore never be supported on the tubes but should rest on parts designed to carry it, i.e., on tube sheets, baffles or support plates.

Do not handle tube bundles with hooks or other tools which might damage the tubes. They should be moved about on cradles or skids. Horizontal tube bundles should be lifted by means of suitable slings. Baffles can be easily damaged by dragging a bundle over a rough surface.

4 Provide convenient means as necessary for cleaning heat exchangers at regular intervals:

A Circulating hot wash oil or light distillate through tubes or shell at high velocity will effectively remove sludge or other similar soft deposits.

B Soft salt deposits may be washed out by circulating hot fresh water.

C Some commercially available cleaning compounds may be used for removing sludge or coke, provided hot wash oil or water, as described above, do not give satisfactory results.

D Removal of various scales and foreign material by chemical cleaning is now being extensively practiced. Certain qualified organizations will check the nature of the deposits to be removed, furnish proper acid solutions containing inhibitors, and provide equipment and personnel for a complete apparatus and piping cleaning job.

E If none of the above methods are effective for the removal of a hard scale, coke, or other deposits, mechanical means may be used for straight tube heat exchangers.

5 **Cleaning Precautions**

A Do not attempt to clean tubes by blowing steam through individual tubes. This overheats the tube and results in severe expansion strains and possible leaky tube joints.

B Do not blow out heat exchangers with air when fluids normally handled are inflammable.

C In cleaning a tube bundle, tubes should not be hammered on to remove hard scale. In case it is necessary to use scrapers, make sure that the scraper is not sharp enough to cut the metal of the tubes.

D If scaling or other fouling were expected, provisions in the piping could be made to allow connections for flushing out or chemical circulation cleaning; these openings, of course, would be normally plugged. In large plants where there are a number of exchangers, it may be profitable to have a tank of cleaning fluid available for periodic flushing of shell and/or tubes. Makers of commercial cleaning compounds would be glad to advise in this respect. Then, there are qualified organizations with experienced personnel who can furnish a complete service of apparatus for the removal of hard scale and sludge not easily removed otherwise. Small exchangers that can be easily removed from the line and small tube bundles can be sent to organizations that do such cleaning on their premises.

6 **Tube Rolling**

To tighten a loose tube joint, use a suitable roller type expander. Do not roll tubes that are not leaking as this needlessly thins the tube wall, and work hardens the metal which makes it brittle. Tubes are rolled in at our factory by means of roller type expanders, and the amount of expansion is controlled by means of a torquing device for uniformity and positive sealing. Do not over-roll the tubes as this would permanently damage the tube sheet.

7 **Gasket Replacement:**

Gaskets and gasket faces should be thoroughly clean and should be free of scratches and other defects. Gaskets should be accurately positioned before re-tightening bolts. It is recommended that when a heat exchanger is dismantled for any reason, it be re-assembled with new gaskets. Composition gaskets become dried out and brittle so that they do not always provide an effective seal when re-used. Metal or metal- jacketed gaskets, when compressed initially, flow to match their contact surfaces. In so doing, they are work-hardened, and when re-used, may provide an imperfect seal. Re-used metallic gaskets could result in deformation or damage to the gasket contact faces of the exchanger.

8 **Spare and Replacement Parts:**

Spare or replacement parts may be obtained for Armstrong heat exchangers by reference to the part required and to the serial number of the exchanger appearing on the nameplate. Consideration should be given to stocking parts for exchangers used in a process as inconvenient shutdowns may be necessary until receipt of parts. Since some gaskets are made to order with a long lead-time, it may be desirable to have them on hand.

In situations where a shut-down for cleaning and/or repairs could not be conveniently arranged, a standby heat exchanger connected in parallel, or a complete replacement tube bundle on hand for emergency, is recommended.

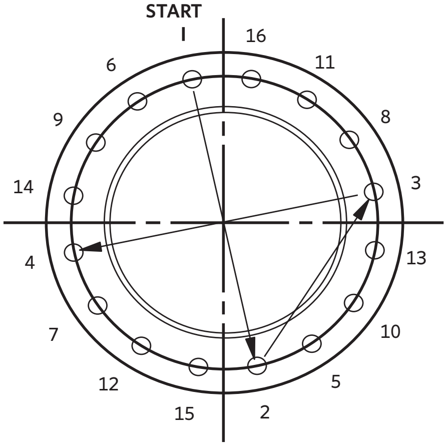
9 **Bolting**

It is important that all bolted joints be tightened uniformly and in a diametrically staggered pattern, as illustrated in the diagram, except for special high pressure closures when the instructions of the manufacturer should be followed.

NOMINAL BOLT DIA.	STD. MACHINE BOLTS A-307 TORQUE IN FT/LBS.	HIGH TENSILE BOLTS A-326 OR A193-B7 TORQUE IN FT/LBS.
½	15	40
⅝	30	75
¾	50	125
⅞	80	200
1	125	310
1⅛	200	450
1¼	276–5	650
1⅜	–	850
1⅝	–	1000
1½	–	1400
1¾	–	1900
1⅞	–	2500
8	–	2800

Torque required to tighten new flange ring bolts

Parts of the above excerpts from the Standards of the Tubular Exchanger Manufacturers Association.

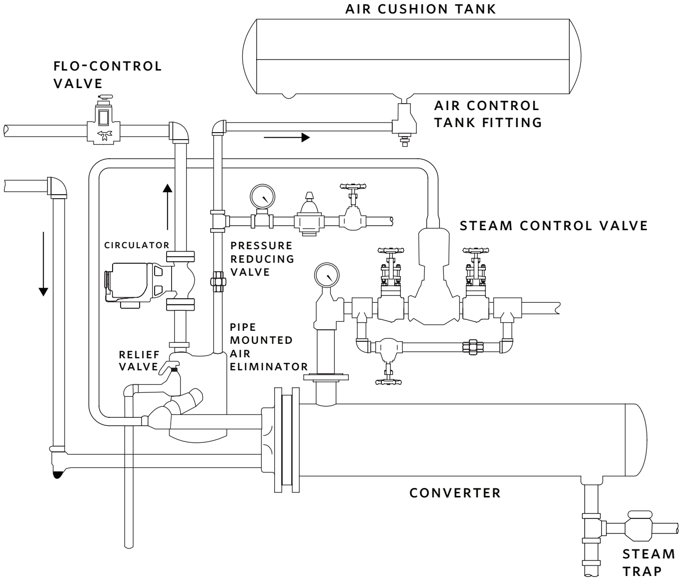


TYPICAL INSTALLATION OF "WS" HEAT EXCHANGER SHOWING RECOMMENDED METHOD OF INSTALLING CONVERTORS WITH ARMSTRONG AIR CONTROL SYSTEM

To establish air control in convertor or heat exchanger installations, a pipe mounted air eliminator is installed as shown in the accompanying diagram. The vortex air separator consists of a large cross-sectional area reducing the flow velocity and allowing air bubbles to rise into the air-line to the compression tank.

1 The air-line from the vortex air separator must pitch up to the air control tank fitting and compression tank.

2 The pump must be installed in the supply main, pumping to the system, regardless of the size of convertor or pump. In this way, pump head is added to the piping circuit.



CAUTION

Steam hammer can cause serious damage to the tubes of any heat exchanger. A careful consideration of the following points before an installation is made can prevent costly repairs which may be caused by a steam hammer.

1. A vacuum breaker and/or vent, should be used in accordance with the type of alarm system installed.
2. The proper trap should be used for the steam system installed.
3. The trap and one condensate return line to the trap should be properly sized for the total capacity of the convertor.
4. The trap should be sized for the pressure at the trap, not the inlet pressure to the steam controller.

Appendix D

Flow Transmitter & Temperature Gauge (Boiler Room) Specifications

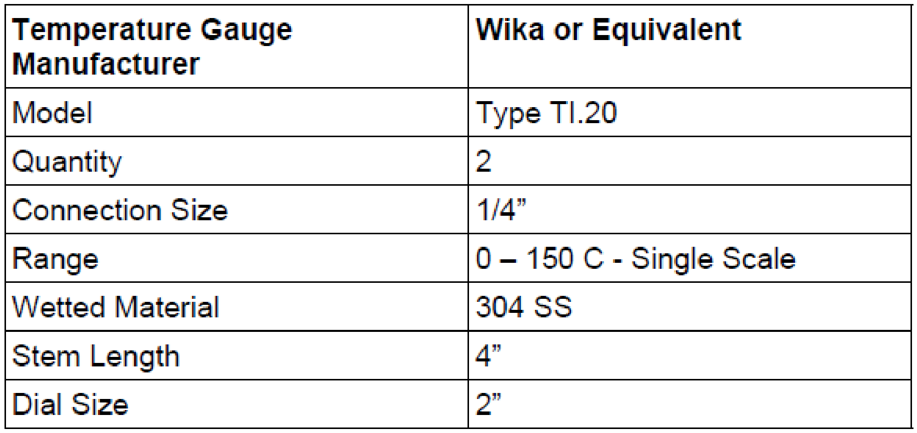
Instruments

Specifications summaries for the required flow and temperature instruments in the boiler room are provided in **Table 4** and **Table 5**. The full specification sheets for the flow instruments are given in **Appendix D**. Locations for the required instruments are highlighted on the P&ID in **Appendix A**.

Table 4 – Flow Transmitter Specifications

Flow Transmitter Manufacturer	**Endress & Hausser or Equivalent**
Model	91WA1-BA1A20RCB4AA
Quantity	2
Type	Ultrasonic – Proline Prosonic 91W
Range	0.3 to 10 m/s – Factory calibration
Sensors Material	304 SS
Number of Sensors	2
Transmitter / Control	4-20 mA

Table 5 – Temperature Gauge Specifications



Temperature Gauge Manufacturer	**Wika or Equivalent**
Model	Type TI.20
Quantity	2
Connection Size	1/4”
Range	0 – 150 C - Single Scale
Wetted Material	304 SS
Stem Length	4”
Dial Size	2”

Proline Prosonic Flow 91W Ultrasonic flowmeter

Device with automatic frequency scan for max. measuring performance and cost-effective transmitter

More information and current pricing:

www.ca.endress.com/91W

Benefits:

- Low capital investment – cost-effectiveness increases with pipe diameter (up to DN 4000)
- Long-term stable signal - maintenance-free permanent mounting from outside with coupling pads
- Process transparency – diagnostic capability
- Economical transmitter – designed for easy applications
- Fast and reliable commissioning – Quick Setup menu for installation
- Automatic recovery of data for servicing

Specs at a glance

- **Max. measurement error** Volume flow: ±3% o.r. for DN15 ±2% o.r. for DN25 to 200 ±2% o.r. above DN200
- **Measuring range** 0.3 to 10 m/s (1 to 33 ft/s)
- **Medium temperature range** -20 to +80°C (-4 to +176 °F) 0 to +130°C (32 to +265 °F) option
- **Max. process pressure** N/A
- **Wetted materials** Clamp on system: Sensor holder 1.4308/CF-8 Sensor housing 1.4301/304 Strapping bands 1.4301/304

Field of application: The Prosonic Flow W clamp-on sensor is specially designed for water and wastewater applications. Combined with the cost-effective Prosonic Flow 91 transmitter with push buttons, Prosonic Flow 91W is ideally suited for flow monitoring in the water industry.

Features and specifications

Liquids

Measuring principle

Ultrasonic flow

Product headline

The flowmeter with automatic frequency scan for maximum measuring performance and cost-effective transmitter. Clamp-on flow measurement of process water, saltwater, demineralized water, drinking water and wastewater.

Sensor features

Low capital investment – cost-effectiveness increases with pipe diameter (up to DN 4000). No additional leakage paths – external measurement from outside the pipe. Process transparency – diagnostic capability. Medium temperature: –20 to +80 °C (-4 to +176 °F). Degree of protection IP68 (Type 6P enclosure) for pipes under water.

Transmitter features

Economical transmitter – designed for easy applications. Fast and reliable commissioning – Quick Setup menu for installation. Automatic recovery of data for servicing. Aluminium field transmitter housing. 2-line display with push buttons.

Nominal diameter range

Single channel, 1 or 2 paths : DN15 to 2000 (1/2 to 80")

Wetted materials

Clamp on system:
Sensor holder 1.4308/CF-8
Sensor housing 1.4301/304
Strapping bands 1.4301/304

Measured variables

Volume flow, sound velocity, flow velocity, signal strength, totalizer

Liquids

Max. measurement error

Volume flow:
±3% o.r. for DN15
±2% o.r. for DN25 to 200
±2% o.r. above DN200

Measuring range

0.3 to 10 m/s (1 to 33 ft/s)

Max. process pressure

N/A

Medium temperature range

-20 to +80°C (-4 to +176 °F)
0 to +130°C (32 to +265 °F) option

Ambient temperature range

-20 to +60 °C (-4 to +140 °F)

Sensor housing material

N/A

Transmitter housing material

AlSi10Mg, coated

Degree of protection

IP67, type 4X for transmitter
IP67 type 4X for sensors
IP68 type 6P for sensors (option). IP67 NEMA 4X

Display/Operation

2 lines backlit display with 3 push button

Outputs

1x 4-20 mA HART (active)
1x Pulse/frequency/switch output (passive)

Inputs

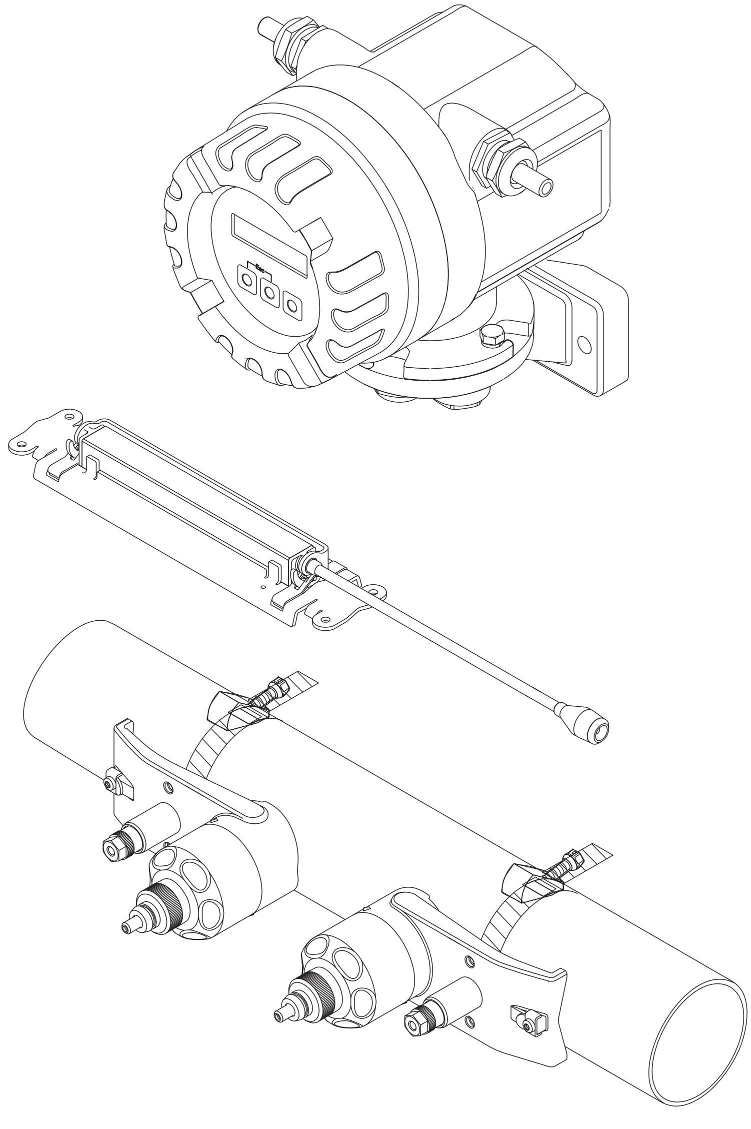
N/A

Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Prosonic Flow 91
HART

Ultrasonic Flow Measuring System



BA00100D/06/EN/13.11
71130013

Valid as of software version
V 1.02.XX (electronics board)

Endress+Hauser
People for Process Automation

Brief operating instructions

The brief operating instructions are aimed at helping you commission your measuring device quickly and easily:

Safety instructions → 🗎 5

First familiarize yourself with the safety instructions to be able to carry out the following work steps quickly and easily. Here, you can find information on:

- The designated use of the measuring device
- The operational safety
- The safety symbols and conventions used in the document

▼

Connecting the transmitter → 🗎 30

Install the sensors using the transmitter software.
Therefore connect the transmitter first to the power supply.

▼

Display and operating elements → 🗎 34

A brief overview of the different display and operating elements to allow you to start quickly.

▼

Installing the sensors → 🗎 10

Installing the flowrate measuring sensors Prosonic Flow W (clamp-on)

▼

Sensor Setup → 🗎 46

Measuring devices ***with*** *a local display:*
Use the "Sensor Setup" (→ 🗎 46) to determine the data required for sensor installation such as sensor distance, wire length, pipe materials, sound velocity in liquids, etc.

- The system provides you with the sensor distance for the W "clamp-on" versions as distance data.
  For the W sensors, you also receive the data in the form of a letter for sensor 1 and in the form of a number for sensor 2. You can thus easily position the sensors with the aid of the mounting rail.

Measuring devices ***without*** *a local display:*
No Sensor Setup is available for devices without a local display.
The sensor installation procedure for such devices is explained on.

Connection of the sensor/transmitter connecting cable→ 🗎 27

▼

Customer-specific configuration → 🗎 49

Complex measurement tasks require the configuration of additional functions which you can individually select, set and adapt to your process conditions using the function matrix. There are two options:

- Setting parameters via the configuration program "FieldCare"
- Setting parameters via the local display (optional)

All functions are described in detail, as is the function matrix itself → 🗎 75.

✎ Note!
Always start troubleshooting with the checklist on → 🗎 55 if faults occur after commissioning or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

Table of contents

1 Safety instructions

1.1 Designated use

The measuring device described in these Operating Instructions is to be used only for measuring the flow of liquids in closed pipes, e.g.:

- Ultra clean water with low conductivity
- Water, wastewater, etc.

As well as measuring the volume flow, the measuring system also always measures the sound velocity of the fluid. In this way, you can distinguish between different fluids or monitor the fluid quality.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages resulting from this.

1.2 Installation, commissioning, operation

Note the following points:

- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorized and trained by the plant operator. Strict compliance with the instructions in these Operating Instructions is mandatory.
- Endress+Hauser is willing to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning. However, small changes in temperature, concentration or the degree of contamination in the process can result in changes to the chemical resistance properties. For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of materials wetted by fluids in a specific application. The user is responsible for the choice of wetted materials with regard to their in-process resistance to corrosion.
- If welding work is performed on the piping system, do not ground the welding appliance through the flowmeter.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, except in cases where special protective measures have been taken (e.g. galvanically isolated power supply SELV or PELV).
- Always note the regulations applicable in your country to the operation, maintenance and repair of electrical devices. Special instructions relating to the device can be found in the relevant sections of the documentation.

1.3 Operational safety

Note the following points:

- The measuring device meets the general safety requirements according to EN 61010-1 and the EMC requirements according to IEC/EN 61326 in addition to the NAMUR recommendations NE 21, NE 43 and NE 53.
- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

1.4 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Always enclose a duly completed "Declaration of Contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.

  ✎ Note!
  You will find a preprinted "Declaration of Contamination" form at the back of this manual.

- Enclose special handling instructions if necessary, for example a safety data sheet as per Regulation (EC) No 1907/2006 REACH.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

⚠ Warning!

- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal or injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

1.5 Notes on safety conventions and icons

The devices are designed and tested to meet state-of-the-art safety requirements, and have left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 -1 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". The devices can, however, be a source of danger if used incorrectly or for other than the designated use.
For this reason, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following icons:

⚠ Warning!
"Warning" indicates an action or procedure which, if not performed correctly, can result in personal injury or a safety hazard. Comply strictly with the instructions and proceed with care.

☝ Caution!
"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

✎ Note!
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2 Identification

2.1 Device designation

The flowmeter system consists of the following components:

- Transmitter Prosonic Flow 91
- Prosonic Flow W sensor

- Prosonic Flow W clamp on version (DN 15 to 65 / ½ to 2½")
- Prosonic Flow W clamp on version (DN 50 to 4000 / 2 to 160")

2.1.1 Nameplate of the transmitter

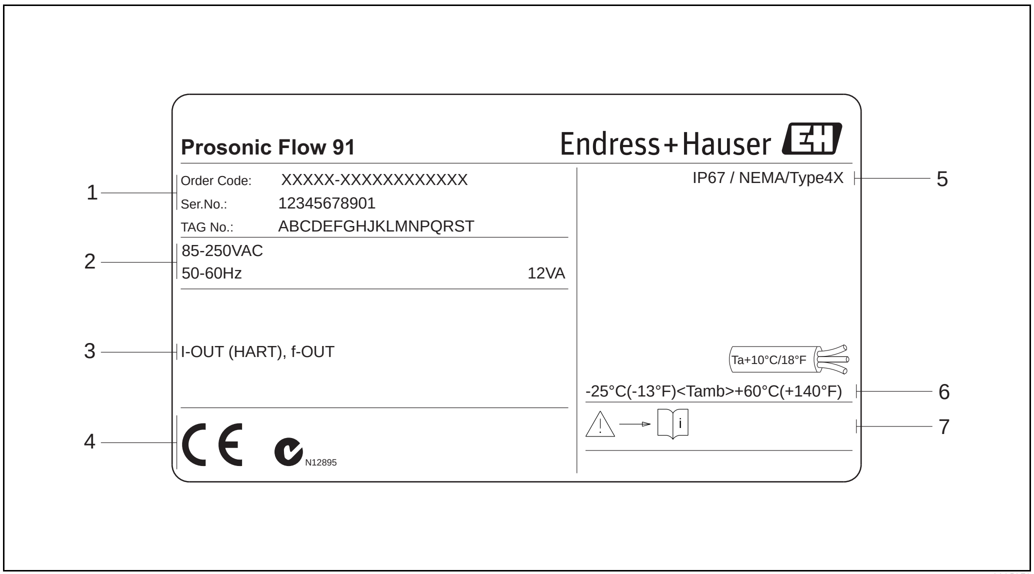


Fig. 1: Nameplate specifications for the "Prosonic Flow 91" transmitter (example)

1 Order code /serial number: see the specifications on the order confirmation for the meanings of the individual letters and digits
2 Power supply, frequency, power consumption
3 Outputs available:
I-OUT (HART): with current output (HART)
PULSE-OUT: with pulse/status output
4 Reserved for additional information on device version (approvals, certificates)
5 Permitted ambient temperature range
6 Degree of protection
7 Please comply with the Operating Instructions

2.1.2 Nameplate of the sensor

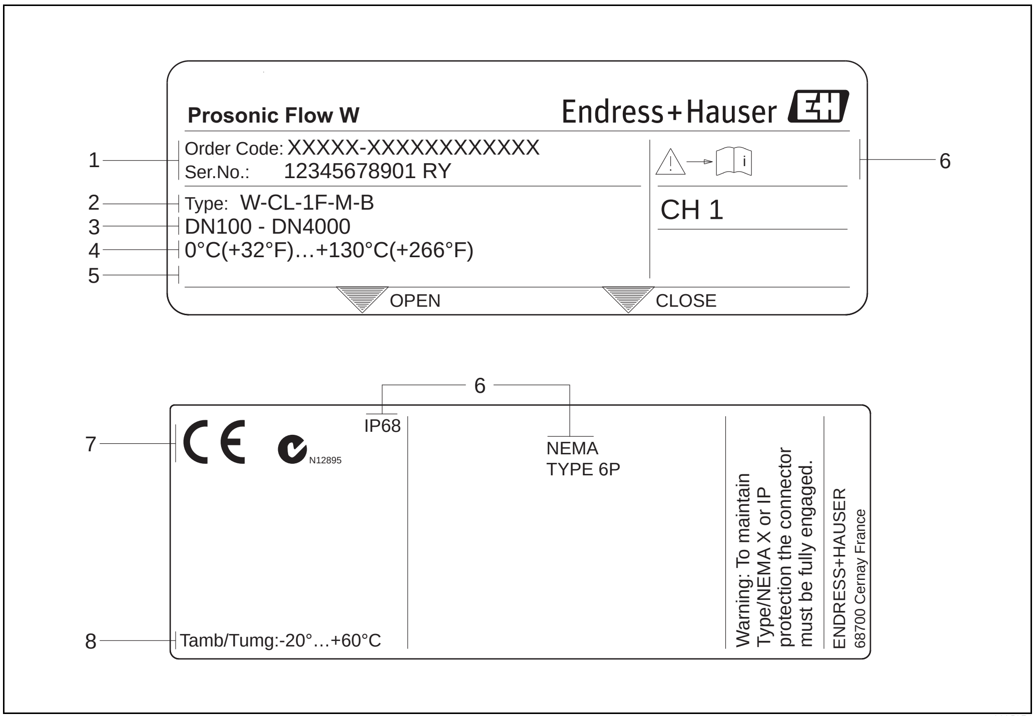


Fig. 2: Nameplate specifications for the "Prosonic Flow W" sensors (example)

1	*Ordering code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.*
2	*Sensor type*
3	*Recommended operating range for sensor type*
4	*Fluid temperature range*
5	*Reserved for information on special products*
6	*Please comply with the Operating Instructions*
7	*Reserved for additional information on device version (approvals, certificates)*
8	*Degree of protection*
9	*Permitted ambient temperature range*

2.1.3 Nameplate of the connections

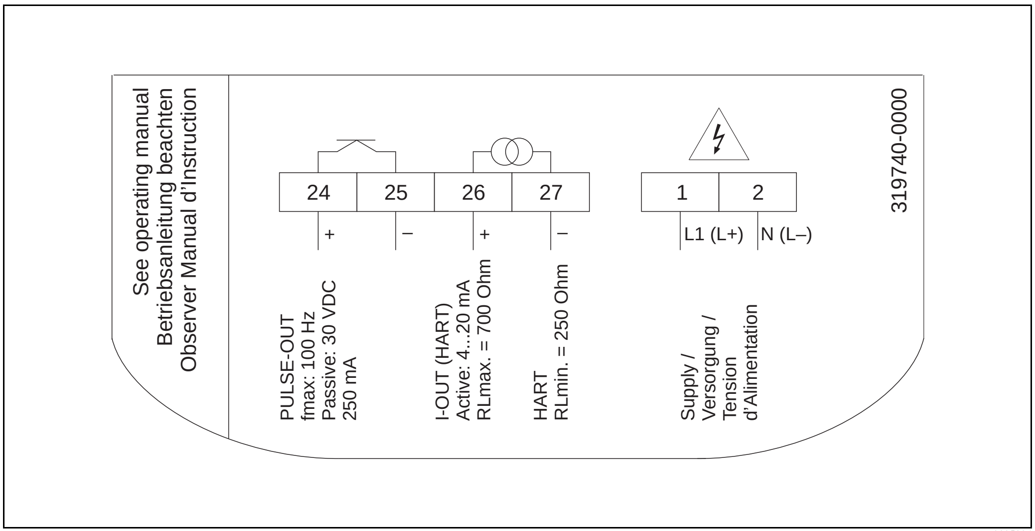


Fig. 3: Nameplate specifications for the transmitter (example)

2.2 Certificates and approvals

The devices are designed and tested to meet state-of-the-art safety requirements in accordance with sound engineering practice. They have left the factory in a condition in which they are safe to operate. The devices comply with the standards EN 61010 -1 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and with the EMC requirements of IEC/EN 61326.
The measuring system described in these Operating Instructions therefore complies with the legal requirements of the EU Directives. Endress+Hauser confirms this by affixing the CE mark to it and by issuing the CE Declaration of Conformity.
The measuring system is in conformity with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

2.3 Registered trademarks

HART®
Registered trademark of HART Communication Foundation, Austin, USA

HistoROM™, T-DAT™, FieldCare®, Field Xpert™, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

On receipt of the goods, check the following points:
- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.1.2 Transport

The devices must be transported in the container supplied when transporting them to the measuring point.

3.1.3 Storage

Note the following points:

- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation).
  The original packaging provides optimum protection.

- The storage temperature corresponds to the ambient temperature range of the transmitter, the measuring sensors and the corresponding sensor cables → 🗎 72.

- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

3.2 Installation conditions

3.2.1 Installation dimensions

The dimensions and lengths of the sensor and transmitter can be found in the "Technical Information" document for the device in question. This can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in Section "Documentation" on → 🗎 74.

3.2.2 Mounting location

Correct measuring is possible only if the pipe is full. **Avoid** the following mounting locations:

- Do not install at the highest point in the run. Risk of air accumulating!
- Do not install directly upstream from an open pipe outlet in a down pipe.

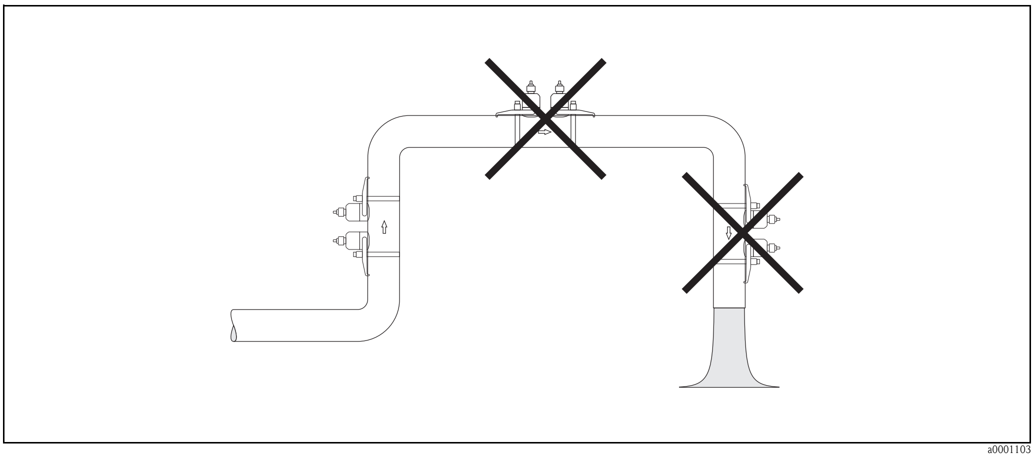


Fig. 4: Mounting location

3.2.3 Orientation

Vertical orientation

Recommended orientation with upward direction of flow (View A). Entrained solids sink down. Gases rise away from the measuring sensor when fluid is not flowing. The piping can be completely drained and protected against buildup.

Horizontal orientation

In the recommended installation range in a horizontal installation position (View B), gas and air accumulation at the pipe cover and problematic buildups at the bottom of the pipe have a minor influence on the measurement.

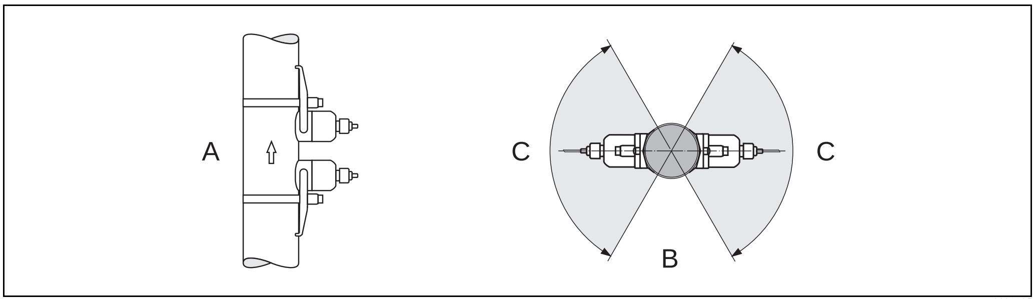


Fig. 5: Orientation

A Vertical: Recommended installation with vertical/upward direction of flow
B Horizontal: Recommended installation range with horizontal orientation
C Recommended installation range max. 120°

3.2.4 Inlet and outlet runs

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows, etc. If several flow obstructions are installed, the longest inlet or outlet run must be considered. Compliance with the following requirements for the inlet and outlet runs is recommended to ensure measuring accuracy.

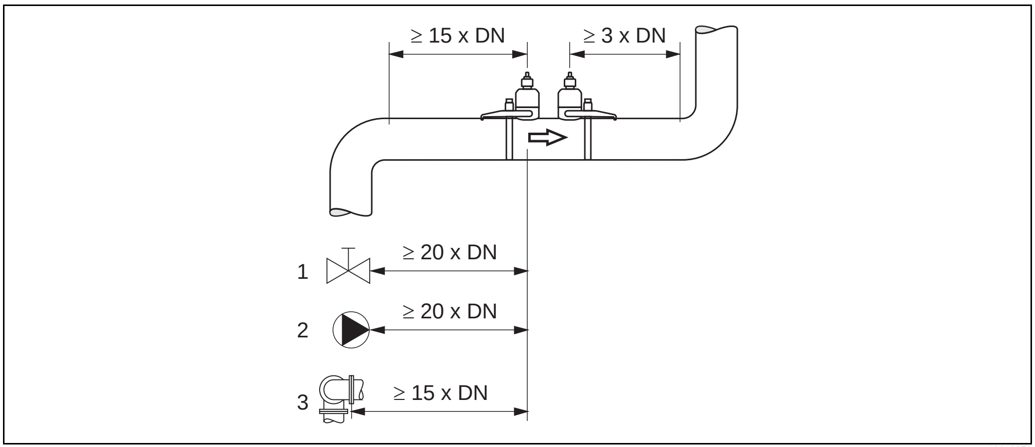


Fig. 6: Inlet and outlet runs (top view)

1 Valve (2/3 open)
2 Pump
3 Double bends

3.2.5 Sensor selection and arrangement

The sensors can be arranged in two ways:

- Mounting arrangement for measurement via one traverse: the sensors are located on opposite sides of the pipe.
- Mounting arrangement for measurement via two traverses: the sensors are located on the same side of the pipe.

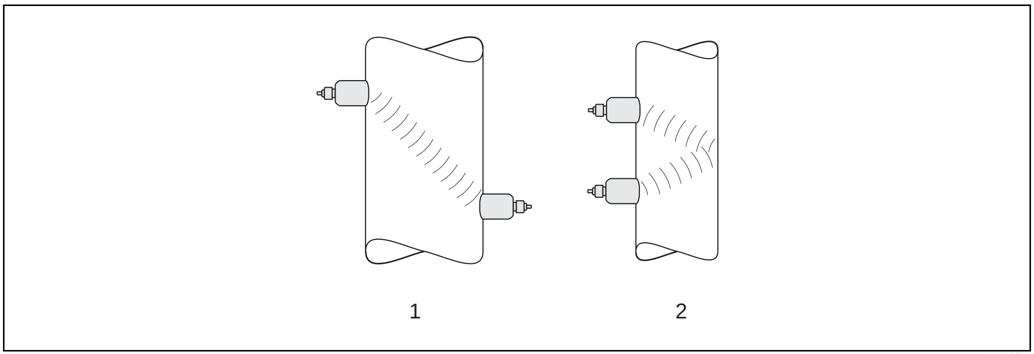


Fig. 7: Sensor mounting arrangement (top view)

1 Mounting arrangement for measurement via one traverse
2 Mounting arrangement for measurement via two traverses

Recommendations

The number of traverses required depends on th sensor type, the nominal diameter and the thickness of the pipe wall. We recommend the following types of mounting:

Sensor type	Nominal diameter	Sensor Frequency	Sensor ID	Type of mounting [1]
Prosonic Flow W	DN15 to DN65 (½" to 2½")	6 MHz	W-CL-6F	2 traverses [2]
	DN 80 (3")	2 MHz	W-CL-2F	2 traverses
	DN 100 to 300 (4" to 12")	2 MHz (or 1 MHz)	W-CL-1F W-CL-2F	2 traverses [2]
	DN 300 to 600 (12" to 24")	1 MHz (or 2 MHz)	W-CL-1F W-CL-2F	2 traverses [2]
	DN 650 to 4000 (26" to 160")	1 MHz (or 0.5 MHz)	W-CL-1F W-CL-05F	1 traverses [2]

[1] The installation of clamp-on sensors is principally recommended in the 2 traverse type installation. This type of installation allows the easiest and most comfortable type of mounting. However, in certain applications a 1 traverse installation may be preferred.

These include:

- Certain plastic pipes with wall thickness > 4 mm (0,16 in)
- Lined pipes
- Applications with fluids with high acoustic damping

[2] 0.5 MHz sensors are also recommended for applications with composite material pipes such as GRP*) and may be recommended for certain lined pipes, pipes with wall thickness >10 mm, or applications with media with high acoustic damping. In addition, for these applications we principally recommend mounting the W sensors in a 1 traverse configuration.

[3] 6 MHz sensors for applications where flow velocity ≤ 10m/s (32.8Hz/s)

3.3 Preparatory steps prior to installation

Depending on the conditions specific to the measuring point (e.g. clamp-on, number of traverses, fluid, etc.), a number of preparatory steps have to be taken before actually installing the sensors:

1. Determination of the values for the necessary installation distances based on the conditions specific to the measuring point. A number of methods are available for determining the values:
   - Local operation of the device
   - FieldCare (operating program), connect a notebook to the transmitter
   - Applicator (software), online on the Endress+Hauser Internet site
2. Mechanical preparation of the clamp-on retainers for the sensors:
   - Premount the strapping bands (DN 50 to 200 / 2 to 8") or (DN 250 to 4000 / 10 to 160")
   - Fix the welded bolts

3.4 Determining the necessary installation distances

The installation distance that have to be maintained depend on:

- The type of sensor: W (DN 50 to 4000 / 2 to 160"), W(DN 15 to 65 / ½ to 2½")
- Type of mounting:
  - Clamp-on with strapping band or welded bolt
  - Insertion version, installation in the pipe
- Number of traverses or single-path/dual-path version

3.4.1 Installation distances for Prosonic Flow W clamp-on

DN 50 to 4000 (2 to 160")				DN 15 to 65 (½ to 2½")
Clamp-on Strapping band		Clamp-on Welded bolts		Clamp-on Strapping band
1 traverse	2 traverses	1 traverse	2 traverses	2 traverses
SENSOR DISTANCE	SENSOR DISTANCE	SENSOR DISTANCE	SENSOR DISTANCE	SENSOR DISTANCE
WIRE LENGTH	POSITION SENSOR	WIRE LENGTH	POSITION SENSOR	–

3.4.2 Determining values for installation distances

Perform the following steps to determine the installation distances:

1. Mount the transmitter.
2. Connect the power supply.
3. Switch on the measuring device.
4. Run the "Sensor Setup menu.

3.5 Mechanical preparation

The way in which the sensors are secured differs on account of the pipe nominal diameter and the sensor type. Depending on the type of sensor, users also have the option of securing the sensors with strapping bands or screws such that they can be later removed, or permanently fixing the sensors in place with welded bolts or welded retainers.

Overview of possible ways to secure the various sensors:

Prosonic Flow	For the measuring range	Pipe nominal diameter	Secured by
91W	DN 15 to 65 (½ to 2½")	DN ≤ 32 (1¼")	Sensor holder with U-shaped screws (small nominal diameters) → 🗎 15
		DN > 32 (1¼")	Sensor holder with strapping bands (small nominal diameters) → 🗎 16
91W	DN 50 to 4000 (2 to 160")	DN ≤ 200 (8")	Strapping bands (medium nominal diameters) → 🗎 16
			Welded bolts → 🗎 14
		DN > 200 (8")	Strapping bands (large nominal diameters) → 🗎 18
			Welded bolts → 🗎 14

3.5.1 Mounting the sensor holder with U-shaped screws (small nominal diameters)

For mounting on a pipe with a nominal diameter of DN ≤ 32 (1¼")
For sensors: Prosonic Flow (DN 15 to 65 / ½ to 2½")

Procedure

1. Disconnect the sensor from the sensor holder.
2. Position the sensor holder on the pipe.
3. Put the U-shaped screws through the sensor holder and slightly lubricate the thread.
4. Screw nuts onto the U-shaped screws.
5. Set the holder to the exact position and tighten the nuts evenly.

   ⚠ Warning!
   Risk of damaging plastic or glass pipes if the nuts of the U-shaped screws are tightened too much! The use of a metal half-shell is recommended (on the opposite side of the sensor) when working with plastic or glass pipes.

   ✎ Note!
   The visible pipe surface "A" must be smooth to ensure good acustic contact.

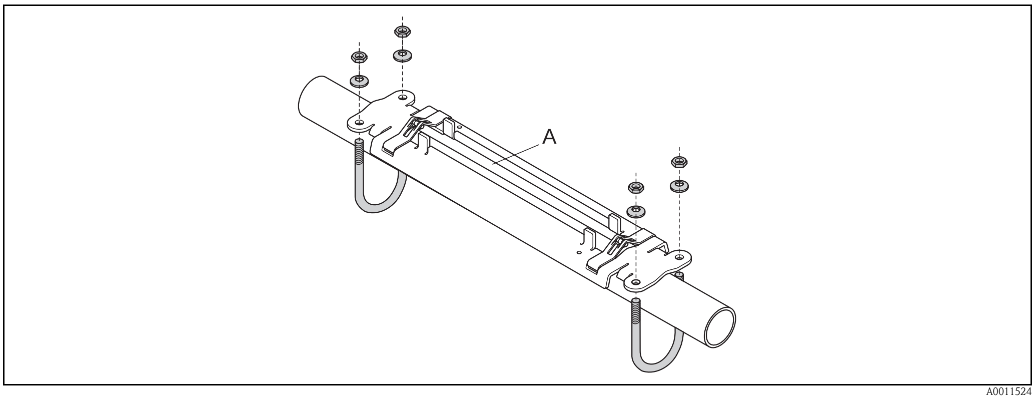


Fig. 8: Mounting the Prosonic Flow-sensor holder (DN 15 to 65 / ½ to 2½") with U-shaped screws

3.5.2 Mounting the sensor holder with strapping bands (small nominal diameters)

For mounting on a pipe with a nominal diameter of DN > 32 (1¼")

For sensors:
- Prosonic Flow 91W (DN 15 to 65 / ½ to 2½")

Procedure

1. Disconnect the sensor from the sensor holder.
2. Position the sensor holder on the pipe.
3. Wrap the strapping bands around the sensor holder and pipe without twisting them.
4. Guide the strapping bands through the strapping band locks (strapping screw is pushed up).
5. Tighten the strapping bands as tight as possible by hand.
6. Set the sensor holder to the correct position.
7. Push down the strapping screw and tighten the strapping bands so that they cannot slip.
8. Where necessary, shorten the strapping bands and trim the cut edges.

   ⚠ Warning!
   Risk of injury. To avoid sharp edges, trim the cut edges after shortening the strapping bands.

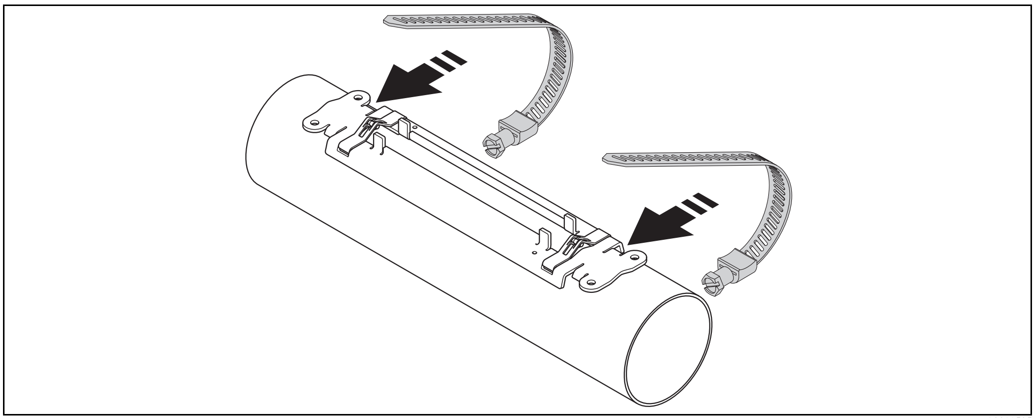


Fig. 9: Positioning the sensor holder and mounting the strapping bands

Note!
The visible pipe surface "A" must be smooth to ensure good acustic contact.

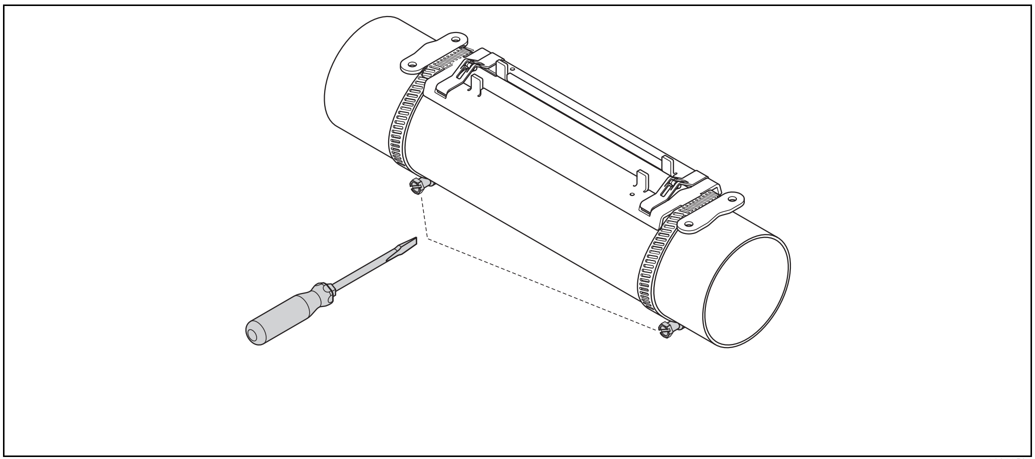


Fig. 10: Tightening the strapping screws of the strapping bands

3.5.3 Premounting the strapping bands (medium nominal diameters)

When mounting on a pipe with a nominal diameter of DN ≤ 200 (8")

For sensors:
- Prosonic Flow 91W (DN 50 to 4000 / 2 to 160")

Procedure

First strapping band

1. Fit the mounting bolt over the strapping band.
2. Wrap the strapping band around the pipe without twisting it.
3. Guide the end of the strapping band through the strapping band lock (strapping screw is pushed up).
4. Tighten the strapping band as tight as possible by hand.
5. Set the strapping band to the desired position.
6. Push down the strapping screw and tighten the strapping band so that it cannot slip.

Second strapping band

7. Proceed as for the first strapping band (steps 1 to 7). Only slightly tighten the second strapping band for final mounting. It must be possible to move the strapping band for final alignment.

Both strapping bands

8. Where necessary, shorten the strapping bands and trim the cut edges.

   ⚠ Warning!
   Risk of injury. To avoid sharp edges, trim the cut edges after shortening the strapping bands.

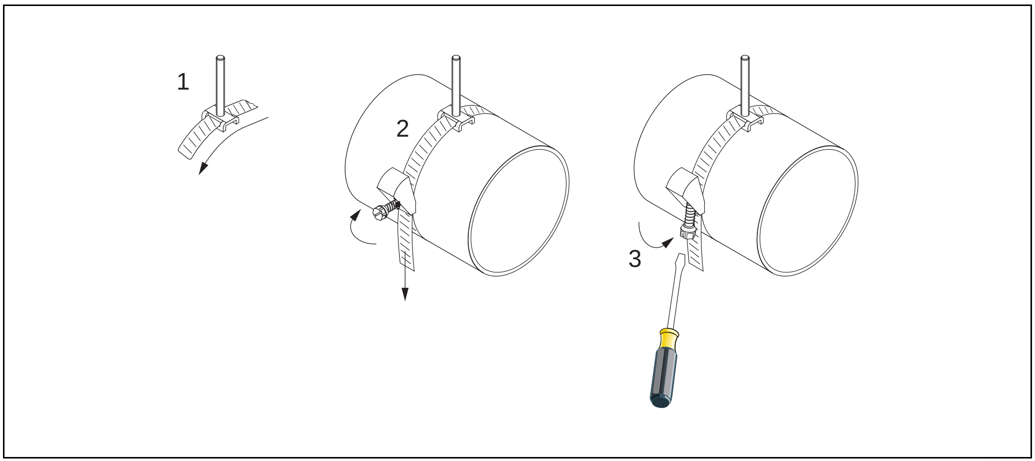


Fig. 11: Premounting strapping bands for pipe diameters DN ≤ 200 (8")

1 Mounting bolt
2 Strapping band
3 Strapping screw

3.5.4 Premounting the strapping bands (large nominal diameters)

When mounting on a pipe with a nominal diameter in the range of DN > 600 (24")

For sensors:
- Prosonic Flow 91W (DN 50 to 4000 / 2 to 160")

Procedure

1. Measure the pipe circumference.
2. Shorten the strapping bands to one length (pipe circumference + 32 cm (12.6 in)) and trim the cut edges.

   ⚠ Warning!
   Risk of injury. To avoid sharp edges, trim the cut edges after shortening the strapping bands.

First strapping band

3. Fit the mounting bolt over the strapping band.
4. Wrap the strapping band around the pipe without twisting it.
5. Guide the end of the strapping band through the strapping band lock (strapping screw is pushed up).
6. Tighten the strapping band as tight as possible by hand.
7. Set the strapping band to the desired position.
8. Push down the strapping screw and tighten the strapping band so that it cannot slip.

Second strapping band

9. Proceed as for the first strapping band (steps 3 to 8). Only slightly tighten the second strapping band for final mounting. It must be possible to move the strapping band for final alignment.

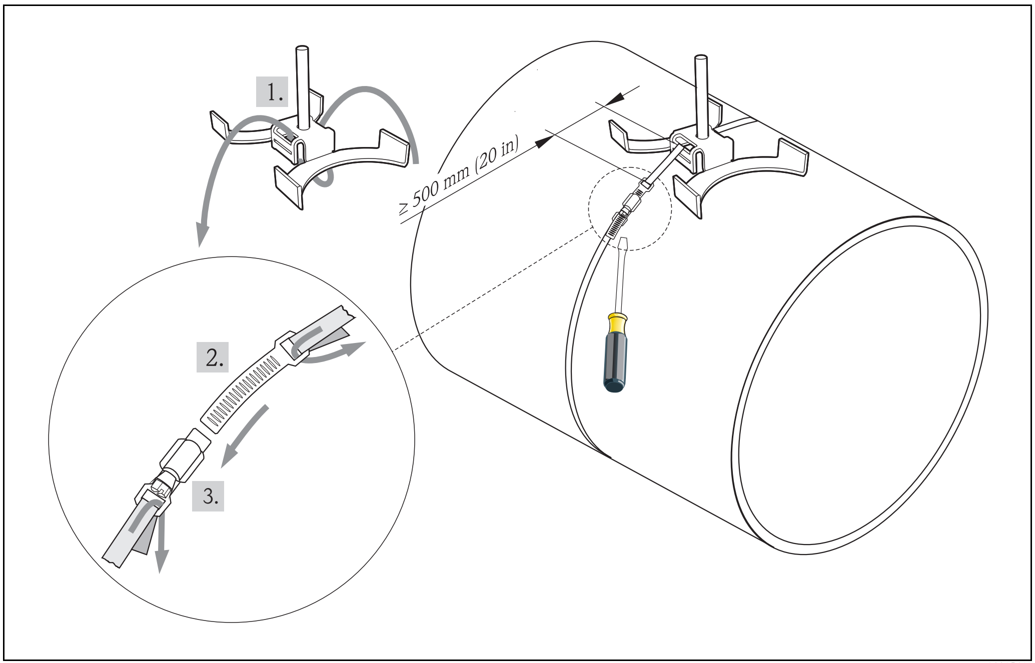


Fig. 12: Premounting strapping bands for pipe diameters DN > 600 (24 ")

*1 Mounting bolt with guide**
*2 Strapping band**
3 Strapping screw
** Distance between mounting bolt and strapping band lock min 500 mm (20 in)*

3.6 Installing Prosonic Flow W sensor

3.6.1 Installing Prosonic Flow W (DN 15 to 65 / ½ to 2½")

Mounting the sensor

Prerequisites

- The installation distance (sensor distance) is known → 🗎 14.
- The sensor holder is already mounted → 🗎 15.

Material

The following material is needed for mounting:
- Sensor incl. adapter cable
- Connecting cable for connecting to the transmitter
- Coupling fluid for an acoustic connection between the sensor and pipe

Procedure

1. Set the distance between the sensors as per the value determined for the sensor distance. Press the sensor down slightly to move it.

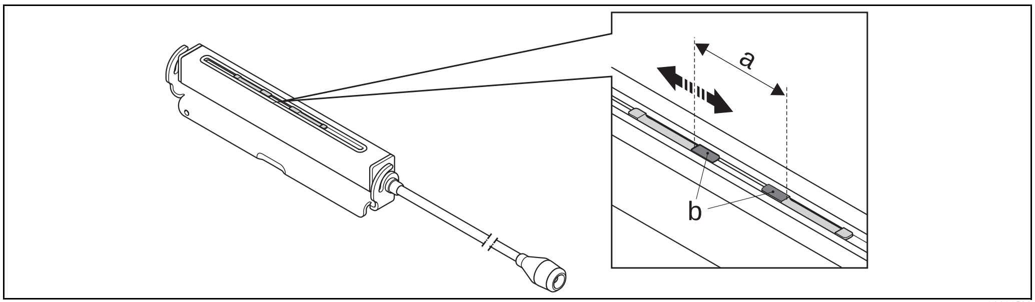


Fig. 13: Setting the distance between the sensors as per the value for the sensor distance

a Sensor distance
b Contact surfaces of the sensor

2. Coat the contact surfaces of the sensors with an even layer of coupling fluid (approx. 0.5 to 1 mm / 0.02 to 0.04") thick.
3. Fit the sensor housing on the sensor holder.

✎ Note!
- Avoid to use a thick layer of the coupling fluid (less is more).
- Clean and reapply new coupling fluid when sensor is removed from the pipe.

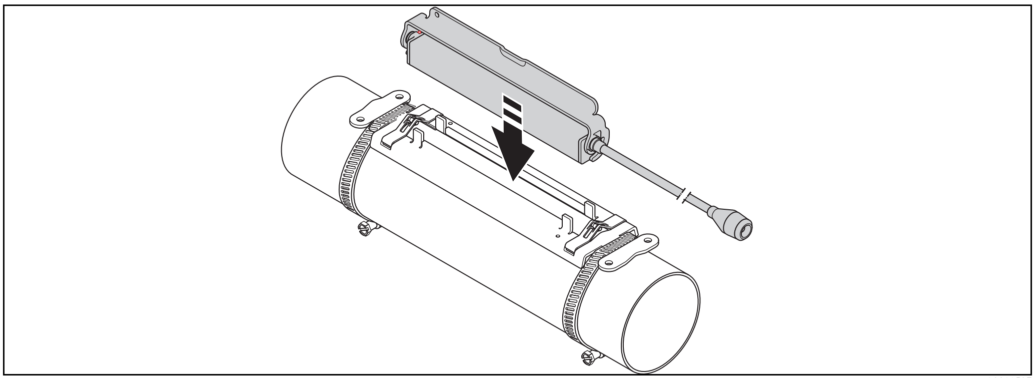


Fig. 14: Fitting the sensor housing

4. Fix the sensor housing with the bracket.

✎ Note!

– If necessary, the holder and sensor housing can be secured with a screw/nut or a lead-seal (not part of the scope of supply).
– The bracket can only be released using an auxiliary tool.

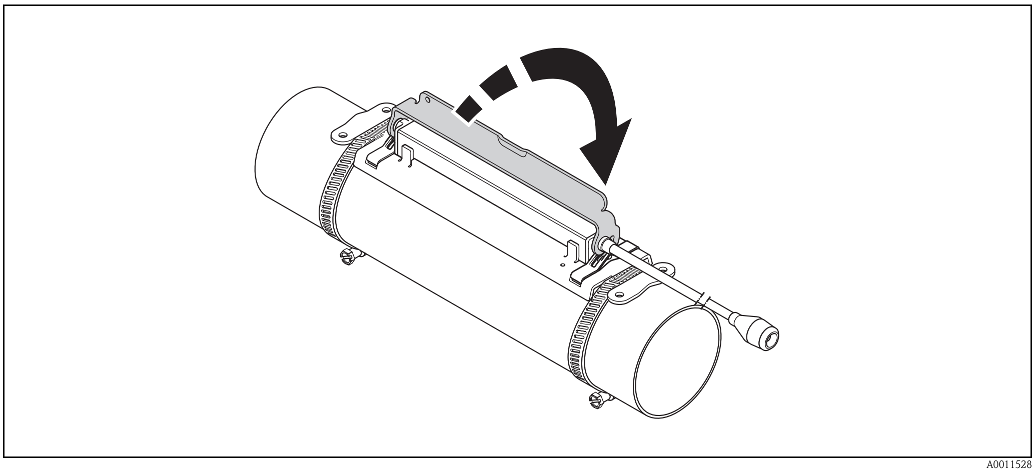


Fig. 15: Fixing the sensor housing

5. Connect the connecting cable to the adapter cable.

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🗎 27.

3.6.2 Installing Prosonic Flow W (DN 50 to 4000 / 2" to 160")

Installation for measurement via one traverse (DN 600 to 4000 /24" to 160")

Prerequisites

- The installation distances (sensor distance and wire length) are known → 🗎 14.
- The strapping bands are already mounted → 🗎 16.

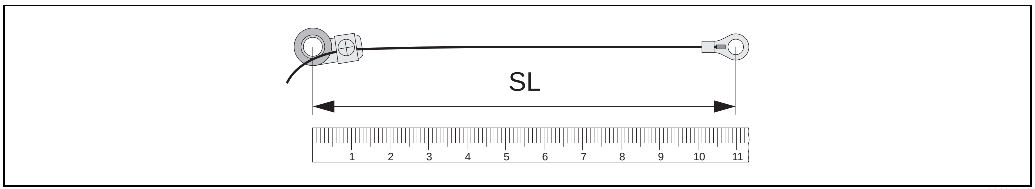
Material

The following material is needed for mounting:

- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 🗎 16)
- Two measuring wires, each with a cable lug and a fixer to position the strapping bands
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

Procedure

1. Prepare the two measuring wires:
   - Arrange the cable lugs and fixer such that the distance they are apart corresponds to the wire length (SL).
   - Screw the fixer onto the measuring wire.



A0001112

Fig. 16: Fixer (a) and cable lugs (b) at a distance that corresponds to the wire length (SL)

2. With the first measuring wire:
   - Fit the fixer over the mounting bolt of the strapping band that is already securely mounted.
   - Run the measuring wire **clockwise** around the pipe.
   - Fit the cable lug over the mounting bolt of the strapping band that can still be moved.
3. With the second measuring wire:
   - Fit the cable lug over the mounting bolt of the strapping band that is already securely mounted.
   - Run the measuring wire **counterclockwise** around the pipe.
   - Fit the fixer over the mounting bolt of the strapping band that can still be moved.
4. Take the still movable strapping band, incl. the mounting bolt, and move it until both measuring wires are evenly tensioned and tighten the strapping band so that it cannot slip.

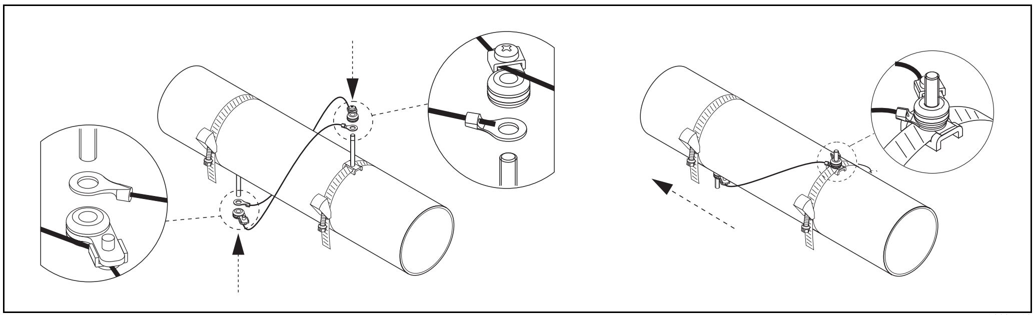


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Fig. 17: Positioning the strapping bands (steps 2 to 4)

5. Loosen the screws of the fixers on the measuring wires and remove the measuring wires from the mounting bolt.
6. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.

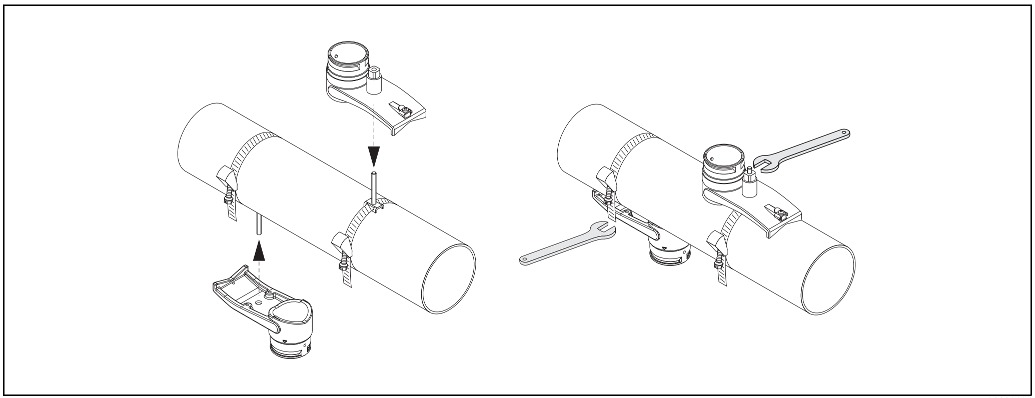


Fig. 18: Mounting the sensor holders

7. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.

✎ Note!

- Avoid to use a thick layer of the coupling fluid (less is more).
- Clean and reapply new coupling fluid when the sensor is removed from the pipe.
- On rough pipe surface e.g. GRP pipes ensure that the gaps crevices within the surface roughness are filled. Apply suffizienet copling fluid.

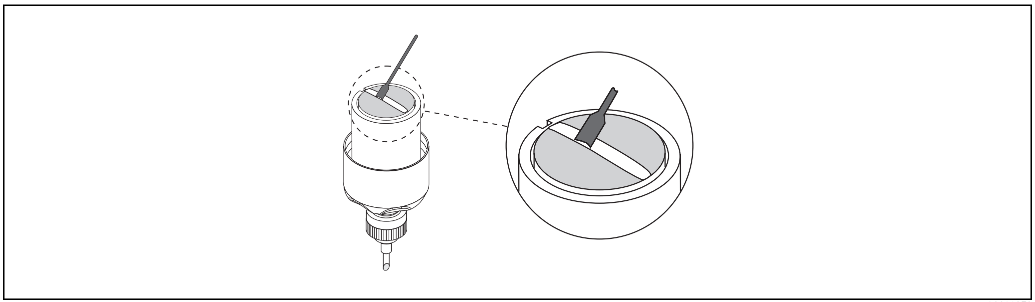


Fig. 19: Coating the contact surfaces of the sensor with coupling fluid

8. Insert the sensor into the sensor holder.
9. Fit the sensor cover on the sensor holder and turn until:
   – The sensor cover engages with a click
   – The arrows (▲ / ▼ "close") are pointing towards one another.
10. Screw the connecting cable into the individual sensor.

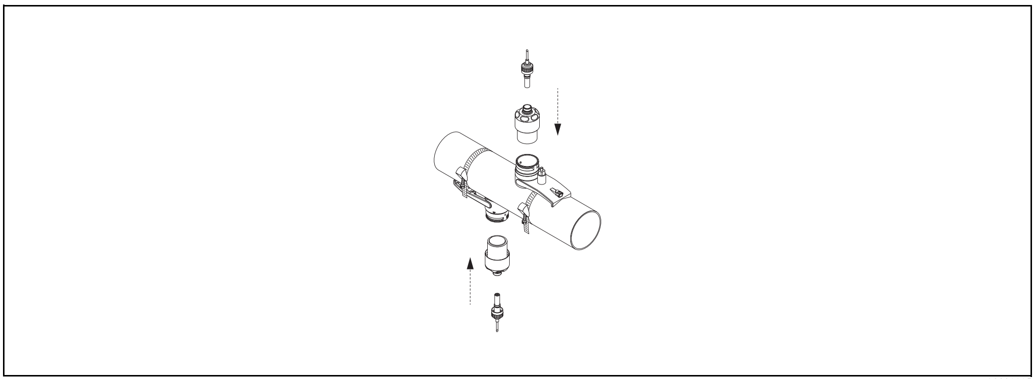


Fig. 20: Mounting the sensor and connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🗎 27.

Installation for measurement via two traverses (DN 50 to 600 /2" to 24")

Prerequisites

- The installation distance (position sensor) is known → 🗎 14.
- The strapping bands are already mounted → 🗎 16.

Material

The following material is needed for mounting:

- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 🗎 16)
- A mounting rail to position the strapping bands
- Two mounting rail retainers
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

Mounting rail and POSITION SENSOR installation distance

The mounting rail has two rows with bores. The bores in one of the rows are indicated by letters and the bores in the other row are indicated by numerical values. The value determined for the POSITION SENSOR installation distance is made up of a letter and a numerical value.
The bores that are identified by the specific letter and numerical value are used to position the strapping bands.

Procedure

1. Position the strapping bands with the aid of the mounting rail.
   - Slide the mounting rail with the bore identified by the letter from POSITION SENSOR over the mounting bolt of the strapping band that is permanently fixed in place.
   - Position the movable strapping band and slide the mounting rail with the bore identified by the numerical value from POSITION SENSOR over the mounting bolt.

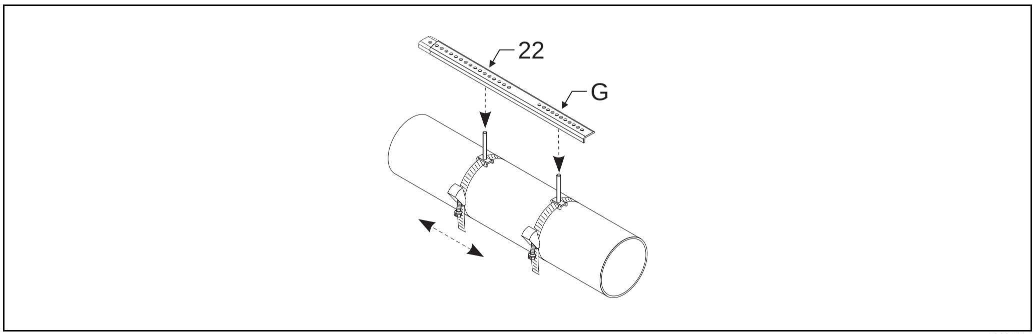


Fig. 21: Determining the distance in accordance with the mounting rail (e.g. POSITION SENSOR G22)

2. Tighten the strapping band so that it cannot slip.
3. Remove the mounting rail from the mounting bolt.
4. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.

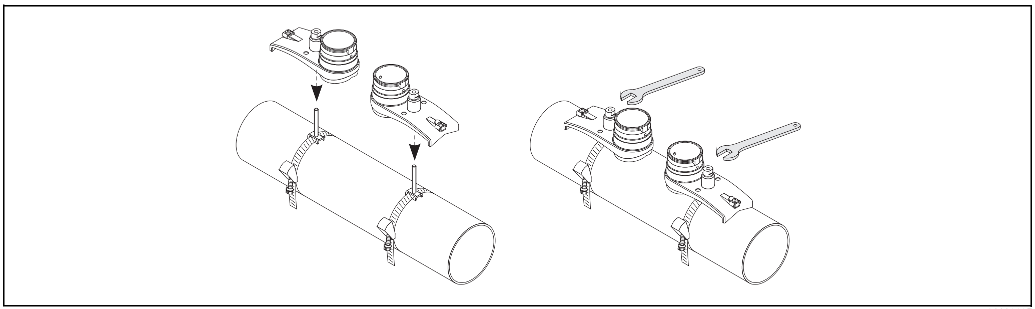


Fig. 22: Mounting the sensor

5. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.

Note!
- Avoid to use a thick layer of the coupling fluid (less is more).
- Clean and reapply new coupling fluid when the sensor is removed from the pipe.
- On rough pipe surface e.g. GRP pipes ensure that the gaps crevices within the surface roughness are filled. Apply suffizienet copling fluid.

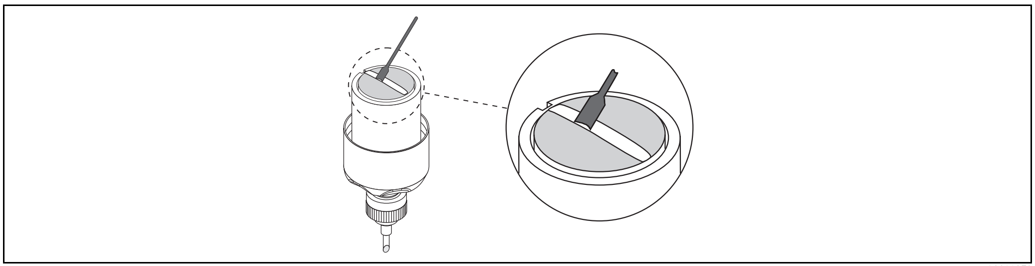


Fig. 23: Coating the contact surfaces of the sensor with coupling fluid

6. Insert the sensor into the sensor holder.
7. Fit the sensor cover on the sensor holder and turn until:
   – The sensor cover engages with a click
   – The arrows (▲ / ▼ "close") are pointing towards one another.
8. Screw the connecting cable into the individual sensor.

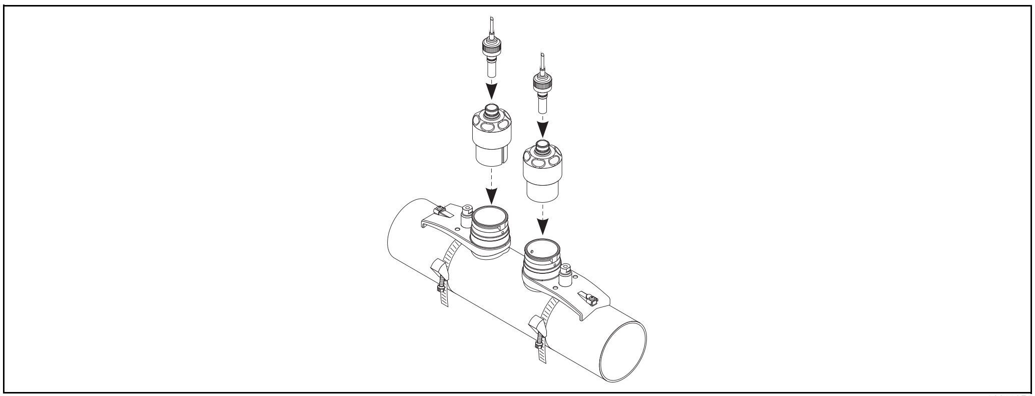


Fig. 24: Connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🗎 30.

Affixing the local display to the blind version

A local display can be temporarily affixed to devices which do not have a local display.

1. Switch off power supply.
2. Remove the cover of the electronics compartment.
3. Affix local display.
4. Switch on power supply.

Rotating the local display

1. Unscrew cover of the electronics compartment from the transmitter housing.
2. Remove the display module from the transmitter retainer rails.
3. Turn the display to the desired position (max. 4 × 45° in each direction).
4. Place the display back on the retaining rails.
5. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

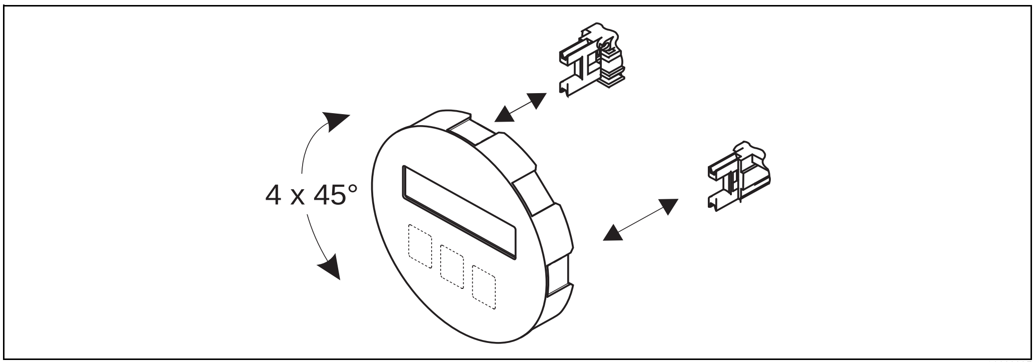


Fig. 25: Rotating the local display

3.7 Mounting the transmitter

The transmitter can be mounted in the following ways:

- Wall mounting
- Pipe mounting (with separate mounting kit, accessories → 🗎 52)

Caution!

- The ambient temperature range (–25 to +60 °C; –13 to +140 °F) may not be exceeded at the mounting location. Avoid direct sunlight.
- If a warm pipe is used for the installation, ensure that the housing temperature does not exceed the max. permitted value of +60 °C (+140 °F).

Mount the transmitter as illustrated in → 🖼 26.

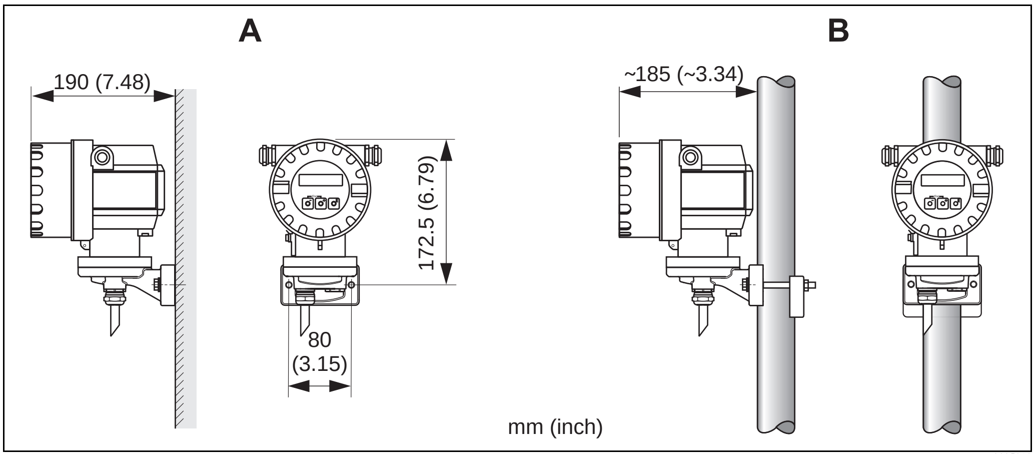


Fig. 26: Mounting the transmitter

A Direct wall mounting
B Pipe mounting

3.8 Post-installation check

Perform the following checks after installing the measuring device in the pipe:

Device condition and specifications	**Notes**
Is the device damaged (visual inspection)?	-
Does the device correspond to specifications at the measuring point, including process temperature, process pressure, ambient temperature, measuring range, etc.?	→ 🗎 72
Installation	**Notes**
Are the measuring point number and labeling correct (visual inspection)?	-
Process environment / process conditions	**Notes**
Are the inlet and outlet runs respected?	→ 🗎 12
Is the measuring device protected against moisture and direct sunlight?	-

3.9 Wiring

3.10 Connecting and grounding Prosonic Flow W (DN 50 to 4000 / 2 to 160") Two single coaxial cables

3.10.1 Connecting Prosonic Flow W

✎ Note!
The outer shield of the sensor connecting cable (triaxial cable) is grounded by a ground disk in the cable feedthrough (A). This grounding is absolutely essential to ensure correct measurement.

1. Unscrew the cover (c) of the cable gland (A). Remove the rubber seal (d).
2. Guide the sensor connecting cables (a, b) through the cover of the cable gland.
3. Guide the sensor connecting cables individually through the ground disk in the cable gland holder (g) and into the connection compartment.
4. Plug in the connectors of the sensor connecting cables.
   Left sensor upstream (a), right sensor downstream (b).
   The connector engages with a click when correctly plugged in.
5. Spread the rubber seal (d) along side slits (e.g. using a screwdriver) and fix the cables in place appropriately. Push up the rubber seal in the cable gland until the sensor cable sleeves are pressed against the ground disk.
6. Close the cover of the cable gland (c) so that it is tight.
7. In the connection compartment, fix the two sensor connecting cables in place in the holder (i) provided.

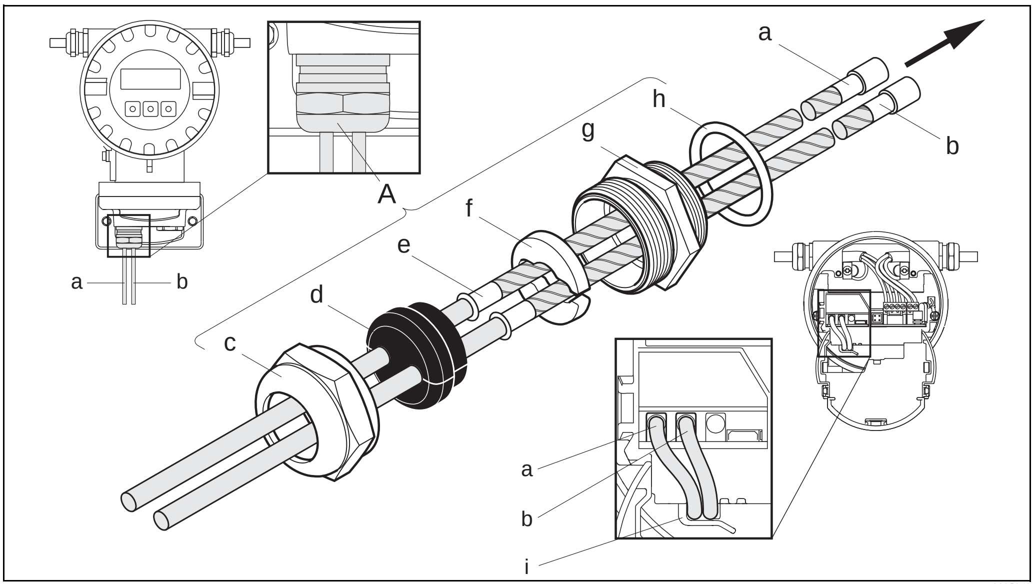


Fig. 27: Connecting the measuring system

a, b	*Sensor connecting cables*
c	*Cable gland cover*
d	*Rubber seal*
e	*Cable fixing sleeves*
f	*Ground disk*
g	*Cable gland holder*
h	*Seal*
i	*Cable holder*

3.10.2 Connecting and Grounding Prosonic Flow W DN 15 to 65 (½ to 2½") Multicore cable

The Prosonic Flow W DN 15 to 65 (½ to 2½") is grounded via the cable gland.

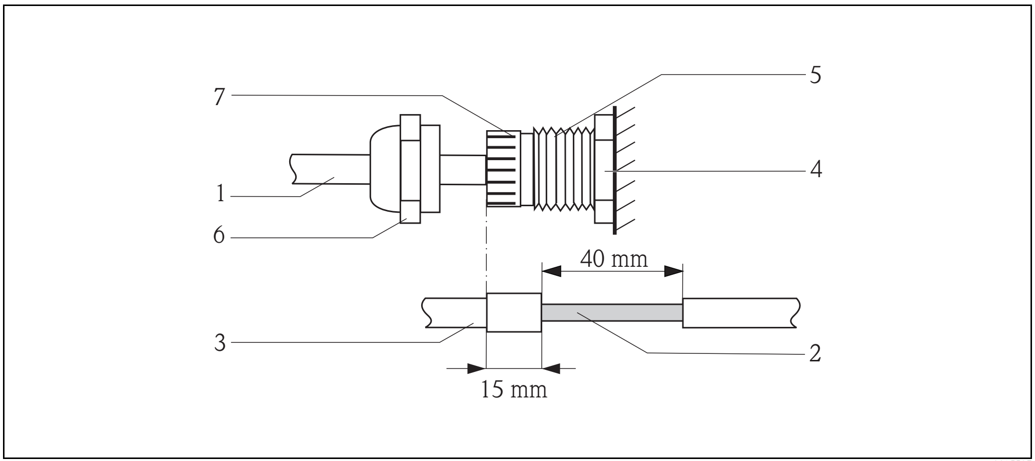


Fig. 28: Connecting and grounding the measuring system

1	*Cable sheath*
2	*Bared braided screen (pre-prepared)*
3	*Rubber grommet*
4	*Internal contact point for the grounding on this level (External inspection not possible)*
5	*Cable gland*
6	*Cable gland cover*
7	*Grounding mechanism*

Procedure

1. Screw the cable gland (E) into the transmitter housing.
2. Guide the sensor connecting cables through the cable gland cover (F).
3. Threat the sensor connecting cables into the transmitter housing.
   Align the outer end of the rubber grommet with the end of the cable gland/grounding mechanism. This ensures that the cable entry will be a) tight and b) the cable is correctly grounded to the transmitter housing at the internal contact point (D) once tightended.
   An external inspection is not possible, so it is important to follow this instruction.
4. Tighten the cable gland by turning the cable gland cover clockwise.

✎ Note!
The red marked cable is sensor "up"; the blue marked cable is sensor "down".

✎ Note!
The cable gland can be released from the cable by unscrewing and removing tha cable gland cover. Then retract the grounding mechanism (G) with pair of pliers. The retraction of the mechanism does not require strong force (strong force might destroy the screen). It might be required to lift the internal hooks of the grounding mechanism out of a locked position by pressing the grounding mechanism further forward by turning the cable gland clockwise. Remove the cable gland cover again. Then retry to retract with the pair of pliers.

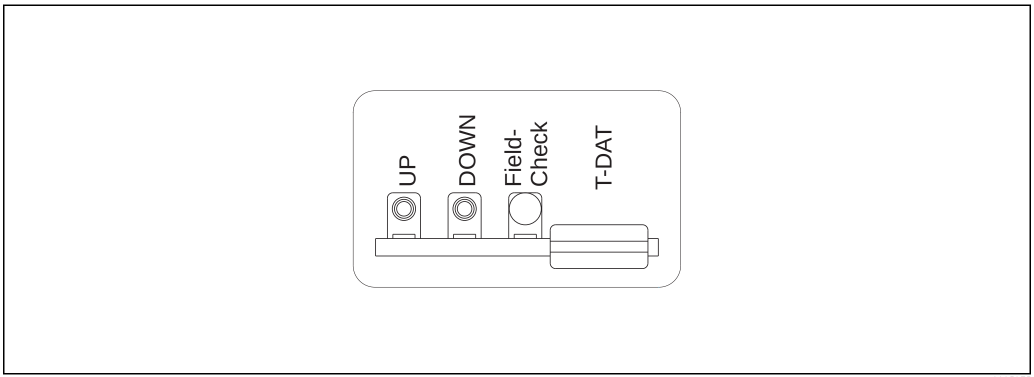


Fig. 29: Connecting nameplate for sensor connecting cables

3.10.3 Cable specifications

Sensor cable

- Use the ready-to-use cables supplied by Endress+Hauser with each sensor pair.
- The following cable lengths are available:
  - 5 m, 10 m, 15 m , 30 m, 60 m
  - 16 ft, 33 ft, 49 ft, 98 ft, 197 ft
- Cable material:
  PVC (DN 50 to 4000/ 2" to 160")
  TPE-V (DN 15 to 65 / ½" to 2½")
- Operating temperature: –20 to +70 °C (–4 to +158 °F)

Operation in zones of severe electrical interference:
The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 "Emission to class A requirements", and NAMUR Recommendation NE 21.

Bimetal Thermometer - Industrial Grade - All Stainless Steel Construction Type TI.20, 2” Dial Size - Back Connected

Applications

- A wide range of applications including machine building, vessels, micro-brewing, boilers and water systems/piping
- Heating and air-conditioning technology (HVAC)
- Temperature measurement in harsh and agressive environments

Product features

- Back connection with external reset
- Robust industrial design
- All stainless steel case construction
- NSF approval available

Thermometer TI.20

Specifications

Size
2” (50.8 mm) - Type TI.20

Accuracy
± 1.0% full scale value per ASME B40.3 Grade A

Min./Max. Ranges
From -100 °F (-70 °C) to +1000 °F (+540 °C)
From -50 °C to +550 °C (as single scale)
Reference table on page 2

Working Range

Steady:	full scale value
Short time:	110% of full scale value

Over/Under Range Protection
≤ +500 °F (+260 °C): Temporary up to 50% of full scale
> +500 °F (+260 °C): Continuous to 800 °F (+427 °C)
Intermittant up to 1000 °F (+538 °C)

Connection
Material: 304 stainless steel
Center back mount (CBM)
1/4” NPT

Stem
Material: 304 stainless steel
Diameter: ¼” (6.35 mm)
Length: 2½” to 24” (63.5 mm to 609.6 mm)

Measuring Element
Bi-metal helix

Case
Material: 304 stainless steel; hermetically sealed per ASME B40.3 standard

Dial
White aluminum, dished, with black markings

Pointer
Black aluminum

Standard Scales
Single: Fahrenheit or Celsius
Dual: Fahrenheit (outer) and Celsius (inner)

Window
Flat instrument glass

Weight
5 oz. (142 g), 2” (50 mm) dial;
Add 1 oz. (28 g) for every 2” (50 mm) of stem length

Dampening
Inert gel to minimize pointer oscillation

Order Options (min. order may apply)
Special scales and dial markings; Acrylic windows
Calibration certification traceable to NIST

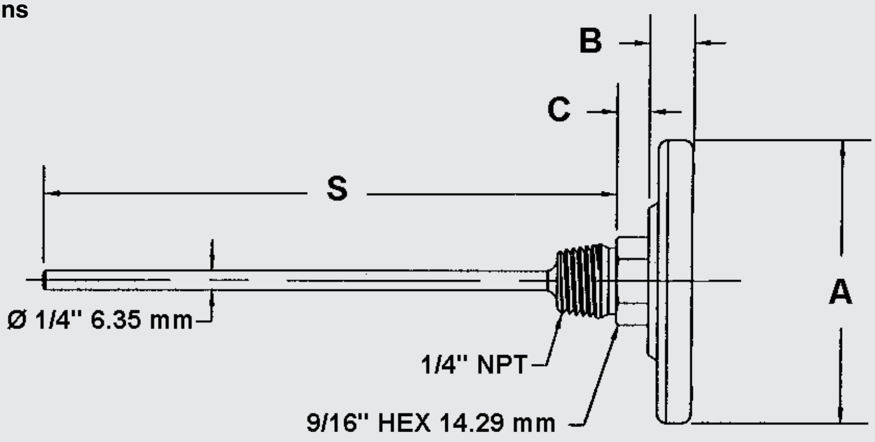
Warranty
Limited one year warranty as stated in WIKA’s Terms & Conditions of Sale

STANDARD RANGES		
Fahrenheit Single Scale	Dual Scale F & C F Outer, C Inner	Celsius Single Scale
-100/150 F	-100/150 F & -70/70 C	-50/50 C
-40/120 F	40/120 F & -40/50 C	-20/120 C
0/140 F	0/140 F & -20/60 C	0/50 C
0/200 F	0/200 F & -15/90 C	0/100 C
0/250 F	0/250 F & -20/120 C	0/150 C
20/240 F	20/240 F & -5/115 C	0/200 C
25/125 F	25/125 F & -5/50 C[1]	0/250 C
50/300 F	50/300 F & 10/150 C	0/300 C
50/400 F	50/400 F & 10/200 C	0/450 C[1]
50/550 F	50/500 F & 10/260 C	100/550 C[1]
150/750 F	150/750 F & 65/400 C	
200/1000 F[1]	200/1000 F & 100/540 C[1]	

[1] Not recommended for continous service over 800°F (425°C)

Dimensions

Standard versions



Stem Length
2½" (63.5 mm)
4" (101.6 mm)
6" (152.4 mm)
9" (228.6 mm)
12" (304.8 mm)
15" (381.0 mm)
18" (457.2 mm)
24" (609.6 mm)

WIKA TYPE	DIAL SIZE	A	B	C	S (STEM LENGTH)
20	2" (50.8 mm)	2-1/16" (52.4 mm)	7/16" (11.1 mm)	1/4" (6.4 mm)	As Specified

Note: Thermowells for temperature instruments are recommended for all process systems where pressure, velocity, or viscous, abrasive and corrosive materials are present individually or in combination. A properly selected thermowell protects the temperature instrument from possible damage resulting from these process variables. Furthermore, a thermowell permits removal of the temperature instrument for replacement, repair or testing without effecting the process media or the system.

Ordering information
State computer part number (if available) /type number/size/range/connection size and locations/options required. WIKA reserves the right to make changes without prior notice.

WIKA Instrument Corporation
1000 Wiegand Boulevard
Lawrenceville, GA 30043
1-888-WIKA-USA /770-513-8200 (in GA)
Fax 770-338-5118
info@wika.com www.wika.com

Process Operation & Maintenance Manual
for the Iqaluit Water Treatment Plant
Iqaluit, Nunavut

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Iqaluit

March 2022

1 INTRODUCTION

Year of Completion: 2004

Original Scope: Design and upgrade existing Water Treatment Plant to meet current and future demands.

This manual has been updated to include:

DATE	DESCRIPTION OF CHANGE
October, 2018	Inclusion of updates and upgrades made to the water treatment plant as per the 2017 Water and Wastewater Facilities Improvement Project (#SC711).
March, 2022	Inclusion of updates and upgrades made to the water treatment plant as per WTP Project No. 211-12487-00.

Iqaluit Water Treatment Plant

Project History

The City of Iqaluit:	City of Iqaluit Public Works & Engineering P.O. Box 460 Iqaluit, NU X0A 0H0 Simon Doiron, Director of Public Works Phone: (867) 222-2966 S.Doiron@iqaluit.ca Sumon Ghosh, Director of Engineering Phone: (867) 979-5636 S.Ghosh@iqaluit.ca
Project Engineer:	2004 Upgrades Earth Tech Canada Inc. (Currently AECOM) 4916 47th Street P.O. Box 1259 Yellowknife, NT X1A 2N9 Phone: 1 (867) 873-6316 2017 Upgrades Glenn Prosko, Project Manager Nunami-Stantec 10160 112 Street Edmonton AB T5K 2L6 P: (780) 969-3258 Glenn.Prosko@stantec.com 2021-2022 Upgrades Justin Rak-Banville, Project Manager WSP Canada Inc. 1600 Buffalo Place, Winnipeg, MB, R3T 6B8
General Contractor:	2004 Upgrades 90 North Construction & Development Ltd. (No longer in operation) Suite 106, 6131-6th Street S.E. Calgary, AB T2H 1L9 2017 Upgrades Maxime Gaudreau, Project Manager Kudlik Construction Ltd. P.O. Box 727, 1519 Federal Road Iqaluit, NU X0A 0H0 P: (418) 802-8224 mgaudreau@kudlik.biz

Mechanical Subcontractor:	2004 Upgrades Schendel Mechanical Contracting Ltd. 20310-107 Avenue Edmonton, AB T5T 3L7 Phone: (780) 447-3400 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, P: (855) 437-4001 carl@sifec.ca
Electrical Subcontractor:	2004 Upgrades KRT Electric 1505 Federal Rd, Iqaluit, NU P.O. Box 1259 Iqaluit, NU X0A 0H0 Phone: 1 (867) 979-2639 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, P: (855) 437-4001 carl@sifec.ca
Instrumentation Subcontractor:	2004 Upgrades Vector Electric & Controls 3524-78 Avenue Edmonton, AB X1A 2P4 Phone: (780) 469-7900 2017 Upgrades Carl Fauteux, Vice-President Sifec North Inc. P.O. Box 556, Rankin Inlet, NU, X0C 0C0, P: (855) 437-4001 carl@sifec.ca

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I-105	**P&ID – Backwash & Filter-To-Waste**
I-106	**P&ID – Caustic Soda and Hydrofluorosilicic Acid Supply**
I-107	**P&ID – Sodium Hypochlorite and Domestic Supply System**
I-108	**P&ID – Chlorine Supply**
I-301	**Filters Floor Device Locations**
I-302	**Pumps Floor Device Locations**
I-303	**Clearwell Floor and WTP Underground Device Locations**

3 BACKGROUND

3.1 ORIGINAL WATER TREATMENT PLANT

The City of Iqaluit uses Lake Geraldine as its raw water source. Lake Geraldine water quality is of good quality, apart from algal blooms in the summer months. Raw water is characterized as containing low concentrations of organic carbon, alkalinity, hardness, and pH which is slightly acidic.

The old treatment plant had a maximum design output of 1,296 m^3/day and a useful output of 1,050 m^3/day. The 2002 average day demand on the plant exceeded the useful output by approximately 20%. The capacity of the filters was the main limitation of the treatment process. The old treatment plant comprised the following major components:

- Lake Geraldine dam structure and valve chamber;
- Raw water intake pipeline and tempering system (upgraded in 1999);
- Treatment plant inlet flow control valve;
- Prechlorination and pH control (through lime contact) system;
- Settling tanks;
- Sand/gravel filtration system;
- Fluoridation system;
- Backwash system;
- Below-ground treated water tanks with a combined capacity of 575m^3; and
- Treated water storage reservoir 2,280m^3.

3.2 2003-2004 WTP UPGRADES PROJECT

In 2003-2004, the original WTP was retrofitted and upgrades to both increase capacity and operational control of the system. The upgrades included the following:

- Increased capacity by constructing four new dual-media rapid gravity filters;
- Installation of new ultraviolet (UV) disinfection systems;
- Retrofit of existing settling tanks and sand filters to flocculation tanks;
- Repurposing of the filtered water tank to a backwash waste tank;
- Repurposing of the surge tank to a filter-to-waste tank;
- Modifications to the below-ground treated water tanks via the construction of new walls to include a Mixing Chamber and Pumping Chamber as well as new interconnecting piping between these tanks;

- New chlorine gas dosing system;
- Updated chemical dosing systems; and
- Updated PLC-based control.

The design life of the new WTP was 20 years projected to 2022. In 2022 the average day demand was anticipated to be 4,520 m^3/day with a peak day demand of 9,040 m^3/day. The gross design capacity for the WTP was set at 9,500 m^3/day. The projected water demand was based on the estimated population in 2021of 11,300.

3.3 2017 UPGRADES AND IMPROVEMENT WORK

In 2017, maintenance and upgrade work were carried out at the WTP as part of the Water and Wastewater Facilities Improvement Project (#SC711), in which the following elements were maintained, replaced, or newly installed:

- A new replacement TwinCity exhaust fan in the Chlorine Room
- 5 new Hach TU5300sc Turbidity Meter
- 2 new Wallace & Tiernan Depolox 3 Plus Chlorine and pH analyzers
- A new replacement Wallace & Tiernan Chlorine Gas Detection System for ChlorineRoom
- All Bray Control Valve Actuators were inspected, maintained, and repaired. NewBray Valve Actuators were supplied as spares.
- A new flow switch was installed on the chlorinated water injection line in theChlorine Room. This includes PLC low flow alarm.
- A new plant inlet pressure transmitter was installed and incorporated in thePLC/HMI.
- A new replacement electromagnetic flow meter was installed for reservoir discharge flow.
- Air scour blower #1 was inspected, deemed unrepairable, and thus replaced.
- The 6 chemical metering pumps were replaced, including installation of new chemical delivery piping (hydrofluorosilicic acid, zinc orthophosphate, caustic soda).
- Service water pump #1 was replaced.
- The backflow preventers for the chemical injection systems were replaced.
- Piping for the chlorination system was replaced.

3.4 2021-2022 UPGRADES AND IMPROVEMENT WORK

In 2021 and 2022, maintenance and upgrade work were carried out at the WTP as part of WSP Project No. 211-12487-00, in which the following elements were maintained, replaced, or newly installed:

- The installation of S::CAN online water quality monitoring devices at the WTP intake and on the treated water pipe between the WTP and the Reservoir;
- Replacement of a permanent sump pump in the Void space beneath the WTP including audible and SCADA-integrated alarms;
- The installation of a WTP bypass pipe that directs raw water post-ultraviolet disinfection to the Reservoir including chlorine injection;
- Replacement of the filter media (anthracite and sand) with granular activated carbon (pending);
- The like-for-like replacement of isolation valve V2035 in the South Clearwell (pending);
- Removal of existing submersible service pumps P410 and P411 from the Pumping Chamber (pending) and the installation of two new inline Service Pumps in the utilidor tunnel below the Reservoir;
- Coating of the below-ground treated water tanks with a waterproofing product (pending);
- New sample ports before and after the Reservoir; and
- The installation of two new ultraviolet disinfection systems in place of the existing system (pending).

Additional formatting updates to the previous version have been made as follows:

- Moved *General Operating Procedures* to an earlier portion of the document to highlight the key aspects of each treatment component prior to getting into more detail;
- Added a detailed description of each of the major process components including purpose and general design parameters;
- *Domestic Supply Flow* subsections to the *Design Data* and *Schematics and Functional Data* sections which include mechanical components, pumps, and piping appurtenances for the Utilidor tunnel from the WTP to the Reservoir and below the Reservoir – a notable absence in previous version;

END OF CHAPTER 3

4 GENERAL OPERATING PROCEDURES

4.1 OVERVIEW

Raw water enters the WTP through a 250 mm from Geraldine Lake, which is located approximately 0.5 km north of the plant . The raw water flow is metered and controlled as it enters the plant. The raw water undergoes primary disinfection with UV light to inactivate chlorine resistant pathogens, Following primary disinfection, water flows through four dual-media (anthracite and sand) rapid gravity filters, which operate in parallel. From the filter effluent header water is directed to the chemical mixing chamber where chlorine (as Cl_2 in water, i.e., HOCl) is added for secondary disinfection, along with hydrofluorosilicic acid (fluoride) Chemically treated water is rapidly mixed in the Mixing Chamber prior to being diverted to any of the below-ground treated water tanks (i.e., the North Clearwell, South Clearwell, or Backwash Pumping Chamber). Normal operation moves treated water from the Mixing Chamber to the North Clearwell, followed by the South Clearwell and finally the Backwash Pumping Chamber. From the Pumping Chamber, water is directed to the treated water storage reservoir by gravity via a 300 mm PVC pipe. Caustic soda can be added to the treated water through a dosing line on the Reservoir influent line. . The movement of water from the WTP to the Reservoir is controlled using the PLC system and requires minimal operator intervention unless there is an alarm indicated. Monitoring, optimizing, and scheduled maintenance of the WTP operating systems help to ensure reliability and dependability with reduced system malfunctions and breakdowns.

4.2 TEMPERED WATER SYSTEM

Tempering of the Raw Water is required during the winter to prevent the raw water from freezing in route from the Dam to the Plant. The raw water temperature is tempered via a shell and tube heat exchanger on the hydronic heating system to maintain the raw water temperature above 5°C. A raw water recirculation pump cycles heated raw water from the WTP to Lake Geraldine, through the raw water intake line and back to the heat exchanger to prevent freezing.

4.3 RAW WATER TO FILTER FLOW

(Refer to Drawing I-102 and I-301 in Section 11)

Operation of the Treated Water System is initiated by the Reservoir water level indicator located in the off-site Reservoir (Level Indicating Transmitter-5001) or the level indicator located in the Backwash Pumping Chamber (Level Indicating Transmitter-2501). Both water level indicators will initiate the Treated Water System. On initiation of the Treated Water System, the flow control valve (FCV-1001) located at the WTP intake is opened. This allows raw water to flow through one of the UV reactors (X-120 or X-121), by gravity, which operate in a lead-lag configuration. The water can then be diverted through flocculation tanks or through the flocculation by-pass line. The flocculation tank mixing components have not yet been installed and these tanks is intended as an optional future treatment in the event of changing raw water quality conditions. However, historical raw water is of exceptional quality and flocculation has not been a necessary pre-treatment method. As such, under normal operation water bypasses the flocculation system where it is sent to the sand filters.

4.4 FILTERED/TREATED WATER FLOW

(Refer to Drawing **I**-103, **I**-104, **I**-301 and **I**-302 in Section 11)

The UV treated water flows through the filter media (sand & anthracite) and through the filter effluent channel of each filter. The motorized flow control valve on the 200 mm filtered water line is opened to allow the water to flow to the Mixing Chamber. Chlorine solution is injected into the filter effluent header for secondary chlorination and hydrofluorosilicic acid is added directly to the Mixing Chamber for fluoridation. The treated water can then be diverted to any of the below-ground treated water tanks – North Clearwell, South Clearwell, and Pumping Chamber. Normal operation moves water through the tanks in series in the order listed above. From the Pumping Chamber, water is sent to the downhill Reservoir by gravity via a 300 mm PVC pipe. Caustic soda can be flow-pace-injected along this pipe for pH adjustment. Chlorine and pH are also measured along this pipe.

4.5 CHEMICAL FLOWS

(Refer to Drawing **I**-106, **I**-107, and **I**-108 in Section 11)

There are four chemicals used in the water treatment process. Each chemical is stored in its own containment area and is equipped with a skid containing two chemical metering/injection pumps and the associated equipment and valving. Shelf spare pumps are maintained on the lower floor of the WTP. A description of each has been provided in the table below.

CHEMICAL	PURPOSE	LOCATION	CONTAINER
Chlorine Solution	Secondary Chlorination	Chlorine Gas Room, Main Floor	Chlorine Gas Cylinder
Sodium Hypochlorite	Secondary Chlorination (used as backup in case Chlorine Gas injection system is non-operational)	Main Floor	205 L Drum
Hydrofluorosilicic Acid	Fluoridation	Main Floor	205 L Drum
Caustic Soda	pH Adjustment	Lower Floor	205 L Drum

4.6 BACKWASH FLOW

(Refer to Drawing I-104, I-105, and I-302 in Section 11)

There are two backwash pumps (P205 and P206) located on the lower floor of the WTP. These pumps operated in duty-standby configuration. A backwash cycle is initiated by any one of the following scenarios:

- the filtered water turbidity > 0.3 NTU;
- the pressure indicating transmitter on the filtered water line senses the drop in pressure across the filter media;
- the operator manually enables the backwash sequence on the PLC; or
- the elapsed time has passed between backwash cycles (variable set in the LC).

On backwash start-up, the pump relief valve (PRV-2501) is set to the open position so that when the backwash pump starts, the backwash water flow initially goes back to the Pumping Chamber. The backwash waste valve and backwash supply valves will now be opened. After a delay of about 3 minutes the PRV-2501 pilot solenoid will be energized allowing this valve to close slowly, thereby closing the pump bypass allowing backwash water to be introduced into the filter. The backwash water flows from the filters, over the effluent weir, and into the Backwash Waste Tank. The backwash wastewater in the Backwash Waste Tank is discharged and to the City sanitary sewer system and metered. Discharge flow is limited by a 60 mm diameter orifice plate. The backwash pump will deliver water to the filter for approximately 10 minutes at which time the PRV-2501 pilot solenoid will be de-energized allowing PRV-2501 to return to bypass mode. Backwash supply and backwash waste valves are also closed. The backwash pump will be shut down following 2 minutes after PRV-2501 is fully open and once the valve status is confirmed for all backwash-related valves, the filter is then ready to enter a filter-to-waste cycle.

4.7 FILTER-TO-WASTE FLOW

(Refer to Drawing I-104, I-105, and I-302 in Section 11)

A filter-to-waste cycle allows the filter to ripen following the backwash sequence and pass filtered water, expected to contain excess turbidity, to the Filter-to-Waste Tank (otherwise known as the Surge Tank). The filter influent valve will open allowing UV treated water to begin flowing through the filter. The filter-to-waste valve is be modulated to maintain the filter water level. The filtered wastewater flows to the Filter-to-Waste tank, is discharged to the City sanitary sewer system, and metered. The filter-to-waste cycle will continue for a pre-set time (~ 10-15 minutes) or until the turbidity of the filtered water is < 0.3 NTU. At this time, the filtered water valve is opened, the filter-to-waste valve is closed, and the filter is returned to normal operation.

4.8 AIR SCOUR FLOW

(Refer to Drawing **I**-103 and **I**-302 in Section 11)

There are two air scour blowers (C200 and C201) located on the lower floor of the Water Treatment Plant that operate in duty-standby configuration. At the start of the backwash cycle the air scour valve opens, followed by the starting of one of the air scour blowers. Air will be delivered to the filter for approximately 5 minutes followed by the blower shutting down, then the air scour valve closing.

END OF CHAPTER 4

5 DESIGN DATA

5.1 CURRENT OPERATION

As of 2022, the major components of the Water Treatment Plant include:

- Inlet flow control valve;
- Primary disinfection by ultraviolet (UV) disinfection;
- Flocculation tanks;
- Dual-media (anthracite and sand) rapid gravity filtration;
- Backwash system;
- Secondary chlorination by chlorine gas injection;
- Backup secondary chlorination by sodium hypochlorite;
- Fluoridation system;
- Below-ground treated water tanks (Mixing Chamber, North Clearwell, South Clearwell, Pumping Chamber) with a combined capacity of 575 m^3;
- pH adjustment with caustic soda; and
- Two-treated water storage reservoir cells with a combined capacity of 4,560 m^3.

A description of each of these major components is given below.

5.2 INLET FLOW CONTROL VALVE

Raw water enters the plant through an existing 250 mm main and a flow control valve. The flow control valve is capable of accurately controlling flows from 1,000 m^3/day up to about 10,000 m^3/day.

5.3 UV DISINFECTION

As the raw water enters the Water Treatment Plant, it is disinfected with UV light to inactivate pathogens. UV light is the primary disinfectant with chlorination as a secondary disinfectant to provide a residual through the distribution system. The design parameters of the UV system are as follows:

Number of UV Reactors	1 Duty and 1 Standby
Maximum flow per reactor	9 ML/Day
UV Transmittance	90% (1 cm Length)
Maximum dose	40 mJ/cm^2

5.4 FLOCCULATION TANKS

Flocculation tanks are provided downstream of the UV. These tanks will only be required to operate as flocculation tanks in the event that future coagulation is required to meet the final water quality targets. At this time mixers will be required in the tanks to maintain the flocculation particles in suspension. Two trains each with three stages of flocculation are provided. The total volume of the flocculation stage is 300 m^3 resulting in a hydraulic retention time of 45 minutes at design capacity.

5.5 FILTRATION

The filtration process consists of dual media rapid gravity filters for the removal of particulate matter from the water. The design parameters of the filters are as follows:

Number of filters	4
Total Filter Area	47 m^2
Individual Filter Area	11.75 m^2
Max Filtration Rate	8.5 m^3/m^2/hr
Media Type	Anthracite & Sand
Expected Filter Run Time	120 hours
Air Scour Rate	25 m^3/m^2/hr
Backwash Rate	50 m^3/m^2/hr
Backwash Duration	12 mins
Expected Daily Wash Volume	232 m^3
Filter-to-Waste Flow	100 m^3/h
Expected Filter-to-Waste Volume	23.5 m^3

5.6 BACKWASH AND FILTER TO WASTE STORAGE

Backwashing produces large amounts of wastewater for a relatively short time, and because the capacity of the sanitary sewage system is limited, a 130 m^3 Backwash Waste Tank is utilized. This tank only has sufficient volume for one filter backwash cycle and therefore need to be drained at a controlled rate to the sewer prior to a second backwash cycle.

A Filter-to-Waste tank with a volume of 55 m^3 is provided to accept and discharge filter-to-waste flow to the City sanitary sewer. This tank also drains at a controlled rate to the sewer system.

A 60 mm diameter orifice plate has been included in the drain to sewer in order to restrict the flow to a maximum of 70 m^3/hour to prevent surcharging in the sewer. This orifice can be changed in the future should a different flow rate be required.

5.7 CHLORINE GAS SYSTEM

The chlorine gas injection system uses gas cylinders with an automatic switchover system. The chlorine is injected into the water system through a gas chlorinator and injector. The design parameters are as follows:

Maximum dose rate	90 kg/Day
Average dose rate	1.6 to 16 kg/Day

5.8 SODIUM HYPOCHLORITE

Sodium hypochlorite is supplied to the Mixing Chamber in the event that the chlorine gas injection system is non-operational. This is controlled manually by operations staff and is intended for short-term use.

Maximum Dose Rate	30 L/h
Minimum Dose Rate	0.030 L/h

5.9 HYDROFLUOROSILICIC ACID

Hydrofluorosilicic acid is metered into the clearwell inlet chamber to provide a dose of 1 mg/L to meet the fluoride design criteria.

Maximum Dose Rate	2.2 L/h
Minimum Dose Rate	0.004 L/h

5.10 BELOW-GROUND TREATED WATER TANKS

There are four below-ground treated water tanks at the Water Treatment Plant – the Mixing Chamber, South Clearwell, North Clearwell, and Pumping Chamber. The purpose of these tanks is to provide additional mixing and contact time for chlorine as well as for in-plant use (such as a backwash cycle). Normal operation is to direct water through the tanks in the order listed above. The combined capacity of all below-ground treated water tanks is approximately 575 m^3.

5.11 CAUSTIC SODA

Caustic Soda can be dosed into the Water Treatment Plant treated water effluent pipe for pH adjustment prior to discharge to the Reservoir. This is an optional system meant to provide operators with greater control of finished water quality.

Maximum dose rate	17 L/h
Minimum dose rate	0.017 L/h

5.12 TREATED WATER RESERVOIR

Treated water storage is important for providing sufficient disinfection and to balance the needs of the community with respect to fire storage, equalization storage, and emergency storage.

A two-cell treated water Reservoir is installed immediately south of the Water Treatment Plant at the bottom of the hill. Treated water flows by gravity from the WTP effluent pipe (located in the Pumping Chamber) and fills each of the Reservoir cells from the top. An interconnecting pipe between the cells is located below the Reservoir that is normally used to hydraulically connect the two cells and discharge treated water to the distribution system. The Reservoir provides approximately 4,560 m^3 of treated water storage. Combined with the capacity of the below-ground treated water tanks, the total onsite treated water storage capacity is approximately 5,135 m^3.

As of 2022, the existing storage meets all storage requirements for disinfection, fire flow, equalization, emergency, and in-plant needs.

END OF CHAPTER 5

6 SCHEMATICS AND FUNCTIONAL DATA

6.1 GENERAL

The following tables describe where the components to the various systems are located and the function that each performs. For each table there are drawings that can be referenced to better understand the flow of that part of the WTP.

6.2 RAW WATER FLOW

(Refer to Drawing I-102 and I-301 in Section 11)

The following table identifies the components related to the flow of water from the plant intake to the filters.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Intake Valve (V1000)	RW Intake Pipe, Main Floor	Shuts off water from Geraldine Lake	Normally Open
2	Online Monitoring Device (AE1003)	RW Intake Piping, Main Floor	Provides a reading to the PLC on the petroleum hydrocarbon concentration of the Raw Water	Sends info. To PLC
3	Isolation Valve (V1036)	On 300 Dia. RW Piping, Main Floor	Used to isolate solenoid valve that controls flow to the turbidity sensor	Normally Open
4	Solenoid Valve (SV1001)	On 300 Dia. RW Piping, Main Floor	Controls the flow to the turbidity sensor	PLC controlled
5	Turbidity Sensor (AE1001)	On the RW Intake Piping just inside the Plant, Main Floor	Provides a reading to the PLC on the clarity of the water.	Sends info. to PLC
6	Drain Valve (V1034)	On 300 Dia. RW Piping, Main Floor	Used to Drain the Main Raw Water line from Geraldine Lake	Normally Closed
7	Isolation Valve (V1035)	Tempered Water Piping, Main Floor	Used to isolate the Tempered water system from the raw water	Normally Open
8	Isolation Valve (V1037)	On 300 Dia. RW Piping, Main Floor	Used to isolate solenoid valve that controls flow to the pH sensor	Normally Open
9	Solenoid Valve (SV1002)	On 300 Dia. RW Piping, Main Floor	Controls the flow to the pH sensor	PLC controlled
10	pH Sensor (AE1002)	On the RW Intake Piping just inside the Plant, Main Floor	Provides a reading to the PLC on the acidity of the water.	Sends info. To PLC
11	Isolation Valve (V1029)	RW Intake Piping, Main Floor	Used to Isolate the Flow Meter and the Flow Control Valve.	Normally Open
12	Flow Meter (FE1001)	RW Intake Piping, Main Floor	Indicates the flow of Raw Water into the Plant	Sends info to PLC
13	Flow Control Valve (FCV1001)	RW Intake Piping, Main Floor	Controls the amount of flow into the Plant.	PLC controlled

14	Isolation Valve (V1003)	RW Intake Piping, Main Floor	Used to Isolate the Flow Meter and the Flow Control Valve.	Normally Open
15	Bypass Valve (V1004)	Bypass RW Intake Piping, Main Floor	Allows the Raw Water to be bypassed around the Flow Control Valve and Flow Meter	Normally Closed
16	Drain Valve (V1005)	RW Intake Piping, Main Floor	Allows the water to be drained from this section of piping.	Normally Closed
17	Isolation Valve (V1006)	On 350 Dia. RW Piping, Main Floor	Used to isolate the air release valve	Normally Open
18	Air Release Valve (ARV1001)	RW Intake Piping, Main Floor	Allows air to be released from the intake line.	Normally Open
19	Isolation Valve (V1007)	RW Intake Piping, Main Floor	Allows for isolation of the UV unit (X120).	Normally Open
20	Isolation Valve (V1038)	On 350 Dia. RW Piping, Main Floor	Used to isolate the air release valve	Normally Open
21	Air Release Valve (ARV1002)	RW Intake Piping, Main Floor	Allows air to be released from the intake line	Normally Open
22	Isolation Valve (V1039)	Off the UV unit (X120), Main Floor	Used to isolate UV (X120) cooling solenoid	Normally Open
23	Solenoid Valve (SV201)	Off the UV unit (X120), Main Floor	Controls the flow of cooling water on the UV unit start-up.	UV panel Controlled
24	Isolation Valve (V1008)	RW Intake Piping, Main Floor	Allows for isolation of the UV unit (X121).	Normally Open
25	Isolation Valve (V1040)	Off the UV unit (X121), Main Floor	Used to isolate UV (X121) cooling solenoid	Normally Open
26	Solenoid Valve (SV211)	RW Intake Piping, Main Floor	Controls the flow of cooling water on the UV unit start-up.	UV panel Controlled
27	UV unit (X120)	RW Intake Piping, Main Floor	Partial disinfection of the Raw water	UV panel controlled
28	UV unit (X121)	RW Intake Piping, Main Floor	Partial disinfection of the Raw water	UV panel controlled
29	Drain Valve (V1041)	FLW Piping after UV units, Main Floor	Drains water from the UV unit (X120)	Normally Closed
30	Drain Valve (V1042)	FLW Piping after UV units, Main Floor	Drains water from the UV unit (X121)	Normally Closed
31	Isolation Valve (V1043)	On 350 Dia. RW Piping, Main Floor	Used to isolate the air release valve	Normally Open
32	Air Release Valve (ARV1003)	FLW Piping after UV units, Main Floor	Releases air from the piping just after the UV unit (X120)	Normally Open
33	Motorized Valve (V1009)	FLW Piping after UV units, Main Floor	After UV unit (X120) warms up the valve opens to let the plant make water, this valve also operates as an isolation valve	Normally Closed

34	Motorized Valve (V1012)	FLW Piping after UV units, Main Floor	After UV unit (X121) warms up the valve opens to let the plant make water, this valve also operates as an isolation valve	Normally Closed
35	Drain Valve (V1013)	FLW Piping, Main Floor		Normally Closed
36	Isolation Valve (V1016)	FLW Piping, Main Floor	Isolation valve for mixing tank #1	Normally Open
37	Isolation Valve (V1017)	In Mixing Tank #1	Used to isolate Mixing Tank #1 from Mixing Tank #2	Normally Open
38	Isolation Valve (V1018)	FLW Piping, Main Floor	Isolation valve for mixing tank #2	Normally Open
39	Isolation Valve (V1019)	In Mixing Tank #2	Used to isolate Mixing Tank #2 from Mixing Tank #3	Normally Open
40	Isolation Valve (V1020)	FLW Piping, Main Floor	Isolation valve for mixing tank #3	Normally Open
41	Isolation Valve (V1021)	FLW Piping, Main Floor	Isolation valve for Flocculation Train #1	Normally Open
42	Isolation Valve (V1022)	FLW Piping, Main Floor	Isolation valve for mixing tank #4	Normally Open
43	Isolation Valve (V1023)	In Mixing Tank #4	Used to isolate Mixing Tank #4from Mixing Tank #5	Normally Open
44	Isolation Valve (V1024)	FLW Piping, Main Floor	Isolation valve for mixing tank #5	Normally Open
45	Isolation Valve (V1025)	In Mixing Tank #5	Used to isolate Mixing Tank #5from Mixing Tank #6	Normally Open
46	Isolation Valve (V1026)	FLW Piping, Main Floor	Isolation valve for mixing tank #6	Normally Open
47	Isolation Valve (V1027)	FLW Piping, Main Floor	Isolation valve for Flocculation Train #2	Normally Open
48	Isolation Valve (V1028)	FLW Piping, Main Floor	By-pass Isolation valve, used to by-pass the Flocculation Train's #1 & #2	Normally Open
49	Motorized Valve (FCV2101)	Filter Inlet Piping on Filter #1, Filters Room	Controls the flow of water into Filter #1	PLC Controlled
50	Motorized Valve (FCV2111)	Filter Inlet Piping on Filter #2, Filters Room	Controls the flow of water into Filter #2	PLC Controlled
51	Motorized Valve (FCV2121)	Filter Inlet Piping on Filter #3, Filters Room	Controls the flow of water into Filter #3	PLC Controlled
52	Motorized Valve (FCV2131)	Filter Inlet Piping on Filter #4, Filters Room	Controls the flow of water into Filter #4	PLC Controlled
53	Isolation Valve (V1029)	RW Intake Piping, Main Floor	Allows for Raw Water to move through the Emergency WTP Bypass	Normally Closed

54	Strainer (S1029)	RW Intake Piping, Main Floor	Strainer for use during operation of Emergency WTP Bypass to reduce suspended material	

6.3 FILTERED/TREATED WATER FLOW

(Refer to Drawing I-103, I-104, I-301 and I-302 in Section 11)

The following table identifies the components related to the flow of water from the plant filters to the treated water storage reservoir.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Filter #1	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
2	Level Indicating Transmitter (LIT2101)	Mounted on Filter #1 Tank wall, Filters Room	Indicates the water level in the filter	Signals the PLC
3	Isolation Valve (V2003)	On 300mm FW piping, Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
4	Isolation Valve (V2004)	Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
5	Pressure Indicating Transmitter (PIT2101)	Pumps Floor	Provides a reading to the PLC on the water pressure after the filters	Sends info. to PLC
6	Solenoid Valve (SV2102)	On 300mm FW piping, Pumps Floor	Controls the flow to the turbidity sensor	PLC Controlled
7	Turbidity Sensor (AE2102)	On 300mm FW piping, Pumps Floor	Provides a reading to the PLC on the clarity of the water.	Sends info. to PLC
8	Drain Valve (V2002)	On 300mm FW piping, Pumps Floor	Used to drain the Filtered Water / Backwash Supply pipe	Normally Closed
9	Level Control Valve (LCV2104)	On 300mm FW piping, Pumps Floor	Controls the flow of water to the Clearwell	PLC Controlled
10	Filter #2	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
11	Level Indicating Transmitter (LIT2111)	Mounted on Filter #2 Tank wall, Filters Room	Indicates the water level in the filter	Signals the PLC
12	Isolation Valve (V2055)	On 300mm FW piping, Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
13	Isolation Valve (V2056)	Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
14	Pressure Indicating Transmitter (PIT2111)	Pumps Floor	Provides a reading to the PLC on the water pressure after the filters	Sends info. to PLC
15	Solenoid Valve (SV2112)	On 300mm FW piping, Pumps Floor	Controls the flow to the turbidity sensor	PLC Controlled

16	Turbidity Sensor (AE2111)	On 300mm FW piping, Pumps Floor	Provides a reading to the PLC on the clarity of the water.	Sends info. to PLC
17	Drain Valve (V2054)	On 300mm FW piping, Pumps Floor	Used to drain the Filtered Water / Backwash Supply pipe	Normally Closed
18	Level Control Valve (LCV2114)	On 300mm FW piping, Pumps Floor	Controls the flow of water to the Clearwell	PLC Controlled
19	Filter #3	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
20	Level Indicating Transmitter (LIT2121)	Mounted on Filter #3 Tank wall, Filters Room	Indicates the water level in the filter	Signals the PLC
21	Isolation Valve (V2066)	On 300mm FW piping, Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
22	Isolation Valve (V2067)	Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
23	Pressure Indicating Transmitter (PIT2121)	Pumps Floor	Provides a reading to the PLC on the water pressure after the filters	Sends info. to PLC
24	Solenoid Valve (SV2122)	On 300mm FW piping, Pumps Floor	Controls the flow to the turbidity sensor	PLC Controlled
25	Turbidity Sensor (AE2121)	On 300mm FW piping, Pumps Floor	Provides a reading to the PLC on the clarity of the water.	Sends info. to PLC
26	Drain Valve (V2065)	On 300mm FW piping, Pumps Floor	Used to drain the Filtered Water / Backwash Supply pipe	Normally Closed
27	Level Control Valve (LCV2124)	On 300mm FW piping, Pumps Floor	Controls the flow of water to the Clearwell	PLC Controlled
28	Filter #4	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
29	Level Indicating Transmitter (LIT2131)	Mounted on Filter #4 Tank wall, Filters Room	Indicates the water level in the filter	Signals the PLC
30	Isolation Valve (V2077)	On 300mm FW piping, Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
31	Isolation Valve (V2078)	Pumps Floor	Used to isolate the Pressure Indicating Transmitter	Normally Open
32	Pressure Indicating Transmitter (PIT2131)	Pumps Floor	Provides a reading to the PLC on the water pressure after the filters	Sends info. to PLC
33	Solenoid Valve (SV2132)	On 300mm FW piping, Pumps Floor	Controls the flow to the turbidity sensor	PLC Controlled
34	Turbidity Sensor (AE2131)	On 300mm FW piping, Pumps Floor	Provides a reading to the PLC on the clarity of the water.	Sends info. to PLC
35	Drain Valve (V2076)	On 300mm FW piping, Pumps Floor	Used to drain the Filtered Water / Backwash Supply pipe	Normally Closed
36	Level Control Valve (LCV2134)	On 300mm FW piping, Pumps Floor	Controls the flow of water to the Clearwell	PLC Controlled

37	Chlorine Injection point	On 200mm FW piping, Pumps Floor	Point of chlorine injection for disinfection	
38	Caustic Soda Injection point	On 200mm FW piping, Pumps Floor	Point of caustic soda injection for pH adjustment	
39	Hydrofluorosilicic Acid Injection point	On 200mm FW piping, Pumps Floor	Point of fluoride injection	
40	Contact Chamber	Clearwell Level	Where the chemicals come in contact and are mixed with the Filtered Water	
41	Isolation Valve (V2038)	North Clearwell	Used to isolate the North Clearwell	Normally Open
42	North Clearwell	Clearwell Level	Forms part of the overall treated water reservoir	
43	Isolation Valve (V2039)	South Clearwell 300mm piping	Used to isolate the North Clearwell from the South Clearwell and the Backwash Chamber	Normally Open
44	South Clearwell	Clearwell Level	Forms part of the overall treated water reservoir	
45	Isolation Valve (V2037)	Contact Chamber	Used to isolate the South Clearwell from the Contact Chamber and the Backwash Chamber	Normally Closed
46	Backwash Chamber	Clearwell Level	The chamber containing the Backwash Pumps and Plant Service Pumps	
47	Isolation Valve (V2035)	South Clearwell 300mm piping	Used to isolate the North Clearwell from the South Clearwell	Normally Open
48	Isolation Valve (V2034)	Pumping Chamber	Used to isolate the North & South Clearwells from the from the Backwash Chamber	Normally Closed
49	Isolation Valve (V2033)	Pumping Chamber	Used to isolate the South Clearwell from the Backwash Chamber	Normally Open
50	Level Indicating Transmitter (LIT2501)	Mounted on Filter Tank wall	Indicates the water level in the backwash tank (reservoir & clearwells)	Signals the PLC
51	Isolation Valve (V2036)	Pumping Chamber	Used to isolate the below-ground treated water tanks from the Emergency WTP Bypass	Normally Closed
52	Flow Control Valve (FCV2501)	300mm PVC piping in the Utilidor	Controls the amount of flow to the main treated water reservoir	PLC Controlled
53	Caustic Soda injection point	300mm PVC piping in the Utilidor	Point of Caustic Soda injection for pH adjustment	
54	Isolation Valve (V2040)	Vestibule Lower Stairwell	Used to isolate pre-reservoir sample water for analyzers	Normally Closed
55	Isolation Valve (V2041)	Vestibule Lower Stairwell	Used to isolate pre-reservoir sample water for analyzers	Normally Closed
56	Isolation Valve (V2042)	Vestibule Lower Stairwell	Future use connection for additional instrumentation	Normally Closed

57	Isolation Valve (V2043)	Vestibule Lower Stairwell	Used to isolate post-reservoir sample water for analyzers	Normally Open
58	Isolation Valve (V2044)	Vestibule Lower Stairwell	Used to isolate post-reservoir sample water for analyzers	Normally Open
59	Treated Sample Supply Pump (P310)	Vestibule Lower Stairwell	Used to draw water from the sample ports in the Utilidor	Always On
60	Isolation Valve (V2045)	Vestibule Lower Stairwell	Used to isolate Pressure Indicator PI2045	Normally Open
61	Pressure Indicator (PI2045)	Vestibule Lower Stairwell	Indicates the output pressure of P310	
62	Isolation Valve (V2046)	Vestibule Lower Stairwell	Used to isolate the downstream analyzers	Normally Open
63	Isolation Valve (V2047)	Vestibule Lower Stairwell	Used to control the flow into the downstream analyzers	Partially Open
64	Isolation Valve (V2048)	Vestibule Lower Stairwell	Future use connection for additional instrumentation	Normally Closed
65	Online Monitoring Device (AE2501 / AE2502 / AE2503)	Vestibule Lower Stairwell	Provides readings to the PLC on the pH (AE2501), chlorine (AE2502) and petroleum hydrocarbons (AE2503)	Sends info. To PLC

6.4 HYDROFLUOROSILICIC ACID CHEMICAL

(Refer to Drawing I-106 and I-301 in Section 11)

The following table identifies the components related to the flow of hydrofluorosilicic acid. The referenced drawing shows the components but not their locations.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Hydrofluorosilicic Acid Drum	Filters Floor	Stores & provides Hydrofluorosilicic Acid for Chemical Addition into filtered water	
2	Pumps Package	Filters Floor	Refer to supplier O&M for more detail	
3	Check Valve (V3052)	Chemical Addition supply piping to Contact Chamber	Prevents backflow of Filtered Water into Chemical Addition system	
4	Isolation Valve (V3053)	Chemical Addition supply piping to Contact Chamber	Used to isolate the Hydrofluorosilicic Acid system from other systems	Normally Open

6.5 CHLORINE SOLUTION CHEMICAL

(Refer to Drawing **I**-108 and **I**-301 in Section 11)

The following table identifies the components related to the flow of chlorine from the chlorine gas system.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Chlorine Gas Cylinders	Filters Floor Chlorine room	Stores & provides Chlorine for Chemical Addition into filtered water	
2	Chlorinator & Injector Package	Main Floor Chlorine room	Refer to supplier O&M for more detail	
3	Check Valve (V3050)	Chemical Addition supply piping to Contact Chamber	Prevents backflow of Filtered Water into Chemical Addition system	
4	Isolation Valve (V3051)	Chemical Addition supply piping to Contact Chamber	Used to isolate the Chlorine system from other systems	Normally Open
5	Isolation Valve (V3052)	Pumps Floor	Allows for manual switchover of chlorine solution dosing to Emergency WTP Bypass	Normally Open
6	Isolation Valve (V3053)	Pumps Floor	Allows for manual switchover of chlorine solution dosing to Emergency WTP Bypass	Normally Closed
7	Isolation Valve (V3054)	Pumps Floor	Allows for manual switchover of chlorine solution dosing to Emergency WTP Bypass	Normally Closed

6.6 SODIUM HYPOCHLORITE CHEMICAL

(Refer to Drawing **I**-107 and **I**-301 in Section 11)

The following table identifies the components related to the flow of sodium hypochlorite.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Zinc Orthophosphate Drums	Filters Floor	Stores & provides Chlorine for Chemical Addition into filtered water	
2	Pumps Package	Filters Floor	Refer to supplier O&M for more detail	
3	Check Valve (V2031)	Chemical Addition supply piping to TW piping in the Utilidor	Prevents backflow of Filtered Water into Chemical Addition system	
4	Isolation Valve (V2032)	Chemical Addition supply piping to TW piping in the Utilidor	Used to isolate the Zinc Orthophosphate system from other systems	Normally Open
5	Isolation Valve (V2033)	Pumps Floor	Allows for manual switchover of sodium hypochlorite dosing to Emergency WTP Bypass	Normally Open

6	Isolation Valve (V2034)	Pumps Floor	Allows for manual switchover of chlorine solution dosing to Emergency WTP Bypass	Normally Closed

6.7 CAUSTIC SODA CHEMICAL

(Refer to Drawing I-106 and I-302 in Section 11)

The following table identifies the components related to the flow of caustic soda.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Caustic Soda Drum	Pumps Floor	Stores & provides Caustic Soda for Chemical Addition into filtered water	
2	Pumps Package	Pumps Floor	Refer to supplier O&M for more detail	
3	Check Valve (V1015)	Chemical Addition supply piping to Contact Chamber	Prevents backflow of Filtered Water into Chemical Addition system	
4	Isolation Valve (V1031)	Chemical Addition supply piping to Contact Chamber	Used to isolate the Caustic Soda system from other systems	Normally Open

6.8 BACKWASH FLOW

(Refer to Drawing I-104, I-105, and I-302 in Section 11)

The following table identifies the components related to the flow of water from the backwash pumps to the City sanitary sewer system.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Backwash Pump (P206)	Pumps Floor/Pumping Chamber	Provides Backwash supply from Treated Water	PLC Controlled
2	Isolation Valve (V2028)	300mm Backwash piping, Pumps Floor	Provides isolation for the Pressure Indicator	Normally Open
3	Isolation Valve (V2028)	300mm Backwash piping, Pumps Floor	Used to remove any debris that might block the Pressure Indicator	Normally Closed
4	Pressure Indicator (PI2061)	300mm Backwash piping, Pumps Floor	Indicates the output pressure of Pump P206	
5	Check Valve (V2023)	300mm Backwash piping, Pumps Floor	Prevents the backflow of water into the Pumping Chamber	
6	Isolation Valve (V2022)	300mm Backwash piping, Pumps Floor	Provides isolation for the check valve V2023 and Pump P206	Normally Open
7	Backwash Pump (P205)	Pumps Floor/Pumping Chamber	Provides Backwash supply from Treated Water	PLC Controlled

8	Isolation Valve (V2026)	300mm Backwash piping, Pumps Floor	Provides isolation for the Pressure Indicator	Normally Open
9	Isolation Valve (V2027)	300mm Backwash piping, Pumps Floor	Used to remove any debris that might block the Pressure Indicator	Normally Closed
10	Pressure Indicator (PI2051)	300mm Backwash piping, Pumps Floor	Indicates the output pressure of Pump P205	
11	Check Valve (V2024)	300mm Backwash piping, Pumps Floor	Prevents the backflow of water into the Pumping Chamber	
12	Isolation Valve (V2025)	300mm Backwash piping, Pumps Floor	Provides isolation for the check valve V2024 and Pump P205	Normally Open
13	Pump Relief Valve (PRV2501)	300mm Backwash piping, Pumps Floor	Provides relief for the Backwash supply pumps on start-up of a backwash sequence	PLC Controlled
14	Flow Control Valve (FCV2105)	300mm Backwash piping, Pumps Floor	Controls the flow of backwash water to Filter #1	PLC Controlled
15	Filter #1	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
16	Flow Control Valve (FCV2106)	400mm Backwash Waste piping, Pumps Floor	Controls the flow of backwash wastewater from Filter #1 to Backwash Waste Chamber	PLC Controlled
17	Flow Control Valve (FCV2115)	300mm Backwash piping, Pumps Floor	Controls the flow of backwash water to Filter #2	PLC Controlled
18	Filter #2	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
19	Flow Control Valve (FCV2116)	400mm Backwash Waste piping, Pumps Floor	Controls the flow of backwash wastewater from Filter #2 to Backwash Waste Chamber	PLC Controlled
20	Flow Control Valve (FCV2125)	300mm Backwash piping, Pumps Floor	Controls the flow of backwash water to Filter #3	PLC Controlled
21	Filter #3	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
22	Flow Control Valve (FCV2126)	400mm Backwash Waste piping, Pumps Floor	Controls the flow of backwash wastewater from Filter #3 to Backwash Waste Chamber	PLC Controlled
23	Flow Control Valve (FCV2135)	300mm Backwash piping, Pumps Floor	Controls the flow of backwash water to Filter #4	PLC Controlled
24	Filter #4	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
25	Flow Control Valve (FCV2136)	400mm Backwash Waste piping, Pumps Floor	Controls the flow of backwash wastewater from Filter #4 to Backwash Waste Chamber	PLC Controlled
26	Backwash Waste Tank	Clearwell Floor level	Contains the wastewater from the backwash process	
27	Level Indicating Transmitter (LIT4001)	Mounted on Backwash Waste Tank wall	Indicates the water level in the backwash waste tank	Signals the PLC

28	Flow Meter (FE4001)	Waste Piping in the Utilidor	Indicates the flow of Backwash Wastewater leaving the Plant	Sends info to PLC
29	Flow Control Valve (FCV4001)	Waste Piping in the Utilidor	Controls the flow rate of Backwash wastewater leaving the Plant	PLC Controlled
30	Orifice Plate	Waste Piping in the Utilidor	Back-up wastewater flow rate control for all process waste leaving the Plant	

6.9 FILTER-TO-WASTE FLOW

(Refer to Drawing I-104, I-105, and I-302 in Section 11)

The following table identifies the components related to the flow of water from the plant filters to the City sanitary sewer system.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Filter #1	Filters Room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
2	Flow Control Valve (FCV2103)	200mm Backwash piping, Pumps Floor	Controls the flow of Filter to waste water from Filter #1 to the Surge Tank	PLC Controlled
3	Filter #2	Filters Room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
4	Flow Control Valve (FCV2113)	200mm Backwash piping, Pumps Floor	Controls the flow of Filter to waste water from Filter #2 to the Surge Tank	PLC Controlled
5	Filter #3	Filters Room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
6	Flow Control Valve (FCV2123)	200mm Backwash piping, Pumps Floor	Controls the flow of Filter to waste water from Filter #3 to the Surge Tank	PLC Controlled
7	Filter #4	Filters Room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
8	Flow Control Valve (FCV2133)	200mm Backwash piping, Pumps Floor	Controls the flow of Filter to waste water from Filter #4 to the Surge Tank	PLC Controlled
9	Surge Tank	Under Mixing Tanks, Access from the exterior of the Plant	Used for the storage of the filter to waste water enabling the wastewater to be released gradually into the City sanitary system	
10	Level Indicating Transmitter (LIT4011)	Mounted on Surge Tank access wall	Indicates the water level in the Surge Tank	Signals the PLC
11	Flow Meter (FE4011)	Waste Piping in the Utilidor	Indicates the flow rate of Filter wastewater leaving the Plant	Sends info to PLC
12	Flow Control Valve (FCV4011)	Waste Piping in the Utilidor	Controls the flow rate of Backwash wastewater leaving the Plant	PLC Controlled
13	Orifice Plate	Waste Piping in the Utilidor	Back-up waste water flow rate control for all process waste leaving the Plant	

14	Level Indicating Transmitter (LIT4021)	WTP Underground	Indicates the standing water in the WTP Underground	Sends info. To PLC
15	Submersible Pump (P420)	WTP Underground	Discharges water from the WTP Underground to the Filter-to-Waste Tank	

6.10 AIR SCOUR FLOW

(Refer to Drawing I-103 and I-302 in Section 11)

The following table identifies the components related to the flow of water from the air blowers to the filters.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Air Scour Blower #1 (C200)	Pumps Floor	Provides the air for the air scour operation during the backwash sequence	PLC Controlled
2	Isolation valve (V2001)	100mm Air Scour piping, Pumps Floor	Used to isolate Blower #1 from the rest of the system	Normally Open
3	Air Scour Blower #2 (C201)	Pumps Floor	Provides the air for the air scour operation during the backwash sequence	PLC Controlled
4	Isolation valve (V2041)	100mm Air Scour piping, Pumps Floor	Used to isolate Blower #2 from the rest of the system	Normally Open
5	Flow Control Valve (FCV2107)	100mm Air Scour piping, Pumps Floor	Controls the flow of air into Filter #1	PLC Controlled
6	Filter #1	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
7	Flow Control Valve (FCV2117)	100mm Air Scour piping, Pumps Floor	Controls the flow of air into Filter #2	PLC Controlled
8	Filter #2	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
9	Flow Control Valve (FCV2127)	100mm Air Scour piping, Pumps Floor	Controls the flow of air into Filter #3	PLC Controlled
10	Filter #3	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	
11	Flow Control Valve (FCV2137)	100mm Air Scour piping, Pumps Floor	Controls the flow of air into Filter #4	PLC Controlled
12	Filter #4	Filters room	Filters raw water with a 300mm sand layer and a 700mm anthracite layer	

Note: All drain valves are Normally Closed

6.11 DOMESTIC SUPPLY SYSTEM

(Refer to Drawing I-107 and I-303 in Section 11)

The following table identifies the components related to the flow of water from the air blowers to the filters.

NO.	COMPONENT	LOCATION	FUNCTION PERFORMED	REMARKS
1	Isolation Valve (D3)	Utilidor Below-Reservoir	Pre-reservoir sample port	Normally Open
2	Isolation Valve (WM1)	Utilidor Below-Reservoir	Used to isolate both reservoir cells	Normally Closed
3	Isolation Valve (WM4)	Utilidor Below-Reservoir	Used to isolate the treated water supply from Reservoir Cell #1	Normally Open
4	Isolation Valve (D1)	Utilidor Below-Reservoir	Pre-Reservoir Cell #1 sample port	Normally Closed
5	Level Indicating Transmitter (LIT5001)	Utilidor Below-Reservoir	Indicates the water level in Reservoir Cell #1	Sends info. To PLC
6	Isolation Valve (D2)	Utilidor Below-Reservoir	Post-Reservoir Cell #1 sample port	Normally Open
7	Isolation Valve (WM7)	Utilidor Below-Reservoir	Used to isolate Reservoir Cell #1 from the Distribution System	Normally Open
8	Isolation Valve (WM9)	Utilidor Below-Reservoir	Used to isolate the treated water supply from Reservoir Cell #2 (and future cells)	Normally Open
9	Isolation Valve (WM10)	Utilidor Below-Reservoir	Used to isolate the treated water supply from Reservoir Cell #2	
10	Level Indicating Transmitter (LIT5002)	Utilidor Below-Reservoir	Indicates the water level in Reservoir Cell #2	Sends info. To PLC
11	Isolation Valve (WM11)	Utilidor Below-Reservoir	Used to isolate Reservoir Cell #2 from the Distribution System	Normally Open
12	Isolation Valve (WM3)	Utilidor Below-Reservoir	Used to isolate the Flow Meter	Normally Open
13	Flow Meter (FIT5001)	Utilidor Below-Reservoir	Indicates the flow of Treated Water into the Distribution System	Sends info. To PLC
14	Isolation Valve (WM2)	Utilidor Below-Reservoir	Used to isolate the Flow Meter	Normally Open
15	Isolation Valve (WM8)	Utilidor Below-Reservoir	Allows treated water to bypass the Flow Meter	Normally Closed
16	Isolation Valve (WM5)	Utilidor Below-Reservoir	Used to isolate Reservoir Supply from City Distribution	Normally Open
17	Isolation Valve (V1)	Utilidor Below-Reservoir	Sample port for pre-City Distribution	Normally Closed

18	Isolation Valve (WM6)	Utilidor Below-Reservoir	Used to isolate Reservoir Supply from City Distribution	Normally Open
19	Isolation Valve (V2)	Utilidor Below-Reservoir	Sample port for pre-City Distribution	Normally Closed
20	Domestic Supply Pump (P430)	Pumps Floor	Supply of domestic water to laboratory sink	
21	Isolation Valve (DS1)	Utilidor Below-Reservoir	Isolation valve for Domestic Supply Pump P410	Normally Open
22	Domestic Supply Pump (P410)	Utilidor Below-Reservoir	Supply pump for domestic water to WTP and power plant	Normal On
23	Isolation Valve (DS2)	Utilidor Below-Reservoir	Isolation valve for Domestic Supply Pump P410	Normally Open
24	Isolation Valve (DS3)	Utilidor Below-Reservoir	Isolation valve for Domestic Supply Pump P411	Normally Closed
25	Domestic Supply Pump (P411)	Utilidor Below-Reservoir	Supply pump for domestic water to WTP and power plant	Normally Off
26	Isolation Valve (DS4)	Utilidor Below-Reservoir	Isolation valve for Domestic Supply Pump P411	Normally Closed
27	Isolation Valve (DS5)	Utilidor Below-Reservoir	Used to isolate Pressure Indicator PI4112	Normally Open
28	Pressure Indicator (PI4112)	Utilidor Below-Reservoir	Indicates the output pressure of Domestic Supply Pump(s)	
29	Backflow Preventer (DS6)	Utilidor Below-Reservoir	Prevents backflow of domestic water into Distribution System	

END OF CHAPTER 6

7 COMPONENT DETAILS

7.1 GENERAL OVERVIEW

The following tables describe the components of the various systems and provide some basic details and settings. Reference drawings are provided (where?) for added clarity.

7.2 RAW WATER FLOW

(Refer to Drawing I-102 and I-301 in Section 11)

The following table identifies the components related to the flow of water from the plant intake to the filters.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Intake Valve (V1000)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
2	Online Monitoring Device (AE1003)	S::CAN online monitoring device with con::cube terminal and spectro::lyser		Supplier: Aquatic Life Ltd., Pinawa, MB
3	Isolation Valve (V1036)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
4	Solenoid Valve (SV1001)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
5	Turbidity Sensor (AE1001)	Hatch 1720D Aqua Trend Interface/SOM	0 – 100.0 NTU	Supplier: Hach Company Loveland, Colorado
6	Drain Valve (V1034)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
7	Isolation Valve (V1035)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
8	Isolation Valve (V1037)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
9	Solenoid Valve (SV1002)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
10	pH Sensor (AE1002)	Depolox 3 Plus pH sensor	4.0 – 10.0	Supplier: Wallace & Tiernan Products Markham, ON
11	Isolation Valve (V1029)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB

12	Flow Meter (FE1001)	Promag 50W	0-120 l/sec	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
13	Flow Control Valve (FCV1001)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
14	Isolation Valve (V1003)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
15	Bypass Valve (V1004)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
16	Drain Valve (V1005)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
17	Isolation Valve (V1006)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
18	Air Release Valve (ARV1001)	APCO Air Vent Valve		Supplier: Summit Valve & Controls Edmonton, AB
19	Isolation Valve (V1007)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
20	Isolation Valve (V1038)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
21	Air Release Valve (V1036)	APCO Air Vent Valve		Supplier: Summit Valve & Controls Edmonton, AB
22	Isolation Valve (V1039)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
23	Solenoid Valve (SV201)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
24	Isolation Valve (V1008)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
25	Isolation Valve (V1040)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
26	Solenoid Valve (SV211)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
27	UV unit (X120)	UV Disinfection System	Max. dosage: 40 mJ/cm^2	Supplier: Trojan Technologies Inc. London, ON

28	UV unit (X121)	UV Disinfection System	Max. dosage: 40 mJ/cm^2	Supplier: Trojan Technologies Inc. London, ON
29	Drain Valve (V1041)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
30	Drain Valve (V1042)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
31	Isolation Valve (V1043)	MAS G2 Ball Valve		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
32	Air Release Valve (V1039)	APCO Air Vent Valve		Supplier: Summit Valve & Controls Edmonton, AB
33	Motorized Valve (V1009)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0301 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
34	Motorized Valve (V1012)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0301 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
35	Drain Valve (V1013)	Kitz Ball Valve #58cc		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
36	Isolation Valve (V1016)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
37	Isolation Valve (V1017)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
38	Isolation Valve (V1018)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
39	Isolation Valve (V1019)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
40	Isolation Valve (V1020)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
41	Isolation Valve (V1021)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
42	Isolation Valve (V1022)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
43	Isolation Valve (V1023)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB

44	Isolation Valve (V1024)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
45	Isolation Valve (V1025)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
46	Isolation Valve (V1026)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
47	Isolation Valve (V1027)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
48	Isolation Valve (V1028)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
49	Motorized Valve (FCV2101)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
50	Flow Control Valve (FCV2111)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
51	Motorized Valve (FCV2121)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
52	Motorized Valve (FCV2131)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
52	Isolation Valve (V1029)		Open or Closed	
53	Strainer (S1029)	CLA-VAL Model X43H H Style Strainer with X141DP differential pressure gauge assembly		

7.3 FILTERED/TREATED WATER FLOW

(Refer to Drawing I-103, I-104, I-301 and I-302 in Section 11)

The following table identifies the components related to the flow of water from the plant filters to the off-site reservoir.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Filter #1	Underdrains & Media	1,000 mm Granular Activated Carbon	
2	Level Indicating Transmitter (LIT2101)	MultiRanger, Echomax XPS-10	0.3 – 10m	Supplier: Siemens Milltronics Edmonton, AB

3	Isolation Valve (V2003)	Kitz Ball Valve #58		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
4	Isolation Valve (V2004)	Kitz Ball Valve #58		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
5	Pressure Indicating Transmitter (PIT2101)	Deltabar S PMD235	0 – 4.00 m H_2O	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
6	Solenoid Valve (SV2102)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
7	Turbidity Sensor (AE2102)	Hatch 1720D Aqua Trend Interface/SOM	0 – 2.0 NTU	Supplier: Hach Company Loveland, Colorado
8	Drain Valve (V2002)	Kitz Ball Valve #58cc		Supplier: Bartel & Gibson Co Ltd. Edmonton, AB
9	Level Control Valve (LCV2104)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
10	Filter #2	Underdrains & Media	1,000 mm Granular Activated Carbon	
11	Level Indicating Transmitter (LIT2111)	MultiRanger, Echomax XPS-10	0.3 – 10m	Supplier: Siemens Milltronics Edmonton, AB
12	Isolation Valve (V2055)	Kitz Ball Valve		Supplier: Emco Ltd. Edmonton, AB
13	Isolation Valve (V2056)	Kitz Ball Valve		Supplier: Emco Ltd. Edmonton, AB
14	Pressure Indicating Transmitter (PIT2111)	Deltabar S PMD235	0 – 4.00 m H_2O	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
15	Solenoid Valve (SV2112)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
16	Turbidity Sensor (AE2111)	Hatch 1720D Aqua Trend Interface/SOM	0 – 2.0 NTU	Supplier: Hach Company Loveland, Colorado
17	Drain Valve (V2054)	Ball Valve		Supplier: Emco Ltd. Edmonton, AB
18	Level Control Valve (LCV2114)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
19	Filter #3	Underdrains & Media	1,000 mm Granular Activated Carbon	

20	Level Indicating Transmitter (LIT2121)	MultiRanger, Echomax XPS-10	0.3 – 10m	Supplier: Siemens Milltronics Edmonton, AB
21	Isolation Valve (V2066)	Ball Valve		Supplier: Emco Ltd. Edmonton, AB
22	Isolation Valve (V2067)	Ball valve		Supplier: Emco Ltd. Edmonton, AB
23	Pressure Indicating Transmitter (PIT2121)	Deltabar S PMD235	0 – 4.00 m H_2O	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
24	Solenoid Valve (SV2122)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
25	Turbidity Sensor (AE2121)	Hatch 1720D Aqua Trend Interface/SOM	0 – 2.0 NTU	Supplier: Hach Company Loveland, Colorado
26	Drain Valve (V2065)	Ball Valve		Supplier: Emco Ltd. Edmonton, AB
27	Level Control Valve (LCV2124)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
28	Filter #4	Underdrains & Media	1,000 mm Granular Activated Carbon	
29	Level Indicating Transmitter (LIT2131)	MultiRanger, Echomax XPS-10	0.3 – 10m	Supplier: Siemens Milltronics Edmonton, AB
30	Isolation Valve (V2077)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
31	Isolation Valve (V2078)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
32	Pressure Indicating Transmitter (PIT2131)	Deltabar S PMD235	0 – 4.00 m H_2O	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
33	Solenoid Valve (SV2132)	ASCO Red Hat II		Supplier: Emco Ltd. Edmonton, AB
34	Turbidity Sensor (AE2131)	Hatch 1720D Aqua Trend Interface/SOM	0 – 2.0 NTU	Supplier: Hach Company Loveland, Colorado
35	Drain Valve (V2076)	Ball Valve		Supplier: Emco Ltd. Edmonton, AB
36	Level Control Valve (LCV2134)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB

37	Chlorine Injection point			
38	Caustic Soda Injection point			
39	Hydroflourosilicic Acid Injection point			
40	Contact Chamber			
41	Isolation Valve (V2038)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
42	North Clearwell			
43	Isolation Valve (V2039)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
44	South Clearwell			
45	Isolation Valve (V2037)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
46	Backwash Chamber			
47	Isolation Valve (V2035)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
48	Isolation Valve (V2034)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
49	Isolation Valve (V2033)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
50	Level Indicating Transmitter (LIT2501)	MultiRanger, Echomax XPS-10	0.3 – 10m	Supplier: Siemens Milltronics Edmonton, AB
51	Isolation Valve (V2036)	Bray series 30-109, wafer style Butterfly Valve	Open or Closed	
51	Flow Control Valve (FCV2501)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0301 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
52	Caustic Soda injection point			
53	Isolation Valve (V2056)	Kitz Ball Valve		Supplier: Emco Ltd. Edmonton, AB
54	Isolation Valve (V2040)		Open or Closed	

55	Isolation Valve (V2041)		Open or Closed	
56	Isolation Valve (V2042)		Open or Closed	
57	Isolation Valve (V2043)		Open or Closed	
58	Isolation Valve (V2044)		Open or Closed	
59	Treated Sample Supply Pump (P310)			
60	Isolation Valve (V2045)		Open or Closed	
61	Pressure Indicator (PI2045)			
62	Isolation Valve (V2046)		Open or Closed	
63	Isolation Valve (V2047)		Open or Closed	
64	Isolation Valve (V2048)		Open or Closed	
65	Online Monitoring Device (AE2501 / AE2502 / AE2503)	S::CAN online monitoring device with con::cube terminal, spectro::lyser, pH::lyser, and chlorine::lyser		Supplier: Aquatic Life Ltd., Pinawa, MB

7.4 HYDROFLUOROSILICIC ACID

(Refer to Drawing I-106 and I-301 in Section 11)

The following table identifies the components related to the flow of hydrofluorosilicic acid..

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Hydrofluorosilicic Acid Drum			
2	Pumps Package (P305 / P306)	LMI series A Electronic Metering Pumps, etc.	0.004 – 2.2 l/h	Supplier: Peacock Inc. Edmonton, AB
3	Check Valve (V3052)	Stainless Steel Swing Check Kitz class 200		Supplier: Emco Ltd. Edmonton, AB
4	Isolation Valve (V3053)	MA Stewart Stainless Steel G5 full port Ball Valve		Supplier: Emco Ltd. Edmonton, AB

7.5 CHLORINE GAS SOLUTION

(Refer to Drawing I-108 and I-301 in Section 11)

The following table identifies the components related to the flow of chlorine solution from the chlorine gas system.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Chlorine Cylinders			
2	Chlorination Package	200 PPD Vacuum Regulator, Series V10K Chlorinator, etc.		Supplier: Alberta Mequipco Ltd. Calgary, AB
3	Check Valve (V3052)	Stainless Steel Swing Check Kitz class 200		Supplier: Emco Ltd. Edmonton, AB
4	Isolation Valve (V3053)	MA Stewart Stainless Steel G5 full port Ball Valve		Supplier: Emco Ltd. Edmonton, AB
5	Isolation Valve (V3052)		Open or Closed	
6	Isolation Valve (V3053)		Open or Closed	
7	Isolation Valve (V3054)		Open or Closed	

7.6 SODIUM HYPOCHLORITE

(Refer to Drawing I-107 and I-301 in Section 11)

The following table identifies the components related to the flow of Sodium Hypochlorite. The referenced drawing shows the components but not their locations.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Zinc Orthophosphate Drum			
2	Pumps Package (P303 / P304)	LMI series C Electronic Metering Pumps, etc.	0.030 – 30 l/h	Supplier: Peacock Inc. Edmonton, AB
3	Check Valve (V3052)	Stainless Steel Swing Check Kitz class 200		Supplier: Emco Ltd. Edmonton, AB
4	Isolation Valve (V3053)	MA Stewart Stainless Steel G5 full port Ball Valve		Supplier: Emco Ltd. Edmonton, AB
5	Isolation Valve (V2033)		Open or Closed	

6	Isolation Valve (V2034)		Open or Closed	

7.7 CAUSTIC SODA

(Refer to Drawing I-106 and I-302 in Section 11)

The following table identifies the components related to the flow of caustic soda.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Caustic Soda Drum			
2	Pumps Package	LMI series B Electronic Metering Pumps	0.017 – 17 l/h	Supplier: Peacock Inc. Edmonton, AB
3	Check Valve (V3052)	Stainless Steel Swing Check Kitz class 200, etc.		Supplier: Emco Ltd. Edmonton, AB
4	Isolation Valve (V3053)	MA Stewart Stainless Steel G5 full port Ball Valve		Supplier: Emco Ltd. Edmonton, AB

7.8 BACKWASH FLOW

(Refer to Drawing I-104, I-105, and I-302 in Section 11)

The following table identifies the components related to the flow of water from the backwash pumps to the City sanitary sewer system.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Backwash Pump (P206)	Verti-line –1200 14FHH (1 stage)		Supplier: National Process Equipment Edmonton, AB
2	Isolation Valve (V2028)	Ball Valve		Supplier: Ener-Tech Mechanical sales Ltd. Edmonton, AB
3	Isolation Valve (V2029)	Kitz Ball Valve		Supplier: Emco Ltd. Edmonton, AB
4	Pressure Indicator (PI2061)	Trerice #620B		Supplier: Ener-Tech Mechanical sales Ltd. Edmonton, AB
5	Check Valve (V2023)	Check Rite model 15-XMZ A351-CF8M body A351-CF8 hinge		Supplier: Summit Valve & Controls Edmonton, AB

6	Isolation Valve (V2022)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
7	Backwash Pump (P205)	Verti-line –1200 14FHH (1 stage)		Supplier: National Process Equipment Edmonton, AB
8	Isolation Valve (V2026)	Ball Valve		Supplier: Ener-Tech Mechanical sales Ltd. Edmonton, AB
9	Isolation Valve (V2027)	Kitz Ball Valve		Supplier: Emco Ltd. Edmonton, AB
10	Pressure Indicator (PI2051)	Trerice #620B		Supplier: Ener-Tech Mechanical sales Ltd. Edmonton, AB
11	Check Valve (V2024)	Check Rite model 15-XMZ A351-CF8M body A351-CF8 hinge		Supplier: Summit Valve & Controls Edmonton, AB
12	Isolation Valve (V2025)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
13	Pump Relief Valve (PRV2501)	Singer model 106-DWX-RPS c/w model 81-RP pilot, 120VAC solenoid, X129 SPDT limit switch, and 82-B booster pilot		Supplier: Summit Valve & Controls Edmonton, AB
14	Flow Control Valve (FCV2105)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0301 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
15	Filter #1	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
16	Flow Control Valve (FCV2106)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
17	Flow Control Valve (FCV2115)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0301 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
18	Filter #2	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
19	Flow Control Valve (FCV2116)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
20	Flow Control Valve (FCV2125)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0301 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
21	Filter #3	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA

22	Flow Control Valve (FCV2126)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
23	Flow Control Valve (FCV2135)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0301 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
24	Filter #4	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
25	Flow Control Valve (FCV2136)	Motorized Bray series 30-111, wafer style Butterfly Valve, c/w Bray S70-0501 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
26	Backwash Waste Tank			
27	Level Indicating Transmitter (LIT4001)	MultiRanger, Echomax XPS-10	0.3 – 10m	Supplier: Siemens Milltronics Edmonton, AB
28	Flow Meter (FE4001)	Promag 50W	0-12 l/sec	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
29	Flow Control Valve (FCV4001)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0031 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
30	Orifice Plate		60 mm hole for a regulated flow of 70 L/min	

7.9 FILTER-TO-WASTE FLOW

(Refer to Drawing **I**-104, **I**-105, and **I**-302 in Section 11)

The following table identifies the components related to the flow of water from the plant filters to the City sanitary sewer system.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Filter #1	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
2	Flow Control Valve (FCV2103)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
3	Filter #2	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
4	Flow Control Valve (FCV2113)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
5	Filter #3	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA

6	Flow Control Valve (FCV2123)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
7	Filter #4	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
8	Flow Control Valve (FCV2133)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0121 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
9	Surge Tank			
10	Level Indicating Transmitter (LIT4011)	Waterpilot FMX167	0 – 4.00m	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
11	Flow Meter (FE4011)	Promag 50W	0-5 l/sec	Supplier: Endress + Hauser Canada Ltd. Edmonton, AB
12	Flow Control Valve (FCV4011)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0031 actuator	Modulating	Supplier: Summit Valve & Controls Edmonton, AB
13	Orifice Plate		60 mm hole for a regulated flow of 70 L/min	
14	Level Indicating Transmitter (LIT4021)			
15	Submersible Pump (P420)			

7.10 AIR SCOUR FLOW

(Refer to Drawing I-103 and I-302 in Section 11)

The following table identifies the components related to the flow of water from the air blowers to the filters.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Air Scour Blower #1 (C200)	Delta Blower Package Aerzen model #GM 15L Blower		Supplier: National Process Equipment Edmonton, AB
2	Isolation valve (V2001)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB
3	Air Scour Blower #2 (C201)	Delta Blower Package Aerzen model #GM 15L Blower		Supplier: National Process Equipment Edmonton, AB
4	Isolation valve (V2041)	Bray series 31 trim 109, lug style Butterfly Valve		Supplier: Summit Valve & Controls Edmonton, AB

5	Flow Control Valve (FCV2107)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0031 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
6	Filter #1	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
7	Flow Control Valve (FCV2117)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0031 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
8	Filter #2	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
9	Flow Control Valve (FCV2127)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0031 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
10	Filter #3	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA
11	Flow Control Valve (FCV2137)	Motorized Bray series 30-109, wafer style Butterfly Valve, c/w Bray S70-0031 actuator	Open or Closed	Supplier: Summit Valve & Controls Edmonton, AB
12	Filter #4	Underdrains & Media	300mm sand layer & 700mm anthracite	Supplier: Leopold Zelienpole, PA

7.11 DOMESTIC SUPPLY SYSTEM

(Refer to Drawing I-107 and I-303 in Section 11)

The following table identifies the components related to the domestic supply system.

NO.	COMPONENT	DETAILS	SETTING	REMARKS
1	Isolation Valve (D3)		Open or Closed	
2	Isolation Valve (WM1)		Open or Closed	
3	Isolation Valve (WM4)		Open or Closed	
4	Isolation Valve (D1)		Open or Closed	
5	Level Indicating Transmitter (LIT5001)			
6	Isolation Valve (D2)		Open or Closed	
7	Isolation Valve (WM7)		Open or Closed	
8	Isolation Valve (WM9)		Open or Closed	
9	Isolation Valve (WM10)		Open or Closed	
10	Level Indicating Transmitter (LIT5002)			
11	Isolation Valve (WM11)		Open or Closed	
12	Isolation Valve (WM3)		Open or Closed	
13	Flow Meter (FIT5001)			
14	Isolation Valve (WM2)		Open or Closed	
15	Isolation Valve (WM8)		Open or Closed	
16	Isolation Valve (WM5)		Open or Closed	
17	Isolation Valve (V1)		Open or Closed	
18	Isolation Valve (WM6)		Open or Closed	

19	Isolation Valve (V2)			
20	Domestic Supply Pump (P430)			
21	Isolation Valve (DS1)		Open or Closed	
22	Domestic Supply Pump (P410)			
23	Isolation Valve (DS2)		Open or Closed	
24	Isolation Valve (DS3)		Open or Closed	
25	Domestic Supply Pump (P411)			
26	Isolation Valve (DS4)		Open or Closed	
27	Isolation Valve (DS5)		Open or Closed	
28	Pressure Indicator (PI4112)			
29	Backflow Preventer (DS6)			

END OF CHAPTER 7

8 TROUBLESHOOTING PROCEDURES

8.1 GENERAL ALARMS

The WTP process, mechanical and electrical operating systems, and equipment are continuously monitored with appropriate alarms to indicate if there is a system or equipment failure.

8.2 PRE-TREATMENT ALARMS

ALARM NO.	TRIPPED BY	SET POINT	CONSEQUENCE
FAL-1001	Low flow in raw water supply header *Alarm held out or 5minutes on plant start sequence*	2 L/s	Plant Shut Down
X-120 Minor Alarm	X-120 Control Panel	Various Conditions	None
X-120 Major Alarm	X-120 Control Panel	Various Conditions	Duty/Standby reactor change over
X-120 Critical Alarm	X-120 Control Panel	Various Conditions	Duty/Standby reactor change over
X-121 Minor Alarm	X-120 Control Panel	Various Conditions	None
X-121 Major Alarm	X-120 Control Panel	Various Conditions	Duty/Standby reactor change over
X-121 Critical Alarm	X-120 Control Panel	Various Conditions	Duty/Standby reactor change over
LAL-5001	Low level in the existing reservoir	(Operator Defined) ~3.6 m	WTP Start
LAH-5001	High level in the existing reservoir	(Operator Defined) ~4.15 m	WTP Stop
LAL-2501	Low level in the backwash pumping chamber	(Operator Defined) x.x m	WTP Start
LAH-2501	High level in the backwash pumping chamber	(Operator Defined) x.x m	WTP Stop
AAH-1003	High concentrations of PHCs in the raw water intake	50 µg/L	Plant Shutdown

8.3 FILTRATION ALARMS

ALARM NO.	TRIPPED BY	SET POINT	CONSEQUENCE
AAH-2101	Filtration Mode – High filtered water turbidity Filter to Waste Mode – High filtered water turbidity	>0.3 NTU <0.3 NTU	Backwash sequence initiated Change to filtration mode
ZOA-2101	Failure of filter influent valve to open		Filter will not enter filtration or filter to waste mode
ZCA-2101	Failure of filter influent valve to close		Filter will not enter backwash mode
ZOA-2103	Filter to waste valve is fully open		Filter shutdown. Backwash was not effective.
ZCA-2103	Filter to waste valve has failed to open		Filter shutdown. Filter to waste can't occur
ZOA-2104	Filtered water valve is fully open		Backwash required.
ZCA-2104	Filtered water valve has failed to open		Filtration can't proceed
ZOA-2105	Failure of backwash water supply valve to open		Backwash pumps (P-205/206) can't start, backwash can't proceed
ZCA-2105	Failure of backwash water supply valve to close		Filter to waste can't proceed
ZOA-2106	Failure of backwash waste valve to open		Backwash pumps (P-205/206) can't start, backwash can't proceed
ZCA-2106	Failure of backwash waste valve to close		Filter to waste can't proceed, filter influent valve remains closed
ZOA-2107	Failure of air scour valve to open		Air scour blowers (C-200/201) can't start, backwash can't proceed
ZCA-2107	Failure of air scour valve to close		Backwash can't proceed.
UA-2001*	Fault in C-200		If duty blower, set C-201 as duty pump. If UA-201 active, plant Shut down.
UA-2011*	Fault in C-201		If duty blower, set C-200 as duty pump. If UA-200 active, plant shut down

LAH 2101	High level in filter	300mm above normal operating level	FCV 2101 filter inlet valve closed

8.4 CLEARWELL & BACKWASH SUPPLY ALARMS

ALARM NO.	TRIPPED BY	SET POINT	CONSEQUENCE
UA-2051	Fault with P-205		If duty pump, set P-206 as duty pump. If UA-2061 active, plant shut down
UA-2061	Fault with P-206		If duty pump, set P-205 as duty pump. If UA-2051 active, plant shut down
LAL-2501	Low level in backwash pumping chamber		Backwash sequence disabled
LAH-2501	High level in backwash pumping chamber		Plant shut down
AAH-2501C	High concentrations of PHCs entering the Reservoir	50 µg/L	Plant Shutdown

8.5 CHLORINATION ALARMS

ALARM NO.	TRIPPED BY	SET POINT	CONSEQUENCE
AAH-3401 Chlorine alarms are always active	Chlorine Leak	2 ppm	Ventilation in chlorine room stops. HN-3401 starts BA-3401 starts

8.6 FLUORIDE, CAUSTIC SODA & HYPOCHLORITE ALARMS

ALARM NO.	TRIPPED BY	SET POINT	CONSEQUENCE
UA-3031	Pump failure		P-304 starts Plant Shutdown
UA-3041	Pump failure		P-303 starts Plant Shutdown
UA-3051	Pump failure		P-306 starts Plant Shutdown

UA-3061	Pump failure		P-305 starts Plant Shutdown
UA-3621	Pump failure		P-363 starts Plant Shutdown
UA-3631	Pump failure		P-362 starts Plant Shutdown

8.7 WASTE TANKAGE ALARMS

ALARM NO.	TRIPPED BY	SET POINT	CONSEQUENCE
LAH-4001	High level in the backwash waste tank	3.1 m	Filters are locked out from backwashing and P-205 and P-206 shutdown
LAH-4011	High level in the filter to waste tank	3.1 m	Filters are locked out from filter to waste mode
FAH-4001	High flow out of backwash tank	10 L/s	FCV-4001 closes
FAH-4011	High flow out of filter to waste tank	5 L/s	FCV-4001 closes

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8.8 SERVICE WATER PUMPS ALARMS

ALARM NO.	TRIPPED BY	SET POINT	CONSEQUENCE
UA-4101	Pump failure		P-411 starts Plant Shutdown
UA-4111	Pump failure		P-410 starts Plant Shutdown
PAL-4112	Low Pressure in service water	245 kPag	Plant Shutdown

END OF CHAPTER 8

9 MAINTENANCE PROCEDURES AND SERVICE INFORMATION

9.1 GENERAL

To ensure uninterrupted use, equipment should be regularly inspected, tested, and proper repairs made and recorded. The objective is to minimize equipment operating problems and prevent failures by making minor or necessary repairs before major difficulties occur. The importance of record keeping cannot be over-emphasized. Good maintenance protects the owner's interest with manufacturer warranties, continuity, or maintenance despite staff turnovers and equipment reliability track record.

Environmental and operating conditions are key elements affecting proper and reliable operation of equipment. Costly repairs can be minimized if the following items are attended to:

KEEP IT CLEAN

KEEP IT TIGHT

9.1.1 KEEP IT CLEAN

Day-to day accumulation of normal atmospheric particles, lint, metallic particles form mechanical equipment cause problems with equipment over a long period of time. An accumulation affects equipment reliability and operating life. ALL equipment should be regularly cleaned.

9.1.2 KEEP IT TIGHT

All contactors and control devices operate with high-speed movement. This motion creates vibration that can loosen hardware and other parts. External vibration from equipment may cause the loosening of hardware and connections in any equipment. All hardware and connections should be tightened regularly. This simple procedure takes only a small amount of time and can save hours of searching for intermittent problems. All rotating equipment such as motors are affected by vibrations. This can cause alignment problems, which can result in bearing failures.

9.2 RENEWAL PARTS

Availability of parts can be a major problem these days as distributors are keeping very low inventories in a move to economize. This may make any part a long delivery item. For this reason, local distributors should be contacted, and parts availability assessed.

Any critical part affecting the reliability of the system should be ordered, recorded, and stored by the maintenance department.

9.3 PARTS AND EQUIPMENT ORDERING PROCEDURE

During the first year of operation of the new part or component, the Contractor should be contacted for any replacement parts required. This will ensure that parts covered by warranty will be replaced under warranty. Failure to contact the Contractor may result in difficulties in obtaining warranty replacement.

Following the first year of operation, it is recommended that the Contractor also be contacted as many of the suppliers have a wholesale only policy. If it is necessary to purchase parts directly from the original supplier, the following information is required.

- Make
- Model No.
- Year of Installation
- Installing Contractor
- Description of Part Required (ie. Fan Bearing)
- Part No. if Available

When quoting a part number contained in manufacturer’s catalogue, always provide the date of the catalogue you are referring to, as these numbers are often subject to change. The equipment supplier will have the latest edition of the manufacturer’s catalogue.

If the original supplier is no longer in business, contact the contractor who will be able to suggest an alternate source of supply.

9.4 SCHEDULED PREVENTIVE MAINTENANCE PROGRAM

Scheduled preventive maintenance is an effective means to improve services from systems and equipment. Where failure of equipment can result in shutdown, scheduled preventive maintenance is an economical alternative.

Causes of Equipment Failure

An effective maintenance program will attempt to remove or reduce causes of equipment failure. Common failure initiating causes are:

- Loose and broken belts
- Misaligned pulleys

- Dirty or plugged filters
- Dirty or plugged coils
- Worn bearings
- Improper lubrication and oiling or lack of
- Persistent overloading
- Above normal temperatures
- Below normal temperatures
- Obstruction of ventilation by foreign objects or material (blockage of air, dirt on components etc.)
- Normal deterioration from age
- Severe weather conditions

The scheduled preventive maintenance suggestions presented will be applicable to most equipment, but all of the suggestions given in any one section may not be applicable to the particular mechanical component being maintained. Most of the work may be done by the building operator but some may have to be left to the discretion of the building operator.

When equipment repair is necessary, please refer to the Manufacturer Data section provided in this manual. The frequency, which the tasks should be done as indicated.

Most maintenance can be done by average personnel, with a minimum need for specialized service. Refer to the maintenance legend provided below.

D	**DAILY**
W	Weekly
M	Monthly
SA	Semi-Annually
A	Annually
PMI	Per Manufacturer’s Instructions
AN	As Necessary

9.5 GENERAL MAINTENANCE

ITEM	MAINTENANCE OPERATIONS	INSPECTION FREQUENCY	REMARKS
Valves	Check for proper operation	A	
Motorized Valves	Follow maintenance schedule in the manufacturer’s manual	PMI	

UV Reactors	Maintenance as required by the list in the manufacturer’s manual	PMI	
Backwash Pumps	Follow maintenance schedule in the manufacturer’s manual	PMI	
Air Scour Blowers	Follow maintenance schedule in the manufacturer’s manual	PMI	
Item	**Maintenance Operations**	**Inspection Frequency**	**Remarks**
Service Water Pumps	Check pump operation and switch between duty and stand-by	M	
Chemical Metering Pumps	Follow maintenance schedule in the manufacturer’s manual	PMI	

9.6 LUBRICATION SCHEDULE

Note: For details of maintenance requirements or procedures for a specific piece of equipment, refer to the manufacturer’s brochures.

ITEM	PART TO BE LUBRICATED	LUBRICANT TYPE	FREQUENCY	REMARKS

END OF CHAPTER 9

10 TESTING AND CERTIFICATION DATA

10.1 DISINFECTION OF NEW POTABLE WATER PIPE

All new potable water pipe is to be disinfected in accordance with the AWWA C651 standard. This standard describes methods of disinfecting newly constructed potable water pipe; pipe that has been removed from service for planned repairs or for maintenance that exposes them to contamination; pipe that has undergone emergency repairs because of physical failure; and pipe that, under normal operation, continue to show the presence of coliform organisms.

The installation of new pipe requires that two sets of samples for coliform analysis are collected at least 16 hr apart, or two sets collected 15 min apart after at least a 16-hr rest period. For repaired pipe that is depressurized and/or wholly or partially dewatered, one set of samples may be required, and depending on the sanitary conditions, the pipe may be returned to service prior to the completion of bacteriological testing. For repaired mains that are maintained under pressurized conditions at all times, bacteriological testing is not required.

Bacteriological testing in accordance with AWWA C651 is used to verify the absence of coliform organisms and is generally accepted as verification that disinfection of the pipe has been accomplished; and following sanitary practices for handling and installation of pipe, valves, fittings, and accessories, coupled with adequate flushing of the line before disinfection, is necessary to ensure the disinfected pipeline will be ready for connection to the water system.

It remains the responsibility of the operator to understand the AWWA C651 standard to determine that the methods and approaches described in that standard are suitable for use in the particular application being considered.

10.2 PIPE PRESSURE TESTING

Newly installed pipe shall be tested for pressure and for leakage. The tests shall not commence until a minimum of 24 hours has passed since the pipe was filled with water. The duration of each test shall be no less than two hours. At the end of the first hour, the pressure shall be boosted to its initial value as per the pipe material specifications. At the end of the second hour, the pressure shall be checked. The drop in pressure shall not exceed 2%. If the pressure drop is in excess of this, the Contractor shall find the leak, correct it, and repeat the test until the line can show a pressure drop of less than 2% in one hour.

11 SKETCHES AND DRAWINGS

Sketches illustrating the general operating conditions at the WTP are provided at the end of this chapter and include the following:

I-102	**P&ID – Pre-Treatment**
I-103	**P&ID – Filtration**
I-104	**P&ID – Backwash Supply**
I-105	**P&ID – Backwash & Filter-To-Waste**
I-106	**P&ID – Caustic Soda and Hydrofluorosilicic Acid Supply**
I-107	**P&ID – Sodium Hypochlorite and Domestic Supply System**
I-108	**P&ID – Chlorine Supply**
I-301	**Filters Floor Device Locations**
I-302	**Pumps Floor Device Locations**
I-303	**Clearwell Floor and WTP Underground Device Locations**

12 MANUFACTURER’S DATA

Manufacturer data for the equipment installed/replaced as part of the 2021-2022 WTP Upgrades Project (WSP No. 211-12487-00) are appended to this Chapter.

A: S::CAN Online Monitoring Device (AE1003 and AE2501)

B: Domestic Supply Pumps (P410 and P411)

C: H Style Strainer (S1029)

D: Filter Media (Filter No. 1, Filter No. 2, Filter No. 3, Filter No. 4) (Pending installation)

LCP
MCP
AI 1003
AAH 1003
AAL 1003
AAHH 1001
AI 1001
AI 1002
FI 1001
FAL 1001
ZI 1001
ZOA 2101
ZCA 2101
ZOA 1001
ZCA 1001
FC 1001
PHC
AI 1003
ON/OFF
HS 1001
DO
TURB
AI 1001
pH
AI 1002
FLOW
FI 1001
POSIT'N
FC 1001
ZI 1001
AO
AI
HS 1002
PLANT PLC/UV ETHERNET INTERFACE
PLANT FLOW
FI 1001A
AIT 1003
AE 1003
HS 1001C
OCA
AIT 1001
AE 1001
TURB
HS 1002C
SV 1001
AIT 1002
AE 1002
SV 1002
FIT 1001
FE 1001
HS 1001A
HS 1001B
ROL
OSC
ZT 1001
FCV 1001
UV SYSTEM #1 CONTROL POWER PANEL (CPP)
UV SYSTEM #2 CONTROL POWER PANEL (CPP)
UV REACTOR #1 ELECTRICAL ENCLOSURE
UV REACTOR #2 ELECTRICAL ENCLOSURE
FCV 1009
FCV 1012
X 120
X 121
SV 1201
SV 1211
SV1011
50x25
EXTERIOR
WTP INTERIOR
RAW WATER FROM GERALDINE LAKE
250-RW-ST40
V1000
350x250
350-RW-SS10-1000
350x200
V1029
200-RW-SS10-1001
V1003
V1004
200-RW-SS10-1002
TO TEMPERED WATER SYSTEM
350-RW-SS10-1003
V1005
V1006
V1007
V1009
V1008
350-RW-SS10-1004
V1012
350-FLW-SS10-1006
350-FLW-SS10-1005
V1013
V1029
WYE STRAINER (S1029)
WTP BYPASS PIPE (MULTI-TANK BYPASS)
PID I-104
UV DISINFECTED WATER TO WTP
FLOCCULATION TANKS
350-FLW-SS10-1007
350-FLW-SS10-1010
V1016
V1018
V1020
V1017
V1019
V1021
MIXER No. 1
MIXER No. 2
MIXER No. 3
L 103
L 104
L 105
FLOCCULATION TANK 1A
FLOCCULATION TANK 1B
FLOCCULATION TANK 1C
500-FLW-SS10
TYP. OF 4
350-FLW-SS10-2000
PID I-103
PRE-TREATMENT WATER TO FILTERS
FLOCCULATION TANKS
350-FLW-SS10-1012
350-FLW-SS10-1014
450x350
V1022
V1024
V1026
V1023
V1025
V1027
MIXER No. 4
MIXER No. 5
MIXER No. 6
L 106
L 107
L 108
FLOCCULATION TANK 2A
FLOCCULATION TANK 2B
FLOCCULATION TANK 2C
FLOCCULATION BYPASS LINE
350-FLW-SS10-1008
V1028
D
S
M

NOTES:

1. TEMPORARY WTP WILL UTILIZE ALL EQUIPMENT, CONTROLS, PIPING INCLUDED ON THIS DRAWING AND FRAWING PD-I-10 AND PID-I-11
2. UV OUTLET FLOW VALVES LIMITED 50% OPEN MAX.
3. CCN#30
4. RECIRC LINE IS TIED IN AT THIS POINT.

FCV 1001
1.2 ML/day - 10ML/day
MODULATING CONTROL
Head Loss Across Valve,
5.8m-0.5m

FCV 1009
1.2 ML/day - 10ML/day
ON/OFF CONTROL

FCV 1012
1.2 ML/day - 10ML/day
ON/OFF CONTROL

IS	RE	DATE	DESCRIPTION
1	-	2022-03-28	FOR INFORMATION ONLY

SEAL:
FOR INFORMATION ONLY

CLIENT:
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Iqaluit
CITY OF IQALUIT
CLIENT REF. #:

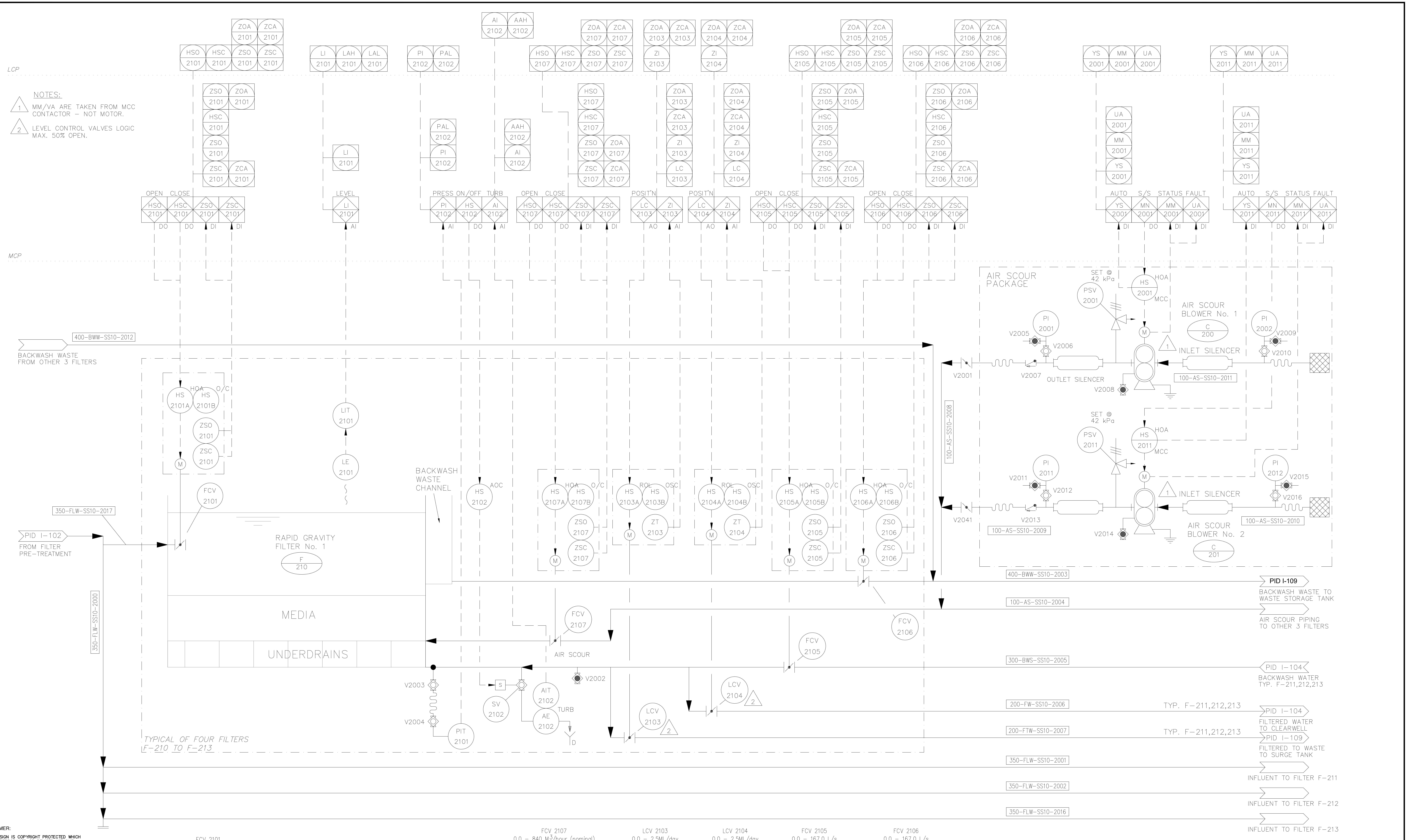
PROJECT:
IQALUIT
WATER TREATMENT PLANT
PROJECT NO: 211-12487-00
DATE: 2021/11/23

wsp
1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
WWW.WSP.COM

ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - PRETREATMENT
SHEET NUMBER: I-102

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: INSTRUMENTATION
ISSUE: FOR INFORMATION ONLY
2022/03/28
REV #: -



NOTES:

1. MM/VA ARE TAKEN FROM MCC CONTACTOR – NOT MOTOR.
2. LEVEL CONTROL VALVES LOGIC MAX. 50% OPEN.

FCV 2101
0.0 ML/day – 2.5ML/day
ON/OFF CONTROL

FCV 2107
0.0 – 840 M^3/hour (nominal)
ON/OFF CONTROL

LCV 2103
0.0 – 2.5ML/day
MODULATING CONTROL
Head Loss Across Valve,
0.3m to 3.0m

LCV 2104
0.0 – 2.5ML/day
MODULATING CONTROL
Head Loss Across Valve,
0.3m to 3.0m

FCV 2105
0.0 – 167.0 L/s
ON/OFF CONTROL

FCV 2106
0.0 – 167.0 L/s
ON/OFF CONTROL

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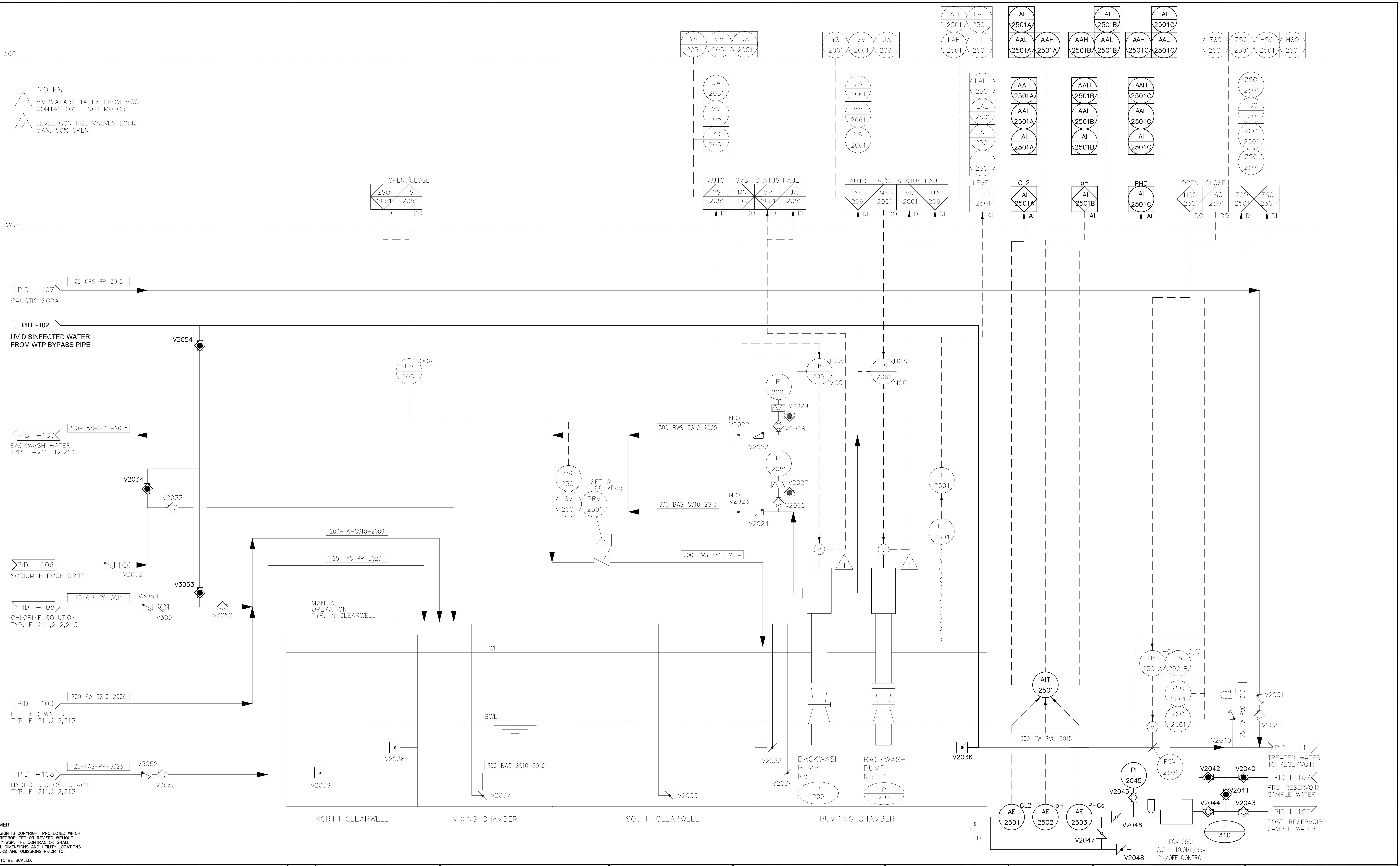
ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - FILTRATION SYSTEM

SHEET NUMBER: I-103

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: INSTRUMENTATION
ISSUE: FOR INFORMATION ONLY
2022/03/28
REV #: -



NOTES:

1. MM/VA ARE TAKEN FROM MCC CONTACTOR - NOT MOTOR.
2. LEVEL CONTROL VALVES LOGIC MAX. 50% OPEN.

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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - BACKWASH SUPPLY
SHEET NUMBER: I-104

DESIGNED BY: IM / CG / JRB
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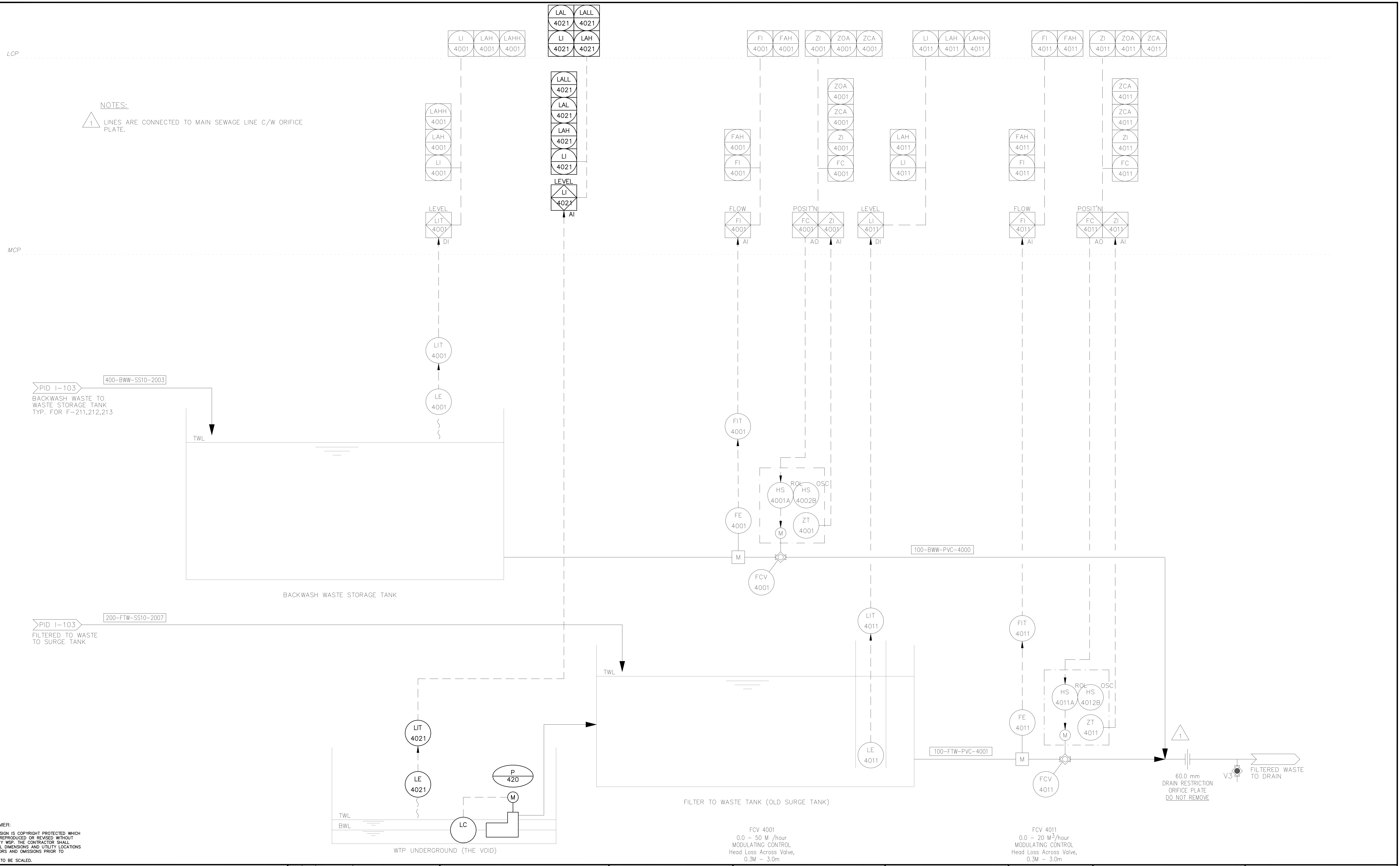

NOTES:

1. LINES ARE CONNECTED TO MAIN SEWAGE LINE C/W ORIFICE PLATE.

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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - BACKWASH AND
FILTER-TO-WASTE SYSTEMS

SHEET NUMBER: I-105

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
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LCP
MCP
UA 3041
UA 3031
UA 3061
UA 3051
FAULT
S/S
FLOW
UA 3041
MN 3041
FC 1001E
DI
DO
AO
UA 3031
MN 3031
FC 1001D
UA 3061
MN 3061
FC 1001G
UA 3051
MN 3051
FC 1001F
PID I-107
CAUSTIC SODA DILUTION FROM SERVICE WATER SYSTEM
CAUSTIC SODA DOSING SYSTEM
PSV 3031
SET @ 700 kPa
25-OPS-PP-3014
CALIBRATION COLUMN
V3013
PI 3031
V3023
V3022
PULSATION DAMPER
V3020
M
V3012
V3014
25-OPS-PP-3012
V3024
FS
V3021
P 303
V3019
FLUSHING CONNECTION
PSV 3041
SET @ 700 kPa
CHANNEL_ID
25-OPS-PP-3017
SAMPLE PORT
25-OPS-PP-3016
PI 3041
V3016
V3017
25-OPS-PP-3013
V3015
V3018
P 304
CAUSTIC SODA DRUMS
25-OPS-PP-3015
PID I-104
CAUSTIC SODA SOLUTION TO TREATED WATER RESERVOIR
HYDRO FLUOROSILICIC ACID DOSING SYSTEM
PSV 3051
SET @ 700 kPa
25-FAS-PP-3020
CALIBRATION COLUMN
PI 3051
V3037
V3036
V3026
V3025
V3028
25-FAS-PP-3018
V3035
V3027
P 305
SET @ 700 kPa
PSV 3061
25-FAS-PP-3019
25-FAS-PP-3022
FLUSHING CONNECTION
25-FAS-PP-3021
PI 3061
V3030
PULSATION DAMPER
V3031
V3034
FLUOROSILICIC ACID DRUMS
V3029
V3032
25-FAS-PP-3023
PID I-104
HYDROFLUOROSILICIC ACID TO MIXING CHAMBER
V3033
SAMPLE PORT
P 306

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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - CAUSTIC SODA AND HYDROFLOUOROSILICIC SUPPLY

SHEET NUMBER: I-106

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
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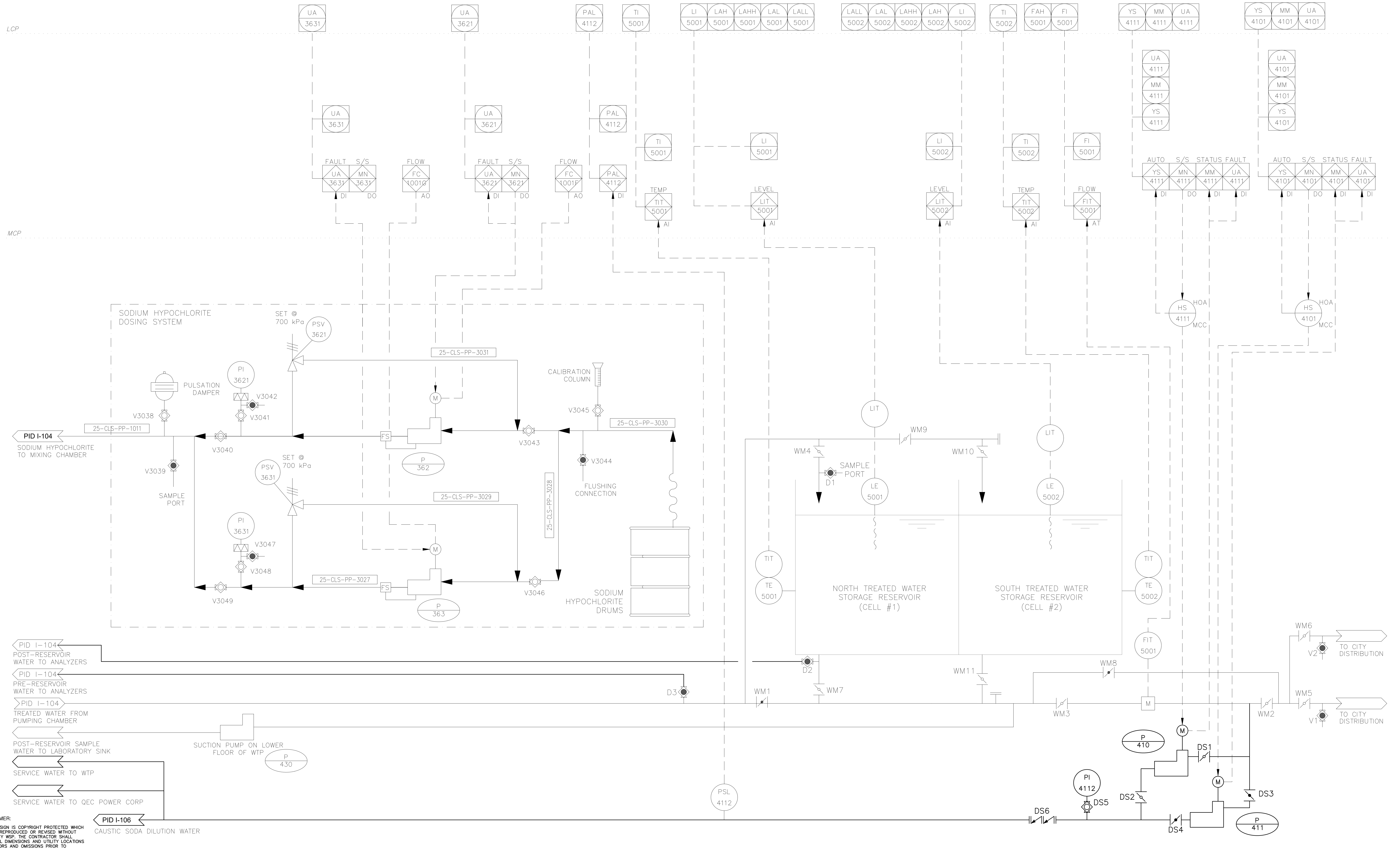

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ORIGINAL SCALE: AS NOTED

TITLE:
P&ID - SODIUM HYPOCHLORITE AND DOMESTIC WATER SYSTEM

SHEET NUMBER: I-107

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
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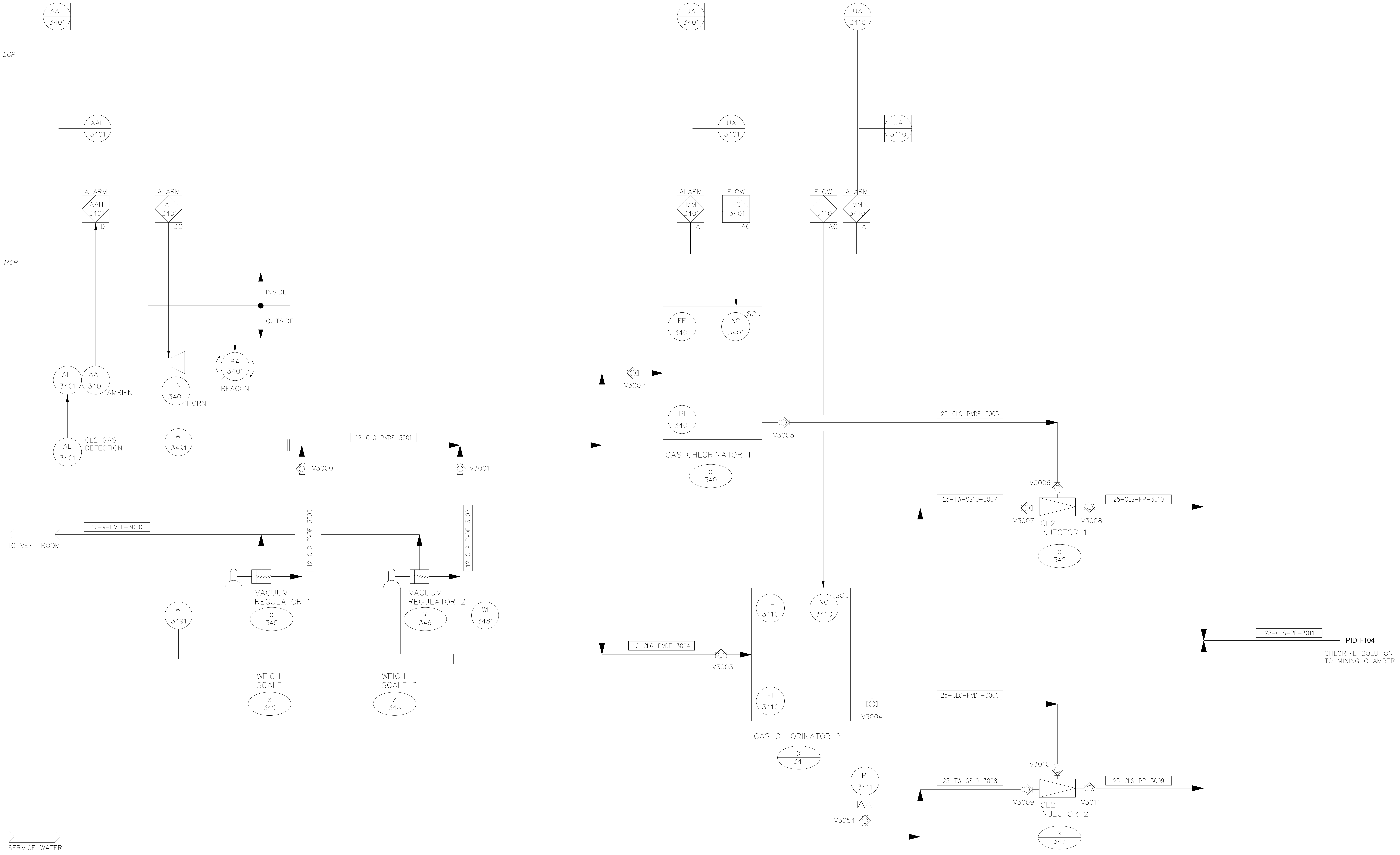

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ORIGINAL SCALE:
AS NOTED

TITLE:
P&ID - CHLORINE SOLUTION SUPPLY

SHEET NUMBER:
I-108

DESIGNED BY:
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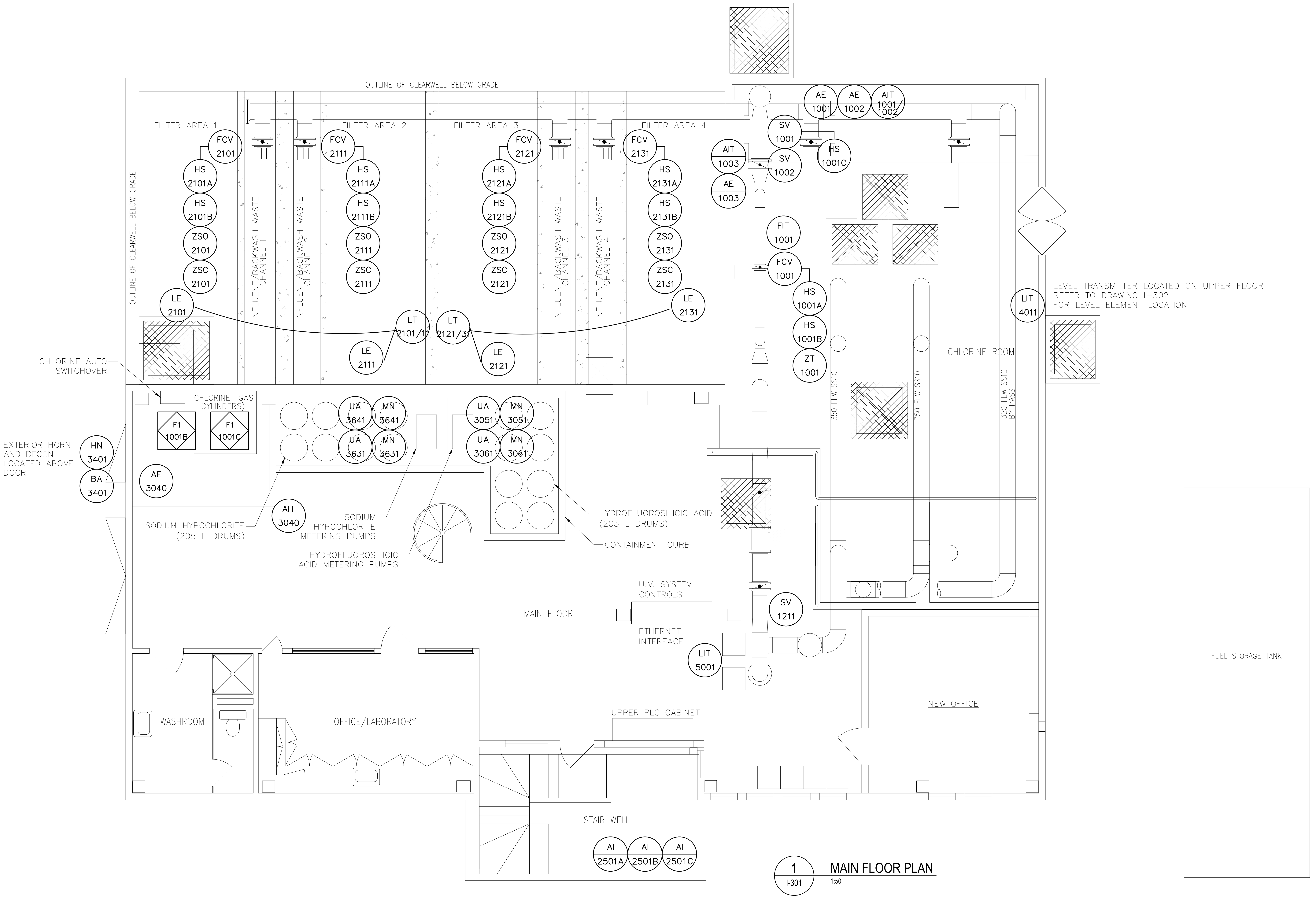

1 I-301 MAIN FLOOR PLAN 1:50

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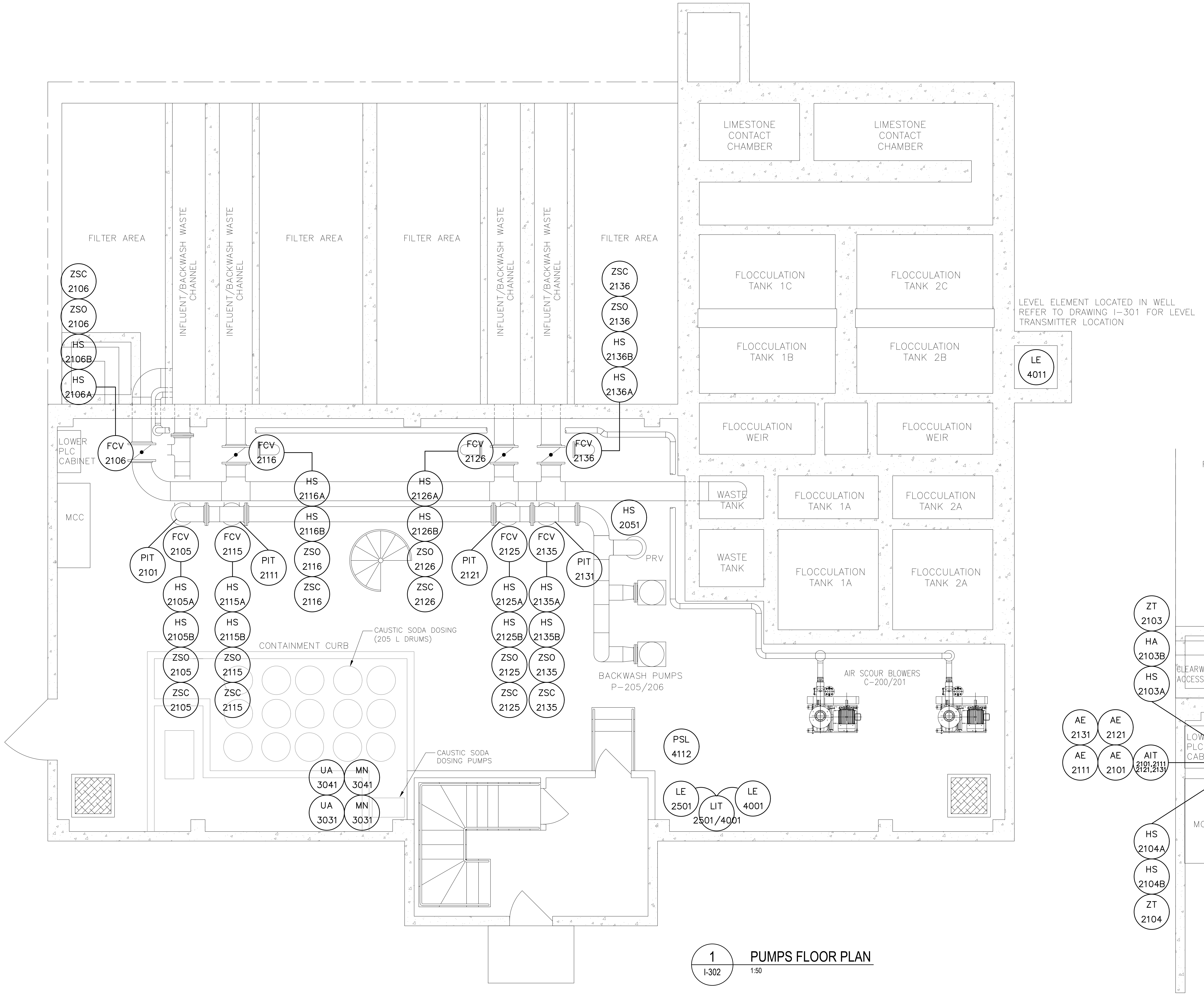
ORIGINAL SCALE: AS NOTED

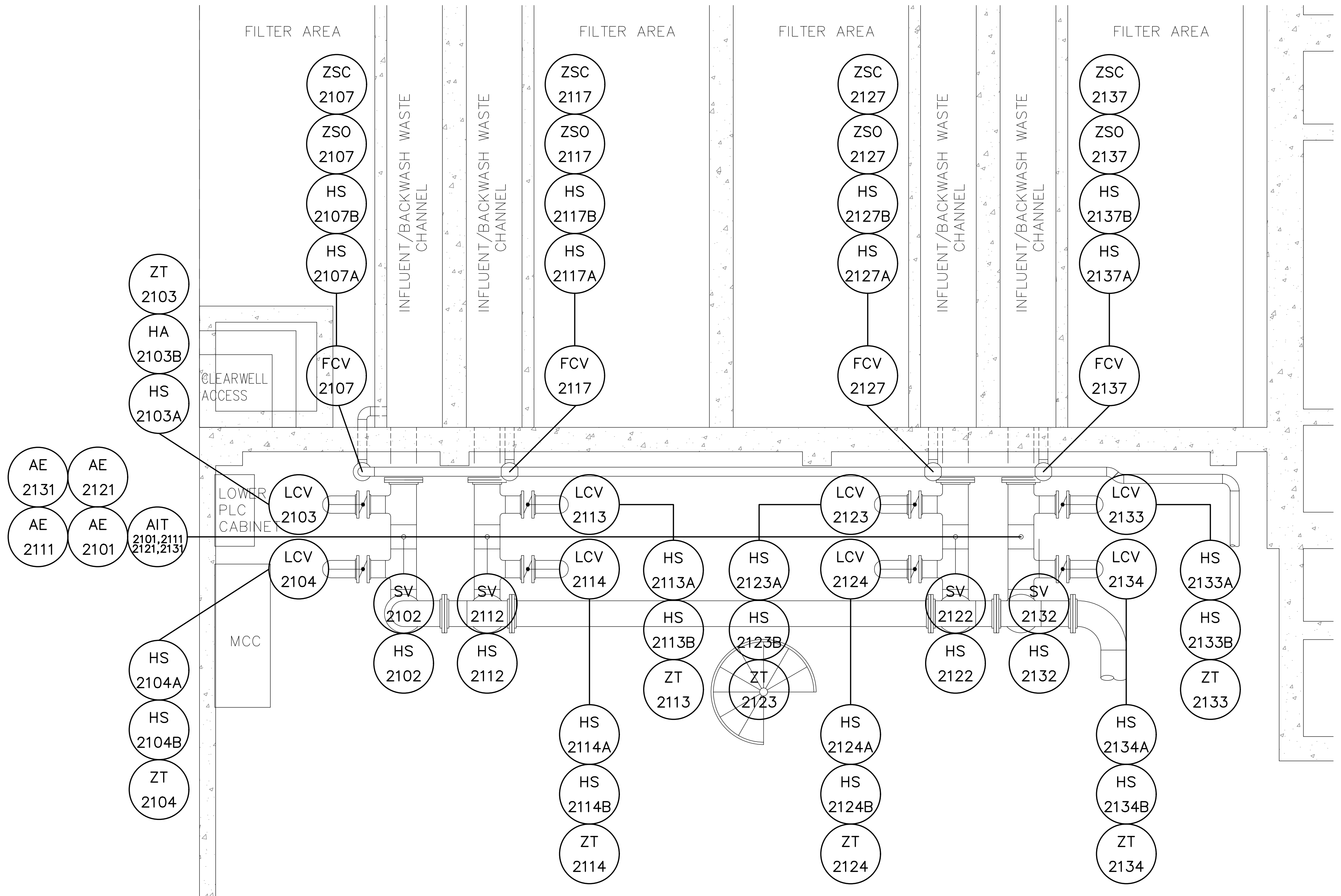
TITLE:
FILTERS FLOOR
DEVICE LOCATIONS

SHEET NUMBER: I-301

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
CHECKED BY: CG / JRB
DISCIPLINE: INSTRUMENTATION
ISSUE: FOR INFORMATION ONLY 2022/03/28
REV #: -



1 PUMPS FLOOR PLAN
I-302
1:50



2 PARTIAL PUMPS FLOOR PLAN
I-302
1:50

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ORIGINAL SCALE:
AS NOTED

TITLE:
PUMPS FLOOR
DEVICE LOCATION

SHEET NUMBER:
I-302

DESIGNED BY:
IM / CG / JRB
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IM
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CG / JRB
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REV #
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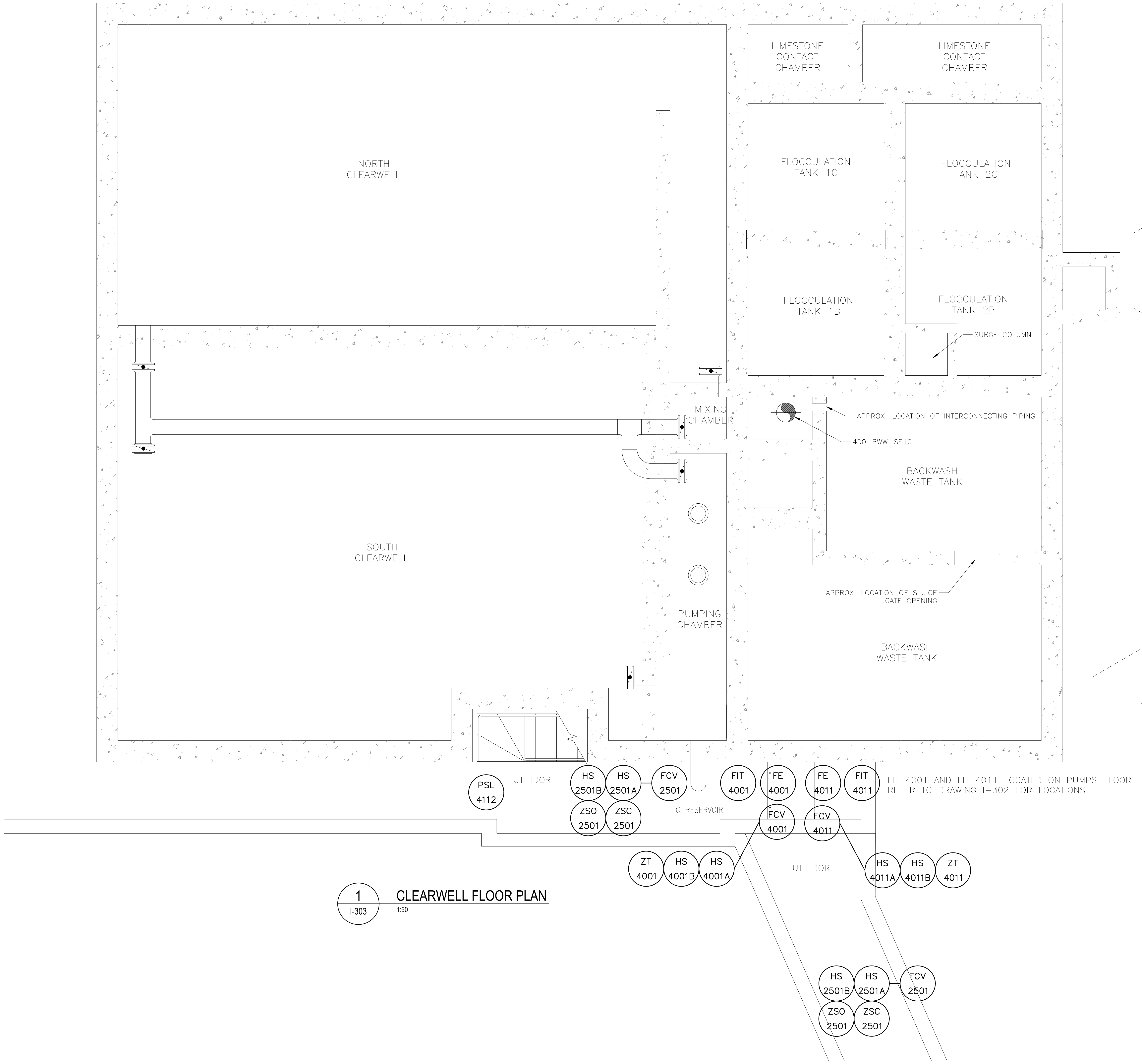
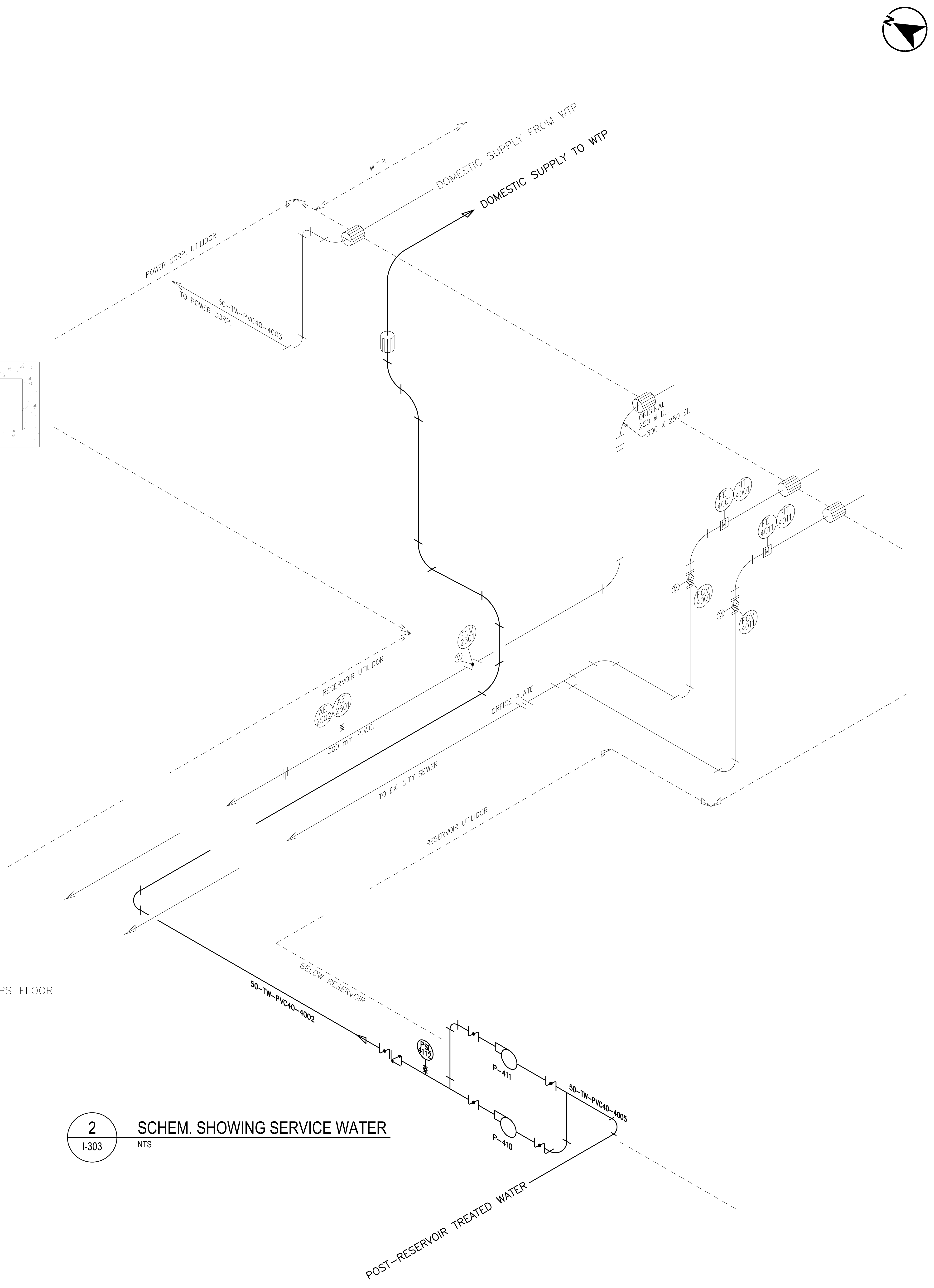


1 / I-303 CLEARWELL FLOOR PLAN

1:50



2 / I-303 SCHEM. SHOWING SERVICE WATER

NTS

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CANADA R3T 6B8
PHONE: 204-477-6650 FAX : 204-474-2864
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ORIGINAL SCALE: AS NOTED

TITLE:
CLEARWELL FLOOR AND WTP UNDERGROUND DEVICE LOCATIONS

SHEET NUMBER: I-303

DESIGNED BY: IM / CG / JRB
DRAWN BY: IM
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2022/03/28
REV #: -

Appendix A

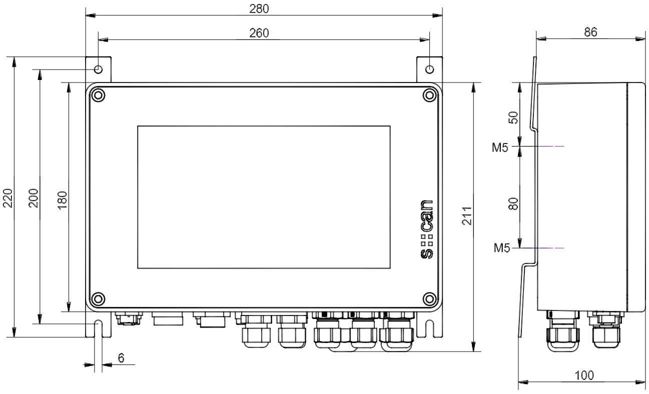
S::CAN Online Monitoring Device

CITY OF IQALUIT – WATER
TREATMENT PLANT - HEATING
SYSTEMS UPGRADE
Project No. 201-09487-01 – PCR 001
City of Iqaluit

WSP
March 2022

con::cube V3

- s::can high-end IoT (Internet of Things) terminal based on an industrial PC, IP65
- widescreen color graphical display (9”) and touch screen
- highly intuitive use, informative visualization & easy operation: time series, optical spectra and all events in clear text
- sensor and station management of up to 64 parameters: automatic cleaning, data logging, sample & calibration including history and multipoint calibration, sensor function check, user management and easy data transfer via USB-stick
- low power operation with less than 3 watts (@ 15 min. measuring interval): wide range AC and DC variants available
- IoT (Internet of Things) and M2M (Machine to Machine) connectivity: 100 Mb/s Ethernet, 300 Mb/s WLAN and optional worldwide WCDMA 4G interface, remote control (http) and data transfer into “Cloud” via FTP, SSH and TML
- process interface to SCADA via Modbus RTU/TCP, SDI-12, Profibus DP, analog 0/4-20 mA and relay outputs (state)
- integration of third-party sensors via analog 0/4-20 mA and digital (solid state) inputs, Modbus RTU/TCP
- easily extendable & all moni::tool features available: 8 slots to customize I/Os, moni::tool software pre-installed, additional software features like online data validation and event detection optional



standard accessories

part number	article name
S-11-04-moni	moni::tool - Basic s::can monitoring station software for 4 parameters
D-315-out-relay	4 digital outputs (output module), provides 4 configurable relay contacts 1A
D-303-LX	Linux Application Licence (obligatory to D-330)

technical specification

integration of	1 x s::can spectrometer probe and 4 x s::can sensors or ISE probes
display	color-display 9" TFT
function indicator	4 x LED
operation via	integrated touch-screen (optional) Ethernet - Browser or VNC WIFI - Browser or VNC USB (keyboard, mouse) 3G modem (optional)
operating system	Linux
main memory	2 GB RAM
onboard memory	16 GB
interface to s::can spectrometric probes	M12 RSTS 8Y (IP67), RS485, Ethernet
interface to s::can sensors	4 x sys plug, RS485
interface to third party sensors	Modbus RTU/TCP, analog inputs
network connection	802.11n a/b/g WIFI 300Mb/s Ethernet LAN 1 Gb/s worldwide 3G HSPA+
interface to SCADA	Modbus RTU/TCP, Profibus DP (optional), SDI-12 (optional), analog outputs
data transfer	via SSH, FTP, TML (XML) and USB stick
remote control	via http

power supply	D-330-230: 100 ... 240 VAC D-330-024: 10 ... 36 VDC
power consumption (typical)	1.5 W (in sleep mode) 10 W (no analogue ports) 30 W (fully equipped)
power consumption (max.)	20 W (no analogue ports) 60 W (fully equipped)
grounding	<0.5 Ohm to process media
analog outputs	up to 8x2 x 0/4-20 mA
analog inputs	up to 8x2 x 0/4-20 mA
outputs for automatic cleaning	2
digital inputs	up to 8x2 x 14 VDC
relay outputs	4 x 2A (500 VAC)
system error relay	1 x 2A (500 VAC)
dimensions (width x height x depth)	280 x 209 x 85 mm
housing material	aluminium alloy, powder coated
weight (min.)	4 kg
operating temperature	-20 ... 50 °C
storage temperature	-20 ... 60 °C
storage humidity	5 ... 90 %
ingress protection class	IP65
conformity - EMC	EN 61326-1
conformity - safety	IEC/EN/UL/CSA 61010-1 IEC/EN/UL/CSA 61010-2-201 IEC/EN 60529
part number 24V	D-330-024
part number 230V	D-330-230

recommended accessories

part number	article name
C-31-eu	Optional 2 m power cable
C-31-us	Optional 2 m power cable
C-32-MIL	Cable to connect a V2 spectrometer probe to a con::cube V3 terminal
D-315-3GLX	Worldwide 3D internet connection via Quad-band HSPA (up to 5.7 Mbps/21 Mbps)
D-315-in-mA	2 analogue inputs (input module), provides 2 analogue inputs (4-20mA) for integration of 3rd party readings
D-315-in-relay	2 digital inputs (input module), provides 2 digital IN (5-24V) for integration of 3rd party readings
D-315-out-mA	2 analogue outputs (output module), provides data transfer to PLC systems
D-315-out-Profibus	provides Profibus DPV0 for data transfer to PLC systems
D-315-out-SDI12	SDI 12 (output module), provides SDI 12 for data transfer to PLC systems
D-315-antenna-pro	External, high range antenna option for con::cube, incl. 10 m extension cable
D-315-antenna-plug	Internal antenna adapter cable and connector, option for con::cube
S-11-autosampler	moni::tool - auto sampler feature
S-11-basic-PLC	moni::tool - basic PLC functionality (time control, pulsing, custom bits)
S-11-camera	moni::tool - camera input
S-11-data-export	moni::tool - automatic data transfer (via SSH, FTP, TML)
S-11-free-formula	moni::tool - configureable mathematic formula
S-11-SMS	moni::tool - SMS notification
S-14-vali	vali::tool - s::can data validation software
S-15-ana	ana::tool - s::can event detection software
F-51	weather shield for s::can terminals
S-20-MVA	Complete license of all moni::tool modules, vali::tool and ana::tool

micro::station

BTX
TOC
DOC
UV254
NO3
NO2
NH4
K+
TCl
FCl
F-
TSS
FTU/NTU
Color
pH
ORP
Conductivity
Temperature
O2
O3
H2S
AOC
Fingerprints
Alarms

The fully modular micro::station combines s::can instruments to a compact and versatile system. It presents a complete solution, as the user only has to connect water supply and -discharge (“plug & measure”) in order to receive a previously unheard variety of immediately available information and parameters at no extra cost.

The s::can micro::station is designed for OnLine monitoring of water quality parameters in clean media, such as drinking water. The required components - spectro::lyser, s::can probes and controller - are factory assembled with all required flow cells, mounting fittings and pipework on a compact panel.

micro::station - the s::can solution for water analysis - compact and easy like never before.

1 Terminal

con::cube terminal with moni::tool software for data acquisition, data display and station control

2 Spectrometer probe

All s::can spectrometer probes are multi-parameter instruments that can measure a variety of water quality parameters

Possible parameters:
AOC, BOD, BTX, COD, color, DOC, FTU/NTU, H_2S, NO_2-N, NO_3-N, O_3, TOC, TSS, UV254, fingerprints and spectral alarms, temperature and pressure

3 Flow cell for spectrometer probe

Including auto brush cleaning device to provide cleaning of the optical measuring windows

4 System tubing

Included in panel assembly; Material PU, inside diameter 6 mm, outside diameter 8 mm

5 Flow detector

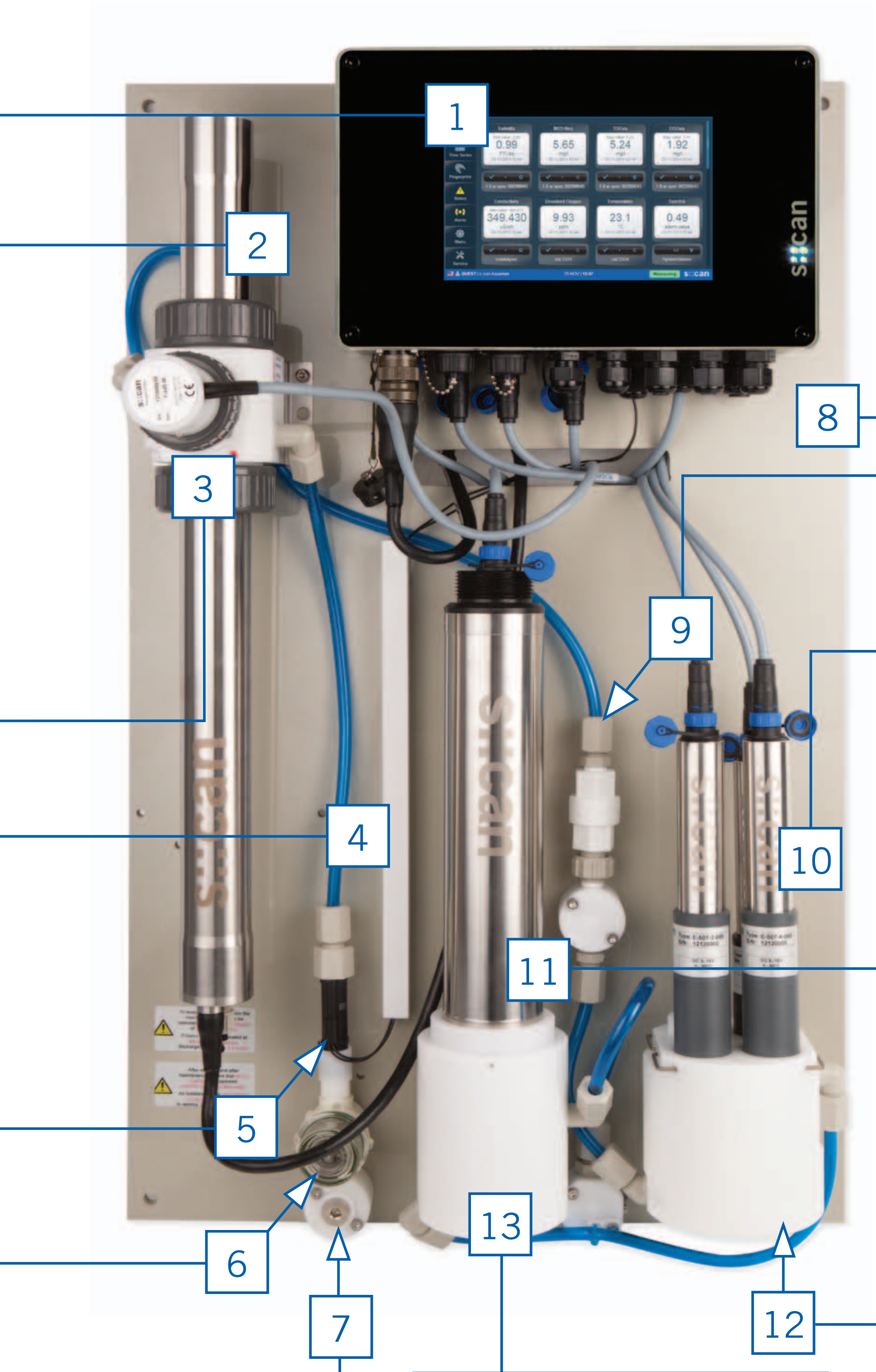
The flow detector is set to give an alarm if the flow rate decreases below a critical value

6 Inlet strainer

The inlet strainer ascertains that no coarse material enters the micro::station. With screw cap for sieve removal/cleaning

7 Pressure transmitter (optional)

Mounting position for pressure transmitter



8 Main panel

Material: PP
Weight of the station (fully equipped): 20 kg (+/- 1 kg)

9 Flow restrictor unit

For automatic flow restriction and back-flow prevention in by-pass

10 Physical probes

Up to four s::can physical probes can be installed in one flow cell

Possible parameters:
conductivity, FCl, pH, PSU, redox, TCl and temperature

11 Physical probe or ISE probe

Place for oxi::lyser, soli::lyser or s::can ISE probe (e.g. ammo::lyser)

Possible parameters:
F-, K+, NH_4-N, NO_3-N, O_2, pH and temperature

12 Flow cell for physical probes

Combined flow cell for up to four s::can physical probes. Provides quick connect/disconnect design by safety pins to reduce offline time during sensor maintenance

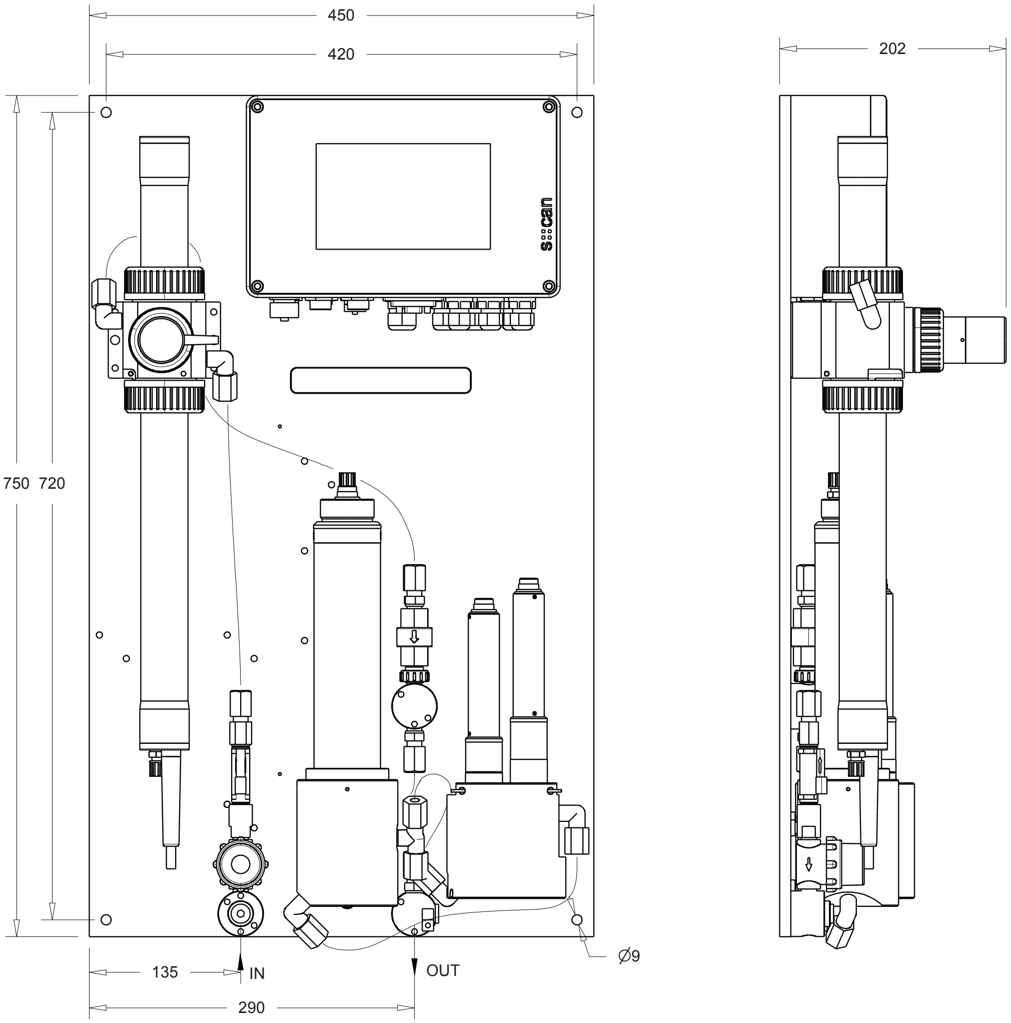
13 Flow cell for ISE probe

Flow cell for one s::can ISE probe

micro::station

Options for s::can micro::station

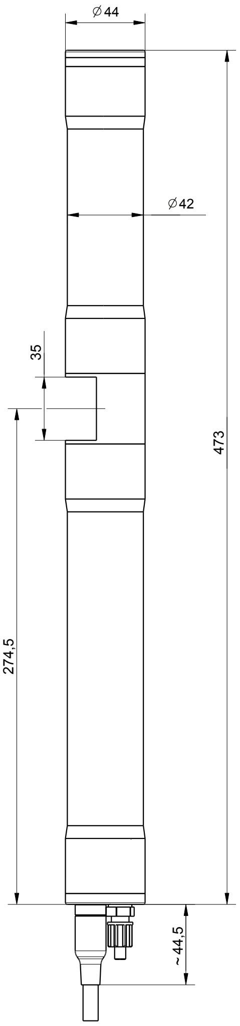
1 Terminal	con::cube con::lyte eco con::lyte pro
2 Spectrometer probe	spectro::lyser carbo::lyser color::lyser multi::lyser nitro::lyser ozo::lyser uv::lyser
3 Flow cell for spectrometer probe	flow-cell (by-pass fitting), POM-C (for pathlengths from 1 mm to 35 mm) flow-cell (by-pass fitting), POM-C (for pathlength 100 mm) flow-cell (by-pass fitting) autobrush, POM-C (for pathlength 35 mm) flow-cell (by-pass fitting) autobrush, POM-C (for pathlength 100 mm)
4 System tubing	inside diameter 6 mm, outside diameter 8 mm
5 Flow detector	flow detector
6 Inlet strainer	inlet strainer
7 Pressure transmitter	pressure transmitter for micro::station (optional)
8 Main panel	system panel micro::station US system panel micro::station EU system panel micro::station add-on module EU system panel micro::station add-on module US
9 Flow restrictor unit	automatic flow restrictor unit flow adjustment valve
10 Physical probes	pH::lyser redo::lyser condu::lyser chlori::lyser
11 Physical probe or ISE probe	ammo::lyser eco ammo::lyser pro fluor::lyser oxi::lyser soli::lyser
12 Flow cell for physical probes	flow-cell for up to 4 s::can physical probes, POM-C s::can physical probe flow-cell (by-pass setup), POM-C
13 Flow cell for ISE probe or physical probe	ammo::lyser flow-cell (by-pass setup), POM-C oxi::lyser flow-cell


450
420
202
750
720
s::can
135
IN
OUT
290
Ø9

spectro::lyser V3

spectro::lyser® UV-Vis monitors depending on the application an individual selection of: TSS, TS, turbidity, color, TOC, DOC, BOD, COD, NO_3-N, NO_3, HS-, O_3, CLD, UV254, fingerprints, spectral alarms and temperature

- measuring principle: UV-Vis spectrometry over the total range (190-750 nm)
- web server on board - IoT enabled, no user software is needed to configure the probe
- communicates directly with your mobile device via WLAN
- 8 GB onboard memory - capacity for logging data for many years
- improved optical performance - revolutionary precision
- fast measurement interval - every 10 seconds possible
- extremely power efficient - sleep mode for low energy consumption
- multiparameter probe with 1 mm, 5 mm or 35 mm optical path length, ideal for waste water, surface water and drinking water
- long term stable and maintenance free in operation
- factory precalibrated, local multi-point calibration possible
- automatic cleaning with compressed air or brush



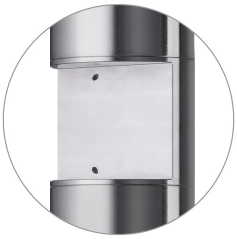
recommended accessories

part number	article name
D-330-xxx	con::cube V3
B-33-012	con::nect V3
B-32-xxx	s::can compressor
B-44 B-44-2	cleaning valve
C-32-V3	Adapter cable to connect a V3 spectrometer (M12) to V2 Terminal (MIL Plug)
F-110-V3	carrier s::can spectrometer V3 & V2 probe, 45°
F-120-V3	carrier s::can spectrometer V3 & V2 probe, vertical attachment
F-446-V3	flow cell AutoBrush, POM-C (for spectrometer V3 & V2 pathlength 35 mm)
S-11-xx-moni	moni::tool Software

technical specification	
measuring principle	UV-Vis spectrometry 190 - 750 nm
measuring principle detail	xenon flash lamp, pixel array detector
measurement interval	10 sec (configurable, depending on application)
automatic compensation instrument	real dual beam measurement for compensation and detailed diagnostics
automatic compensation cross sensitivities	turbidity / solids / organic substances
precalibrated ex-works	all parameters
accuracy standard solution (>1 mg/l)	NO_3-N: +/- 2% +1/OPL[mg/l]* COD-KHP: +/-2% +10/OPL[mg/l]* (* OPL ... optical pathlength in mm)
access to raw signals	access to spectral information
reference standard	distilled water
onboard memory	8 GB
integrated temperature sensor	0 ... 45 °C
resolution temperature sensor	0.1 °C
integration via	con::cube V3 con::nect V3 con::lyte V5 (D-320-pro2) and adapter cable (C-32-V3)
power supply	10 ... 18 VDC
power consumption (typical)	3 W
power consumption (sleep model)	60 mW
power consumption (max.)	20 W
interface to s::can terminals	M12 RSTS 8Y (IP67), RS485, Ethernet
interface to third party terminals	con::nect V3 incl. Modbus RTU, REST API, Modbus TCP/IP
digital interface (for cleaning devices)	1 digital in/out 1 digital out
network connection	100Base-T Ethernet, WLAN
status information	RGB LED ring
internal sensors	supply voltage sensor, tilt sensor, rotation sensor
cable length	1 m fixed cable (-010) or 7.5 m fixed cable (-075) or 15 m fixed cable (-150)
cable type	PU jacket
housing material	stainless steel 1.4404
window material	optical path length 5 and 1 mm: sapphire optical path length 35 mm: fused silica (UV-grade)
weight (min.)	3.4 kg (incl. cable)
dimensions (Ø x l)	optical path length 35 mm: 44 x 473 mm / 517.5 mm optical path length 5 mm: 44 x 457 mm / 501.5 mm optical path length 1 mm: 44 x 453 mm / 497.5 mm
operating temperature	0 ... 45 °C
operating pressure	0 ... 3 bar
high pressure specification (optional)	10 bar
installation / mounting	submersed or in a flow cell
flow velocity	3 m/s (max.)
mechanical stability	30 Nm
ingress protection class	IP68
automatic cleaning	media: compressed air or autobrush permissible pressure: 3 ... 6 bar
storage temperature	-10 ... 65 °C
conformity - environmental testing	EN 60721-3
conformity - EMC	EN 61326-1
conformity - RoHS 2	EN 50581
standard warranty	2 years
extended warranty (optional)	3 years

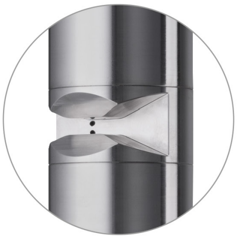
The perfect accuracy for every application

The spectro::lyser V3 is available with three different optical path lengths.



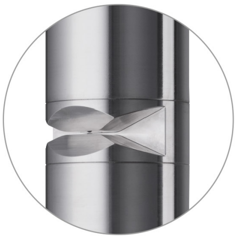
drinking water:

35 mm



surface water:

5 mm

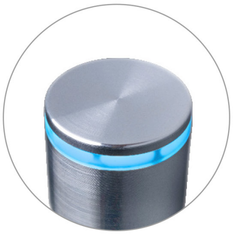


waste water:

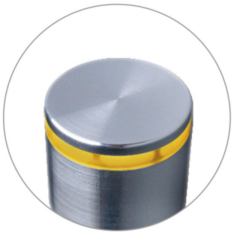
1 mm

Optical information ring

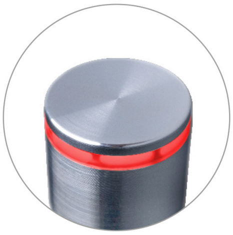
The color of the optical information ring signals the state of the sensor.



everything
okay



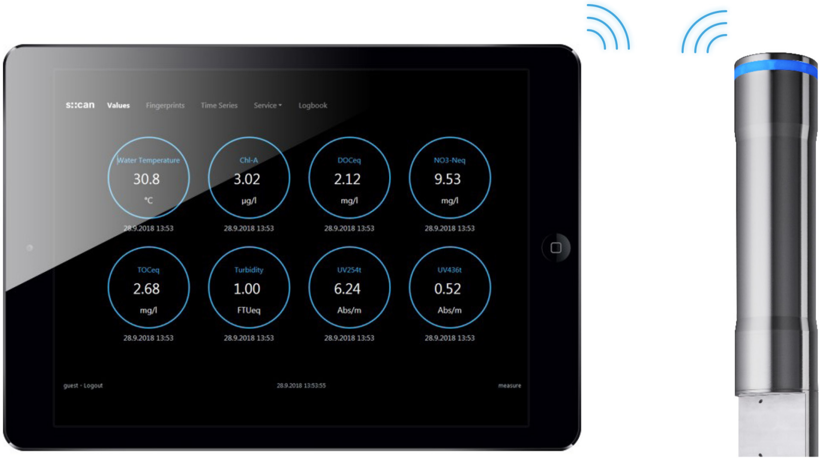
sensor in
service mode



parameter or device
error

Wireless communication - Io::Tool

Intuitive web interface for data visualization and configuration of the spectro::lyser V3.



Water Temperature 30.8 °C 28.9.2018 13:53

Chl-A 3.02 µg/l 28.9.2018 13:53

DOCeq 2.12 mg/l 28.9.2018 13:53

NO3-Neq 9.53 mg/l 28.9.2018 13:53

TOCeq 2.68 mg/l 28.9.2018 13:53

Turbidity 1.00 FTUeq 28.9.2018 13:53

UV254t 6.24 Abs/m 28.9.2018 13:53

UV436t 0.52 Abs/m 28.9.2018 13:53

guest - Logout

28.9.2018 13:53:55

measure

ground water

		parameter										
		turbidity [NTU/FTU]	color (app) [Hazen]	color (tru) [Hazen]	TOC [mg/l]	DOC [mg/l]	NO_3 [mg/l]	UV254 [Abs/m]	UV254 f [Abs/m]	BTX [mg/l]	H_2S [mg/l]	part number
spectro::lyser™ V3 (35 mm OPL, UV-Vis)	min.	0	0	0	0	0	0	0	0	0	0	SP3-1-35-NO-xxx
	max.	170	500	300	20	15	88	71	60	51	5	

surface water

		parameter															
		TSS [mg/l]	turbidity [NTU/FTU]	color (app) [Hazen]	color (tru) [Hazen]	TOC [mg/l]	DOC [mg/l]	BOD [mg/l]	COD [mg/l]	COD f [mg/l]	NO_3 [mg/l]	HS- [mg/l]	Chl-a [µg/l]	UV254 [Abs/m]	UV254 f [Abs/m]	BTX [mg/l]	part number
spectro::lyser™ V3 (35 mm OPL, UV-Vis)	min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	SP3-1-35-NO-xxx
	max.	170	200	500	300	30	25	42	71	42	66	5	100	71	60	51	
spectro::lyser™ V3 (5 mm OPL, UV-Vis)	min.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	SP3-1-05-NO-xxx
	max.	1200	1400	3500	2100	210	180	300	500	300	460	35	700	500	420	360	

drinking water

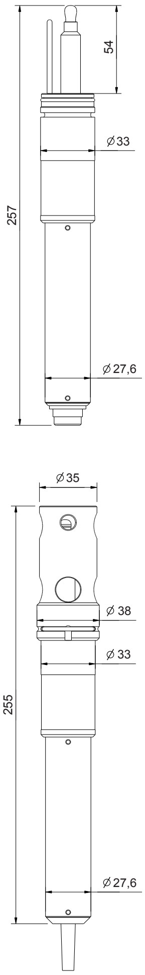
		parameter											
		turbidity [NTU/FTU]	color (app) [Hazen]	color (tru) [Hazen]	TOC [mg/l]	DOC [mg/l]	NO_3 [mg/l]	chloramine [mg/l]	O_3 [mg/l]	CLD [mg/l]	UV254 [Abs/m]	UV254 f [Abs/m]	part number
spectro::lyser™ V3 (35 mm OPL, UV-Vis)	min.	0	0	0	0	0	0	0	0	0	0	0	SP3-1-35-NO-xxx
	max.	170	500	300	22	17	88	42	25	22	71	60	

pH::lyser

pH::lyser eco monitors pH & temperature

pH::lyser pro: high temperature range

- s::can plug & measure
- measuring principle: unique, non-porous / non-leaking combined reference electrode for technically unrivalled and consistent pH performance
- multiparameter sensor
- ideal for surface water, ground water, drinking water and waste water
- long term stable and maintenance free in operation
- factory precalibrated
- mounting and measurement directly in the media (InSitu) or in a flow cell
- operation via s::can terminals & s::can software
- optional: automatic cleaning with compressed air
- plug connection or fixed cable



recommended accessories

part number	article name
D-330-xxx	con::cube V3
D-320-xxx	con::lyte
C-1-010-sensor	1 m connection cable for s::can physical and ISE probes
F-12-sensor	carrier s::can physical probes
F-45-four	flow cell for four s::can physical probes
F-46-four-iscan	i::scan flow cell for up to 3 additional s::can probes
F-45-sensor	flow cell for s::can sensor
S-11-xx-moni	moni::tool Software

technical specification

measuring principle	potentiometric
measuring principle detail	combined, non-porous reference electrode
resolution	0.01 pH
accuracy (standard solution)	0.1 pH
automatic compensation instrument	temperature
response time (T90)	30 ... 0 sec.
integrated temperature sensor	0 ... 90 °C
integration via	con::cube con::lyte con::nect
power supply	9 ... 18 VDC
power consumption (typical)	0.8 W
power consumption (max.)	1 W
interface to s::can terminals	sys plug (IP67), RS485
cable length	7.5 m fixed cable (-075) or plug connection (-000)
cable type	PU jacket

housing material	stainless steel 1.4404/1.4401, POM-C or stainless steel 1.4404/1.4401, PVC (E-514-4-075)
weight (min.)	400 g
dimensions (Ø x l)	33 x 257 mm
operating pressure	0 ... 10 bar
installation / mounting	submersed or in a flow cell
process connection	quick connect
flow velocity	3 m/s (max.) 0.01 m/s (min.)
automatic cleaning	media: compressed air permissible pressure: 3 ... 6 bar
storage temperature (electrode)	-5 ... 30 °C
storage temperature (sensor)	-10 ... 60 °C
conformity - EMC	EN 61326-1
conformity - safety	EN 61010-1
operating temperature (eco)	0 ... 70 °C
operating temperature (pro)	0 ... 90 °C
protection class (-000)	IP67
protection class (-075)	IP68

measuring range

		parameter		
		pH [pH]	temperature [°C]	part number
pH::lyser eco (pH, temp)	min.	2	0	E-514-2-000 / -075
	max.	12	70	
pH::lyser pro (pH, temp)	min.	0	0	E-514-3-000 / -075
	max.	14	90	

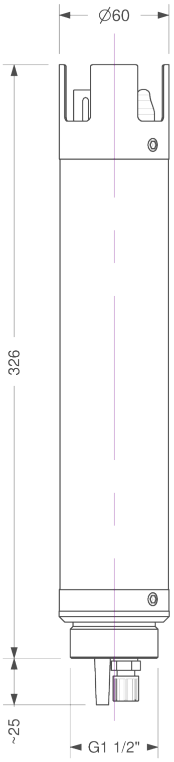
fluor::lyser II

fluor::lyser II monitors fluoride and temperature

- s::can plug & measure
- measuring principle: ISE (ionselective electrodes)
- no cross sensitivities in typical drinking water applications
- multiparameter probe
- long term stable, factory precalibrated
- automatic cleaning with compressed air
- easy and quick mounting and measurement directly in the media (InSitu) or in a flow cell (monitoring station)
- operation via s::can terminals & s::can software
- ideal for drinking water
- minimal maintenance
- plug connection or fixed cable

recommended accessories

part number	article name
B-44 B-44-2	cleaning valve
C-1-010-sensor	1 m connection cable for s::can physical and ISE probes
F-11-oxi-ammo	carrier oxi::lyser / soli::lyser / s::can ISE probes
F-45-ammo	flow cell for ammo::lyser™
F-45-process	process connection 1/4" G
D-330-xxx	con::cube V3
D-320-xxx	con::lyte



technical specification

measuring principle	ISE
measuring principle detail	F: ionophore membrane reference electrode
automatic compensation instrument	temperature
potential interfering ions	OH- (at >pH8), Al3+, Ca2+, Fe3+, Si4+
precalibrated ex-works	all parameters
integration via	con::cube con::lyte con::nect
power supply	10 ... 30 VDC
power consumption (typical)	0.72 W
interface to s::can terminals	sys plug (IP67), RS485
cable length	7.5 m fixed cable (-075) or plug connection (-000)
cable type	PU jacket
housing material	stainless steel 1.4571, POM-C
weight (min.)	2.7 kg
dimensions (Ø x l)	60 x 326 mm

operating temperature	0 ... 60 °C
installation / mounting	submersed or in a flow cell
process connection	G 1 1/2" outside
flow velocity	0.01 m/s (min.) 3 m/s (max.)
pH range	4.5 ... 7.5
ingress protection class	IP68
automatic cleaning	media: compressed air permissible pressure: 2 ... 4 bar
storage temperature	0 ... 60 °C
storage temperature (electrode)	2 ... 40 °C
storage temperature (sensor)	2 ... 40 °C
conformity - EMC	EN 50081-1 EN 50082-1 EN 60555-2 EN 60555-3
conformity - safety	EN 61010-1
protection class (-000)	IP67
protection class (-075)	IP68

measuring range

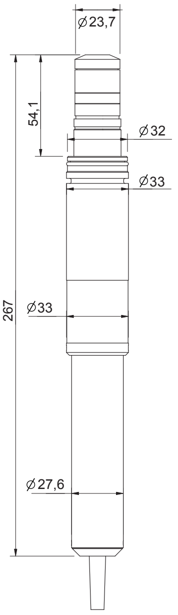
		parameter		
		F [mg/l]	temperature [°C]	part number
fluor::lyser II	min.	0.1	0	E-542-000 / -075
	max.	1000	60	

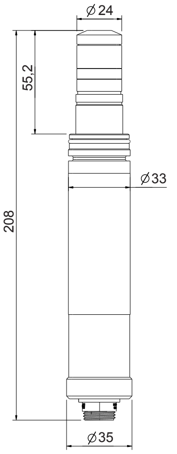
chlori::lyser

chlori::lyser monitors free chlorine (Cl2 + HOCl + OCl-) or total chlorine (free chlorine + combined chlorine)

- s::can plug & measure
- measuring principle: amperometric (membrane covered)
- ideal for drinking, pool and sea water
- long term stable and lowest maintenance in operation
- replacement of membrane only once a year
- readings stable even at high fluctuations of pH, temperature and flow
- compensates fluctuations of pH in an unmatched way pH range from 4 to 10 FCl; pH range from 4 to 12 TCl (<5% per pH between 6 and 10/12 pH, <1% at <6 pH)
- low cross sensitivity to many surfactants
- factory precalibrated
- mounting and measurement in a flow cell
- operation via s::can terminals & s::can software
- additionally also measures temperature

recommended accessories	
part number	**article name**
D-315-xxx	con::cube
S-11-xx-moni	moni::tool Software
F-48-sensor	s::can Sensor flow-cell (by-pass setup), PVC
F-45-four	flow cell for four s::can physical probes
F-12-sensor	carrier s::can physical probes
C-1-010-sensor	1 m connection cable for s::can physical and ISE probes





technical specification

measuring principle	amperometric
measuring principle detail	potentiostatic 3-electrode system
resolution	E-507-1 and E-507-3: 0.001 mg/l E-507-2 and E-507-4: 0.01 mg/l)
automatic compensation instrument	temperature
automatic compensation cross sensitivities	pH
response time	2 min.
power supply	9 ... 18 VDC
power consumption (typical)	0.43 W
power consumption (max.)	0.5 W
interface to s::can terminals	sys plug (IP67), RS485

housing material	PVC
weight (min.)	175 g
dimensions (Ø x l)	35 x 213 mm
operating temperature	5 ... 45 °C
storage temperature	5 ... 45 °C
operating pressure	0 ... 1 bar
installation / mounting	flow cell
process connection	quick connect
flow velocity	0.015 m/s (min.) 0.06 m/s (max.)
pH range	4 ... 10

drinking and pool water

		concentration ranges and sensor/probe type for this application		
		free chlorine [mg/l]	total chlorine [mg/l]	part number
chlori::lyser (FCl)	min.	0		E-507-1-000
	max.	2		
chlori::lyser (FCl)	min.	0		E-507-2-000
	max.	20		
chlori::lyser (TCl)	min.		0	E-507-3-000
	max.		2	
chlori::lyser (TCl)	min.		0	E-507-4-000
	max.		20	

Manual

con::cube D-330

January 2021 Release

S-453-M

Table of Contents

1 General

This manual contains, firstly, general information (chapter 1) and safety guidelines (chapter 2). The next chapter (chapter 3) provides a technical description of the s::can product itself as well as information regarding transport and storage of the product. In further chapters the installation (chapter 4) and the initial startup (chapter 5) are explained. Furthermore information regarding calibration of the device (chapter 6), data management (chapter 7), how to perform a functional check (chapter 8) and maintenance (chapter 9) can be found in this manual. Information regarding troubleshooting (chapter 10), the available accessories (chapter 11) and the technical specifications (chapter 12) complete the document.

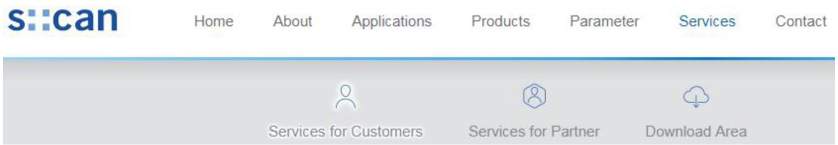
Each term in this document that is marked italic and underlined, can be found on the display of your controller for operation or as lettering on your s::can product.

In spite of careful elaboration this manual may contain errors or incompletion. s::can does not assume liability for errors or loss of data due to such faults in the manual. The original manual is published in English and German by s::can. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into third languages.

This manual and all information and figures contained therein are copyrighted. All rights (publishing, reproduction, printing, translation, storage) are reserved by s::can GmbH. Each reproduction or utilisation outside the permitted limits of the copyright law is not allowed without previous written consent from s::can GmbH. The reproduction of product names, registered trade names, designation of goods etc. in this manual does not imply that these names can be used freely by everyone; often these are registered trade marks, even if they are not marked as such.

This manual, at the time of its publication (see release date printed on the top of this document), concerns the s::can products listed in chapter 3. Information and technical specifications regarding these items in s::can manuals from earlier release dates are herewith replaced by this manual.

The electronic version (pdf-document) of this manual is available on the s::can Customer Portal (Services for Customer) of the s::can Homepage (www.s-can.at).



2 Safety Guidelines

Installation, electrical connection, initial startup, operation and maintenance of any s::can product as well as complete s::can measuring systems must only be performed by qualified personnel. This qualified personnel has to be trained and authorised by the plant operator or by s::can for these activities. The qualified personnel must have read and understood this manual and have to follow the instructions contained in this manual.

For proper initial startup of complete s::can measuring systems, the manuals for the controller and software used for operation (e.g. con::lyte, con::cube, con::nect, moni::tool), the connected probes and sensors as well as the used additional devices (e.g. compressor) have to be consulted.

⚠ The operator has to obtain the local operating permits and has to comply with the joint constraints associated with these. Additionally, the local legal requirements have to be observed (e.g. regarding safety of personnel and means of labour, disposal of products and materials, cleaning, environmental constraints). Before putting the measuring device into operation, the operator has to ensure that during mounting and initial startup - in case they are executed by the operator himself - the local legislation and requirements (e.g. regarding electrical connection) are observed.

⚠ All s::can products are leaving our factory in immaculate technical and safety conditions. Inappropriate or not intended use of the product, however, can cause danger! The manufacturer is not responsible for damage caused by incorrect or unauthorised use. Any kind of manipulation of the instrument is strictly prohibited - except for the activities described in this document.Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid. For details regarding guarantee and warranty please refer to our general conditions of business.

2.1 Declaration of Conformity

This s::can product has been developed, tested and manufactured for electromagnetic compatibility (EMC) and according to applicable European standards, as defined in the declaration of conformity.

CE-marks are applied on the device. The declaration of conformity related to this marking can be requested from s::can or your local s::can sales partner or can be downloaded from the s::can Customer Portal.

2.2 Special Hazard Warning

⚠ Because the s::can measuring systems are frequently installed in industrial and communal waste water applications, one has to take care during mounting and demounting of the system, as parts of the device can be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one’s health during work with the measuring device.

3 Technical Description

3.1 Intended Use

The con::cube is an high-performance, power efficient industrial computer for on-line operation of s::can spectrometer probes (spectro::lyser, nitro::lyser, carbo::lyser, etc.) and i::scan as well as ISE probes (e.g. ammo::lyser) and all other s::can sensors (e.g. pH::lyser, oxi::lyser). Furthermore readings of third party sensors can be integrated via standard interfaces. Once connected to probes and sensors the con::cube fullfils all tasks of a complete monitoring station due to the following scope of functions:

- Numerical and graphical display of the readings from the connected measuring devices
- Simple initialisation of spectrometer probes, i::scan, ISE probes and sensors
- Simple initialisation and parameterisation of s::can infrastructure (e.g. automatic cleaning devices)
- Parameter calibration of spectrometer probes, i::scan, ISE probes and sensors
- Storage of measurement results and all other station information in a local database

- Transfer of measurement results via Modbus RTU/TCP interface
- Transfer of measurement results via analog outputs (optional)
- Transfer of measurement results via Profibus DP interface (optional)
- Transfer of measurement results via SDI12 interface (optional)
- Transfer of measurement results via FTP file transfer
- Potential free digital output relay triggered by current reading (optional)

- Integration of external sensor signals via RS485 input
- Integration of external sensor signals via analog or digital input (optional)

- Network connectivity via ethernet, WLAN or optional 3G/4G modem
- Remote control of s::can monitoring station via ethernet, WLAN or optional 3G/4G modem
- Data synchronisation to central data collection systems via ethernet, WLAN or optional 3G/4G modem
- Display of current and historical readings
- Alarming and Triggering depending on water quality monitored

In all types of applications, the respective acceptable limits, which are provided in the technical specifications in the respective s::can manuals, have to be observed. All applications falling outside of these limits, and which are not authorised by s::can GmbH in written form, do not fall under the manufacturer’s liability.

The device must only be used for the purpose described in this manual. Use in applications not described in this manual, or modification of the device without written agreement from s::can, is not allowed. s::can is not liable for claims following from such unauthorised use. In such a case, the risks are the sole responsibility of the operator.

3.2 Functional Principle

The con::cube is equipped with an operation software (moni::tool) that can be operated via a color graphical display with touch functionality. The software starts automatically when the con::cube is powered up. The con::cube collects readings for probes and sensors using a digital bus connection. It displays the data, stores all information and makes it available for further use.

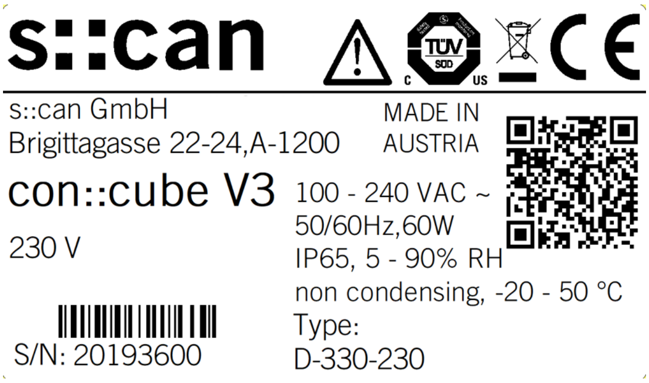
3.3 Product

The following device variants of the con::cube are available. Regarding detailed information of the device variants, please refer to the technical specifications located at the end of this manual.

Type	Specification
D-330-230	Station control terminal with 100-240 VAC, 50-60 Hz power supply
D-330-024	Station control terminal with 10-36 VDC power supply
D-330-TOUCH	Display and touch screen input module
D-315-3GLX	3G modem (OS Linux)
D-315-OUT-PROFIBUS	Profibus DP (output module)
D-315-OUT-SDI12	SDI 12 (output module)
D-315-OUT-MA	2 analog outputs (output module)
D-315-OUT-RELAY	4 digital outputs (output module)
D-315-IN-MA	2 analog inputs for integration of third party readings (input module)
D-315-IN-RELAY	2 digital inputs for integration of third party readings (input module)
D-315-ANTENNA-PLUG	internal antenna adapter cable and connector
D-315-ANTENNA-PRO	external, high range antenna, incl. 10 m extension cable
D-303-LX	Licence Linux application (fix installed OS)
S-20-MVA	Complete license including moni::tool (all features), vali::tool and ana::tool

The device is typified by a type label, as shown on the right, that contains the following information:

- Manufacturer's name and country of origin
- Several certification marks
- Device name (con::cube)
- Type of power supply
- Bar code
- Device serial number (S/N)
- Information on power supply
- Environment rating (IP)
- Acceptable humidity limits
- Acceptable temperature limits
- Item number (Type)
- QR code



s::can

s::can GmbH
Brigittagasse 22-24,A-1200

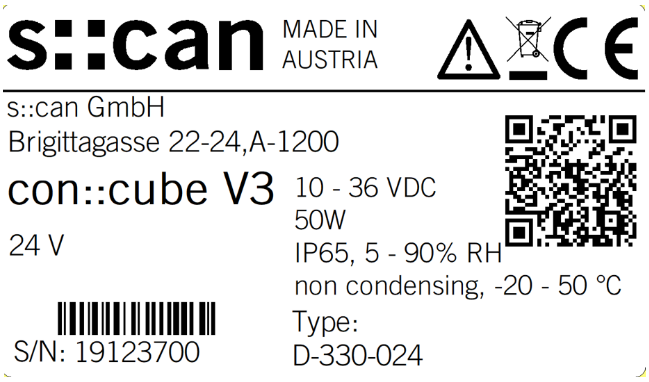
MADE IN
AUSTRIA

con::cube V3
230 V

100 - 240 VAC ~
50/60Hz,60W
IP65, 5 - 90% RH
non condensing, -20 - 50 °C

S/N: 20193600

Type:
D-330-230



s::can

MADE IN
AUSTRIA

s::can GmbH
Brigittagasse 22-24,A-1200

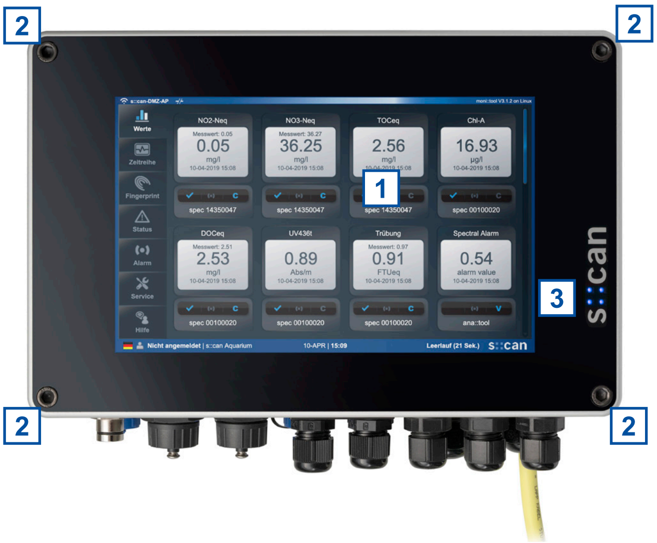
con::cube V3
24 V

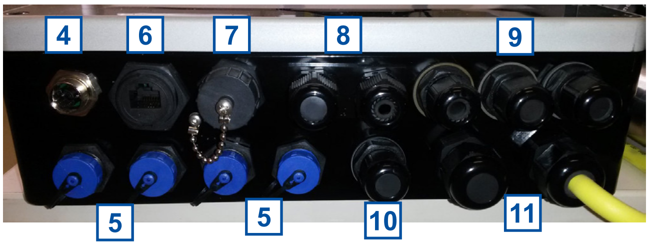
10 - 36 VDC
50W
IP65, 5 - 90% RH
non condensing, -20 - 50 °C

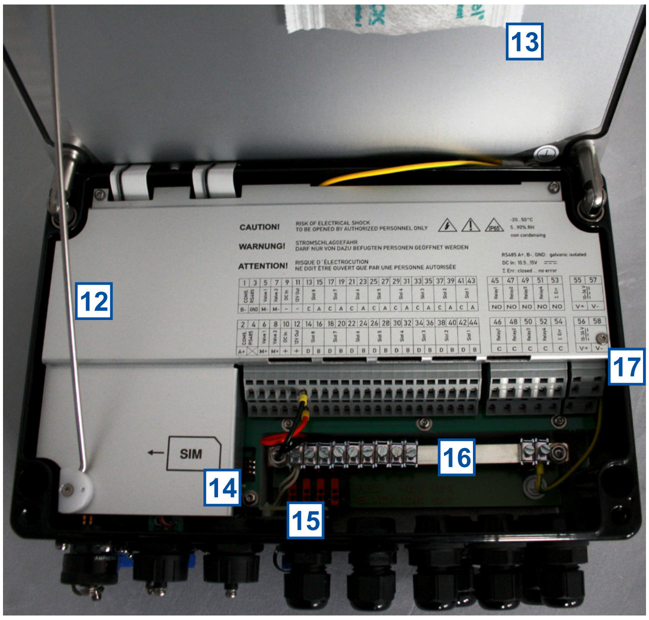
S/N: 19123700

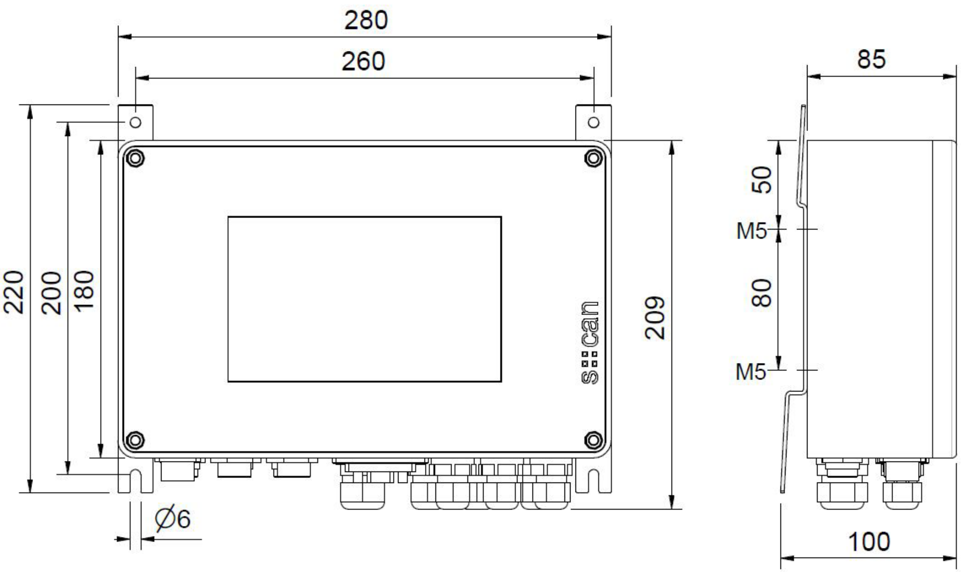
Type:
D-330-024

1	Color graphical display with touch screen
2	Screw to open housing cover
3	Control LED (blue, yellow or red)
4	1 connector for s::can spectrometer probe
5	4 connectors for i::scan, ISE probes or sensors
6	Ethernet (LAN) connector
7	USB connector
8	2 cable glands M16 (optional for Profibus)
9	3 cable glands M16
10	1 cable gland M16 (optional antenna plug)
11	2 cable glands M20
12	Holder for housing cover
13	Desiccant package
14	Insert for SIM card
15	Additional cable terminals for 12 VDC out
16	Grounding bar
17	Power supply connection

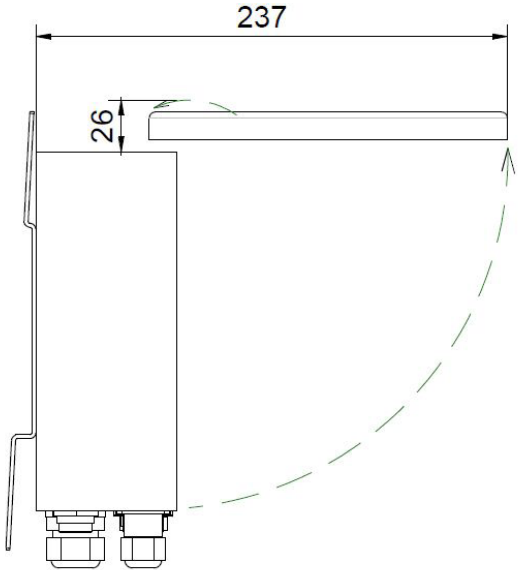








⚠ Ensure correct orientation of mounting rails. Top of con::cube has to be tilted backwards to prevent any water flowing over the touch screen or entering the housing when device is opened.



Dimensions of con::cube in mm

3.4 Storage, Transport and Disposal

The limiting values for device storage and transport, which are described in the section technical specifications, have to be observed at all times. The device shall not be exposed to strong impacts, mechanical loads or vibrations. The device should be kept free of corrosive or organic solvent vapours, nuclear radiation as well as electromagnetic radiation.

Damage to the device caused by wrong storage will not be covered by warranty.

Transport should be done in a packaging that protects the device (original packaging or protective covering if possible).

This product is marked with the WEEE symbol to comply with the European Union’s Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EC. The symbol indicates that this product should not be treated as household waste. It must be disposed and recycled as electronic waste. Please assist to keep our environment clean.

⚠ Take care that no sharp-edged or heavy objects are placed on the housing cover, which might scratch and / or damage the touch screen.

3.5 Scope of Delivery

Immediately upon receipt, please check the received consignment for completeness on the basis of the delivery note and check for any possible damage incurred during shipping. Please inform the delivering dispatcher and s::can immediately in case of any damages in transit.

The following parts should be included in the delivery:

- s::can con::cube (part-no. D-330-xxx)
- Pen for touch screen
- Mounting rail (2 pieces) with 4 screws (M5x8)
- s::can manual con::cube (part-no. S-453-M)

The following parts could be included in the delivery if ordered as an option:

- Cable for power supply (part-no. C-31-xx)
- Gateway to 3G (part-no. D-315-3GLX)
- Internal antenna adapter cable and connector (part-no. D-315-ANTENNA-PLUG)
- External antenna (part-no. D-315-ANTENNA-PRO)
- Different I/O modules, which are assambled into the con::cube already (part-no. D-315-OUT-MA, D-315-OUT-RELAY, D-315-PROFIBUS, D-315-OUT-SDI12, D-315-IN-MA, D-315-IN-RELAY)
- s::can weather shield for con::cube (part-no. F-51)

In case of incompleteness please contact your s::can sales partner immediately!

3.6 Product Updates, Other

The manufacturer reserves the rights to implement, without prior notice, technical developments and modifications in the light of continuous product care.

4 Installation

4.1 Environment

⚠ The con::cube is designed according to environmental protection rating IP 65 and is resistant against environment effects. Indoor use is preferred. In case of outdoor use the installation in a cabinet or on the separately available weather shield is highly recommended to protect the device (housing cover has to be securely closed).

Enclosure class IP 65 protection is only guaranteed if the housing cover is fixed tightly with the four screws, an operative desiccant package is mounted inside the housing and the sealing of the housing cover is undamaged and placed correctly. In addition all cable glands have to be sealed correctly in that way they are closed tightly with the appropriate cables or dummy caps. All connectors must be covered with corresponding caps when not in use. Any damage caused by intrusion of water will not be covered by the warranty.

The correct installation of measuring instruments is an important prerequisite for satisfactory operation. Therefore the following checklist for the installation can be used to ensure that all sources for potential operational problems can be ruled out to the greatest possible extent during the installation, allowing the s::can monitoring system to operate properly.

Installation site:

- Easy accessibility (mounting, sampling, functional check, demounting)
- Availability of sufficient space (probe / sensor, installation fitting, controller for operation, etc.)
- Adherence to limit values (see technical specifications located at the end of this manual)
- Best possible weather and splash water proof set-up

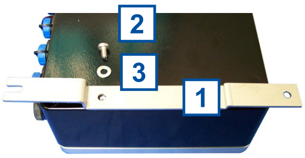
Infrastructure (energy, data and compressed air):

- Power supply for controller for operation (operational reliability, voltage, power, peak free)
- Oil- and particle free compressed-air supply (optional for automatic probe / sensor cleaning)
- Shortest possible distances between system components (probe – controller – compressed-air supply – energy supply)
- Correct dimensioning, mounting and protection of all cables and lines (non-buckling, no risk of stumbling, no damage etc.)

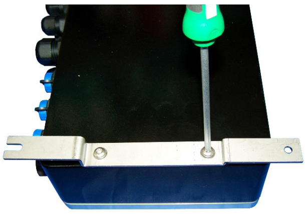
4.2 Mounting

For mounting and electrical installation the following tools and materials are necessary:

- Hexagonal wrench key (size 5) to open housing cover
- Torx wrench key (size TX 25) for fixing screws of mounting rails
- 2 s::can mounting rails (included in delivery)
- 4 screws (M5) and 4 washers for fixing the two mounting rails onto the con::cube (included in delivery)
- 4 screws for fastening the con::cube on the wall (if required)
- Weather shield (F-51, if required)
- Power supply cable (C-31-xx, if required)
- Stripping tool for power supply line
- Cable end sleeves and crimper



The con::cube can be mounted quickly and easily onto a flat wall using one of the following methodes:



- With the two mounting rails [1] included in delivery. Fasten the two mounting rails onto the backside of the con::cube using the four screws [2] and the four spring washers [3] as shown on the right.
- With the four threaded holes on the backside of the con::cube to mount the device directly from the backside (M5 screws, not included in delivery).

For the correct dimensioning and space required for mounting please refer to the figures in section 3.3 and the technical specifications.

5 Initial Startup

Once mounting and installation of the con::cube have been completed and checked (see section 4) the initial startup of the s::can monitoring system will require the following actions, in the order presented below:

- Connect the s::can spectrometer probes (see section 5.2).
- Connect the s::can ISE probes, i::scan and sensors (see section 5.3).
- Connect the cleaning devices to the proper terminal connections in the cable terminal compartment (see section 5.4).
- Connect of optional devices used for the s::can nano::station or micro::station, e.g. flow detector F-45-ALARM or pressure sensor F-500-P.
- Establish main power supply to the con::cube (see section 5.5) and wait until the operation software moni::tool has started up (see section 5.6).
- Please note all information in the moni::tool manual for further startup and configuration of the monitoring system.

5.1 Plan of Terminal Connections

Once the housing cover has been opened (four hexagonal head screws removed) you have access to the cable terminal compartment of the con::cube.

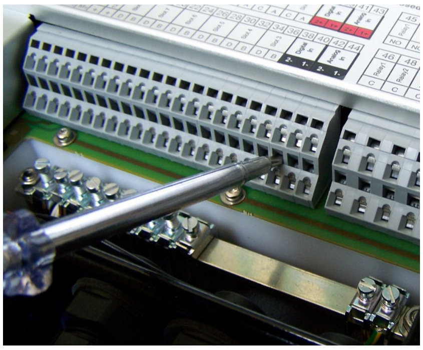
Opening of the cable terminal compartment must be carried out by authorised persons only (see section 2) and after disconnecting the power supply!

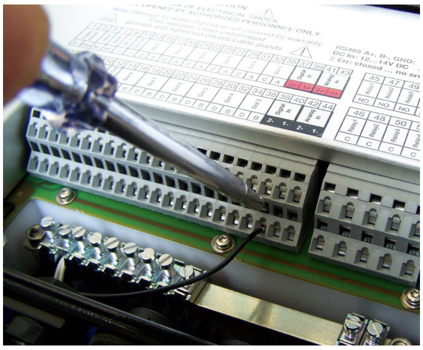
Be aware that cable clamps of relay contacts you have connected to the device might also have power supply (230 VAC), depending on how they have been interconnected!

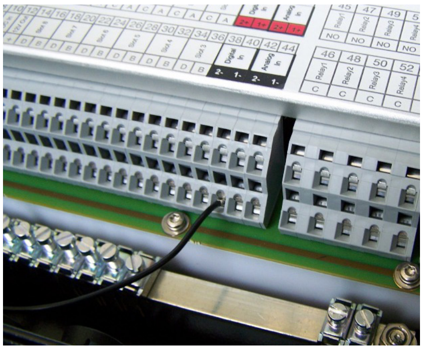
The con::cube is equipped with spring terminals that enable quick and easy wiring.

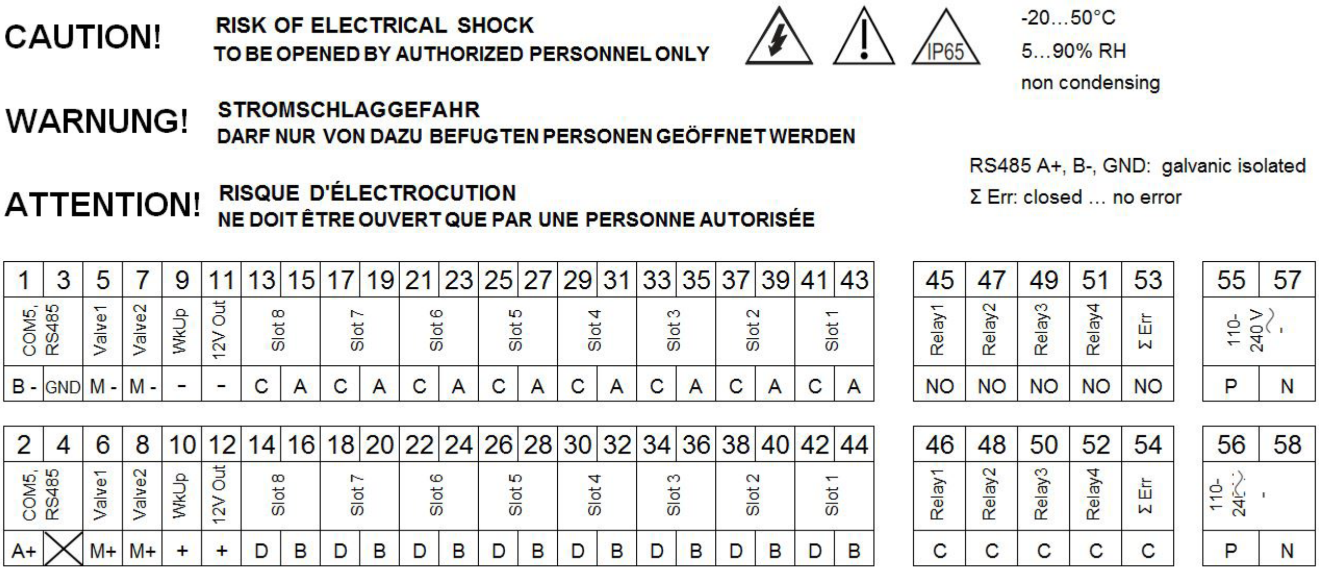
- Insert a small screwdriver into the slot above the cable clamp you want to connect (see left picture below).
- Move the screwdriver upwards, which opens the cable clamp, and insert the wire (see middle picture below).
- Move the screwdriver downwards and remove it. Now wire is locked in the cable clamp (see right picture below).

s::can recommends to use wires with isolated end sleeves for power supply and dater transfer.









CAUTION! **RISK OF ELECTRICAL SHOCK**
TO BE OPENED BY AUTHORIZED PERSONNEL ONLY

WARNUNG! **STROMSCHLAGGEFAHR**
DARF NUR VON DAZU BEFUGTEN PERSONEN GEÖFFNET WERDEN

ATTENTION! **RISQUE D'ÉLECTROCUTION**
NE DOIT ÊTRE OUVERT QUE PAR UNE PERSONNE AUTORISÉE

-20…50°C
5…90% RH
non condensing

RS485 A+, B-, GND: galvanic isolated
Σ Err: closed … no error

1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43
COM5, RS485		Valve1	Valve2	WkUp	12V Out	Slot 8		Slot 7		Slot 6		Slot 5		Slot 4		Slot 3		Slot 2		Slot 1	
B -	GND	M -	M -	-	-	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A

45	47	49	51	53
Relay1	Relay2	Relay3	Relay4	Σ Err
NO	NO	NO	NO	NO

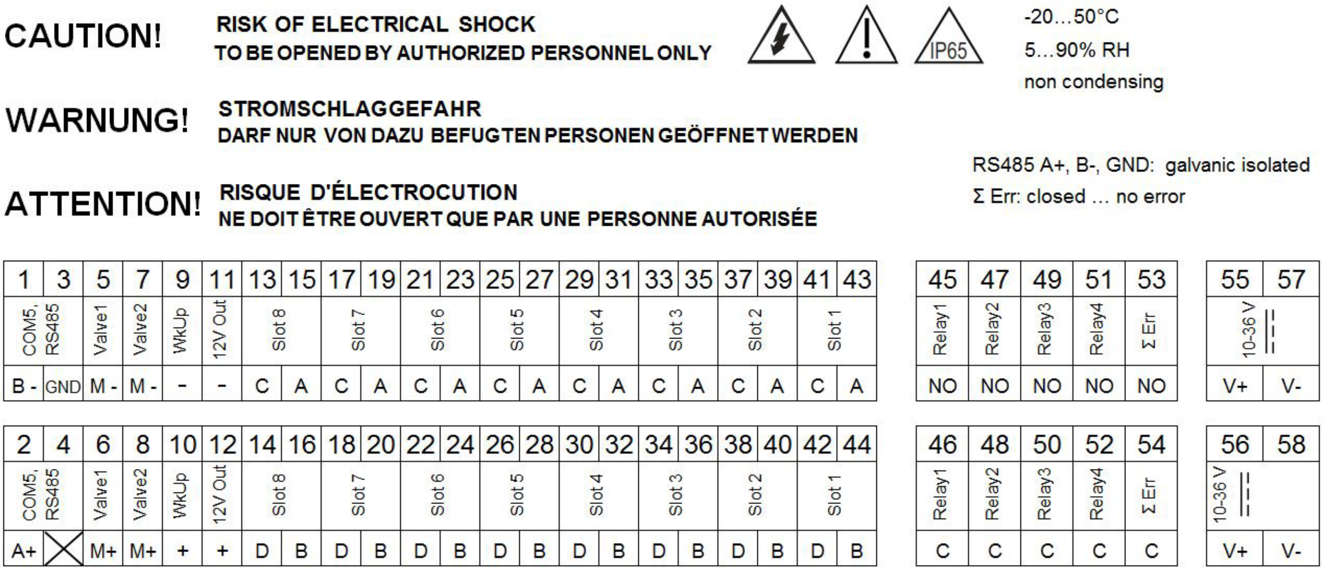
55	57
110-240 V ~ -	
P	N

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
COM5, RS485		Valve1	Valve2	WkUp	12V Out	Slot 8		Slot 7		Slot 6		Slot 5		Slot 4		Slot 3		Slot 2		Slot 1	
A+	☒	M+	M+	+	+	D	B	D	B	D	B	D	B	D	B	D	B	D	B	D	B

46	48	50	52	54
Relay1	Relay2	Relay3	Relay4	Σ Err
C	C	C	C	C

56	58
110-24 ~ -	
P	N

Plan of terminal connections for con::cube D-330-230



CAUTION! **RISK OF ELECTRICAL SHOCK**
TO BE OPENED BY AUTHORIZED PERSONNEL ONLY

WARNUNG! **STROMSCHLAGGEFAHR**
DARF NUR VON DAZU BEFUGTEN PERSONEN GEÖFFNET WERDEN

ATTENTION! **RISQUE D'ÉLECTROCUTION**
NE DOIT ÊTRE OUVERT QUE PAR UNE PERSONNE AUTORISÉE

-20…50°C
5…90% RH
non condensing

RS485 A+, B-, GND: galvanic isolated
Σ Err: closed … no error

1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43
COM5, RS485		Valve1	Valve2	WkUp	12V Out	Slot 8		Slot 7		Slot 6		Slot 5		Slot 4		Slot 3		Slot 2		Slot 1	
B -	GND	M -	M -	-	-	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A

45	47	49	51	53
Relay1	Relay2	Relay3	Relay4	Σ Err
NO	NO	NO	NO	NO

55	57
10-36 V ⎓	
V+	V-

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
COM5, RS485		Valve1	Valve2	WkUp	12V Out	Slot 8		Slot 7		Slot 6		Slot 5		Slot 4		Slot 3		Slot 2		Slot 1	
A+	☒	M+	M+	+	+	D	B	D	B	D	B	D	B	D	B	D	B	D	B	D	B

46	48	50	52	54
Relay1	Relay2	Relay3	Relay4	Σ Err
C	C	C	C	C

56	58
10-36 V ⎓	
V+	V-

Plan of terminal connections for con::cube D-330-024

5.2 Connection of s::can Spectrometer Probe

An s::can spectrometer probe can be connected to the external connector for spectrometer probes, which is marked with no.4 in the figure of section 3.3. If an extension cable is used the total length of the probe‘s cable should not be more than 40 m.

If necessary, a con::nect box (B-23-xxx) has to be used to connect a further spectrometer probe.

5.3 Connection of s::can ISE Probes and Sensors

Alternative or additional to the spectrometer probe it is possible to connect ISE probes, i::scan and / or s::can sensors via the sys plug connectors located on the con::cube. These connectors are marked with no.5 in the figure of section 3.3. If an extension cable is used the total length of the probe's cable should not be more than 40 m.

If necessary, the distribution box (B-41-HUB) has to be used to increase the number of plugs.

⚠ Before connecting the probes or sensors, ensure that the sensor plug and connector on the con::cube are dry and clean. Otherwise communication errors and / or device damage might occur. Connectors not in use should always be covered with the protective cap.

5.4 Connection of Cleaning Devices

For the automatic cleaning of the probe and sensors connected, the cleaning devices have to be wired to the con::cube within the cable terminal compartment. The table below displays the different possibilities of connection.

Cleaning Device	Colour of wire	Labelling	Terminal no.
Cleaning valve via Valve 1	Blue	M+ / Valve 1	6
	Brown	M- / Valve 1	5
Cleaning valve via Valve 2	Blue	M+ / Valve 2	8
	Brown	M- / Valve 2	7
Autobrush via Valve 1	Purple (yellow 1))	M+ / Valve 1	6
	Black (brown 1))	- / 12V Out	11 / black terminal
	Red (white 1))	+ / 12V Out	12 / red terminal
Autobrush via Valve 2	Purple (yellow 1))	M+ / Valve 2	8
	Black (brown 1))	- / 12V Out	11 / black terminal
	Red (white 1))	+ / 12V Out	12 / red terminal
ruck::sack via Valve 1	Purple	M+ / Valve 1	6
	Black	- / 12V Out	11 / black terminal
	Red	+ / 12V Out	12 / red terminal
ruck::sack via Valve 2	Purple	M+ / Valve 2	8
	Black	- / 12V Out	11 / black terminal
	Red	+ / 12V Out	12 / red terminal

1) previous used cable version

Once the cleaning device has been electrically connected, the device needs to be parameterised within the moni::tool software (please refer to manual moni::tool).

5.5 Connection of Main Power Supply

⚠ This type of work must be performed by authorised persons only (see section 2)!

Depending on the device type, the con::cube has to be connected to the appropriate power supply. The connection of power supply (AC or DC, respectively), must be done with an earthed conductor wire (PE - „protective earth“)!

The power supply earth (PE) has to be done properly according to the corresponding norms / standards with a max. restistance between earth grounding of power supply and site‘s earth grounding of 0.1 Ohm.

Process medium (e.g. waste water) must be connected to the same earth ground with less than 0.5 Ohm.

Connection of power supply for con::cube D-330-230	
No / [Labelling]	Assignment
55 / [P] or 56 / [P]	Conductor or phase, resp.
57 / [N] or 58 / [N]	Neutral wire

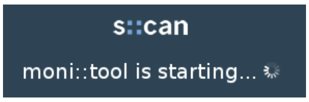
Connection of power supply for con::cube D-330-024	
No / [Labelling]	Assignment
55 / [V+] or 56 / [V+]	+ 24 VDC
57 / [V-] or 58 / [V-]	- 24 VDC

The connection in the cable terminal compartment has to be performed as displayed on the table above. The ground wire (PE) has to be connected to the grounding bar of the con::cube, which is marked with no.16 in the figure of section 3.3.

⚠ A switch or circuit-breaker must be included in the power supply. It must be suitable located and easily reachable. It must be marked as a disconnecting device for the monitoring equipment.

5.6 Starting up of Operation Software

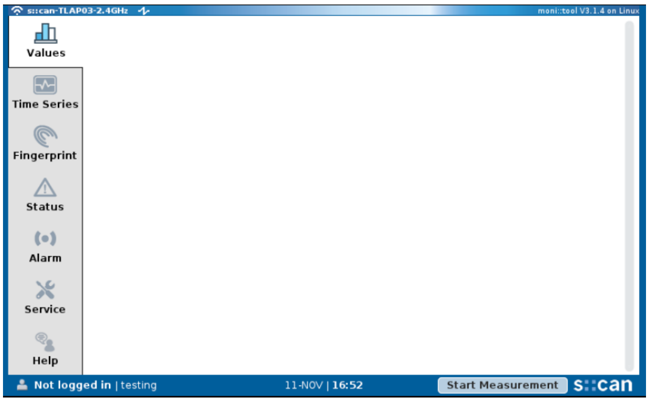
Once the con::cube is connected to the power supply (see section 5.5), it will show the s::can logo for a few seconds while starting up. During the startup of moni::tool a message as shown on the right hand side is visible. Please consider that the complete start up procedure will require appox. 1 - 2 minutes.


s::can

moni::tool is starting...

When no probes and sensors have been installed yet (initial startup), only the main window and the menu tabs are visible on the display.

Please refer to the manual of the operation software moni::tool for all further tasks to complete the initialisation of your s::can monitoring system.



5.7 con::cube Sleep Mode

For operation with low power consumption a specific sleep mode can be configured on the con::cube via moni::tool (*Service \ Terminal \ con::cube \ Power Save*). The sleep mode can be terminated at any time by touching the screen or by apply a voltage of 12 VDC to the *WkUp* terminals (9 and 10).

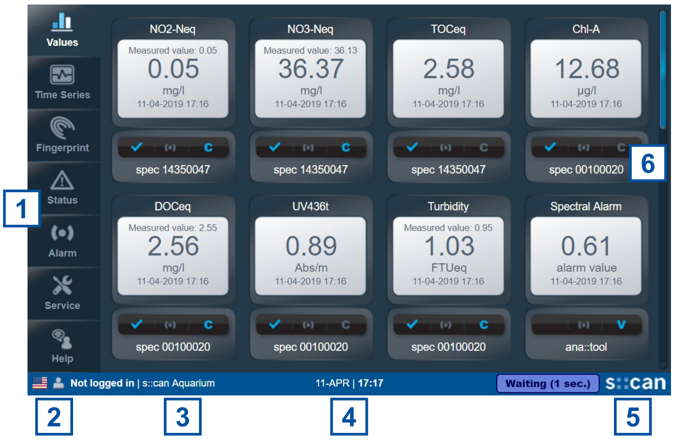
⚠ When using the sleep mode in combination with a 3G/4G modem, the most actual moni::tool version V3.1.4 has to be used. When using an older version, a modification of a jumper is needed (information note how to do this is available via s::can customer support).

6 Operation of con::cube

The con::cube is equipped with the operating software moni::tool and uses multi touch technology and a Web-Browser as grafical user interface. This means that moni::tool can be operated via Web-Browser either directly on the touch screen of the con::cube with your fingers and / or a touch pen (see section 6.1) or via remote connection using a PC, notebook, tablett, etc. (see section 6.2). Please note that only one user can operate the con::cube directly (i.e. can be logged on).

The main frame of the moni::tool display contains the following items that are visible at all times.

1. Tabs for navigating between the main views
2. Clicking on this item will open the login window or logout window
3. Name of the monitoring station
4. Current system date and time (clicking on this icon will display date / time of the last measurement)
5. Clicking on the s::can logo will callup information on the installed software version and the controller
6. Scrollbar to scroll the display up and down



6.1 Direct Operation of con::cube

Normally this direct operation is performed by a person standing in front of the con::cube and using the touch screen. Alternatively moni::tool can also be operated with a USB mouse and / or a USB keyboard. These devices can be connected to the USB-socket (marked with no.7 in the figure of section 3.3) of the con::cube. A USB-hub can be used to operate keyboard and mouse simultaniously.

Please keep in mind that a few service actions (e.g. touch calibration) can be used in direct operation only (see manual moni::tool).

6.2 Remote Operation of con::cube

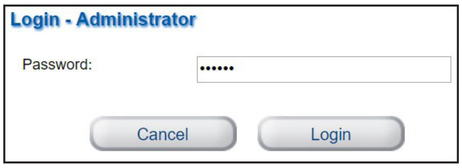
For any kind of remote operation the con::cube needs to be connected to the internet, a VPN network, a local network or directly to a PC (see section 6.5).

6.2.1 Remote Operation of con::cube via Web-Browser

The moni::tool software can be operated from any computer that has access to the con::cube. Simply enter the IP address of the con::cube into the address bar of your Web-Browser.

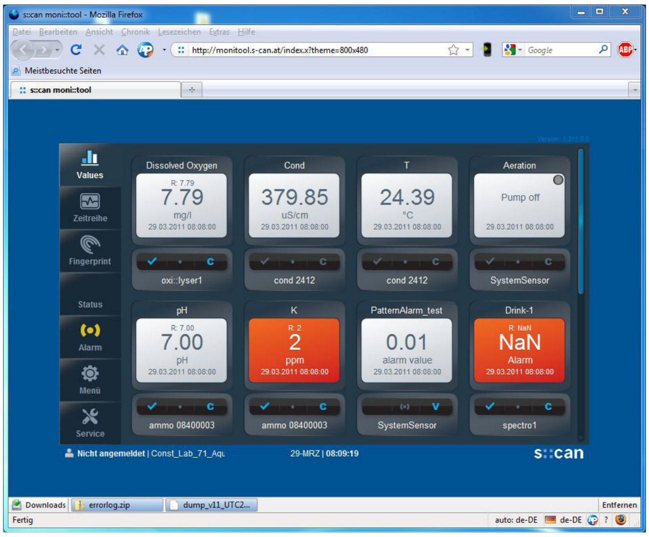
Several users can view moni::tool simultaniously but only one user can be logged in.

User = Administrator
Password = admin1



Login - Administrator

Password: ••••••



s::can moni::tool - Mozilla Firefox

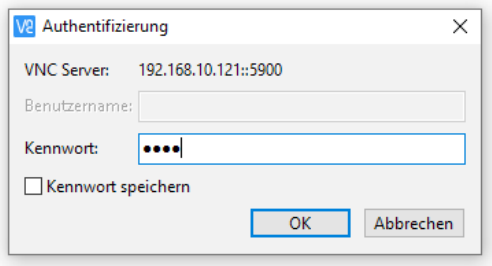
http://monitool.s-can.at/index.x?theme=800x480

6.2.2 Remote Operation of con::cube via Terminal Program (VNC-Viewer)

The terminal program VNC-Viewer can be used for direct operation of the con::cube via remote connection. In this case keyboard, mouse and monitor of the computer running the VNC-Viewer can be used to operate the con::cube.

When using the VNC-Viewer a login window will pop up once the remote connection was successful. The password to be entered is „scan“ (case-sensitive).

If you operate the con::cube via VNC-Viewer, all actions can be seen on the touch screen of the con::cube also.



Authentifizierung

VNC Server: 192.168.10.121::5900

Benutzername:

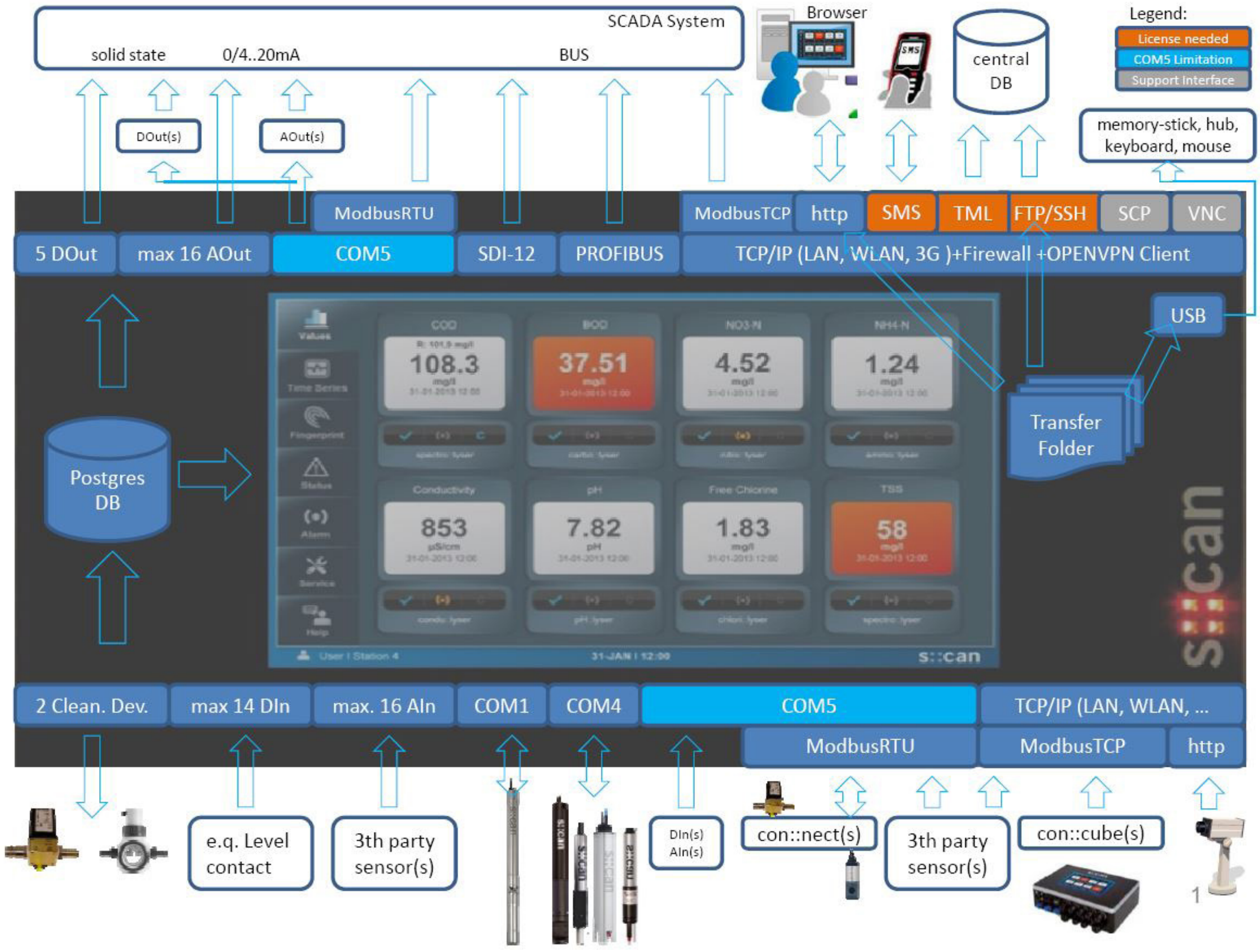
Kennwort: ••••

☐ Kennwort speichern

⚠ For operation of VNC-Viewer with Linux (moni::tool Version V3) the port 5900 has to be unlocked in the con::cube firewall.

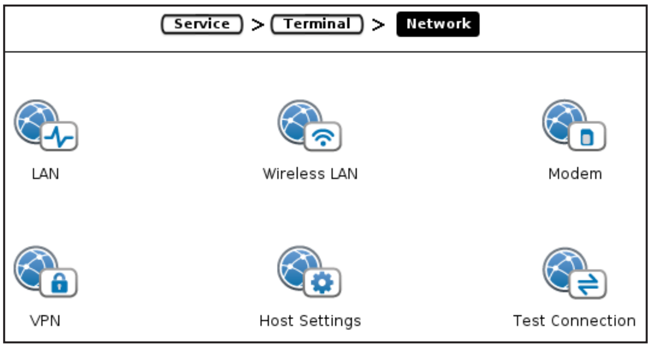
6.3 con::cube Interfaces

The figure below offers an overview of all available interfaces, that can be used for operation of the con::cube.



6.4 con::cube Network Integration and Security

For normal operation, remote control, data transfer and other features it might be necessary to setup a connectivity of the con::cube. Within this section the different possibilities are explained and security background is mentioned also.



The con::cube is based on Microsoft Windows XP embedded (XPe) operating system until moni::tool versions V2.5. From Version 3.0 on it is based on a Linux operating system (Debian).

While the XPe platform is well-proven and stable it already has reached the end of its mainstream support. Microsoft will still supply security updates within a certain period but won‘t fix non-critical issues. Linux will support further security updates.

Nonetheless, the con::cube is a complex device offering services over the network. Software security therefore is an issue which needs to be considered to safely operate the con::cube.

On the con::cube the TCP / IP interface can be used via LAN, WLAN or 3G Modem (optional). All these features can be configured within the *Service / Terminal / Network* menu (see manual moni::tool).

The table below contains all types of possible connectivity setups. Regarding the individual connection types please refer to the subsections afterwards.

con::cube	Type of data transfer	Connection type	Customer infrastructure	Security
acts as client (i.e. con:: cube establishs the connection, performs a task and shuts down the connection)	■ FTP data transfer ■ SSH data transfer ■ NTP-client (for system time synchronization)	all connection types	FTP server SSH server	✓
acts as server (i.e. con::cube waits for a client to connect and responds to its request)	■ Modbus TCP ■ TML ■ VNC remote control ■ FTP remote control	LAN or WLAN	trusted network	✓
		3G private IP	internet	⚠
		3G private IP	VPN server	✓
		3G public IP		✗
		open WLAN without WEP		✗

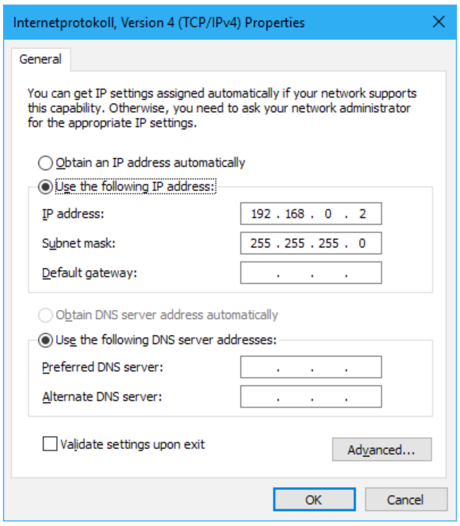
Because of the number of services offered, the con::cube MUST NOT be operated in environments where those services can be reached public. i.e. the con::cube MUST NOT be reachable from the internet. The most common configurations that are NOT safe are a 3G connection with a public IP address and a WLAN connection to a public, non-encrypted network.

It is always safe to operate the con::cube in a private network, i.e. in a LAN unless the firewall is configured to forward external requests to the con::cube (port-forwarding).

6.5 con::cube Connection Types

If one or several con::cube shall be integrated into one network, each device needs it’s own IP address and also it’s own computer name. By default the DHCP service is activated on the con::cube, therefore an IP address for the con::cube will be allocated automatically from the DHCP server of the network to which the con::cube is connected. The actual IP address of the con::cube will be displayed when pushing on the s::can logo on the lower right hand side of the moni::tool display.

If needed the DHCP service can be deactivated and the con::cube can be set to a fixed IP address. This might be necessary if a direct connection from the con::cube to your notebook shall be established. In this case perform the following steps:



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically
● Use the following IP address:
IP address: 192 . 168 . 0 . 2
Subnet mask: 255 . 255 . 255 . 0
Default gateway: . . .

○ Obtain DNS server address automatically
● Use the following DNS server addresses:
Preferred DNS server: . . .
Alternate DNS server: . . .

☐ Validate settings upon exit

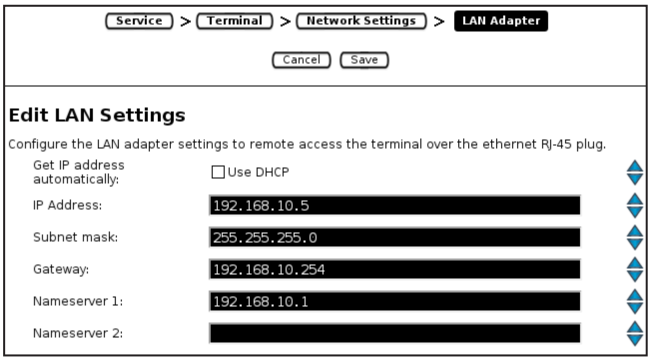
- Disable the *Use DHCP* checkbox to deactivate the DHCP Server option.
- Ensure your PC is equipped with a properly installed network card and you have the user rights required to change network settings.
- Configure the IP address of your PC in the *Network environment* also to a fixed one, using the same settings as for the con::cube except the last number of the IP address. The example below shows a possible configuration:
  IP address of the con::cube: 192.168.10.12
  IP address of the PC: 192.168.10.2
  Subnet mask for both devices: 255.255.255.0
- Connect your network cable (RJ45) to the con::cube and to the PC when working via LAN (see section 6.5.1).
- Alternatively activate the WLAN on your notebook and on the con::cube (see section 6.5.2).
- Search for the con::cube in the *Network environment* of the PC.
  You can either use the IP address or the computer name of the con::cube for searching. The computer name ex factory can be found on the included acceptance certificate.
- In case a logon is needed use:
  User: scan
  Password: scan (case sensitive)

6.5.1 Connectivity via Network Cable (RJ45)

Connect the con::cube into the local area network (LAN) by plugging a network cable of the LAN into the ethernet socket of the con::cube (RJ45 - marked with no.6 in the figure in section 3.3).

If needed, it can be configured via the moni::tool menu item *Service / Terminal / Network Settings / LAN Adapter*.

To ensure proper operation also with older types of PC / notebook, s::can recommends to use a cross-linked RJ45 cable for connection.



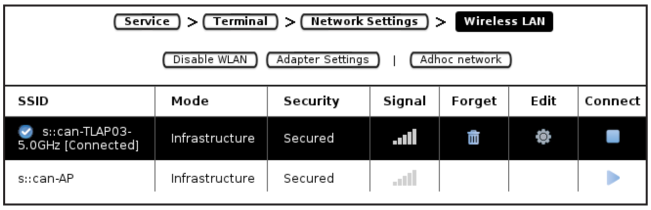
Edit LAN Settings

Configure the LAN adapter settings to remote access the terminal over the ethernet RJ-45 plug.

Get IP address automatically: ☐ Use DHCP
IP Address: 192.168.10.5
Subnet mask: 255.255.255.0
Gateway: 192.168.10.254
Nameserver 1: 192.168.10.1
Nameserver 2:

6.5.2 Connectivity via WLAN

The con::cube is equipped with an internal WLAN modem. The antenna is included in the housing cover. When you enable the WLAN modem via the moni::tool menu *Service / Terminal / Network Settings / WLAN* all available connections are displayed.



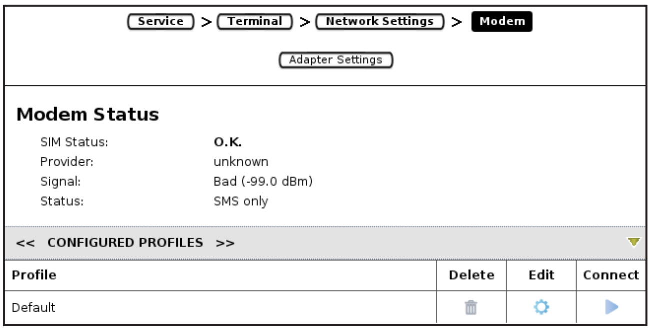
SSID	Mode	Security	Signal	Forget	Edit	Connect
✓ s::can-TLAP03-5.0GHz [Connected]	Infrastructure	Secured	▂▄▆█	🗑	⚙	■
s::can-AP	Infrastructure	Secured	▂▄▆█			▶

6.5.3 Connectivity via 3G Modem

Optionally the con::cube can be equipped with an internal 3G modem. The antenna for this modem is already integrated in the housing cover. In addition an external antenna can be mounted (see section 11.1.3). As long as no SIM card is installed the modem status is *No SIM inserted*.

The configuration of the internal modem is performed by the following steps:

- Power off the con::cube, open the housing cover and install a SIM card into the holding signed with no.14 in the figure of section 3.3 . This SIM should be suited for data transfer and needs to support GPRS / 3G.
- Power on the con::cube. The modem status will be *Ok* (*SIM Status*) and *SMS only* (*Status*).
- Configure a new modem profile (e.g. by editing the existing *Default* profile) via *Service / Terminal / Network Settings / Modem*.
- Select *Default* and push icon *Edit*.
- Enter a *Profile* name and the *PIN* of the SIM card.
- Enter the *Apn* and the *Authentication* of your provider.
- To avoid any problems select *Allow roaming* always.
- Push the *save* button to save your modem profile.
- Now the con::cube tries to connect to the network.
- After successful connection a user message asks you to reboot the con::cube. Push the button *Remind me later* to finish your modem configuration.
- Push the *Connect* symbol (blue triangle) to activate your modem profile.
- Once the con::cube is connected successfully the connection symbol is displayed in the left top corner. In addition you see the sinal strength and the name of your provider.
- Reboot your con::cube to make all changes permanent.

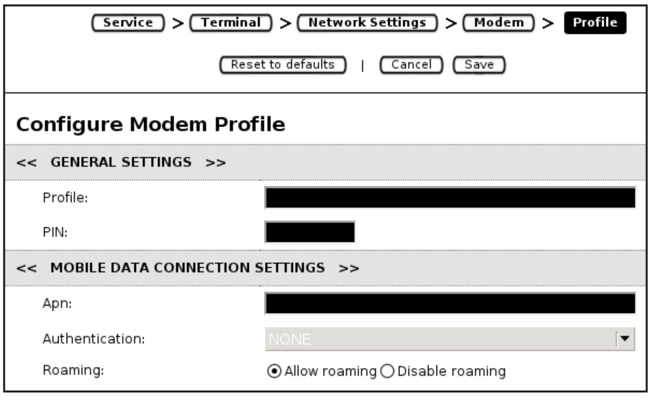


Modem Status

SIM Status: O.K.
Provider: unknown
Signal: Bad (-99.0 dBm)
Status: SMS only

<< CONFIGURED PROFILES >>

Profile	Delete	Edit	Connect
Default	🗑	⚙	▶



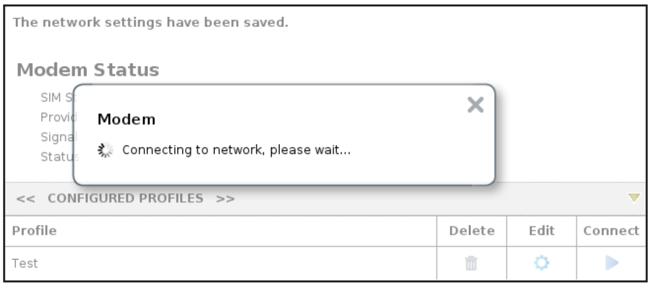
Configure Modem Profile

<< GENERAL SETTINGS >>

Profile: [redacted]
PIN: [redacted]

<< MOBILE DATA CONNECTION SETTINGS >>

Apn: [redacted]
Authentication: NONE
Roaming: ● Allow roaming ○ Disable roaming



The network settings have been saved.

Modem Status

Modem

Connecting to network, please wait...

<< CONFIGURED PROFILES >>

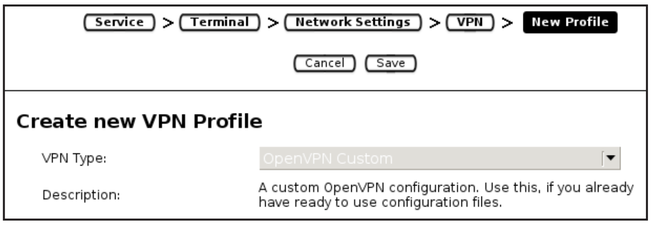
Profile	Delete	Edit	Connect
Test	🗑	⚙	▶

6.5.4 Connectivity via VPN

The con::cube can be connected to a VPN server. s::can offers the possibility to connect your con::cube to the s::can VPN server (item-no. S-VPN-HOSTING). Please ask your local s::can Sales Partner for further details.

The configuration of a VPN profile on the con::cube is performed by the following steps:

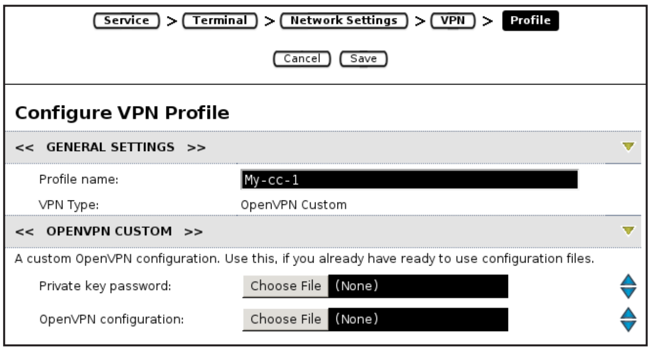
- Select menu *Service / Terminal / Network Settings / VPN* to open the configuration screen.
- In case any VPN profile exists already, select this profile and delete it by pushing the trash icon.
- Push the button *Add new Profile*.
- Within the next window select the *VPN Type*, which is always *OpenVPN Custom*.
- Push the button *Save*.
- Within the next window enter a *Profile name*.
- Select the file containing the *Private key password* (e.g. *password.txt*).
- Select the file containing the *OpenVPN configuration* (e.g. *client.ovpn*).
- Push the button *Save*.
- Now the new profile should be listed in the table. Push the button *Enable* to activate the profile.
- Once the con::cube is connected to the VPN the display will look like the figure on the right.
- The static IP address of the VPN connection will be displayed after pushing the s::can logo in the lower right corner.



Create new VPN Profile

VPN Type: OpenVPN Custom

Description: A custom OpenVPN configuration. Use this, if you already have ready to use configuration files.



Configure VPN Profile

<< GENERAL SETTINGS >>

Profile name: My-cc-1

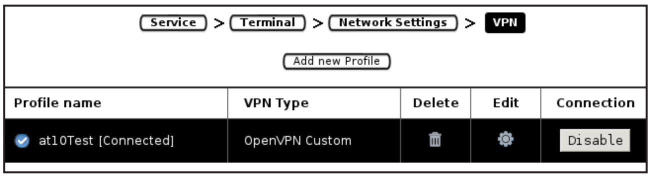
VPN Type: OpenVPN Custom

<< OPENVPN CUSTOM >>

A custom OpenVPN configuration. Use this, if you already have ready to use configuration files.

Private key password: Choose File (None)

OpenVPN configuration: Choose File (None)



Profile name	VPN Type	Delete	Edit	Connection
✓ at10Test [Connected]	OpenVPN Custom	🗑	⚙	Disable

A specific note can be downloaded from the s::can Customer Portal, explaining how a VPN connection can be setup on a mobile phone or tablett.

7 Data Management

7.1 Data Storage

The moni::tool software uses an SQL database for storage of all measurement results, configuration data and information. The size of the database depends on the storage capacity of the flash disk in the con::cube (see technical specifications).

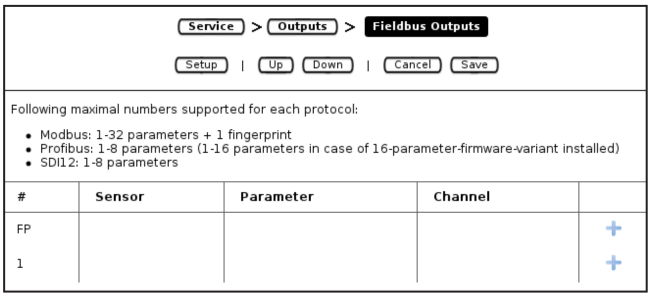
Performing a database dump provides the possibility to save or archive all data stored in the database. Please refer to manual moni::tool for further details.

7.2 Data Transfer

The con::cube with moni::tool provides several possibilities to transfer measurement results and other data and information to external devices.

Transfer of measurement results:

- via analog power outputs (optional D-315-OUT-MA)
- via digital relay interfaces (optional D-315-OUT-RELAY)
- via Modbus TCP/IP interface (Ethernet RJ45, see figure on the right and manual moni::tool)
- via Modbus RTU interface (COM-5, see figure on the right and manual moni::tool). When using Modbus RTU, the COM-5 port cannot be used as sensor interface.
- via Profibus DP interface (optional D-315-OUT-PROFIBUS, see figure on the right and moni::tool manual)
- via SDI12 interface (optional D-315-OUT-SDI12, see figure on the right and moni::tool manual)
- via TML stream (see manual moni::tool menu item *Service / Outputs / TML*)


Service > Outputs > Fieldbus Outputs
Setup | Up Down | Cancel Save

Following maximal numbers supported for each protocol:

- Modbus: 1-32 parameters + 1 fingerprint
- Profibus: 1-8 parameters (1-16 parameters in case of 16-parameter-firmware-variant installed)
- SDI12: 1-8 parameters

#	Sensor	Parameter	Channel	
FP				+
1				+

Transfer of measurement result files:

- automatical via FTP (see manual moni::tool *Service / Outputs / File Output / FTP Transfer*)
- automatical via SSH (see manual moni::tool *Service / Outputs / File Output / SSH Transfer*)
- manual to a USB-stick or a connected computer

For more detailed information about data transfer (e.g. configuration) please refer to the moni::tool manual.

7.3 Data Types

All s::can interfaces use a common representation of data types. Each accessible data item can be allocated to one of the types shown in the table below. The type of a given item can always be found by checking the Modbus mapping. In addition the name of the data item are prefixed by one or two letters to indicate the data type. Data types which are non standard need special attention and are marked specially. Data from Modbus mapping are directly mapped to the according Profibus address space.

Type	Description	Size (Bytes)	Prefix	Note
char[x]	string	x	ab	ASCII
bitmask	bitmask of 16 bits	2	bm	
int16	signed 16 bit integer	2	i	NaN = INT 16_MAX
unit16	unsigned 16 bit integer	2	ui	NaN = UNIT 16_MAX
float	IEEE-754 floating pints	4	f	NaN = 0xFFFF FFFF
enum	enum type	2	e	
timestamp TAI64N	timestamp format	6	ts	see http://cr.yp.to/proto/tai64.txt

⚠ For all data types the Big-Endian encoding is used.

- Characters are represented in ASCII. A single character (for example „a“) with ASCII code 0x61 has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0x61=´a‘								0x00							

- Character strings are represented in ASCII and have a fixed size. If not all bytes are needed the string must be filled with trailing spaces. A three character string (for example “abc”) of size 4 has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0x61=´a‘								0x62=´b‘							
0xXXXX + 1	0x63=´c‘								0x20=´ ´							

- The bitmask is used to represent up to 16 logical states. Unused states are zero by convention. A logical state with bits a15 to a0 has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	a15	a14	a13	a12	a11	a10	a9	a8	a7	a6	a5	a4	a3	a2	a1	a0

For example bitmask with a15:0 = (1100 1010 0011 0110) has the mapping

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	1	1	0	0	1	0	1	0	0	0	1	1	0	1	1	0

- An signed 16bit integer = ±0xXXYY (int16) has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xXX								0xYY							

For example -17289 = 0xBC77 has the mapping

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xBC								0x77							

- An unsigned 16bit integer = 0xXXYY (unit16) has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xXX								0xYY							

For example 45311 = 0xB0FF has the mapping

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xB0								0xFF							

- Floats are represented in IEEE-754 format with 32bit standard precision and have the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	s	e7	e6	e5	e4	e3	e2	e1	e0	f22	f21	f20	f19	f18	f17	f16
0xXXXX + 1	f15	f14	f13	f12	f11	f10	f9	f8	f7	f6	f5	f4	f3	f2	f1	f0

- Timestamps are presented in TAI64n format, which is an unsigned integer counting the seconds from 1.1.1970 using the big-endian format. 1.1.1970 = 0x4000 0000 0000 0000 + 0x0000 0000, e.g. 400000004d9b3395 = 2011-04-05 15:21:47 (for further details please refer to www.tai64.com).

7.4 Data Transfer via Modbus Interface

The con::cube is equipped with a Modbus interface which support the standardized Modbus protocol via RTU or TCP / IP. This interface enables the integration of the con::cube into other networks and supports the following features:

- Reading of device description (see table - Mapping of Device specific Input Register or Device specific Holding Register)
- Reading of parameter results (see table - Mapping of Parameter specific Input Register or Parameter specific Holding Register)
- Reading of parameter status information (see table - Mapping of Parameter Status)
- Reading of system status information (see table - Mapping of System Status)

Access to this information is possible by reading input registers and / or by reading holding registers. The type and the location of the registers is described in the following sections.

The con::cube Modbus is specified according the Modbus-IDA Application Protocol V1.1a and supports the following function codes:

Function	Function code	Description (used for)
Read Input Register	0x04	Parameter readings Parameter status Device status
Read Holding Register	0x03	Device and parameter configuration settings, Mirrored input registers (for support of limited Modbus master devices)

Mapping of Device specific Input Register							
Input register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
device description	uiVersion	0x0000	unit16	1	R	Version of Modbus mapping protocol. For all changes in public registers: 0xAABB AA ... Major version BB ... Minor version (compatible)	0
	eVendor	0x0001	enum	1	R	Vendor code	1
	eModel	0x0002	enum	1	R	Device model	2
	abModel	0x0003	char[20]	10	R	Description of device model, filled with spaces	3
	abSerialNumber	0x000D	char[8]	4	R	Serial number, filled with spaces	13
	abSWRelease	0x0013	char[4]	2	R	Software release: 0xAABB AA ... Major version BB ... Minor version	19
device status public	tSampleTime	0x0068	timestamp	6	R	Time when the parameter results have been updated. Timestamp of logged status and results	104
	bmDeviceStatus	0x0078	bitmask	1	R	Device status	120

Mapping of Parameter specific Input Register							
Input register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
parameter 1 result	bmP1Status	0x0080	bitmask	1	R	Para.1 status 1)	128
	xP1Value	0x0082	float	2	R	Para.1 result	130
parameter 2 result	bmP2Status	0x0088	bitmask	1	R	Para.2 status 1)	136
	xP2Value	0x008A	float	2	R	Para.2 result	138
parameter 3 result	bmP3Status	0x0090	bitmask	1	R	Para.3 status 1)	144
	xP3Value	0x0092	float	2	R	Para.3 result	146
parameter 4 result	bmP4Status	0x0098	bitmask	1	R	Para.4 status 1)	152
	xP4Value	0x009A	float	2	R	Para.4 result	154
parameter 5 result	bmP5Status	0x00A0	bitmask	1	R	Para.5 status 1)	160
	xP5Value	0x00A2	float	2	R	Para.5 result	162
parameter 6 result	bmP6Status	0x00A8	bitmask	1	R	Para.6 status 1)	168
	xP6Value	0x00AA	float	2	R	Para.6 result	170
parameter 7 result	bmP7Status	0x00B0	bitmask	1	R	Para.7 status 1)	176
	xP7Value	0x00B2	float	2	R	Para.7 result	178
parameter 8 result	bmP8Status	0x00B8	bitmask	1	R	Para.8 status 1)	184
	xP8Value	0x00BA	float	2	R	Para.8 result	186
parameter 9 result	bmP9Status	0x00C0	bitmask	1	R	Para.9 status 1)	192
	xP9Value	0x00C2	float	2	R	Para.9 result	194

1) Please refer to table Mapping of Parameter Status

Mapping of Parameter specific Input Register							
Input register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
parameter 10 result	bmP10Status	0x00C8	bitmask	1	R	Para.10 status 1)	200
	xP10Value	0x00CA	float	2	R	Para.10 result	202
parameter 11 result	bmP11Status	0x00D0	bitmask	1	R	Para.11 status 1)	208
	xP11Value	0x00D2	float	2	R	Para.11 result	210
parameter 12 result	bmP12Status	0x00D8	bitmask	1	R	Para.12 status 1)	216
	xP12Value	0x00DA	float	2	R	Para.12 result	218
parameter 13 result	bmP13Status	0x00E0	bitmask	1	R	Para.13 status 1)	224
	xP13Value	0x00E2	float	2	R	Para.13 result	226
parameter 14 result	bmP14Status	0x00E8	bitmask	1	R	Para.14 status 1)	232
	xP14Value	0x00EA	float	2	R	Para.14 result	234
parameter 15 result	bmP15Status	0x00F0	bitmask	1	R	Para.15 status 1)	240
	xP15Value	0x00F2	float	2	R	Para.15 result	242
parameter 16 result	bmP16Status	0x00F8	bitmask	1	R	Para.16 status 1)	248
	xP16Value	0x00FA	float	2	R	Para.16 result	250
parameter 17 result	bmP17Status	0x0100	bitmask	1	R	Para.17 status 1)	256
	xP17Value	0x0102	float	2	R	Para.17 result	258
parameter 18 result	bmP18Status	0x0108	bitmask	1	R	Para.18 status 1)	264
	xP18Value	0x010A	float	2	R	Para.18 result	266
parameter 19 result	bmP19Status	0x0110	bitmask	1	R	Para.19 status 1)	272
	xP19Value	0x0112	float	2	R	Para.19 result	274
parameter 20 result	bmP20Status	0x0118	bitmask	1	R	Para.20 status 1)	280
	xP20Value	0x011A	float	2	R	Para.20 result	282
parameter 21 result	bmP21Status	0x0120	bitmask	1	R	Para.21 status 1)	288
	xP21Value	0x0122	float	2	R	Para.21 result	290
parameter 22 result	bmP22Status	0x0128	bitmask	1	R	Para.22 status 1)	296
	xP22Value	0x012A	float	2	R	Para.22 result	298
parameter 23 result	bmP23Status	0x0130	bitmask	1	R	Para.23 status 1)	304
	xP23Value	0x0132	float	2	R	Para.23 result	306
parameter 24 result	bmP24Status	0x0138	bitmask	1	R	Para.24 status 1)	312
	xP24Value	0x013A	float	2	R	Para.24 result	314
parameter 25 result	bmP25Status	0x0140	bitmask	1	R	Para.25 status 1)	320
	xP25Value	0x0142	float	2	R	Para.25 result	322
parameter 26 result	bmP26Status	0x0148	bitmask	1	R	Para.26 status 1)	328
	xP26Value	0x014A	float	2	R	Para.26 result	330
parameter 27 result	bmP27Status	0x0150	bitmask	1	R	Para.27 status 1)	336
	xP27Value	0x0152	float	2	R	Para.27 result	338
parameter 28 result	bmP28Status	0x0158	bitmask	1	R	Para.28 status 1)	344
	xP28Value	0x015A	float	2	R	Para.28 result	346
parameter 29 result	bmP29Status	0x0160	bitmask	1	R	Para.29 status 1)	352
	xP29Value	0x0162	float	2	R	Para.29result	354
parameter 30 result	bmP30Status	0x0168	bitmask	1	R	Para.30 status 1)	360
	xP30Value	0x016A	float	2	R	Para.30 result	362

1) Please refer to table Mapping of Parameter Status

Mapping of Parameter specific Input Register

Input register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
parameter 31 result	bmP31Status	0x0170	bitmask	1	R	Para.31 status 1)	368
	xP31Value	0x0172	float	2	R	Para.131 result	370
parameter 32 result	bmP32Status	0x0178	bitmask	1	R	Para.32 status 1)	376
	xP32Value	0x017A	float	2	R	Para.32 result	378

1) Please refer to table Mapping of Parameter Status

Mapping of Device specific Holding Register

Holding register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
device description	uiVersion	0x0FA0	unit16	1	R	Version of Modbus mapping protocol. For all changes in public registers: 0xAABB AA ... Major version BB ... Minor version (compatible)	4000
	eVendor	0x0FA1	enum	1	R	Vendor code	4001
	eModel	0x0FA2	enum	1	R	Device model	4002
	abModel	0x0FA3	char[20]	10	R	Description of device model, filled with spaces	4003
	abSerialNumber	0x0FAD	char[8]	4	R	Serial number, filled with spaces	4013
	abSWRelease	0x0FB3	char[4]	2	R	Software release: 0xAABB AA ... Major version BB ... Minor version	4019
device status public	tSampleTime	0x0068	timestamp	6	R	Time when the parameter results have been updated. Timestamp of logged status and results	4104
	bmDeviceStatus	0x0078	bitmask	1	R	Device status	4120

Mapping of Parameter specific Holding Register

Holding register, 16bit, RW	Tag name	Address	Type	Length	R/W	Description	Address
parameter 1 result	bmP1Status	0x1020	bitmask	1	R	Para.1 status 1)	4128
	xP1Value	0x1022	float	2	R	Para.1 result	4130
parameter 2 result	bmP2Status	0x1028	bitmask	1	R	Para.2 status 1)	4136
	xP2Value	0x102A	float	2	R	Para.2 result	4138
parameter 3 result	bmP3Status	0x1030	bitmask	1	R	Para.3 status 1)	4144
	xP3Value	0x1032	float	2	R	Para.3 result	4146
......							
parameter 32 result	bmP32Status	0x1118	bitmask	1	R	Para.32 status 1)	4376
	xP32Value	0x111A	float	2	R	Para.32 result	4378

The representation of the system / device / parameter status and denotation of the single bits (b_0 ... b_{15}) is shown in the tables below. Bits that are not represented in the tables are not supported or reserved.

Each bit reperesents a condition (1=error, 0=o.k.)

Mapping of Parameter Status (bmPxStatus)			
Bit	Display (xPxValue)	Status	Description
b0	NaN or value	General parameter error	■ At least one internal parameter check failed ■ For details check all other status bits ■ Unknown failure if all other status bits are ok
b11	value	Maintenance necessary	■ vali::tool recommends check of system integrity (functional check) ■ If system integrity is ok, vali::tool configuration needs to be adapted.
b13	value	Parameter alarm	■ ana::tool / alarm parameter reports parameter-alarm
b14	value	Parameter warning	■ ana::tool / alarm parameter reports parameter-warning

Mapping of System Status (bmDeviceStatus)			
Bit	Display (xPxValue)	Status	Description
b0	NaN	General device error	■ Communication to connected devices failed ■ Probe or sensor misuse ■ Probe or sensor malfunction or failure

7.5 Data Transfer via Profibus DP Interface

The Profibus DP output module (D-315-OUT-PROFIBUS) provides a Profibus DP compatible fieldbus interface (according to IEC 61158) for the integration of the con::cube into Profibus DP networks. Profibus DP supports up to 244 Bytes of output data. This enables the transfer of readings and status information for up to eight parameters as well as the system status. The location and type of the values are shown in the table below.

Profibus Position	Data Type	Name	Description
0x02 – 0x03	Bitmask	bmDeviceStatus	System status of con::cube
0x04 – 0x05	Bitmask	bmP1Status	Status of parameter 1
0x06 – 0x09	Float	xP1Value	Reading of parameter 1
0x0A – 0x0B	Bitmask	bmP2Status	Status of parameter 2
0x0C – 0x0F	Float	xP2Value	Reading of parameter 2
0x10 – 0x11	Bitmask	bmP3Status	Status of parameter 3
0x12 – 0x15	Float	xP3Value	Reading of parameter 3

Profibus Position	Data Type	Name	Description
0x16 – 0x17	Bitmask	bmP4Status	Status of parameter 4
0x18 – 0x1B	Float	xP4Value	Reading of parameter 4
0x1C – 0x1D	Bitmask	bmP5Status	Status of parameter 5
0x1E – 0x21	Float	xP5Value	Reading of parameter 5
0x22 – 0x23	Bitmask	bmP6Status	Status of parameter 6
0x24 – 0x27	Float	xP6Value	Reading of parameter 6
0x28 – 0x29	Bitmask	bmP7Status	Status of parameter 7
0x2A – 0x2D	Float	xP7Value	Reading of parameter 7
0x2E – 0x2F	Bitmask	bmP8Status	Status of parameter 8
0x30 – 0x33	Float	xP8Value	Reading of parameter 8
0x34 – 0x40	TAI64n	tSampleTime	Time of last measurement

7.6 Data Transfer via SDI12 Interface

The SDI12 module (D-315-OUT-SDI12) provides a SDI12 compatible fieldbus interface for the integration of the con::cube into SDI12 networks. The module enables the transfer of readings and status information for up to eight parameters as well as the system status. The location and type of the values are shown in the table in section 7.5.

Parameter readings can be queried via a SDI12-Master connected to the con::cube using a simple terminal programm (e.g. Docklight). For reading of measurement results the following commands are needed (ASCII-code):

Action	Command	Description
Send	0M!<CR><LF>	Start measurement parameter 1
Answer	00001<CR><LF>	
Send	0D!<CR><LF>	Query of measurement result
Answer		Measurement result of parameter 1
Send	0M1!<CR><LF>	Start measurement parameter 2
Answer	00001<CR><LF>	
Send	0D!<CR><LF>	Query of measurement result
Answer		Measurement result of parameter 2
...		
Send	0M7!<CR><LF>	Start measurement parameter 8
Answer	00001<CR><LF>	
Send	0D!<CR><LF>	Query of measurement result
Answer		Measurement result of parameter 8

<CR> ..... Carriage Return
<LF> ..... Line feed

8 Functional Check

A functional check might be required for one of the following reasons:

- Initial startup
- Routine functional check
- Suspicion of monitoring system malfunction
- Modification of monitoring system (e.g. integration of additional sensor or device)
- Change of measuring location

Depending on the application (water composition), the probes and sensors connected and the environmental conditions a regular functional check (weekly to monthly) is recommended. The following sections provide an overview of all the actions that have to be performed to check the monitoring system quickly (see section 8.1). To check the plausibility of the displayed and collected readings and the integrity of a single probe or sensor, please refer to the according manuals of the connected probes and sensors.

8.1 Check System / Monitoring Station

What to check	How to check	What to do, if check failed
Power supply	LED is on or blinking	Check power supply Dis- and reconnect power supply
System running (up-to-date)	Click on system clock at the bottom of the moni::tool screen and check if current time and time of last measurement is current.	Check time and measurement settings. Please remind that polling of readings needs several seconds.
Automatic measurement active	Readings are actualized? Service mode not active?	Check measuring settings Leave Service mode
System status	LED is blue? Status icon is not flashing? Alarm icon is not flashing?	Click on flashing icon and see displayed information. See moni::tool manual for further details.
System stability	Check *Status > Terminal > Logbook* entries since last functional check.	See help text and moni::tool manual for further details.
Installation	Housing, touch screen, cable connections and plugs are undamaged and tight?	Repair or replace damaged parts, that might influence the IP 65 protection (see section 4.1)
Function of automatic cleaning	Wait for next cleaning cycle or activate cleaning manually. Watch for air bubbles or listen if brush is rotating.	Check configuration, electrical connection, air tubes and cleaning device itself.
Efficiency of automatic cleaning	Perform functional check of the probes and sensors connected to the automatic cleaning.	Improve automatic cleaning settings Replace cleaning brush
Datatransfer	Compare the readings displayed on the s::can terminal for operation with those readings received by the used SCADA system.	Check data transfer settings. Use test function to check data transfer.

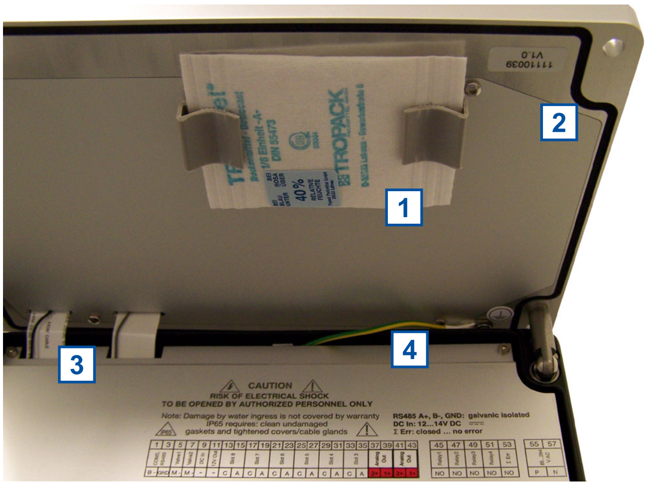
9 Maintenance

9.1 Cleaning

The device housing is made of aluminium alloy. Only use a wet cloth tissue and drinking water and / or mild detergents (e.g. dish washing soap) for cleaning.

9.2 Desiccant Package

To avoid malfunctions due to condensing humidity, one desiccant package [1] is fixed on the cover of the con::cube (see picture on the right hand side). When the package has reached the maximum humidity absorption capacity (the blue-coloured label will turn pink in that case), it has to be exchanged. Before closing the con::cube, every time check the desiccant package.



⚠ The desiccant package is not intended for the continuous absorption of humidity but only for the reduction of humidity below the dew point in a completely closed case. For this reason, properly closed housing cover and tightly screwed cable bushings are a prerequisite for correct functioning. In case of damage to the cord gasket in the housing cover it has to be repaired.

Used desiccant packages can be regenerated using normal drying processes (e.g. drying chamber at max 60°C or nitrogen). In this context, care must be taken that the cartridges cool down and are stored in an absolutely dry environment after the drying process.

Desiccant Packages are also available as spare parts (see section 11.3.1)

9.3 Housing

To ensure IP 65 grade protection, gaskets and case edges have to be checked for cleanliness, possible damage and dirt or foreign bodies before closing the housing cover every time. In case of damage to the cord gasket [2] in the housing cover it has to be repaired! Please ensure that the wires for the display [3] and the earth grounding [4] are positioned correctly (see picture above).

The cover must be tightly screwed (tightening torque 2.5 Nm) and the cable glands filled with cable or fitting plugs, must also be tight (tightening torque 2.5 Nm for 16 mm and 5 Nm for 20 mm). All sockets not in use (USB, MIL, etc.) must be covered with corresponding caps. Damage caused by intrusion of water will not be covered by the warranty.

9.4 Calibration Touch Screen

Every touch screen requires calibration so that each point on the touch surface is assigned to the corresponding spot on the display as accurately as possible.

Calibration has to be repeated if necessary because the touch screen properties may change due to environmental impacts, in particular repeated temperature fluctuations and ageing.

The touch screen calibration programme can be started up directly in moni::tool. For a description of the functionality, please refer to the manual moni::tool.

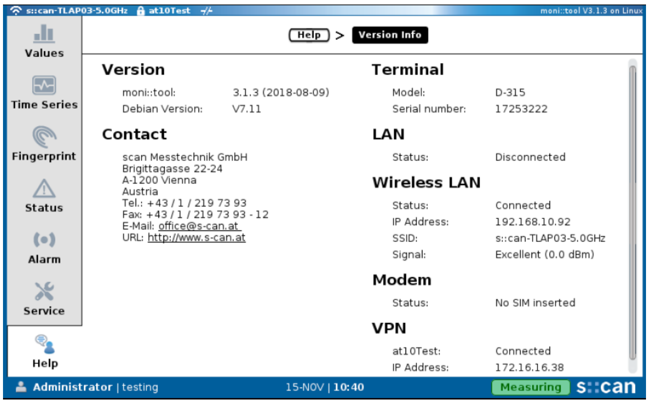
In case the con::cube can no longer be operated via its touch screen, the calibration procedure can be started via web browser, via VNC-Viewer or via mouse / keyboard connected to USB and the calibration can be carried out on the touch screen of the con::cube.

10 Troubleshooting

All information and notes regarding typical error pattern as well as error and status messages can be found in the manual of the operating software moni::tool.

10.1 Device Settings

The most important con::cube settings will be displayed when clicking on the s::can logo in the lower right hand side of the screen (see figure on the right).



Version

moni::tool: 3.1.3 (2018-08-09)
Debian Version: V7.11

Contact

scan Messtechnik GmbH
Brigittagasse 22-24
A-1200 Vienna
Austria
Tel.: +43 / 1 / 219 73 93
Fax: +43 / 1 / 219 73 93 - 12
E-Mail: office@s-can.at
URL: http://www.s-can.at

Terminal

Model: D-315
Serial number: 17253222

LAN

Status: Disconnected

Wireless LAN

Status: Connected
IP Address: 192.168.10.92
SSID: s::can-TLAP03-5.0GHz
Signal: Excellent (0.0 dBm)

Modem

Status: No SIM inserted

VPN

at10Test: Connected
IP Address: 172.16.16.38

10.2 Software Update

Please contact your s::can sales partner in case a software update is needed. In case the con::cube is connected to the internet there is a possibility for live update.

10.3 Return Consignment (RMA - Return Material Authorization)

Return consignments of the s::can monitoring system, or parts of the system, shall be done in a packaging that protects the device (original packaging or protective covering if possible). Before returning a consignment, you have to contact your s::can sales partner or s::can customer support (support@s-can.at). A RMA number will be assigned for each device, independent if the reason of the return consignment is service, repair or demo equipment.

RMA numbers can be requested from the s::can Customer Portal available on the s::can webpage directly. Return consignments without an RMA number will not be accepted. The customer always has to bear the costs for return consignment.

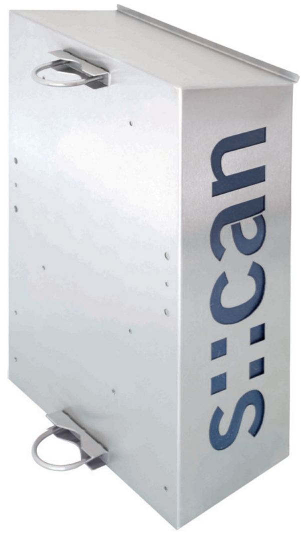
11 Accessories

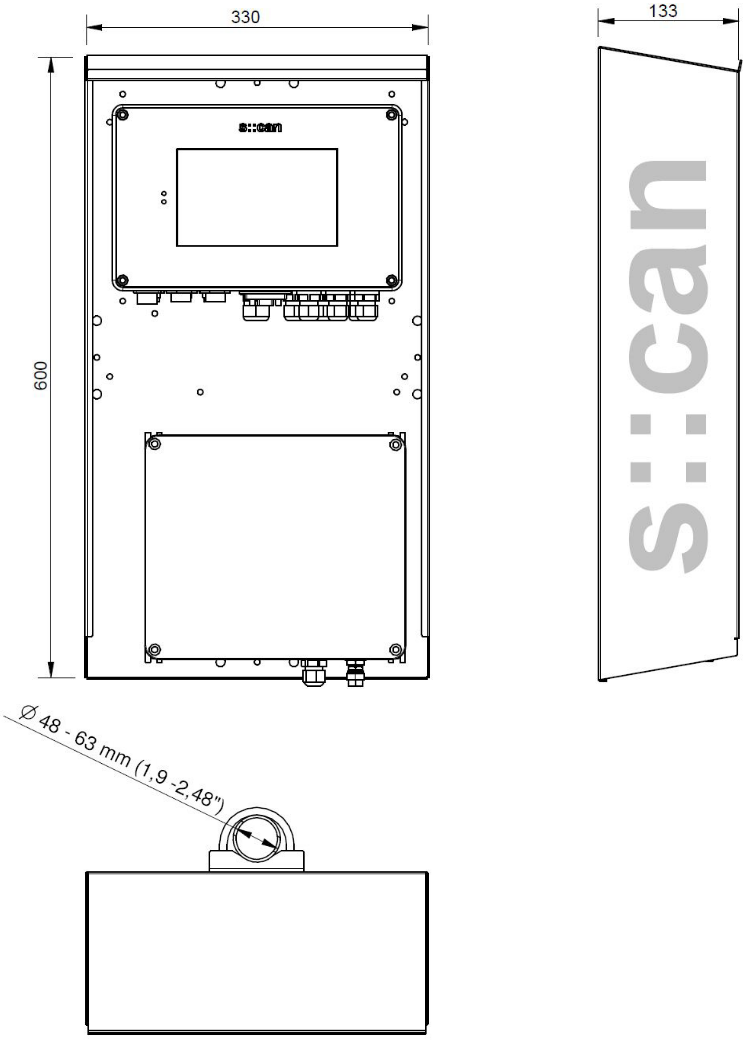
11.1 Installation

11.1.1 Weather Shield

For protection of the con::cube in case of outdoor installation and for easy mounting on walls or railings a specific housing is available.

Name	Specification	Remark
Part-no.	F-51	
Housing material	stainless steel (1.4301)	
Dimensions	363 / 553 / 170 mm	W / H / D
Weight	5 kg	
Mounting bracket	2 x M8 U-bolt with screw nut and spring washer 4 x M5 flange nut	included in delivery for mounting onto rails

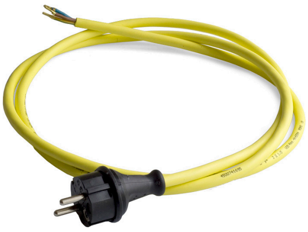




11.1.2 Power Supply Cord

For connection of the device to the power supply, a power supply cable is available.

Name	Specification	Remark
Part-no.	C-31-EU or C-31-US	
Cable length	2 m	
Weight	approx. 300 g	
Material	PU	jacket
Process connection	CEE-7 shockproof plug NEMA 5-15 plug	C-31-EU C-31-US
Environment rating (IP)	IP 44 IP 55	C-31-EU C-31-US



11.1.3 External Antenna and Connector

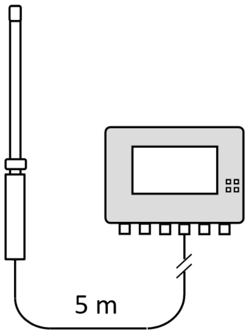
For a con::cube equipped with internal 3G modem (D-315-3G) an external antenna is available. To connect this antenna to the con::cube a seperate plug will be mounted.

Name	Specification	Remark
Part-no.	D-315-ANTENNA-PRO D-315-ANTENNA-PLUG	Antenna Plug
Cable length	5 m + 10 m extension cable	
Cable type	MWC 6/50	
Weight	approx. 0.6 kg	Antenna
Dimension	35 x 756 mm 1060 mm	Diameter / length Length with fixation
Frequency range	800 / 900 / 1800 / 1900 / 2100 MHz	Omni-Directional
Radiation	H-360, V-30	
Polarization	Vertical	
Gain	7 dB	
VSWR	< 2.0 : 1	
Impedance	50 Ohm	
Environment rating (IP)	IP 67	
Operating temperature	-20 to 60 °C (-4 to 140 °F)	
Housing material	Aluminium	
Material other	Fiber glass	
Mounting	fixation included in delivery	see instruction below

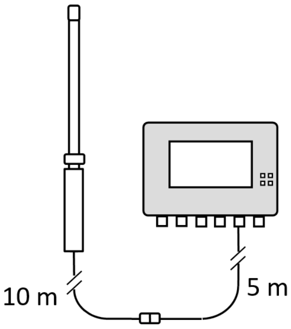
⚠ Install antenna in area protected from lightning strikes! Antenna must be installed away from power lines in a distance equal to at least twice the combined length of the mast and antenna. Avoid to install antenna under large, overhanging tree branches.

The mounting of the antenna is performed by the following steps:

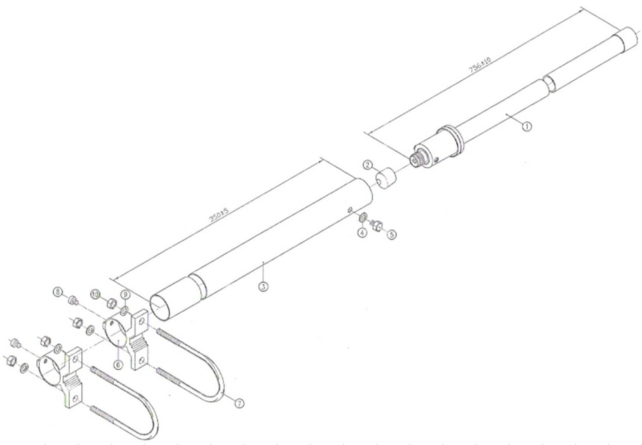
- Fix carrier brackets on mounting console with bolts.
- Fix mounting console (antenna fixing hole should be on the top) to the desired place with round brackets.
- Antenna must be positioned vertically.
- Guide the cable through the mounting console.
- Remove the protective cap from the antenna plug and connect the cable to the antenna.
- For fixing the connector do not rotate the cable but only use the thread. Proper fixing for a connector is “finger tight” plus a quarter turn.
- Fix antenna “finger tight” with washer and bolt.
- Connect the cable to the con::cube.

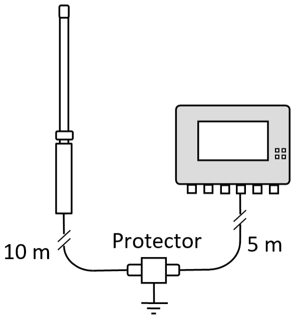


⚠ For all outside installations the lightning protector has to be used. The protector must be attached to a grounded surface. It is a single-use device which means you should change it after lightning hits the antenna.



⚠ For any RF connector it is important to keep contacts clean. Gentle cleaning with isopropyl alcohol is allowed. Do not saturate connector with alcohol. Unused antenna connector should have a protective cap.





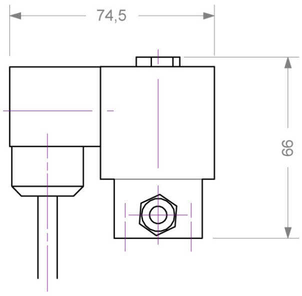
11.2 Automatic Cleaning

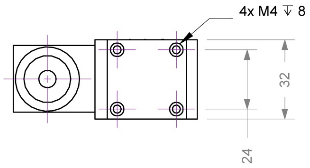
11.2.1 Cleaning Valve

For operation of the automatic compressed air cleaning system, a cleaning valve is available.

Name	Specification	Remark
Part-no.	B-44 B-44-2	
Cable length	2.5 m 1.0 m	B-44 B-44-2
Assembling	ex works, with cable end sleeves	+ blue - brown
Dimensions	85 / 75 / 70 mm	W / H / D
Material	Brass,stainless steel 1.4305 FPM	Housing Sealing material

Name	Specification	Remark
Environment rating (IP)	IP 65	
Media that can be handled	neutral gases and liquids	
Temperature limits	-10 to 90°C (14 to 194°F) -30 to 60°C (-22 to 140°F)	of medium of environment
Operation voltage	12 VDC	supply by controller for operation
Connection fitting compressed air side	B-44: Standard DIN 7.2 coupler B-44-2: coupler screw connection 6/4 mm, nickel-plated brass	P inlet pipe compressor (compressed air side)
Connection fitting probe side	B-44: Hose ID $^3/_8$ inch B-44-2: plug-in fitting (6 mm OD)	A inlet pipe probe (probe side)
Direct connection valve	$^1/_8$ inch	if fittings supplied ex works are removed





11.3 Spare Parts

11.3.1 Desiccant Package

To avoid condensing humidity inside the con::cube a desiccant package is built in. The desiccant packages are available as spare part.

Name	Specification	Remark
Part-no.	B-43-2	10 pieces
Dimensions	70 / 5 / 80 mm	W / H / D
Weight	approx. 10 g	

11.3.2 Touch Pen

For easy operation of the touch screen a touchscreen is included in delivery of the con::cube. Further touch pens can be ordered as spare part.

Name	Specification	Remark
Part-no.	D-312-PEN	3 pieces
Dimensions	87 mm	Length

11.4 Optional Features

The con::cube can be equipped with several optional features explained in the sections below. Regarding detailed information of the optional features please refer to the technical specifications located at the end of this manual.

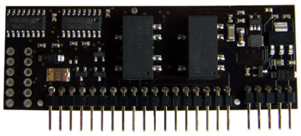
11.4.1 Gateway to 3G Modem

This optional available internal module provides wireless remote control and / or data transfer. The modem should be ordered at the same time as the con::cube because later modification is not possible by customer himself.

Name	Specification	Remark
Part-no.	D-315-3G	
Assembling	ex factory	
Optional features	D-315-ANTENNA-PLUG D-315-ANTENNA-PRO	

11.4.2 Analog Output Module

This optional module provides two analog outputs for data transfer to PLC systems.



Name	Specification	Remark
Part-no.	D-315-OUT-MA	
Output	2 x 4 - 20 mA	
Interface	AWG 28-12, stripped wire	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 12.1 for address mapping
Assembling	only by qualified personal authorized by s::can	con::cube can be equipped with max. 8 modules

11.4.3 Digital Output Module

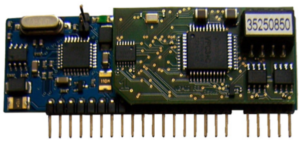
This optional module provides four configurable relay outputs for triggering functions.

Name	Specification	Remark
Part-no.	D-315-OUT-RELAY	
Output	4 x digital out	
Interface	AWG 28-12, stripped wire	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	

11.4.4 Profibus DP Output Module

This optional module provides Profibus DP an interface for data transfer to PLC systems.

Name	Specification	Remark
Part-no.	D-315-OUT-PROFIBUS	
Output	Profibus DP	
Interface	Sub-D9, IP 67	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 12.2
Assembling	only by qualified personal authorized by s::can	con::cube can be equipped with 1 module at slot no. 8



11.4.5 SDI 12 Output Module

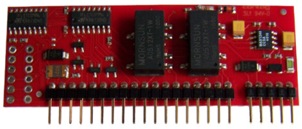
This optional module provides SDI 12 an interface for data transfer to PLC systems.

Name	Specification	Remark
Part-no.	D-315-OUT-SDI12	
Interface		via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	
Assembling	only by qualified personal authorized by s::can	con::cube can be equipped with 1 module at slot no. 8

11.4.6 Analog Input Module

This optional module provides two analog inputs for integration of third party sensors into the s::can monitoring system.

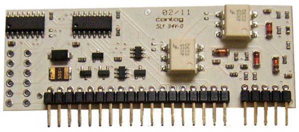
Name	Specification	Remark
Part-no.	D-315-IN-MA	
Input	2 x 4 - 20 mA	
Interface	AWG 28-12, stripped wire	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 12.1 for address mapping
Assembling	only by qualified personal authorized by s::can	con::cube can be equipped with max. 8 modules



11.4.7 Digital Input Module

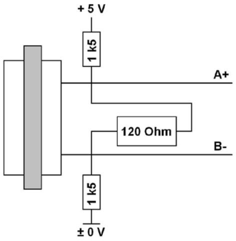
This optional module provides two digital inputs for integration of third party sensors into the s::can monitoring system.

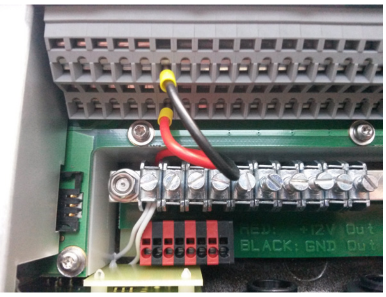
Name	Specification	Remark
Part-no.	D-315-IN-RELAY	
Input	2 x digital in	
Interface	AWG 28-12, stripped wire	via terminal block, see sec-tion 5.1 for correct wiring
Configuration	via moni::tool software	see section 12.1 for address mapping
Assembling	only by qualified personal authorized by s::can	con::cube can be equip-ped with max. 8 modules



12 Technical Specifications

Name	Specification	Remark
Part-no.	D-330-230 D-330-024	con::cube with AC power supply con::cube with DC power supply
Dimensions housing	280 / 209 / 85 mm	W / H / D
Required space	290 / 280 / 240 mm	W / H / D
Weight	approx. 4 kg	
Operation temperature	-20 to 50 °C (-4 to 122 °F)	at max. temperature sun shield recommended
Storage temperature	-20 to 60 °C (-4 to 140 °F)	Acclimatised device to operation temperature before initial operation.
Humidity	5 to 90%	non-condensing
Material housing	Aluminium alloy, powder coated	
Environment rating (IP)	IP 65	see section 4.1
Environmental conditions	Altitude up to 2000 m Overvoltage category II Pollution degree 2	
Mounting	4 x M5 thread holes on backside 2 mounting brackets and 4 screws (included in delivery)	for direct mounting on panels (F-501) for wall mounting from front side
Power supply D-330-024	10 to 36 VDC	
Power supply D-330-230	100 to 240 VAC / 50 to 60 Hz	wide range power supply unit
Power supply cable	outside diameter 5 - 12 mm single cable wires 1.5 - 2.5 mm^2	min. 80°C min. 300 VAC
Required galvanic isolation of power input	3.0 kV 1.5 kV	D-330-230 D-330-024
Power consumption	1.5 W (typical) 10 W (typical) / 20 W (max.) 30 W (typical) / 60 W (max.)	in sleep mode no I/O ports fully equipped
Electric potential	Grounding for D-330-024 and D-330-230	max. 0.1 Ohm PE power supply to site‘s earth grounding max. 0.5 Ohm PE power supply to process medium; see section 5.5
Conformity - ECM	EN 61326-1	
Conformity - safety	EN 61010-1 UL 61010-1:2004 R10.08 CAN/CSA-C22.2 NO. 61010-1-04+GI1 (R2009)	
Fuse	internal	replacement by s::can Service only
Internal battery	CR2032, 3V Lithium battery	for real time clock (RTC)
Connection of s::can spectrometer probe	1 x M12 (IP 67, RS485, 12 VDC) galvanically isolated 1 kV internal network termination 120 Ohm	
Connection of s::can ISE probes or s::can sensors	4 x sys plug connector (IP 67, RS485, 12 VDC) galvanically isolated 1 kV internal network termination 120 Ohm	

Name	Specification	Remark
RS485	galvanically isolated 1 kV internal network termination 120 Ohm	
Display	VGA TFT color display (800x480), 9 inches, (approx. 197 x 110 mm)	
User interface (on device itself)	USB (keyboard, mouse) Touch screen	
User interface (remote control)	Web-browser (TCP/IP) VNC (TCP/IP)	
Network connection (TCP/IP)	WLAN / WIFI 802.11n a/b/g (300Mb/s) Ethernet LAN (100 Mb/s, RJ45) 3G or 4G modem	D-315-3G (optional)
USB	USB connector (type A, 2.0)	for data transfer, software update, keyboard, mouse
Operating system	Linux	installed ex works (D-303-LX)
Main memory	2 GB RAM	
Onboard memory	16 GB	
Functional display (LED)	4 x LED (blue / yellow / red)	linked to digital OUT 5 by default
Interface to SCADA	Modbus RTU Modbus TCP	max. 32 parameters max. 32 parameters
Interface to SCADA (optional)	Profibus DP for max. 8 parameters (Slave according IEC 61158, up to 11 Mbit/s, DPV1, Baudrate bis 12 Mbaud) SDI 12 OUT for max. 8 parameters Analog OUT (4 to 20 mA active) Resolution = 12bit (5 µA) Accuracy = 30 µA Max. load = 500 Ohm, Galvanic isolation = 1 kV	D-315-OUT-PROFIBUS (blue module), address = 1, see section 11.5.4 D-315-OUT-SDI12 see section 11.5.5 D-315-OUT-MA (black module), see section 11.5.2
Interface to third party devices (optional)	Analog IN (4 to 20 mA) Input resistance = 100 Ohm Galvanic isolation = 1 kV Resolution = 12 bit (5 µA)	D-315-IN-mA (red module), see section 11.5.6
3G Modem (optional)	3G: 900 and 2100 MHz 3G: 850, 1900 and 2100 MHz EDGE/GPRS: 850, 900, 1800 and 1900 Mhz	D-315-3G-EU D-315-3G-US both types
Digital OUT (optional) (relay on)	Max: 230 V / 500 VA (AC 15) 24 V / max. 2 A (DC 1) Min: 5 V / 100 mA	D-315-OUT-RELAY 4 modules normally open COM-3, address 33

Name	Specification	Remark
Digital OUT sum error (relay on)	Max: 230 V / 500 VA (AC 15) 24 V / max. 2 A (DC 1) Min: 5 V / 100 mA	1 module normally open COM-3, address 33 LED: red = open, blue = closed
Digital IN	Logic levels: low < 5 V high > 10 V Max. voltage = 14 V Galvanic isolation > 1 kV	D-315-IN-RELAY (white module), see section 11.5.7
Digital OUT (relay change)	for 2 cleaning devices	
Power supply output 12 V	12 VDC, max. 8 W via red (+12 V) and black (-12 V) terminal block on bottom which are connected to the terminals 11 and 12 see picture on the right	

12.1 Terminal- and Address Assignment for optional I /O Modules

Slot	Terminal number for In- / Output 1 and 2	mA Output Address	mA Input Address	Digital Input Address
Slot 1	43 (+) / 44 (-) and 41 (+) / 42 (-)	49 and 50	17 and 18	33 and 34
Slot 2	39 (+) / 40 (-) and 37 (+) / 38 (-)	51 and 52	19 and 20	35 and 36
Slot 3	35 (+) / 36 (-) and 33 (+) / 34 (-)	53 and 54	21 and 22	37 and 38
Slot 4	31 (+) / 32 (-) and 29 (+) / 30 (-)	55 and 56	23 and 24	39 and 40
Slot 5	27 (+) / 28 (-) and 25 (+) / 26 (-)	57 and 58	25 and 26	41 and 42
Slot 6	23 (+) / 24 (-) and 21 (+) / 22 (-)	59 and 60	27 and 28	43 and 44
Slot 7	19 (+) / 20 (-) and 17 (+) / 18 (-)	61 and 62	29 und 30	45 and 46
Slot 8	15 (+) / 16 (-) and 13 (+) / 14 (-)	63 and 64	31 and 32	47 and 48

12.2 Pin Assignment for optional Profibus DP connector (Sub-D9)

Pin	Specification
1	not connected
2	not connected
3	PB +
4	not connected
5	Profibus GND
6	Profibus 5 V
7	not connected
8	PB -
9	not connected

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Manual

Spectrometer Probe V3

March 2022 Release

S-30-M

Table of Contents

1 General

This manual contains, firstly, general information (chapter 1) and safety guidelines (chapter 2). The next chapter (chapter 3) provides a technical description of the s::can product itself as well as information regarding transport and storage of the product. In further chapters the installation (chapter 4) and the initial startup (chapter 5) are explained. Furthermore information regarding calibration of the device (chapter 6), data management (chapter 7), how to perform a function check (chapter 8) and maintenance (chapter 9) can be found in this manual. Information regarding troubleshooting (chapter 10), the available accessories (chapter 11) and the technical specifications (chapter 12) complete the document.

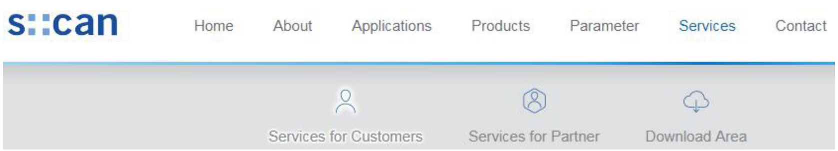
Each term in this document that is marked *italic and underlined*, can be found on the display of your controller for operation or as lettering on your s::can product.

In spite of careful elaboration this manual may contain errors or incompletion. s::can does not assume liability for errors or loss of data due to such faults in the manual. The original manual is published in English and German by s::can. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into third languages.

This manual and all information and figures contained therein are copyrighted. All rights (publishing, reproduction, printing, translation, storage) are reserved by s::can Messtechnik GmbH. Each reproduction or utilisation outside the permitted limits of the copyright law is not allowed without previous written consent from s::can Messtechnik GmbH. The reproduction of product names, registered trade names, designation of goods etc. in this manual does not imply that these names can be used freely by everyone; often these are registered trade marks, even if they are not marked as such.

This manual, at the time of its publication (see release date printed on the top of this document), concerns the s::can products listed in chapter 3. Information and technical specifications regarding these items in s::can manuals from earlier release dates are herewith replaced by this manual.

The electronic version (pdf-document) of this manual is available on the s::can Customer Portal (Services for Customer) of the s::can website (www.s-can.at).



2 Safety Guidelines

Installation, electrical connection, initial startup, operation and maintenance of any s::can product as well as complete s::can measuring systems must only be performed by qualified personnel. This qualified personnel has to be trained and authorised by the plant operator or by s::can for these activities. The qualified personnel must have read and understood this manual and have to follow the instructions contained in this manual.

For proper initial startup of complete s::can measuring systems, the manuals for the controller and software used for operation (e.g. con::lyte, con::cube, con::nect, moni::tool), the connected probes and sensors as well as the used additional devices (e.g. compressor) have to be consulted.

⚠ The operator has to obtain the local operating permits and has to comply with the joint constraints associated with these. Additionally, the local legal requirements have to be observed (e.g. regarding safety of personnel and means of labour, disposal of products and materials, cleaning, environmental constraints). Before putting the measuring device into operation, the operator has to ensure that during mounting and initial startup – in case they are executed by the operator himself – the local legislation and requirements (e.g. regarding electrical connection) are observed.

⚠ All s::can products are leaving our factory in immaculate technical and safety conditions. Inappropriate or not intended use of the product, however, can cause danger! The manufacturer is not responsible for damage caused by incorrect or unauthorised use. Any kind of manipulation of the instrument is strictly prohibited - except for the activities described in this document. Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid. For details regarding guarantee and warranty please refer to our general conditions of business.

2.1 Declaration of Conformity

This s::can product has been developed, tested and manufactured for electromagnetic compatibility (EMC) and according to applicable European standards, as defined in the declaration of conformity.

CE-marks are applied on the device. The declaration of conformity related to this marking can be requested from s::can or your local s::can sales partner or can be downloaded from the s::can Customer Portal.

2.2 Special Hazard Warning

⚠ Because the s::can measuring systems are frequently installed in industrial and municipal waste water applications, one has to take care during mounting and demounting of the system, as parts of the device can be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one’s health during work with the measuring device.

⚠ The light source of the s::can spectrometer probe emits visible light as well as UV-light, which is extremely dangerous for human eyes (health hazard!). Do not look into the pulsed light beam (e.g. directly or by using mirrors)!

⚠ As internal parts of the s::can spectrometer probe are under high voltage, the opening of the probe‘s housing can cause injury, is strictly forbidden and will cancel all guarantee / warranty.

3 Technical Description

3.1 Intended Use

All s::can spectrometer probes are compact spectrometer probes, designed for continuous online measurement of absorption spectra (UV-Vis and derived parameters) with high quality. The spectrometer probes are available with three different optical path lengths (OPL).

These probes can be operated either directly submersed in liquid media (in-situ) or in by-pass via flow cell setup. Furthermore small samples of the medium can be measured with help of the multifunctional slide. Applications range from ultra pure water (DOC > 0,01 mg/l) up to industrial waste water with COD concentrations of several 1000 mg/l, and from single substance detection in sub-ppm concentrations up to surrogate and sum parameters in highest concentrations. The possibility to use the measured absorption spectrum (fingerprint) for spectral alarms completes the application field.

In all types of applications, the respective acceptable limits, which are provided in the technical specifications in the respective s::can manuals, have to be observed. All applications falling outside of these limits, and which are not authorised by s::can GmbH in written form, do not fall under the manufacturer’s liability.

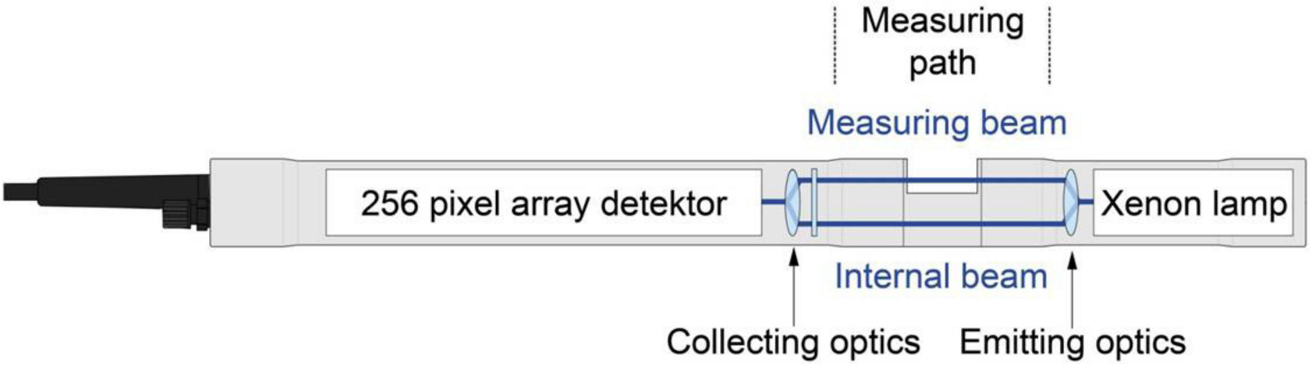
⚠ The device must only be used for the purpose described in this manual. Use in applications not described in this manual, or modification of the device without written agreement from s::can, is not allowed. s::can is not liable for claims following from such unauthorised use. In such a case, the risks are the sole responsibility of the operator.

3.2 Functional Principle

Spectrometer probes work according to the principle of UV-Vis spectrometry. Substances contained in the medium to be measured weaken a light beam that moves through this medium. The light beam is emitted by a lamp, and after contact with the medium its intensity is measured by a detector over a range of wavelengths. Each molecule of a dissolved substance absorbs radiation at a certain and known wavelength. The concentration of substances contained determines the size of the absorption of the sample – the higher the concentration of a certain substance, the more it will weaken the light beam.

Extinction or absorbance stands for a ratio of two light intensities: The intensity of light after the beam passed through the medium to be measured and the intensity of light determined after the beam passed through a so-called reference medium (distilled water). There is a linear increase in absorption with higher concentrations.

Every s::can spectrometer probe consists of three main components: the emitter unit, the measuring section and the receiving unit.



The central element of the emitter is a light source – a xenon flash lamp. This is complemented by an optical system to guide the light beam and an electronic control system to operate the lamp.

In the measuring section the light passes through the space between the two measuring windows which is filled with the measuring medium and interacts with it. A second light beam within the probe – called compensation beam - is guided across an internal comparison section. Every probe is a dual-beam measuring instrument, allowing the automatic compensation of disturbances in the measuring process (e.g. ageing of the flash lamp).

The receiving unit is located on the side of the spectrometer probe where the probe cable is attached, and it consists of two major components: the detector and the operating electronics. An optical system focuses the measuring and compensation beams on the entrance port of the detector. The light received by the detector is split up into its wavelengths and guided to the 256 fixed photodiodes, making the use of sensitive moving components unnecessary. The operating electronics contained in this part of the probe are responsible for controlling the entire measuring process and all the various processing steps required to edit and check the measuring signal and to calculate fingerprints and parameters values.

3.3 Product

The s::can spectrometer probes are offered in two different device variants (spectro::lyser and G-series) and three optical path lengths (OPL). The needed parameters can be configured individually for the different applications. Regarding detailed information of the device please refer to the technical specifications located at the end of this manual.

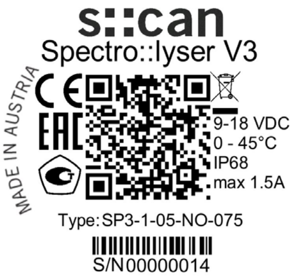
Part-no.	Type / specification
SP3-1-01-NO-xxx	UV-Vis spectro::lyser for waste water with 1 mm optical path length
SP3-1-05-NO-xxx	UV-Vis spectro::lyser for surface water with 5 mm optical path length
SP3-1-35-NO-xxx	UV-Vis spectro::lyser for drinking water with 35 mm optical path length
SP3-1-xx-NO-010	UV-Vis spectro::lyser with 1 m fixed sensor cable, for by-pass installation
SP3-1-xx-NO-075	UV-Vis spectro::lyser with 7.5 m fixed sensor cable, for submersed installation
SP3-1-xx-NO-150	UV-Vis spectro::lyser with 15 m fixed sensor cable, none standard, longer delivery time
N2-1-xx-NO-xxx	nitro::lyser (Turbidity or TSS and Nitrate)
U5-1-xx-NO-xxx	uv::lyser (Turbidity or TSS and up to four specified wavelengths)
O2-1-xx-NO-xxx	ozo::lyser (Turbidity or TSS and ozone)
C2-1-xx-NO-xxx	carbo::lyser (Turbidity or TSS and one organic parameter)
C3-1-xx-NO-xxx	carbo::lyser (Turbidity or TSS and two organic parameters)
M4-1-xx-NO-xxx	multi::lyser (Turbidity or TSS and Nitrate and two organic parameters)
Additional features	
V3-LOGGER	License fee for integrated data logger

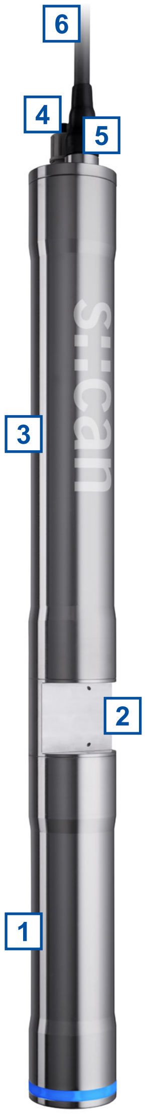
Part-no.	Type of application	SP3	G.ser
I	municipal waste water influent / sewage	x	x
A	municipal waste water aeration basin	x	x
E	municipal waste water effluent	x	x
R	river water / surface water	x	x
G	ground water	x	x
O	sea water	x	
D	drinking water	x	x
M	dairy industry	x	
P	paper industry influent	x	
Q	paper industry effluent	x	
B	brewery industry	x	
X	industrial water	x	

Regarding detailed information of the measured parameters please refer to section 5.5.

The device is typified by a type label, as shown below, that contains the following information:

- Manufacturer‘s name and country of origin
- Several certification marks
- Device name
- QR code to s::can Support
- Part number (Type)
- Bar code
- Device serial number (S/N)
- Information on power supply
- Acceptable temperature limits
- Environment rating (IP)
- Maximal power consumption





1 Probe housing (lamp side)

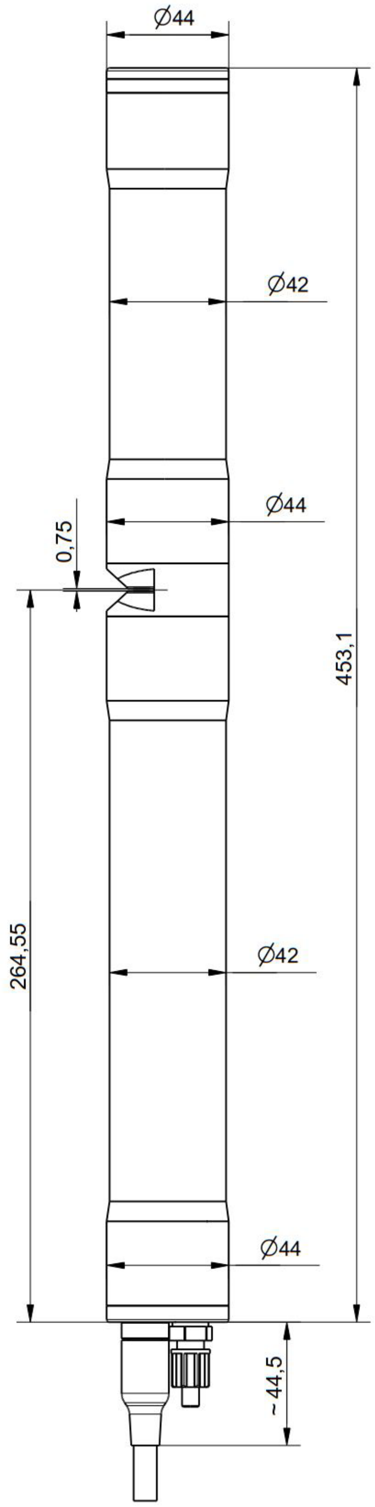
2 Measuring section (OPL - optical path length)

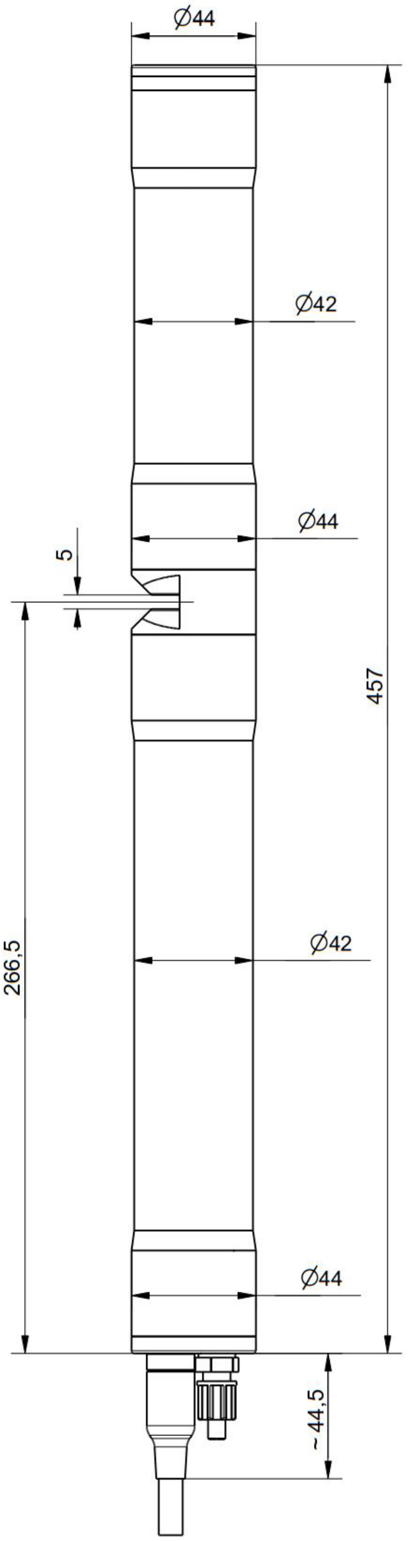
3 Probe housing (detector side)

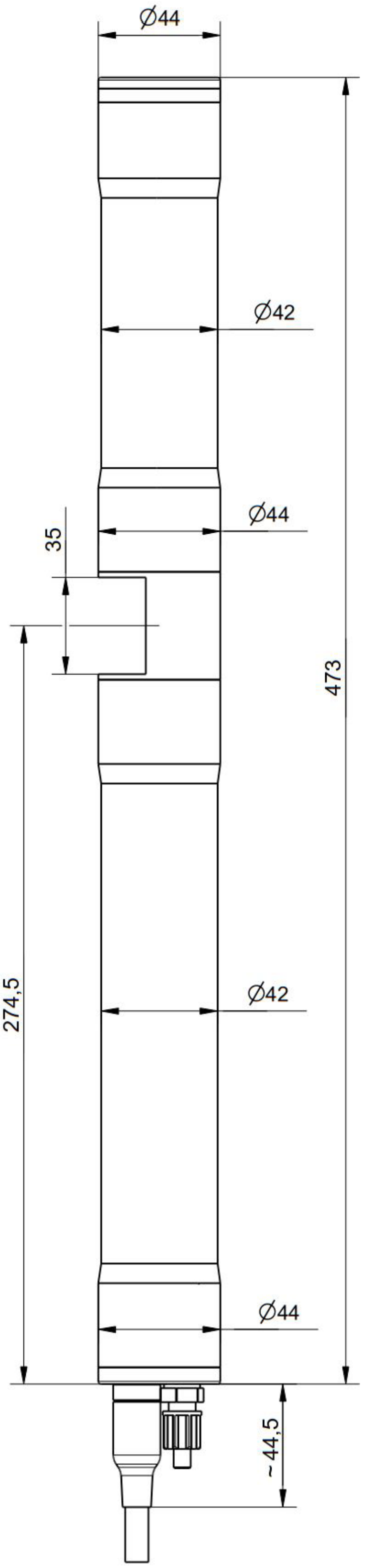
4 Connection for automatic cleaning

5 Cable gland

6 Probe cable







Dimensions of probe in mm:

- OPL 1 mm (see left figure above)
- OPL 5 mm (see middle figure above)
- OPL 35 mm (see right figure above)

3.4 Storage and Transport

The temperature limits for device storage and transport, which are described in the section technical specifications, have to be observed at all times. The device shall not be exposed to strong impacts, mechanical loads or vibrations. The device should be kept free of corrosive or organic solvent vapours, nuclear radiation as well as electromagnetic radiation.

Damage to the device caused by wrong storage will not be covered by warranty.

Transport should be done in a packaging that protects the device (original packaging or protective covering if possible).

This product is marked with the WEEE symbol to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EC. The symbol indicates that this product should not be treated as household waste. It must be disposed and recycled as electronic waste. Please assist to keep our environment clean.

3.5 Scope of Delivery

Immediately upon receipt, please check the received consignment for completeness on the basis of the delivery note and check for any possible damage incurred during shipping. Please inform the delivering dispatcher and s::can immediately in case of any damages in transit.

The following parts should be included in the delivery:

- s::can spectrometer probe (part-no. according to section 3.3)
- Connection set for automatic cleaning (part-no. B-41-SENSOR)
- Cleaning brush (part-no. B-60-2 for OPL 5 and 35 mm)
- Multifunctional slide (part-no. E-421-V3 for all OPL)
- s::can manual spectrometer probe (part-no. S-30-M)

The following parts could be included in the delivery if ordered as an option:

- Adapter cable (part-no. C-32-V3, C-32-MIL)
- Extension cable (part-no. C-210-V3 or C-220-V3)
- con::nect box (part-no. B-33-012)
- Probe carrier (part-no. F-110-V3 and F-140-V3 for 45 degree installation or F-120-V3 and F-150-V3 for vertical installation)
- Fixing adapter for railing (part-no. F-15)
- Flow cell waste water (part-no. F-48-V3 for all OPL)
- Flow cell clean water (part-no. F-445-V3 for all OPL)
- Flow cell - autobrush (part-no. F-446-V3 for OPL 35 mm or F-446-V3-TI for OPL 35 mm titanium)
- Cleaning valve (part-no. B-44 or B-44-2)
- s::can compressor (item-no. B-32-230, B-32-110 or B-32-012)

In case of incompleteness please contact your s::can sales partner immediately!

3.6 Product Updates, Other

The manufacturer reserves the rights to implement, without prior notice, technical developments and modifications in the light of continuous product care.

4 Installation

4.1 Environment

The correct installation of measuring instruments is an important prerequisite for satisfactory operation. Therefore the following checklist for the installation can be used to ensure that all sources for potential operational problems can be ruled out to the greatest possible extent during the installation, allowing the monitoring system to operate properly.

- Favourable flow conditions (little turbulence, acceptable flow rate, etc.)
- Unadulterated, representative measuring medium
- Measuring medium is in equilibrium state (no gas release, no precipitation, etc.)
- No external interferences (no electric and electro-magnetic interferences by leakage current, earth fault of pumps, electric motors, electric power lines, etc.)
- Easy accessibility (mounting, sampling, function check, demounting)
- Availability of sufficient space (probe / sensor, installation fitting, controller, etc.)
- Adherence to limit values (see technical specifications located at the end of this manual)

- Power supply for controller (operational reliability, voltage, power, peak free)
- Oil- and particle free compressed-air supply (optional for automatic probe / sensor cleaning)
- Best possible weather and splash water proof conditions of the controller used for operation
- Shortest possible distances between system components (probe / sensor – controller – compressed-air supply – energy supply)
- Correct dimensioning, mounting and protection of all cables and lines (non-buckling, no risk of stumbling, no damage etc.)

4.2 Mounting

When mounting the s::can spectrometer probe, please ensure that it is not possible that the measuring section (optical path) becomes blocked accidentally or by build-up of large particles present in the medium.

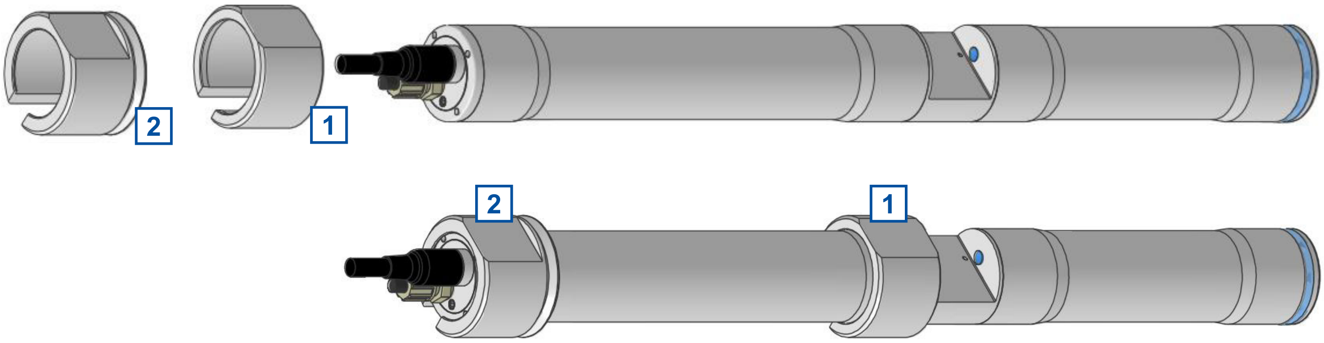
- Inclined or horizontal orientation (i.e. with measuring windows in vertical position) with plane face of the measuring section in vertical position. This will ensure no sedimentation of particles in the measuring section will take place and no gas bubbles will adhere to the measuring windows. The proper usage of an s::can probe carrier or s::can flow cell setup will ensure the correct position.
- Vertical orientation (i.e. with measuring windows in horizontal position) is only possible in applications with sufficient medium flow or automatic cleaning to ensure that no particles can sediment on the lower measuring window and no gas bubble might be captured within the measuring section.
- Flow velocity: < 3 m/s to avoid cavitations and therefore reduced measuring quality
  > 1 m/s when vertically mounted
- Abrasive solids (sand): < 1 g/l
- Recommended water level: > 10 cm at horizontal installation
- The probe housing must not be in direct contact with other metals, to prevent the possibility of contact corrosion.

- The probe cable has to be protected appropriately against cuts or damage induced by foreign objects in the water.
- In case of shallow water and / or low flow velocities the compressed-air cleaning system may swirl up sediments surrounding the measuring site (e.g. at the sewerage bottom). As a result the state of the measuring medium will not be representative of the normal water quality directly after cleaning. To avoid this, the openings of the cleaning nozzles shall point upwards.

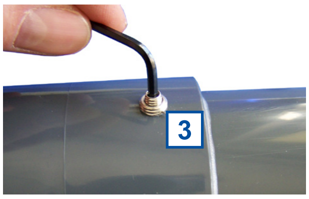
⚠ Even though the cable entry of the spectrometer probe is equipped with a protective mechanism against forces along the axis of the probe, the probe cable must never bear the weight of the spectrometer probe!

4.2.1 Mounting with Probe Carrier for submersed Installation (F-110-V3 / F-120-V3)

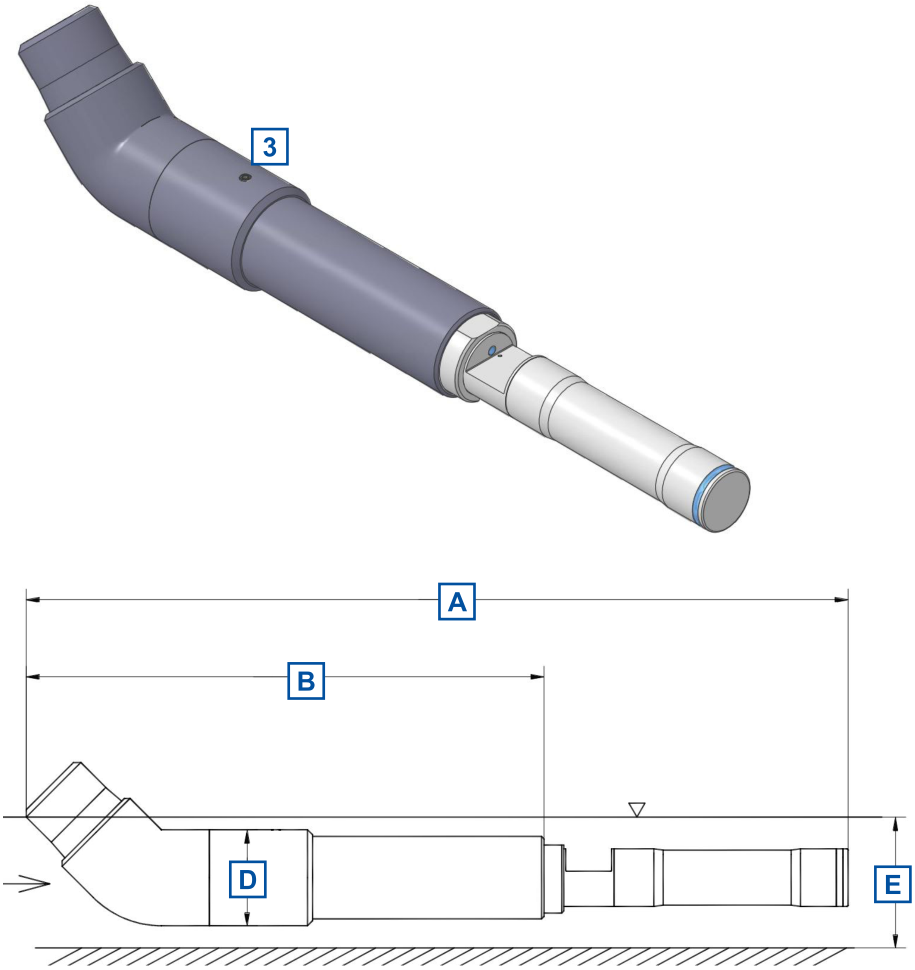
The submersed installation of a spectrometer probe using the specific probe carrier (part-no. F-110-V3 or F-120-V3) is performed by the following steps (see figures below also):

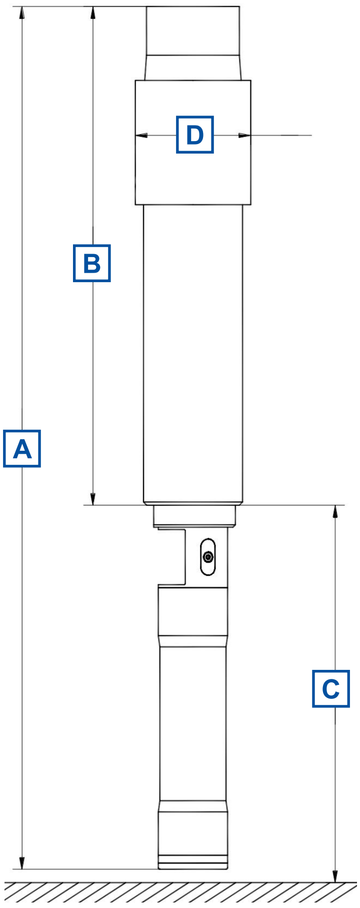


1. The shorter spacer ring has to be placed on the cable side of the probe housing close to the measuring section.
2. The longer spacer ring has to be placed on the cable side of the probe housing close to the probe cable with the groove towards the optical path.
3. After mounting the spacer rings, the compressed-air cleaning will be connection to the probe if used (see section 4.3).
4. Subsequently, the probe cable and the compressed-air hose are inserted into the probe carrier (e.g. with the help of a cable pulling device); when doing so, the cable plug and cleaning hose end must be protected against contamination.



5. The delivered M5 hexagon socket screw [3] has to be placed in the provided threaded hole, but should not be tightened yet.
6. Now slide the spectrometer probe into the probe carrier, so that the spacer ring close to the measuring section juts out 1.5 cm of the edge of the carrier. For horizontal installation the probe has to be placed in such a way that the plane face of the measuring section has a perpendicular orientation so that there can be no sedimentation in the measuring section and so that air bubbles can escape upwards.
7. The probe can now be fixed in this position by means of the hexagon socket screw [3], which will fall into the V-shaped groove of the spacer ring sitting on the end of the probe where the cable is located.



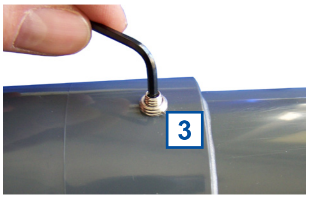


Probe Carrier F-120-V3

Probe Carrier F-110-V3

Carrier / OPL	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]
F-110-V3 / 1 mm	608.6	396	---	73.4	> 100
F-110-V3 / 5 mm	612.5	396	---	73.4	> 100
F-110-V3 / 35 mm	628.5	396	---	73.4	> 100
F-120-V3 / 1 mm	528.6	317	240	73.4	---
F-120-V3 / 5 mm	532.5	317	240	73.4	---
F-120-V3 / 35 mm	548.5	317	240	73.4	---

When necessary the probe carrier can be supplied with a tube extension that can simply be fixed to a railing by means of the fixing adapter (part-no. F-15). Appropriate measures must be taken to protect the probe cable and the compressed-air hose from damage due to buckling, abrasion etc. at the point where they exit the extension pipe.



For cleaning or checking the reference measurement (function check) using the multifunctional slide, the spectrometer probe can be slid out of the probe carrier slightly after loosening of the hexagon socket.

Probe Carrier V-120-V3

4.2.2 Mounting with Probe Carrier for submersed Installation (F-140-V3 / F-150-V3)

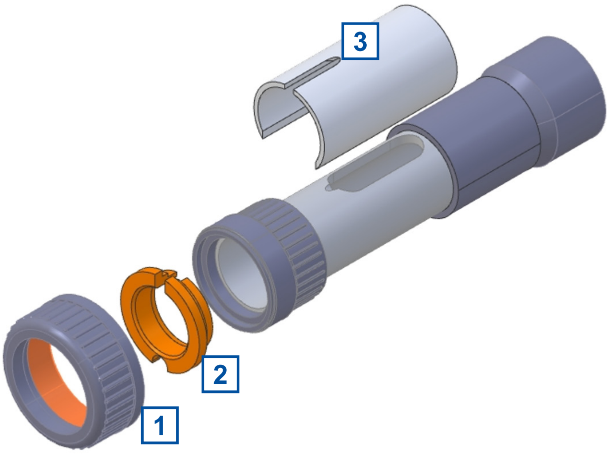
The submersed installation of a spectrometer probe using the specific probe carrier (part-no. F-140-V3 or F-150-V3) is performed by the following steps (see figures below also):

1 Unscrew the grey union nut [1] to disable the probe carrier into the single parts (see figure on the right).

2 The spacer ring [2] has to be placed on the cable side of the probe housing.

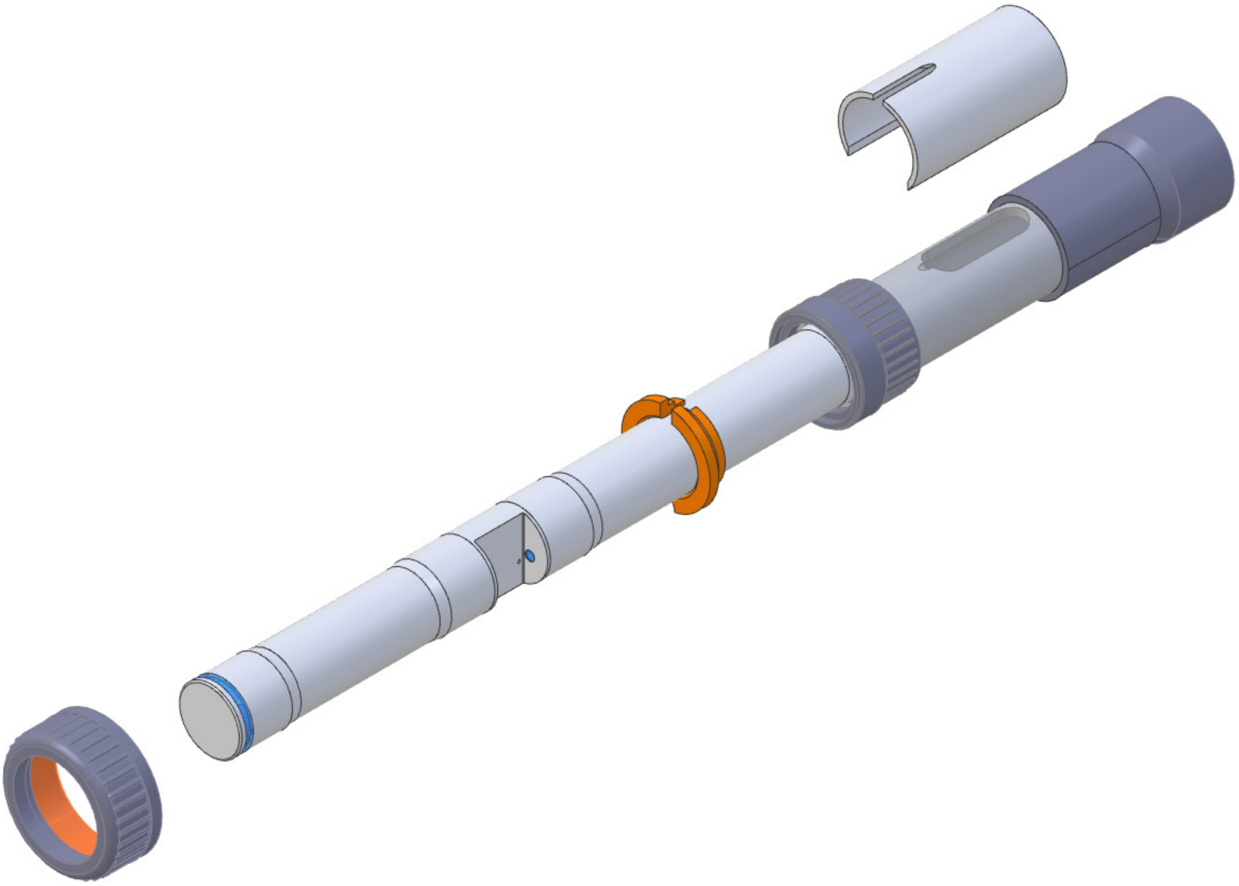
3 If necessary, connect the compressed-air cleaning to the probe (see section 4.3).

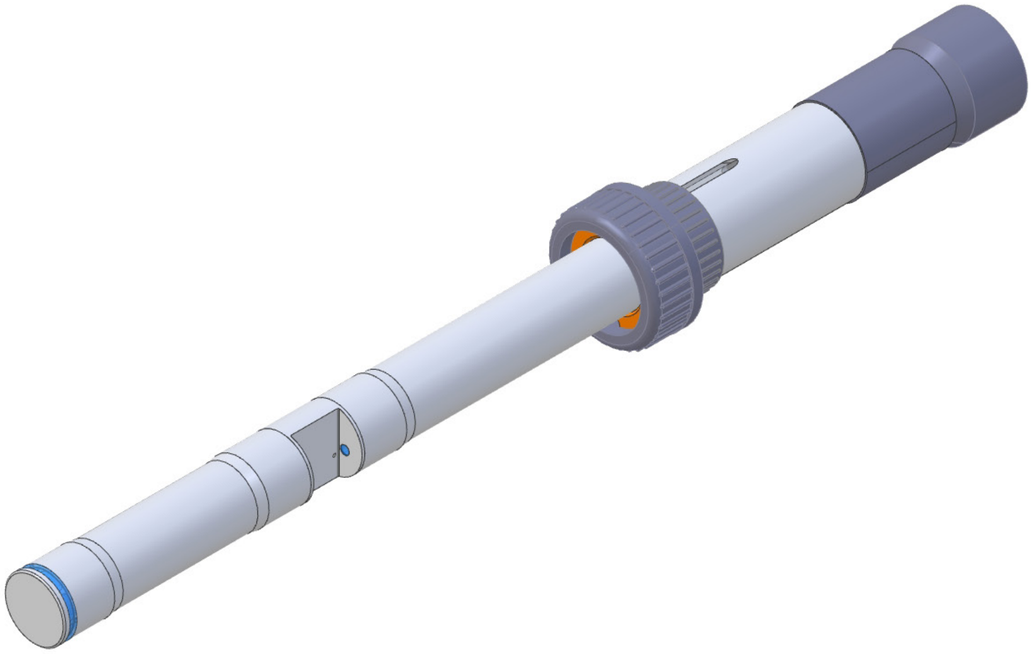
4 Subsequently, the probe cable and the compressed-air hose are inserted into the probe carrier (e.g. with the help of a cable pulling device); when doing so, the cable plug and cleaning hose end must be protected against contamination.



5 If a ruck::sack is used, slide the cable of the ruck::sack through the small slot [3] into the extension pipe (see section 4.3.2).

6 Now slide the spectrometer probe into the probe carrier as far as possible and fix it with the grey union nut. Ensure that the spacer ring is adjusted correctly. When using probe carrier for horizontal installation the probe has to be placed in such a way that the plane face of the measuring section has a perpendicular orientation so that there can be no sedimentation in the measuring section and so that air bubbles can escape upwards.





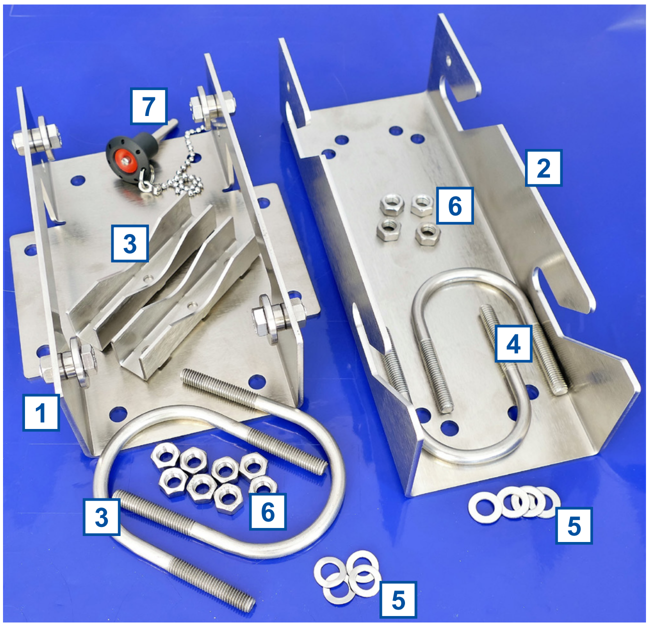
Probe Carrier V-150-V3

4.2.3 Monting of Railing Bracket / Fixing Adapter (F-15)

This section explains the mounting of the railing bracket (fixing adapter) with the extension pipe on the railing in case of a submersed installation.

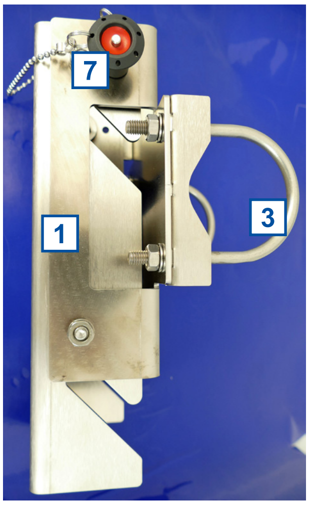
The following parts are included in the delivery of the railing bracket F-15:

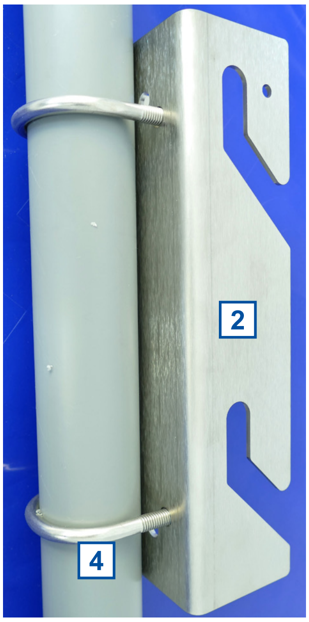
1	Fixing adapter for railing
2	Fixing adapter for extension pipe of sensor carrier
3	Fixing clamp for railing ($2^1/_2$ inch)
4	Fixing clamp for extension pipe of sensor carrier (50 mm)
5	Washers for fixing clamp
6	Screw nuts for fixing clamp
7	Safety pin for railing bracket



Once the sensor is installed in the sensor carrier with the extension pipe (see section 4.2.1 or 4.2.2) the mounting of the railing bracket is performed by the following steps:

- Fasten the fixing adapter for the railing [1] with the fixing clamp [3], the screw nuts and the washers, included in delivery, onto the railing.
- Fasten the other part of the fixing adapter [2] with the fixing clamp [4], the screw nuts and the washers, included in delivery, onto the extension pipe of the sensor carrier.
- Now insert the sensor with the extension pipe into the railing bracket from top.
- Secure the railing bracket with the locking pin [7] to prevent it from being pulled out unintenionally.
- If necessary, adjust the inclination of the extension pipe and the immersion depth of the sensor. To do this, loosen the corresponding screw nuts of the fixing clamps.

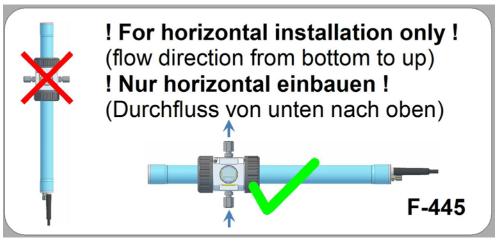




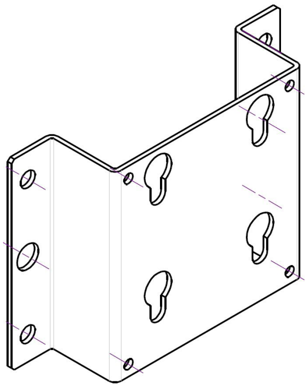
4.2.4 Mounting in Flow Cell for Clean Water (F-445-V3)

The flow cell can be mounted directly on a solid and flat surface (wall, mounting panel, etc.) using the mounting bracket (included in delivery). Once the mounting bracket is fixed the complete flow cell can easily be removed by unscrewing the safety screw (M4x45).

⚠ Please note, that the spectrometer probe should be mounted horizontal with water flow from bottom to top. This ensures the flow cell is always filled completely and no air bubbles will be captured.

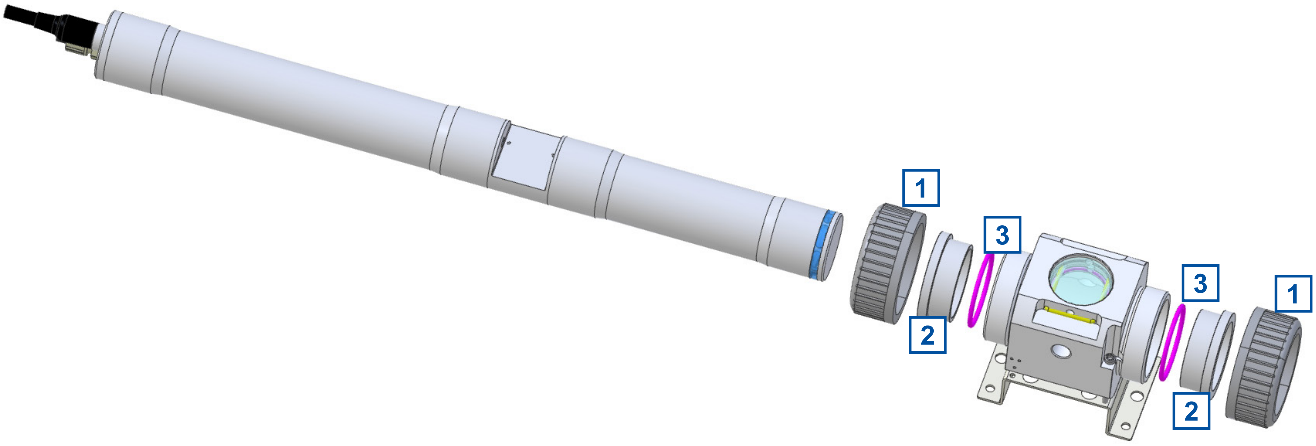


! For horizontal installation only !
(flow direction from bottom to up)
! Nur horizontal einbauen !
(Durchfluss von unten nach oben)

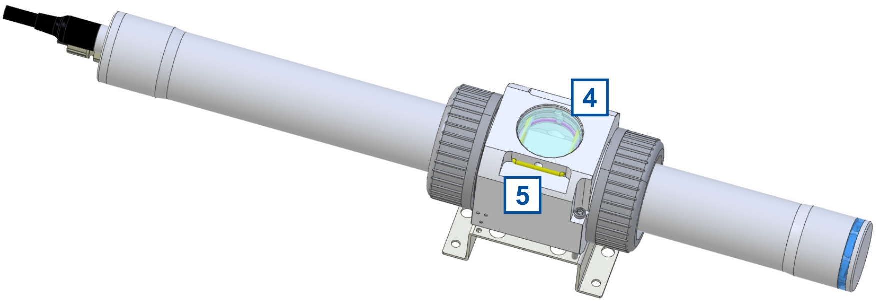


The installation of a spectrometer probe using the flow cell setup (part-no. F-445-V3) is performed by the following steps (see figures below also):

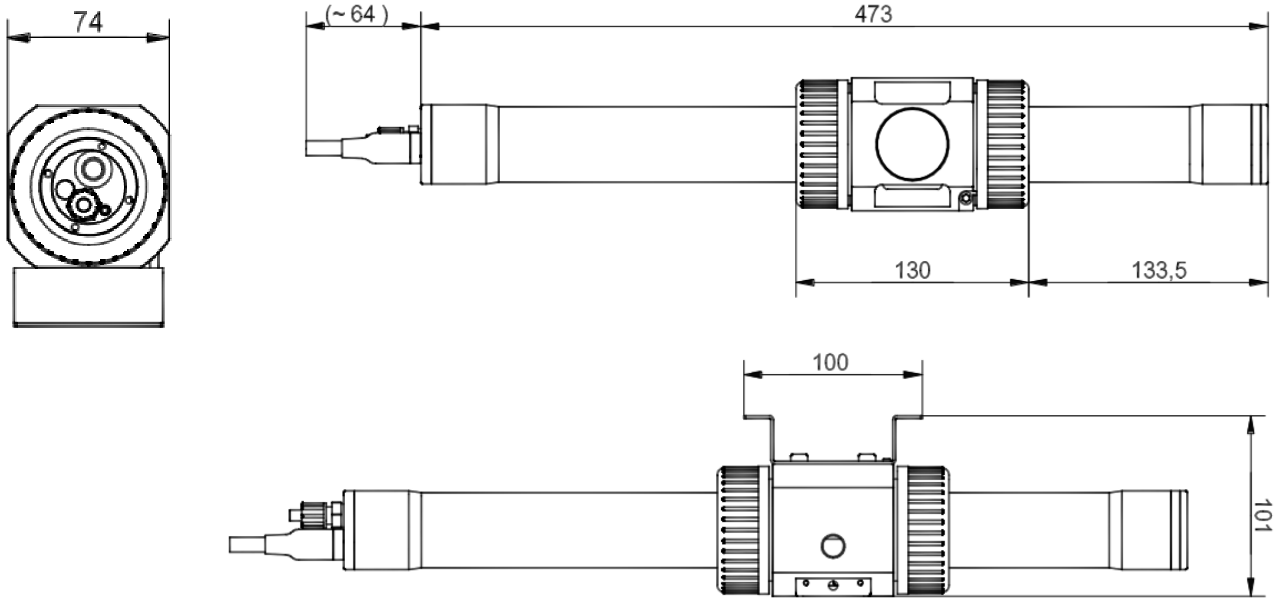
- Loosen both union nuts [1], which compress the O-rings of the flow cell. Do not unscrew completely – the compression inserts [2] and O-rings [3] must stay in place.
- Insert the spectrometer probe so that the cable points to the marked side (red marking dot and label) and align, so that the optical path appears level and centred in the flow cell.
- Fasten both union nuts [1] while holding the spectrometer probe firmly in place.
- Check the correct assembly by peering into the glass window [4] on top of the flow cell.



- For cleaning purposes the glass window [4] can be opened by removing the metal bracket [5] with a flat screw driver.



⚠ After final mounting the plane face of the measuring section shall have a vertical orientation to avoid any sedimentation in the measuring section and ensure that air bubbles can escape upwards.



Dimension of flow cell (F-445-V3) and required space for 35 mm spectrometer probe in [mm]

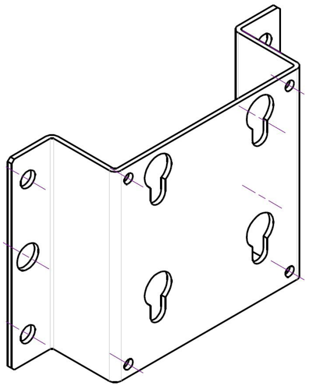
4.2.5 Mounting in Flow Cell for Clean Water with autobrush (F-446-V3)

The flow cell can be mounted directly on a solid and flat surface (wall, mounting panel, etc.) using the mounting bracket (included in delivery). Once the mounting bracket is fixed the complete flow cell can easily be removed by unscrewing the safety screw (M4x45).

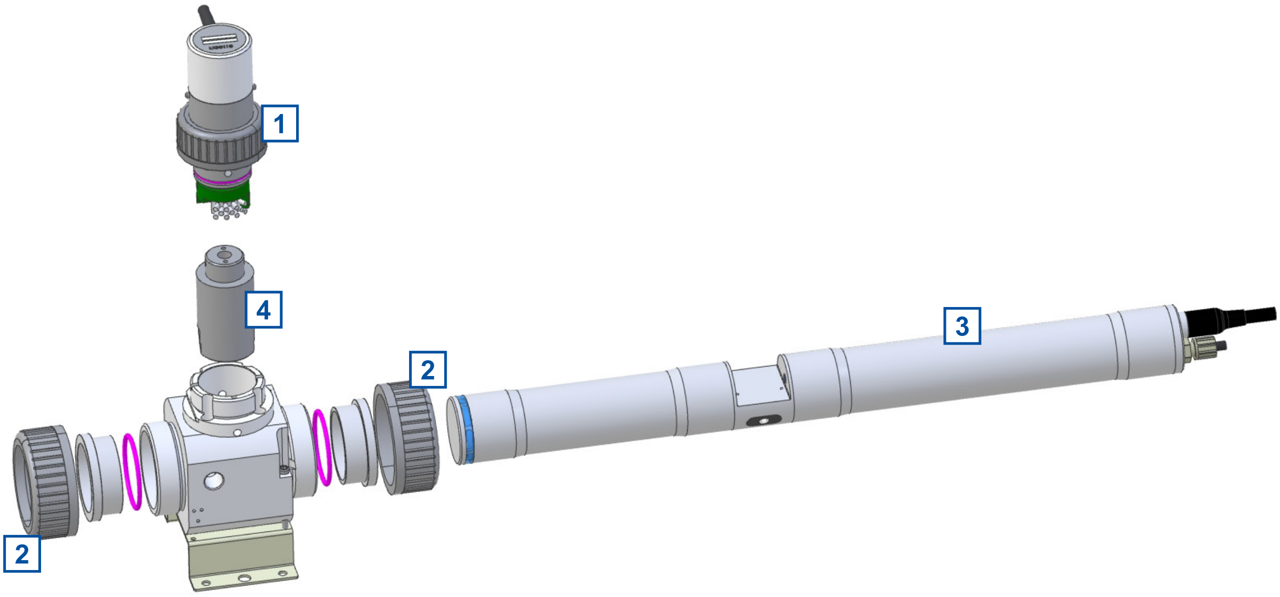
Please note, that the spectrometer probe can be mounted in one way only, because the measurement cell as well as the inside of the flow cell are not symmetrical. A red marking dot and a label on the flow cell indicate the position of the spectrometer probe in respect of the probe cable.

probe cable this side

Sondenkabel diese Seite



The installation of a spectrometer probe using the flow cell setup autobrush (part-no. F-446-V3) is performed by the following steps (see figures below also):

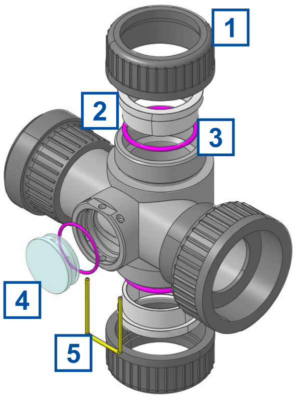


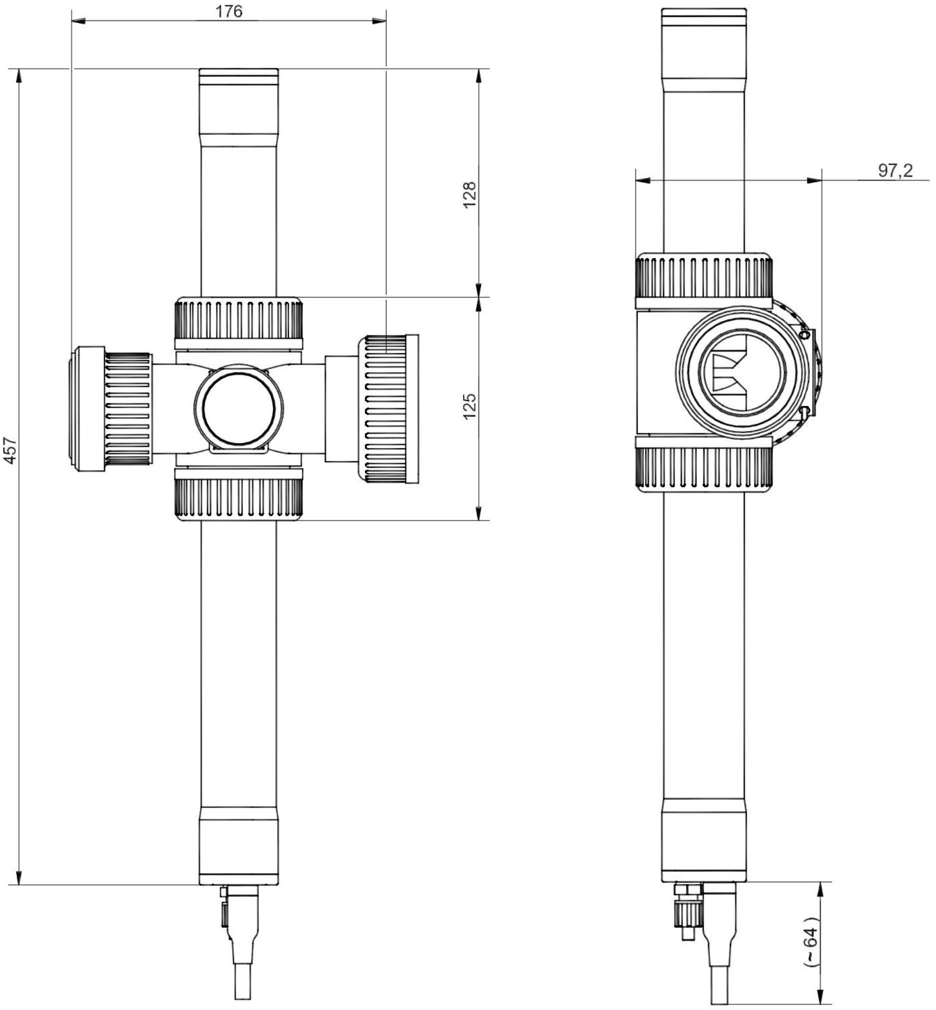
- Unscrew the union nut for fastening of the brush unit [1] and lift it out of the unit carefully. The brush unit is sealed with an O-ring and will need some force to take it out of the flow cell.
- Loosen both union nuts [2], which compress the O-rings of the flow cell. Do not unscrew completely – the compression inserts and O-rings must stay in place.
- Insert the spectrometer probe [3] so that the cable points to the marked side (red marking dot and label) and align, so that the optical path appears approximately level and centred in the brush opening. Observe that the optical path of the spectrometer probe is properly positioned in the brush unit.
- Insert the provided alignment tool [4] – the cross hole lined with the spectrometer axis - to find the exact position. Rotate and shift the spectrometer probe slightly, until the tool sits flush with the rim of the flow cell. The tool should not bend, while at the same time, the spectrometer cannot rotate.
- Fasten both union nuts while holding the alignment tool firmly in place.
- Remove the alignment tool. It is now assured, that the brush will rotate freely and will clean both windows properly.
- Insert the brush unit. Make sure that the alignment pin on the brush unit fits in one of the notches on the armature. This ensures, that the brush will not obstruct the optical path, when in rest position. The brush unit may be rotated 180° so that the cable exits at a convenient position.
- Note during insertion that approximately 4 mm short of the final position, you will notice a significant resistance from the O-ring seat.

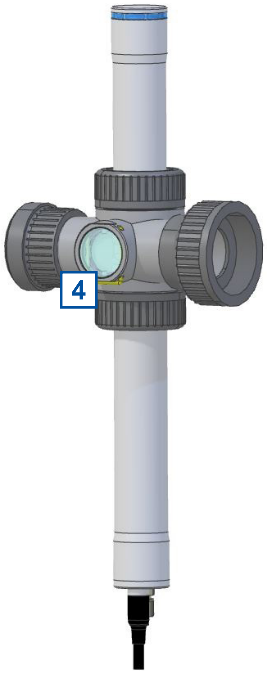
4.2.6 Mounting in Flow Cell for Waste Water (F-48-V3)

The installation of a spectrometer probe using the flow cell setup waste water (part-no. F-48-V3) is performed by the following steps (see figures below also):

- Loosen both union nuts [1], which compress the O-rings of the flow cell. Do not unscrew completely – the compression inserts [2] and O-rings [3] must stay in place.
- Insert the spectrometer probe so that the optical path appears level and centred in the flow cell.
- Fasten both union nuts [1] while holding the spectrometer probe firmly in place.
- Check the correct assembly by peering into the glass window [4].
- For cleaning purposes the glass window [4] can be opened by removing the metal bracket [5] with a flat screw driver.







Dimension of flow cell (F-48-V3) and required space for 5 mm spectrometer probe in [mm]

4.3 Automatic Probe Cleaning

The automatic cleaning of optical windows is needed to ensure a correct and stable measurement. For automatic probe cleaning either compressed air or cleaning devices with a rotating brush (autobrush in the flow cell or ruck::sack when istalled submersed) are needed. In special occasions, drinking water may be used to operate the hydraulic-pneumatic cleaning appliance instead or compressed air.

Sometimes it is possible that the air introducd by the automatic cleaning causes oxidation reactions to take place in the water. As a result, thin films of Fe / Mn / Ca can be formed. When the risk exists that such deposits are formed, it is recommended to use a very brief cleaning time only (1 – 2 seconds) and to reduce cleaning frequency (one cleaning cycle per hour) or to use drinking water instead of air for the automatic cleaning. The rotating brushes of the autobrush flow cell (F-446-V3) or the ruck::sack (F-146-RS) will avoid such coatings of oxidized Fe / Mn / Ca also.

The cleaning valve should never be connected to the compressed air coupling of your compressor directly, i.e. without a pressure hose in between. The total length of hoses should be as short as possible to avoid unnecessary pressure loss.

Any foreign matter in the compressed air supply may impair the hydraulic-pneumatic cleaning process. If you have any doubts about the purity of the air used (contamination by particles, oil, etc.), please install an appropriate filter upstream from the solenoid valve.

In areas with extremely low outside air temperature, s::can recommends laying the compressed air hoses such that they remain frost-free to prevent freezing of condensed water in the compressed air hose.

Please note that depending on the s::can probe and sensor type you are using, different maximum allowed pressures may be specified. In case a central pressurised air supply is used in such a case the lowest maximum allowed pressure amongst those specified for the individual instruments is to be used to supply all instruments or the use of pressure reducing valves to supply each instrument with the correct pressure is necessary.

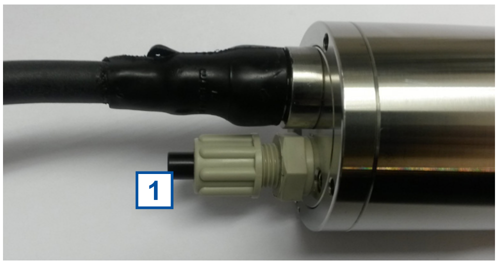
In order to ensure proper operation of automatic cleaning s::can highly recommends to use s::can compressor optimized for compressed air supply of all probes and sensors.

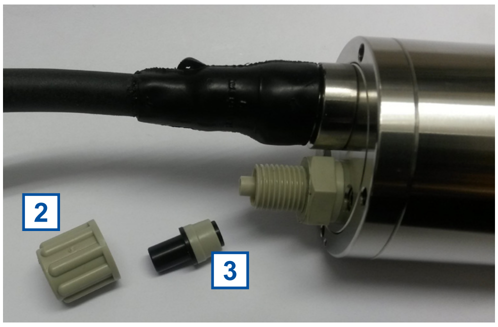
For mounting of the cleaning devices please see the manuals and installation notes of the specific devices. The connection of the pressurized air cleaning and the mounting of the ruck::sack are explained in the following sections.

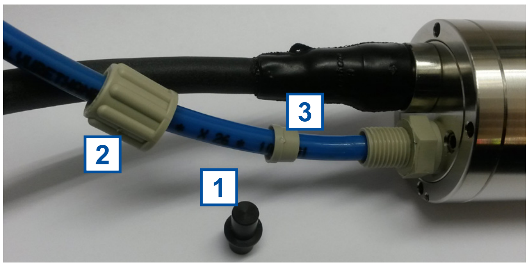
4.3.1 Connection of compressed Air Cleaning

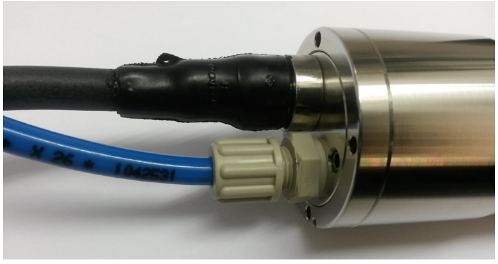
The pressure connection set (B-41) supplied with the system contains components necessary to connect the spectrometer probe to the cleaning valve. The connection to the probe is performed by the following steps (see pictures on the right hand side also):

- Remove black dummy insert [1] from pressure connection on top of probe.
- To do this, unscrew the connecting nut [2] and removing the conical part [3].



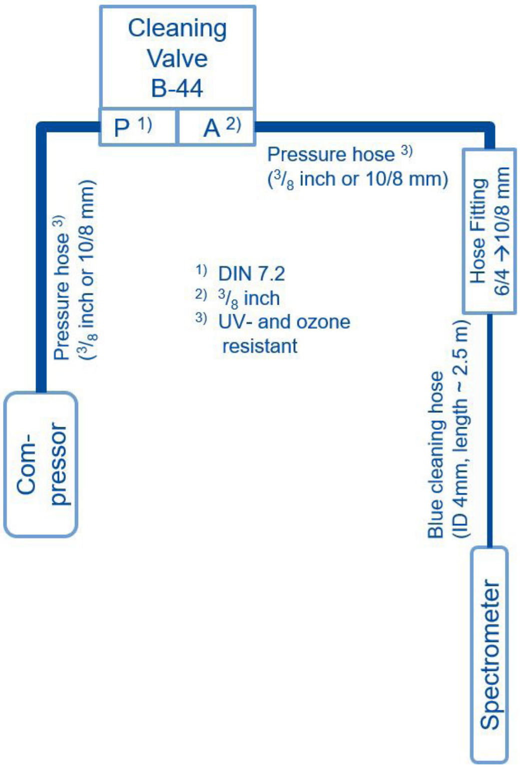






- Put the connecting nut [2] and the conical part [3] over the blue cleaning hose.
- Push the cleaning hose over the pressure connection on top of the probe (warm up cleaning hose in hot water if necessary).
- Fasten connecting nut [2] by hand.

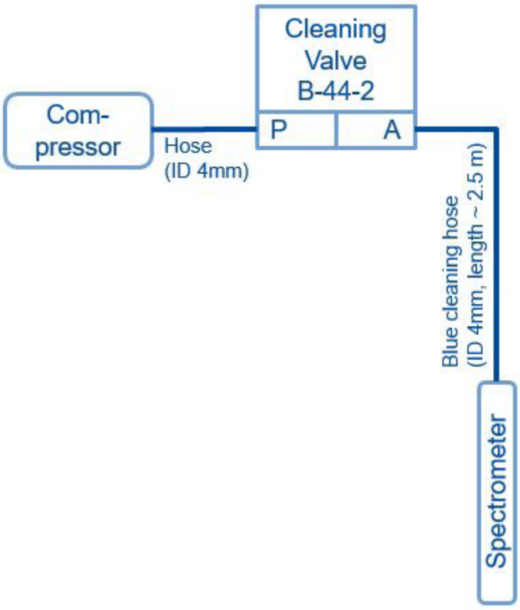
The connection to the cleaning valve depends on the used type of cleaning valve.


Cleaning Valve B-44
P 1)
A 2)
Pressure hose 3) (3/8 inch or 10/8 mm)
Hose Fitting 6/4 →10/8 mm
1) DIN 7.2
2) 3/8 inch
3) UV- and ozone resistant
Pressure hose 3) (3/8 inch or 10/8 mm)
Com-pressor
Blue cleaning hose (ID 4mm, length ~ 2.5 m)
Spectrometer

- Cleaning valve B-44

A compressed air hose (to be provided by customer, ID 8 to 9 mm, UV- / ozone resistant) must be used to connect the adapter fitting of the pressure connection set to the output side of the cleaning valve (marked with A). Fasten the air hose with hose clamps.

Another air hose and DIN 7.2 compressed air coupling are required to hook up the compressed air supply to the input side of the cleaning valve (marked with P).

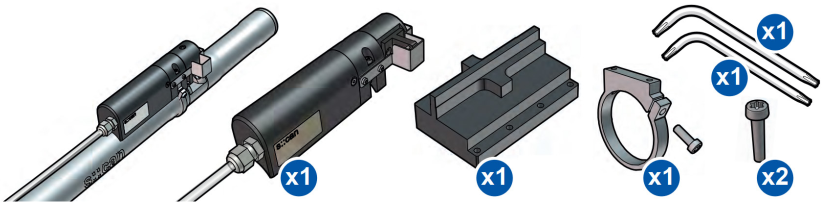


- Cleaning valve B-44-2

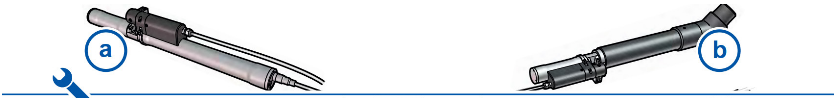
The adapter fitting of the pressure connection set can be removed to connect the blue tube directly to the push-pull fitting of the cleaning valve. The same type of tube can be used to connect the cleaning valve to the s::can compressor.

4.3.2 Mounting of ruck::sack (F-146-RS)

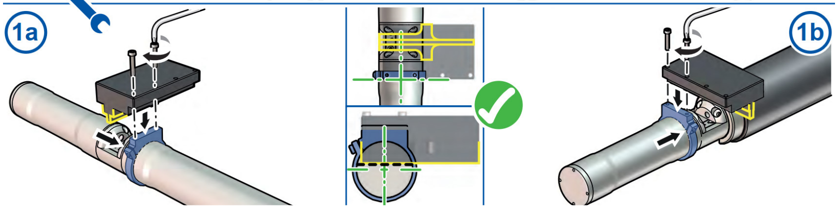
All needed tools for mounting of the ruck::sack are included in the scope of delivery (see figure on the right).

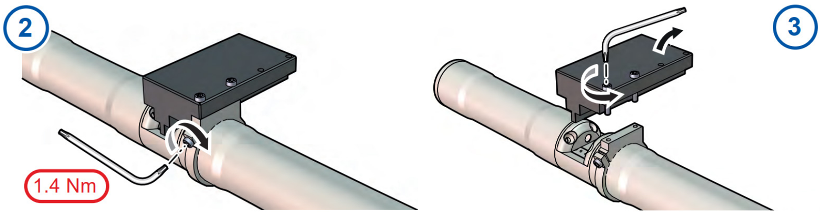


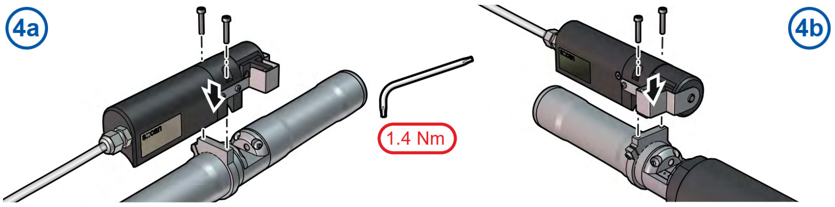
The ruck::sack will be mounted onto the probe housing either cable side (variant a) or, if a probe carrier (F-110-V3 or F-120-V3) is used, on the lower part of the probe housing (variant b).

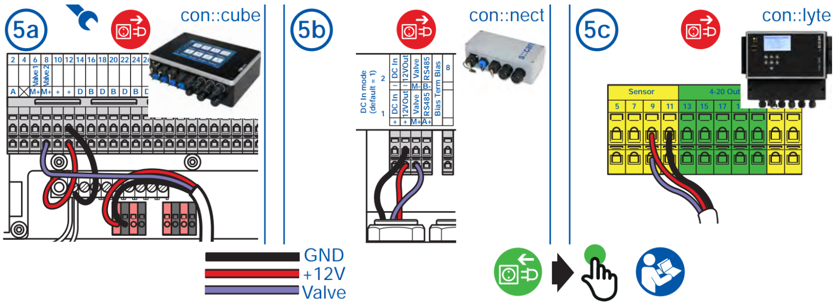


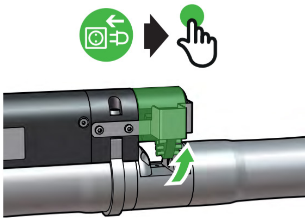
The mounting is performed by the following steps (see figures on the right also):





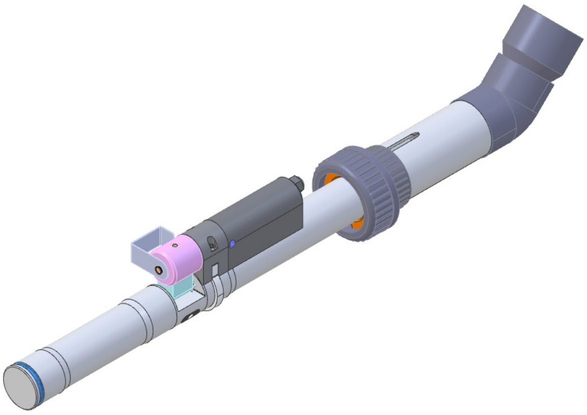


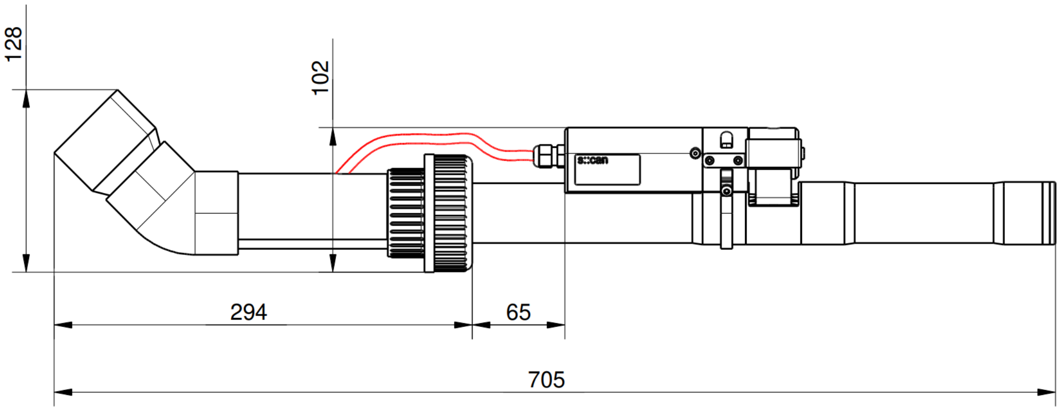




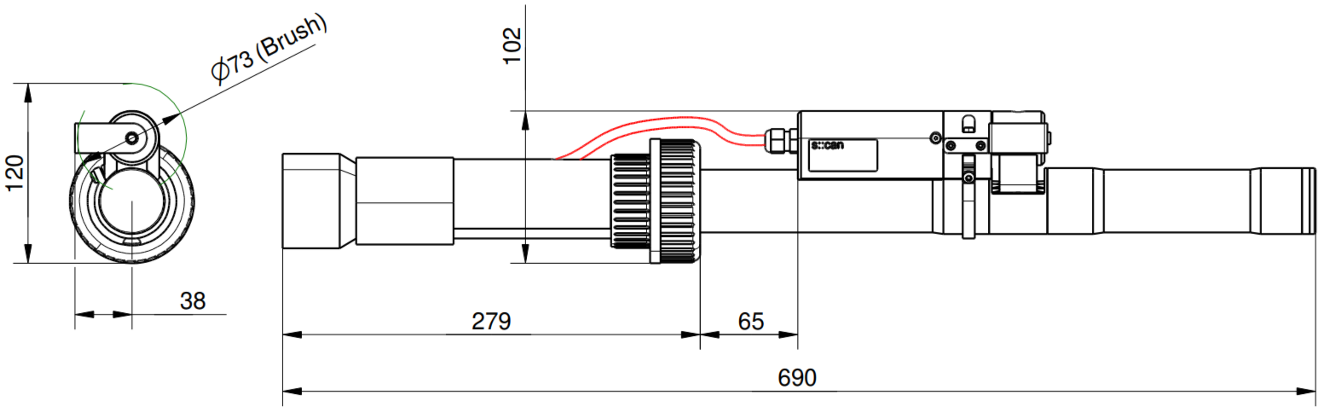
1. Place the fixing ring over the probe housing. Place the alignment tool onto the optical path according the path length and fix it to the ring with the two screws included in delivery.
2. Position the alignment tool flat and then fasten the fixing ring onto the probe housing.
3. Unscrew the alignment tool from the fixing ring and remove it.
4. Screw the ruck::sack onto the fixing ring with the two screws included in delivery.
5. Connect the ruck::sack to the terminal used for operation (see manual of controller used for operation).
6. Check the correct position of the brush and the function of the ruck::sack.

When using the probe carrier F-140-V3 and F-150-V3 the ruck::sack can be mounted on cable side (see figure on the right).





Dimension of probe carrier (F-140-V3) and required space for 35 mm spectrometer with ruck::sack in [mm]



Dimension of probe carrier (F-150-V3) and required space for 35 mm spectrometer with ruck::sack in [mm]

5 Initial Startup

Once the mounting and installation of the s::can spectrometer probe have been completed and checked (see chapter 4) the initial startup of the s::can monitoring system will require the following actions, in the order presented below:

- Connect the spectrometer probe to the controller used for operation (see section 5.1 and 5.2).
- Connect the cleaning devices to the proper terminal connections in the cable terminal compartment of the used controller (please refer to the manual of the cleaning device and the controller).
- Establish main power supply to the controller (please refer to the manual of the controller) and wait until the operation software has started up. In case of using con::nect, Io::Tool has to be started manually.
- Perform initialisation of the spectrometer probe. Refer to section 5.3.1 in case of using a con::lyte D-320, refer to section 5.3.2 in case of using con::cube with moni::tool and refer to section 5.3.3 in case of using con::nect B-33-012 with Io::Tool.
- Perform parameterisation of the spectrometer probe. Refer to section 5.5.9 in case of using a con::lyte D-320, refer to section 5.5.10 in case of using con::cube with moni::tool and refer to section 5.5.11 in case of using con::nect B-33-012 with Io::Tool.
- Configure the measurement and automatic cleaning settings (please refer to the manual of the controller or section 5.4.2 in case of using Io::Tool. See section 12 regarding cleaning settings).
- Check the proper functioning of the cleaning system.
- Connection and parameterisation of data transfer when desired (please refer to the manual of the controller).
- Check the plausibility of the readings obtained after sufficient running-in time (at least 15 minutes).
- If necessary calibrate the readings of the spectrometer probe to the local water matrix when the readings are stable (see chapter 6).

5.1 Controller for Operation

The s::can spectrometer probe is equipped with a web application for direct operation (Io::Tool). Therefore the probe can be operated directly via mobile device or can be connected to a s::can controller for operation. Depending on the used configuration, different features are available. The table below provides a general overview of possible configurations.

Controller	con::cube D-330	con::cube D-315	con::lyte D-320	con::nect B-33-012
Connection	via M-12 plug	via B-33-012	via C-32-V3 cable	via M-12 plug
Communication	ReST-API [1)]	ReST-API [1)]	Modbus RTU	ReST-API / Modbus RTU
Operating software	moni::tool V4	moni::tool V4	con::lyte V7.11	Io::Tool / SCADA
Parameter transfer	yes	yes	yes	yes
Fingerprint transfer	yes	yes	via Io::Tool	via Io::Tool
Trigger cleaning	via D-330	via D-315	via D-320	spectrometer / SCADA
Function Check	yes	yes	yes	Io::Tool
Local Calibration	yes	yes	yes	Io::Tool

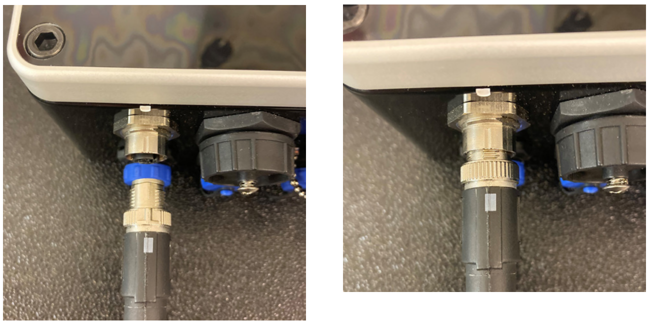
[1)] Representional State Transfer Application Programming Interface

The spectrometer probe offers a specific operating mode (Legacy-Mode) for limited operation with con::lyte D-319 and con::cube D-315 without con::nect B-33-012. Please ask your s::can sales partner for further details.

5.2 Connection to the Controller

The s::can spectrometer will be delivered with a fixed cable including a plug that can be used to connect the probe to a compatible socket provided on the controller used for operation. Ensure that the probe plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.

- Ensure that the orientation of the probe plug is aligned with the terminal socket (see white marking of cable and socket in the figure on the right).
- Push probe plug in carefully and fasten fixing screw at the same time.



Some of the s::can controller do not supply the specific M12 plug. When using a con::lyte D-320 a specific connection cable (part-no. C-32-V3) has to be used (see section 11.1.2).

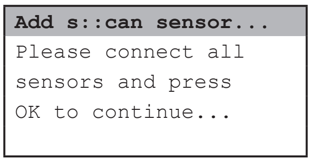
For initialisation on a D-315 con::cube the con::nect B-33-012 must be used. Connect the spectrometer to the con::nect via M12 plug and use a network cable to connect the con::nect to the con::cube. In addition the IP settings of D-315 and spectrometer have to be configured to the same address range (please refer to manual con::nect B-33-012).

5.3 Probe Initialisation

For operating one or several probes / sensors with one operation controller, it is necessary to allocate an individual address to every probe / sensor. This will be done during probe initialisation process, at which the connected measuring device has to be recognized by the controller for operation first, and then a modification of the actual (preset) probe / sensor address might be performed. The corresponding address will be stored on the respective measuring device. For s::can probes and sensors of the same type, the same address is preset ex factory.

5.3.1 Probe Initialisation using con::lyte

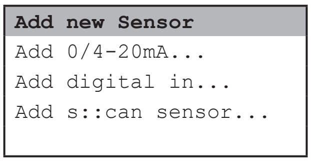
At the initial start-up the con::lyte D-320 provides an automatic probe and sensor initialisation procedure (see screen on the right). After connecting the spectrometer probe using the connection cable C-32-V3 to the MIL plug of the con::lyte, wait until the LED ring of the probe stops flashing. Then push the *OK* button to start the probe initialisation.



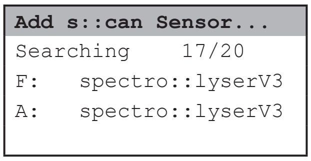
```
Add s::can sensor...
Please connect all
sensors and press
OK to continue...
```

If sensor will be initialized at a later date, the following steps are needed:

- Switch to Status display by using the *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select menu *Add sensor ...* and confirm with *OK*.
- Connect sensor to the D-320.
- Wait until the LED-ring of the probe stops flashing.
- Select menu *Add s::can sensor ...* and confirm with *OK*.

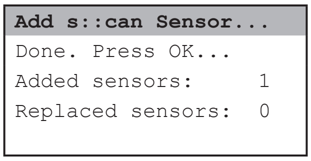


```
Add new Sensor
Add 0/4-20mA...
Add digital in...
Add s::can sensor...
```



```
Add s::can Sensor...
Searching    17/20
F:   spectro::lyserV3
A:   spectro::lyserV3
```

As soon as the entry is confirmed by pushing the *OK* button, the con::lyte will automatically search the Modbus port for a new sensor and will add the new sensor to the sensor list.



```
Add s::can Sensor...
Done. Press OK...
Added sensors:     1
Replaced sensors:  0
```

5.3.2 Probe Initialisation using moni::tool

1 Click the *Service* tab on the moni::tool screen.

2 Login as *Administrator* with Password *admin1* or your individual username.

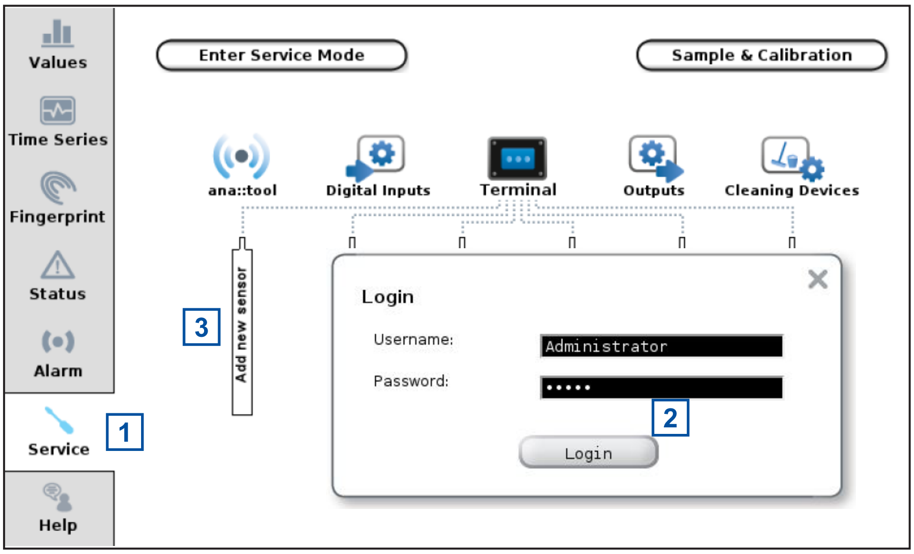
3 Click on an empty sensor icon (*Add new Sensor*) to initiate the initialisation process.

4 An automatic search procedure will start, searching for the connected sensor.

5 When the automatic search prodedure is finished, all connected probes and sensors will be displayed. Those sensors that are connected for the first time and not installed will have the Status *Found new sensor*. These sensors are listed as *New Sensors* below also.

6 If needed the suggested *Sensor name* can be modified. This name will be used in the system overview of the *Status* and *Service* display also.

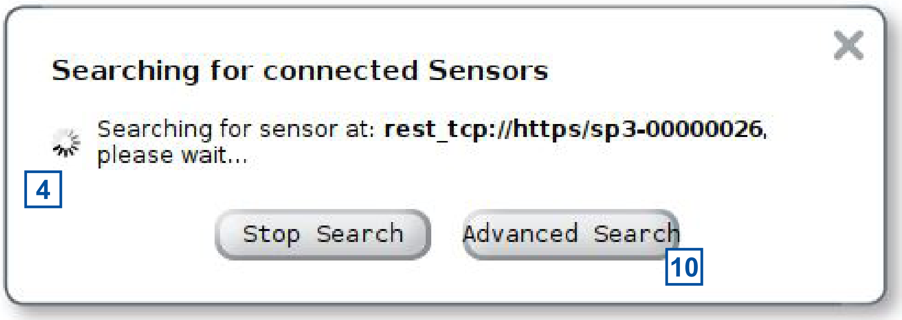
7 To install the new sensor click either on the blue + sign on the right side of the sensor or push the button *Install All*.



Login

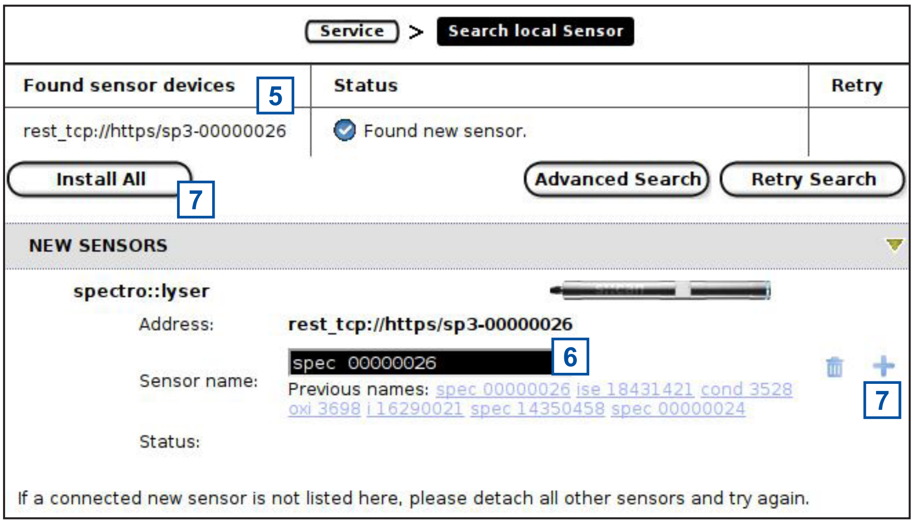
Username: Administrator

Password: •••••



Searching for connected Sensors

Searching for sensor at: **rest_tcp://https/sp3-00000026**, please wait...



Found sensor devices	Status	Retry
rest_tcp://https/sp3-00000026	Found new sensor.	

spectro::lyser

Address: **rest_tcp://https/sp3-00000026**

Sensor name: spec 00000026

Previous names: spec 00000026 ise 18431421 cond 3528 oxi 3698 i 16290021 spec 14350458 spec 00000024

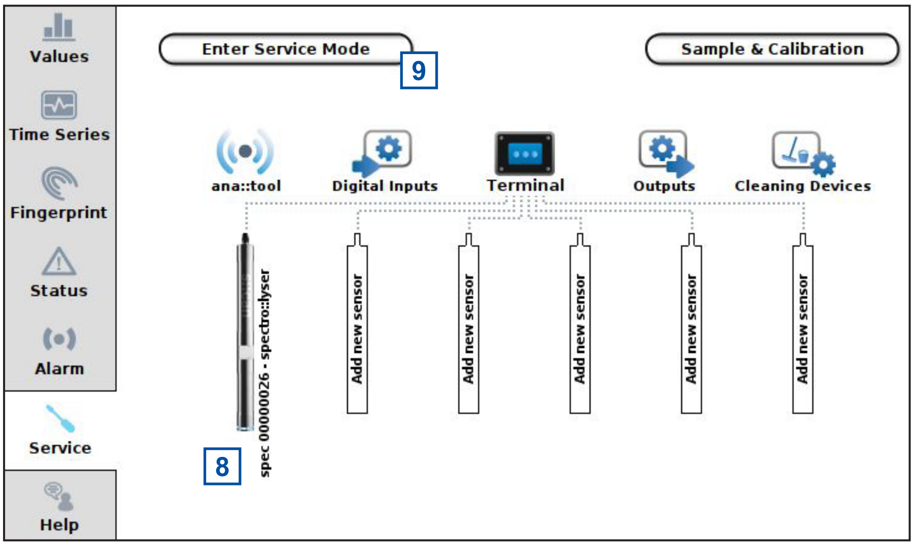
Status:

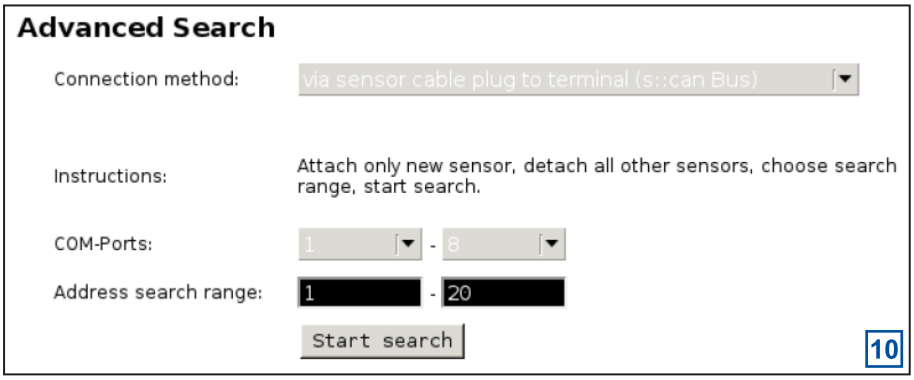
If a connected new sensor is not listed here, please detach all other sensors and try again.

8 moni::tool will install the sensor and switch to the *Service* display. The new sensor is displayed in the system overview.

9 Push the button *Leave Service Mode* located on the upper left side to start the measuring process.

10 When pushing the button *Advanced Search* the method how the sensor is connected (*Connection methode)*, the used *COM-Port* and the *Address* can be defined exactly. This option shall be used by advanced users only.





Advanced Search

Connection method: via sensor cable plug to terminal (s::can Bus)

Instructions: Attach only new sensor, detach all other sensors, choose search range, start search.

COM-Ports: 1 - 8

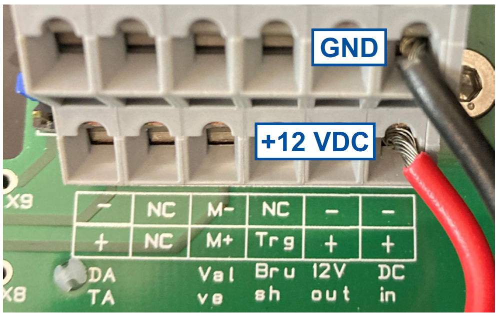
Address search range: 1 - 20

5.3.3 Probe Initialisation using con::nect

In case the s::can spectrometer probe will be operated as stand alone measuring device without a s::can terminal, the probe initialisation and the start-up of Io::Tool is performed by the following steps:

- Connect the spectrometer probe to the compatible socket of the con::nect. Ensure that the sensor plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.
- Wire the cleaning device for automatic cleaning of the spectrometer probe to the con::nect directly. The table below displays the different possibilities for connection.

Cleaning Device	Color of wire	Labelling
Cleaning valve	Blue	M+ Valve
	Brown	M- Valve
autobrush	Purple (yellow 1))	Trg Brush
	Black (brown 1))	- 12V out
	Red (white 1))	+ 12V out
ruck::sack	Purple	Trg Brush
	Black	- 12V out
	Red	+ 12V out



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1) previous used cable version

Once the cleaning device has been electrically connected, the device needs to be parameterised within the operating software (please refer to section 5.4.3 or the according manual of the used terminal for operation).

- Connect the con::nect to the main power supply (+12 VDC to lower terminal (*+ DC in*) and ground to upper terminal (*- DC in*) as displayed in figure above).
- Several seconds after the con::nect box was connected to power supply, the LED ring of the probe will flash blue.
- Within one minute the LED ring will change from flashing to continuous color. The spectro::lyser is online now and measurements will start automatically according to user settings.
- Connect your mobile device to the WLAN of the spectrometer probe. The network name belonging to spectrometer probe start with *sp3-xxxxxxxx* (xxxxxxxx corresponds to the serial number of the probe). The WLAN password = *spectrolyser*.
- Alternatively connect your notebook with a LAN cable to the con::nect. Please consider administrator rights might be needed to establish connection.
- Enter the IP address of the spectro::lyser into your webbrowser to start Io::Tool. The table below displays the different possibilities to get the correct IP address.
- If you do not know the correct IP address, enter https://iotool.lan or http://iotool.lan.

⚠ When using a wireless connection, we recommend to use WLAN because it offers a higher data rate than a Bluetooth connection.

Connection methode	IP address of spectrometer	Remark
via WLAN	192.168.43.1	default address; password = *spectrolyser*
via Bluetooth	192.168.44.1	default address
via LAN	to be checked on DHCP Server	DHCP active on spectrometer probe per default
via LAN	192.168.42.10	fall back (static) if network without DHCP Server (e.g. when connecting directly with notebook). Please see manual of con::nect for further details how to set static IP on your notebook.
con::cube ReST-API	192.168.30.xxx	

5.4 Io::Tool

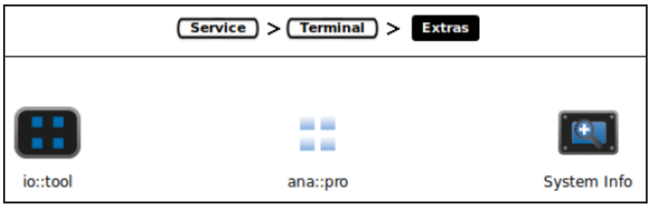
The operating software Io::Tool is installed on the spectromter probe. Enter the IP address of the spectrometer (e.g. 192.168.42.10) or https://iotool.lan (http://iotool.lan) in the webbrowser of a connected device (e.g. notebook, mobile phone, tablet, etc.) to start Io::Tool.

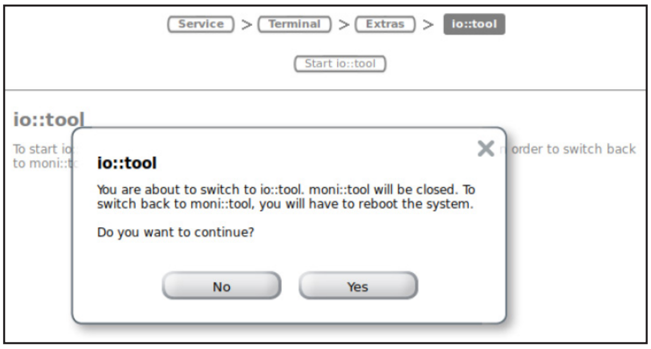
The moni::tool software also provides the possibility to start Io::Tool directly on the con::cube display (*Service > Terminal > Extras > io::tool*).

Push the button *Start io::tool* on top of the screen and confirm the user message with button *Yes*.

Click on the displayed Link (*http://sp3-xxxxxxxx.concube3.lan*) to start Io::Tool on the con::cube screen.

To exit Io::Tool on the con::cube, simply reboot the device.





io::tool

You are about to switch to io::tool. moni::tool will be closed. To switch back to moni::tool, you will have to reboot the system.

Do you want to continue?

As soon as the connection is established, Io::Tool will pop up in the webbrowser showing the actual readings of the spectrometer probe (see figure below).

Io::Tool will use the same language like the webbrowser. That means the language of Io::Tool can be changed by changing the default language of the webbrowser.

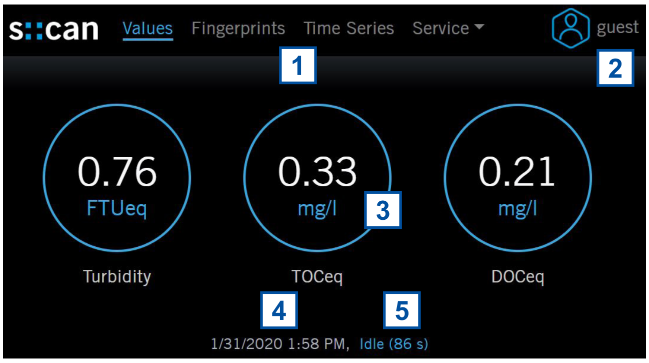
1 Main tabs to change the displayed information.

2 Name of user logged in currently. For operation of Io::Tool there are three users available. Per default the user is logged in as *guest* automatically (no password required). For the normal operator the level *user* (with password *scan*) and for service personal the user *expert* (with password *scan*) is available.

3 Actual parameter readings and unit.

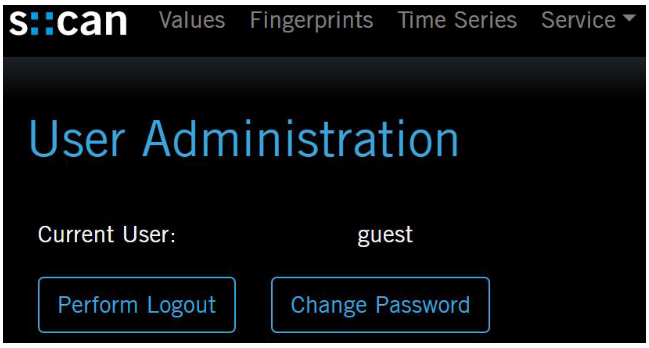
4 Actual system date and time.

5 Current state (e.g. *Idle*, *Measuring*, *Offline*). In case the probe is operated with an s::can terminal (e.g. con::lyte) the displayed activity is *con::lyte Operation*.



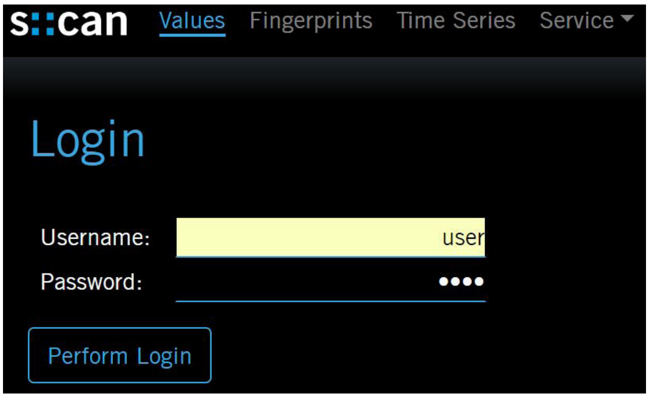
When connected to Io::Tool for the first time, the login as user *guest* is automatic. A change of the user is performed by the following steps:

- Click on the user icon in the upper right corner of Io::Tool.
- Click on button *Perform Logout* to logout the current user.
- Enter the new *Username* (e.g. guest, user or expert).
- Enter the *Password* (scan for user or expert, no password for guest).
- Click on button *Perform Login* to login as new user.



User Administration

Current User: guest



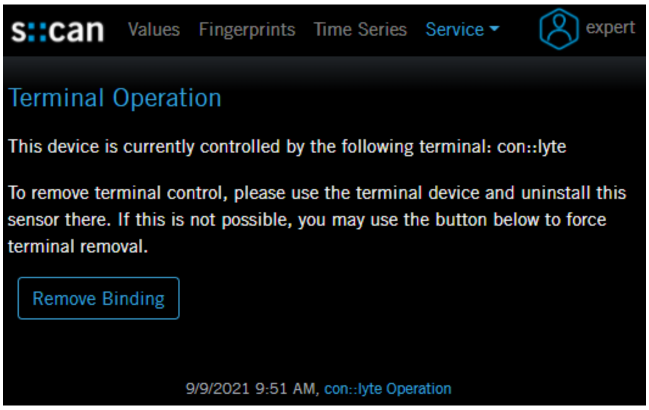
Login

Username: user

Password: ••••

Even when the spectrometer probe is operated by a s::can terminal (con::cube, con::lyte) it is possible to start Io::Tool. In this case you can see within the device status that the probe is operated by an external terminal. Therefore some configurations (e.g. measurement settings, function check, spectral references) can be executed via the s::can terminal only.

Push the button *Remove Binding* to operate the spectrometer probe as stand alone device.



Terminal Operation

This device is currently controlled by the following terminal: con::lyte

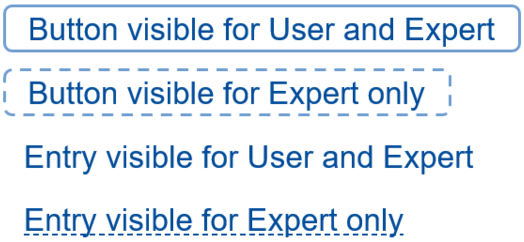
To remove terminal control, please use the terminal device and uninstall this sensor there. If this is not possible, you may use the button below to force terminal removal.

9/9/2021 9:51 AM, con::lyte Operation

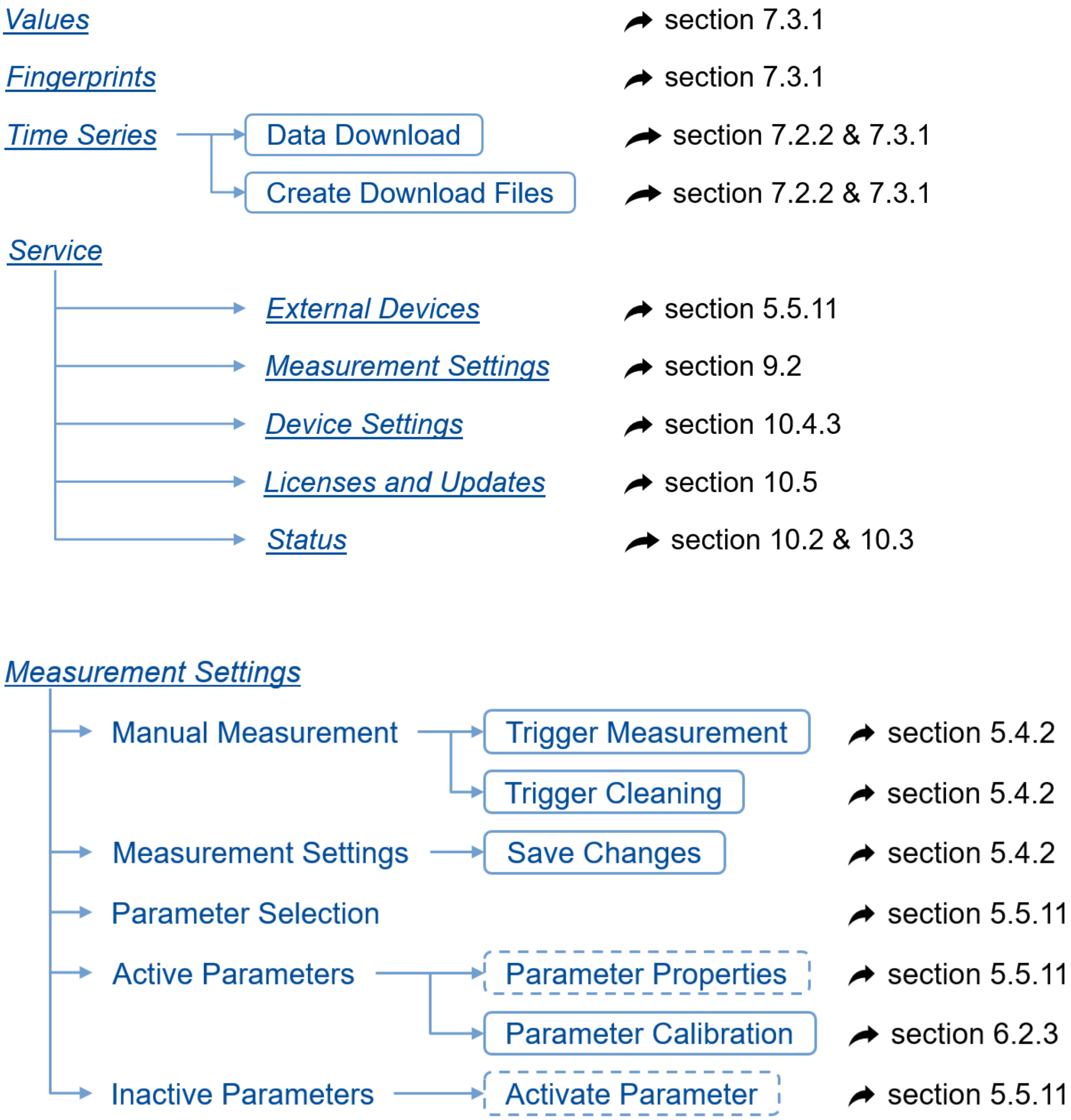
5.4.1 General Overview of Io::Tool

This section provides a general overview of the Io::Tool menu and the available functions. Beside the function name there is a reference to the section where a detailed description can be found. Depending on the user level some functions might be hidden (see legend below).

Legend:

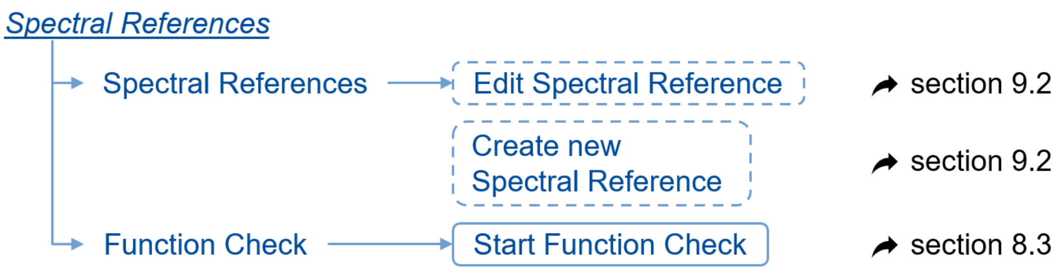


- Button visible for User and Expert
- Button visible for Expert only
- Entry visible for User and Expert
- Entry visible for Expert only

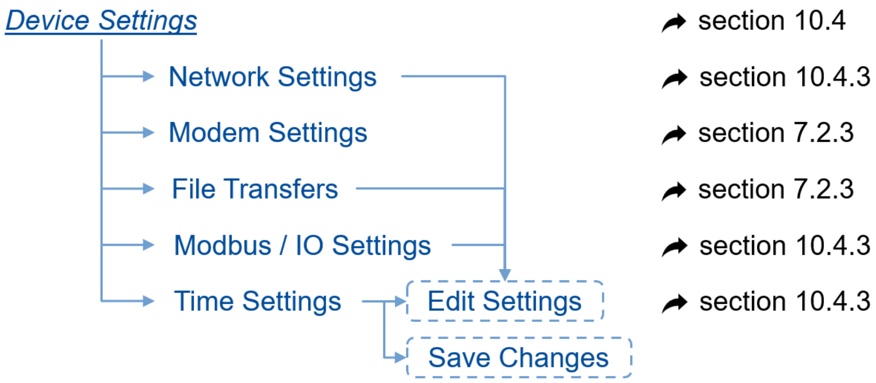


- *Values* → section 7.3.1
- *Fingerprints* → section 7.3.1
- *Time Series*
  - Data Download → section 7.2.2 & 7.3.1
  - Create Download Files → section 7.2.2 & 7.3.1
- *Service*
  - *External Devices* → section 5.5.11
  - *Measurement Settings* → section 9.2
  - *Device Settings* → section 10.4.3
  - *Licenses and Updates* → section 10.5
  - *Status* → section 10.2 & 10.3

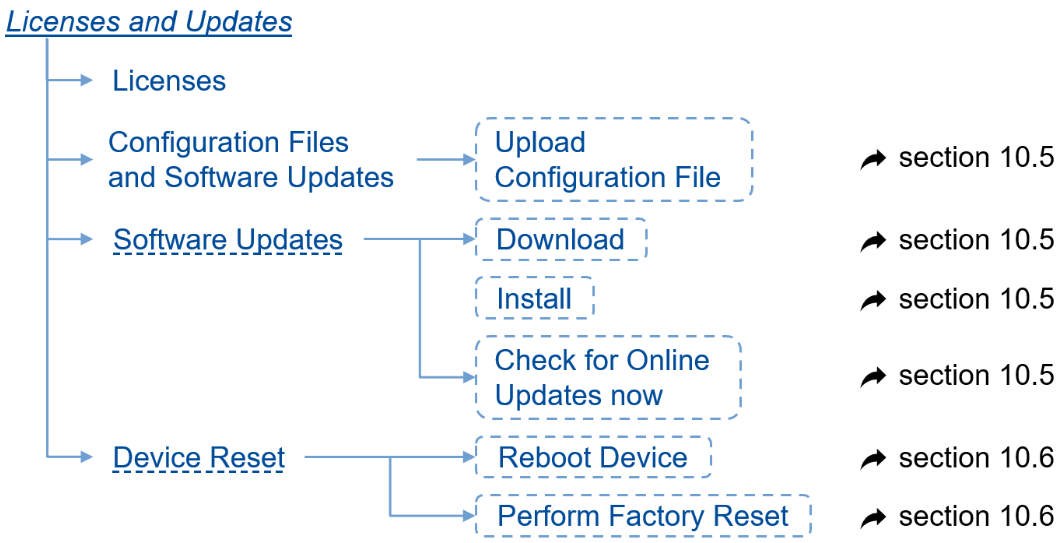
- *Measurement Settings*
  - Manual Measurement
    - Trigger Measurement → section 5.4.2
    - Trigger Cleaning → section 5.4.2
  - Measurement Settings
    - Save Changes → section 5.4.2
  - Parameter Selection → section 5.5.11
  - Active Parameters
    - Parameter Properties → section 5.5.11
    - Parameter Calibration → section 6.2.3
  - Inactive Parameters
    - Activate Parameter → section 5.5.11



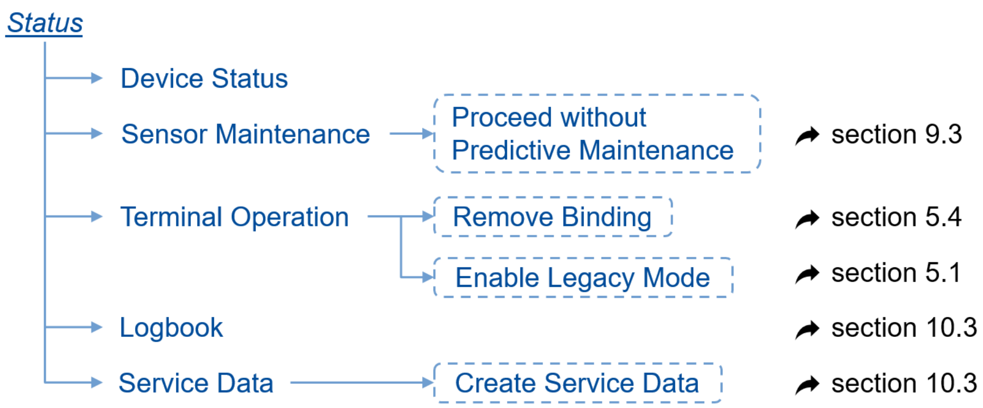
Spectral References
- Spectral References
  - Edit Spectral Reference ➦ section 9.2
  - Create new Spectral Reference ➦ section 9.2
- Function Check
  - Start Function Check ➦ section 8.3



Device Settings ➦ section 10.4
- Network Settings ➦ section 10.4.3
- Modem Settings ➦ section 7.2.3
- File Transfers ➦ section 7.2.3
- Modbus / IO Settings ➦ section 10.4.3
- Time Settings ➦ section 10.4.3
  - Edit Settings
  - Save Changes



Licenses and Updates
- Licenses
- Configuration Files and Software Updates
  - Upload Configuration File ➦ section 10.5
- Software Updates
  - Download ➦ section 10.5
  - Install ➦ section 10.5
  - Check for Online Updates now ➦ section 10.5
- Device Reset
  - Reboot Device ➦ section 10.6
  - Perform Factory Reset ➦ section 10.6

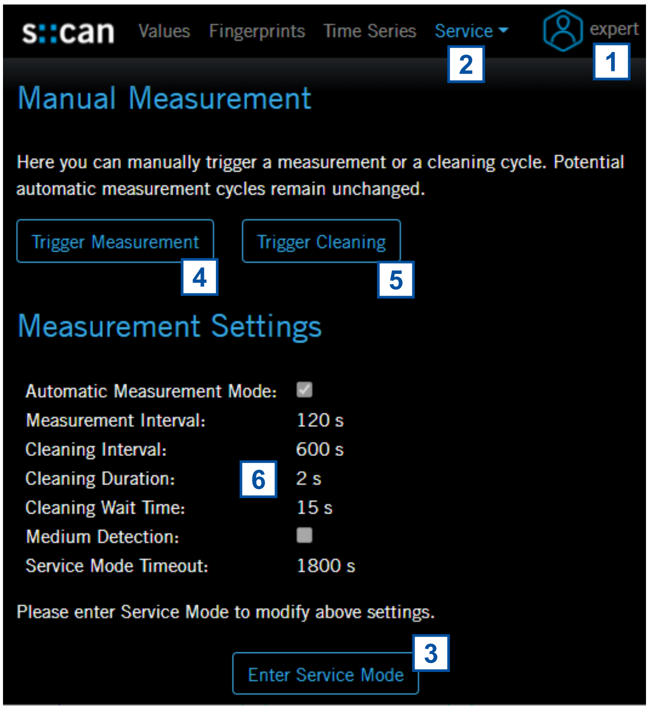


Status
- Device Status
- Sensor Maintenance
  - Proceed without Predictive Maintenance ➦ section 9.3
- Terminal Operation
  - Remove Binding ➦ section 5.4
  - Enable Legacy Mode ➦ section 5.1
- Logbook ➦ section 10.3
- Service Data
  - Create Service Data ➦ section 10.3

5.4.2 Measurement Settings and Sleep Mode using Io::Tool

Subject to proper power supply, the spectrometer probe can be operated in stand alone mode, without any controller connected.

A change of the measurement settings and the automatic cleaning settings of the spectrometer probe is performed by the following steps:



Manual Measurement

Here you can manually trigger a measurement or a cleaning cycle. Potential automatic measurement cycles remain unchanged.

Measurement Settings

Automatic Measurement Mode: ☑
Measurement Interval: 120 s
Cleaning Interval: 600 s
Cleaning Duration: 2 s
Cleaning Wait Time: 15 s
Medium Detection: ☐
Service Mode Timeout: 1800 s

Please enter Service Mode to modify above settings.

1 Start Io::Tool and logon as *user* or *expert*.

2 Select menu *Service \ Measurement Settings*.

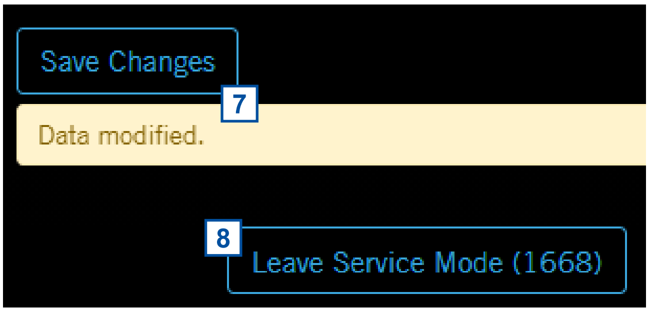
3 Push the button *Enter Service Mode*.

4 Push the button *Trigger Measurement* to execute a single measurement.

5 Push the button *Trigger Cleaning* to execute a single cleaning process according to the actual settings.

6 Configure the settings for measurement as explained below:

- *Automatic Measurement mode*: Tick this checkbox to activate automatic measurements.
- *Measurement Interval*: Can be set between 15 and 86400 sec. (1 measurement per day). In case the measurement process needs more time, the spectrometer will skip single measurements.
- *Cleaning Interval*: Can be set between 0 and 86400 seconds. The cleaning interval cannot be configured smaller than the actual measurement interval.
- *Cleaning Duration*: Time the automatic cleaning is active. Can be set between 0 and 60 seconds. A value of 0 s will deactivate the automatic cleaning.
- *Cleaning Wait Time*: Time between the end of automatic cleaning and the start of measurement. This time can be set between 5 and 600 seconds.
- *Medium Detection*: Tick this checkbox, if the spectrometer shall check the plausibility of the measured fingerprint. In case the probe is measuring on air, the parameter status will switch to warning (*No medium detected*) and the LED becomes red.
- *Service Mode Timeout*: This is the time when the Service Mode will stop automatically, in case no further action is performed. This time can be set between 600 and 86400 sec.



Data modified.

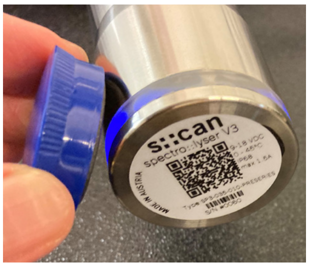
7 As soon as any setting has been changed the text *Data modified* is visible on the display. Push the button *Save Changes* to store the new settings permanently.

8 Push the button *Leave Service Mode* to stop the Service Mode and to start the normal measuring process again.

Within the *Service / Device Settings* menu the *Automatic Sleep* mode can be activated (see section 10.4). When this mode is activated, the spectrometer probe goes into the sleep (low power consumption) mode after the measurement process is finished and all connections are closed (e.g. Io::Tool, Modbus). During sleep mode the LED flashes blue every 2 seconds.

The sleep mode will be interrupted with the start of the next measurement. A manual interruption between the measurements is possible by activating the reed switch as explained below and shown in the figure on the right.

Place a magnet (e.g. from magnetic flip chart) below the LED ring in that way it is located below the serial number written on the type label. After a few seconds the LED ring stops flashing and is permanently on, which means the sleep mode is interrupted and you can connect to the spectrometer probe via Io::Tool. Now magnet can be removed.



⚠ For low power operation please use sleep mode and do not power the spectrometer probe on / off permanent. This might cause hardware damage on the measuring device (especially with measuring interval < 1 hour). If extreme low power consumption is requested, please ask your s::can Sales Partner for deep sleep mode.

5.5 Probe Parameterisation

Number and type of the measured parameters can be configured individually on the spectrometer probe. For each parameter one Global Calibration will be uploaded to the probe. Therefore later upgrade is possible.

The G-Series (e.g. nitro::lyser) will be delivered with a fix set of parameter.

In the following sections all available parameters and the possible measuring ranges for the different types of applications are shown. These measuring ranges are the same for spectro::lyser and G-Series.

5.5.1 Parameter Measuring Ranges in Clean Water

Below the s::can part no. of the specific parameter (e.g. GC-G-TURB, which is Turbidity for ground water) the measurable concentration ranges, which may vary due to water matrix, are displayed for all three optical path lengths (1 mm, 5 mm and 35 mm).

Parameter	Ground water	Surface water	Drinking water
Turbidity [FTU/NTU]	GC-G-TURB	GC-R-TURB	GC-D-TURB
OPL = 1 mm ⁽¹⁾	0 - 8000	0 - 9300	0 - 8000
OPL = 5 mm	0 - 1200	0 - 1400	0 - 1200
OPL = 35 mm	0 - 170	0 - 200	0 - 170
TSS [mg/l]	not available	GC-R-TSS	not available
OPL = 1 mm ⁽¹⁾		0 - 8000	
OPL = 5 mm		0 - 1200	
OPL = 35 mm		0 - 170	
COLORapp / COLORtru [Hazen]	GC-G-COL	GC-R-COL	GC-D-COL
OPL = 1 mm ⁽¹⁾	0 - 23000 / 14000	0 - 23000 / 14000	0 - 23000 / 14000
OPL = 5 mm	0 - 3500 / 2100	0 - 3500 / 2100	0 - 3500 / 2100
OPL = 35 mm	0 - 500 / 300	0 - 500 / 300	0 - 500 / 300

Parameter	Ground water	Surface water	Drinking water
TOC / DOC [mg/l]	GC-G-TOC	GC-R-TOC	GC-D-TOC
OPL = 1 mm 1)	0 - 930 / 700	0 - 1400 / 1200	0 - 1000 / 800
OPL = 5 mm	0 - 140 / 100	0 - 210 / 180	0 - 160 / 120
OPL = 35 mm	0 - 20 / 15	0 - 30 / 25	0 - 22 / 17
BOD [mg/l]	not available	GC-R-BOD	not available
OPL = 1 mm 1)		0 - 2000	
OPL = 5 mm		0 - 300	
OPL = 35 mm		0 - 42	
COD / CODf [mg/l]	not available	GC-R-COD	not available
OPL = 1 mm 1)		0 - 3300 / 2000	
OPL = 5 mm		0 - 500 / 300	
OPL = 35 mm		0 - 71 / 42	
NO_3-N / NO_3 [mg/l]	GC-G-NO3-N	GC-R-NO3-N	GC-D-NO3-N
OPL = 1 mm 1)	0 - 930 / 4100	0 - 700 / 3100	0 - 930 / 4100
OPL = 5 mm	0 - 140 / 620	0 - 100 / 460	0 - 140 / 620
OPL = 35 mm	0 - 20 / 88	0 - 15 / 66	0 - 20 / 88
Chl-a [µg/l]	not available	GC-R-CHL-A	not available
OPL = 1 mm 1)		0 - 4600	
OPL = 5 mm		0 - 700	
OPL = 35 mm		0 - 100	
HS^- [mg/l]	GC-G-HS	GC-R-HS	not available
OPL = 1 mm 1)	0 - 240	0 - 240	
OPL = 5 mm	0 - 35	0 - 35	
OPL = 35 mm	0 - 5	0 - 5	
BTX [mg/l]	GC-G-BTX	GC-R-BTX	not available
OPL = 1 mm 1)	0 - 2400	0 - 2400	
OPL = 5 mm	0 - 360	0 - 360	
OPL = 35 mm	0 - 51	0 - 51	
Chloramine [mg/l]	not available	not available	GC-D-CHLORAMINE
OPL = 1 mm 1)			0 - 2000
OPL = 5 mm			0 - 300
OPL = 35 mm			0 - 42
Ozone O_3 [mg/l]	not available	not available	GC-D-O3
OPL = 1 mm 1)			0 - 1200
OPL = 5 mm			0 - 180
OPL = 35 mm			0 - 25
Chlorine demand CLD [mg/l]	not available	not available	GC-D-CLD
OPL = 1 mm 1)			0 - 1000
OPL = 5 mm			0 - 160
OPL = 35 mm			0 - 22
UV254t / UV254f [Abs/m]	GC-G-UV254	GC-R-UV254	GC-D-UV254
OPL = 1 mm 1)	0 - 3300 / 2800	0 - 3300 / 2800	0 - 3300 / 2800
OPL = 5 mm	0 - 500 / 420	0 - 500 / 420	0 - 500 / 420
OPL = 35 mm	0 - 71 / 60	0 - 71 / 60	0 - 71 / 60

1) real OPL is approx. 0.75 mm

5.5.2 Parameter Measuring Ranges in Municipal Waste Water

Parameter	Influent & sewer	Aeration	Effluent
TSS [mg/l]	GC-I-TSS	not available	GC-E-TSS
OPL = 1 mm 1)	0 - 8000		0 - 4000
OPL = 5 mm	0 - 1200		0 - 600
OPL = 35 mm	0 - 170		0 - 85
TS [g/l]	not available	GC-A-TS	not available
OPL = 1 mm 1)		0 - 20	
OPL = 5 mm		0 - 3	
OPL = 35 mm		0 - 0.42	
Turbidity [FTU/NTU]	not available	not available	GC-E-TURB
OPL = 1 mm 1)			0 - 8000
OPL = 5 mm			0 - 1200
OPL = 35 mm			0 - 170
COLORapp / COLORtru [Hazen]	GC-I-COL	not available	GC-E-COL
OPL = 1 mm 1)	0 - 23000 / 14000		0 - 23000 / 14000
OPL = 5 mm	0 - 3500 / 2100		0 - 3500 / 2100
OPL = 35 mm	0 - 500 / 300		0 - 500 / 300
TOC / DOC [mg/l]	GC-I-TOC	not available	GC-E-TOC
OPL = 1 mm 1)	0 - 3300 / 2600		0 - 2600 / 2000
OPL = 5 mm	0 - 500 / 400		0 - 400 / 300
OPL = 35 mm	0 - 71 / 57		0 - 57 / 42
BOD [mg/l]	GC-I-BOD	not available	GC-E-BOD
OPL = 1 mm 1)	0 - 5300		0 - 2000
OPL = 5 mm	0 - 800		0 - 300
OPL = 35 mm	0 - 110		0 - 42
COD / CODf [mg/l]	GC-I-COD	GC-A-COD	GC-E-COD
OPL = 1 mm 1)	0 - 10000 / 5300	0 - 530 (CODf only)	0 - 3300 / 2000
OPL = 5 mm	0 - 1500 / 800	0 - 80 (CODf only)	0 - 500 / 300
OPL = 35 mm	0 - 210 / 110	0 - 11 (CODf only)	0 - 71 / 42
NO_3-N / NO_3 [mg/l]	GC-I-NO3-N	GC-A-NO3-N	GC-E-NO3-N
OPL = 1 mm 1)	0 - 100 / 460	0 - 26 / 110	0 - 300 / 1300
OPL = 5 mm	0 - 16 / 70	0 - 4 / 17	0 - 45 / 190
OPL = 35 mm	0 - 2.2 / 10	0 - 0.6 / 2.5	0 - 6.4 / 28
HS^- [mg/l]	GC-I-HS	not available	not available
OPL = 1 mm 1)	0 - 80		
OPL = 5 mm	0 - 12		
OPL = 35 mm	0 - 1.7		
Ozone O_3 [mg/l]	not available	not available	GC-E-O3
OPL = 1 mm 1)			0 - 1200
OPL = 5 mm			0 - 180
OPL = 35 mm			0 - 25
UV254t / UV254f [Abs/m]	GC-I-UV254	GC-A-UV254	GC-E-UV254
OPL = 1 mm 1)	0 - 3300 / 2800	0 - 3300 / 2800	0 - 3300 / 2800
OPL = 5 mm	0 - 500 / 420	0 - 500 / 420	0 - 500 / 420
OPL = 35 mm	0 - 71 / 60	0 - 71 / 60	0 - 71 / 60

1) real OPL is approx. 0.75 mm

5.5.3 Parameter Measuring Ranges in Industrial Waste Water

Parameter	Brewery	Paper mill influent	Paper mill Effluent	Dairy
TSS [mg/l]	GC-B-TSS	GC-P-TSS	GC-Q-TSS	GC-M-TSS
OPL = 1 mm 1)	0 - 13000	0 - 8000	0 - 4000	0 - 8000
OPL = 5 mm	0 - 2000	0 - 1200	0 - 600	0 - 1200
OPL = 35 mm	0 - 280	0 - 170	0 - 85	0 - 170
COD / CODf [mg/l]	GC-B-COD	GC-P-COD	GC-Q-COD	GC-M-COD
OPL = 1 mm 1)	0 - 60000 / 53000	0 - 13000 / 11000	0 - 5300 / 3300	0 - 33000 / 16000
OPL = 5 mm	0 - 9000 / 7900	0 - 2000 / 1700	0 - 790 / 490	0 - 5000 / 2400
OPL = 35 mm	0 - 1200 / 1100	0 - 280 / 240	0 - 110 / 70	0 - 710 / 340
NO_3-N / NO_3 [mg/l]	GC-B-NO3-N	GC-P-NO3-N	GC-Q-NO3-N	GC-M-NO3-N
OPL = 1 mm 1)	0 - 100 / 470	0 - 100 / 470	0 - 100 / 470	0 - 210 / 940
OPL = 5 mm	0 - 16 / 70	0 - 16 / 70	0 - 16 / 70	0 - 140 / 32
OPL = 35 mm	0 - 2.2 / 10	0 - 2.2 / 10	0 - 2.2 / 10	0 - 4.5 / 20
UV254t / UV254f	GC-B-UV254	GC-P-UV254	GC-Q-UV254	GC-Q-UV254
[Abs/m]	0 - 3300 / 2800	0 - 3300 / 2800	0 - 3300 / 2800	0 - 3300 / 2800
OPL = 1 mm 1)	0 - 500 / 420	0 - 500 / 420	0 - 500 / 420	0 - 500 / 420
OPL = 5 mm	0 - 71 / 60	0 - 71 / 60	0 - 71 / 60	0 - 71 / 60
OPL = 35 mm				

1) real OPL is approx. 0.75 mm

5.5.4 Available Parameters for nitro::lyser

Part-no. / Application	FTU	NTU	TSS	TS	NO_3-N	NO_3
N2-D / Drinking water	[X]	X			X	[X]
N2-G / Ground water	[X]	X			X	[X]
N2-R / Surface - / River water	[X]	X			X	[X]
N2-E / Effluent			[X]		[X]	X
N2-A / Aeration				[X]	[X]	X
N2-I / Influent & sewer			[X]		[X]	X

X	Parameter available and can be activated instead of another
[X]	Parameter available and activated per default

5.5.5 Available Parameters for ozo::lyser

Part-no. / Application	FTU	NTU	TSS	OZONE
O2-D / Drinking water	[X]	X		[X]
O2-E / Effluent			[X]	[X]

X	Parameter available and can be activated instead of another
[X]	Parameter available and activated per default

5.5.6 Available Parameters for carbo::lyser

Part-no. / Application	FTU	NTU	TSS	TS	NO_3-N	NO_3	COD	CODf	BOD	TOC	DOC	UV254t	UV254f
C2-D / Drinking water	[X]	X								[X]	X	X	X
C3-D / Drinking water	[X]	X								[X]	[X]	X	X
C2-R / Surface - / River water	[X]	X	X				X	X	X	[X]	X	X	X
C3-R / Surface - / River water	[X]	X	X				X	X	[X]	[X]	X	X	X
C2-E / Effluent			[X]				[X]	X	X	X	X	X	X
C3-E / Effluent			[X]				[X]	X	[X]	X	X	X	X
C2-A / Aeration				[X]				[X]					
C2-I / Influent			[X]				[X]	X	X	X	X	X	X
C3-I / Influent			[X]				[X]	X	[X]	X	X	X	X

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.5.7 Available Parameters for multi::lyser

Part-no. / Application	FTU	NTU	TSS	TS	NO_3-N	NO_3	COD	CODf	BOD	TOC	DOC	UV254t	UV254f
M4-D / Drinking water	[X]	X			X	[X]				[X]	[X]	X	X
M4-R / Surface - / River water	[X]	X	X		X	[X]	X	X	[X]	[X]	X	X	X
M4-E / Effluent			[X]		[X]	X	[X]	X	[X]	X	X	X	X
M4-A / Aeration				[X]	[X]	X		[X]					
M4-I / Influent			[X]		[X]	X	[X]	X	[X]	X	X	X	X

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.5.8 Available Parameters for uv::lyser

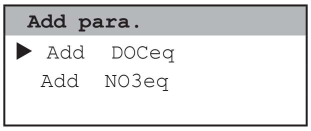
Besides Turbidity, TSS or TS the uv::lyser provides the absorbance value (UV) of up to 4 individual wavelengths.

Part-no. / Application	FTU	NTU	TSS	TS	UV254t	UV254f
U5-D / Drinking water	[X]	X			X	X
U5-R / Surface - / River water	[X]	X			X	X
U5-E / Effluent			[X]		X	X
U5-A / Aeration				[X]	X	X
U5-I / Influent			[X]		X	X

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.5.9 Probe Parameterisation using con::lyte

After successful probe initialisation (see section 5.3.1) the needed measuring parameters of the spectrometer probe have to be added to the parameter display. This is performed by the following steps:



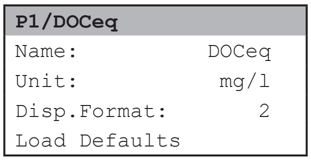
```
Add para.
▶ Add  DOCeq
  Add  NO3eq
```

- Switch to status display with *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select *spectro::lyserV3/0/x* and confirm with *OK*.
- Select menu *Add parameters...* and confirm with *OK*.
- Select needed parameter and confirm with *OK*.

The selected parameter will be displayed now on the next free position of the parameter display. The default display configuration is used. Changing the display format is performed by the following steps:

- Select the parameter in the parameter display using *Up-* or *Down* button.
- Push *Function* button, select menu *Display settings...* and confirm with *OK*.

In the displayed parameter configuration the following settings can be modified.



```
P1/DOCeq
Name:             DOCeq
Unit:              mg/l
Disp.Format:          2
Load Defaults
```

Name	Displays the actual name of the parameter.
Unit	Displays the actual unit of the parameter.

A change of the name or unit of the parameter is performed by the following steps:

- Select the entry with *Up-* and *Down* buttons and confirm by pushing the *OK* button.
- Change the name with *Up-*, *Down-*, *Left-* and *Right* buttons.
- Push the *OK* button to confirm the new name.

Please note that change of parameter name or unit will not change the parameter configuration itself (e.g. if you change the parameter name NO_3-N to NO_3 the reading will still be NO_3-N).

Disp.Format	Within this line the number of displayed decimal places (between 0 and 5) can be set. Please note that in case of too many digits high values can not be displayed and the parameter reading will switch to plus signs (++.+++++).
Load Defaults	Confirming this entry by pushing the *Ok* button will restore the default display settings from the sensor.

All modifications performed by the operator within these settings menu will be documented in the config file of the con::lyte (see manual con::lyte D-320).

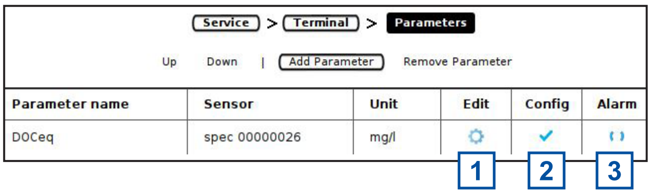
If further licenses for parameters will be installed on the spectrometer probe after the initial start-up or inactive parameters shall be changed to active parameters (e.g. on G-Series), this can be done via Io::Tool only. After the additional parameters have been activated on the spectrometer probe, a new probe initialisation on the con::lyte might be needed.

5.5.10 Probe Parameterisation using moni::tool

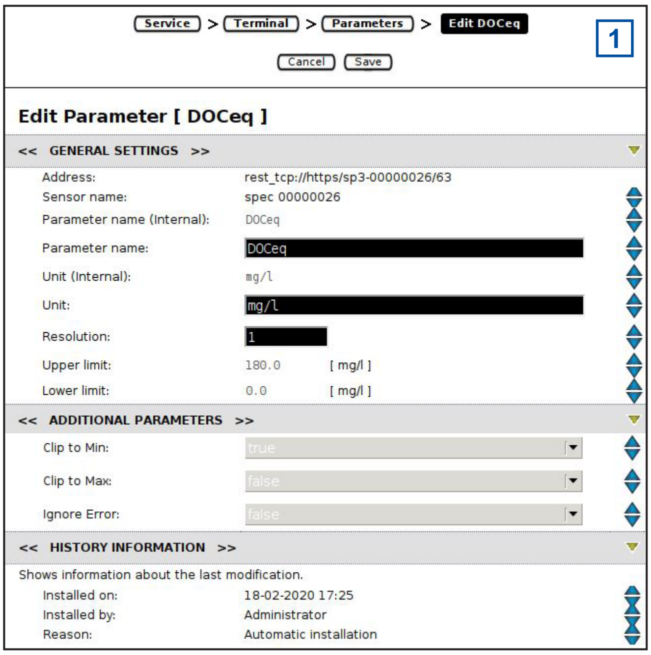
After successful probe initialisation (see section 5.3.2) all parameters of the spectrometer probe will be installed and the active parameters will be displayed on the *Values* screen of moni::tool. If you want to configure the measuring parameters individually, this can be done using the menu item *Service / Terminal / Parameters*.

After selecting this menu item a list of all installed parameters is displayed. After selecting one or several parameters by clicking on them, the following activities can be performed:

- Moving the selected parameter to a higher position in the *Values* display by pushing the entry *Up*.
- Moving the selected parameter to a lower position in the *Values* display by pushing the entry *Down*.
- Deleting the selected parameter from *Values* display by pushing the entry *Remove Parameter*. This action has to be confirmed in a new screen by pushing the button *Delete all*.
- A new parameter can be added to the *Value* display by pushing the entry *Add Parameter*. A table of all parameters that are available will be displayed.
- Click on the blue plus sign (+) on the right hand side of the parameter you want to add to the *Values* display.
- Click on the blue wheel (*Edit*) on the right hand side of the parameter will display the actual parameter settings [1].
- Depending on the used *Service Level* different settings are displayed and can be edited. *Parametername*, *Unit* and *Resolution* can be modified in the *Basic* level. On a higher *Service Level* (*Advanced*, *Expert*) the *Additional Parameters* can be configured.
- Click on the blue check mark (*Config*) on the right hand side of the parameter to check or modify the settings for vali::tool of this parameter [2]. The *Basic* screen is displayed on the right. Please refer to the manual moni::tool for further information.
- Click on the next blue sign (*Alarm*) on the right hand side of the parameter to check or modify the alarm settings for this parameter [3]. The basic screen is displayed on the right. Please refer to the manual moni::tool for further information.



Parameter name	Sensor	Unit	Edit	Config	Alarm
DOCeq	spec 00000026	mg/l	⚙	✓	( )



Edit Parameter [DOCeq]

<< GENERAL SETTINGS >>

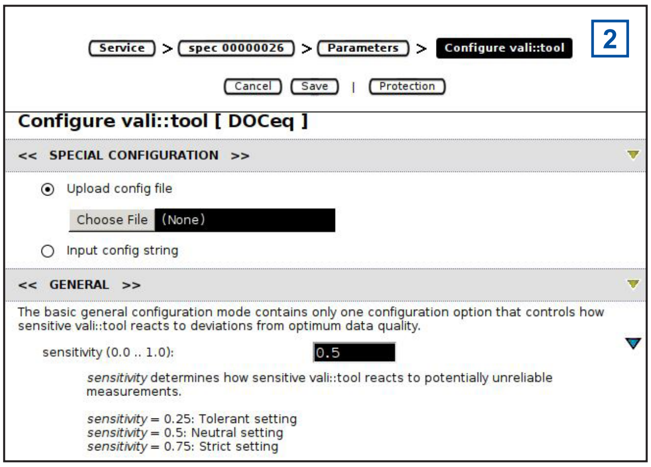
Address: rest_tcp://https/sp3-00000026/63
Sensor name: spec 00000026
Parameter name (Internal): DOCeq
Parameter name: DOCeq
Unit (Internal): mg/l
Unit: mg/l
Resolution: 1
Upper limit: 180.0 [mg/l]
Lower limit: 0.0 [mg/l]

<< ADDITIONAL PARAMETERS >>

Clip to Min: true
Clip to Max: false
Ignore Error: false

<< HISTORY INFORMATION >>

Shows information about the last modification.
Installed on: 18-02-2020 17:25
Installed by: Administrator
Reason: Automatic installation



Configure vali::tool [DOCeq]

<< SPECIAL CONFIGURATION >>

● Upload config file
Choose File (None)
○ Input config string

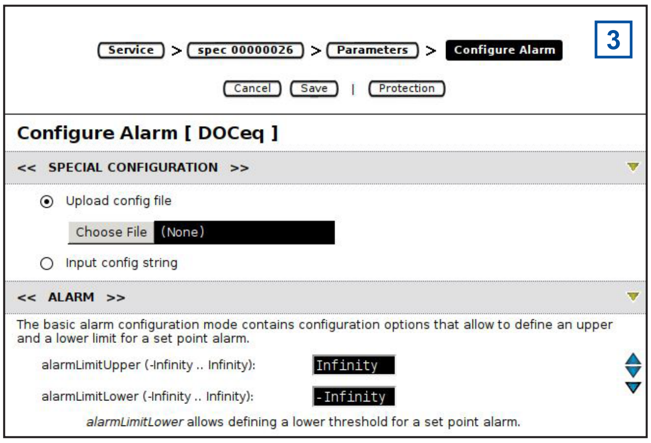
<< GENERAL >>

The basic general configuration mode contains only one configuration option that controls how sensitive vali::tool reacts to deviations from optimum data quality.

sensitivity (0.0 .. 1.0): 0.5

sensitivity determines how sensitive vali::tool reacts to potentially unreliable measurements.

sensitivity = 0.25: Tolerant setting
sensitivity = 0.5: Neutral setting
sensitivity = 0.75: Strict setting



Configure Alarm [DOCeq]

<< SPECIAL CONFIGURATION >>

● Upload config file
Choose File (None)
○ Input config string

<< ALARM >>

The basic alarm configuration mode contains configuration options that allow to define an upper and a lower limit for a set point alarm.

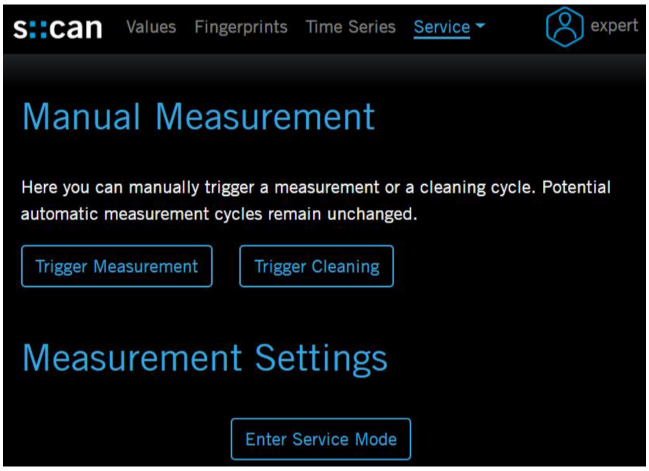
alarmLimitUpper (-Infinity .. Infinity): Infinity
alarmLimitLower (-Infinity .. Infinity): -Infinity

alarmLimitLower allows defining a lower threshold for a set point alarm.

5.5.11 Probe Parameterisation using Io::Tool

After successful probe initialisation (see section 5.3.3) all active parameters of the spectrometer probe will be displayed on the *Values* screen of Io::Tool. If you want to configure the measuring parameters individually, this can be done using the menu item *Measurement Settings*.

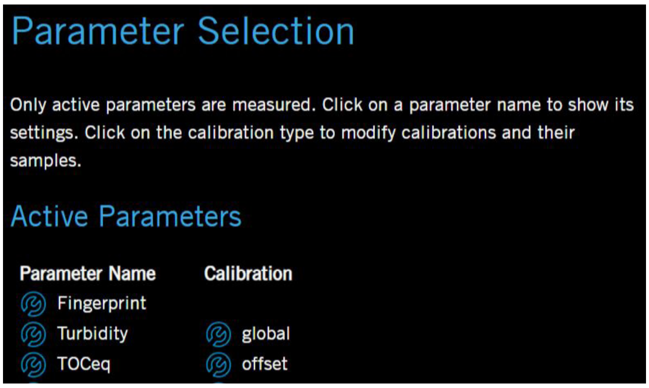
- Logon as user *user* or *expert* (see section 5.4).
- Select menu *Service \ Measurement Settings*.
- Activate the *Service Mode* by pushing the button.
- Below the *Parameter Selection* all active fingerprints and parameters are displayed. Push the blue icon on the left side of the *Parameter Name* to open the configuration window of the *Parameter Properties* for this parameter.
- *Name* displays the used parameter name. This can be changed if needed.
- *Description* is the exact description of the parameter.
- *Id* and *Application* are the identification of the calculation algorithm (Global Calibration).
- *Unit* displays the used parameter unit. This can be changed if necessary.
- *Decimals* is the number of displayed decimal places of the parameter. This can be changed if necessary.
- *Averaging* displays the number of used readings to calculate the average. The number 1 (factory setting) deactivates the averaging.
- *Limits* displays the defined measuring range for the used optical path length.
- *Error Limits* displays the range outside of that an error message for this parameter will be displayed.
- The following check boxes define if the reading display will be limited to the measuring range (*Value clipping*) and if the exceed of the measuring range will cause an error (*Ignore Error*).
- Pushing the button *Remove Parameter* will not display readings of this parameter anymore and move the parameter to the inactive parameters.
- Any changes made must be confirmed by pushing the button *Save*.
- By pushing the blue *+* sign on the left hand side of the *Parameter Name*, an *inactive Parameter* will be added to the *Values* screen again.



Manual Measurement

Here you can manually trigger a measurement or a cleaning cycle. Potential automatic measurement cycles remain unchanged.

Measurement Settings

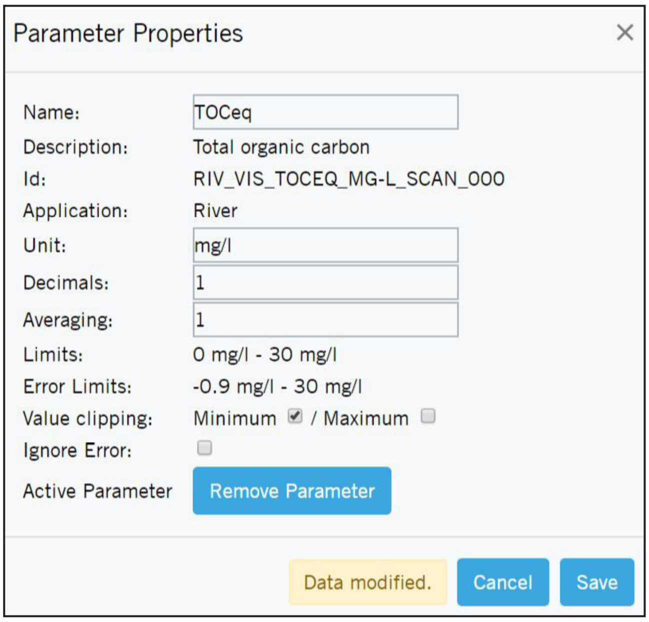


Parameter Selection

Only active parameters are measured. Click on a parameter name to show its settings. Click on the calibration type to modify calibrations and their samples.

Active Parameters

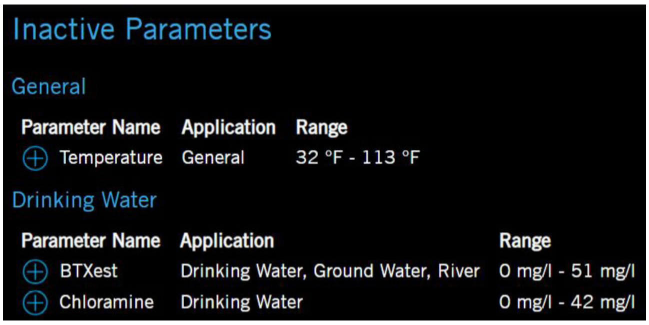
Parameter Name	Calibration
Fingerprint	
Turbidity	global
TOCeq	offset



Parameter Properties

Name: TOCeq
Description: Total organic carbon
Id: RIV_VIS_TOCEQ_MG-L_SCAN_000
Application: River
Unit: mg/l
Decimals: 1
Averaging: 1
Limits: 0 mg/l - 30 mg/l
Error Limits: -0.9 mg/l - 30 mg/l
Value clipping: Minimum ☑ / Maximum ☐
Ignore Error: ☐
Active Parameter

Data modified.



Inactive Parameters

General

Parameter Name	Application	Range
Temperature	General	32 °F - 113 °F

Drinking Water

Parameter Name	Application	Range
BTXest	Drinking Water, Ground Water, River	0 mg/l - 51 mg/l
Chloramine	Drinking Water	0 mg/l - 42 mg/l

6 Calibration

At each measurement the s::can spectrometer probe detects the absorbance at different wavelengths caused by the measured medium. This so called fingerprint is used to calculate different parameters (e.g. NO_3-N, COD) based on the global calibration the spectrometer probe is equipped with. Global calibrations are standard spectral algorithms available for specific conditions of typical applications (e.g. municipal waste water, river water, drinking water) in such a way, that the spectrometer probe can be used immediately after delivery.

With a local calibration the respective parameters can be adapted to the actual concentrations of the local water matrix, if necessary. A local calibration can be performed directly on site without demounting the spectrometer probe or using standard solutions.

⚠ Once the spectrometer probe is calibrated locally to the specific medium, there is no need to recalibrate the spectrometer probe any more. Only the measuring windows have to be kept clean.

Data base for each local calibration are results of conventional laboratory analysis on the one hand and the absorbance spectra measured with the spectrometer probe on the other hand. Because comparison analyses are made in the laboratory, it is necessary to take random samples. The measurement of the fingerprints takes place directly in the process (on-line and in-situ). Caused by this fact not only the deviation of the different methods influences the quality of the calibration but also the total sampling failure (homogeneity of medium, biochemical reactions from sampling to analysing).

Samples have to be chosen in such a way, that they enable you to cover the whole measuring range with only a few samples. Therefore s::can recommends to take one sample at low and one at high concentration. Under normal circumstances a two-point calibration based on these samples will be satisfactory.

⚠ When using calibration standards you have to keep in mind that these standards will always present a different background matrix compared to the real measuring medium.

- Before performing any kind of sample measurement, the cleanliness of the measuring windows should be ensured (please refer to section 9.1).
- Before performing the sample measurement in-situ, the probe has to be submersed into the medium (at least 15 min.).
- When performing the sample measurement with the multifunctional slide, rinse the slide serveral times with the calibration medium (sample) before measuring the sample.
- Perform the sample measurement immediately after filling the multifunctional slide, to avoid any influences due to sedimentation.
- A sample measurement has to be triggered at the same time the sample for laboratory analysis is taken.
- The result of the laboratory analysis can be entered later.
- The calibration will not be executed and used till the menu item *Calibrate!* is confirmed.
- When performing a parameter calibration the result will be checked for plausibility. In case of faulty calibration an error message will be displayed to the operator.
- On the spectrometer probe itself sample readings and corresponding laboratory results can be stored for each parameter using lo::Tool (see section 6.2.3). Furthermore the coefficients of the local calibration (offset and slope) are stored on the probe.

6.1 Types of Calibration

Depending on the type of the spectrometer probe (G-Serie or spectro::lyser) and the used controller for operation different types of calibration can be performed.

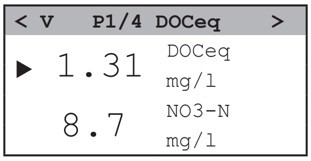
	Offset	Linear	Multi
Number of samples	1 sample	2 samples	3 or more samples
Modified coefficients	offset	offset and slope	offset and slope
con::lyte D-320	possible	possible	not possible
moni::tool V4	possible	possible	possible using samples stored on con::cube
Io::Tool	possible	possible	possible using samples stored on the spectrometer probe

6.2 Performing a Calibration

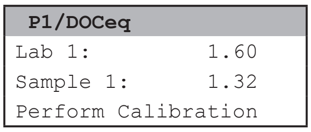
6.2.1 Calibration using con::lyte

This controller for operation provides, beside normal calibration procedure (see further down), the possibility for a quick calibration call directly from the parameter view. This is performed by following steps:

- Select the parameter in the parameter display with *Up-* or *Down* button.
- Push *OK* button, which directly displays the calibration screen.
- Select *Sample 1* and confirm with *OK* to store the global (raw) signal of the actual reading.
- Simultaneously take a water sample to analyse real parameter concentration.
- Enter the result from laboratory analyse into the field *Lab 1*.
- Select entry *Perform Calibration* and confirm with *OK*.
- Leave the calibration screen with *Back* button.



```
< V    P1/4 DOCeq    >
▶ 1.31  DOCeq
        mg/l
  8.7   NO3-N
        mg/l
```



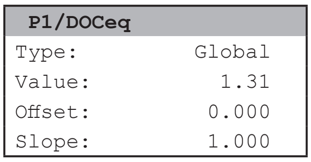
```
 P1/DOCeq
Lab 1:          1.60
Sample 1:       1.32
Perform Calibration
```

Now the selected parameter is offset calibrated. The advanced local calibration provides extensive possibilities for calibration of selected parameter.

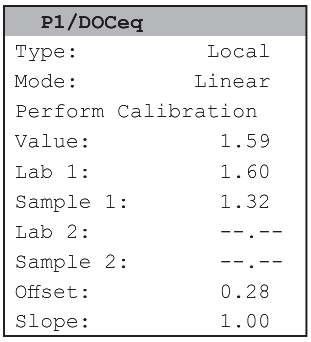
- Select the parameter in the parameter display with *Up-* or *Down* button
- Push the *Function* button.
- Select the menu *Calibrate expert...* and pushing the *OK* button

Now the complete calibration screen is displayed and provides the following options:

- *Type* Two different types of calibration are available: *Local* or *Global*. By default *Local* is selected. This is the normal calibration performed by the operator. As soon as *Global* is selected and confirmed with *OK* a reset of this parameter to factory calibration (global) is performed and the actual reading (*Value*), the default offset (*Offset*) and the default slope (*Slope*) will be displayed.
- *Mode* As available local calibration variants either *Offset* or *Linear* can be selected.
- *Perform Calibration* Confirming this entry by pushing the *Ok* button will execute the local calibration, using the *Lab* and *Sample* values displayed on the calibration screen.



```
 P1/DOCeq
Type:         Global
Value:          1.31
Offset:        0.000
Slope:         1.000
```



```
  P1/DOCeq
Type:          Local
Mode:         Linear
Perform Calibration
Value:          1.59
Lab 1:          1.60
Sample 1:       1.32
Lab 2:         --.--
Sample 2:      --.--
Offset:         0.28
Slope:          1.00
```

- *Value* Displays the measured value of the sensor like on the parameter screen (i.e. using the actual calibration). The value will be updated permanently.
- *Lab 1* Within this line the correct value for the measured *Sample 1* (laboratory result) has to be entered. The unit of the lab value has to be in accordance with the measuring parameter.
  An entered *Lab* value can be deleted by selecting it and pushing the *Function* button so that it will not be used in the calibration.
- *Sample 1* When confirming this entry by pushing the *Ok* button, a measurement will be performed and stored as sample 1 for the local calibration. The sample for the laboratory should be taken at the same time.
  Existing readings (*Sample 1* or *Sample 2*) are overwritten whenever a new measurement is performed by pushing *OK*. If no sample measurement was performed or the measurement was invalid, the message *Measure!* will be displayed instead of a numerical value.
- *Offset* Displays the used offset of the actual calibration. It is not possible to edit this value. The offset of the global calibration is 0.
- *Slope* Displays the used slope of the actual calibration. It is not possible to edit this value. The slope of the global calibration is 1.

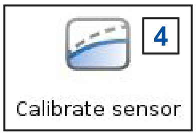
6.2.2 Calibration using moni::tool

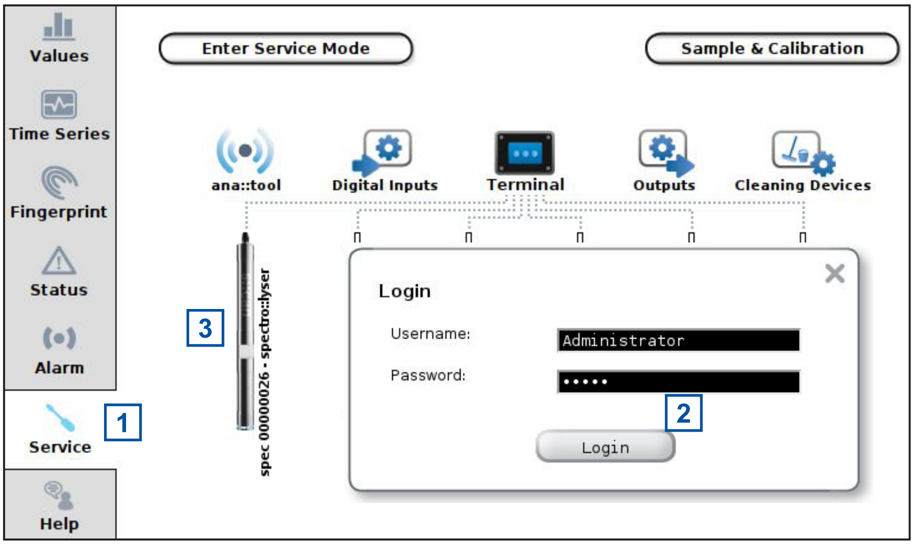
1 Click the *Service* tab of the moni::tool screen.

2 Logon as *Administrator* with password *admin1* or your individual username.

3 Click the icon of the sensor you want to calibrate in the displayed system overview.

4 Click the icon *Calibrate sensor* in the next screen.



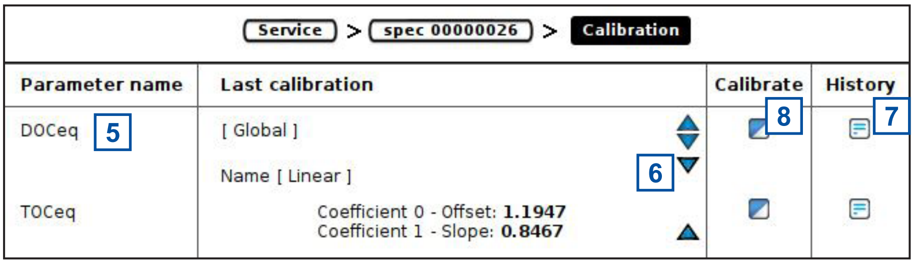


Login

Username: Administrator

Password: •••••

5 Now the screen shows a list of all parameters being measured by this sensor (*Parameter name*).



Parameter name	Last calibration	Calibrate	History
DOCeq	[Global]		
TOCeq	Name [Linear] Coefficient 0 - Offset: 1.1947 Coefficient 1 - Slope: 0.8467		

6 Clicking on the blue triangles will display more information about actual used calibration for this parameter. The global calibration uses offset=0 and slope=1.

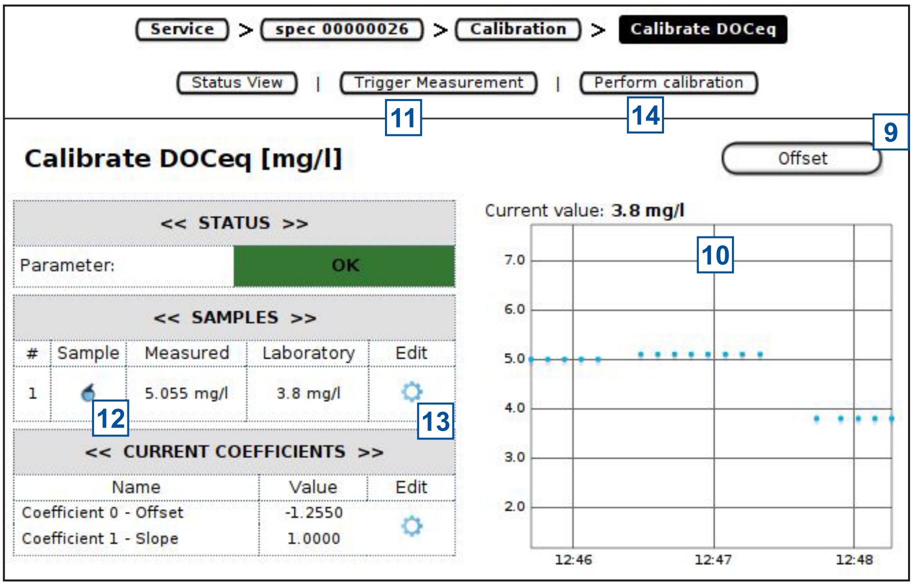
7 Furthermore a click on the *History* icon rightmost opens a logbook showing all calibration procedures performed with this con::cube up to now.

8 Open the calibration screen by clicking on the *Calibrate* icon on the right side of the parameter you want to calibrate.

9 This button displays the actual used calibration (*Global*, *Offset*, *Linear* or *Multi*). Push this button to select the type of calibration you want to perform.

10 The current readings of the parameter will be displayed numerically and graphically.

11 A new measurement of the spectrometer probe will be performed whenever you push the button *Trigger measurement*.



Calibrate DOCeq [mg/l]

Current value: **3.8 mg/l**

<< STATUS >>

Parameter:	OK

<< SAMPLES >>

#	Sample	Measured	Laboratory	Edit
1	💧	5.055 mg/l	3.8 mg/l	⚙

<< CURRENT COEFFICIENTS >>

Name	Value	Edit
Coefficient 0 - Offset	-1.2550	⚙
Coefficient 1 - Slope	1.0000	

12 Push the *Sample* icon to perform a new measurement and store the reading on the probe. Please note that the value (*Measured*) displayed below *SAMPLES* is the raw value, based on the global calibration. The *Sample #1* will be used for offset and linear calibration.

13 Push the *Edit* icon to enter the result of the laboratory analysis and store it on the probe.

14 Push the button *Perform Calibration* to start the calibration procedure.

After the calibration procedure is finished a user message will inform you if the local *calibration of parameter was successful*. In case of an error the reason will be displayed to the user in red letters (e.g. *Please enter at least lab values for 2 samples*).

The coefficients of the new local calibration will be displayed in the column *Value*. It is also possible to write coefficients directly onto the probe by pushing the button *Edit*.

6.2.3 Calibration using Io::Tool

1 Enter the IP address of the spectrometer probe into your webbrowser to start Io::Tool. Logout user *guest* and logon as *user* or *expert*. (see section 5.4)

2 Select menu *Service \ Measurement Settings*.

3 Push the button *Enter Service Mode*.

4 Push the blue calibration icon on the right side of the parameter name you want to calibrate.

5 Within the *Samples* screen all stored samples up to now for this parameter are displayed.

6 Results of laboratory analysis can be entered in the row *Lab Values*.

7 Date and time when the samples were taken are displayed in the row *Timestamp*.

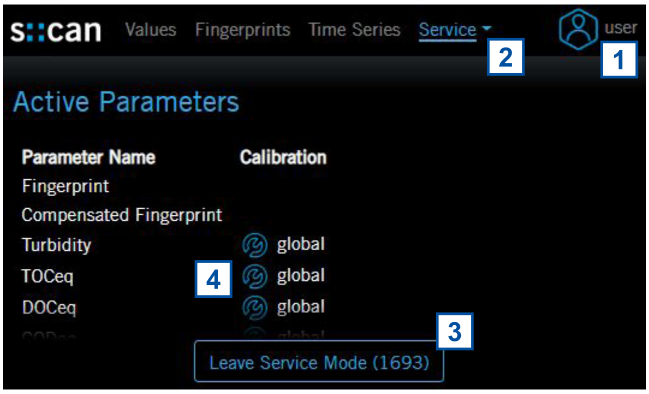
8 If a further sample is needed, push the button *Add Row*.

9 When pushing the button *Trigger Measurement* a new measurement is performed and the readings are displayed above as *Last measurement*. Push the *Sample* button to add this measurement to the sample row.

10 The checkbox on the left side (*Use*) defines which samples will be used for local calibration.

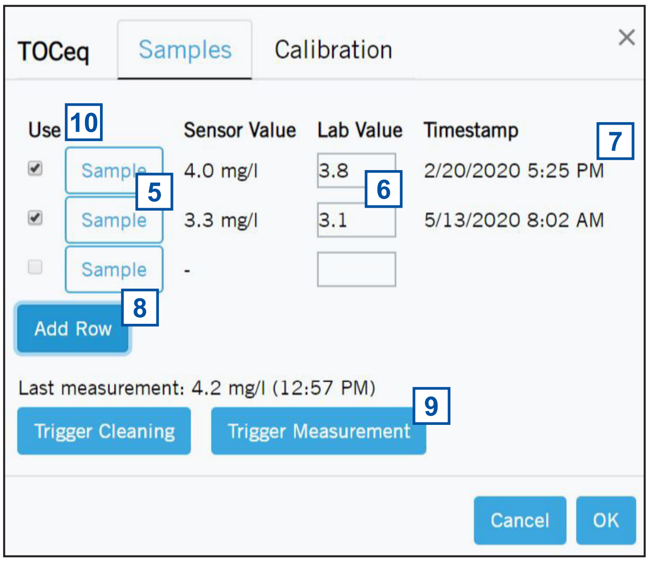
11 Within the *Calibration* screen the actual used calibration is displayed. Below the *Calibration mode* (*global*, *offset* or *linear*) the actual used offset (*calibration offset*) and the slope (*calibration slope*) are displayed.

12 Below the information about the *Used Calibration* the *Suggested Calibrations* are displayed. Depending on the number of used samples, it is *offset* or *linear* calibration. Simply push the button *Use This* on the right side of the suggested calibration to use it.



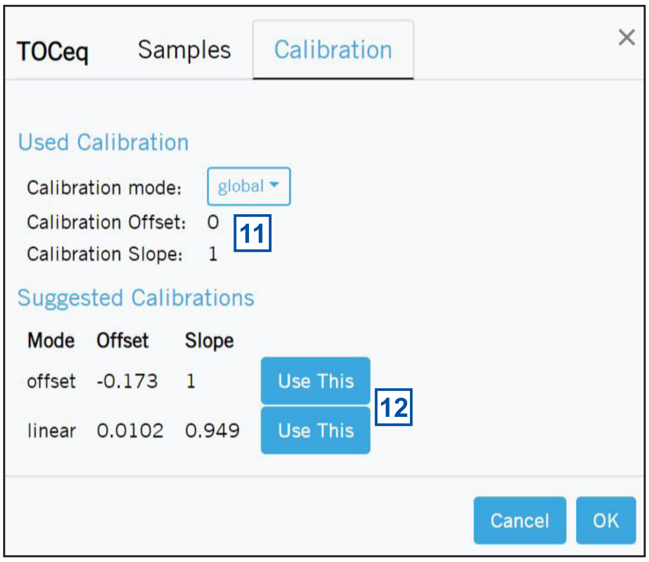
Active Parameters

Parameter Name	Calibration
Fingerprint	
Compensated Fingerprint	
Turbidity	global
TOCeq	global
DOCeq	global



Use		Sensor Value	Lab Value	Timestamp
☑	Sample	4.0 mg/l	3.8	2/20/2020 5:25 PM
☑	Sample	3.3 mg/l	3.1	5/13/2020 8:02 AM
☐	Sample	-		

Last measurement: 4.2 mg/l (12:57 PM)



Used Calibration

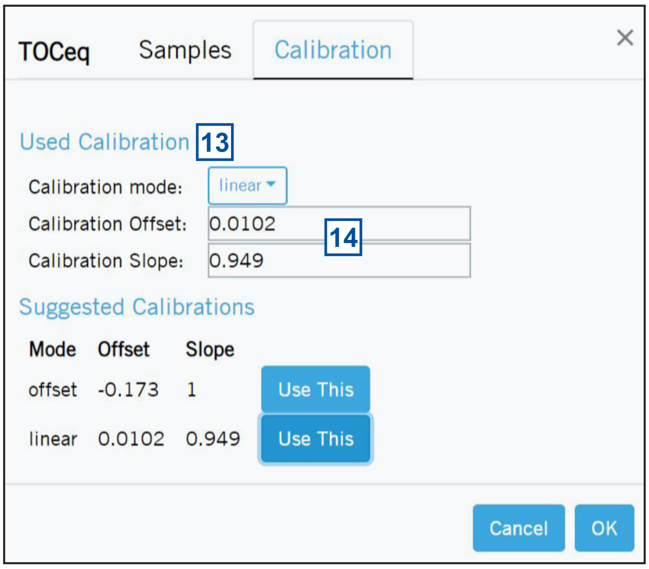
Calibration mode: global
Calibration Offset: 0
Calibration Slope: 1

Suggested Calibrations

Mode	Offset	Slope	
offset	-0.173	1	Use This
linear	0.0102	0.949	Use This

13 As soon as the button *Use This* has been pushed, the new calibration mode with used offset and slope is displayed in the upper part of the calibration screen.

14 The used calibration coefficients can be modified manually in the entry field.



Calibration mode: linear

Calibration Offset: 0.0102

Calibration Slope: 0.949

Suggested Calibrations

Mode	Offset	Slope
offset	-0.173	1
linear	0.0102	0.949

7 Data Management

7.1 Data Storage

The following information is stored directly on the spectrometer probe in addition to the readings:

- Global calibration for all installed parameters
- Actual used local calibration for each parameter
- Readings of sample measurements for each parameter
- Laboratory results of samples for each parameter
- Reference measurements (air, water)
- Device information (e.g. type, serialnumber, address, please refer to section 10.4)
- Service information in the internal logfile of the probe

The spectrometer probe is equipped with an 8 GB onboard memory (please refer to the technical specifications located at the end of this manual). A fixed part of this memory is resered to store the measured fingerprints and another part is reserved to store the measured parameter readings. Within the table below there are two examples how many data can be stored maximal. Before the memory is full, the oldest entries will be deleted.

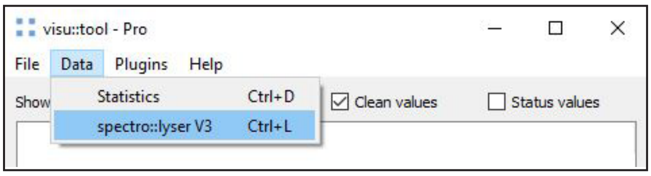
Measuring Interval	No. of Fingerprints	No. of optical Parameters	Storage capacity of Fingerprints	Storage capacity of Parameters
2 minutes	1	2	555 days	730 days
2 minutes	2	6	277 days	603 days

⚠ The storage capacity is related to the measuring interval directly. The number of parameters is not correlated to storage capacity of parameters directly. There are several internal parameters logged additionally. Activating temperature in °C does not decrease storage capacity as it is always logged as internal parameter, but activating temperature in °K counts as additional parameter.

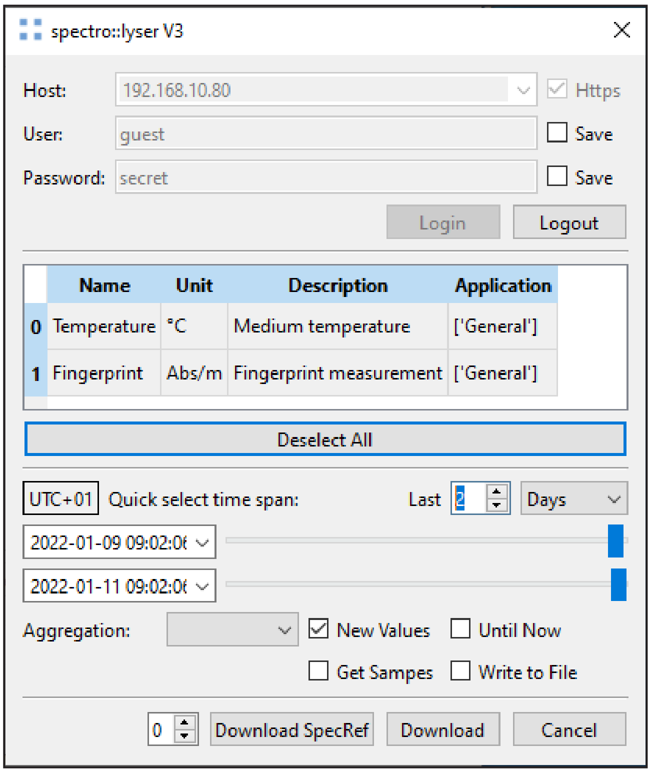
7.2 Data Transfer

If no s::can terminal (con::cube or con::lyte) is used for the operation of the spectrometer probe, there a several possibilities available to transfer the data. In the following sections these options are described.

7.2.1 Data Transfer via visu::tool



Stored fingerprint and parameter results can be downloaded from the spectrometer probe with visu::tool. Please refer to manual visu::tool for further details.


spectro::lyser V3

Host: 192.168.10.80 ☑ Https
User: guest ☐ Save
Password: secret ☐ Save

	Name	Unit	Description	Application
0	Temperature	°C	Medium temperature	['General']
1	Fingerprint	Abs/m	Fingerprint measurement	['General']

UTC+01 Quick select time span: Last 2 Days
2022-01-09 09:02:06
2022-01-11 09:02:06
Aggregation: ☑ New Values ☐ Until Now
☐ Get Sampes ☐ Write to File
0

7.2.2 Data Transfer via Io::Tool

Stored fingerprint and parameter results can be downloaded from the spectrometer probe with Io::Tool. The following steps are required:

1 Start Io::Tool and logon as *expert*.

2 Select menu *Time Series* and scroll down to the bottom of the screen.

3 Push the button *Data Download*.

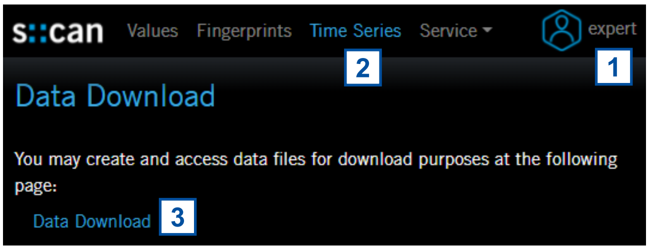
4 Push the button *Create Download Files*. Now the download window (*File Download Request*) pops up.

5 Select the type of data, that shall be downloaded within the selection field *Content*. It is possible to download either parameter readings (*Measurement data*), or measured fingerprints (*Fingerprint data*), or performed local calibrations (*Calibration data*) or all configurations performed on the spectrometer probe (*Configuration data*).

6 Select the time period that shall be downloaded (*Start date*, *End date*). This option is available for parameter readings and fingerprints only.

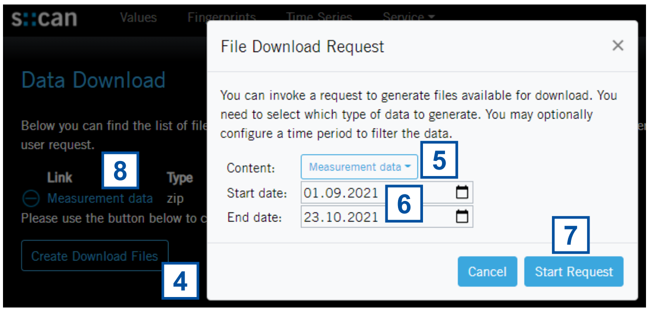
7 Push the button *Start Request*.

8 After the download is finished (File name is colored blue) the zip file with the measurements can be downloaded by clicking on the file name (*Measurement data.zip*).



Data Download

You may create and access data files for download purposes at the following page:



Below you can find the list of file… user request.

Link	Type
Measurement data	zip

Please use the button below to c…

File Download Request

You can invoke a request to generate files available for download. You need to select which type of data to generate. You may optionally configure a time period to filter the data.

Content: Measurement data
Start date: 01.09.2021
End date: 23.10.2021

7.2.3 Data Transfer via FTP, SFTP or SCP

The setup of an automatic data transfer from the spectrometer probe to an external server is performed by the following steps:

1 Start Io::Tool and logon as *expert*.

2 Select menu *Service \ Device Settings \ File Transfer*.

3 Push the button *Enter Service Mode*.

4 Push the button *Edit Settings*.

5 Push the button *Add new File Upload* to open the window for configuration.

6 Select the *Protocol*, that shall be used (*FTP*, *SFTP* or *SCP*).

7 Enter the address and directory for the destination server.

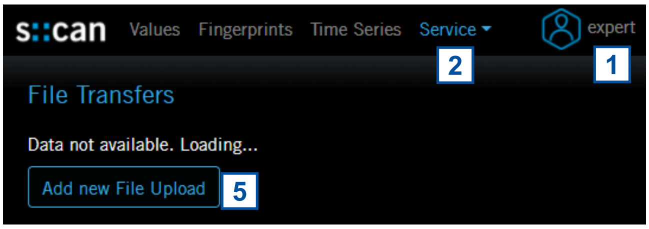
8 Select the amount of data that shall be transfered (*Measurement data*, *Fingerprint data*, *Configuration data*, *Calibration data*).

9 Select if a *Data aggregation* (*none*, *hourly* or *daily*) shall be used for *Measurement data* and define the general transfer interval (*Interval*).

10 Enter the *Username* and the *Password* for the destination server.

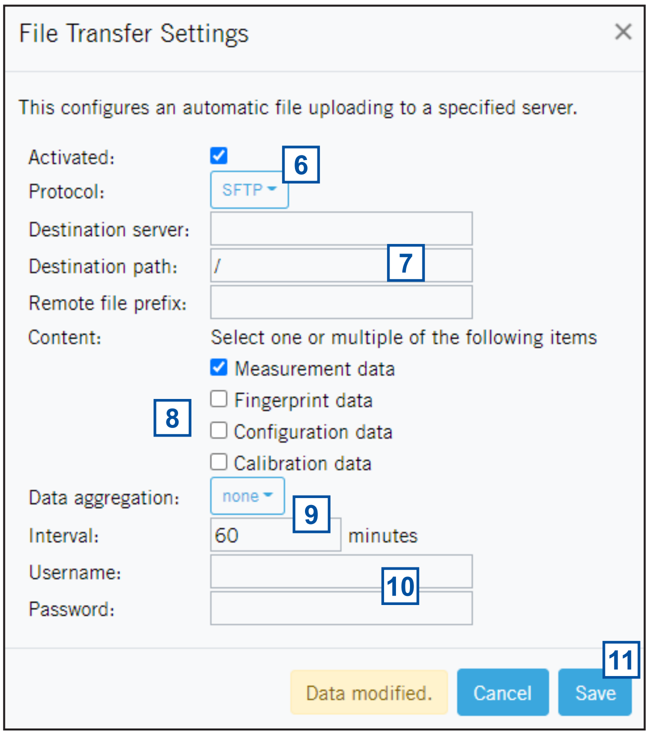
11 Push the button *Save* to store the configuration permanently.

Already existing data transfers as well as the time stamp of the last transfer will be displayed below and can be configured if needed. To do this, simply push the blue icon on the left side.



File Transfers

Data not available. Loading...



File Transfer Settings

This configures an automatic file uploading to a specified server.

Activated: ☑
Protocol: SFTP
Destination server:
Destination path: /
Remote file prefix:
Content: Select one or multiple of the following items
☑ Measurement data
☐ Fingerprint data
☐ Configuration data
☐ Calibration data
Data aggregation: none
Interval: 60 minutes
Username:
Password:

7.3 Data Visualisation

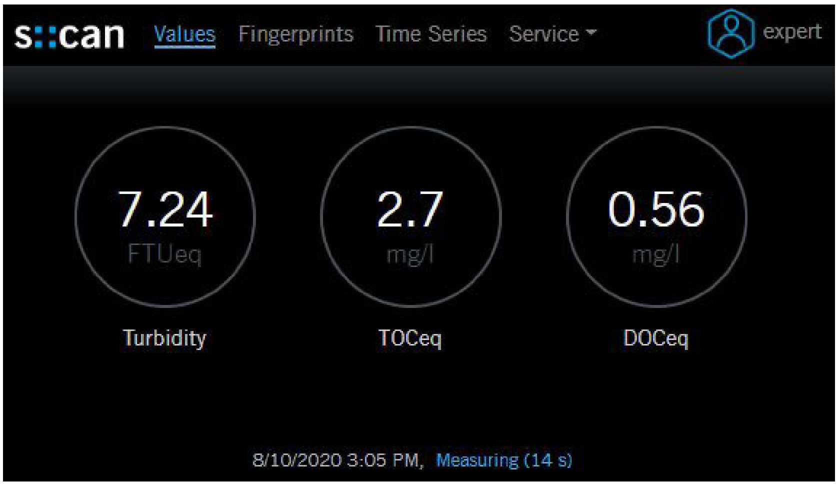
For visualisation of the spectrometer probe readings one of the following s::can controller for operation or s::can tools can be used:

- con::lyte (parameter readings)
- con::cube (parameter readings, time series and fingerprints when using of spectro::lyser)
- con::nect with PC using Io::Tool (parameter readings, time series and fingerprints when using spectro::lyser)
- visu::tool for offline visualisation of readings, fingerprints and status messages

7.3.1 Data Visualisation using Io::Tool

On the *Values* screen the most actual readings of all active parameters are displayed. When clicking on the parameter reading a window pops up which contains all parameter details.

- Value
- Measurement date
- Status
- Description of the parameter
- Limits of the measuring range
- Actual used local calibration

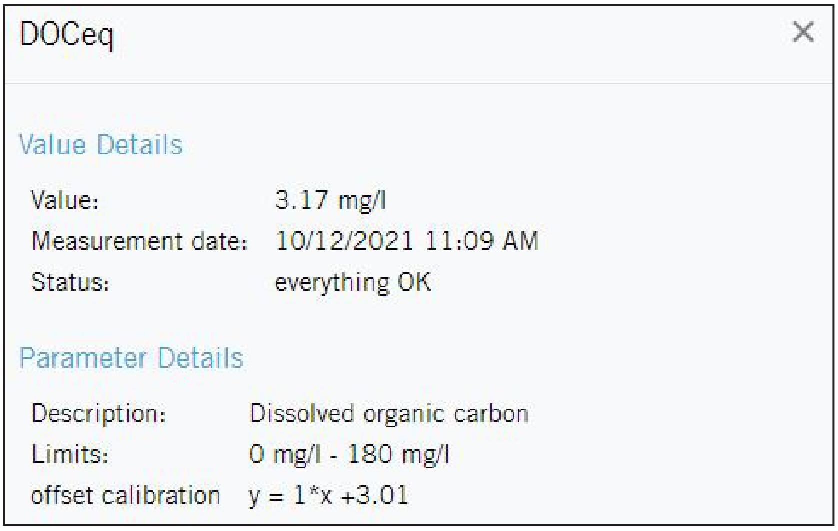


7.24 FTUeq Turbidity

2.7 mg/l TOCeq

0.56 mg/l DOCeq

8/10/2020 3:05 PM, Measuring (14 s)



DOCeq

Value Details

Value: 3.17 mg/l
Measurement date: 10/12/2021 11:09 AM
Status: everything OK

Parameter Details

Description: Dissolved organic carbon
Limits: 0 mg/l - 180 mg/l
offset calibration y = 1*x +3.01

On the *Fingerprints* screen the current fingerprint of the spectro::lyser is displayed. There is one diagram for each measured or calculated fingerprint.

1 Description of the fingerprint with date and time of measurement.

2 Measured fingerprint displayed as Absorption per meter over the wavelengths.

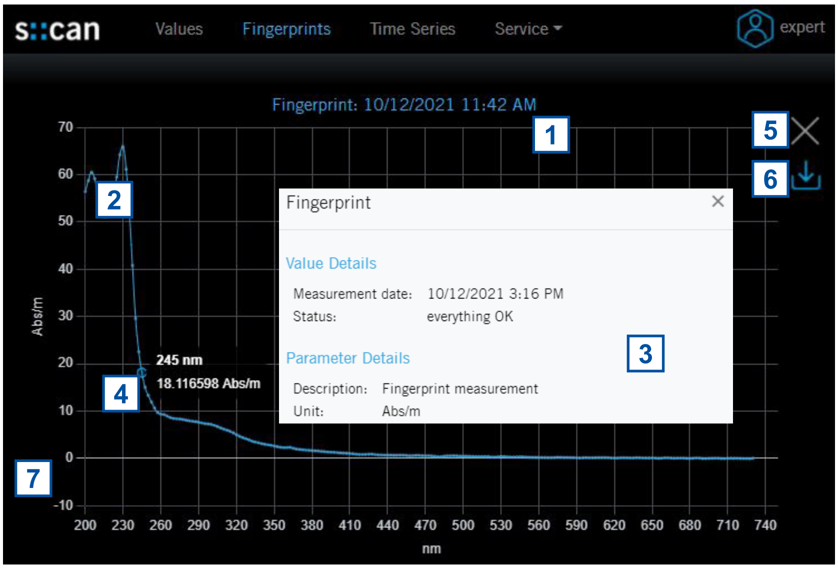
3 General information is displayed when clicking somewhere on the background of the displayed fingerprint.

4 Detailed information is displayed when moving the cursor over one measuring point.

5 Pushing this icon will reset any zoom configuration.

6 Pushing this icon will copy the fingerprint data to the clipboard. So the data can be copied to any other program easily.

7 When clicking somewhere on the background outside the diagram axis, a window pops up to configure the view (*Graph View Settings*).



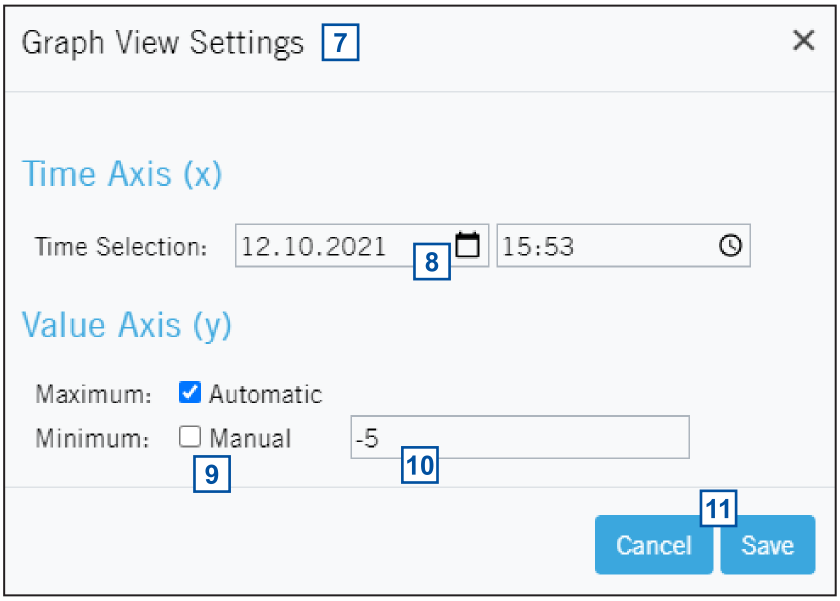
Fingerprint

Value Details

Measurement date: 10/12/2021 3:16 PM
Status: everything OK

Parameter Details

Description: Fingerprint measurement
Unit: Abs/m



Graph View Settings

Time Axis (x)

Time Selection: 12.10.2021 15:53

Value Axis (y)

Maximum: ☑ Automatic
Minimum: ☐ Manual -5

8 Within the entry field *Time Selection* the date and the time of a historical fingerprint that shall be displayed can be entered. Clicking on the calender and time icon will open a selection field.

9 The y-axis (Absorbance per meter) is scalled automtically by default. Deactivate the checkbox *Automatic* to switch to *Manual*.

10 Once the manual scaling is activated, a value for the minimum and the maximum of the y-axis can be entered.

11 Push the button *Save* to store the settings and see the modified display of the fingerprint. Push the button *Cancel* to keep the fingerprint view unchanged.

Depending on the number and type of parameters one or more diagrams are displayed on the *Time Series* screen. Within one diagram all parameters using the same unit are summarized.

1 Legend of displayed parameter. A parameter can be removed from the diagram by clicking on the parameter name (~~*CODfeq*~~).

2 Detailed information is displayed when moving the cursor over one measuring point.

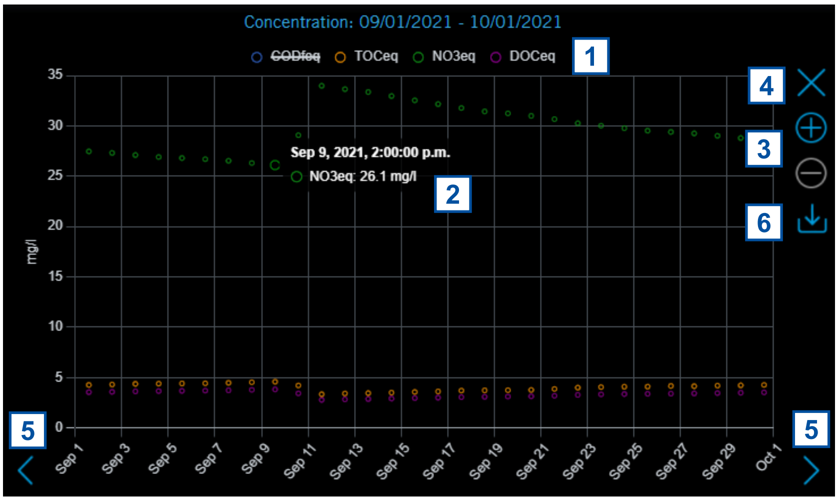
3 Zoom icons to diplay one hour, one day, one week or one month.

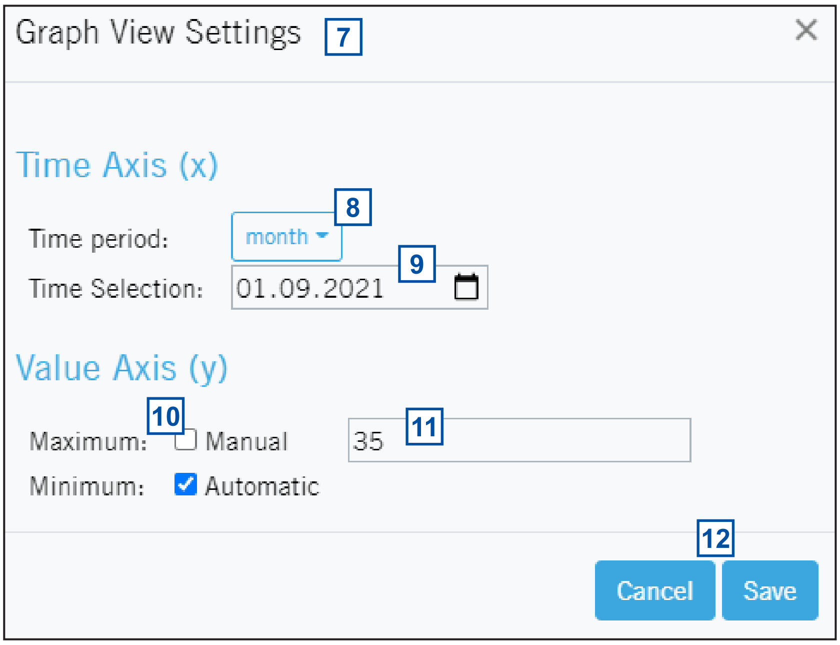
4 Pushing this icon will reset any zoom configuration.

5 Arrow icons to move timeseries back or forward.

6 Copy icons to copy all displayed parameter readings into the clipboard. So the data can be copied to any other program easily.

7 When clicking somewhere on the background outside the diagram axis, a window pops up to configure the view (*Graph View Settings*).





Graph View Settings

Time Axis (x)

Time period: month

Time Selection: 01.09.2021

Value Axis (y)

Maximum: ☐ Manual 35

Minimum: ☑ Automatic

Cancel Save

8 Within the selection field *Time period* the displayed time frame can be set to *month*, *week*, *day* or *hour*. The time series starts alwaays on 1st of the month, on Monday, at 0 a.m. or at full hour.

9 Within the entry field *Time Selection* the date and the time of historical readings can be entered that shall be displayed. Clicking on the calender and time icon will open a selection field.

10 The y-axis is scalled automtically by default. Deactivate the checkbox *Automatic* to switch to *Manual*.

11 Once the manual scaling is activated, a value for the minimum and the maximum of the y-axis can be entered.

12 Push the button *Save* to store the settings and see the modified display of the time series. Push the button *Cancel* to keep the time series view unchanged.

⚠ At the lower part of the *Time Series* screen there is the possibility to download the measured data from the spectrometer probe (see section 7.2.2).

8 Function Check

A function check might be required for one of the following reasons:

- Initial startup
- Routine function check
- Suspicion of monitoring system malfunction
- Modification of monitoring system (e.g. integration of additional sensor or device)
- Change of measuring location

Depending on the application (water composition), the probes and sensors connected and the environmental conditions a regular function check (weekly to monthly) is recommended. The following sections provide an overview of all the actions that have to be performed to check the monitoring system quickly (see section 8.1), to check the plausibility of the collected readings (see section 8.2) and to check the integrity of a single probe or sensor (see section 8.3).

8.1 Check of System / Monitoring Station

Check	con::lyte	moni::tool / con::cube	Actions needed
Power supply controller	Green LED is on? Text is visible on the display?	LED on housing cover is on or at least flashing? moni::tool screen is displayed after touching the screen?	Check power supply of controller. Power off controller for 5 minutes and power on again.
System running (up-to-date)	Displayed system time is current and is updated every second?	Click on system clock at the bottom of the screen shows current time and last measurement. Both are current?	Check for displayed error messages. Check if Service mode is acitvated or automatic measurement is paused.
System status	No error messages or error symbols are displayed?	LED of con::cube is blue and *Status* icon of moni::tool is not blinking yellow?	See section 10 for Troubleshooting.
Reason for bad system status	Check logbook entries since last function check.	Open *Status* tab and select symbol of affected sensor for more information.	See section 10 for Status- and Errorcodes.

Check	Remark
Function of automatic cleaning	Use function *Clean now* or wait for next cleaning cycle. Watch for air bubbles when cleaning is activated or listen if cleaning brush is rotating.
Compressed air supply for automatic cleaning	All tubes and fittings are tight?
Function of compressor and storage tank	Drain condensed water from storage tank of compressor (not necessary for s::can compressor B-32). Check pressure.
Monitoring station (by-pass)	All tubes and fittings are tight and all probes and sensors are supplied with medium? No air bubbles within the tubes?
Submersed Installation (in-situ)	Mounting equipment of all devices is ok and all probes and sensors are submersed?
Data transfer	Check if displayed readings on local controller are equal with displayed readings on customer display system.

8.2 Check of Readings

Check	con::lyte	moni::tool / con::cube	Actions needed
Current readings displayed completely	No *NaN* and no dashes (- - - -,- -) or plus sign (++++,++) displayed. Use arrow buttons to scroll through all displayed parameters.	No *NaN* is displayed.	Check status and configuration of parameter.
Current parameter status of displayed readings	Check logbook entries since last function check.	Red background for parameter indicates an error or alarm. Grey background indicates reading is not current.	Check sensor integrity.

Check	Reason	Remark
Up-to-date: Readings are updated on regulary base?	- Measuring interval is too long - Automatic measurement has been stopped manually	Consider measuring interval and smoothing.
Continuity: Check historical data (timeseries) for interruptions or discontinuities	- Change of medium - Local calibration - Maintenance of probe / sensor (cleaning, etc.) - Readings out of range - System failure (loss of power, communication error, etc.) - Unsteady flow through flow cell installation	Only possible if timeseries are availbale.
Plausibility: Timeseries look plausible with daily or seasonal fluctuation	- Drift of readings (can be caused by fouling) - Increasing noise (can be caused by flow conditions or fouling) - Fixed readings / no fluctuation	Check logbook of plant operator if possible.
Measuring range: Readings are within the specified and calibrated measuring range?		Quality of results might be reduced outside the specified range.
Accuracy: Difference between laboratory (comparison) values and readings of the spectrometer probe	In case of significant difference during initial operation, a local calibration has to be performed (please refer to section 6). In case of significant difference during normal operation, a function check has to be performed to ensure cleanness of measuring section (optical path).	To verify the accuracy of the displayed readings, only a reliable and validated comparison method has to be used.

8.3 Check of Probe / Sensor Integrity (Function Check)

During the software supported function check of the spectrometer probe the operation software of con::cube or con::lyte or Io::Tool will guide the user through all necessary steps, .

Bei der softwareunterstützten Funktionskontolle der Spektrometersonde führt die Bediensoftware von con::cube oder con::lyte oder Io::Tool den Anwender durch alle notwendigen Schritte, where the following is checked:

- Effectiveness of the automatic and / or manual cleaning
- Cleanness of the optical measuring windows
- Quality of zero referneced used currently
- Status of internal optic

The software supported function check is executed as follows:

- Take the spectrometer probe out of the measuring medium.
- General cleaning of the probe and careful cleaning of the measuring section. The measuring windows themselves must not be cleaned at this point. Finish the cleaning procedure by rinsing with distilled water. Start the function check in the operating software or on the controller (see manual of operating software).
- Place the carefully cleaned multifunctional slide over the cleaned measuring section of the spectrometer probe. This step can be skipped when performing function check on air.
- Fill the multifunctional slide with distilled water and pour it out. Rinse the multifunctional slide several times (at least 3 times) in this way. This step can be skipped when performing function check on air.
- Fill the multifunctional slide once again with distilled water. This step can be skipped when performing function check on air.
- Start execution of function check in Io::Tool or on the controller used for operation:
  Io::Tool: *Service \ Spectral References \ Start Function Check*
  con::cube: *Service \ spectrometer \ Function Check*
  con::lyte: *Status / Manage sensors / Configure... / Execute check!*

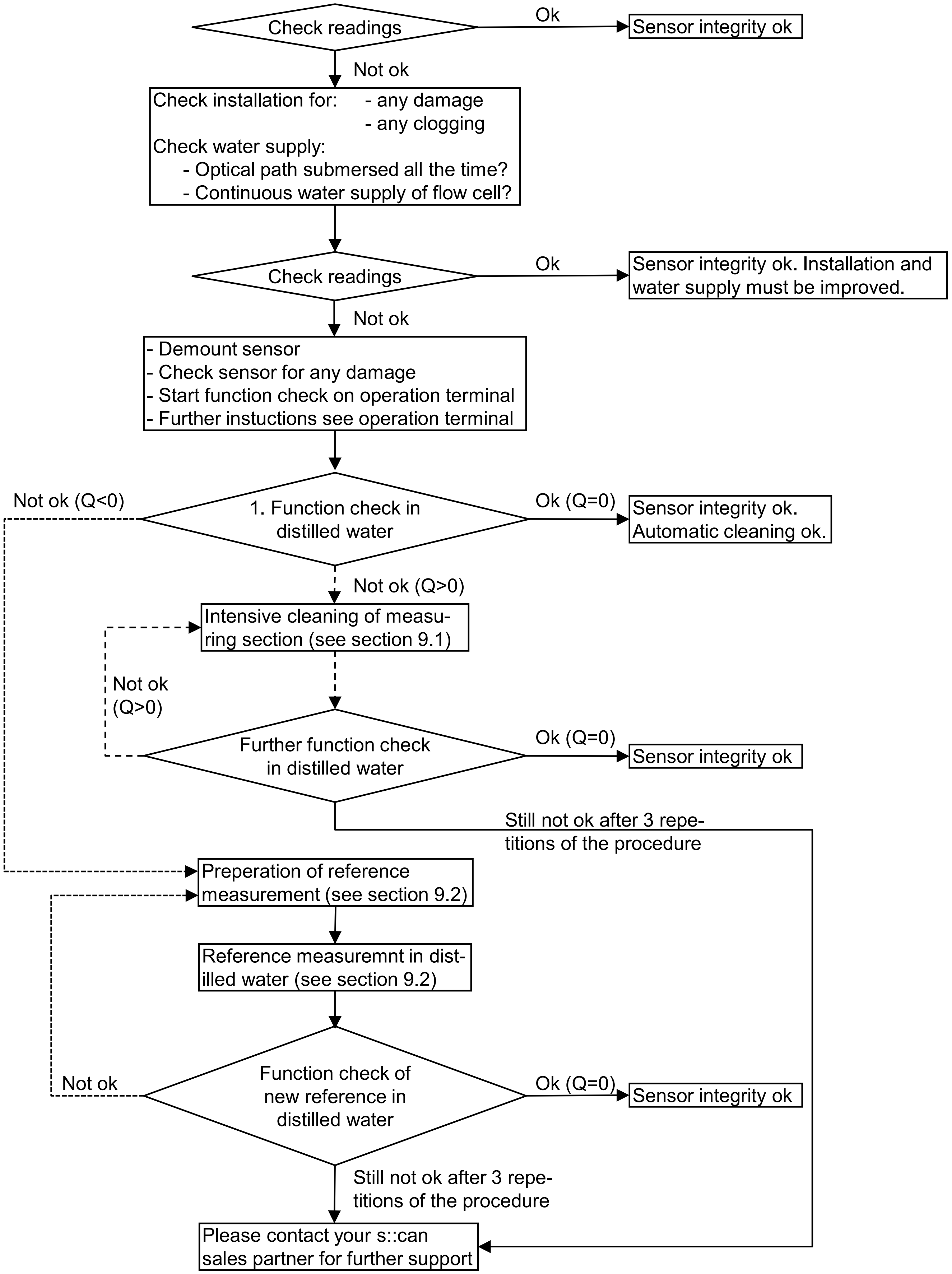
The probe now executes a measurement. Once the measurement has been finished, a quality number Q between -2 to +2 will be displayed.According to this the following actions are necessary:

- Q = 0: The probe is fully operative and can be mounted again without any modification (sensor integrity is ok).
- Q < 0: A new reference measurement is necessary (see section 9.2).
- Q > 0: Due to fouling of the measuring windows a manual cleaning is required (see section 9.1). If the quality number is still > 0 after three repetitions, proceed as follows:
  Q = 1: Perform a new reference measurement (see section 9.2).
  Q = 2: Inform your s::can sales partner or request a RMA.

The s::can website provides a support video, showing the complete prodedure of the function check (link: www.s-can.at/support-video-spectrolyser).

Alternatively, for experienced users it is also possible to assess the status of the measuring windows and reference measurement by looking at the fingerprint recorded when distilled water is measured and comparing these with the zero / background line. When using of the software controlled function check this evaluation is done automatically.

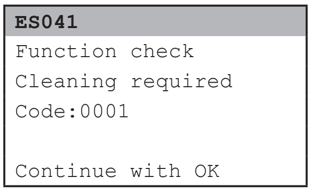
The flow chart below gives an overview of the procedure of the function check, which can be divided into several steps. Depending on the results of the test measurements that have to be performed in distilled water or on air, these steps will be executed or not.


Check readings
Ok
Sensor integrity ok
Not ok
Check installation for: - any damage
- any clogging
Check water supply:
- Optical path submersed all the time?
- Continuous water supply of flow cell?
Check readings
Ok
Sensor integrity ok. Installation and water supply must be improved.
Not ok
- Demount sensor
- Check sensor for any damage
- Start function check on operation terminal
- Further instuctions see operation terminal
Not ok (Q<0)
1. Function check in distilled water
Ok (Q=0)
Sensor integrity ok. Automatic cleaning ok.
Not ok (Q>0)
Intensive cleaning of measuring section (see section 9.1)
Not ok (Q>0)
Further function check in distilled water
Ok (Q=0)
Sensor integrity ok
Still not ok after 3 repetitions of the procedure
Preperation of reference measurement (see section 9.2)
Reference measuremnt in distilled water (see section 9.2)
Not ok
Function check of new reference in distilled water
Ok (Q=0)
Sensor integrity ok
Still not ok after 3 repetitions of the procedure
Please contact your s::can sales partner for further support

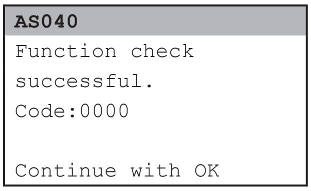
8.3.1 Performing a Function Check using con::lyte

When using the con::lyte for operation, the result of the function check will be displayed as follow. The quality number defines the next step necessary (see section 8.3.1).

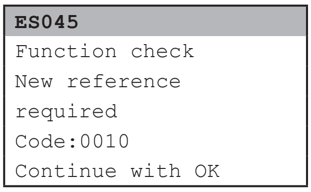
Q > 0	Q = 0	Q < 0
Suspect of strong (Q=2) or small (Q=1) window fouling.	The probe is fully operative (sensor integrity is ok).	A new reference measurement is necessary.
Perform cleaning until measuring windows are clean (Q=0). At least 3 times.	Probe can be installed again without modification.	Perform a new reference measurement (see section 9.2).



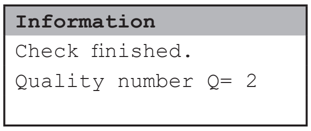
```
ES041
Function check
Cleaning required
Code:0001

Continue with OK
```



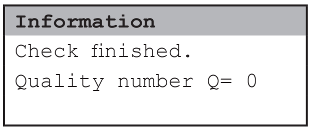
```
AS040
Function check
successful.
Code:0000

Continue with OK
```



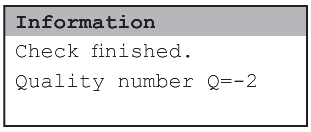
```
ES045
Function check
New reference
required
Code:0010
Continue with OK
```



```
Information
Check finished.
Quality number Q= 2
```



```
Information
Check finished.
Quality number Q= 0
```

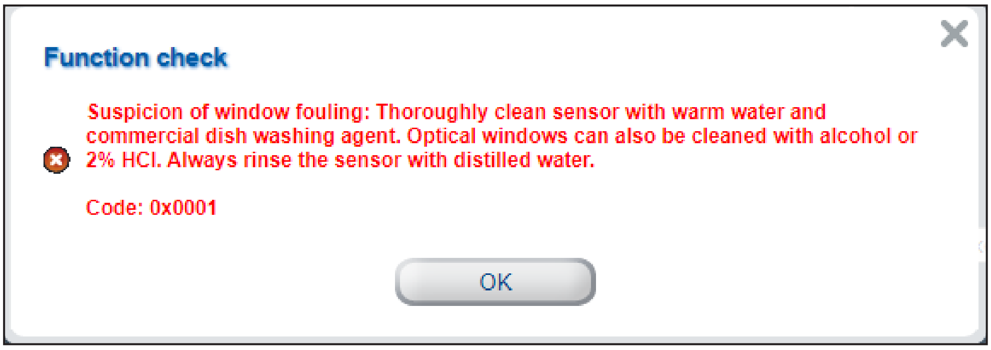


```
Information
Check finished.
Quality number Q=-2
```

8.3.2 Performing a Function Check using moni::tool

When using the con::cube for operation, the result of the function check will be displayed as follow. The quality number defines the next step necessary (see section 8.3.1).

- Q > 0:
- Suspect of strong (Q=2) or small (Q=1) window fouling.
- Perform cleaning until measuring windows are clean (Q=0). At least 3 times.

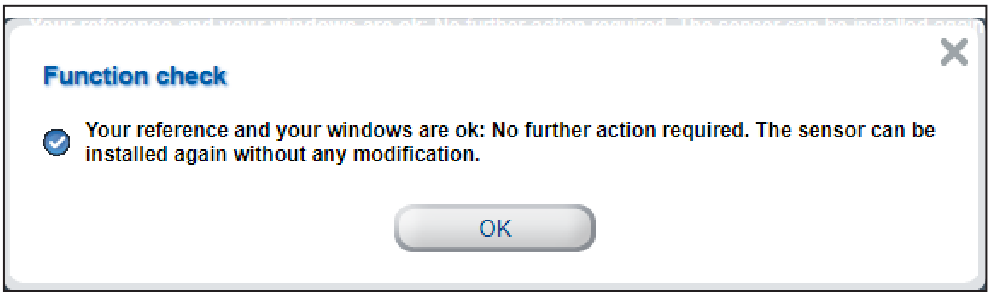


Function check

Suspicion of window fouling: Thoroughly clean sensor with warm water and commercial dish washing agent. Optical windows can also be cleaned with alcohol or 2% HCl. Always rinse the sensor with distilled water.

Code: 0x0001

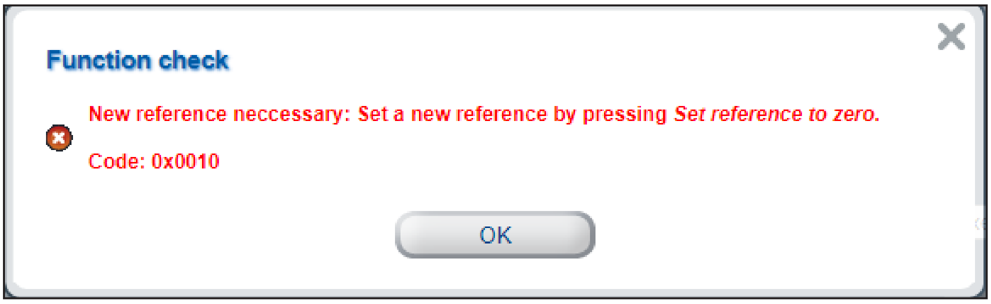
- Q = 0
- The probe is fully opereative (sensor integrity is ok).
- Probe can be installed again without modification.



Function check

Your reference and your windows are ok: No further action required. The sensor can be installed again without any modification.

- Q < 0
- A new reference measurement is necessary.
- Perform a new reference measurement (see section 9.2).

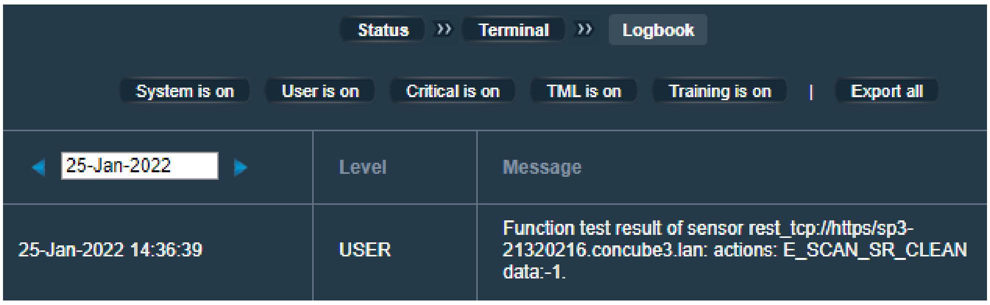


Function check

New reference neccessary: Set a new reference by pressing *Set reference to zero.*

Code: 0x0010

The result of the function check is displayed in the moni::tool logbook also (see figure on the right).

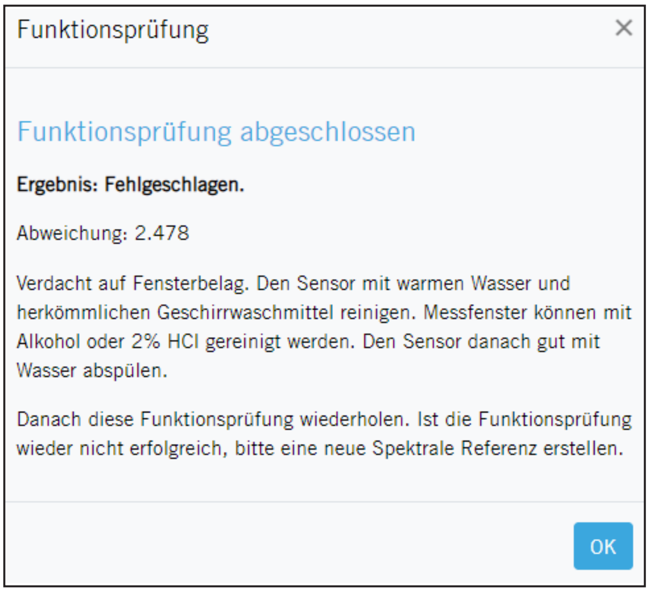


25-Jan-2022	Level	Message
25-Jan-2022 14:36:39	USER	Function test result of sensor rest_tcp://https/sp3-21320216.concube3.lan: actions: E_SCAN_SR_CLEAN data:-1.

8.3.3 Performing a Function Check using Io::Tool

When using the Io::Tool operating software, the result of the function check will be displayed as follow. The quality number defines the next step necessary (see section 8.3.1).

- Q > 0: Suspect of strong (Q=2) or small (Q=1) window fouling. Perform cleaning until measuring windows are clean (Q=0). At least 3 times.



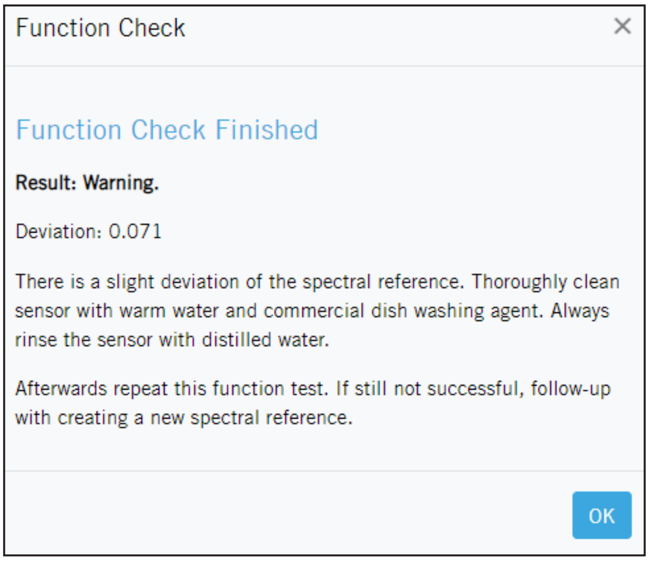
Funktionsprüfung abgeschlossen

Ergebnis: Fehlgeschlagen.

Abweichung: 2.478

Verdacht auf Fensterbelag. Den Sensor mit warmen Wasser und herkömmlichen Geschirrwaschmittel reinigen. Messfenster können mit Alkohol oder 2% HCl gereinigt werden. Den Sensor danach gut mit Wasser abspülen.

Danach diese Funktionsprüfung wiederholen. Ist die Funktionsprüfung wieder nicht erfolgreich, bitte eine neue Spektrale Referenz erstellen.



Function Check Finished

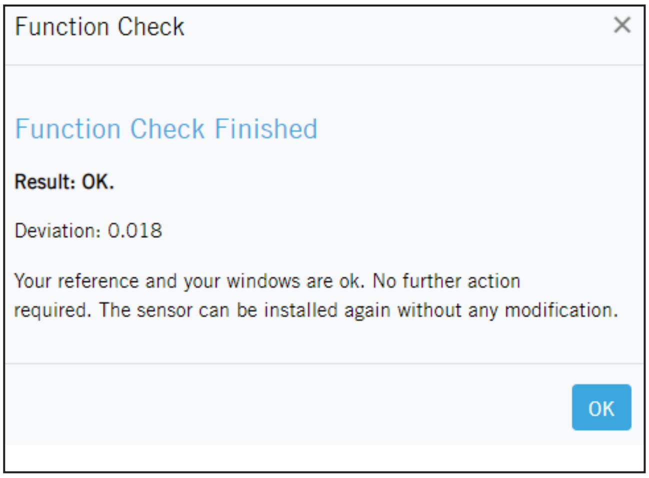
Result: Warning.

Deviation: 0.071

There is a slight deviation of the spectral reference. Thoroughly clean sensor with warm water and commercial dish washing agent. Always rinse the sensor with distilled water.

Afterwards repeat this function test. If still not successful, follow-up with creating a new spectral reference.

- Q = 0: The probe is fully opereative (sensor integrity is ok). Probe can be installed again without modification.



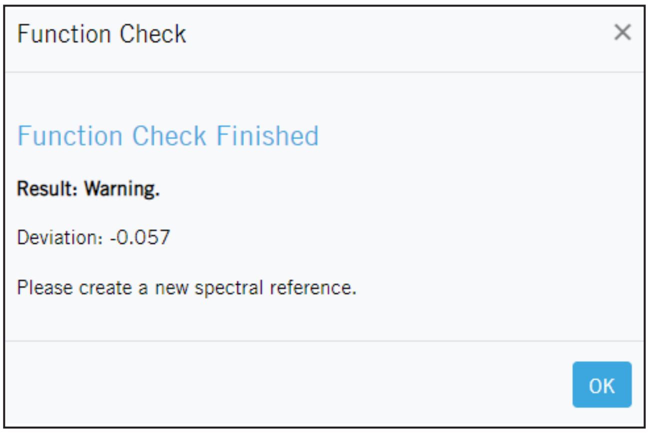
Function Check Finished

Result: OK.

Deviation: 0.018

Your reference and your windows are ok. No further action required. The sensor can be installed again without any modification.

- Q < 0: A new reference measurement is necessary. Perform a new reference measurement (see section 9.2).

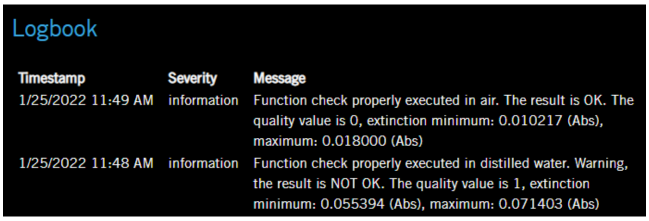


Function Check Finished

Result: Warning.

Deviation: -0.057

Please create a new spectral reference.



Logbook

Timestamp	Severity	Message
1/25/2022 11:49 AM	information	Function check properly executed in air. The result is OK. The quality value is 0, extinction minimum: 0.010217 (Abs), maximum: 0.018000 (Abs)
1/25/2022 11:48 AM	information	Function check properly executed in distilled water. Warning, the result is NOT OK. The quality value is 1, extinction minimum: 0.055394 (Abs), maximum: 0.071403 (Abs)

9 Maintenance

9.1 Cleaning

During routine operation the cleaning of the spectrometer probe, i.e. the optical measuring windows of the instrument, is performed automatically (see section 4.3). To clean the probe manually the following is recommended:

⚠ Before demounting the probe be sure that automatic air cleaning is deactivated via operating software and air supply line is depressurised to avoid dirt and / or injury by suddenly escaping pressurized air.

- Rinse sensor with hand-hot (lukewarm) drinking water to remove course deposits.
- Put the probe in a bucket of hand-hot (lukewarm) drinking water for several minutes to remove deposits on and in between the measuring gap.
- To clean the sensor housing a soft cleaning agent (e.g. dish-washing detergent) can be used.

⚠ When cleaning the measuring windows, care has to be taken that the windows are not damaged (do not use abrasive materials such as scouring sponges or stiff brushes).

The cleaning of the measuring windows is performed using a soft cloth (one that does not leave behind fibres), cotton swabs or paper tissues that are moistened with cleaning liquid before they are applied. Furthermore, cleaning tissues for eye glasses, e.g. available in supermarkets, are suited. For the removal of strongly adhering fouling, s::can cleaning brushes are available.

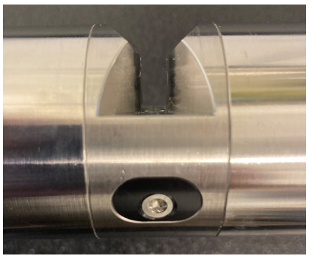
The use of the following liquids is allowed for cleaning of the windows.

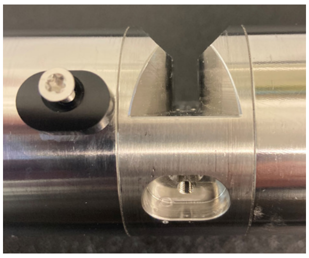
- Water (can be mixed with a commercial liquid dishwashing agent)
- Pure alcohol (Ethanol)
- s::can cleaning agent
- 3% Hydrochloric acid (HCl) in case of mineral film on the windows

⚠ All cleaning liquid must only be applied on the windows using cleaning cloth or tissue. Rinse with distilled water directly after the cleaning. Otherwise the residue of cleaning agents may change the optical characteristics of the windows under UV light and thus lead to a distortion of measurements.

⚠ After every step undertaken in the cleaning process, the measuring section must be rinsed with sufficient amounts of distilled water. After finishing the cleaning the internal cleaning tube of the probe shall be spilled with distilled water. This can be done with a disposable syringe as shown in the figure on the right.

In case the cleaning nozzles are blocked, unscrew the black covering on the backside of the measuring section (using a TX10 screw driver) and clean this area in addition (see figure on the right).





9.2 Reference Measurement

All s::can spectrometer probes will be delivered with a high quality reference measurement and therefore can be used at once. The reference measurement serves to define the zero point of all wavelengths that are measured by the spectrometer probe.

⚠ A new reference measurement shall only be performed due to result of a performed function check (see section 8.3) or if recommended from your s::can sales partner. As faulty reference measurement will lead to falsification of all subsequent readings, replacing a reference measurement has to be done with great care.

- Thoroughly clean the measuring section, the measuring windows (see section 9.1) as well as the multifunctional slide.
- Place the carefully cleaned multifunctional slide over the cleaned measuring section of the spectrometer probe.
- Fill the multifunctional slide with distilled water and pour it out. Rinse the multifunctional slide several times (at least 3 times) in that way.
- Fill the multifunctional slide once again with controlled distilled water.
- Start the reference measurement (see the following sections or moni::tool manual or con::lyte manual). The measurement ends automatically and replaces the last reference measurement. With Io::Tool the reference measurement can be started via *Service \ Spectral References*.
- Check the new reference measurement by means of the function check (quality number Q = 0) or manual measurement in the reference medium (Fingerprint = zero).

⚠ High quality distilled water must be used for the reference measurement. In this context, please ensure that it contains no foreign matter (e.g. air bubbles, contamination) whatsever! There is no way to check the quality of the used distilled water automatically.

For the highest possible accuracy of measurements, it is recommended to perform the reference measurement at the environmental temperature and with the probe in the same orientation as it will be used when the probe is installed.

⚠ Poor referencing (e.g. when the measuring windows have not been properly cleaned or there are traces of cleaning agents on the measuring windows) will reduce the quality of the readings provided by your spectrometer probe.

Besides the reference measurement with distilled water an additional reference measurement on air is stored on the spectrometer probe. This reference measurement will be used if the function check is performed on air.

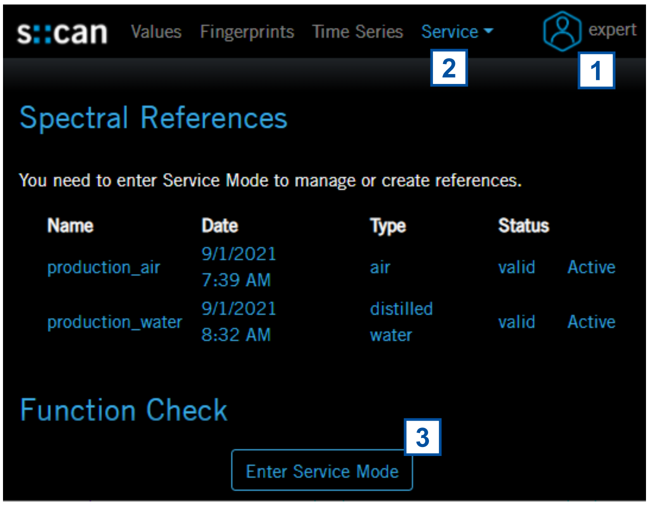
9.2.1 Reference Measurement with Io::Tool

All s::can terminals for operation support the possibility to measure a new zero reference. Io::Tool can be used to:

- Measure a new zero reference in distilled water (see section 9.2.3).
- Measure a new air reference (see section 9.2.3) that can be used for a function check on air.
- Activate a previous measured air or water reference (e.g. original references from factory, see section 9.2.2).
- Delete a previous measured air or water reference. Original references from factory cannot be deleted (see section 9.2.2). Existing references cannot be replaced (overwritten).

To perform any of the actions mentioned above, the following steps are needed:

1. Start Io::Tool and logon as *expert* (see section 5.4).
2. Select menu *Service \ Spectral References*.
3. Push the button *Enter Service Mode*.



Spectral References

You need to enter Service Mode to manage or create references.

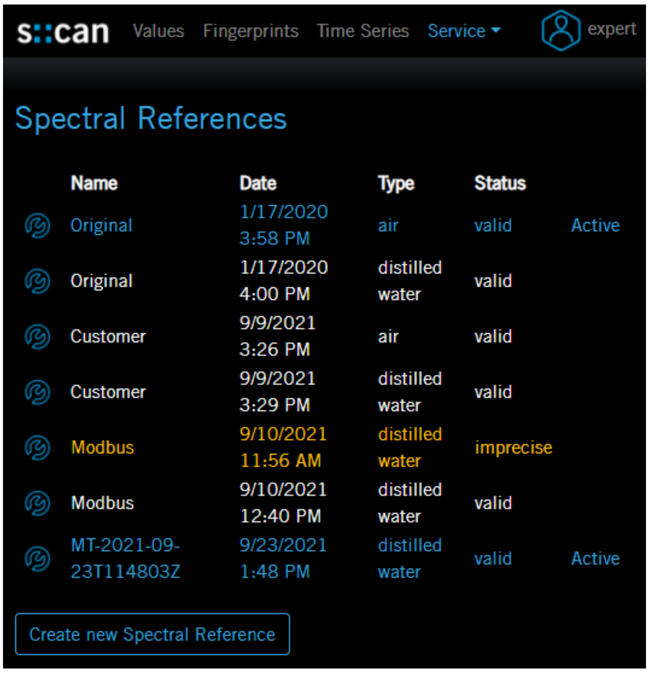
Name	Date	Type	Status	
production_air	9/1/2021 7:39 AM	air	valid	Active
production_water	9/1/2021 8:32 AM	distilled water	valid	Active

Function Check

9.2.2 Configuration of Reference Measurement with Io::Tool

Within the menu *Service \ Spectral Reference* an overview of all performed reference measurements is displayed (see figure on the right).

Name	Indication if the reference was mede during production (Original), by the operator via Io::Tool (Customer) or during operation with con::lyte (Modbus) or con::cube (MT-YYYY-MM-DD).
Date	Day and time when the reference measurement was performed.
Type	Indication if it is an air reference or a distilled water reference.
Status	Quality of the reference measurement which can be valid (white) or imprecise (yellow).
Active	Indication that this reference is in use currently (blue).

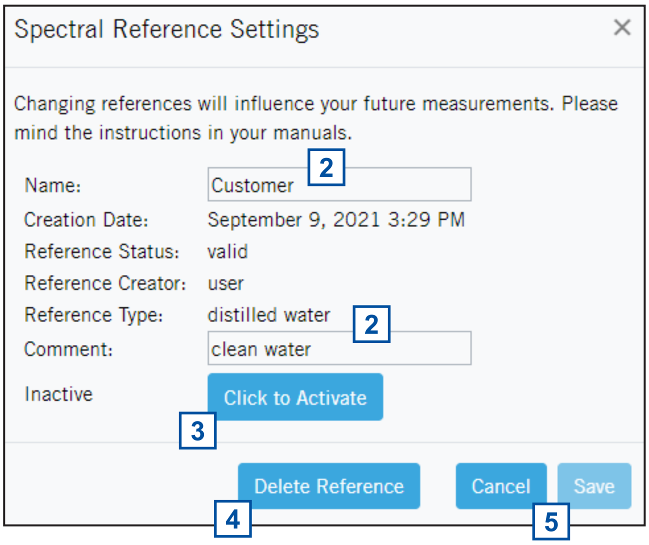


Spectral References

Name	Date	Type	Status	
Original	1/17/2020 3:58 PM	air	valid	Active
Original	1/17/2020 4:00 PM	distilled water	valid	
Customer	9/9/2021 3:26 PM	air	valid	
Customer	9/9/2021 3:29 PM	distilled water	valid	
Modbus	9/10/2021 11:56 AM	distilled water	imprecise	
Modbus	9/10/2021 12:40 PM	distilled water	valid	
MT-2021-09-23T114803Z	9/23/2021 1:48 PM	distilled water	valid	Active

To change any configuration within the spectral references the following steps are needed:

1. Push the blue icon on the left side of the reference that needs to be configured.
2. The displayed name (*Name*) and the remark (*Comment*) can be modified.
3. Push the button *Click to Activate* if this reference shall be used now.
4. Push the button *Delete Reference* if you want to remove the reference permanently. Please note that references from factory cannot be deleted.
5. Push the button *Save* to store the new configuration or push *Cancel* to keep the previous configuration.



Spectral Reference Settings

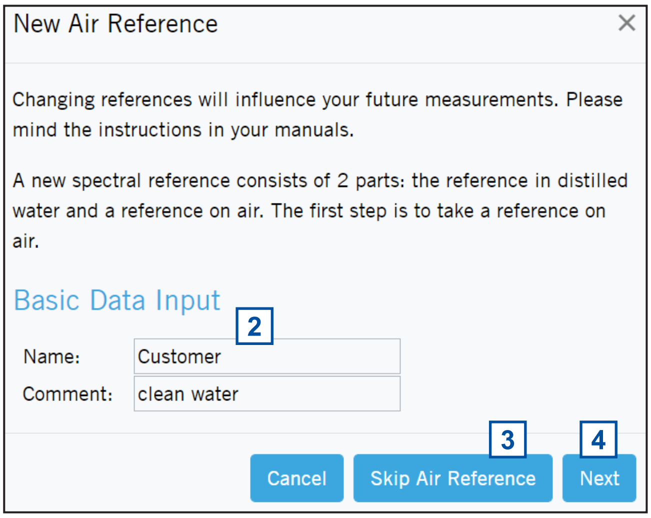
Changing references will influence your future measurements. Please mind the instructions in your manuals.

Name: Customer
Creation Date: September 9, 2021 3:29 PM
Reference Status: valid
Reference Creator: user
Reference Type: distilled water
Comment: clean water
Inactive

9.2.3 New Reference Measurement with Io::Tool

To perform a new spectal reference measurement the following steps are needed:

1. Push the button *Create new Spectral Reference*.
2. First enter the Basic Data (*Name* and *Comment*) of the new reference on air.
3. Push the button *Skip Air Reference* if you don't want to measure a reference on air.
4. Otherwise push the button *Next* to start measurement on air. Please note all instructions displayed on the Io::Tool screen (see figures on the right and below).



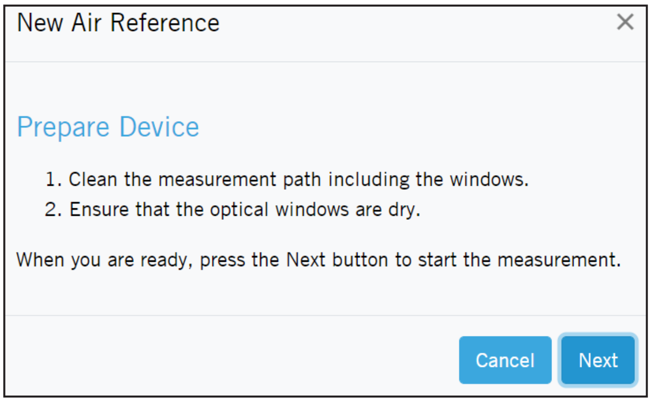
New Air Reference

Changing references will influence your future measurements. Please mind the instructions in your manuals.

A new spectral reference consists of 2 parts: the reference in distilled water and a reference on air. The first step is to take a reference on air.

Basic Data Input

Name: Customer
Comment: clean water

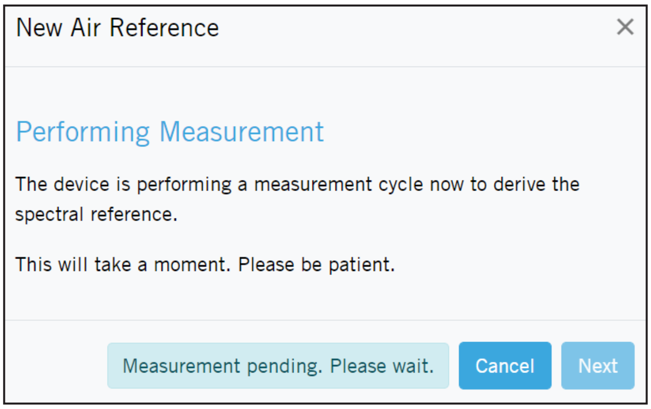


New Air Reference

Prepare Device

1. Clean the measurement path including the windows.
2. Ensure that the optical windows are dry.

When you are ready, press the Next button to start the measurement.



New Air Reference

Performing Measurement

The device is performing a measurement cycle now to derive the spectral reference.

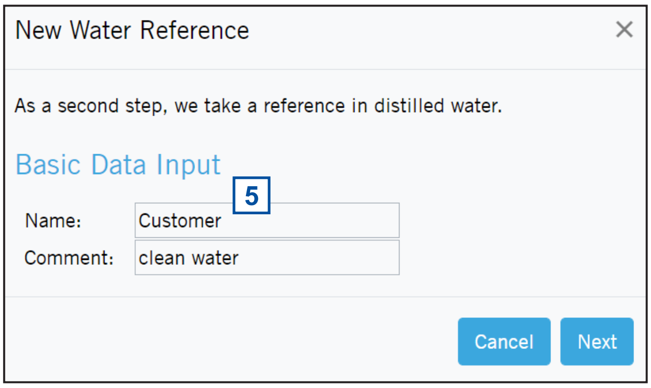
This will take a moment. Please be patient.

Measurement pending. Please wait.

5 After the air reference measurement is finished or skipped the Basic Data (*Name* and *Comment*) for the distilled water reference can be entered.

6 Push the button *Next* to start the measurement. Please note all instructions displayed on the Io::Tool screen (see figures on the right and below).

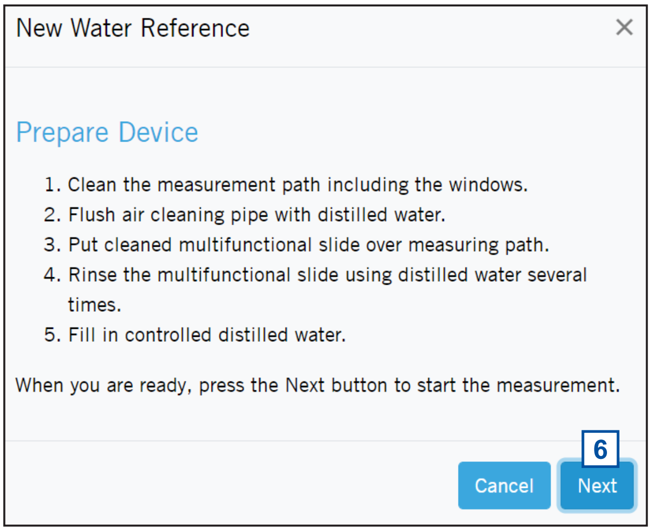
7 Push the button *Ok* when the *New Water Reference* measurement is finished.


New Water Reference

As a second step, we take a reference in distilled water.

Basic Data Input

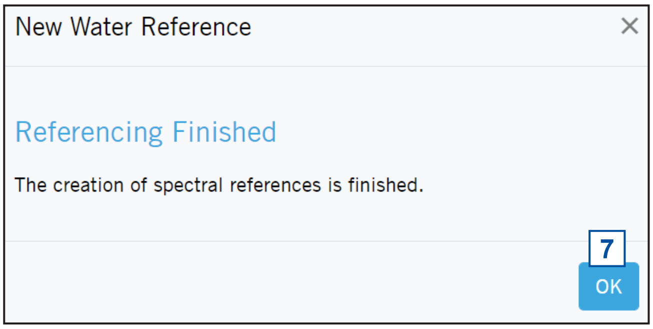
Name: Customer
Comment: clean water


New Water Reference

Prepare Device

1. Clean the measurement path including the windows.
2. Flush air cleaning pipe with distilled water.
3. Put cleaned multifunctional slide over measuring path.
4. Rinse the multifunctional slide using distilled water several times.
5. Fill in controlled distilled water.

When you are ready, press the Next button to start the measurement.


New Water Reference

Referencing Finished

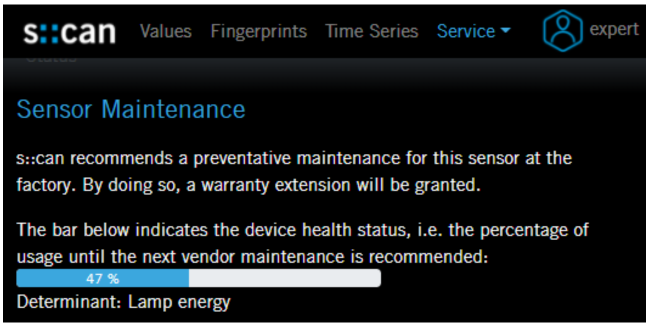
The creation of spectral references is finished.

9.3 Predictive Maintenance

s::can recommends a regular maintenance of the spectrometer probe in the factory. In the menu *Service / Status* the duration until the next maintenance is displayed. This will be calculated based on the device age or the last maintenance, the actual lamp energy and the number of performed measurements.

Once the indicator bar is close to 100 %, the operator will be informed about the recommended maintenance and the Status LED switches from blue to yellow (see section 10.2 and 10.3).

After a confirmation of the operator (pushing the button *Proceed without Preventive Maintenance*) further measurements are possible and the color of the LED changes from yellow to blue or red. After some time the operator is reminded again about the recommended maintenance.

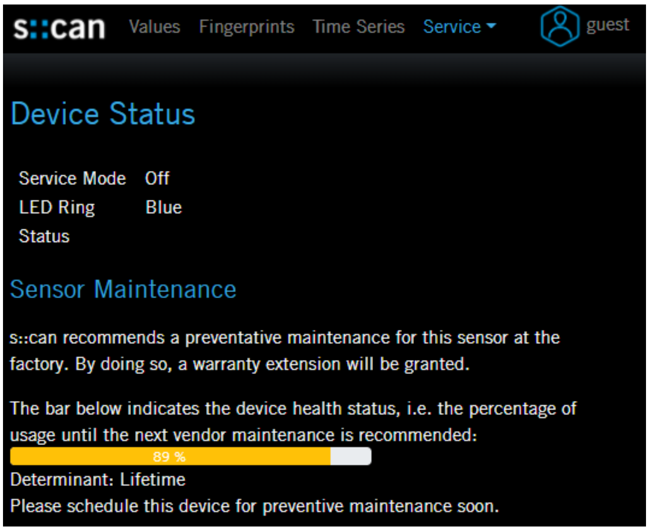


Sensor Maintenance

s::can recommends a preventative maintenance for this sensor at the factory. By doing so, a warranty extension will be granted.

The bar below indicates the device health status, i.e. the percentage of usage until the next vendor maintenance is recommended:

Determinant: Lamp energy



Device Status

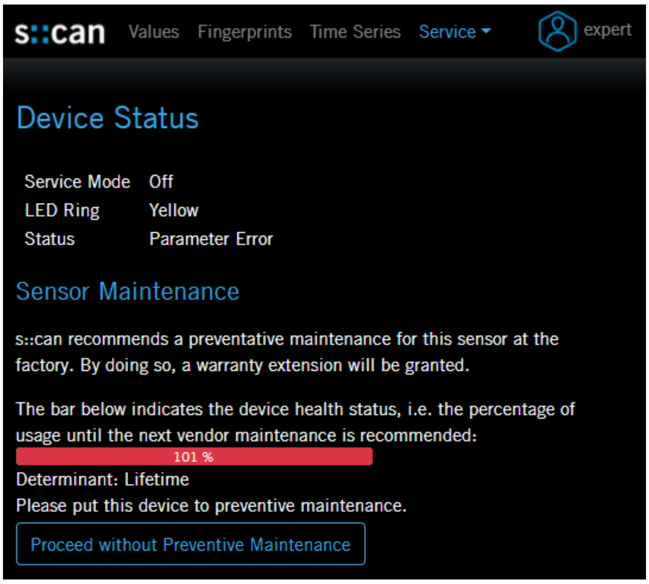
Service Mode Off
LED Ring Blue
Status

Sensor Maintenance

s::can recommends a preventative maintenance for this sensor at the factory. By doing so, a warranty extension will be granted.

The bar below indicates the device health status, i.e. the percentage of usage until the next vendor maintenance is recommended:

Determinant: Lifetime
Please schedule this device for preventive maintenance soon.



Device Status

Service Mode Off
LED Ring Yellow
Status Parameter Error

Sensor Maintenance

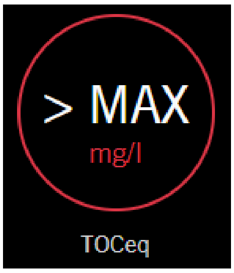
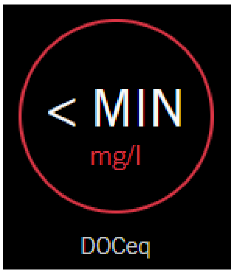
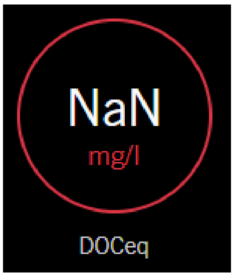
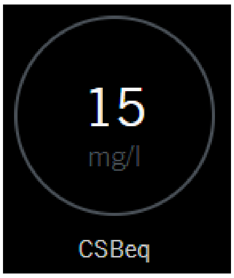
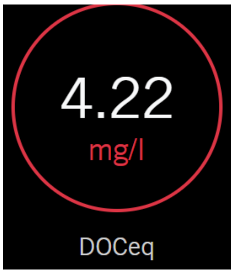
s::can recommends a preventative maintenance for this sensor at the factory. By doing so, a warranty extension will be granted.

The bar below indicates the device health status, i.e. the percentage of usage until the next vendor maintenance is recommended:

Determinant: Lifetime
Please put this device to preventive maintenance.

10 Troubleshooting

10.1 Typical Error Pattern

Error	Reason	Removal
	■ Reading is above the upper measuring range (outside the error limits, see section 5.5.11)	■ Check plausibility of parameters (see section 8.2) ■ Check measuring range of parameter ■ Read the logbook
	■ Reading is far below the lower measuring range (outside the error limits, see section 5.5.11)	■ Check plausibility of parameter (see section 8.2) ■ Check measuring range of parameter ■ Read the logbook
	■ Reading cannot be calculated for this parameter	■ Check plausibility of fingerprint ■ Perform check of spectrometer probe (see section 8.3) ■ Read the logbook
	■ Last reading is not current (i.e. is older than measuring interval + 75 s)	■ Stop Service mode ■ Start automatic measurement again ■ Check measuring interval ■ Read the logbook
	■ At least one parameter error flag is active ■ Hardware error or system error	■ Check parameter status ■ Check system status ■ Read the logbook

10.2 LED Ring

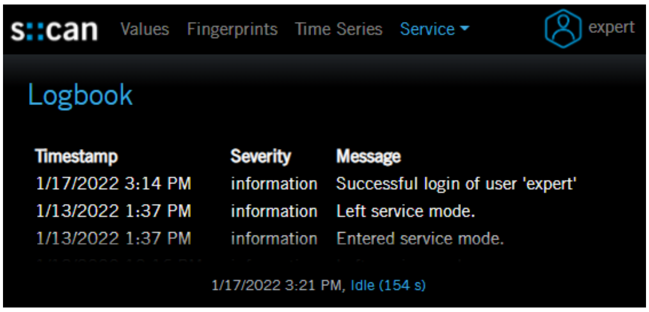
The spectrometer probe is equipped with a LED ring on the bottom end of the probe. The color of the LED ring informs about the actual status of the spectrometer probe. The table below explains the meaning of the different LED codes.

Color	Illumination	Status	Comment
blue	continuous	Normal operation	
red	continuous	Device error	Check error message on operator terminal or in Io::Tool
red	continuous	Parameter error	Check parameter status on operator terminal or in Io::Tool
yellow	continuous	Service mode	End service mode for normal operation
yellow	continuous	Maintenance needed	Check status of sensor maintenance in Io::Tool (see section 9.3)
blue	regular flashing	Booting sequence	Wait for 2 minutes
blue	fast flashing	Reed switch is aktivated	see section 5.4.2 and 10.6
blue	a short flash every 2 second	Sleep mode	see section 5.4.2
blue	a short flash every 5 seconds	Deep sleep mode	can be activated by s::can Service only
yellow	regular flashing	Update in progress	Wait up to 35 minutes
red	regular flashing	Factory reset in progress	Wait up to 5 minutes

10.3 Error / Status Messages and Logbook

Within the Io::Tool Status window all logbook messages of the spectrometer are displayed. This can be simple information but also error and status messages.

During execution of a measurement the monitoring system (system status), the measuring device itself (device status) and the result (parameter status) will be checked for possible errors and for plausibility. In case of an error (status bit will be set from 0 to 1) a user message will be displayed to the operator.



Logbook

Timestamp	Severity	Message
1/17/2022 3:14 PM	information	Successful login of user 'expert'
1/13/2022 1:37 PM	information	Left service mode.
1/13/2022 1:37 PM	information	Entered service mode.

1/17/2022 3:21 PM, Idle (154 s)

There are specific error messages available for the spectrometer probe which are displayed in Io::Tool (see section 10.3.1) and transfered to the controller used for operation also (see section 10.3.2).

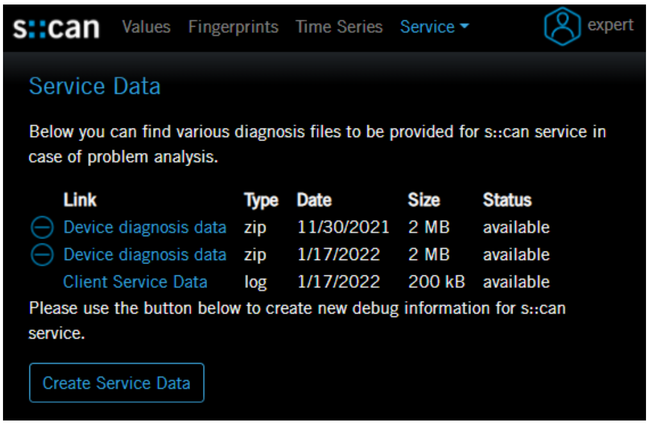
Depending on the controller used for operation these messages will be shown on the display (function *Monitor...* in case of con::lyte D-320, *Status* tab in case of moni::tool) and also stored within the result files or logfiles. Aditional to the user message (general error reason and recommendations for removal) the detailled status code will be displayed either in binary form (0000, 0001, 0010, 0011, 0100, etc.) or as a hex number (0x0001, 0x0002, 0x0004, 0x0008, 0x0010, etc).

Up to 16 status bits are used for different errors. If several errors occur at the same time, the con::lyte and moni::tool will add up all the status bits. This detailed information might be important if you request s::can support. Below you will find examples how to translate these combined hex codes:

Hex	Bin	Bits
0x8000	1000 0000 0000 0000	b15
0x8001	1000 0000 0000 0001	b0, b15
0x4011	0100 0000 0001 0001	b0, b4, b14

All error and status messages as well as additional information for s::can support can be downloaded from the spectrometer probe directly via Io::Tool.

After pushing the button *Create Service Data* a zip file and a log file will be created and displayed (*Device Diagnosis Data.zip* and *Client Servicedata.log*). These files can be downloaded by clicking on the file name.



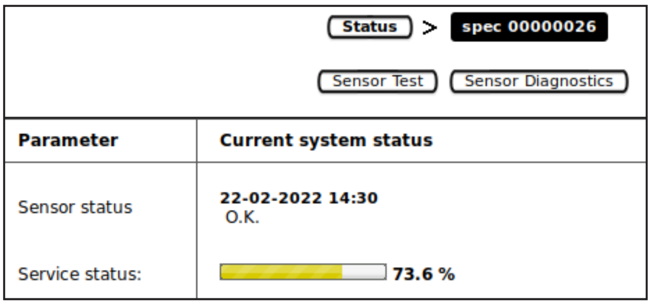
Service Data

Below you can find various diagnosis files to be provided for s::can service in case of problem analysis.

Link	Type	Date	Size	Status
Device diagnosis data	zip	11/30/2021	2 MB	available
Device diagnosis data	zip	1/17/2022	2 MB	available
Client Service Data	log	1/17/2022	200 kB	available

Please use the button below to create new debug information for s::can service.

The service data can be created and downloaded directly in the Status display of moni::tool using the button *Sensor Diagnistics* (see figure on the right).



Parameter	Current system status
Sensor status	22-02-2022 14:30 O.K.
Service status:	73.6 %

10.3.1 Error / Status Messages in Io::Tool

No	API name	Message Io::Tool	Reason	Removal
1	VOLT_HIGH	supply voltage too high	Power supply of the spectrometer probe > 18 VDC	Check power supply
2	VOLT_LOW	supply voltage too low	Power supply of the spectrometer probe < 9.5 VDC	Check power supply
3	MED_TEMP_HIGH	water temperature too high	Reading of temperature sensor > 45 °C	Take sensor out of hot medium
4	MED_TEMP_LOW	water temperature too low	Reading of temperature sensor < 0.0 °C	Take sensor out of cold medium
5	DEV_TEMP_HIGH	device temperature too high	Reading of internal temperature sensor > 90 °C	Remove sensor from hot environment
6	DEV_TEMP_LOW	device temperature too low	Reading of internal temperature sensor < 0.0 °C	Remove sensor from cold environment
7	NO_MEDIUM	no medium detected	The shape of the measured fingerprint does not look like a typical application	Check installation and medium supply (flow cell setup; water level when installed submersed)

No	API name	Message Io::Tool	Reason	Removal
8	VAL_BELOW	value below minimum	Reading < lower error limit in GC	Check medium and calibration. Error limit is displayed in parameter settings. Activate checkbox *Ignore Error*.
9	VAL_ABOVE	value above maximum	Reading > upper error limit in GC	Check medium and calibration. Error limit is displayed in parameter settings. Activate checkbox *Ignore Error*.
10	MED_BELOW	signal below sensor range	Optical signal < 200 counts in medium	Check cleanliness of optical windows and optical path for blocking. Check medium. Maybe different optical path length is needed.
11	MED_ABOVE	signal above sensor range	Optical signal > 65000 counts in medium	Check medium and optical path.
12	COMP_BELOW	compensation signal below range	Compensation signal < 200 counts	Sensor service needed, request RMA number
13	COMP_ABOVE	compansation signal above range	Compansation signal > 65000 counts	Sensor service needed, request RMA number
14	CHECK_BELOW	check signal above range	Check signal < 200 counts	Sensor service needed, request RMA number
15	CHECK_ABOVE	check signal below range	Check signal > 65000 counts	Sensor service needed, request RMA number
16	DARK_NOISE	dark noise above limit	Dark noise out of limits	Ignore error, if temporary. Request RMA number, if error is permanent.
17	DARK_MAX	maximum dark noise above limit	Dark noise amplitude out of limits	Ignore error, if temporary. Request RMA number, if error is permanent.
18	MEAS_RETRY	retry needed	Measuring process did not finish successfully and was restarted	Wait for next measurement
19	HIGH_STD_DEV_DARK	high variance dark measurement	Standard deviation of dark measurement > 100	Check if there is any external influence (e.g. modem).
20	HIGH_STD_DEV_MEDIUM	high variance of measurement signal	Standard deviation in medium > 0.05	Check if flow is turbulent or measurement is influenced by air bubbles.
21	HIGH_STD_DEV_COMP	high variance compensation path	Standard deviation of compensation > 0.03	Check if power supply is stable. Check for external vibrations.
22	HIGH_STD_DEV_CHECK	high variance check signal	Standard deviation of check > 0.03	Check if power supply is stable. Check for external vibrations.

No	API name	Message Io::Tool	Reason	Removal
23	MAINT_NEEDED	maintenance needed	Life time OR number of measurements OR lamp intensity has reached limit for predictive maintenance	Request RMA and send spectrometer probe to s::can for Service. Confirm in Io::Tool to proceed without maintenance temporarily.
24	SERV_NEEDED	service needed	At least one of several internal checks reports an error.	Check logbook entries.
25	HW_DEFECT	hardware error	Hardware error within optical unit	Request RMA, if error is permanent.
26	HIGH_UNCERT	high signal uncertainty	Error during fingerprint or parameter calculation	Request RMA, if error is permanent.
27	NEG_MED	negative medium signal	Optical signal < dark signal	Check cleanliness of optical windows and optical path for blocking. Check medium. Maybe different optical path length is needed.
28	NEG_COMP	negative compensation signal	Compensation signal < dark signal	Request RMA, if error is permanent.
29	NEG_CHECK	negative check signal	Check signal < dark signal	Request RMA, if error is permanent.
30	NEG_FP	negative fingerprint	Fingerprint significant below zero (QM of function check is -2)	Perform function check, perform new reference measurement.
31	NEG_LIMIT_EXT	extinction limit reached	Not implemented yet	
32	COMP_ABOVE_REF	compensation above reference	Compensation signal too high (lamp intensity > 1.3)	Perform new reference measurement.
33	COMP_BELOW_REF	compensation below reference	Compensation signal too low (lamp intensity < 0.5)	Request RMA, if error is permanent.
34	CHECK_ABOVE_REF	check signal above reference	Check signal too high (> 50 % light energy)	Perform new zero reference. Request RMA, if error is permanent.
35	CHECK_BELOW_REF	check signal below reference	Check signal too low (< 50 % light energy)	Perform new zero reference. Request RMA, if error is permanent.
36	INV_REF_ENER	invalid spectral reference	Optical signal < 30000 counts in reference medium	Repeat zero reference. Ignore error, if lower precision of readings is accepted. Request RMA.
37	MATH_UNCERT	high mathematical uncertainty	Error during calculation of results	Check medium and optical path.
38	MATH_ERR	calculation error	Error during calculation of results	Check medium and optical path.

10.3.2 Error Messages / Statusbits on Controller for Operation

No	API name	Device	Para Public	Para Private	Message moni::tool
1	VOLT_HIGH			b5 - 0020	Power supply of spectrometer is too high
2	VOLT_LOW			b4 - 0010	Power supply of spectrometer is too low
3	MED_TEMP_HIGH	b1 - 0002		b9 - 0200	Sensor misuse Environmental temperature of probe is too high (outside of specification). No measurements possible
4	MED_TEMP_LOW	b1 - 0002		b8 - 0100	Sensor misuse Environmental temperature of probe is too low (outside of specification). No measurements possible
5	DEV_TEMP_HIGH	b1 - 0002			Sensor misuse
6	DEV_TEMP_LOW	b1 - 0002			Sensor misuse
7	NO_MEDIUM		b3 - 0008		Parameter error, wrong medium
8	VAL_BELOW		b15 - 8000		Reading out of measuring range
9	VAL_ABOVE		b15 - 8000		Reading out of measuring range
10	MED_BELOW		b3 - 0008		Parameter error, wrong medium
11	MED_ABOVE			b12 - 1000	Probe energy failure (Overflow)
12	COMP_BELOW	b15 - 8000	b1 - 0002	b14 - 4000	Sensor maintenance required Parameter error, hardware error Probe compensation failure (below lower limit)
13	COMP_ABOVE	b15 - 8000	b1 - 0002	b15 - 8000	Sensor maintenance required Parameter error, hardware error Probe compensation failure (above upper limit)
14	CHECK_BELOW	b15 - 8000	b1 - 0002	b14 - 4000	Sensor maintenance required Parameter error, hardware error Probe compensation failure (below lower limit)
15	CHECK_ABOVE	b15 - 8000	b1 - 0002	b15 - 8000	Sensor maintenance required Parameter error, hardware error Probe compensation failure (above upper limit)
16	DARK_NOISE		b1 - 0002	b10 - 0400	Parameter error, hardware error Probe energy failure (Darknoise too high)
17	DARK_MAX	b0 - 0001		b10 - 0400	General sensor error Probe energy failure (Darknoise too high)

No	API name	Device	Para Public	Para Private	Message moni::tool
18	MEAS_RETRY	b0 - 0001		b6 - 0040	General sensor error internal communication problem in board (timeout)
19	HIGH_STD_DEV_DARK		b6 - 0040		Parameter qualitiy not met
20	HIGH_STD_DEV_MEDIUM		b6 - 0040		Parameter qualitiy not met
21	HIGH_STD_DEV_COMP		b6 - 0040		Parameter qualitiy not met
22	HIGH_STD_DEV_CHECK			b11 - 0800	
23	MAINT_NEEDED	b14 - 4000			Sensor cleaning required
24	SERV_NEEDED	b15 - 8000			Sensor maintenance required
25	HW_DEFECT	b15 - 8000			Sensor maintenance required
26	HIGH_UNCERT		b2 - 0004		Parameter error, configuration error
27	NEG_MED		b3 - 0008		Parameter error, wrong medium
28	NEG_COMP		b3 - 0008		Parameter error, wrong medium
29	NEG_CHECK	b15 - 8000			Sensor maintenance required
30	NEG_FP	b15 - 8000	b2 - 0004		Sensor maintenance required Parameter error, configuration error
31	NEG_LIMIT_EXT		b3 - 0008		Parameter error, wrong medium
32	COMP_ABOVE_REF			b0 - 0001	Actual used reference measurement is not valid
33	COMP_BELOW_REF			b0 - 0001	Actual used reference measurement is not valid
34	CHECK_ABOVE_REF			b0 - 0001	Actual used reference measurement is not valid
35	CHECK_BELOW_REF			b0 - 0001	Actual used reference measurement is not valid
36	INV_REF_ENER	b14 - 4000			Sensor cleaning required
37	MATH_UNCERT		b2 - 0004		Parameter error, configuration error
38	MATH_ERR		b2 - 0004		Parameter error, configuration error

10.4 Device Settings

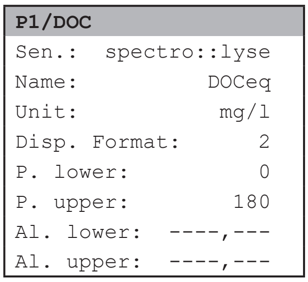
In case detailed sensor information or configuration settings have to be checked, the following sections will explain how to find these information when operating the sensor with a s::can operator terminal.

10.4.1 Check of Device Settings using con::lyte

Select the entry *Manage sensors...* in the main menu of the status screen. Select the name *spectro::lyserV3/0/4* in the list of installed sensors, in which the second number (*4*) indicates the address assigned to the sensor. After confirming the entry *Configure...* as well as the entry *Probesettings* in the next view, the following information of the sensor will be displayed:

- Internal sensor identifier (*M-Version* and *Model*)
- Sensor name (*spectro::lyser*)
- Serialnumber of the sensor (*S/N*)
- Hardware version of the sensor (*H/W-Version*)
- Software version of the sensor (*S/W-Version*)
- Information about sensor type (*UV-VIS*)
- Information about optical pathlength (*Path length*)
- Information about actual used reference (*Name*, *Date*)
- Information about maintenance (*xx %*)

Information of the single measuring parameter can be retrieved via the entry *Parameter info...* from the main menu of the parameter display (see figure on the right). In addition to the parameter name (*Name*), the unit of measurement (*Unit*) the number of decimal places (*Disp. Format*), also the lower and upper limit of the parameter range (*P. lower* / *P. upper*) and the adjusted alarm range (*Al. lower* / *Al. upper*) are displayed.

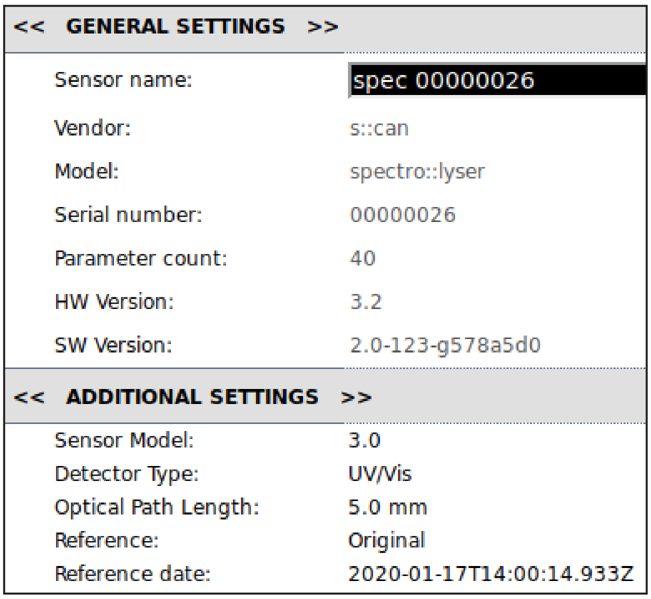


```
P1/DOC
Sen.:  spectro::lyse
Name:          DOCeq
Unit:            mg/l
Disp. Format:       2
P. lower:           0
P. upper:         180
Al. lower:   ----,---
Al. upper:   ----,---
```

10.4.2 Check of Device Settings using moni::tool

For checking the sensor settings click on the spectrometer icon within the system overview of the *Service* tab and select *Sensor Settings*. Depending on the *Service Level* (figure below is *Service Level Advanced*) some or all of the following information will be displayed:

- Interface of the sensor (*Address*)
- Sensor name used internal (*internal*). Should not be changed by the operator.
- *Sensor Name* allocated to the device by the operator
- Manufacturer name of the sensor (*Vendor*)
- Type of the sensor (*Model*)
- Serial number of the sensor (*Serial Number*)
- Number of available parameters (*Parameter count*)
- Information regarding the purchase (*Purchase date*, *Warranty expiry date*). Can be entered by the operator at initial startup.
- Actual hardware and software version of the sensor (*HW Version*, *SW Version*)
- Cleaning device allocated to the sensor (*Cleaning device*)
- *Sensor Model* of the spectrometer probe
- Type of the spectrometer probe (*Detector Type*)
- *Optical Path Length* of the spectrometer probe in mm
- Name of the actual used zero reference (*Reference*)



<< GENERAL SETTINGS >>

Sensor name: spec 00000026
Vendor: s::can
Model: spectro::lyser
Serial number: 00000026
Parameter count: 40
HW Version: 3.2
SW Version: 2.0-123-g578a5d0

<< ADDITIONAL SETTINGS >>

Sensor Model: 3.0
Detector Type: UV/Vis
Optical Path Length: 5.0 mm
Reference: Original
Reference date: 2020-01-17T14:00:14.933Z

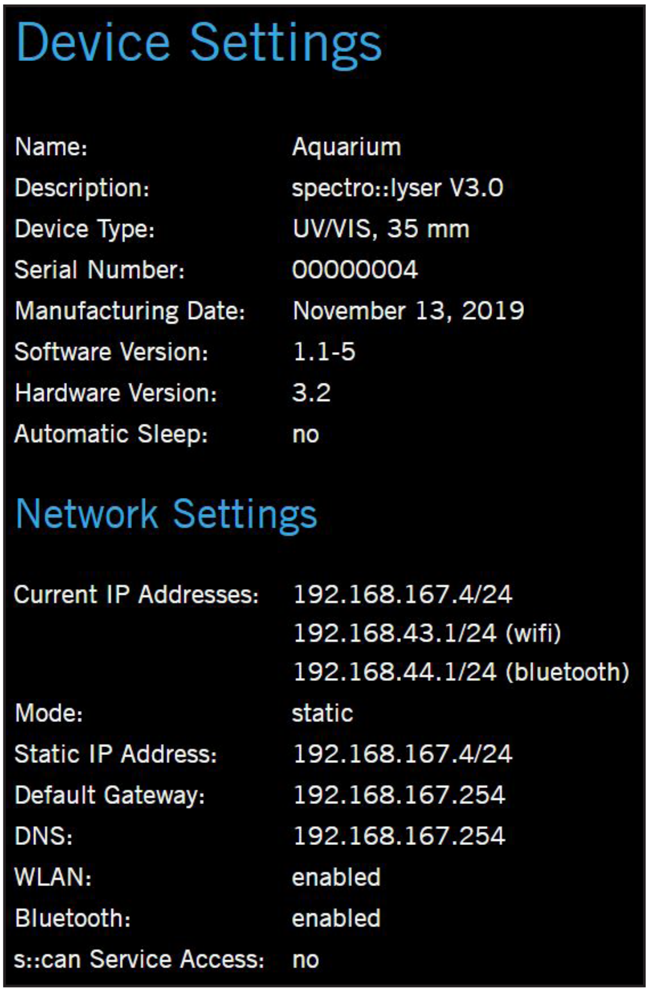
- Internal number of the actual used zero reference (*Reference index*)
- Date of the actual used zero reference (*Reference date*)
- Actual used operation mode of the spectrometer probe (*Measurement mode*)
- Actual used measuring interval of the spectrometer probe (*Measurement interval*)
- *Logging interval* for Datalogger of the spectrometer probe
- Actual used mode of allocated *cleaning* device (e.g. automatic, manual off)
- Actual used cleaning interval (*Time between cleaning*) in sec.
- Actual used cleaning duration (*Cleaning duration*) in sec.
- Actual used waiting time (*Delay after cleaning*) in sec.
- Settings for sleep mode (*automatic*, *ramsleep*, *eep*)
- Settings for predictive maintenance (*false*, *true*)
- Percentage display until next predictive maintenance (*serviceStatus*)
- Serial number of controller used for operation (*eTerminalId*)
- Used port number of spectrometer probe on terminal used for operation (*ePrivateIotoolsPort*)
- History information about installation (*Installed on*, *Installed by*)

10.4.3 Check of Device Settings using Io::Tool

Enter the IP address of the spectrometer probe into your webbrowser to start Io::Tool (see section 5.3.3 and 5.4). Now select menu *Service \ Device Settings* to display the following information:

- User specific *Name* of the location
- *Description* of the measuring device
- Detector type (e.g. UV/Vis) and optical path length of the spectrometer probe (*Device Type*)
- Serial number of the sensor (*Serial Number*)
- Production date of the sensor (*Manufacturing Date*)
- Actual software version of the sensor (*Software Version*)
- Actual hardware version of the sensor (*Hardware Version*)
- Information if *Automatic Sleep* mode is activated or not
- Within the *Network Settings* all *Current IP Addresses* are displayed (static IP, *Wifi*, etc.).
- The *Mode* can be *static* or *DHCP*.
- For actual network settings the following options are possible: *enabled*, *disabled* or *at startup only* (i.e. connection is enabled for approx. 10 minutes after a power reset of the spectrometer probe).

⚠ If WLAN is switched off during operation, the reed switch can be used to activate WLAN (please refer to section 5.4.2). The LED will start flashing for 5 seconds when the reed switch contact is activated. Now WLAN is active for 10 minutes and connection via mobile devices possible.



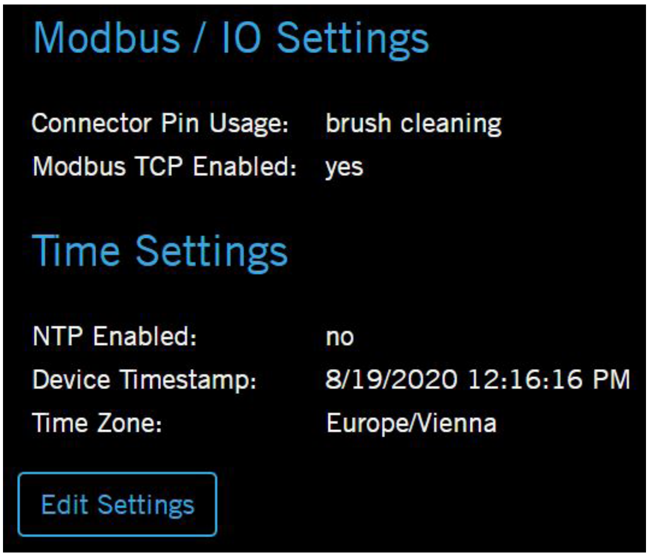
Device Settings

Name: Aquarium
Description: spectro::lyser V3.0
Device Type: UV/VIS, 35 mm
Serial Number: 00000004
Manufacturing Date: November 13, 2019
Software Version: 1.1-5
Hardware Version: 3.2
Automatic Sleep: no

Network Settings

Current IP Addresses: 192.168.167.4/24
192.168.43.1/24 (wifi)
192.168.44.1/24 (bluetooth)
Mode: static
Static IP Address: 192.168.167.4/24
Default Gateway: 192.168.167.254
DNS: 192.168.167.254
WLAN: enabled
Bluetooth: enabled
s::can Service Access: no

⚠ For best measurement performance, for reduced energy consumption and for security reasons s::can recommends to use configuration *disabled* or *at startup only* for Bluetooth and WLAN.



Modbus / IO Settings

Connector Pin Usage: brush cleaning
Modbus TCP Enabled: yes

Time Settings

NTP Enabled: no
Device Timestamp: 8/19/2020 12:16:16 PM
Time Zone: Europe/Vienna

- Information if *s::can Service Access* is activated or not.
- Status of actual *Connector Pin Usage*. The following options are possible: *Modbus*, *air cleaning* or *brush cleaning*.

⚠ If a cleaning device is chosen, the spectrometer probe can not use Modbus RTU anymore. If Modbus is used, the spectrometer probe can not trigger a cleaning device directly.

- Information if *Modbus TCP* is enabled (*yes*) or disabled (*no*).
- Actual status of *NTP* server (enabled or disabled)
- Actual date and time of the internal clock (*Device Timestamp*).
- Actual used time zone (*Time Zone*).

To modify the device properties logon as user *expert* is needed. Then push the button *Edit Settings* which is visible below the *Time Settings*. Now properties can be modified. After all changes are finished, push the button *Save Changes* to change the configuration permanently.

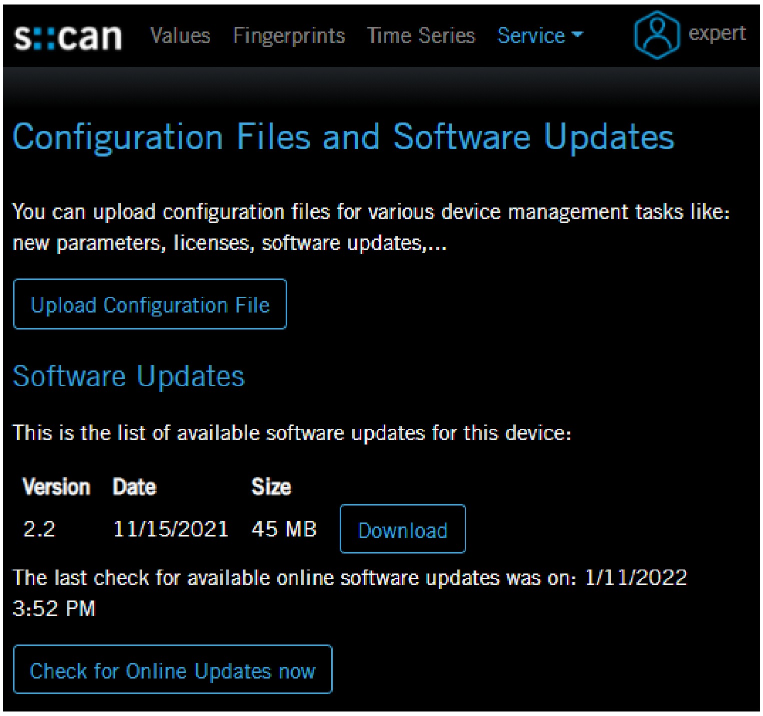
10.5 Software Update

A firmware update shall be performed by trained personal only. There are several possibilities how the update can be performed. The update procedure is always performed by the following steps:

- Check the software version installed on the spectrometer probe currently (see section 10.4.1, 10.4.2 or 10.4.3).
- Have the correct update package available (download from s::can Server or ask your s::can Sales Partner).
- Upload of update package to the spectrometer probe. This can be done with the spectrometer probe connected to the internet directly, with Io::Tool from a mobile device or with the con::cube.
- File processing on spectrometer probe. This is performed automatically on the spectrometer probe after successful upload of the update package.
- Installation of new firmware. This is performed on the spectrometer probe after successful file processing.

The most recommended procedure, to perform a software update via Io::Tool with the spectrometer probe connected to the internet, is performed by the following steps:

- Enter the IP of the spectrometer probe into your webbrowser to start Io::Tool (see section 5.3.3).
- Logout user *guest* and logon as *expert* (see section 5.4).
- Select menu *Service \ Licenses and Updates*.
- Below the header line *Software Updates* all available download files are displayed. You can also push the button *Check for Online Updates now* to search for actual updates.
- Select the most actual version and push the button *Download*.
- If the spectrometer probe is not connected to the Internet the update file can be uploaded from a connected mobile device. Push the button *Upload Configuration File* to select the file on the mobile device.
- After the download is finished push the button *Install* to start the update procedure.



Configuration Files and Software Updates

You can upload configuration files for various device management tasks like: new parameters, licenses, software updates,...

Software Updates

This is the list of available software updates for this device:

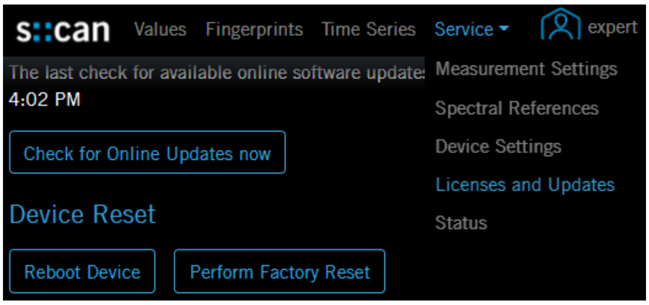
Version	Date	Size	
2.2	11/15/2021	45 MB	Download

The last check for available online software updates was on: 1/11/2022 3:52 PM

⚠ The Software Update function will be used for upload and installation of additional parameter licenses (Global Calibrations) also.

10.6 Reboot and Factory Reset of Spectrometer Probe

If necessary, a reboot of the spectrometer probe can be performed by pushing the button *Reboot Device* (see figure on the right).

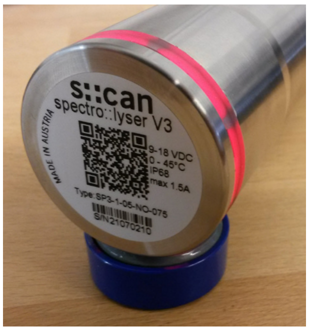


The last check for available online software update
4:02 PM

⚠ When pushing the button *Perform Factory Reset* the spectrometer probe will be reset to the state at delivery. All customer specific settings and configurations are lost. Please contact your s::can sales partner in case of open questions.

A factory reset can be perform via the reed switch of the spectrometer probe also. This might be necessary, if no remote connection to the probe is possible and Io::Tool cannot be started. The procedure is performed by the following steps:

- Power off the spectrometer and place it onto a flat surface with the measuring path facing upwards.
- Place the magnet below the LED ring. That means the magnet is located below the serial number written on the type label (see figure in the right).
- Power on the spectrometer and ensure that the magnet does not move.
- As soon as the LED ring starts flashing, start to count the number of flashes. After 15 flashes (corresponding to 30 sec.) remove the magnet.
- As soon as the magnet is removed, start again to count the number of flashes.



✗ If the spectrometer stops flashing and the LED ring is permanently red, yellow or blue before you have counted up to 15 flashes, the reset has failed. Power off the spectrometer and start the complete procedure from the beginning.

✓ If the spectrometer stops flashing and the LED ring is permanently red, yellow or blue after 1 – 4 minutes, the reset was successful.

10.7 Return Consignment (RMA - Return Material Authorization)

Return consignments of the s::can monitoring system, or parts of the system, shall be done in a packaging that protects the device (original packaging or protective covering if possible). Before returning a consignment, you have to contact your s::can sales partner or s::can customer support (support@s-can.at). A RMA number will be assigned for each device, independent if the reason of the return consignment is service, repair or demo equipment.

RMA numbers can be requested from the s::can Customer Portal available on the s::can website directly. Return consignments without an RMA number will not be accepted. The customer always has to bear the costs for return consignment.

11 Accessories

11.1 Installation

11.1.1 Extension Cable

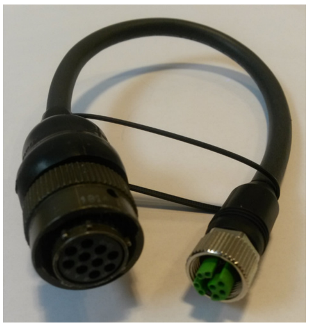
The cable of the spectrometer probe can be elongated when necessary with an extension cable (10 m or 20 m length). The extension cable is attached using the probe cable connector plug.

Name	Specification	Remark
Part-no.	C-210-V3 C-220-V3	
Cable length	10 m 20 m	C-210-V3 C-220-V3
Assembling	ex works	
Material	polyurethane jacket with double screening	cable
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can probe cable and controller

11.1.2 Connection Cable for Spectrometer Probe V3 to MIL-Plug

For connection of the spectrometer probe V3 to a con::lyte with MIL-plug connection a specific adapter cable is available.

Name	Specification	Remark
Part-no.	C-32-V3	
Cable length	0.3 m	
Assembling	ex works	
Material	polyurethane jacket with double screening	cable
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can controller with MIL-plug



Please note that for connection to s::can terminal con::cube D-315 this cable will provide limited compartibility with Legarcy Mode only. For full compartibility the con::nect box B-33-012 has to be used.

11.1.3 Connection Cable for Spectrometer Probe V2 to M12-Plug

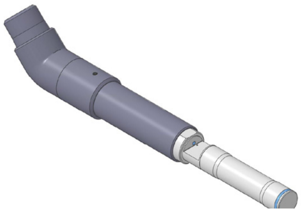
For connection of the spectrometer probe V2 to a con::cube D-330 with M12-plug connection a specific adapter cable is available.

Name	Specification	Remark
Part-no.	C-32-MIL	
Cable length	0.3 m	
Assembling	ex works	
Material	polyurethane jacket with double screening	cable
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can controller with M12-plug

11.1.4 Spectrometer Probe Mounting (inclined / horizontal)

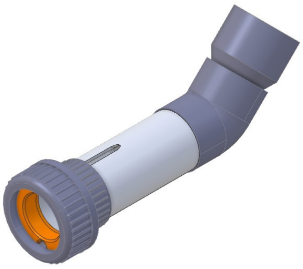
For proper, inclined or horizontal submersed installation of the spectrometer probe a seperate probe carrier with 45° connection bend is available. This part can be extended by a pipe (to be provided by the customer) if necessary. For length > 1 m stainless steel pipes or plastic pipes with higher wall thickness are recommended.

Name	Specification	Remark
Part-no.	F-110-V3	
Scope of delivery	1 mounting pipe 2 spacer rings 3 fixing screws (M5x10)	
Material	PVC POM stainless steel	mounting pipe spacer rings fixing screw
Dimensions	73 / 396 mm	diameter / length
Weight	approx. 0.9 kg	
Process connection	ID 50 mm	to mounting pipe OD 50 mm
Installation / mounting	submersed (in situ)	see section 4.2.1



Besides the existing carrier, already known from previous versions of the spectrometer probe, a new probe carrier is available.

Name	Specification	Remark
Part-no.	F-140-V3	
Scope of delivery	1 mounting pipe 1 spacer ring	
Material	PVC POM	mounting pipe spacer ring
Dimensions	128 / 294 mm	high / length
Weight	approx. 0.6 kg	
Process connection	ID 50 mm	to mounting pipe OD 50 mm
Installation / mounting	submersed (in situ)	see section 4.2.1



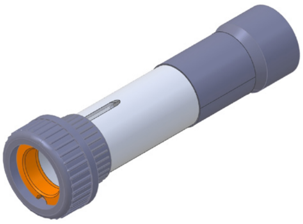
11.1.5 Spectrometer Probe Mounting (vertical)

For proper, vertical submersed installation of the spectrometer probe a seperate probe carrier is available. This part can be extended by a pipe (to be provided by the customer) if necessary. For length > 1 m stainless steel pipes or plastic pipes with higher wall thickness are recommended.

Name	Specification	Remark
Part-no.	F-120-V3	
Scope of delivery	1 mounting pipe 2 spacer rings 3 fixing screws (M5x10)	
Material	PVC POM stainless steel	mounting pipe spacer rings fixing screw
Dimensions	73 / 317 mm	diameter / length
Weight	approx. 0.6 kg	
Process connection	ID 50 mm	to mounting pipe OD 50 mm
Installation / mounting	submersed (in situ)	see section 4.2.1

Besides the existing carrier, already known from previous versions of the spectrometer probe, a new probe carrier is available.

Name	Specification	Remark
Part-no.	F-150-V3	
Scope of delivery	1 mounting pipe 1 spacer ring	
Material	PVC POM	mounting pipe spacer rings
Dimensions	83 / 309 mm	diameter / length
Weight	approx. 0.6 kg	
Process connection	ID 50 mm	to mounting pipe OD 50 mm
Installation / mounting	submersed (in situ)	see section 4.2.1



11.1.6 Railing Bracket / Fixing Adapter

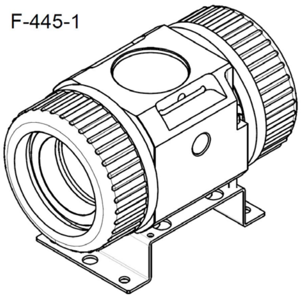
For proper and easy mounting of installation pipes onto the railing a seperate fixing adapter carries is available.

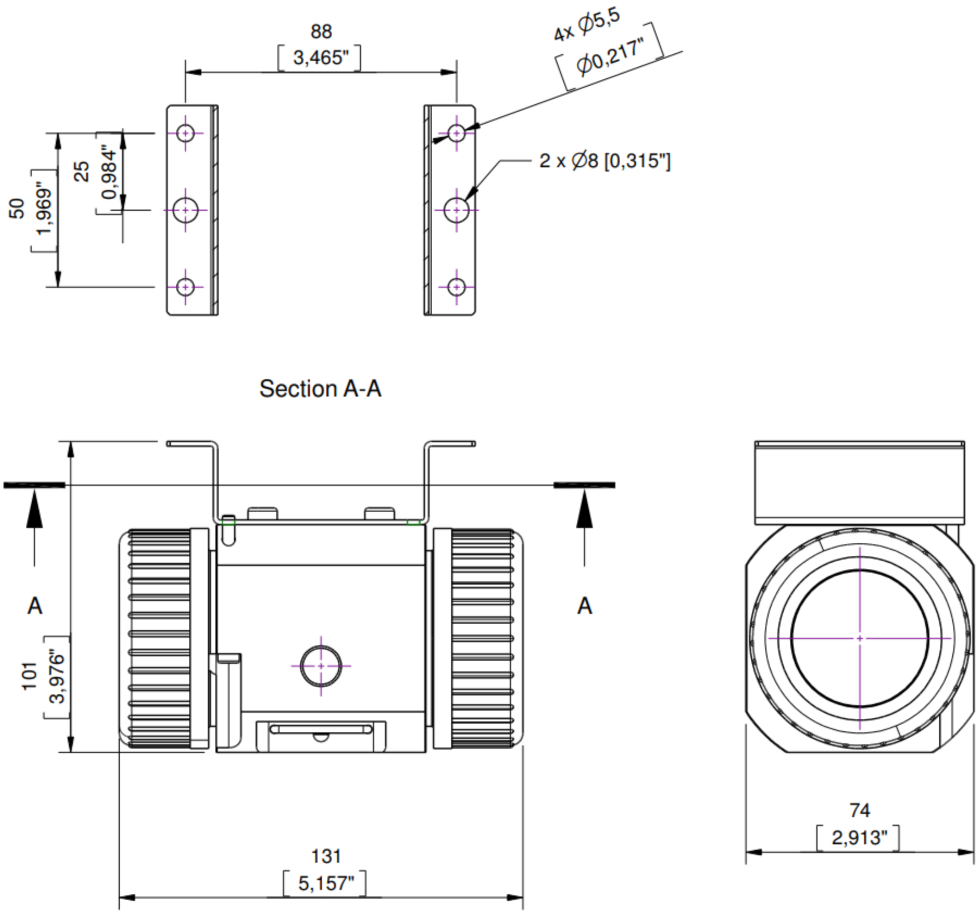
Name	Specification	Remark
Part-no.	F-15	
Material	Stainless steel	
Dimensions	158 / 267 / 73 mm	W / H / D
Weight	approx. 2.8 kg	
Process connection	50 mm	OD extension pipe of spectrometer carrier
Installation / mounting	up to 64 mm (2.5 inch)	OD of railing

11.1.7 Flow Cell Setup Clean Water

For measurement of sample stream outside the medium with a spectrometer probe a separate flow-through installation is available.

Name	Specification	Remark
Part-no.	F-445-V3	suitable for all OPL
Material	POM-C stainless steel	flow cell mounting
Dimensions	132 / 101 / 74 mm	W / H / D
Weight	approx. 0.45 kg	
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 60 °C (32 to 140 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose nozzle $^1/_4$ inch (ID 6 mm)	F-45-PROCESS





11.1.8 Flow Cell Setup autobrush

For measurement of sample stream outside the medium with a spectrometer probe in such applications, where fouling of the measuring windows may occur and automatic cleaning with compressed air is not sufficient or not applicable, a separate flow-through installation with an automatic brush is available.

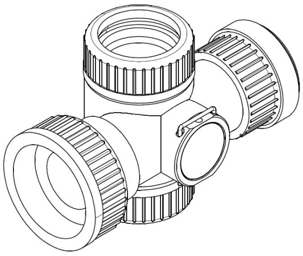
Name	Specification	Remark
Part-no.	F-446-V3	for 35 mm OPL
Material	POM-C stainless steel	flow cell mounting
Dimensions	132 / 155 / 74 mm	W / H / D
Weight	approx . 0.9 kg	
Power supply	10.5 to 13.5 VDC	
Power consumption	1.2 W (typ.)	
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 40 °C (32 to 104 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose nozzle $^1/_4$ inch (ID 6 mm)	F-45-PROCESS

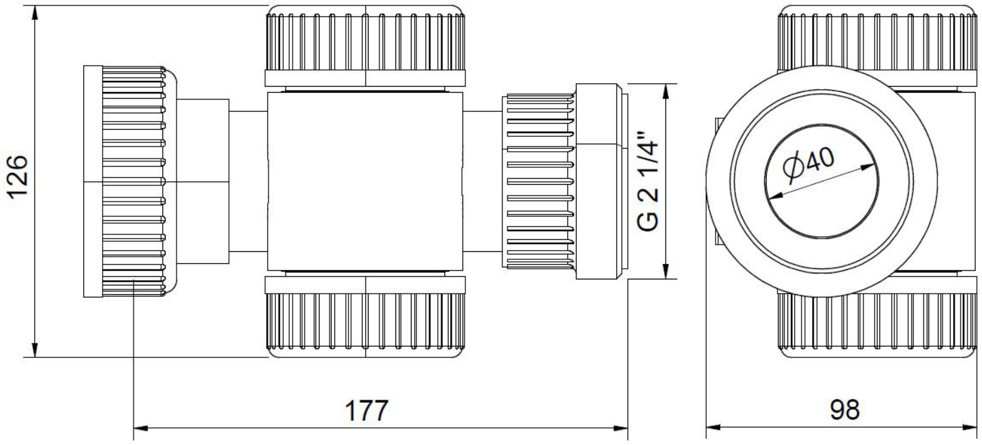
For this s::can product a seperate manual is available.

11.1.9 Flow Cell Setup Waste Water

For measurement of waste water sample stream outside the medium with a spectrometer probe a separate flow-through installation is available.

Name	Specification	Remark
Part-no.	F-48-V3	suitable for all OPL
Material	PVC	
Dimensions	126 / 98 / 177 mm	W / H / D
Weight	approx. 0.65 kg	
Process connection	ID 40 mm	
Installation / mounting	flow-through (by pass)	
Operating pressure	0 to 3 bar (0 to 43.5 psi)	





11.1.10 System Panel micro::station

For easy attachment of a complete s::can monitoring system (s::can controller, flow cell autobrush and two other flow cells) a separate system panel with holes for mounting of different devices is available.

Name	Specification	Remark
Part-no.	F-501-ECO-EU F-501-ECO-US	
Material	PP	
Dimensions	450 / 750 / 10 mm 450 / 750 / 210 mm	W / H / D (panel itself) W / H / D (required depth)
Process connection	G $^1/_4$ inch $^1/_4$ inch NPT	F-501-ECO-EU F-501-ECO-US

11.2 Automatic Cleaning

11.2.1 Pressure Connection Set

For connection of the automatic air cleaning system of the spectrometer probe a specific pressure connection set is available.

Name	Specification	Remark
Part-no.	B-41-sensor	
Pressure hose	3 m	ID 4 mm / OD 6 mm
Assembling	ex works	
Material	PU Nickel-plated brass	tube connection fitting
Process connection	$^3/_8$ inch	
Operating pressure	1 to 6 bar (14.5 to 87 psi)	

11.3 Maintenance

11.3.1 Cleaning Brush

For easy and proper manual cleaning of the measuring windows of the spectrometer probes a specific brush is available. This is especially suited for mechanical removal of persistent window fouling.

Name	Specification	Remark
Part-no.	B-60-2	for OPL 5 and 35 mm
Dimensions	200 mm	length

11.3.2 Cleaning Agent

For easy and proper manual cleaning of the measuring windows of the spectrometer probes a specific cleaning agent is available. It is especially suited for chemical removal of grease and persistent organic window fouling.

Name	Specification	Remark
Part-no.	B-61-1	
Weight	approx. 1.3 kg	
Volume	1 000 ml	

11.3.3 Multifunctional Slide

For easy and proper function check and reference measurements of the spectrometer probe a multifunctional slide is available.

This slide can also be used for measuring individual samples outside the process flow (e.g. spot samples in a laboratory). To place the multifunctional slide without requiring excessive force and risk of damaging the O-rings, the contacting surfaces on the probe, as well as the O-rings of the multifunctional slide can be moistened with water.

After fitting, the multifunctional slide must always be rinsed first using distilled water. This is done to avoid influence of subsequent measurements by traces of O-ring material left on the probe during fitting.

Name	Specification	Remark
Part-no.	B-421-V3	
Material	POM-H FPM	housing sealing
Dimensions	100 / 60 mm 26 mm	W / D circular opening

Volume	10 ml
	25 ml
		for 1 mm OPL
		for 35 mm OPL

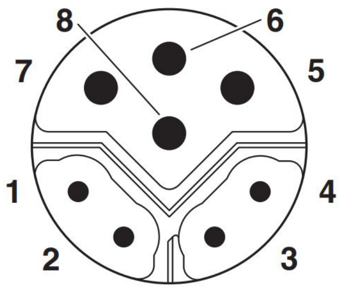
Weight	approx. 0.2 kg	

12 Technical Specifications

Name	Specification	Remark
Part-no.	SP3-1-xx-NO-yyy G3-1-xx-NO-xxx	spectro::lyser G-Serie (no access to fingerprint), see section 3.3 for further details
Measuring parameter	depending on type and installed global calibrations	see section 5.5
Measuring principle	UV-Vis spectrometry with xenon flash lamp (190 - 750 nm)	256 photo diodes, dual beam instrument, automatic compensation of flash lamp aging
Automatic spectral compensation	Turbidity, solids, organic substances, etc.	compensation of cross sensitivities
Measuring range	depending on optical pathlegth (OPL)	
Resolution	2.5 nm	wavelenght
Measurement interval	15 sec (min.) 120 sec (typical)	min. depending on number of parameters and application
Accuracy spectro::lyser	NO3-STD: +/- 2% + 1/OPL [mg/l] COD-KHP: +/- 2% + 10/OPL [mg/l]	in standard solution (>1 mg/l) OPL ... optical pathlength
Accuracy G-Serie	NO3-STD: +/- 3% + 1/OPL [mg/l] COD-KHP: +/- 3% + 10/OPL [mg/l]	in standard solution (>1 mg/l) OPL ... optical pathlength
Repeatability	+/- 0.004 Abs. - spectro::lyser +/- 0.010 Abs. - G-Serie	in air at 20°C with 10 flashes per measurement without averaging of measurements
Drift (peak to peak)	< +/- 0.005 Abs./day - spectro::lyser < +/- 0.010 Abs./day - G-Serie	in air at 20°C with 10 flashes per measurement without averaging of measurements
Global calibration	all parameter precalibrated ex-works	depending on application
Local calibration	offset or linear	to real (local) water matrix
Reference	distilled water, air	e.g. dist. water for analysis by Merck
Temperature sensor	0 to 45 °C (32 to 113 °F) 0.1 °C resolution	readings displayed license free
Sensors internal	Supply voltage, tilt and rotation	readings display for s::can service
Power supply	10 to 18 VDC, 350 mA < 1.5 A 5 mA	full activity during flashing (measuring process) in sleep modus (logger mode)
Power consumption	3.0 W (typical) 20 W (max) 60 mW (during sleep mode)	Sleep mode can be activated from remote (e.g. LTE modem) either via REST API or via Modbus

Name	Specification	Remark
Electrical potential	max. 1 Ohm < 0.5 Ohm	max. resistance between power supply earth of probe (=PE) and the real site ground resistance between the medium to be measured and the ground of the probe's power supply (e.g. con::lyte, con::cube)
Electrical isolation	galvanic isolation	between electronic and housing
Sensor cable length	1.0 m fixed cable 7.5 m fixed cable 15 m fixed cable	-010 -075 -150
Max. recommended sensor cable length	12.5 VDC 18 m 13.5 VDC 23 m 15.0 VDC 31 m 18.0 VDC 46 m	con::lyte D-320 con::cube D-315 con::cube D-330
Sensor cable specification	OD 8 mm +/- 0.5 mm, polyurethane jacket with double screening	min. bending radius 5 cm, no buckling allowed at probe connection
Status information	RGB LED ring on bottom	see section 10.2
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can operator terminal
Interface connection to third party terminals	con::nect V3 incl. Modbus RTU, REST API	for proper Modbus communication with 3rd party operator terminals ensure a terminating resistance of 120 Ohm
Digital interface for cleaning device	1 digital in/out ; 1 digital out	only available when Modbus is not in use
Network connection	100Base-T Ethernet, Bluetooth, WLAN	Bluetooth and WLAN only works if sensor is not submersed completely
Network ports	HTTP .... 80 HTTPS .... 443 Modbus-TCP .. 502 SSH .... 22 NTP 123	for lo::Tool for lo::Tool Default server: pool.ntp.org
Sensor materials (in contact with measuring medium)	stainless steel 1.4404 X2 Cr Ni Mo 17-12-2 fused silica (UV-grade) sapphire (Al_2O_3)	housing (ISO) DIN material number measuring windows (OPL 35 mm) measuring windows (OPL 1 and 5 mm)
Weight	ca. 3.4 kg	incl. cable
Dimension (without cable gland)	44 / 473 mm 44 / 457 mm 44 / 453 mm	diameter / length (OPL 35 mm) diameter / length (OPL 5 mm) diameter / length (OPL 1 mm)
Operating limits temperature	0 to 45 °C (32 to 113 °F) up to 50 °C (122 °F) < 3 minutes	temperature, min. freezing, max. 45°C submerged
Operating limits pressure	0 to 5 bar (0 to 72.5 psi)	
Operating limits others	max. 3 m/s max. 30 Nm	flowrate mechanical stability, centric load, adequate for most known application conditions and all s::can installation / mounting parts

Name	Specification	Remark
Storage limits temperature	-10 to 65 °C (14 to 149 °F)	probe has to be acclimatised to medium temperature before initial operation
Installation / mounting	submersed or in flow cell	
Environment rating (IP)	IP 68	
Internal storage	8 GB on board memory	see section 7.1
Back-up battery	5 years life duration without external power supply (e.g. storage)	exchange by s::can service only
Automatic cleaning - probe connection	G $^1/_8$ inch for air hose OD 6 mm	
Automatic cleaning - specification	compressed air, free of oil & particles min. 3 bar (43.5 psi) max. 6 bar (87 psi)	medium (drinking water alternative) allowed pressure at probe cleaning connection
Automatic cleaning - settings	duration: 1 to 10 sec. interval: 1 min. to 6 hours delay: >10 sec.	valve open or brush rotating depending on application delay until start of next measurement (consider that flow cell has to be filled up with new medium)
Mechanical tests	deviation, shock, temperature 8 bar (116 psi)	acc. internal quality criteria leak test
Quality tests	99% within tolerance over 24 hours NO_3 standard solution 8 fingerprints within specification	precision / stability linearity absorbance in distilled water
Light source	xenon gas discharge lamp	
Stability light source	> 99 % > 99.5 % (typical)	UV-Vis (230 - 650 nm) standard deviation in air at 20°C with 10 flashes
Life time light source	> 1 x 10^9 flashes	Life time = 50 % of output energy
Protection light source	shielded, encapsulated	
Regulation light energy	between 60 and 100%	by s::can service only
Flashes per measurement	20 - 60 flashes / measurement	depending on application
Predictive maintenance ligth source	after 2 - 3 years after 1 - 2 Mio. measurements at lamp intensity 50 - 60 %	for one-time extension of the warranty claim by 3 years (Item-no. X-03-SPECTRO)
Warranty standard	2 years	
Warranty extended (optional)	3 years	

Name	Specification	Remark
Conformity - environmental testing	EN 60721-3	
Conformity - EMC	EN 61326-1	
Conformity - RoHS2	EN 50581	
Assignment Probe Plug (pin side view) 	7 ..... Brown (BN)	RS485 Data +
	5 ..... Blue (BU)	RS458 Data -
	6 ..... White (WH)	+12 V Power supply
	8 ..... Black (BK)	Ground Power supply
	3 ..... White / Green (WH-GN)	Ethernet pair 1
	4 ..... Green (GN)	Ethernet pair 1
	1 ..... White / Orange (WH-OG)	Ethernet pair 2
	2 ..... Orange (OG)	Ethernet pair 2

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s::can
Intelligent. Optical. Online.

Manual

moni::tool V4.0

December 2020 Release

S-11-M

ABOUT THIS MANUAL

Structure

This manual is structured into four parts:

- Part A – General Information
- Part B – Getting Started
- Part C – Operation of *moni::tool*
- Part D – Additional Information

General Information comprises safety guidelines, background information on s::can products as well as information regarding product updates. Furthermore, and of major relevance for using this manual, an introductory chapter on the used terminology defines how certain terms are used in this manual and with respect to s::can products in general.

Getting Started focuses on the steps from unpacking the product to the initial start-up. The first chapter addresses technical product information on the intended use as well as on the functional principles of key product components. Following a chapter on the installation of the system finally the initial start-up is explained.

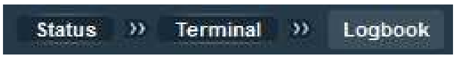
The main part of the manual addresses ***Operation of moni::tool***. Its structure follows the graphical user interface of *moni::tool* and all components are addressed as they are accessed when working through the various software menus and items.

Finally, ***Additional Information*** provides insight into various issues of function checks, troubleshooting as well as into using the VNC software for taking over *con::cube* display, touch and keyboard from remote.

Usability

Terms in this document which are marked italic and underlined (*<u>example</u>*) indicate that a corresponding item can be found on the display of your terminal or on your s::can product. Terms which are formatted italic only refer to proprietary notations of or within s::can products.

For easy navigation in areas of *moni::tool* with a deep hierarchical order, i.e. several levels of windows, on top of the screens a "navigation line" indicates the level of the currently active screen. The elements of this line can also be used for navigating to the higher software levels.



The concept of *Service Levels* in *moni::tool* helps adapting the information on some screens to actual needs. This is indicated in the respective chapter with →*<u>Service Level</u>* / *<u>Expert</u>*

While this manual focuses on *moni::tool* version 4.0, it basically covers version 2 and 3 as well since operational aspects have not been affected by this version step. However, due to the change from a Microsoft Windows© operating system (V 2.5) to a Linux-based platform (V 3.0) activities which are implemented on the level of the operating system need to be handled differently. These differences are indicated in the respective chapters of this manual.

Disclaimer

In spite of careful elaboration this manual may contain errors or incompletion. s::can does not assume liability for errors or loss of data due to such faults in the manual. The original manual is published in English and German by s::can. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into third languages.

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This manual, at the time of its publication (see release date printed on the top of this document), concerns the s::can products listed in the chapter *Product Packages* of *Part A* in this manual. Information and technical specifications regarding these items in s::can manuals from earlier release dates are herewith replaced by this manual.

TABLE OF CONTENTS

PART A – GENERAL INFORMATION

TERMINOLOGY

Terminal	*Terminal* refers to the hardware which is used to operate the monitoring station and to which the various sensors are connected. In the framework of this manual this will usually mean a *con::cube* running *moni::tool*.
Sensor	All devices producing the data which are then further processed as measurement values are referred to as *sensor*, irrespectively whether it is complex hardware such as a *spectro::lyser* or a simple device such as a temperature sensor.
Raw values	*Raw values* are the data as they are originally produced by the respective sensor, without any further processing. Very often this will be measurements of mV or mA which have no deeper meaning for a standard user and are hence usually not accessible.
Measured values	*Measured values* are delivered by the respective device to the user. This usually involves the physical *sensor* measuring the *raw data* and some data processing relating those raw values to the typical unit of the respective parameter (e.g. mV → °C). The second step is referred to as *calibration*.
Clean values	*Clean values* are *measured values* which have been further processed by the *vali::tool* software.
Local / **Remote Access**	Basically a monitoring station can be accessed and operated either locally or remotely. *Local access* means that input devices (touch screen, optional mouse, keyboard using the USB interface) and output devices (display) of the station hardware are used. *Remote access* means that the web-server forming a key component of *moni::tool* (and actually producing and providing the various *moni::tool* screens) is not accessed through the built-in web-browser but through any standard web-browser running on another computer. The connection between the "remote" computer and the monitoring station (*con::cube*) which facilitates the required internet communication between the two devices is based on http and uses port 80. However, It is important to note that whenever this manual talks about services to be available locally only, the respective activities can be implemented via VNC as well (please refer to section 0 of Part D for further information).

SAFETY GUIDELINES

Installation, electrical connection, initial set-up, operation and maintenance of any s::can product as well as complete s::can measuring systems must be performed by qualified personnel only. Such qualified personnel need to be trained and authorized by the plant operator or by s::can for these activities. The qualified personnel must have read and understood this manual and have to follow the instructions contained in this manual.

For setting up s::can measuring systems correctly, the manuals for

- the terminal (*con::lyte*, *con::cube* or PC / notebook with *con::nect*),
- the operating software *(ana::lyte*, *ana::pro* or *moni::tool*) as well as
- the connected sensors

have to be consulted.

The operator is responsible for obtaining required local operating permits and for complying with the joint constraints associated with these. Additionally, local legal requirements have to be observed (e.g. regarding safety of personnel and means of labor, disposal of products and materials, cleaning, environmental constraints). Before putting the measuring device into operation, the operator has to ensure that during mounting and initial start-up – in case they are executed by the operator himself – the local legislation and requirements (e.g. regarding electrical connection) are observed.

All s::can products are leaving our factory in immaculate technical and safety conditions. However, inappropriate or not intended use of products can cause danger! The manufacturer is not responsible for damage caused by incorrect or unauthorized use.

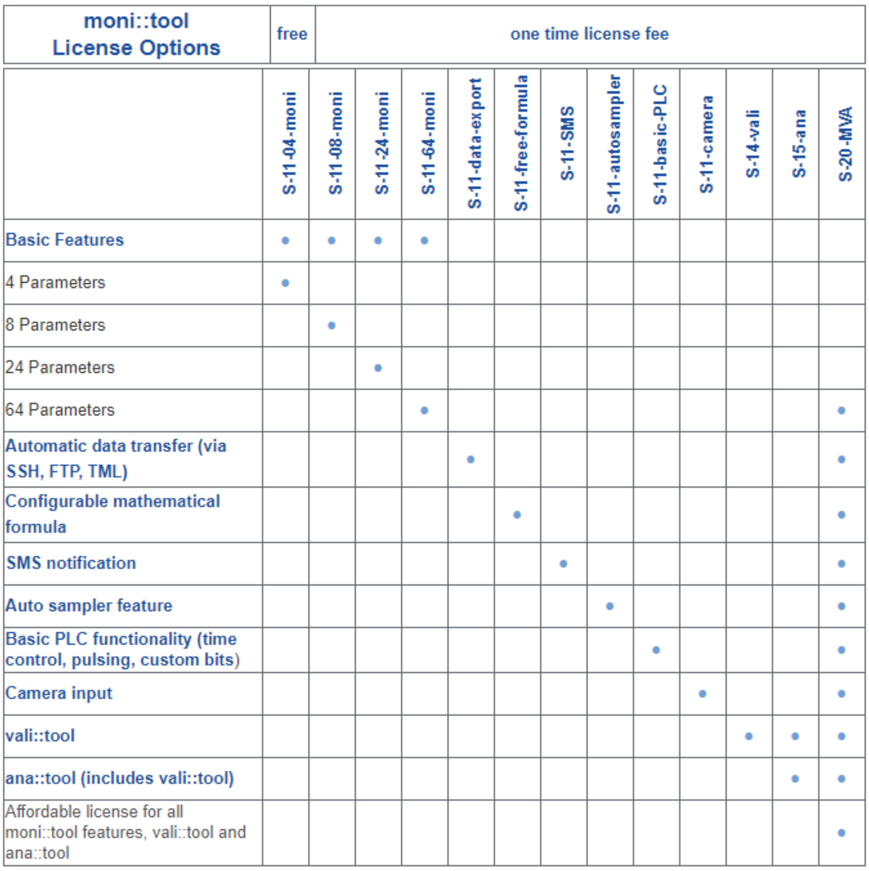
Any kind of manipulation of the instrument is strictly prohibited - except for the activities described in this document. Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid. For details regarding guarantee and warranty please refer to our general conditions of business.

Special Hazard Warning

⚠ As s::can measuring systems are frequently installed in industrial and communal waste water applications, special care has to be taken during mounting and demounting of the system as parts of the device might be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one’s health during work with the measuring device.

PRODUCT PACKAGES

The following variants and extension packages of the *moni::tool* software are available. For detailed information about software variants please refer to the s::can homepage www.s-can.at or directly to www.moni-tool.at**.**



moni::tool License Options	free	one time license fee											
	S-11-04-moni	S-11-08-moni	S-11-24-moni	S-11-64-moni	S-11-data-export	S-11-free-formula	S-11-SMS	S-11-autosampler	S-11-basic-PLC	S-11-camera	S-14-vali	S-15-ana	S-20-MVA
Basic Features	●	●	●	●									
4 Parameters	●												
8 Parameters		●											
24 Parameters			●										
64 Parameters				●									●
Automatic data transfer (via SSH, FTP, TML)					●								●
Configurable mathematical formula						●							●
SMS notification							●						●
Auto sampler feature								●					●
Basic PLC functionality (time control, pulsing, custom bits)									●				●
Camera input										●			●
vali::tool											●	●	●
ana::tool (includes vali::tool)												●	●
Affordable license for all moni::tool features, vali::tool and ana::tool													●

* Every s::can con::cube terminal is delivered with the basic moni::tool version for four parameters at no extra costs!

Annual support and carefree packages are available. Please contact your s::can Sales Partner regarding these products.

SCOPE OF DELIVERY

Upon receipt, please check the received consignment for completeness on the basis of the delivery note and check for any possible damage incurred during shipping. Please inform the delivering dispatcher and s::can immediately in case of any damages in transit.

The following parts should be included in the delivery:

- s::can software *moni::tool*, already pre-installed on your terminal (item-no. S-11-xx-MONI),
- s::can manual *moni::tool*.

The following parts might be included in the delivery if ordered as an option:

- s::can software *vali::tool* and *ana::tool*, already pre-installed on your terminal (item-no. S-14-VALI and S-15-ANA)

In case of incompleteness please contact your s::can sales partner as soon as possible!

PRODUCT UPDATES

The manufacturer reserves the rights to implement, without prior notice, technical developments and modifications in the light of continuous product care. Software updates will be made available in the form of update packages that can be downloaded and installed on the s::can terminal.

PART B – GETTING STARTED

Intended Use

The s::can software *moni::tool* is intended for operation of s::can monitoring stations. Based on an open, innovative, location-independent architecture, it uses a local database for collecting all data and a web server for visualization and operation.

moni::tool supports the following functions:

- All sensor and monitoring station management tasks (e.g. initialization, configuration, calibration)
- Automatic restart and continuation of measurement after interruption of power supply
- Data management, visualization and export of results (values, time series, UV/Vis-spectra in 2D/3D)
- Indication of sensor status and performance
- Advanced system for quality assurance and quality control (QA/QC)
- Logging and tracking of all maintenance actions performed on the monitoring station (e.g. changes of sensor settings or components, calibration and any other activities)
- Automatic feedback to the operator using the incoming and logged information
- Online calculation of customized parameters on the terminal
- Support of all terminal interfaces
- PLC (*Programmable Logic Controller*) functions

For the *moni::tool* basic module the following add-ons are available:

- *vali::tool* - advanced module for real time data validation
- *ana::tool* - advanced module for real time event detection
- higher number of supported parameters
- advanced features - advanced module for data export (Auto-Export, TML), see software variants above for complete list.

Functional Principle

moni::tool

The *moni::tool* software package consists of several components. The central component of the system is a PostgreSQL database in which all measurement data as well as all configurations and settings are stored. Measurement data are obtained from all s::can sensors through specific drivers that communicate with the devices using either the Modbus protocol or a mA signal.

Information is presented to the user via webpages that are generated by a webserver on the s::can terminal. On these webpages measurement results and status information can be viewed, configurations can be changed and service actions can be performed. When the s::can terminal is connected to a network, these webpages can also be accessed from any computer with access to the terminal. In this way true remote control of the station is possible.

All implemented tools are programmed in Java and the platform independent client runs on any Java enabled web browser. This means that sensors and stations can be accessed from any suitable device that is connected to the internet.

Tools, devices and protocols can easily be integrated or customized at any time.

vali::tool

vali::tool is s::can's data validation module. Its task is to automatically detect, mark and (optionally) clean-up untrustworthy data. This data evaluation provides valuable quality information on the individual measurements performed by the system.

The results from this online validation are utilized in several ways. Firstly, the user can be provided with indications that a sensor requires maintenance or that malfunctions have been detected. And secondly, the marking of questionable results enables the alarm tool (*ana::tool*, see below) to ignore data of insufficient quality and hence improve its accuracy significantly.

The use of automatically cleaned measurement results is of special interest for process control where a loss of signal can lead to undesirable consequences in the process while intelligent data clean-up allows the controls to continue working properly.

For data validation a number of simple but robust statistical methods such as the detection of outliers, discontinuities or noise have been implemented.

ana::tool

ana::tool is s::can's event detection module. It is designed to evaluate data cleaned by the validation module regarding its normality and, in cases of identified significant deviations, to trigger specific alarms. While *ana::tool* has been optimized for utilizing multi-dimensional spectral data, it will work just as well with single or multiple one-dimensional inputs from conventional sensors. However, the integration of spectral data provides a much more complete picture of water quality than can be obtained through single parameters.

The applied methods for identifying alarm situations comprise static thresholds, dynamic thresholds, pattern recognition, spectral alarms and cumulative alarms.

Installation

The *moni::tool* software has been developed for its use on the s::can *con::cube* hardware. It has already been installed on any purchased terminal and no separate installation of the software is required.

Update or recovery packages are available on the s::can partner portal (www.s-can.at/services/partner-portal). Please refer also to the manual delivered with the respective s::can terminal.

Requirements Web Browser

The local browser on your s::can terminal is preinstalled and fulfils all requirements for optimal performance. For using *moni::tool* remotely, the browser on the PC / notebook has to meet the following specifications:

- Mozilla Firefox >= V3.6 (no compatibility mode)
- Google Chrome >= V14
- Opera >= V8.9 (equates V11.5)
- MS Internet Explorer >= V9 (no compatibility mode)
- Apple Safari >= V5

Requirements Spectrometer probes

For being operated with *moni::tool*, spectrometers have to be equipped with firmware V1.0.z (V0133) or higher. s::can recommends to always use the most actual firmware version available.

Conditions for Use / Licensing Terms and Conditions

For each terminal an individual license file is needed which is already installed at delivery according to the ordered software package. For an upgrade of the *moni::tool* software (see section *Product Packages* above) a new license file can be downloaded to the terminal.

The license text can be found in *moni::tool* in the *Help* tab. Licenses are deemed accepted when an s::can product is used.

System Set-up

The s::can terminal is delivered with a pre-installed operating software *moni::tool*. Whenever the terminal is newly connected to power supply (please refer to the terminal manual), *moni::tool* will start automatically. Depending on the type of the terminal it will take 1 - 2 minutes for the start-up process to be completed.

After the initial start-up the monitoring station needs to be configured and sensors need to be installed. For this purpose a list of tasks has to be performed as is indicated below.

Task	***moni::tool* Path**	**Manual page**
Set **terminal language**	Service / Terminal / Terminal Language Bottom Menu / flag symbol (external browser only!)	51 15
Log-in	Bottom Menu / User icon or Tab *Service* (Default password for user “Administrator” is “admin1”)	15, 33
Set **time zone** and **network time server**	Service / Terminal / Date & Time / Time Configuration	51
Set **date and time**	Service / Terminal / Date & Time / System Time	51
Set **station name**	Service / Terminal / Settings / Station	42
Set **computer name** and **network configuration**	Service / Terminal / Network	41
Configure **users**	Service / Terminal / Settings / User Accounts	42
Install **sensors**	Service / Add new sensor	64
Configure the **parameter order** in which they are displayed	Service / Terminal / Parameters	44
Configure **measurement interval**	Service / Terminal / Measurement	38
Configure automatic **cleaning devices**	Service / Cleaning Devices	84
Configure ***vali::tool***	Service / Terminal / Parameters	48
Configure **outputs**	Service / Outputs / • Analog Outputs • Digital Outputs • Fieldbus Outputs • SMS Notification • Auto-sampler Service / Outputs / File Output / • File Generation / Setup • FTP(SSH) Transfer	70 75
Collect samples	Service / Samples & Calibration / Taking Samples	36
Check sensor readings, **calibrate** if necessary	Service / Sensors / Calibrate sensor	61

Once the system has been operated successfully for some days and validated results have been produced, the set-up process can be completed.

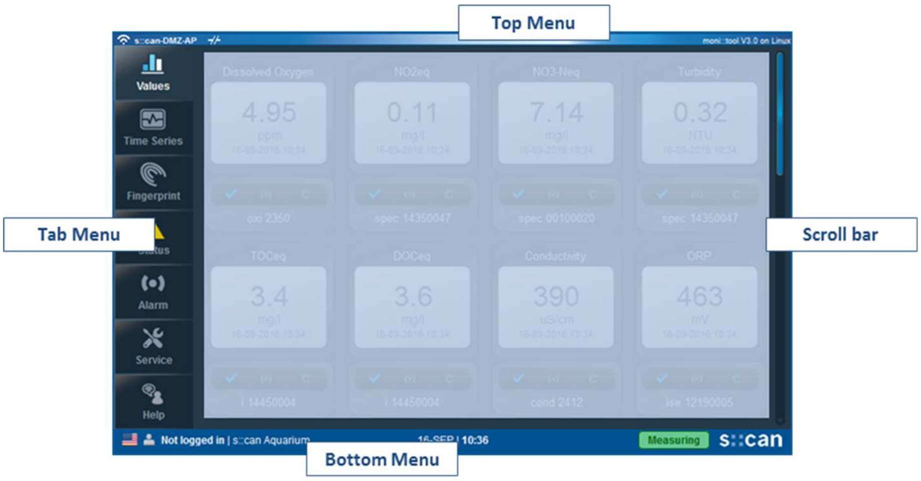
Configure ***ana::tool***	Service / ana::tool	67

Please refer to the respective chapters of this manual for details!

⚠ Typically, some of the tasks listed above will be implemented only during the initial system set-up. However, other activities will need to be repeated on a regular basis. Hence, the list above can also be seen as an overview on operations and maintenance and as a guide to the respective sections of *moni::tool* and of this manual.

PART C – OPERATION OF *MONI::TOOL*

0 Permanently Visible Components



These *moni::tool* elements are shown as part of the start screen but are available on all other screens as well.

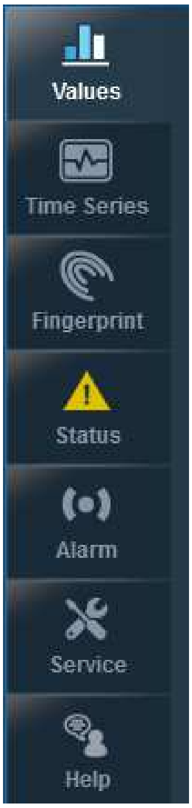
They form the backbone of *moni::tool* navigation and provide access to all its functions.

Their respective functionalities are explained below.

0.1 Tab Menu

The seven Tab Menu icons are the main navigation tool for accessing the different views and possibilities of the *moni::tool* software. Furthermore, they also highlight key status information of the monitoring station, as shown for instance for the *Status* tab below.

The currently selected tab is highlighted, as shown for *Values* below.



Values is *moni::tool*'s default view and displays the current readings as well as information on the measurement quality for all installed parameters and provides additional functions.
*(see **Chapter** 1)*

Time Series is the main view to assess recorded measurements through displaying time series of parameter results, including various manipulation options.
*(see **Chapter** 2)*

Fingerprint is the tab specialized on analysing absorbance spectra as produced by spectro::lyser.
*(see **Chapter** 3)*

Status provides actual information on all the measurement system's components. It covers various issues and its icon blinks yellow if an error is detected.
*(see **Chapter** 4)*

Alarm provides access to the component designed to detect irregularities within the monitored media. The icon blinks yellow if an alarm has been triggered.
*(see **Chapter** 5)*

Service aggregates all aspects of system configuration as well as of setting specific controls. The icon blinks yellow if the monitoring station has been set into service mode.
*(see **Chapter** 6)*

Help addresses various formal aspects and provides background information on the system and its functionality. However, the use of this tab can also be adapted to user preferences.
*(see **Chapter** 7)*

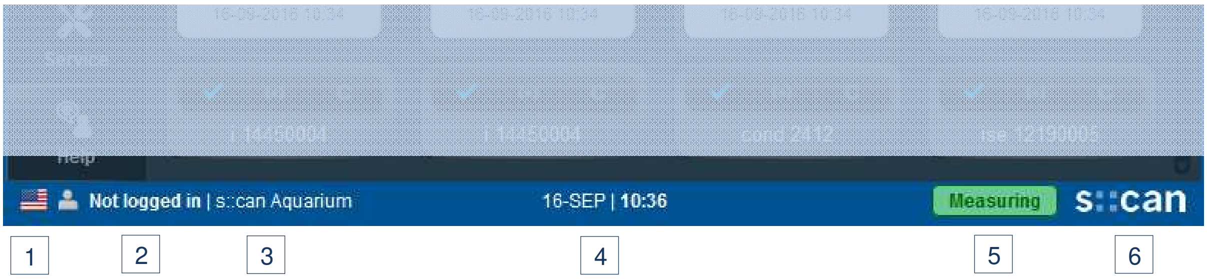
⇨ *Available **Quick reference guides**:*

Manuals	*moni::tool / Service_Guides*	note_monitool_overview

Please refer to the s::can Customer Portal!

0.2 Bottom Menu

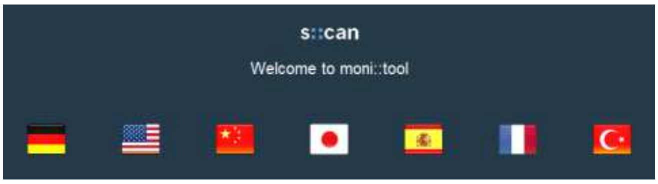
The *Bottom Menu* shows some key information about the monitoring station's status and provides access to some key functions. An overview on the individual elements is provided below.



No.	Element	Information	Push-Function
1	**Language**	Language selected for the remote browser session indicated by the flag symbol	Change the language used for the remote browser *moni::tool* session
2	**User**	User currently logged-in	log-in / log-out; *con::cube* shutdown/re-start; change Service Level
3	**Station name**	Name of the monitoring station	-
4	**Date & time**	System date and time	Display date / time of the last measurement
5	**Activity**	Activity the system is currently performing (partly incl. remaining time)	-
6	**Logo**	s::can logo	Pushing the logo will show information about the terminal and *moni::tool* (as *Help* / *Version Info*)

Details on the individual elements and their respective push-functions are presented in the following sections of this chapter.

0.2.1 Language Selection



Select one of the offered languages by pushing its flag symbol.

This selection influences only the language used for the current remote session via an external browser. It has no impact on the language settings for the terminal itself!

⇨ *Relevant **Manual sections**:*

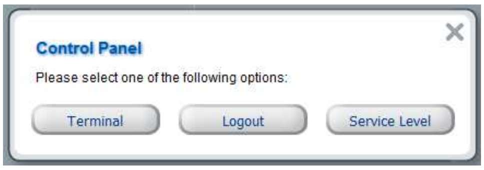
Terminal language selection	Service / Terminal / Terminal Language	6.4.7, p. 51

0.2.2 User

Beside the *Bottom Menu*'s User icon the current log-in status is shown. When no user is logged-in, pushing the text field opens the log-in dialogue.

Usually, in this dialogue a username and the respective password can be entered. Alternatively, the options for a simple (only the password needs to be entered) or for an automatic log-in can be activated in the *Service* tab.

When a user has been logged-in already the respective user name is displayed (e.g. *Administrator*) and pushing the name provides access to the following options:



Control Panel

Please select one of the following options:

- *Terminal*: *Shutdown* (switches the *con::cube* off, app. 15 s; before a restart the power needs to be disconnected for app. 60 s) / *Reboot* (re-starts the *con::cube*, app.3 minutes)
- *Logout*: Log-out of the current user (happens also automatically after an inactive period)
- *Service Level*: *Basic* / *Advanced* / *Expert* (the available levels depend on the active user profile)

⇨ *Relevant* ***Manual sections****:*

User administration	Service / Terminal / Settings / User Accounts	6.4.4, p. 42
Log-in mode	Service / Terminal / Settings / Login Mode	6.4.4, p. 42

0.2.3 Station Name

The name of the station allows the quick identification of the respective system which is especially relevant when several stations are accessed remotely.

⇨ *Relevant* ***Manual sections****:*

Setting the station name	Service / Terminal / Settings / Station	6.4.4, p. 41

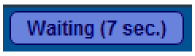
0.2.4 Date & Time

The *Bottom Menu* displays the current date and time as configured for the station and provides quick information on the time of the last measurement.

⇨ *Relevant* ***Manual sections****:*

Setting date and time	Service / Terminal / Date & Time / Time Configuration	6.4.6, p. 51
Setting the time zone	Service / Terminal / Date & Time / System Time	6.4.6, p. 51

0.2.5 Activity



The Activity element indicates the activity status of the station.

This is helpful when an automatic measurement program is active for understanding at which point of the measurement cycle the system stands and how long the respective phase will still last.

⇨ *Relevant* ***Manual sections****:*

Configure automatic cleaning devices	Service / Cleaning Devices	6.10, p. 84
Configure the measurement interval	Service / Terminal / Measurement	6.4.1, p. 38

0.2.6 Logo

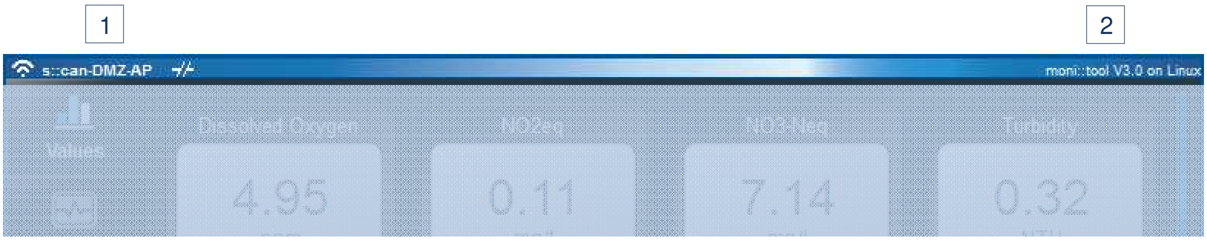
The s::can logo provides direct access to information on the used terminal, the installed software and the network, which is part of the Help tab.

⇨ *Relevant* ***Manual sections****:*

Version Info	Help / Version Info	7.1, p. 86

0.3 Top Menu

The Top Menu provides information about the station’s connection status and the current software version.



No.	Element	Information	Push-Function
1	**Connection status**	Active network connection	Access to network configuration (*admin rights required*)
2	**Software version**	Software version and operating system	-

0.3.1 Connection Status

The first part of the element symbolizes the physical type of the network connection:

	Local Area Network (LAN)		Wireless LAN
	Modem	🔒	Virtual Private Network (VPN)

Beside the network-type symbol the name of the network (if available) or of the used settings-profile and the connection status are shown.

	con::cube not connected to network using LAN adapter
	con::cube connected to network using LAN adapter
JAHome	*con::cube* connected to network using WLAN adapter; signal strength 1 (poor signal), 2 (weak signal) or 3 (good signal). In addition the WLAN network name is displayed
T-Mobile A	*con::cube* connected to network using internal modem (optional); signal strength 0 (no signal), 1 (very poor signal), 2 (poor signal), 3 (weak signal), 4 (good signal) or 5 (perfect signal). In addition the Sim-card provider name is displayed.

The available options for configuring the respective settings can be accessed directly through this element. However, this will require a user with administrator rights.

⇨ *Relevant **Manual sections**:*

Configure network settings	Service / Terminal / Network	6.4.3, p. 41
User administration	Service / Terminal / Settings / User Accounts	6.4.4, p. 42

0.3.2 Software Version

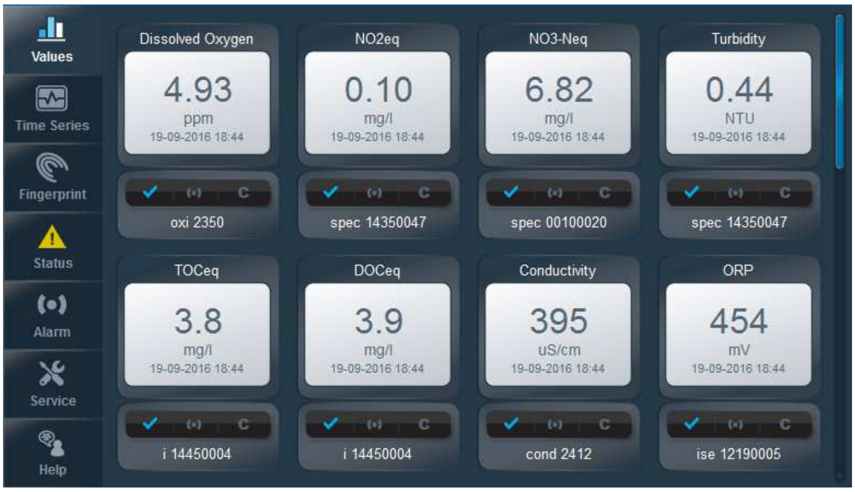
This element of the Top Menu shows the installed *moni::tool* version and the *con::cube*’s operating system.

0.4 Scroll Bar

The Vertical Scroll Bar can always be found on the right side of the frame. It is highlighted when it is active for navigating through views which are longer than the standard *moni::tool* screen.

⚠ The *con::cube* touchscreen also offers the possibility to navigate by using typical gestures (“*swiping*”).

1 Values



The *Values* screen provides a detailed overview of the last parameter results as well as status information from all configured sensors.

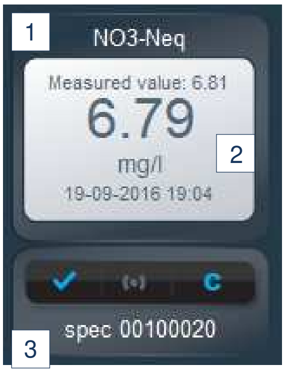
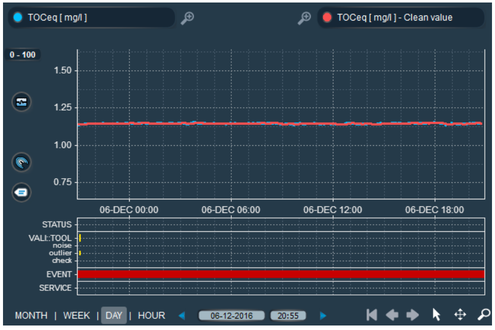
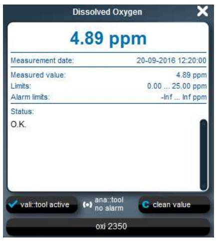
The information for up to eight parameters can be displayed simultaneously, the respective indices run from top left (=1) to bottom right.

In situations where more than the displayed number of parameters are monitored the scroll bar on the right screen side allows moving down and up for viewing the other parameters.

➪ *Relevant **Manual sections**:*

Configure parameter order	Service / Terminal / Parameters / Parameter Order	6.4.5, p. 45
Configure Values screen	Service / Terminal / Display / Values Layout	6.4.8, p. 52
Configure logged-out display	Service / Terminal / Display / Parameter Display	6.4.8, p. 52

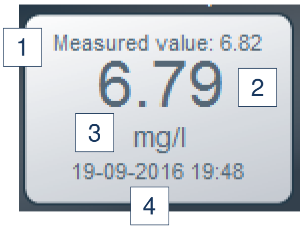
For each configured parameter a display module is defined, which consists of a main upper part showing names and values and a lower part providing additional information.

	No.	Element	Information	Push-Function
 1 NO3-Neq Measured value: 6.81 6.79 mg/l 19-09-2016 19:04 2 spec 00100020 3	1	**Parameter name**	Name assigned to this parameter	-
	2	**Parameter results**	Last measurement results	→ *Parameter Time Series (see 2.5)*  TOCeq [mg/l] TOCeq [mg/l] - Clean value 0 - 100 1.50 1.25 1.00 0.75 06-DEC 00:00 06-DEC 06:00 06-DEC 12:00 06-DEC 18:00 STATUS VALI::TOOL noise outlier check EVENT SERVICE MONTH | WEEK | DAY | HOUR 06-12-2016 20:55
	3	**Parameter info**	Additional information on how results are produced and used	→ *Parameter Details (see 1.3)*  Dissolved Oxygen 4.89 ppm Measurement date: 20-09-2016 12:20:00 Measured value: 4.89 ppm Limits: 0.00 ... 25.00 ppm Alarm limits: -Inf ... Inf ppm Status: O.K. vali::tool active ana::tool no alarm clean value oxi 2350

1.1 Parameter Name

The name for a parameter can be chosen freely and is independent from the name of the respective sensor (see 6.4.5). It is used for display in *moni::tool* as well as for identifying entries in the various log files.

1.2 Parameter Results

	No.	Element	Information	Push-Function
 Measured value: 6.82 6.79 mg/l 19-09-2016 19:48 	1	**Measured value**	Reading as delivered by the sensor (visible only when “clean value” is displayed as parameter reading)	→ *Parameter Time Series* *(see 2.5)*
	2	**Parameter reading**	Reading of the parameter (either measured or clean value)	
	3	**Unit**	Physical unit of the parameter	
	4	**Time stamp**	Date and time of the measurement	

1.2.1 Measured Value

This is the value which has actually been produced by the respective sensor, i.e. without applying *vali::tool*'s cleaning algorithms (which is also indicated in *Parameter Info* - see below). Accordingly, it is displayed only if a cleaned value is displayed,

1.2.2 Parameter reading

If the clean value as calculated by *vali::tool* is selected for display, the cleaned value is shown as parameter reading which might differ from the *Measured Value*, which is then displayed above (see also 1.3.3).

1.2.3 Unit

The physical unit of a parameter can be assigned in the parameter configuration.

1.2.4 Time Stamp

The displayed the date and the time show when the measurement of the displayed parameter reading took place. It is also used to identify the respective measurement in the results data base, e.g. for display in *Time Series*.

1.2.5 Functions

Besides displaying the information as described above, *Parameter Results* has two more functions:

- The **background color** provides information on the measurement quality.

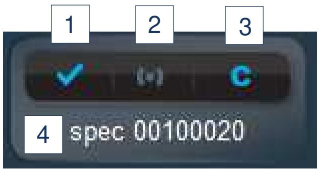
White	Displayed measurement okay
Red	An error occurred – see status message
Grey	The displayed result is older than three measurement intervals

- **Pushing** the display field switches directly to a ***specific view*** of *Time Series* and will display measured and cleaned values of the respective parameter over the last 24 hours (see also 2.5)

⇨ *Relevant **Manual sections**:*

Parameter settings	Service / Terminal / Parameters	6.4.5, p. 44
Parameter validation with *vali::tool*	Service / Sensors / Parameters	6.5.4, p. 60
Results analysis with *Time Series*	Time Series	2, p. 22
Checking the station status	Status	4, p. 27

1.3 Parameter Info

	No.	Element	Push-Function
	1	**vali::tool status**	→ *Parameter Details* *(see 1.3.5)*
	2	**Alarm status**	
	3	**Value Type**	
	4	**Sensor name**	

1.3.1 vali::tool Status

The colour of the checkmark indicates the status of the *vali::tool* component:

✓ *vali::tool* is active and monitors the parameter permanently
Respective information is available within the system and written into output files

✓ *vali::tool* is inactive, no respective information is available for this parameter

1.3.2 Alarm Status

If *ana::tool* is installed and used for generating alarms from a parameter's results, this is indicated by the *alarm symbo*l. The actual alarm status is indicated by the color of the symbol.

(•) *Grey*: The current parameter reading is within the limits configured for alarm / warning

(•) *Yellow and blinking*: The current parameter reading is outside the limits configured for alarm/warning
➔ ALARM / WARNING event has been detected by the system.

⚠ The alarm events are visible within the parameter result file. For (simple) parameter the information is included within the "clean value" status (0xVVVV.vvvv). For virtual parameter (spectral alarm or pattern alarm) the information is included within parameter status (0xtttt.PPPP.pppp).

1.3.3 Value Type

The symbol in this field indicates which type of values is displayed as the parameter result.

C Clean value display is active (measured value from the sensor is displayed in small letters additionally).

C Clean value display is inactive, the value measured by the sensor is displayed.

V The V indicates that this is a virtual parameter. This parameter is not measured by a physical sensor but generated on base of a mathematical calculation and hence not observed by vali::tool. Accordingly, no clean value is available for display.

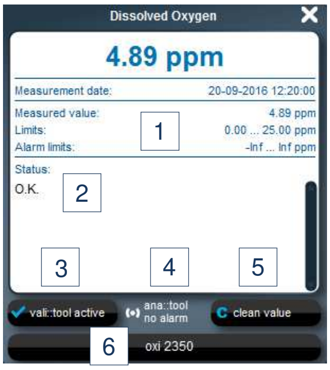
⚠ When *vali::tool* is active, both non-corrected ("*measured*") and validated ("*clean*") results are stored in the database, irrespective of the value type selected for display.

1.3.4 Sensor Name

The name of a sensor is configured during its installation for easy identification. But the name can also be changed later on.

1.3.5 Parameter Details

Pushing anywhere on *Parameter Info* will pop up additional detailed information about the parameter and also provide access to configuration functions.

	No.	**Element**	**Information**	**Push-Function**
	1	**Limits**	Measuring and alarm limits	-
	2	**Status**	Parameter status information	-
	3	**vali::tool**	Status of vali::tool	Activate / deactivate
	4	**Alarm**	Alarm status	-
	5	**Clean value**	Value type	Toggle between measured / cleaned value
	6	**Sensor**	Sensor name	→ *Sensor Details* *(see 1.3.6)*

Dissolved Oxygen

4.89 ppm

Measurement date: 20-09-2016 12:20:00

Measured value: 4.89 ppm

Limits: 0.00 ... 25.00 ppm

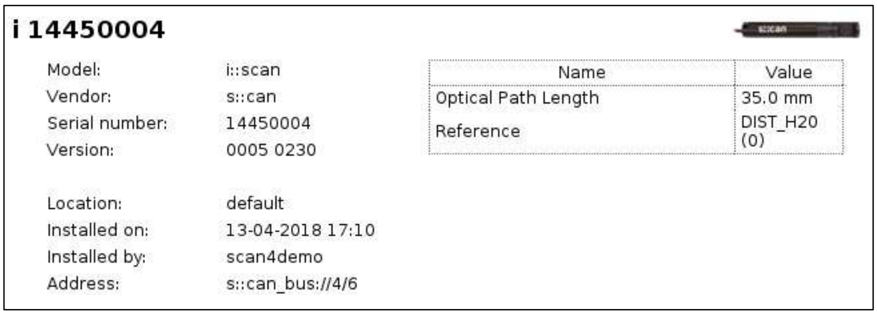
Alarm limits: -Inf ... Inf ppm

Status:

O.K.

1.3.6 Sensor Details

Pushing the sensor name in *Parameter Details* will pop up additional detailed information about the parameter.



i 14450004

Model: i::scan
Vendor: s::can
Serial number: 14450004
Version: 0005 0230

Location: default
Installed on: 13-04-2018 17:10
Installed by: scan4demo
Address: s::can_bus://4/6

Name	Value
Optical Path Length	35.0 mm
Reference	DIST_H20 (0)

⇨ *Relevant **Manual sections**:*

Parameter settings	Service / Terminal / Parameters	6.4.5, p. 44
Parameter validation with *vali::tool*	Service / Sensors / Parameters	6.5.4, p. 60
Defining static alarms	Service / Terminal / Parameters	6.4.5, p. 45
Parameter monitoring with *ana::tool*	Service / ana::tool	6.7, p. 67
Managing alarms	Alarms	5, p.30
Graphical results analysis	Time Series	2, p. 22
Configure virtual parameters	Service / Terminal / Parameters	6.4.5, p. 45
Sensor settings	Service / Sensors / Sensor Settings	6.5.1, p. 59

⇨ *Available **Quick reference guides**:*

Manuals	*moni::tool / Service_Guides*	note_moni-tool_overview

Please refer to the s::can Customer Portal!

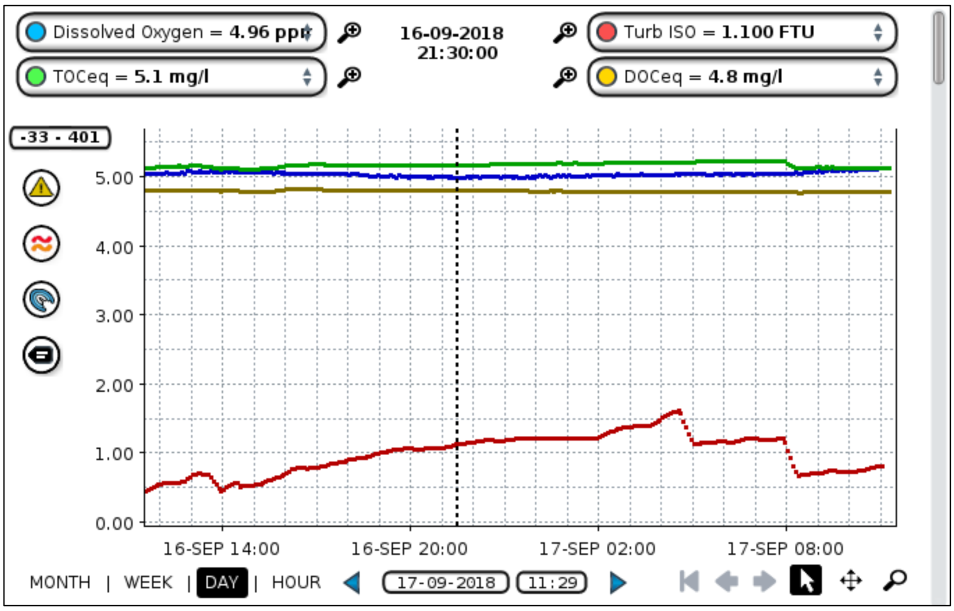
2 Time Series

2.1 Overview

The standard view of the *Time Series* screen, is displayed when the respective tab is selected. It shows historical parameter results graphically.
As a default view the last day (24 hours) of results for the first four parameters are presented.

Using the various screen elements, the display can be adapted to the needs

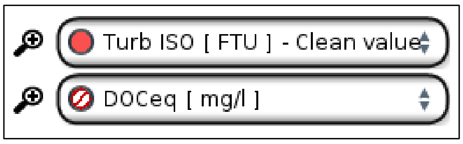
- Parameter selection (2.2);
- Axes scaling (2.3);
- Data selection (2.4);
- Data scaling (2.5).



2.2 Selecting Parameters

By default four parameters are combined in a single graph, based on the order used on the *Values* screen. If more than four parameters have been configured several graphs are produced automatically. This is indicated by the active scroll bar which can also be used to navigate between the different graphs.

However, the composition of parameters displayed together in a single graph can also be chosen freely.

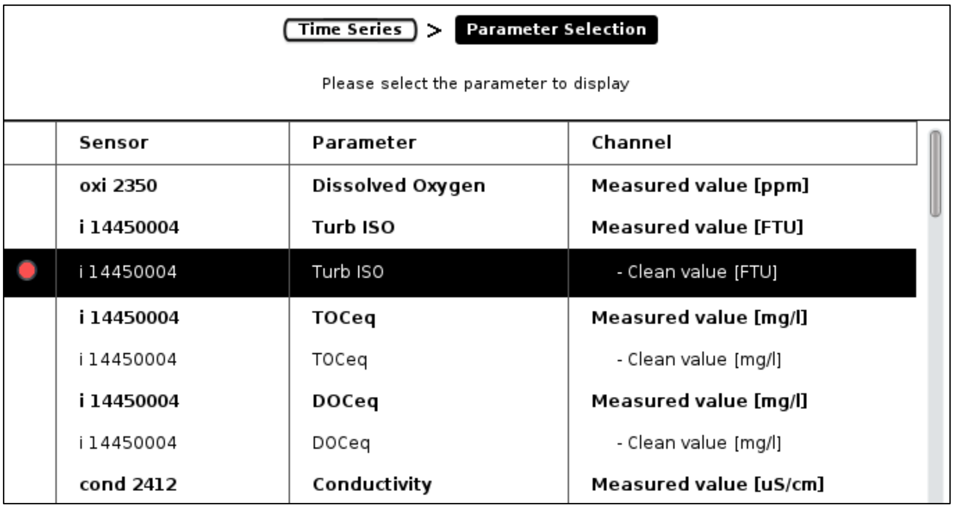


Firstly, a parameter can be temporarily hidden by pushing the respective parameter's coloured marker in the legend (the marker will then change into a red / white symbol). A hidden parameter can be displayed again by pushing its symbol once more.

Secondly, parameters displayed in a graph can be replaced by pushing their name in the legend on top of the graph.

This will open a selection list, from which the desired parameter can be selected. The parameter to be replaced is marked in the list as it is in the legend.

The selection list includes not only all currently active parameters, but also historical parameters, i.e. parameters that have meanwhile been removed. Respective results exist only for the phases when the parameters actually existed and accordingly can be displayed only for those periods.



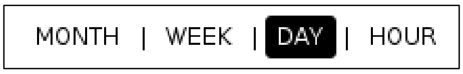
Please select the parameter to display

	Sensor	Parameter	Channel
	oxi 2350	**Dissolved Oxygen**	**Measured value [ppm]**
	i 14450004	**Turb ISO**	**Measured value [FTU]**
●	i 14450004	Turb ISO	- Clean value [FTU]
	i 14450004	**TOCeq**	**Measured value [mg/l]**
	i 14450004	TOCeq	- Clean value [mg/l]
	i 14450004	**DOCeq**	**Measured value [mg/l]**
	i 14450004	DOCeq	- Clean value [mg/l]
	cond 2412	**Conductivity**	**Measured value [uS/cm]**

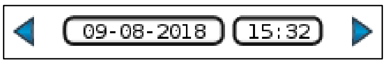
2.3 Axes Scaling

For exploring parameter data effectively it is useful to scale the **x-axis (displayed period)** and the **y-axis (parameter values)** of the graphs appropriately. In this respect it can also be helpful to configure the parameters displayed together accordingly (see 2.2) as the average values of different parameters can differ significantly, hence making it difficult to produce meaningful graphs.

Selecting the displayed period



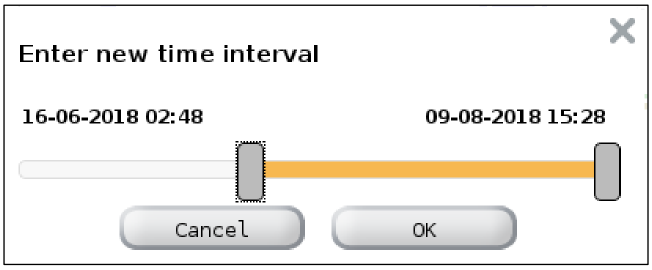
The default view in *Time Series* shows the results collected over the last 24 hours ("*Day*"). Other periods are activated by pushing the respective buttons.



09-08-2018 15:32

The time stamp of the last displayed value is shown in the respective fields which can also be used for entering the desired values directly. Pushing the blue triangles shifts the displayed data-window for half of the currently selected period.

Another possibility to change the displayed period is to push directly the x-axis which makes a window as shown on the right pop up. Here both start and end date of the displayed period can be selected directly by pulling the respective markers (see also Data Navigation below).



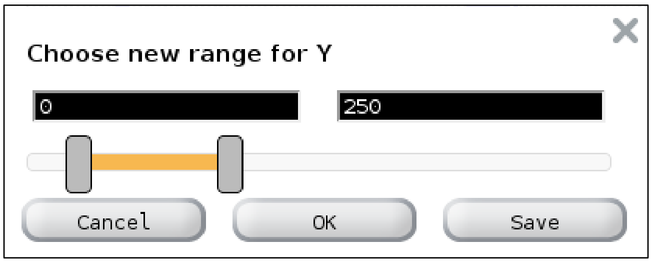
Enter new time interval

16-06-2018 02:48 09-08-2018 15:28

Selecting the displayed values

Automatic „y-axis zoom“ can be done by activating the magnifying glasses shown next to each parameter name which will scale the y-axis so that the minimum and maximum values of the respective parameters can be displayed.

Besides, pushing directly the y-axis produces a similar window as described above which can be used accordingly.



Choose new range for Y

0 250

The selected range can be stored in the button for quick y-axis setting on the according display by pushing *Save*.

Zoom

The activation of the magnifying class allows a free and simultaneous selection of both the displayed period and the displayed values.

Undo – Redo

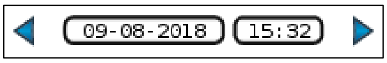
All axis-related changes can be managed with the following graphical elements.

The *Reset Button* will undo all zoom and scroll (see below) functions performed in the current graph. *History Back* will undo the last action while *History Next* can be used to redo an action that was just undone.

In all *Time Series* views with an x-axis comprising more than six hours aggregated data are displayed. This means that the number of data points shown has been reduced and the larger the displayed time window the fewer data points are shown per interval. As a result of this data aggregation the full dynamics of the data might not always be visible! However, when zooming in far enough, each single measurement will become visible again.

2.4 Data Navigation

Besides the scaling of axes *Time Series* allows also to navigate through historic data.


09-08-2018 15:32

The date and time fields always indicate the newest displayed data. They can also be used to enter values directly while the blue arrow buttons *Older* and *Newer* can be used to shift the data window a half of the selected display period.

By activating the *Move* button the data window can be moved around freely with the cursor while maintaining the selected span of the both axes.

2.5 Data Exploration

Once the axes are scaled and the appropriate period has been selected, the displayed data can be explored further (see Figure in section 2.1 also).

When the *Data Selection* button is activated a yellow marker line is displayed within the data window which can then be snapped to every timestamp displayed. Simultaneously, the respective time stamps of the marked data as well as the corresponding parameter values are displayed in yellow letters. Details for each parameter can then be displayed by pushing the parameters' names. The marker is deactivated by pushing the arrow button again.

Other possibilities for data exploration are provided through the list of buttons on the left which are explained below.

The first button allows selecting one parameter for which then the measured and the cleaned values are displayed graphically, together with the status over time. This is also the view which can be accessed directly from the *Values* tab by pushing a parameter's result and from the *Alarm* tab. Other parameters can be displayed using the scroll bar.

The second button allows selecting two parameters which are then displayed together on two y-axes which makes it easier to detect mutual dependencies and joint influences. Again, the scollbar is working to compare the first selected parameter with all the others.

The fingerprint button changes to the *Fingerprint* view for the currently selected timestamp (using the *Arrow* button). This fingerprint can then be compared directly to another one. For further details please refer to the *Fingerprint* chapter (3).

The *Tag* button can be used to assign an individual name to the currently selected timestamp. Tagged measurements can then be selected for displaying them while tag names can be exported into files. Please refer also to 6.4.4 / Measurement Tags.

The Back button, which is visible when the fingerprint of a selected measuring point is displayed, will switch back to the previous time series view.

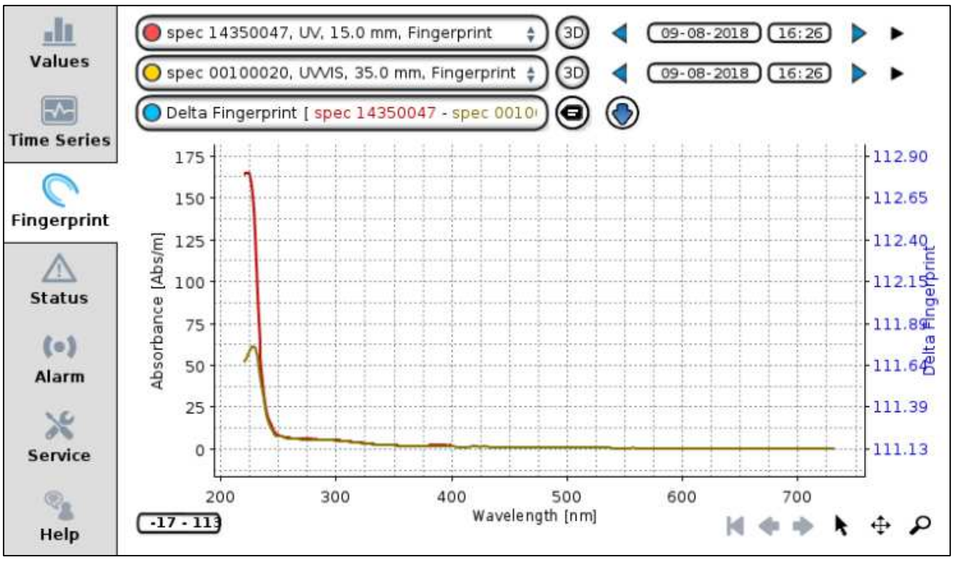
When data exploration changed to another view, the *Time series* button brings the user back to the standard time series view.

⇨ *Relevant* ***Manual sections****:*

Parameter settings	Service / Terminal / Parameters	6.4.5, p. 44
Parameter validation with *vali::tool*	Service / Sensors / Parameters	6.5.4, p. 60
Parameter monitoring with *ana::tool*	Service / ana::tool	6.7, p. 67
Measurement tags	Service / Terminal / Settings / Measurement Tags	6.4.4, p. 44

3 Fingerprint

3.1 Standard view

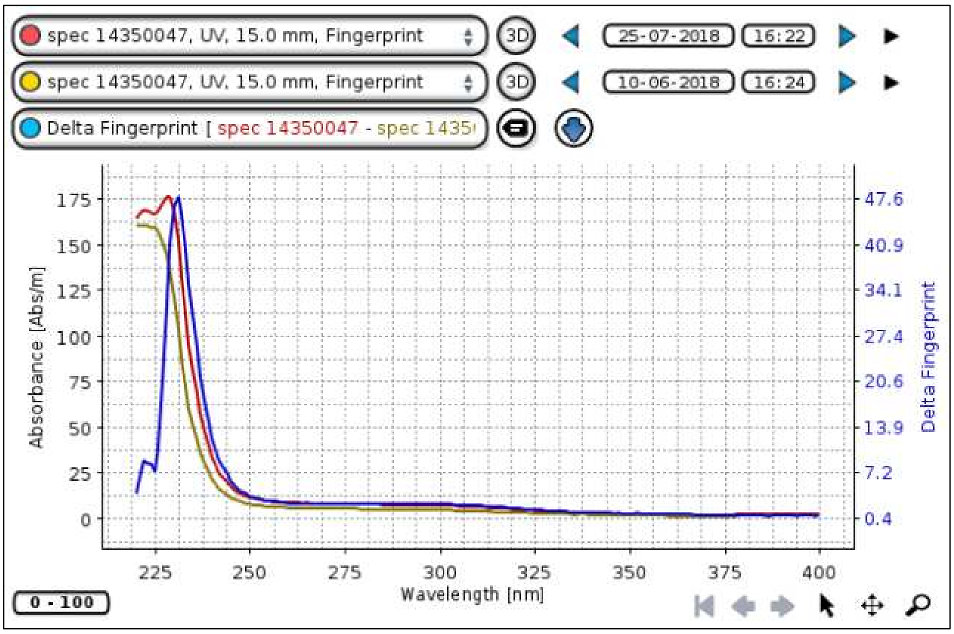


When one or more spectro::lysers are installed, the *Fingerprint* screen as a standard shows the most recent absorption spectrum („fingerprint“) measured by these sensors.

On the horizontal axis (x-axis) the wavelengths in nm are presented while on the vertical axis (y-axis) the measured absorbance values in Abs/m are displayed.

Two fingerprints can be displayed simultaneously where the second fingerprint can be either from another time stamp or from another spectro::lyser.

Selecting the sensor(s) to be displayed is done by pushing the parameter names in the legend on top of the graph.



When a second fingerprint from the same sensor is selected, the difference between the two fingerprints (*Delta Fingerprint*) is shown as a blue line scaled individually on its own (right) y-axis. With this method developments in the media composition over time can be easily detected.

For selecting the time stamps of the displayed fingerprints the following options exist:

- Entering date and time directly in the respective legend fields.
- Using the blue navigation arrows which will move to the previous or next fingerprint.

3.2 View Configuration

Configuring the view of *Fingerprint* according to the individual preferences and needs can be done similar to how it has been described under *Time Series* by making use of the same buttons and functions (axes scaling, zooming, moving undoing, data selecting).

It is also possible to temporarily remove fingerprints from the screen. Like for *Time Series* this is done by pushing the colored marker of the fingerprint in the legend. This will change the marker into a red and white symbol and the respective fingerprint will be hidden. It can be displayed again by pushing the marker symbol once more.

3.3 Special Features

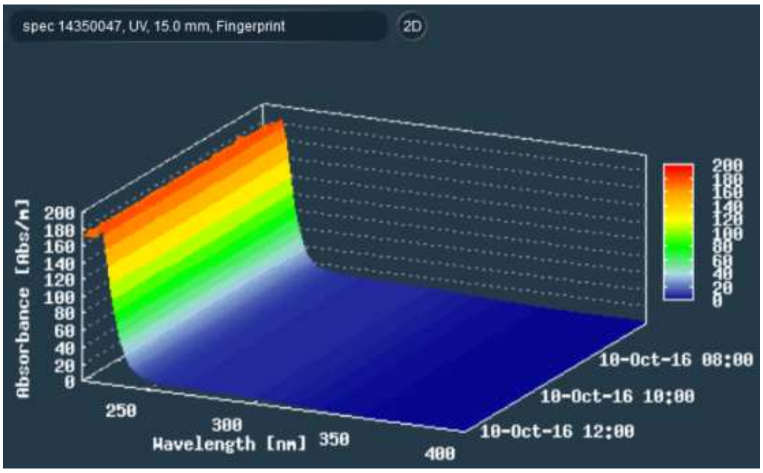
While basically working with fingerprints is very much like manipulating time series, *moni::tool* also comprises some features which exist only for analyzing data from spectro::lysers.

Animation

When the selected time stamp is older than the newest available data the *Play* buttons beside the time stamp fields allows starting an animation. One fingerprint after the other is loaded and displayed automatically, hence providing a lively impression of how quality developed over time.

During the animation the *Play* button changes to *Pause* and can be used to stop the animation.

3D Graph



Besides the standard two-dimensional view it is also possible to show fingerprints from one spectro::lyser in a three- dimensional graph which provides a good impression of quality developments.

This option is activated by pushing one of the *3D* buttons in the legend next to the name of the sensors. Each button will link to a 3D graph for the respective sensor, displaying the fingerprints of six hours before the entered time stamp.

For re-activating the normal 2D-display either the *2D* button within the 3D-view can be used or the *Fingerprint* tab can be reloaded.

Wavelength time series

When the *Data Selection* tool is activated the *3D* buttons as described above change into the *Wavelengths* button. A click on it changes to a special view within the *Time Series* tab showing data of four wavelengths of the respective spectro::lyser. As a standard initially the first four wavelengths are displayed, subsequent wavelengths can be accessed using the *Scroll Bar*.

The *Return* button can be used to get back to the previous *Fingerprint* view.

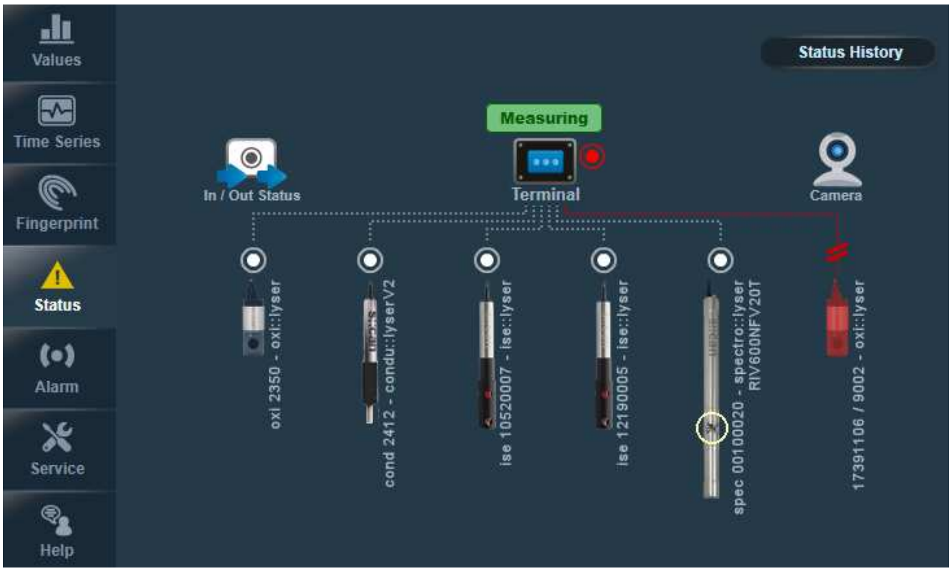
Data download

The detailed data from spectro::lyser can be used in a variety of ways which go beyond the capacities of the standard terminals. Therefore the *Download* button beside the *Delta Fingerprint* field offers the opportunity select one of the installed sensors and to download the fingerprint data for the indicated time stamp. The respective data is saved as a csv-type file which can be easily processed with standard calculation software.

4 Status

4.1 Overview

The *Status* screen provides an overview of the active monitoring system, including the terminal, all sensors, in- and output modules as well as other devices (e.g. camera) that are currently configured in *moni::tool*.


Values
Time Series
Fingerprint
Status
Alarm
Service
Help
Status History
Measuring
In / Out Status
Terminal
Camera
oxi 2350 - oxi::lyser
cond 2412 - condu::lyserV2
ise 10520007 - ise::lyser
ise 12190005 - ise::lyser
spec 00100020 - spectro::lyser RIV600NFV20T
17391106 / 9002 - oxi::lyser

Within this station overview various coloured circles indicate the components' status:

- ⚪ *White* - OK
- 🟡 *Yellow* – spectrometer measuring
- 🔴 *Red* - error or fault

A *red connection* between the terminal and a sensor together with a *red sensor symbol* indicates that communication with the sensor is not possible.

Above the terminal symbol the remaining time until the next measurement or Measuring is displayed.

Whenever any problem has been detected the *Status* tab is animated with a yellow sign.

For each system component further status information can be retrieved by pushing the respective symbol. In case of problems the messages provide the following information:

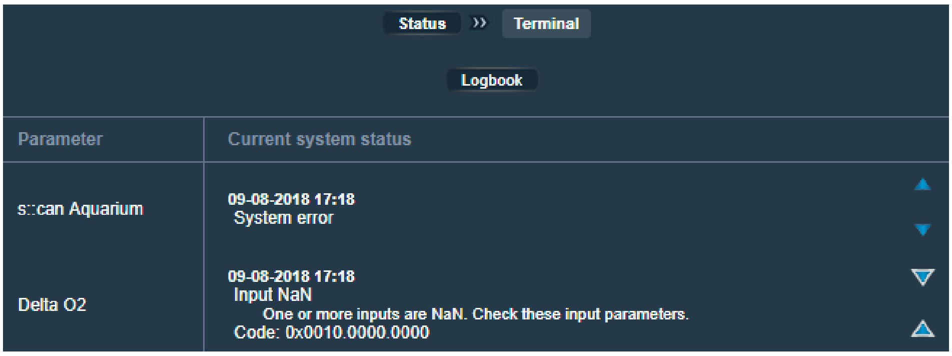
- **Origin** of the error (e.g. the related parameter of the sensor)
- **Timestamp** indicating when the error occurred.
- General **description** of the error.
- A **code** for communicating the error to the s::can sales partner (see Part D, chapter 2.2)

Pushing the general error description provides the detailed information and suggestions on how to resolve the problem.

The *Status History* button leads to a graphical overview of status and *vali::tool* messages.

On top of the details screens a "navigation line" indicates the hierarchical level of the currently active screen. Its elements can also be used for navigating.

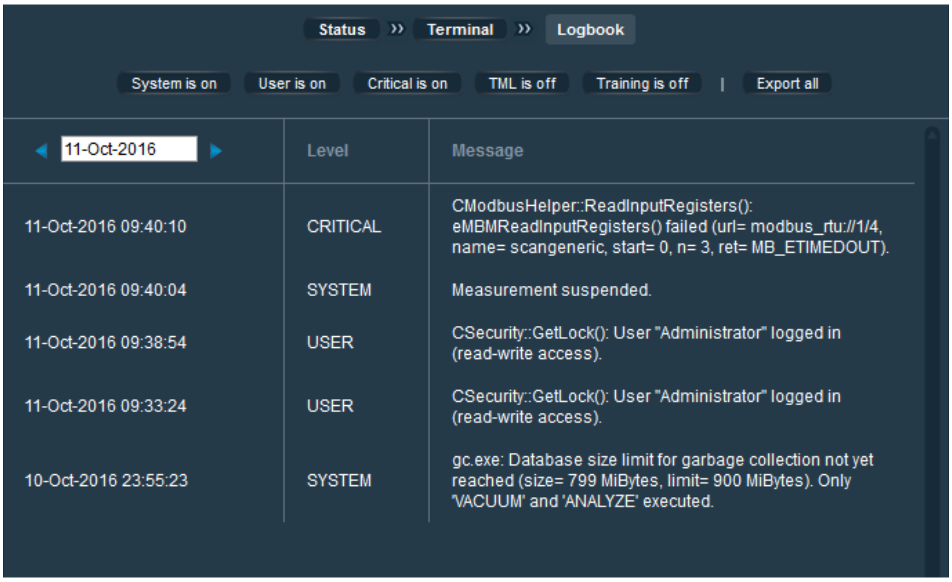
4.2 Terminal



Parameter	Current system status
s::can Aquarium	09-08-2018 17:18 System error
Delta O2	09-08-2018 17:18 Input NaN One or more inputs are NaN. Check these input parameters. Code: 0x0010.0000.0000

Pushing the *Terminal* icon opens the respective *Status* view, displaying all relevant messages.

Additional details on the messages, e.g. error codes and clear text messages can be displayed by pushing the blue triangles.



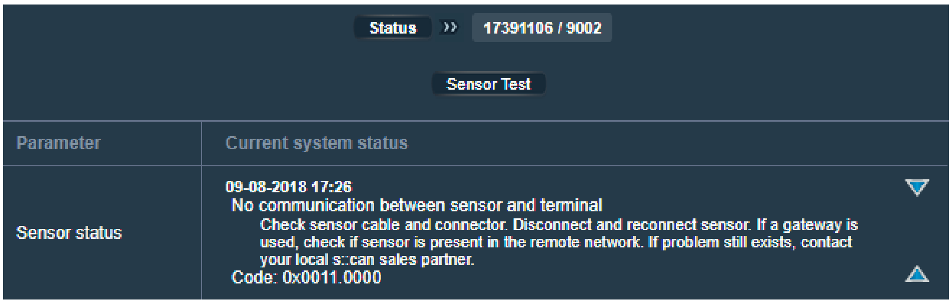
11-Oct-2016	Level	Message
11-Oct-2016 09:40:10	CRITICAL	CModbusHelper::ReadInputRegisters(): eMBMReadInputRegisters() failed (url= modbus_rtu://1/4, name= scangeneric, start= 0, n= 3, ret= MB_ETIMEDOUT).
11-Oct-2016 09:40:04	SYSTEM	Measurement suspended.
11-Oct-2016 09:38:54	USER	CSecurity::GetLock(): User "Administrator" logged in (read-write access).
11-Oct-2016 09:33:24	USER	CSecurity::GetLock(): User "Administrator" logged in (read-write access).
10-Oct-2016 23:55:23	SYSTEM	gc.exe: Database size limit for garbage collection not yet reached (size= 799 MiBytes, limit= 900 MiBytes). Only 'VACUUM' and 'ANALYZE' executed.

Pushing the *Logbook* button in the terminal status window opens a list with all logbook messages. The types of messages (*Level*) to be displayed can be configured using the buttons above the list.

Also the date of the messages can be selected in the respective field.

Pushing the *Export all* button leads directly to a file dialog pop-up for exporting the available logbook entries to a compressed zip-File.

4.3 Sensors

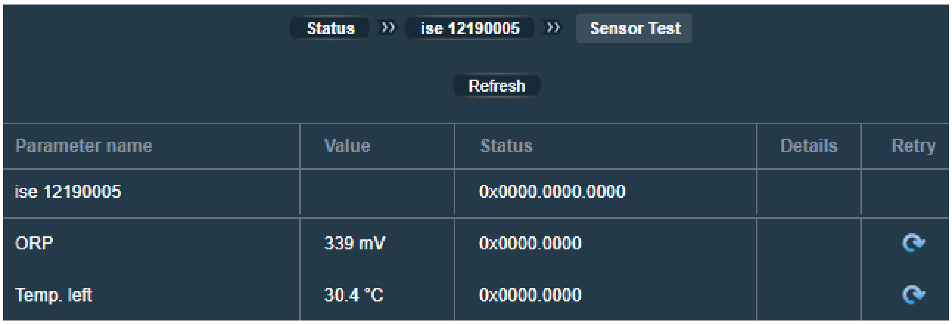


Parameter	Current system status
Sensor status	09-08-2018 17:26 No communication between sensor and terminal Check sensor cable and connector. Disconnect and reconnect sensor. If a gateway is used, check if sensor is present in the remote network. If problem still exists, contact your local s::can sales partner. Code: 0x0011.0000

Pushing the icon of any sensor opens the respective *Status* view, displaying all relevant messages for both the hardware and the measured parameters.

Additional details on the messages, e.g. error codes and clear text messages can be displayed by pushing the blue triangles (0xTTTT.SSSS.ssss).

Besides the standard status messages as described above, the sensor status screen provides also a *Sensor Test* button.



Parameter name	Value	Status	Details	Retry
ise 12190005		0x0000.0000.0000		
ORP	339 mV	0x0000.0000		⟳
Temp. left	30.4 °C	0x0000.0000		⟳

Pushing this button collects and displays the current readings and status information from the sensor.

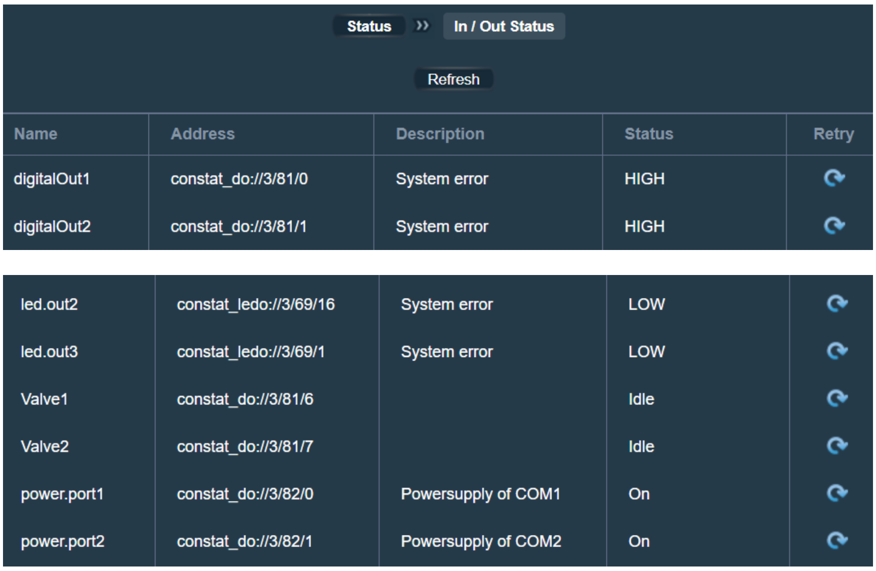
The information can be refreshed either by pushing *Refresh*” or for each parameter individually by pushing the *Retry* icons on the right side.

4.4 Other components

4.4.1 Input / Output Modules

The In / Out Status window showing all configured interfaces as well as their current status is displayed which can be refreshed manually can be opened by pushing the respective icon.

The Address is displayed in user level *Expert* only.

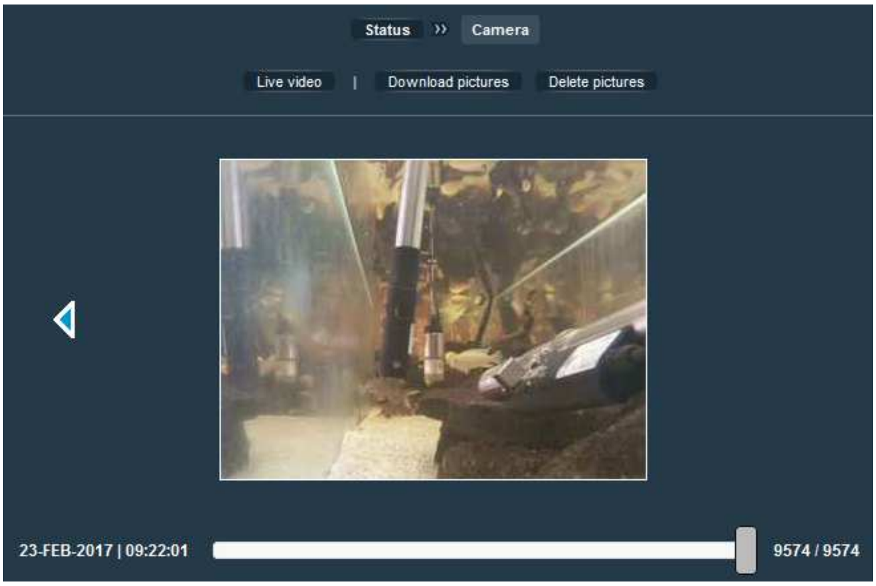


Name	Address	Description	Status	Retry
digitalOut1	constat_do://3/81/0	System error	HIGH	⟳
digitalOut2	constat_do://3/81/1	System error	HIGH	⟳
led.out2	constat_ledo://3/69/16	System error	LOW	⟳
led.out3	constat_ledo://3/69/1	System error	LOW	⟳
Valve1	constat_do://3/81/6		Idle	⟳
Valve2	constat_do://3/81/7		Idle	⟳
power.port1	constat_do://3/82/0	Powersupply of COM1	On	⟳
power.port2	constat_do://3/82/1	Powersupply of COM2	On	⟳

4.4.2 Camera

If a camera is part of the monitoring system the respective status window shows the newest picture made and provides the options to launch a live video or to download the saved pictures.

Please be aware that depending on the speed of the network connection displaying images might take some time.

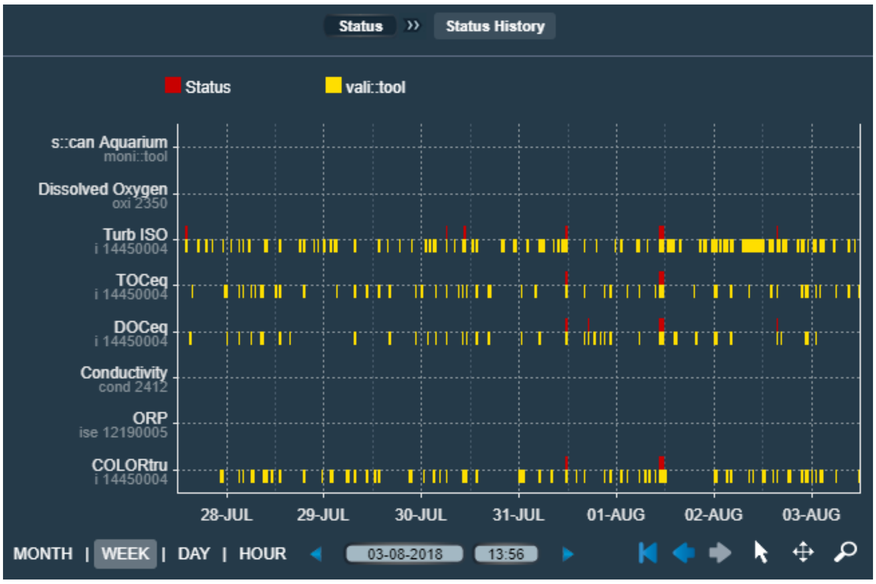


4.5 Status History

Pushing the *Status History* button on the status overview screen's upper right corner opens a graph displaying the history of both the system status and, if it is activated, the *vali::tool* status.

The graph shows for each parameter when a status error message has been recorded (red marks) and when *vali::tool* reported suspicious data quality (yellow marks).

The default view shows the status history for the previous day but the shown period can be adjusted using the x-axis scaling tools (see also section 2.3).



If not all configured parameters can be displayed in one window the scroll bar will be activated.

5 Alarm

5.1 Background

Basically warnings and alarms can be triggered in three different ways:

- ***Static alarms*** based on checking single parameter readings between an upper and a lower limit;
- ***Spectral alarms*** based on data from spectro::lysers;
- ***Pattern alarms*** based on the combined signals of several sensors.

Both, warnings and alarms are always based on the same criteria but a warning is issued already at a certain level before the actual alarm limit has been reached.

For further details on alarms and the respective configuration steps please refer also to chapters 6.4.5 and 6.5.4 dealing with the *Parameters* sections of individual sensors and the monitoring system, respectively.

Static alarms

For each parameter the upper and lower thresholds can be set individually. Whenever the cleaned value is outside the defined boundaries an alarm will be triggered for the parameter.

Spectral alarms

This alarm type is based on virtual parameters building on a combination of wavelength measurements from spectrometer sensors. For further details on the configuration of spectral alarm parameters please refer to chapter 6.4.5. Information on the capacities of the ana::tool software in monitoring virtual parameters is presented in chapter 6.7.

Pattern alarms

This alarm type is based on virtual parameters building on a combination of several parameters from one or several sensors. For further details on the configuration of pattern alarm parameters please refer to chapter 6.4.5. Information on the capacities of the ana::tool software in monitoring virtual parameters is presented in chapter 6.7.

5.2 Overview

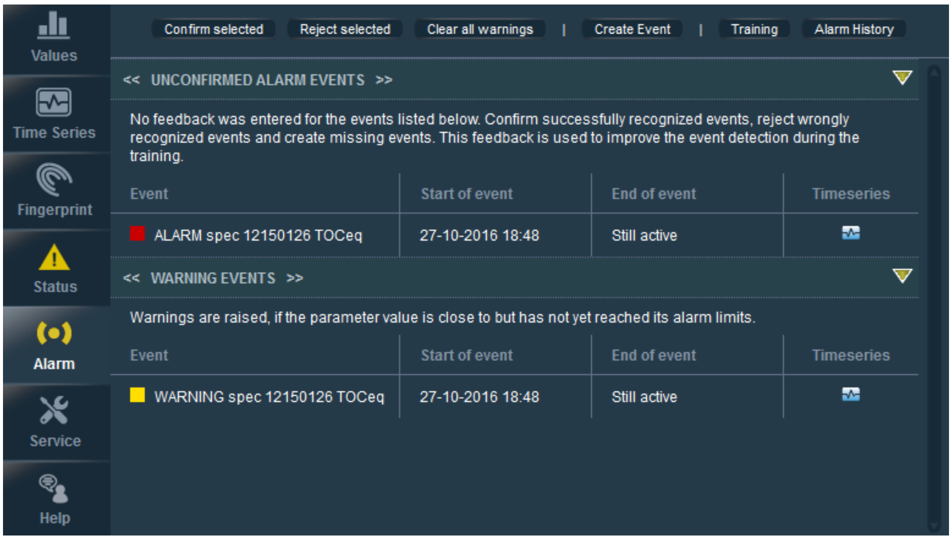
The *Alarm* main window provides an overview of all currently pending warnings and alarms.

Each entry provides the following information:

- Source of event
- Start and end of event

The headline of each column can be used for sorting the recorded events.

Using the *Timeseries* icon of an entry, the event can be explored in the respective view of the *Time Series* tab (see also 2.5).



<< UNCONFIRMED ALARM EVENTS >>

No feedback was entered for the events listed below. Confirm successfully recognized events, reject wrongly recognized events and create missing events. This feedback is used to improve the event detection during the training.

Event	Start of event	End of event	Timeseries
🟥 ALARM spec 12150126 TOCeq	27-10-2016 18:48	Still active	

<< WARNING EVENTS >>

Warnings are raised, if the parameter value is close to but has not yet reached its alarm limits.

Event	Start of event	End of event	Timeseries
🟨 WARNING spec 12150126 TOCeq	27-10-2016 18:48	Still active	

Whenever the system identified an event, user feed-back must be provided, firstly, for acknowledging the respective information and secondly, because a correct working of ana::tool depends on secured data quality based on user feedback.

Warnings have to be cleared.

⚠ As long as alarms or warnings are pending, the overall system status will be set to *Alarm*, which is also indicated by a yellow blinking tab icon

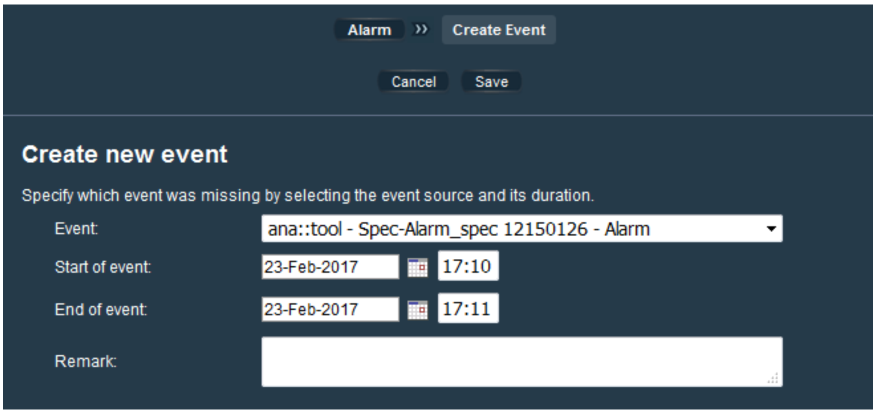
If the detected event is not considered to be a real alarm situation it has to be rejected by marking the respective entry and pushing *Reject selected* afterwards. In all other cases – also when unsure if the system has identified a real event - the alarm should be confirmed by marking the respective alarm line and pushing *Confirm selected* afterwards.

In both cases a new page will appear afterwards in which further details about the event can be entered.

Neither confirmed alarms nor warnings will have an effect on the next training. Only rejected alarms and manually created alarms (in case of missed events, see below) will change the *ana::tool* training dataset and will hence have an impact on the results of the next training.

⚠ Once an alarm has been triggered no other events will change eventually assigned digital outputs or notifications. Therefore pending alarms should be either confirmed or rejected as soon as possible so the system becomes ready to react on new events.

5.3 Create Events



Create new event

Specify which event was missing by selecting the event source and its duration.

Event: ana::tool - Spec-Alarm_spec 12150126 - Alarm

Start of event: 23-Feb-2017 17:10

End of event: 23-Feb-2017 17:11

Remark:

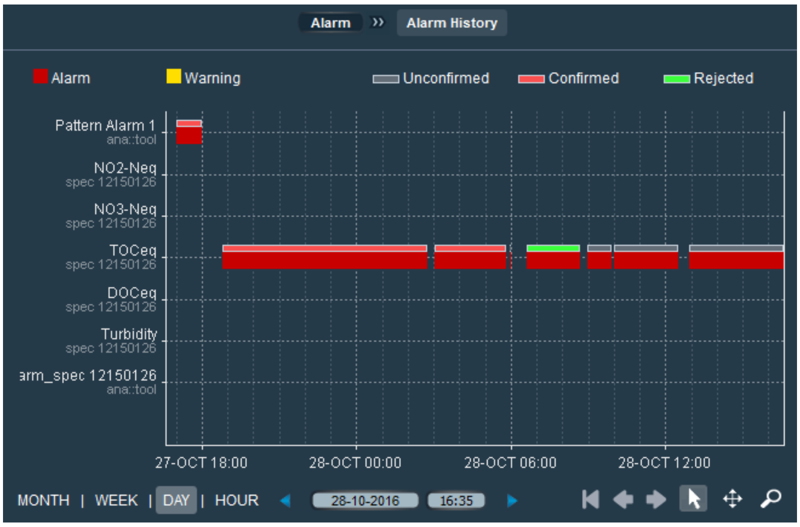
Relevant events which were not detected by *ana::tool* should be made known to the system by using the *Create* function.

Consequently, a window will pop up to enter the following information:

- Parameter which triggered the alarm;
- Start and end time of the alarm;
- Additional remarks.

Pushing *Save* will store the customer created alarm which is automatically considered as *confirmed.*

5.4 Alarm History

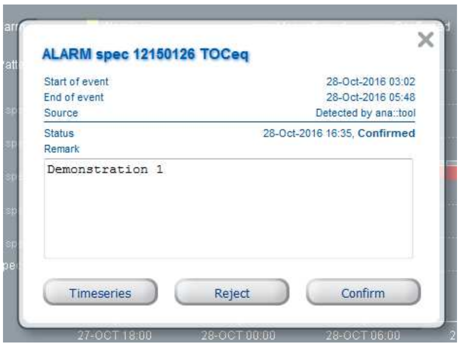


The entry *Alarm History* provides a graphical overview of the alarm status of all parameters over time.

Yellow indicates that a parameter was in the state of *warning* and *red* indicates a state of *alarm.*

Furthermore, the actual status of the currently saved events is indicated (*Unconfirmed*, *Confirmed*, *Rejected*).

With the activated "*Select*" tool (white arrow) individual events can be marked. This will open a dialogue window providing detailed information about the event. Furthermore, a remark on the event can be added and it is also possible to modify the event's status. Events created by the user can also be deleted.



ALARM spec 12150126 TOCeq

Start of event 28-Oct-2016 03:02

End of event 28-Oct-2016 05:48

Source Detected by ana::tool

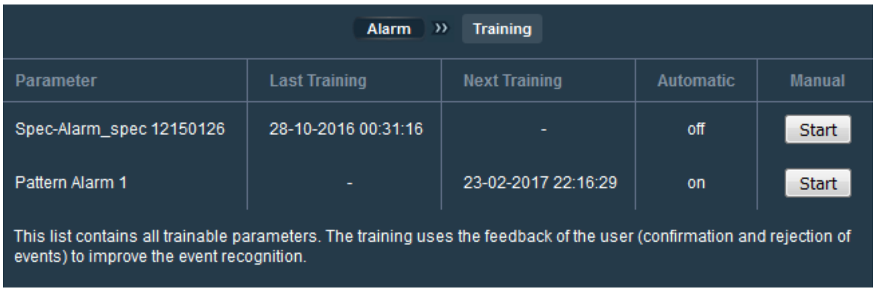
Status 28-Oct-2016 16:35, **Confirmed**

Remark

Demonstration 1

5.5 Training

As mentioned already earlier, the system’s capabilities for detecting spectral and pattern alarms based on the *ana::tool* component can (and should!) be trained through learning from user feed-back (see above).



Parameter	Last Training	Next Training	Automatic	Manual
Spec-Alarm_spec 12150126	28-10-2016 00:31:16	-	off	Start
Pattern Alarm 1	-	23-02-2017 22:16:29	on	Start

This list contains all trainable parameters. The training uses the feedback of the user (confirmation and rejection of events) to improve the event recognition.

Pushing the button *Training* opens a window providing an overview of all trainable parameters, their last training and the planned next training (if *Automatic* is on).

Besides, also a *manual training* can be initiated through the *Start* button.

If the user has no rights to change settings, the window is in read mode only.

For detailed information on training and other aspects of alarm parameters please refer to the chapter on *ana::tool* under the *Service* tab (6.7)

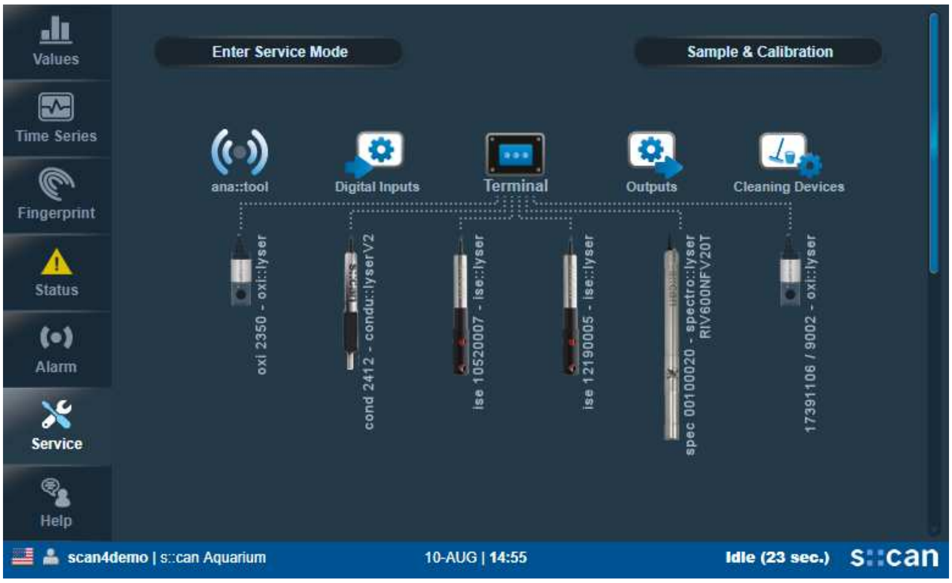
Relevant ***Manual sections****:*

Configure parameters	Service / Terminal / Parameters	6.4.5
Configure sensor parameters	Service / Sensors / Parameters	6.5.4
Parameter monitoring with *ana::tool*	Service / ana::tool	6.7

6 Service

6.1 Overview

The *Service* tab provides access to all functions related to configuration, service and maintenance of all the monitoring station's components.



Service can be accessed only when a user is logged in.

The actually available options depend on the specific rights granted to the respective users, with insufficient rights read-only access is possible to some areas.

From the tab's main screen all elements of the monitoring system can be accessed via their respective icons. If more than 6 sensors are installed, additional icons for active or new sensors can be found after scrolling down to the next page.

Besides, the two buttons *Enter Service Mode* and *Sample & Calibration* provide access to additional specific tasks.

The table below provides an overview on the components accessible via the various elements as well as the respective chapters.

Enter / Leave Service Mode (6.2)
- Suspend / continue measurements

Sample & Calibration (6.3)
- Take samples
- Sample list

Terminal (6.4)
- Measurement
- *con::cube*
- Network
- Settings
- Parameters
- Date & Time
- Terminal Language
- Display
- Security
- Extras

Sensors (6.5)
- Sensor settings
- Remove sensor
- Replace sensor
- Parameters
- Global calibration
- Calibrate sensor
- Optical path length
- Function check

Add New Sensor (6.6)
- s::can sensors
- Analog sensors
- Sensors via TCP
- 3rd party Modbus sensors

ana::tool (6.7)
- Manage spectral and pattern alarm parameters
- *ana::tool* training

Digital Inputs (6.8)
- List al *con::cube* digital inputs

Outputs (6.9)
- Analog outputs
- Digital outputs
- Fieldbus outputs
- File output
- TML
- Auto-sampler
- SMS Notification

Cleaning Devices (6.10)
- Configure cleaning devices
- Test cleaning devices
- Remove cleaning devices

⇨ *Available **Quick reference guides**:*

Manuals	*moni::tool / Service_Guides*	note_moni-tool_overview

Please refer to the s::can Customer Portal!

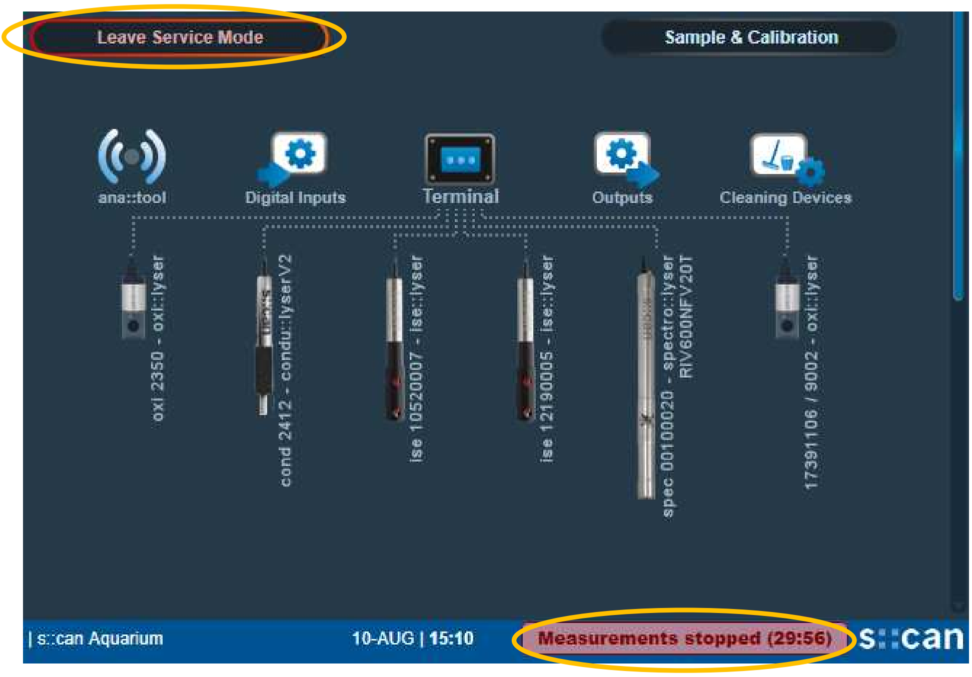
6.2 Service Mode

⚠ Some of the configuration options available under <u>*Service*</u> cannot be changed while the monitoring system is operating. Hence, changing into *Service Mode* stops automatic measurements and data storage while all parameter results and outputs are frozen.

Service Mode can be activated manually by pushing the respective button but will also be triggered automatically by starting certain activities within the <u>*Service*</u> tab.

Automatic operation can be resumed by pushing the <u>*Leave Service Mode*</u> button or on the <u>*Measurements stopped!*</u> field (see figure on the right).

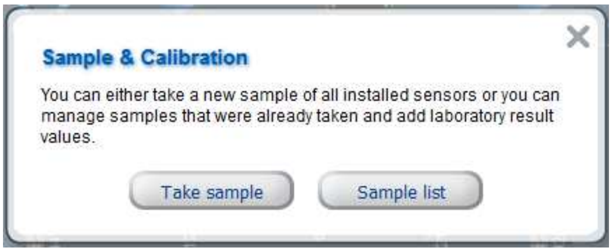
Measurements are also resumed after user logout, which happens automatically at the latest after 30 minutes of inactivity (see also chapter 6.4.4 / User Accounts).


Leave Service Mode
Sample & Calibration
ana::tool
Digital Inputs
Terminal
Outputs
Cleaning Devices
oxi 2350 - oxi::lyser
cond 2412 - condu::lyserV2
ise 10520007 - ise::lyser
ise 12190005 - ise::lyser
spec 00100020 - spectro::lyser RIV600NFV20T
17391106 / 9002 - oxi::lyser
| s::can Aquarium
10-AUG | 15:10
Measurements stopped (29:56)
s::can

As long as the monitoring system is in service mode, the <u>*Service*</u> symbol in the main navigation bar is changed to yellow and blinks.

6.3 Sample & Calibration

The <u>*Sample & Calibration*</u> button of the <u>*Service*</u> main window provides access to taking and managing sample measurements. It is hence a key component for the advanced calibration features available for the different sensors.



Sample & Calibration

You can either take a new sample of all installed sensors or you can manage samples that were already taken and add laboratory result values.

⚠ For details on how to actually perform sensor calibration please refer also to chapter 6.5.6!

Before dealing with moni::tool's sampling features it is useful to look into some details on calibration. Hence, the next chapter deals with the characteristics and requirements of various calibration types, while taking and managing the respective samples is dealt with in subsequent chapters!

6.3.1 <u>Calibration types</u>

Calibration in *moni::tool* basically means procedures which allow accurately assigning sensor measurements to results of reference analytics.

One respective option are pre-defined relations valid for certain circumstances, so called *Global Calibrations* (see 6.5.5) They do not depend on sample or laboratory measurements.

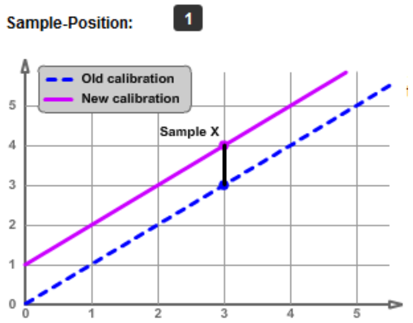
A second approach is to take samples from the medium to be tested and collect both the sensor readings and the corresponding laboratory measurements for the required parameters from the respective sample. This approach is facilitated by *moni::tool*'s <u>*Sample & Calibration*</u> function.

Depending on the number and the quality of available sample data various calibration approaches can be used for sensor calibration (please refer also to chapter 6.5.6). What they have in common is that they all make use of a linear relationship between sensor readings and reference analytic results, i.e. that a calibration is always characterized by a straight line defined by its *offset* and its *slope*.

The differences between the various calibration methods refer to the parameters which are actually changed (offset and/or slope) and to the way the new values are identified, as is shown in the following paragraphs.

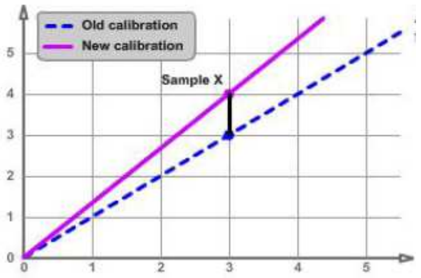
Offset

- *Offset* will be changed while *slope* remains unchanged (for *ammo::lyser* and *oxi::lyser* parameters please refer also to the respective sensor manuals for additional details)
- One sample measurement and one laboratory result are needed
- Sample and laboratory results are stored on the sensor
- Special case Zero: One sample measurement in zero medium is needed



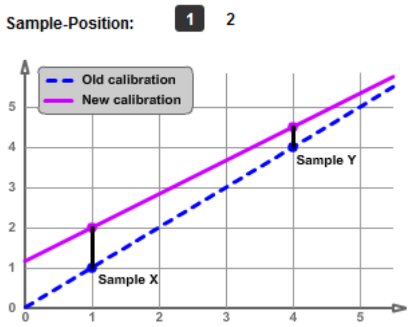
Span

- *Slope* will be changed.
- One sample measurement and one laboratory result in a relatively high concentration range are needed
- Sample and laboratory results are stored on the sensor



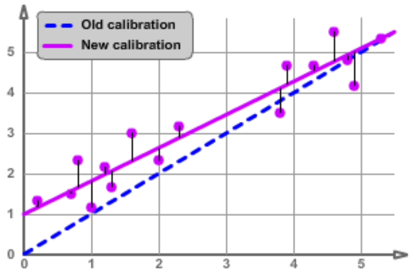
Linear

- *Offset* and *slope* will be changed (for *ammo::lyser* and *oxi::lyser* parameters please refer also to the respective sensor manuals for additional details).
- Two sample measurements (position 1 and 2) and two laboratory results are needed
- Sample and laboratory results are stored on the sensor



Multi

- The performed calibration is a linear fit with smallest possible deviation
- *Offset* and *slope* will be changed
- Store up to 1000 samples and laboratory result on the terminal to see correlation and identify outliers
- Samples are stored with a sample ID and a sample timestamp.



⚠ *Sample* measurements can be done directly in the medium, in grab samples or in standard solutions. *Laboratory* measurements can be results of laboratory analyses, values of standard solutions or readings of a validated reference device. Please also refer to the specific sensor-manuals for respective recommendations.

6.3.2 Taking samples

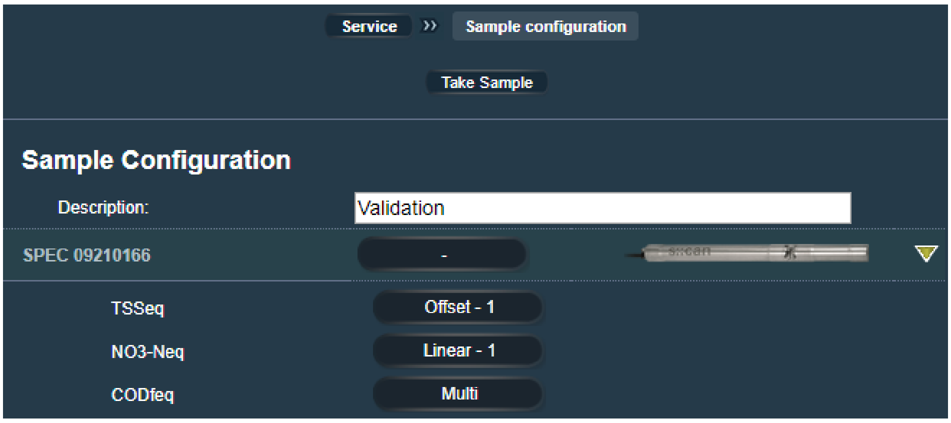
Once *Sample & Calibration* has been selected, activating the *Take sample* function changes the system into *Service Mode*.

Firstly, the *Sample Configuration* screen will be displayed and in the top field a sample description can be entered which supports selecting the correct samples when it comes to sensor calibration. However, samples are identified in the sample list (see chapter 6.3.3) by their automatically assigned ID and by their time stamp.

Pushing the button to the left of the sensor picture opens the *Select calibration type* window which allows selecting a calibration type (as described in chapter 6.3.1) for the sensor in general. Still, pushing the yellow triangle on the right of the sensor picture displays all parameters configured on this sensor and calibration types can be defined individually for each parameter.

Calibration types:

- *None*:
  sample will not be used
- *Offset* (Index 1):
  sample will be stored (*moni::tool* database and on the sensor) as sample 1
- *Linear (Index 1/2)*:
  will be stored (database & sensor) as sample 1 or 2
- *Multi*: will only be stored in the *moni::tool* database and not on the sensor.



Sample Configuration

Description: Validation

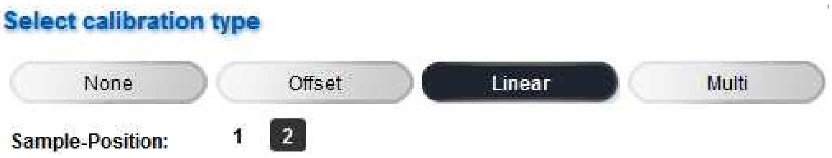
SPEC 09210166 -

TSSeq Offset - 1

NO3-Neq Linear - 1

CODfeq Multi

As the calibration type Linear uses two samples it is necessary to define whether sample 1 or sample 2 shall be replaced by the new sample. This is done by selecting either index 1 or index 2 in the *Select calibration type* window.


Select calibration type

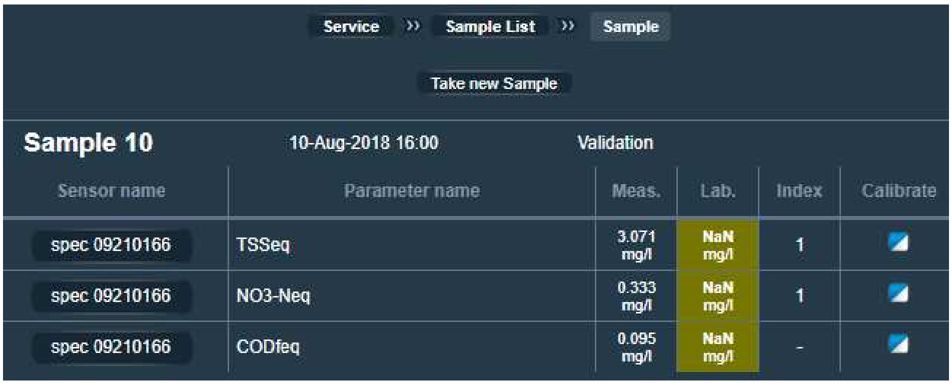
Sample-Position: 1 **2**

Once all settings have been done, the *Take Sample* button starts the measurement. The measuring progress and the results will then be displayed on a new screen. During the measurement a sample can be taken from the medium or reference measurements can be made.

As soon as the sampling process is finished all raw values are displayed, together with the number assigned for use in linear calibration (*Index*).

This window can also be accessed at a later time via *Sample list* (see below).

The *Lab* column can be activated for entering the results of laboratory analyses. In the respective dialogue all information regarding the current sample are displayed. The entered result of the laboratory analysis can be stored (*Save*) or deleted (*Clear*).



Sample 10 10-Aug-2018 16:00 Validation

Sensor name	Parameter name	Meas.	Lab.	Index	Calibrate
spec 09210166	TSSeq	3.071 mg/l	NaN mg/l	1	☑
spec 09210166	NO3-Neq	0.333 mg/l	NaN mg/l	1	☑
spec 09210166	CODfeq	0.095 mg/l	NaN mg/l	-	☑

⚠ When several samples of a parameter are assigned to the same sample index (1 or 2) of a calibration type, only the one which has been saved latest will be actually available for calibration as only one sample per index can be stored on the sensors. Alternatively, several valid samples can be used for calibration simultaneously by selecting the calibration type *Multi* as it builds on the *moni::tool* samples database.

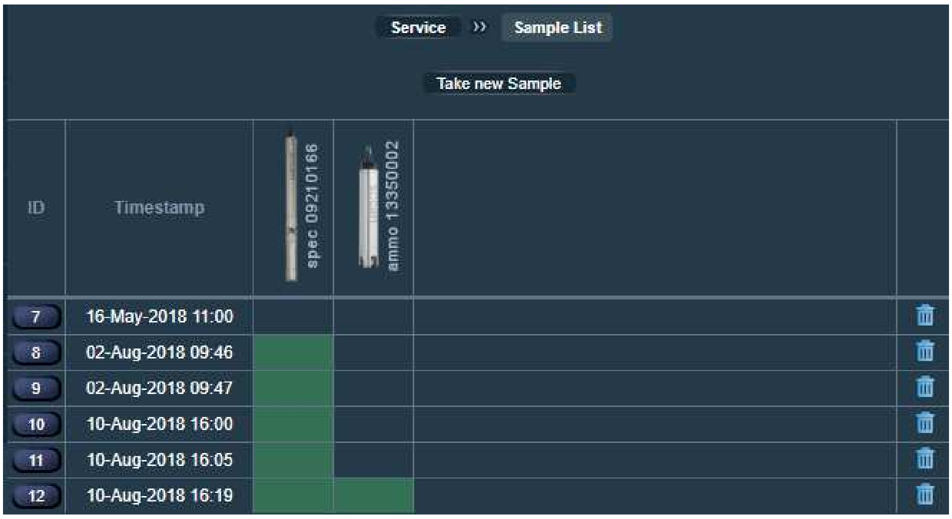
Pushing a parameter's *Calibrate* icon will open the respective calibration window. Please refer to chapter 6.5.6 on sensor calibration!

With *Take new Sample* the sampling procedure can be re-started.

6.3.3 Sample list

When selecting *Sample list* as a first step (see beginning of this section) an overview of all samples stored in the database so far and of the covered sensors will be displayed.

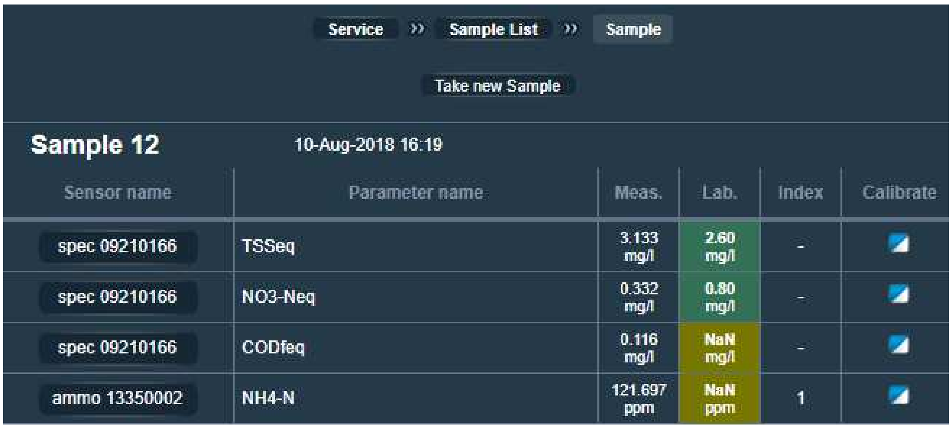
Pushing a sensor symbol opens a detailed view on all sample results collected for that sensor.



ID	Timestamp	spec 09210166	ammo 13350002	
7	16-May-2018 11:00			🗑
8	02-Aug-2018 09:46	🟩		🗑
9	02-Aug-2018 09:47	🟩		🗑
10	10-Aug-2018 16:00	🟩		🗑
11	10-Aug-2018 16:05	🟩		🗑
12	10-Aug-2018 16:19	🟩	🟩	🗑

Pushing a sample's ID opens the *sample details* window while a results field opens the *data entry* window (both as described already in 6.3.2).

Pushing the trash icon on the right hand side will delete the sample and all related data.



Sample 12 10-Aug-2018 16:19

Sensor name	Parameter name	Meas.	Lab.	Index	Calibrate
spec 09210166	TSSeq	3.133 mg/l	2.60 mg/l	-	✓
spec 09210166	NO3-Neq	0.332 mg/l	0.80 mg/l	-	✓
spec 09210166	CODfeq	0.116 mg/l	NaN mg/l	-	✓
ammo 13350002	NH4-N	121.697 ppm	NaN ppm	1	✓

- The **background color** provides information on the sample quality.

Green	The sample can be used for a multi-calibration.
Blue	The sample cannot be used for a multi-calibration, but for another calibration supported by the sensor (e.g. offset or linear).
Yellow	The sample cannot be used for a calibration, because laboratory value is NaN.
Transparent with number	The sample is complete but cannot be used for a calibration. Either the sensor does not support multi-calibration or the sample is not available anymore for the calibration which is supported from the sensor (was overwritten with a later sample).
Transparent without number	For this parameter no sample was stored under the sample-ID from this sensor.

⇨ *Available **Quick reference guides**:*

Manuals	*moni::tool / Service_Guides*	note_moni-toolV2.2_sensorcalibration

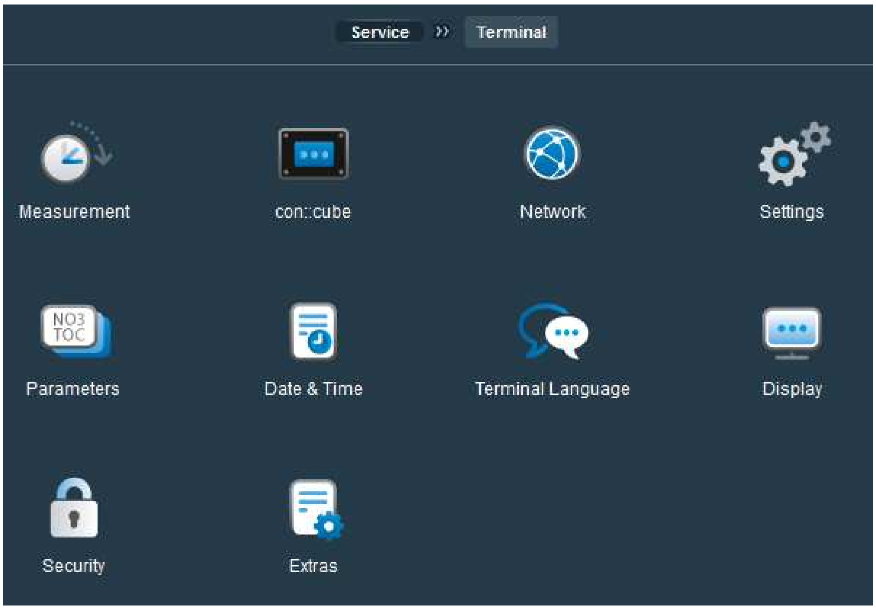
Please refer to the s::can Customer Portal!

6.4 Terminal

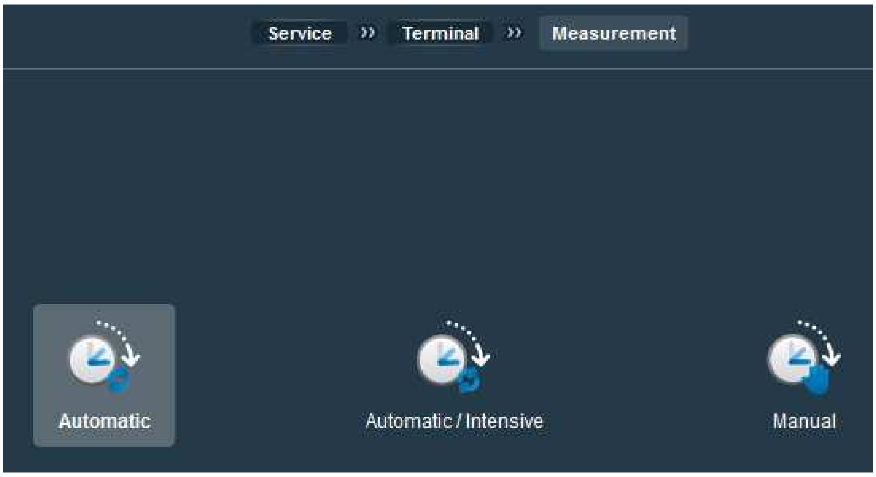
Terminal aggregates all settings and options not linked directly to any of the devices symbolized by individual icons on the *Service* tab main window.

The image on the right shows the view displayed after pushing the *Terminal* icon.

Further details on the individual components are provided in the following sections.

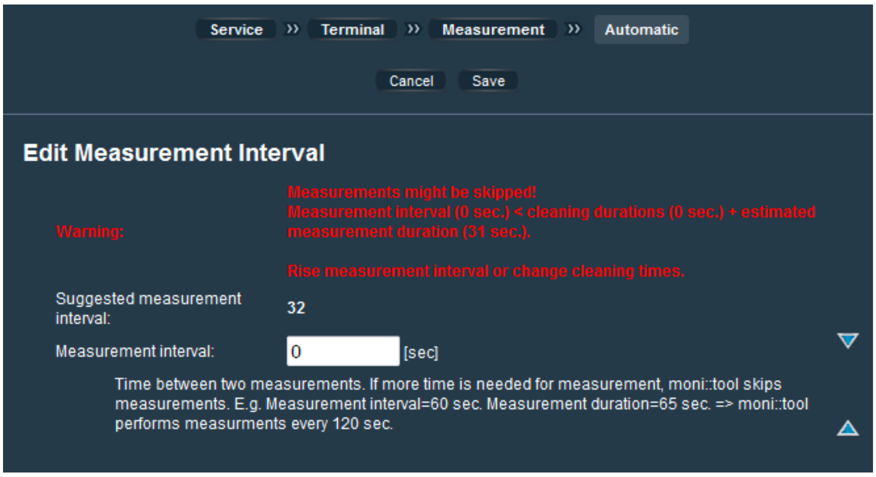


6.4.1 Measurement



Measurement offers three options for controlling the execution of measurements which can be selected by pushing the respective icons.

Automatic



Edit Measurement Interval

Warning: Measurements might be skipped!
Measurement interval (0 sec.) < cleaning durations (0 sec.) + estimated measurement duration (31 sec.).

Rise measurement interval or change cleaning times.

Suggested measurement interval: 32

Measurement interval: 0 [sec]

Time between two measurements. If more time is needed for measurement, moni::tool skips measurements. E.g. Measurement interval=60 sec. Measurement duration=65 sec. => moni::tool performs measurments every 120 sec.

This is the standard operation mode in which *moni::tool* triggers new measurements at regular intervals. In this window the time between automatic measurements (*Measurement interval*), which is set to 120 sec. by default, can be changed (changes will be stored when pushing *Save*).

The user will be warned when the total time of one measuring plus cleaning cycle should be longer than the configured *Measurement interval*.

Whenever the *Measurement interval* is changed, all *vali::tool* and *ana::tool* functions will be re-initialized which may make them unavailable until a new run-in period has been completed.

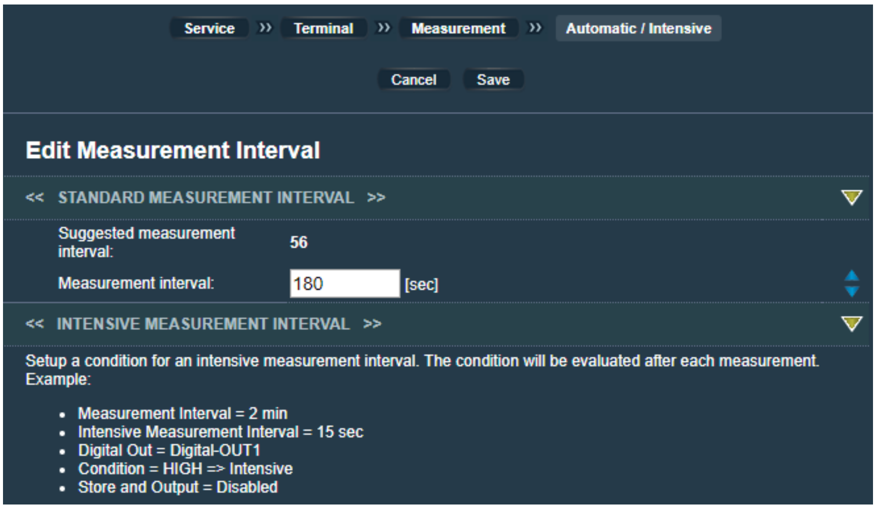
Automatic / Intensive

In this measurement mode besides a *Standard Measurement Interval* a condition can be defined which, as long as it is fulfilled, changes to an *Intensive Measurement Interval* with reduced intervals.

The sections for entering the required settings can be displayed or hidden by pushing the yellow triangles.

Basically changing from the standard to the intensive measurement interval is triggered by a configured digital output linked to a respective event, e.g. to a parameter alarm (see 6.4.5, p. 50) or to an external trigger for reacting on situations not detected by the con::cube sensors (see 6.8).

Further details on this measurement mode are provided directly within *moni::tool* and can be displayed by pushing the blue triangles.



Edit Measurement Interval

<< STANDARD MEASUREMENT INTERVAL >>

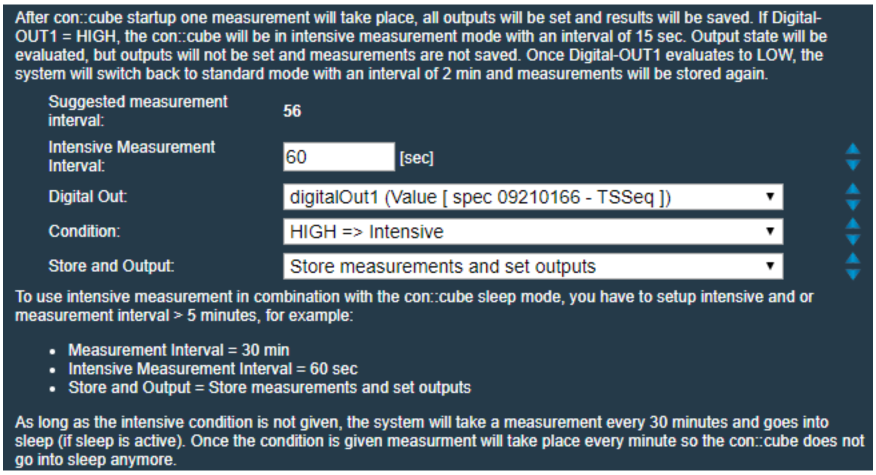
Suggested measurement interval: 56

Measurement interval: 180 [sec]

<< INTENSIVE MEASUREMENT INTERVAL >>

Setup a condition for an intensive measurement interval. The condition will be evaluated after each measurement. Example:

- Measurement Interval = 2 min
- Intensive Measurement Interval = 15 sec
- Digital Out = Digital-OUT1
- Condition = HIGH => Intensive
- Store and Output = Disabled



After con::cube startup one measurement will take place, all outputs will be set and results will be saved. If Digital-OUT1 = HIGH, the con::cube will be in intensive measurement mode with an interval of 15 sec. Output state will be evaluated, but outputs will not be set and measurements are not saved. Once Digital-OUT1 evaluates to LOW, the system will switch back to standard mode with an interval of 2 min and measurements will be stored again.

Suggested measurement interval: 56

Intensive Measurement Interval: 60 [sec]

Digital Out: digitalOut1 (Value [spec 09210166 - TSSeq])

Condition: HIGH => Intensive

Store and Output: Store measurements and set outputs

To use intensive measurement in combination with the con::cube sleep mode, you have to setup intensive and or measurement interval > 5 minutes, for example:

- Measurement Interval = 30 min
- Intensive Measurement Interval = 60 sec
- Store and Output = Store measurements and set outputs

As long as the intensive condition is not given, the system will take a measurement every 30 minutes and goes into sleep (if sleep is active). Once the condition is given measurment will take place every minute so the con::cube does not go into sleep anymore.

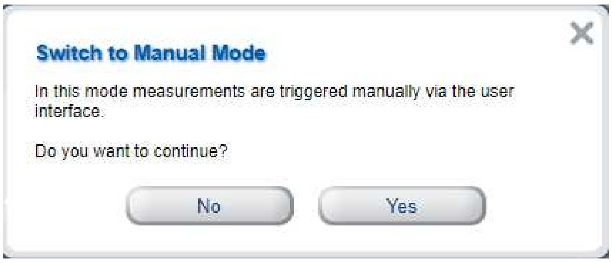
⇨ *Available **Quick reference guides**:*

Manuals	*moni::tool / Service_Guides*	note_moni-tool_IntensiveMode_ExtTrigger

Please refer to the s::can Customer Portal!

Manual

When the system is brought into the *Manual* mode all measurements will be stopped and new measurements can be triggered only by pushing the *Start Measurement* button which then replaces the *activity* field in the bottom menu. Whenever this button is pushed a new window will pop up in which the user has to decide if only a measurement (*Only Measure*) or also a cleaning procedure (*Clean + Measure*) shall be executed.

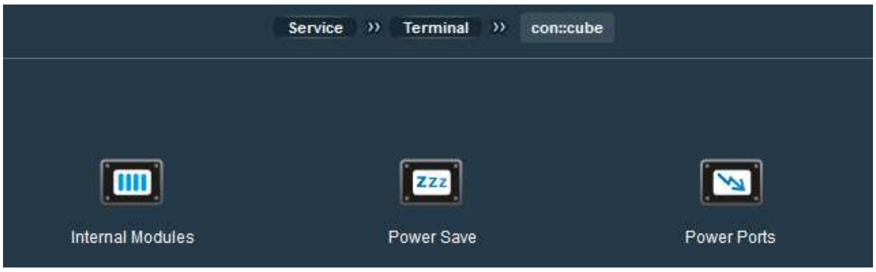


Switch to Manual Mode

In this mode measurements are triggered manually via the user interface.

Do you want to continue?

6.4.2 con::cube



con::cube provides access to hardware-related settings and information.

Internal Modules

This function is only available on the *con::cube* and shows all installed internal modules (digital input, analog input, analog output and digital output).

→*Service Level* / *Expert*

- Also the module's addresses are displayed

Modules ordered together with the system are already configured during the assembly of the terminal. For installing additional modules later on, they need to be configured which is triggered by pushing the button *Search Internal Modules*. *(with newer moni::tool versions all modules are recognized automatically during re-start)*.

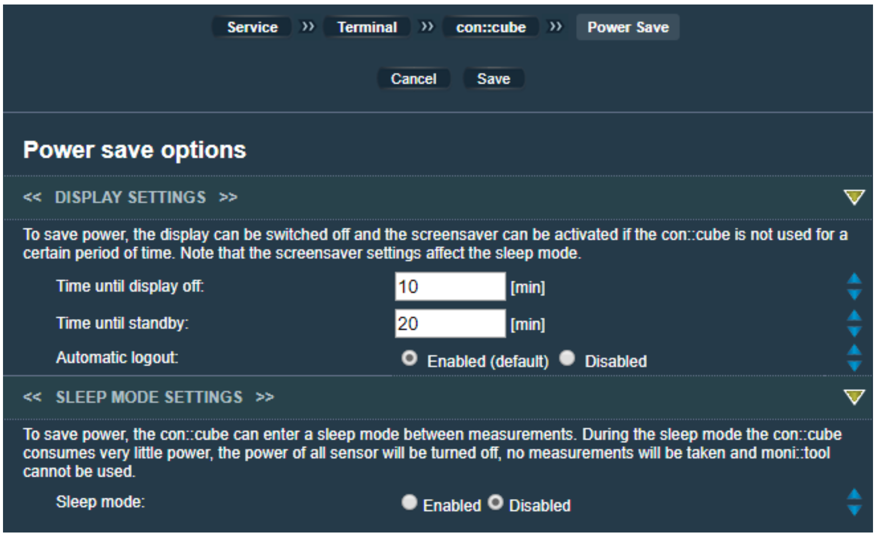
Power Save

In the respective window delays for switching off the display and for bringing the system into stand-by mode can be defined.

For enhanced energy saving during automatic operation (e.g. when operated by a battery) the *con::cube* can also enter into a *sleep mode* between measurements. This switches off the power for most system components and hence no measurements will be taken and *moni::tool* cannot be used.

Sleep mode is enabled by selecting the respective option. Consequently, the number of measurements to be taken before a sleep phase is started and the number of measurements to be skipped (according to the automatic measurement settings, see 6.4.1) have to be configured.

⚠ The *sleep mode* is available only for *con::cube*s already equipped with the required hardware. If a model does not yet support this function a user information will be displayed.



Power save options

<< DISPLAY SETTINGS >>

To save power, the display can be switched off and the screensaver can be activated if the con::cube is not used for a certain period of time. Note that the screensaver settings affect the sleep mode.

Time until display off: 10 [min]

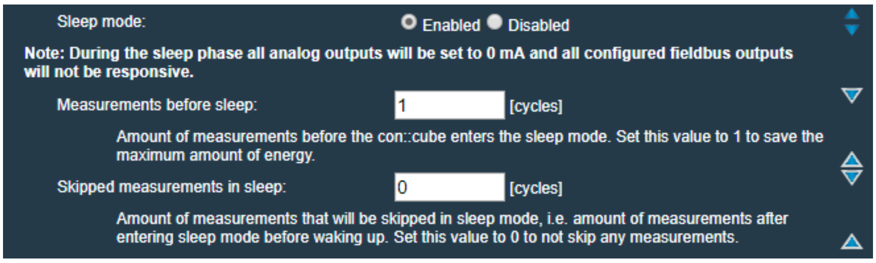
Time until standby: 20 [min]

Automatic logout: ◉ Enabled (default) ○ Disabled

<< SLEEP MODE SETTINGS >>

To save power, the con::cube can enter a sleep mode between measurements. During the sleep mode the con::cube consumes very little power, the power of all sensor will be turned off, no measurements will be taken and moni::tool cannot be used.

Sleep mode: ○ Enabled ◉ Disabled



Sleep mode: ◉ Enabled ○ Disabled

Note: During the sleep phase all analog outputs will be set to 0 mA and all configured fieldbus outputs will not be responsive.

Measurements before sleep: 1 [cycles]

Amount of measurements before the con::cube enters the sleep mode. Set this value to 1 to save the maximum amount of energy.

Skipped measurements in sleep: 0 [cycles]

Amount of measurements that will be skipped in sleep mode, i.e. amount of measurements after entering sleep mode before waking up. Set this value to 0 to not skip any measurements.

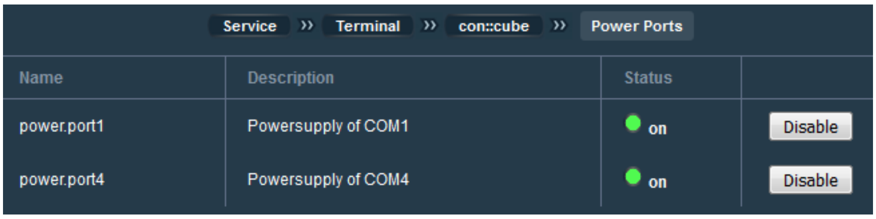
→*Service Level* / *Expert*

- Automatic user log-out after a specified time of inactivity can be enabled / disabled. More details can be found within the online-help.

Power Ports

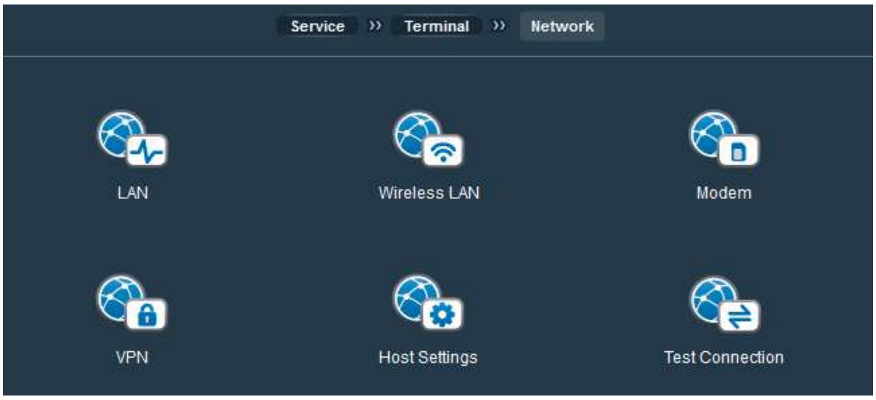
The available con::cube power ports for supplying sensors, can be enabled or disabled within this window.

⚠ This function shall be used by s::can Service only (check correct jumper configuration on board).



Name	Description	Status	
power.port1	Powersupply of COM1	● on	Disable
power.port4	Powersupply of COM4	● on	Disable

6.4.3 Network



Under this components necessary for operating the system in a network environment are addressed.

Usually these points will be configured during the initial set-up (e.g. assigning a computer name under *Host Settings*).

The default setting for accessing the local network under *LAN* is *DHCP activated*. This means that the *con::cube* will accept an IP address assigned by a DHCP server automatically as soon as a network connection is established.

Please refer to the *con::cube* manual and the available *Quick reference guides* for changes of the various network settings.

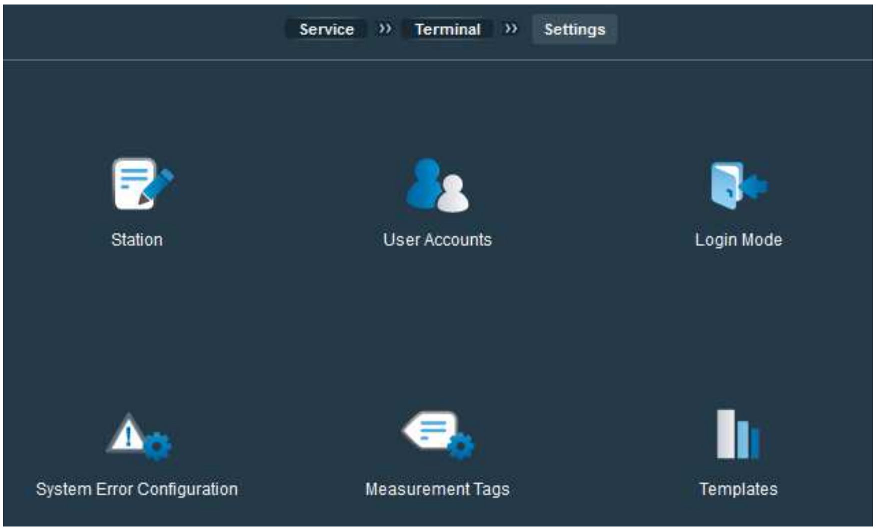
⚠ *moni::tool* can also be controlled by SMS remote control using specific messages.

⇨ *Available* ***Quick reference guides****:*

Manuals	*moni::tool / Service_Guides*	note_moni-tool_3G-Modem-Setup
Manuals	*con::cube / Service_Guides*	note_concube_vpn1.s-can.at_access
Manuals	*con::cube / Service_Guides*	note_concube_SMS_remoteControl_moniV3

Please refer to the s::can Customer Portal!

6.4.4 Settings



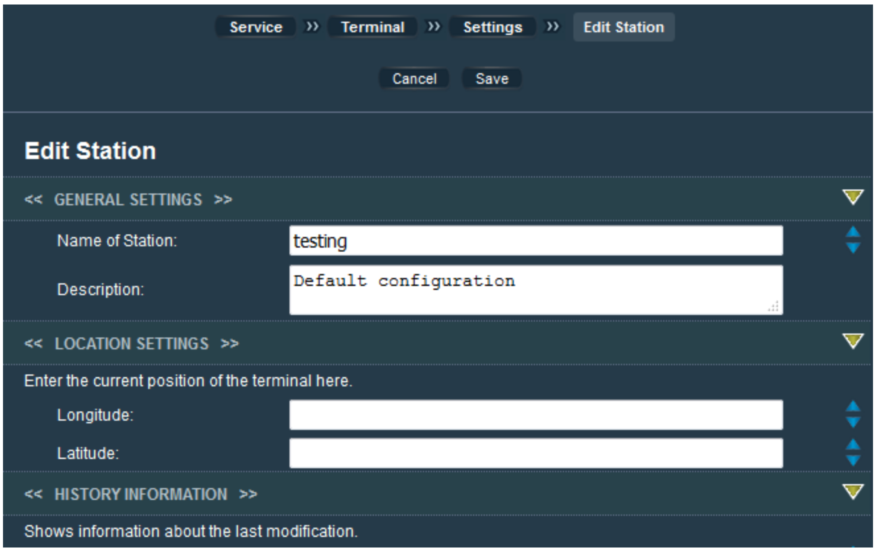
Station

The name of the station can be set which should happen already during the initial setup (see also p. 12).

The station's name will be displayed permanently in the bottom menu and will also be used for generating file names (see chapter 6.9.4).

→ *Service Level* / *Expert*

- Also a description of the station and its geographic position can be configured



Edit Station

<< GENERAL SETTINGS >>

Name of Station: testing

Description: Default configuration

<< LOCATION SETTINGS >>

Enter the current position of the terminal here.

Longitude:

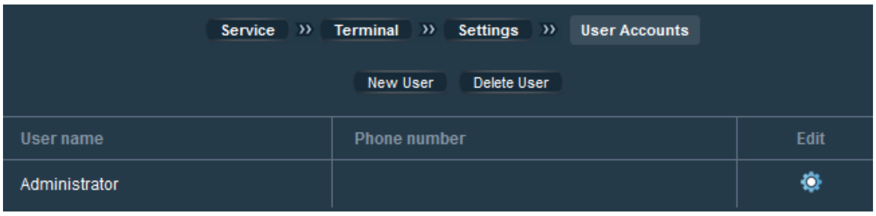
Latitude:

<< HISTORY INFORMATION >>

Shows information about the last modification.

User Accounts

Based on an initial *Administrator* account, new users can be defined and their specific rights during working with the monitoring system can be configured individually.



User name	Phone number	Edit
Administrator		⚙

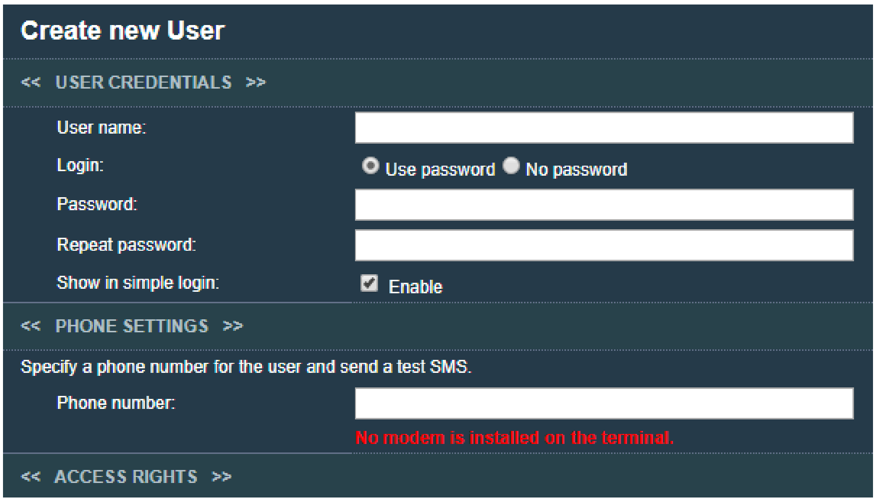
By default the Administrator account is protected by the standard password *admin1*. For security reasons this password should be changed.

In the first window an overview of all current users is displayed.

A new user can be added after pushing *New User* and after defining *User name* and *Password.*

If the *con::cube* is equipped with an internal modem a phone number can be assigned so that the user can receive messages via SMS.

Furthermore, the *Access Rights* for the new user need to be assigned. This is a critical step as it defines which options are actually available when this user is logged into the system and should thus be handled rather restrictively.



Create new User

<< USER CREDENTIALS >>

User name:

Login: ● Use password ○ No password

Password:

Repeat password:

Show in simple login: ☑ Enable

<< PHONE SETTINGS >>

Specify a phone number for the user and send a test SMS.

Phone number:

No modem is installed on the terminal.

<< ACCESS RIGHTS >>

Details on each right can be displayed by pushing the blue arrows on the right side.

→ *Service Level* / *Expert*

- Rights for *Software Update* and *Terminal Control* can be granted
- Service levels *Advanced* and *Expert* can be assigned

A user can be deleted by any user with access rights to *User Management* by pushing the user's name and then pushing the button *Delete User*. To change the user password or to check and re-configure the assigned access rights user profiles can be edited by pushing the blue cogwheel on the right-hand side of a user name.

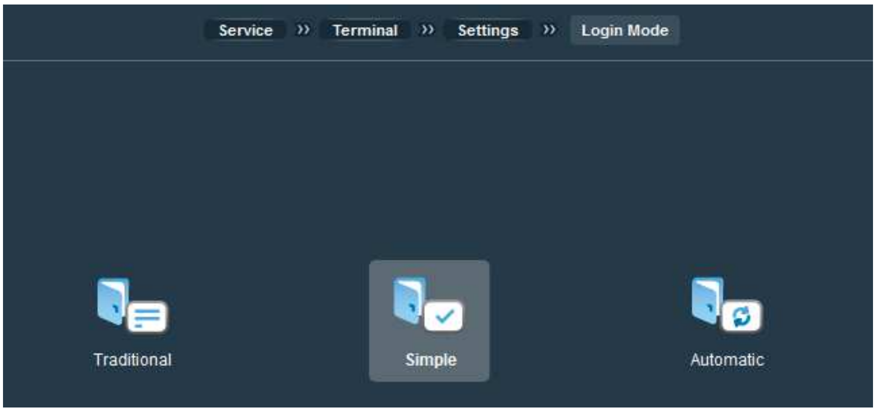
Login Mode

For logging into the system three modes are available:

Traditional:
A user name and the password must be entered during log-in.

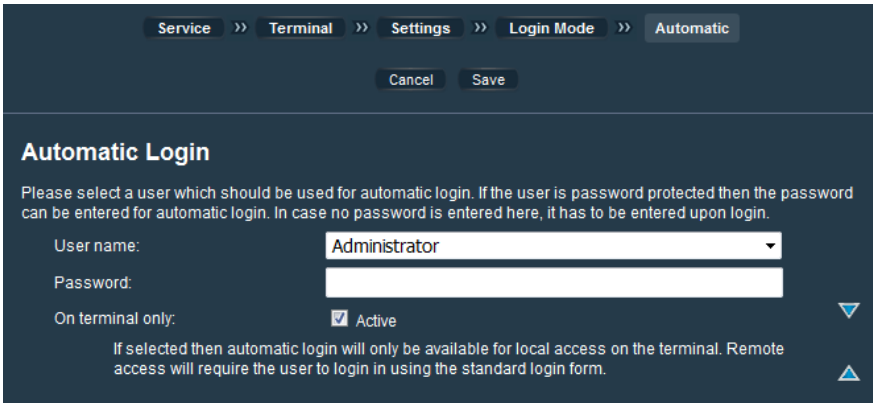
Simple:
Configured usernames are available via Icons, the respective password must be entered manually.

Automatic:
A configured user will be logged-in either automatically or after entering the password.



→ *Service Level* / *Expert*

- Automatic log-in can also be activated for remote sessions



Automatic Login

Please select a user which should be used for automatic login. If the user is password protected then the password can be entered for automatic login. In case no password is entered here, it has to be entered upon login.

User name: Administrator

Password:

On terminal only: ☑ Active

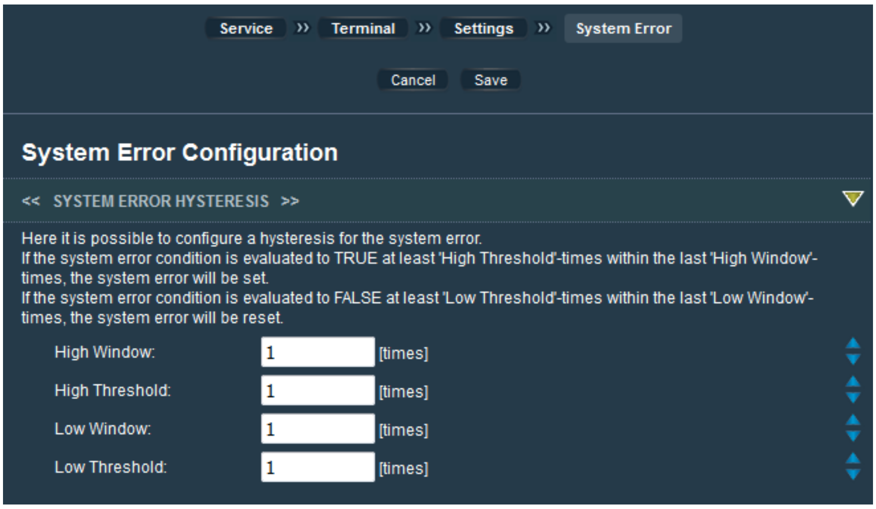
If selected then automatic login will only be available for local access on the terminal. Remote access will require the user to login in using the standard login form.

System Error Configuration

A "System Error" is indicated by the blinking yellow *Status* symbol and by a red *con::cube* LED.

In this menu it can be configured under which conditions a system error is set and when it will be cancelled again.

Per default "System Error" is set whenever any error occurs (e.g. a communication error between a sensor and the terminal). This is also the recommended setting.


Service ›› Terminal ›› Settings ›› System Error
Cancel
Save
<< SYSTEM ERROR HYSTERESIS >>

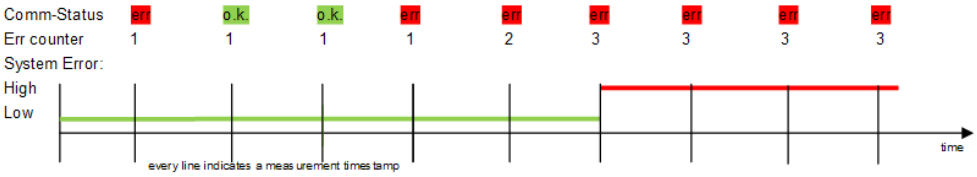
System Error Configuration

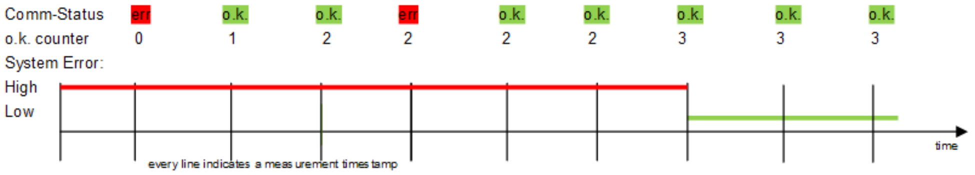
Here it is possible to configure a hysteresis for the system error.
If the system error condition is evaluated to TRUE at least 'High Threshold'-times within the last 'High Window'-times, the system error will be set.
If the system error condition is evaluated to FALSE at least 'Low Threshold'-times within the last 'Low Window'-times, the system error will be reset.

High Window: 1 [times]
High Threshold: 1 [times]
Low Window: 1 [times]
Low Threshold: 1 [times]

However, it is also possible to configure observation windows (= number of observed measurements) and thresholds (= number of respective conditions met) both for setting system error (="High") and for cancelling it (="Low").

The following graphs show examples for the impact of setting all options to 3.

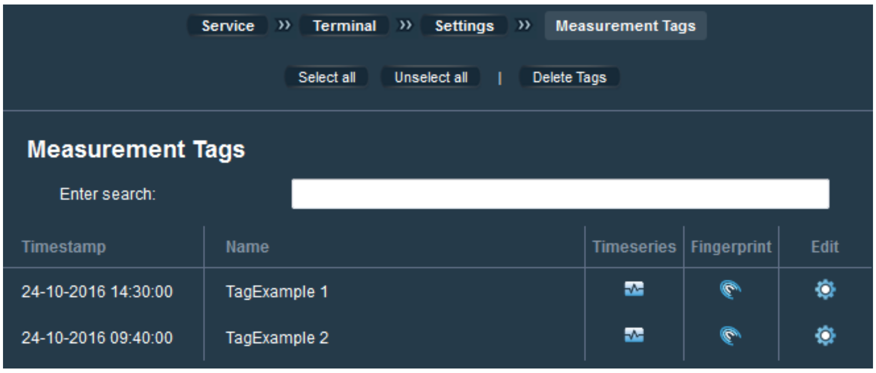




Measurement Tags

As described already in chapter 2.5, individual measurement points can be marked with tags so that they are easy to find later.

This menu displays a list of already assigned tags and allows editing of individual tags as well as shifting directly to the respective time series or fingerprint view by pushing the corresponding icons in the respective tag's line.



Timestamp	Name	Timeseries	Fingerprint	Edit
24-10-2016 14:30:00	TagExample 1			⚙
24-10-2016 09:40:00	TagExample 2			⚙

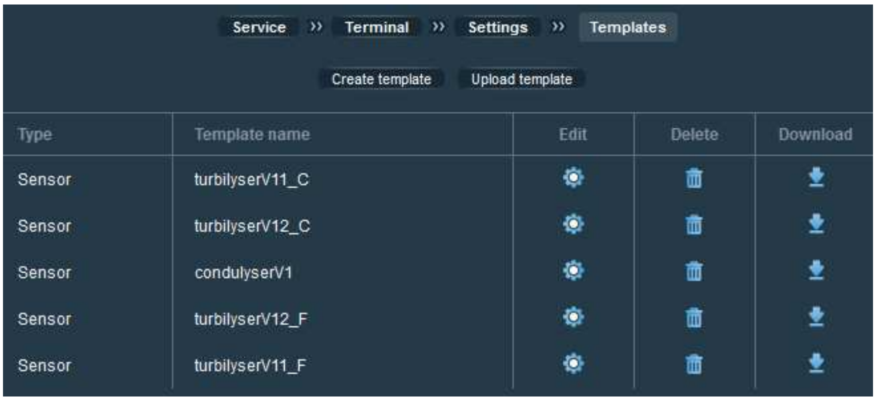
Stored tags can be selected either individually by pushing the respective line or jointly by pushing the respective button (*Select all*) above the list. Selected tags can then be deleted by pushing the respective button (*Delete Tags*).

Templates

Under this point templates for communicating with 3rd party sensors can be managed (see 6.4.4).

The start view shows a list of currently installed templates which can be edited, deleted or downloaded individually by pushing the corresponding icons in the respective template's line.

New templates can either be uploaded as files or be created manually by pushing the respective buttons above the list.



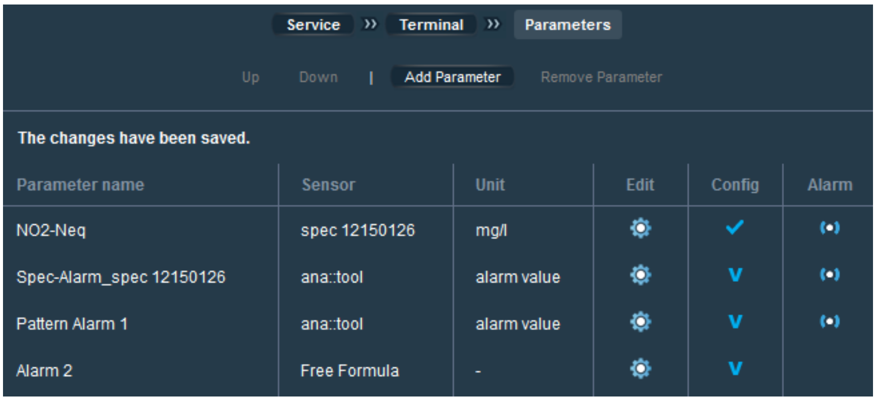
Type	Template name	Edit	Delete	Download
Sensor	turbilyserV11_C	⚙	🗑	⬇
Sensor	turbilyserV12_C	⚙	🗑	⬇
Sensor	condulyserV1	⚙	🗑	⬇
Sensor	turbilyserV12_F	⚙	🗑	⬇
Sensor	turbilyserV11_F	⚙	🗑	⬇

⇨ *Available **Quick reference guides**:*

Manuals	*moni::tool / Service_Guides*	note_moni-tool_Install3rdParty_Modbus_Sensors

Please refer to the s::can Customer Portal!

6.4.5 Parameters



The changes have been saved.

Parameter name	Sensor	Unit	Edit	Config	Alarm
NO2-Neq	spec 12150126	mg/l	⚙	✓	(•)
Spec-Alarm_spec 12150126	ana::tool	alarm value	⚙	V	(•)
Pattern Alarm 1	ana::tool	alarm value	⚙	V	(•)
Alarm 2	Free Formula	-	⚙	V	

This section addresses the configuration of parameter measurements of the *moni::tool* system.

It is closely linked to chapter 6.5.4 which deals with managing sensors and their respective parameters as when installing a sensor usually all parameters provided by this instrument will be installed automatically.

However, as this respective section addresses parameter-related issues more comprehensively and addresses virtual parameters (see below) as well, many aspects are described here in full detail.

⚠ For virtual parameters the software component in which they are produced is shown in the *Sensor* column instead of a sensor ID and a blue *V* is shown in the *Config* field (as it is in the *Values* tab, see 1.3.3).

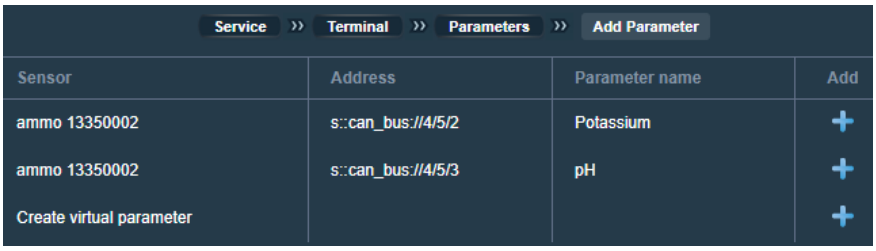
Parameter Order

All active parameters from all installed sensors are listed in the main window and their ranking defines the order in which they are displayed in the Value and Time Series screens. The order can be changed by pushing the parameter name to select the parameter (several names can be selected at the same time, a selection is undone by pushing the parameter a second time) and then pushing *Up* or *Down* to move the parameter(s) in the list.

Deactivate / Reactivate Parameters

Individual parameters can be deactivated using the *Remove Parameter* button both in this window and during defining settings for the respective sensor.

Deactivated parameters are listed on the *Add Parameter* screen and can be reactivated by pushing the blue *plus* sign in the column *Add* on the right hand side.



Sensor	Address	Parameter name	Add
ammo 13350002	s::can_bus://4/5/2	Potassium	+
ammo 13350002	s::can_bus://4/5/3	pH	+
Create virtual parameter			+

Add Parameter also offers the option to create virtual parameters as is described below.

Add Virtual Parameters

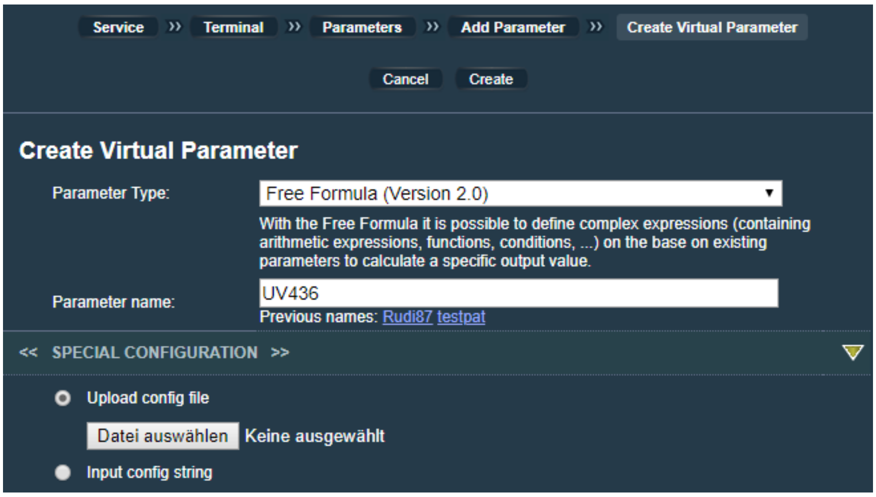
V Besides the option to reactivate sensor parameters as described above, there also exists the possibility to create so called *virtual parameters* in *Add Parameter*. These are derived parameters using the readings of other sensors as inputs and performing calculations within the *moni::tool* software. The respective formulas either exist predefined in the software (e.g. Water Quality Index, WQI) or they can be configured individually by the customer.

Several types of virtual parameters exist which are explained in the following sections.

Each of them is created using the *Add Parameter* button and pushing the blue plus symbol in the *Create virtual parameter* line (see image in the right side).

For each parameter the parameter type needs to be selected and a parameter name must be assigned.

The creation process is finalized using the *Create* button and in the following window the information required for the specified parameter type can be entered.


Service ›› Terminal ›› Parameters ›› Add Parameter ›› Create Virtual Parameter
Cancel
Create

Create Virtual Parameter

Parameter Type: Free Formula (Version 2.0)

With the Free Formula it is possible to define complex expressions (containing arithmetic expressions, functions, conditions, ...) on the base on existing parameters to calculate a specific output value.

Parameter name: UV436

Previous names: Rudi87 testpat

<< SPECIAL CONFIGURATION >>

● Upload config file

Datei auswählen Keine ausgewählt

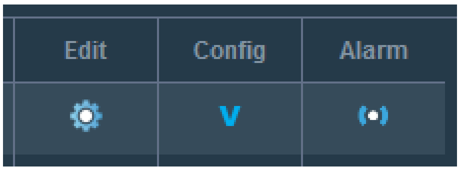
○ Input config string

Generally, for all virtual parameter types it needs to be configured which information shall be used as an input and how this information shall be used.

Further details for the individual types are provided in the sections below.

Once a virtual parameter has been created it is marked in the *Config* field with a blue *V*. Pushing the *V* provides access to editing the various setting.

Like for all parameters, the *Cogwheel* symbol can be used for editing basic parameter settings while the *Alarm* icon provides access to various alarm settings (see sections below).



Edit	Config	Alarm
⚙	V	(•)

Free Formula

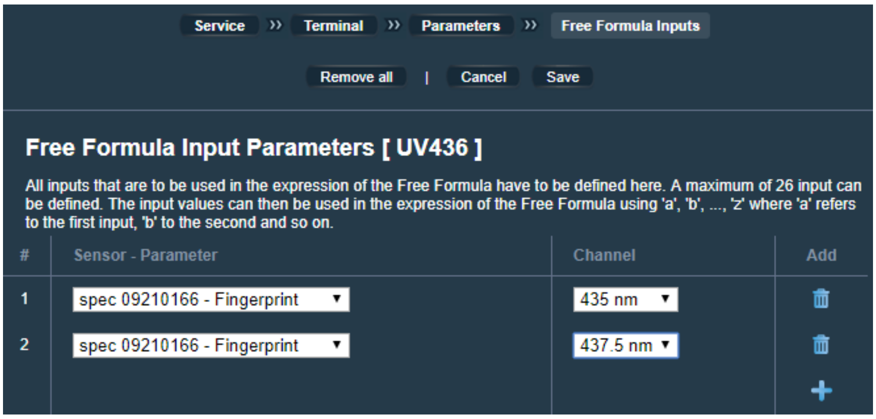
As is indicated by its name, this parameter type allows defining a free formula based on any sensor reading available and on a variety of arithmetic and logical functions.

As a first step, all input parameters that are necessary for calculating the virtual parameter have to be defined. This is done by selecting the *Sensor parameter* in the first column, then selecting the parameter type (measured /clean) (or the wavelength in case of a spectro::lyser) in the column *Channel* and finally pushing the blue *plus* symbol on the right. After all required input parameters have been selected the button *Save* on the top finalizes the step.

In the next window the *Formula* for calculating the parameter can be entered.

The list of all selected input parameters is displayed below the entry field for the formula. Each parameter is assigned a letter as a variable identifier to be used in the formula, starting with "*a*".

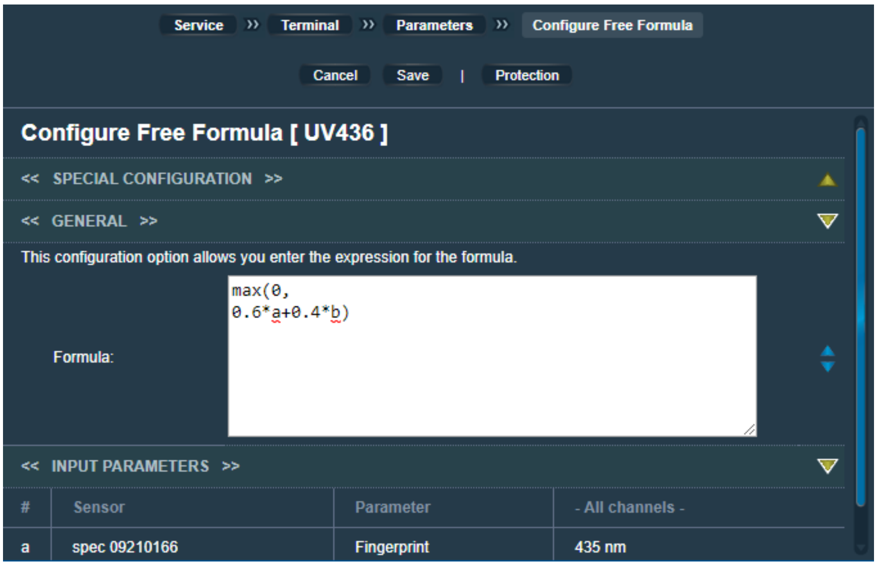
The formula itself can be constructed building on the selected parameters and on a series of predefined functions, constants as well as arithmetic and logical expressions (see examples on the right).



Free Formula Input Parameters [UV436]

All inputs that are to be used in the expression of the Free Formula have to be defined here. A maximum of 26 input can be defined. The input values can then be used in the expression of the Free Formula using 'a', 'b', ..., 'z' where 'a' refers to the first input, 'b' to the second and so on.

#	Sensor - Parameter	Channel	Add
1	spec 09210166 - Fingerprint ▼	435 nm ▼	🗑
2	spec 09210166 - Fingerprint ▼	437.5 nm ▼	🗑
			+



Configure Free Formula [UV436]

<< SPECIAL CONFIGURATION >>

<< GENERAL >>

This configuration option allows you enter the expression for the formula.

Formula:

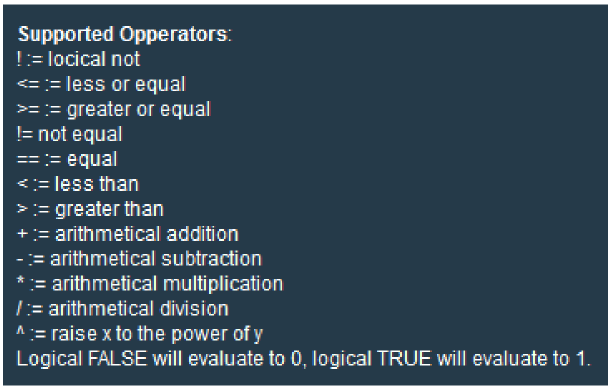
```
max(0,
0.6*a+0.4*b)
```

<< INPUT PARAMETERS >>

#	Sensor	Parameter	- All channels -
a	spec 09210166	Fingerprint	435 nm

As a decimal indicator the sign "." (*dot*) must be used.

⚠ Pushing the blue and yellow triangles on the right hand side of the screen will pop up detailed additional information on how to build formulas! Detailed information is available in the internet (https://beltoforion.de/en/muparser/features.php#idPageTop).



Supported Opperators:
! := locical not
<= := less or equal
>= := greater or equal
!= not equal
== := equal
< := less than
> := greater than
+ := arithmetical addition
- := arithmetical subtraction
* := arithmetical multiplication
/ := arithmetical division
^ := raise x to the power of y
Logical FALSE will evaluate to 0, logical TRUE will evaluate to 1.

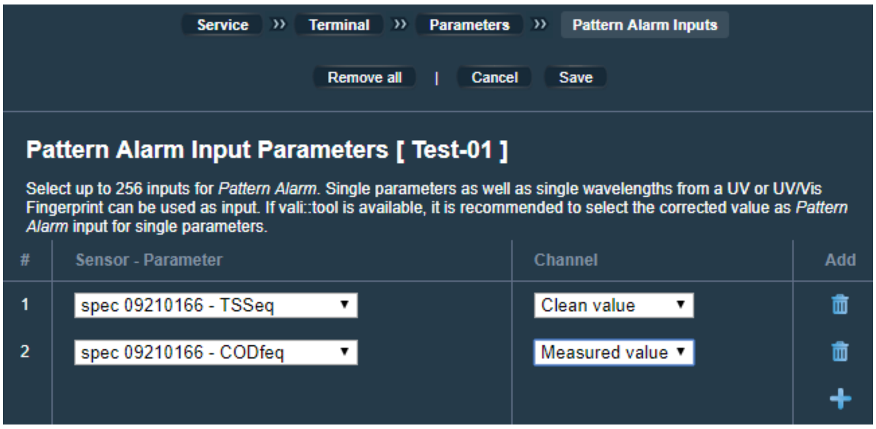
After the formula has been entered, the button *Save* needs to be pushed for storing the newly defined parameter.

Pattern Alarm

A Pattern Alarm is an event detection method that builds on typical relationships between a set of parameters. If the actual pattern changes to a state outside the acceptable range an alarm will be triggered. The software component providing the respective capacities is *ana::tool,* please refer also to chapter 6.7 for further details.

The initial configuration steps for a *Pattern Alarm* are the same like those for a *Free Formula*.

However, different from a formula, alarm parameters are not controlled by a static definition but are based on a continuous learning of sensor readings patterns which are considered acceptable. The respective *training* can be done automatically or manually, respective settings are made in the *Configuration* window launched by pushing the blue *V* once the parameter has been created.



Pattern Alarm Input Parameters [Test-01]

Select up to 256 inputs for *Pattern Alarm*. Single parameters as well as single wavelengths from a UV or UV/Vis Fingerprint can be used as input. If vali::tool is available, it is recommended to select the corrected value as *Pattern Alarm* input for single parameters.

#	Sensor - Parameter	Channel
1	spec 09210166 - TSSeq	Clean value
2	spec 09210166 - CODfeq	Measured value

The user feed-back required for categorizing situations used for training the parameter is provided in the *Alarm* tab as described in chapter 5. Trainings can be triggered manually directly from the *Alarm* tab (see 5.5) but are managed under the menu item *Service* / *ana::tool* as described in chapter 6.7.

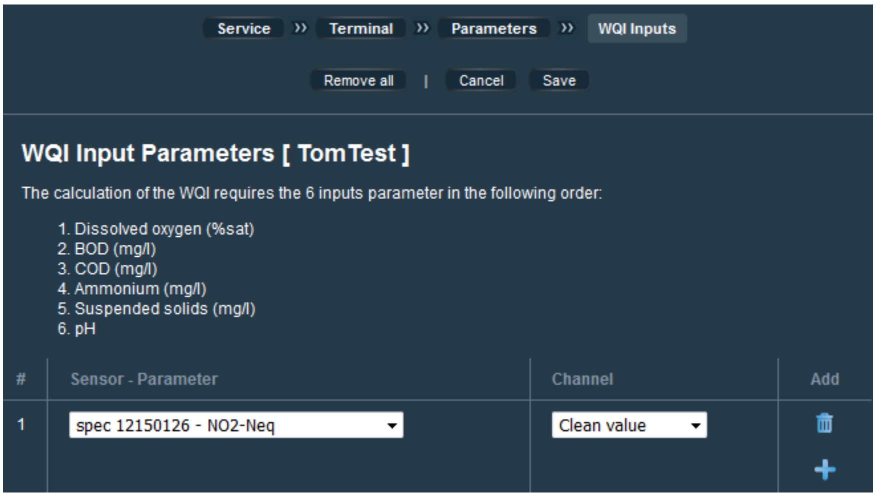
Spectral Alarm

This alarm type is very similar to the *pattern alarm*. The key difference is that instead of a set of parameter data a set of wavelength measurements of a spectrometer sensor is used. Accordingly, in the first configuration step the spectral source (“fingerprint”) that will be used as an input for the spectral alarm needs to be selected.

Water Quality Index

The *Water Quality Index* (*WQI*) used in *moni::tool* is a pre-defined virtual parameter based on the values for dissolved oxygen, BOD, COD, ammonium, suspended solids and pH.

Accordingly, when this parameter type is selected the system asks for adding the respective sensor-parameters.



WQI Input Parameters [TomTest]

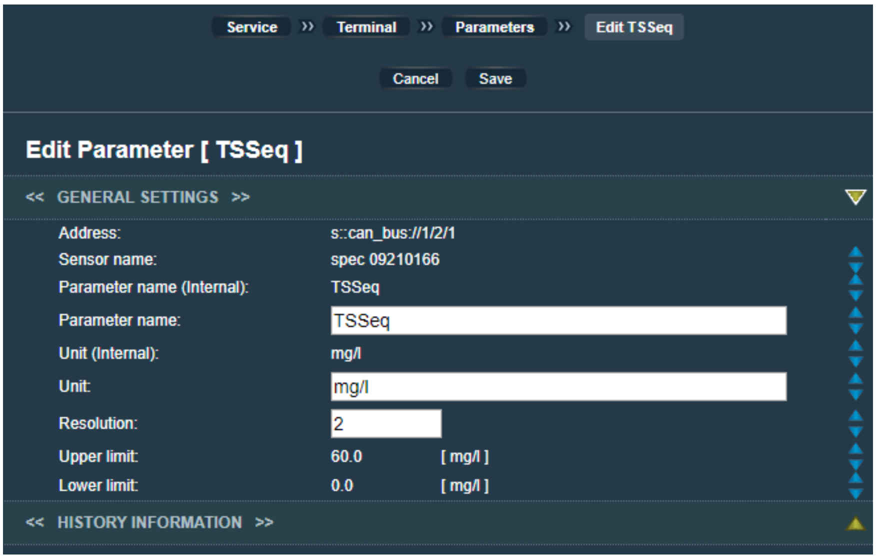
The calculation of the WQI requires the 6 inputs parameter in the following order:

1. Dissolved oxygen (%sat)
2. BOD (mg/l)
3. COD (mg/l)
4. Ammonium (mg/l)
5. Suspended solids (mg/l)
6. pH

#	Sensor - Parameter	Channel
1	spec 12150126 - NO2-Neq	Clean value

Edit Parameter Configuration

Pushing the blue *cogwheel* in a parameter's line opens the window *Edit Parameter.*



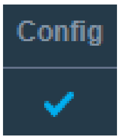
Address: s::can_bus://1/2/1
Sensor name: spec 09210166
Parameter name (Internal): TSSeq
Parameter name: TSSeq
Unit (Internal): mg/l
Unit: mg/l
Resolution: 2
Upper limit: 60.0 [mg/l]
Lower limit: 0.0 [mg/l]

While some settings for the respective parameter are displayed for information only, the settings for *Parameter name*, *Unit* and *Resolution* can also be edited.

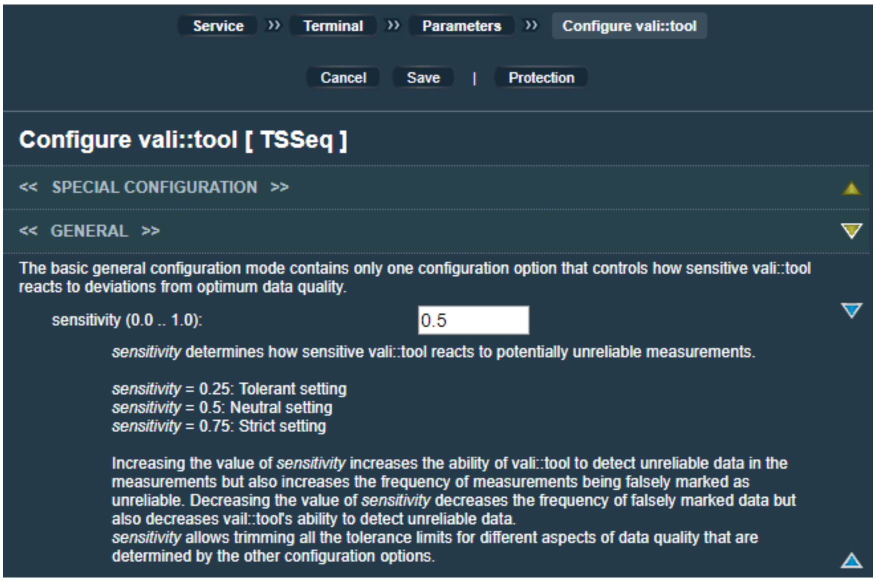
→<u>*Service Level*</u> / <u>*Expert*</u>

- Configuration history is displayed under <u>*History Information.*</u>

Configure vali::tool



Pushing the blue *checkmark* of a **physical parameter** opens the *Configure vali::tool* window where the specific settings for the parameter can be customized.



The basic general configuration mode contains only one configuration option that controls how sensitive vali::tool reacts to deviations from optimum data quality.

sensitivity (0.0 .. 1.0): 0.5

sensitivity determines how sensitive vali::tool reacts to potentially unreliable measurements.

sensitivity = 0.25: Tolerant setting
sensitivity = 0.5: Neutral setting
sensitivity = 0.75: Strict setting

Increasing the value of *sensitivity* increases the ability of vali::tool to detect unreliable data in the measurements but also increases the frequency of measurements being falsely marked as unreliable. Decreasing the value of *sensitivity* decreases the frequency of falsely marked data but also decreases vali::tool's ability to detect unreliable data.
sensitivity allows trimming all the tolerance limits for different aspects of data quality that are determined by the other configuration options.

For the service level *Basic* this is restricted to setting *vali::tool*'s overall sensitivity between 0 and 1 according to the specific measuring situation.

Low sensitivity values mean a tolerant setting, i.e. little false errors are reported but some unreliable data might be ignored.

A value of e.g. 0.75 in return increases the ability to detect unreliable data but might result in a certain number of false alarms.

→<u>*Service Level*</u> / <u>*Expert*</u>

- Configuration of all *vali::tool* settings for physical parameters
- Configuration of virtual parameters

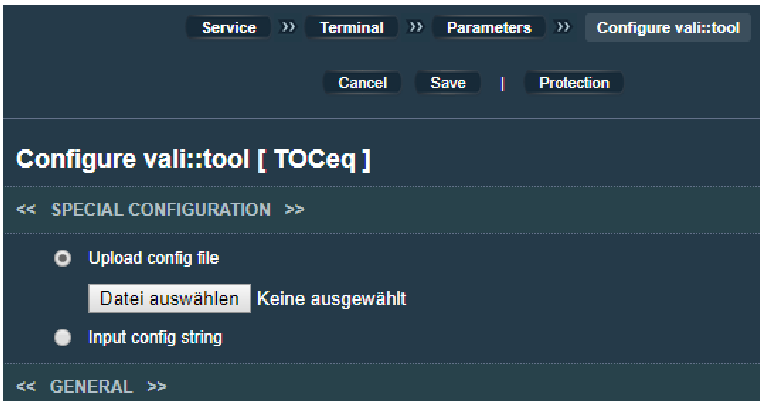
The following table provides an overview on the various settings.

	Name	Possible Settings	Effect	Function
GENERAL	*smoothingPeriod*	0 sec. - infinitely Default = 1500	500 = weak smoothing 1500 = normal smoothing 4500 = strong smoothing	Length of the time window used for the smoothing of clean data.
	rangeCheckUpper	any Default = Infinity	Measurement results above this limit will not be used.	Upper limit for physical / chemical plausible measuring results.
	rangeCheckLower	any Default = -Infinity	Measurement results below this limit will not be used.	Lower limit for physical / chemical plausible measuring results.
	sensitivity	0 - 1 Default =0,5	0,25 = tolerant setting 0,50 = neutral setting 0,75 = strict setting	Defines sensitivity of vali::tool in general.
NOISE DET.	*NOISEinstrumentNoise Threshold*	0 - infinitely Default = 1000,0	The smaller the value the more sensitive the quantification of noise detection.	Upper limit for normal noise level of the parameter.
	NOISEminimumNoise Level	any Default = 0	0 = typical setting -1 = setting for very stable input values	Lower limit for normal noise level of the parameter.

⚠ A specific *vali::tool* configuration file is stored on the terminal for each parameter from any s::can sensor and for specific applications (drinking water, effluent waste water, etc.). These configuration files provide appropriate values for the various configuration settings.

For *vali::tool* to work with highest efficiency, the appropriate configuration file needs to be selected as described below.

- Operate the s::can terminal locally;
- Open the *Configure vali::tool* window for the parameter that needs to be configured;
- Push *Upload config file*;
- Push *Browse* and select the appropriate folder
  - Files are stored at */persistent/scan/scandata/vali-tool/vali-tool/STANDARD/* (until *moni::tool* V2.5: d:\s-can\vali-tool\vali-tool\STANDARD\);
  - Select the folder corresponding to the application, the used spectrometer and the needed parameter;
- Open the file *config.txt* within the selected folder;
- Push *Save* for storing the configuration.



Configure vali::tool [TOCeq]

<< SPECIAL CONFIGURATION >>

● Upload config file

Datei auswählen Keine ausgewählt

○ Input config string

<< GENERAL >>

Configure ana::tool

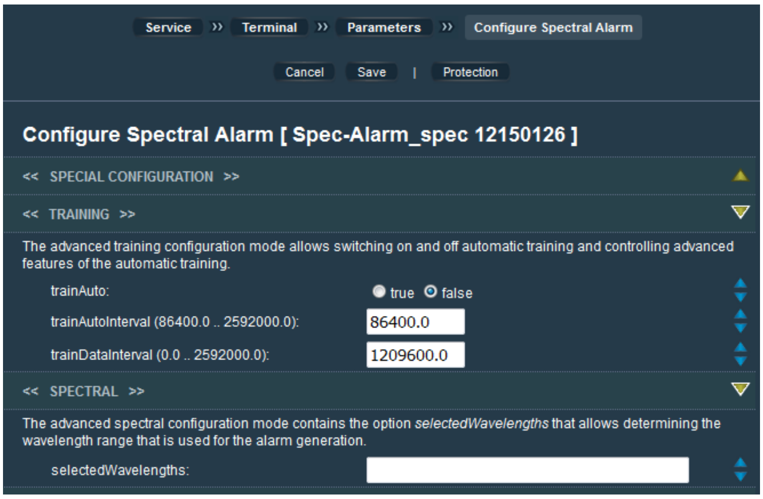
V Pushing the blue *V* of a **virtual parameter** opens the configuration window for the specific settings of the respective virtual parameter, depending on its type (see example on the right).

For the service level *Basic* this is restricted for ana::tool alarm parameters to read-only!

Please refer also to the information on *ana::tool* in chapter 6.7.

→*Service Level / Expert*

- Configuration of all *ana::tool* settings for training alarm parameters


Service ›› Terminal ›› Parameters ›› Configure Spectral Alarm
Cancel
Save
|
Protection

Configure Spectral Alarm [Spec-Alarm_spec 12150126]

<< SPECIAL CONFIGURATION >>

<< TRAINING >>

The advanced training configuration mode allows switching on and off automatic training and controlling advanced features of the automatic training.

trainAuto: ○ true ● false

trainAutoInterval (86400.0 .. 2592000.0): 86400.0

trainDataInterval (0.0 .. 2592000.0): 1209600.0

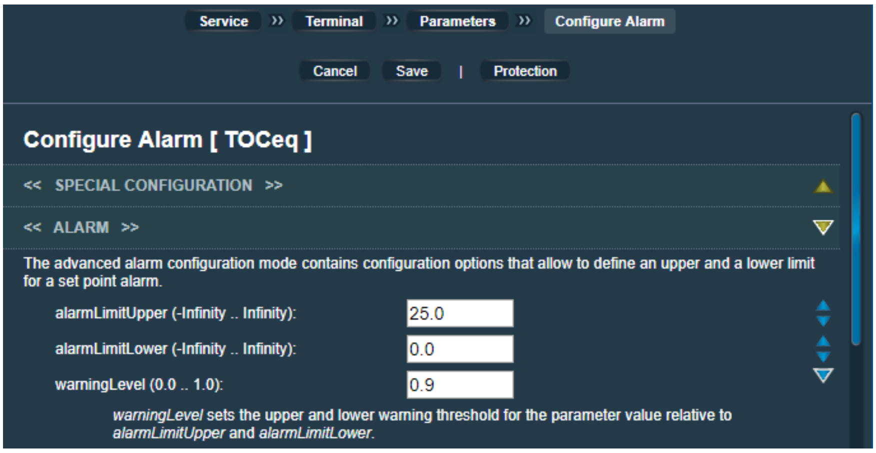
<< SPECTRAL >>

The advanced spectral configuration mode contains the option *selectedWavelengths* that allows determining the wavelength range that is used for the alarm generation.

selectedWavelengths:

Configure alarm

This configuration option allows specifying under which conditions an alarm is triggered by the respective parameter.



Configure Alarm [TOCeq]

The advanced alarm configuration mode contains configuration options that allow to define an upper and a lower limit for a set point alarm.

alarmLimitUpper (-Infinity .. Infinity): 25.0
alarmLimitLower (-Infinity .. Infinity): 0.0
warningLevel (0.0 .. 1.0): 0.9

warningLevel sets the upper and lower warning threshold for the parameter value relative to *alarmLimitUpper* and *alarmLimitLower*.

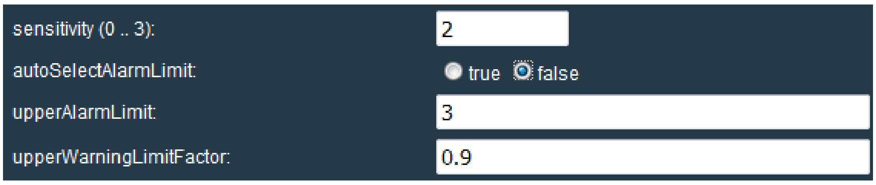
The available options depend on the parameter type (physical or virtual) and on the active service level.

Physical parameters:

- Upper / Lower limit

→*Service Level / Expert*

- Warning level



sensitivity (0 .. 3): 2
autoSelectAlarmLimit: ○ true ● false
upperAlarmLimit: 3
upperWarningLimitFactor: 0.9

Virtual parameters:

- Sensitivity

→*Service Level / Expert*

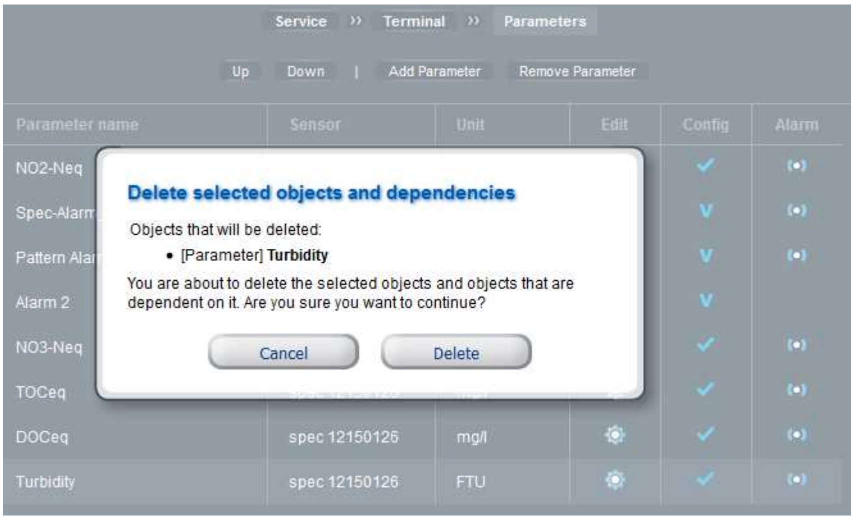
- All configuration parameters

Remove Parameter

This menu item provides the possibility to delete a parameter from the parameter list.

After selecting one or several parameters and pushing the button *Remove Parameter* a query is displayed if the parameter(s) shall really be deleted.

When pushing *Delete*, the parameter will be removed from *Values* and *Time Series* and no new results will be stored in the database.



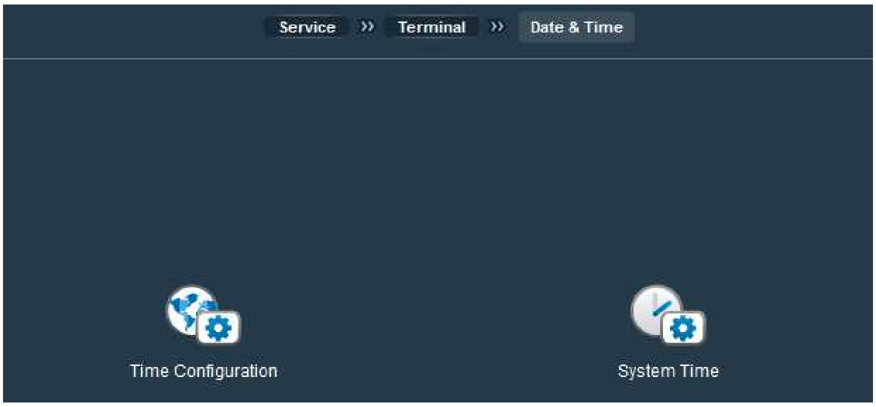
Delete selected objects and dependencies

Objects that will be deleted:

- [Parameter] **Turbidity**

You are about to delete the selected objects and objects that are dependent on it. Are you sure you want to continue?

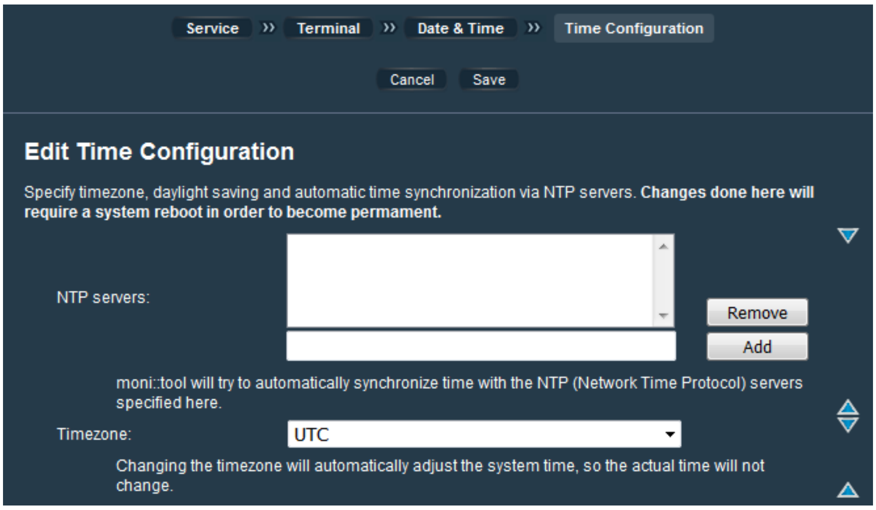
6.4.6 Date & Time



Time Configuration

This menu provides the possibility for configuring NTP (Network Time Protocol) server addresses so that the system will automatically synchronize its time with those servers when the s::can terminal is connected to the internet.

Furthermore, the correct time zone for the monitoring station can be set, using the respective drop down list.



Edit Time Configuration

Specify timezone, daylight saving and automatic time synchronization via NTP servers. **Changes done here will require a system reboot in order to become permament.**

NTP servers:

moni::tool will try to automatically synchronize time with the NTP (Network Time Protocol) servers specified here.

Timezone: UTC

Changing the timezone will automatically adjust the system time, so the actual time will not change.

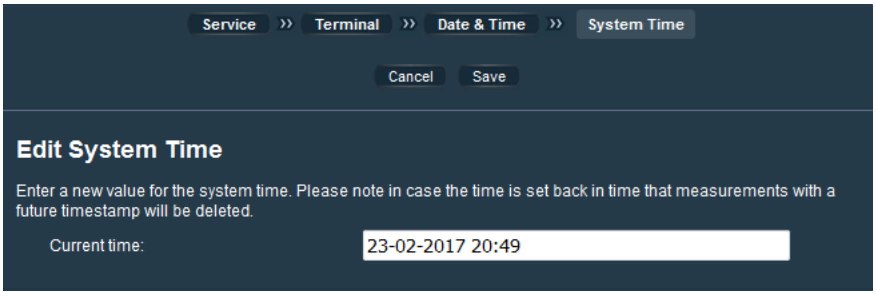
Available ***Quick reference guides***:

Manuals	*moni::tool / Service_Guides*	note_moni-toolV2_TimeSync

Please refer to the s::can Customer Portal!

System Time

This menu item provides the possibility to set the *con::cube*'s system time and date manually.



Edit System Time

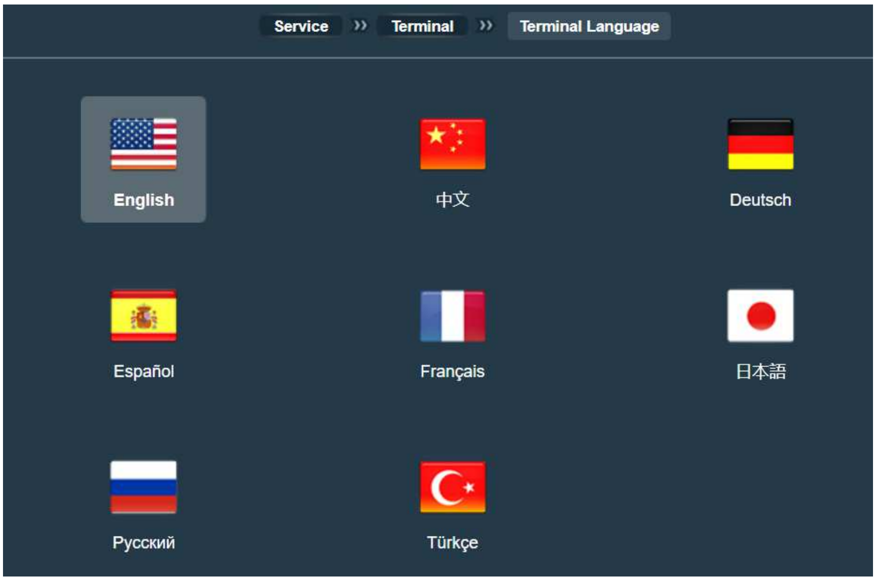
Enter a new value for the system time. Please note in case the time is set back in time that measurements with a future timestamp will be deleted.

Current time: 23-02-2017 20:49

6.4.7 Terminal Language

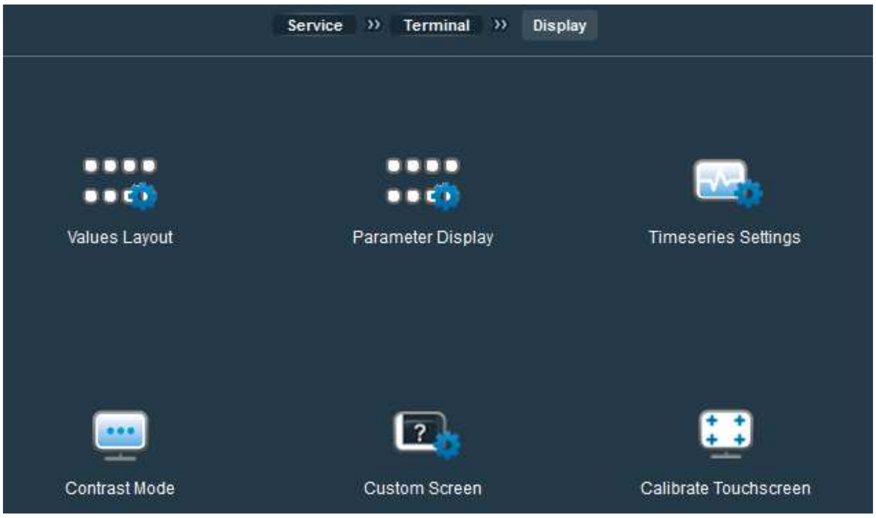
The language of all text in menus and graphics can be changed by selecting one of the available country flags.

When using a web browser for accessing the monitoring system, the used browser language can be set independently from the general setting of the terminal by using the language flag in the main frame (see 0.2.1).



6.4.8 Display

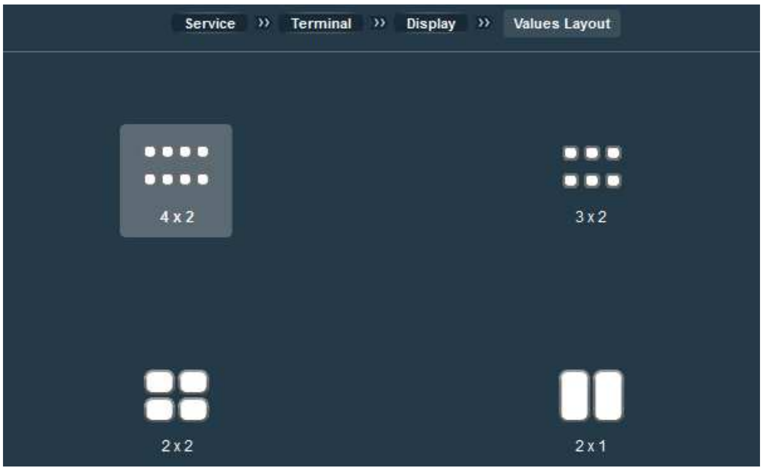
Various options for adapting the moni::tool appearance to specific needs can be configured.



Values Layout

This menu allows selecting one of the pre-defined lay-outs for the *Values* tab.

This is of special interest in cases with less than 7 parameters or when some parameters are of special relevance.



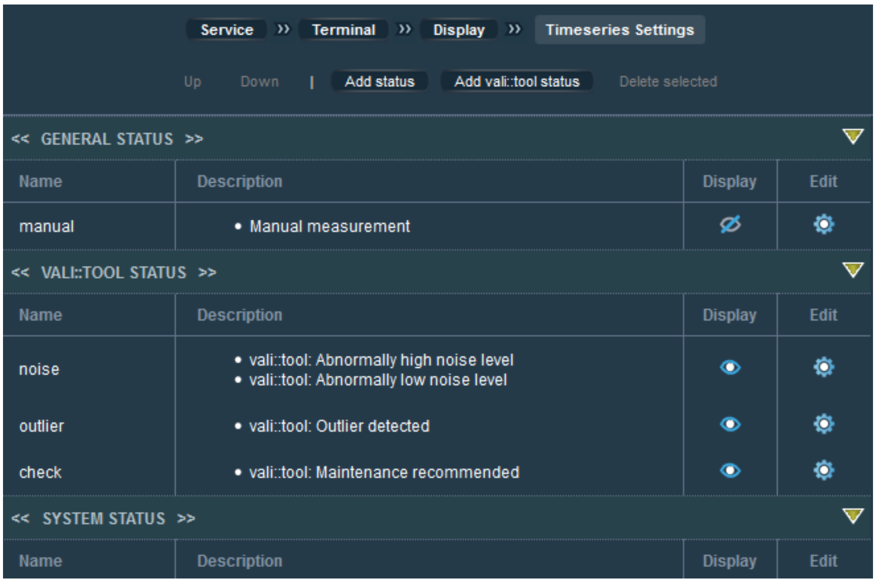
Parameter Display

In this menu the number of parameters to be displayed in *Values* and *Time Series* when no user is logged in can be limited. This can be used for example to hide parameters which serve as input for virtual parameter.

Timeseries Settings

These settings allow the configuration and definition of status messages in terms of *General Status* and *vali::tool Status*.

The predefined status messages can be edited by pushing the respective *Edit* icon, new messages can be added by pushing *Add status* or *Add vali::tool status*, respectively.



<< GENERAL STATUS >>

Name	Description	Display	Edit
manual	• Manual measurement		

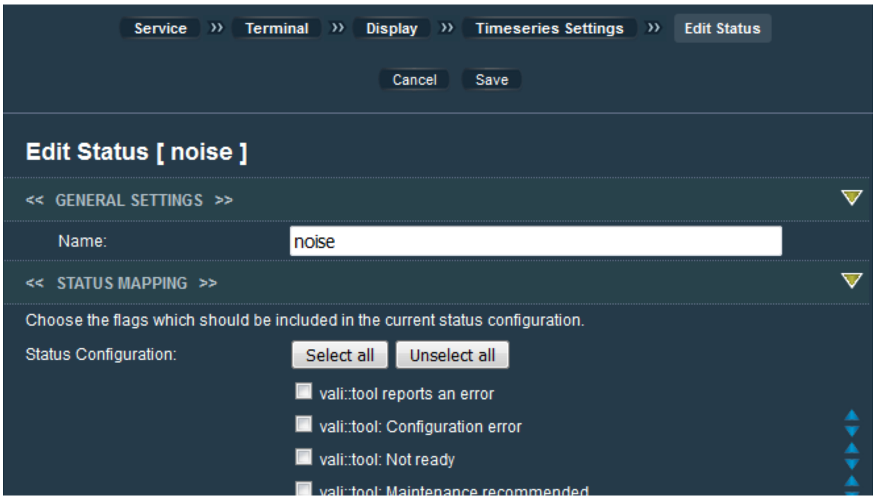
<< VALI::TOOL STATUS >>

Name	Description	Display	Edit
noise	• vali::tool: Abnormally high noise level • vali::tool: Abnormally low noise level		
outlier	• vali::tool: Outlier detected		
check	• vali::tool: Maintenance recommended		

<< SYSTEM STATUS >>

Name	Description	Display	Edit

Configuring new or existing status messages is done by checking one or several tick boxes and hence defining which kind of information is used to trigger the respective status message.



Edit Status [noise]

Name: noise

Choose the flags which should be included in the current status configuration.

Status Configuration:

☐ vali::tool reports an error
☐ vali::tool: Configuration error
☐ vali::tool: Not ready
☐ vali::tool: Maintenance recommended

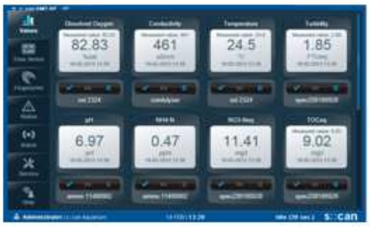
The order in which status messages are shown can be controlled using the _Up_ and _Down_ buttons. Whether a configured status shall be actually shown in time series can be controlled by activating or deactivating the _Display_ icon.

Unused status messages can be marked and removed pushing _Delete selected_.

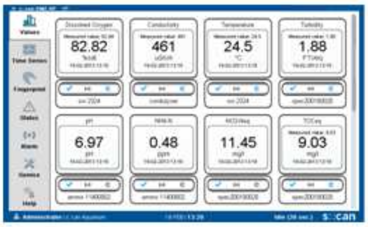
Contrast Mode

This function helps optimizing display readability by offering various contrast mode options.

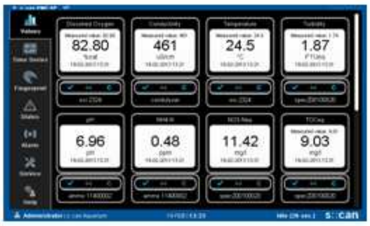
- Classic Mode: Attractive *moni::tool* colors with normal contrast for standard situations
- Day Mode: A white background with black letters for maximized contrast in bright sunlight
- Night Mode: A largely black background for good readability in the dark



Classic-Mode



Day-Mode



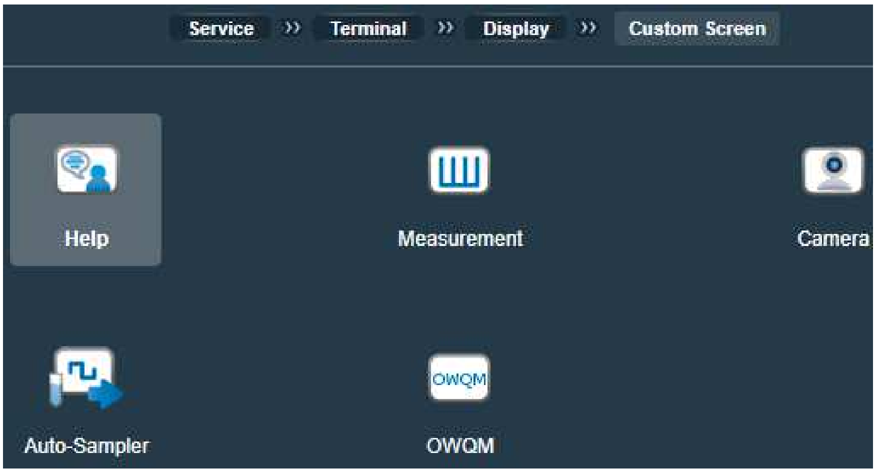
Night-Mode

⚠ This service is available only locally on the *con::cube*.

Custom Screen

The appearance of *moni::tool* can be adapted to specific needs by configuring the use of the last entry in the *Tab Menu* on the left side of the screen.

Help
Per default the last tab is _Help_.



Measurement
By selecting this point the last tab is set to *Measurement*. It allows easy switching between the automatic and the manual measurement modes (see also chapter 6.4.1). The exact way the manual measurement will be executed and other options can be configured.

Camera
If a camera is part of the monitoring system (see 6.4.9, p. 55) this point sets the last tab to *Camera*, for which the modes *Gallery* or *Livestream* can be selected.

Auto sampler
If an auto-sampler is configured the last tab can be set to *Auto-Sampler* which allows quick control and easy feedback for the auto-sampler function.

⚠ While this respective menu allows configuring some predefined screens, new views can be developed as well. Please get into contact with s::can on this option!

Calibrate Touchscreen

⚠ This service is available only locally on the *con::cube*.

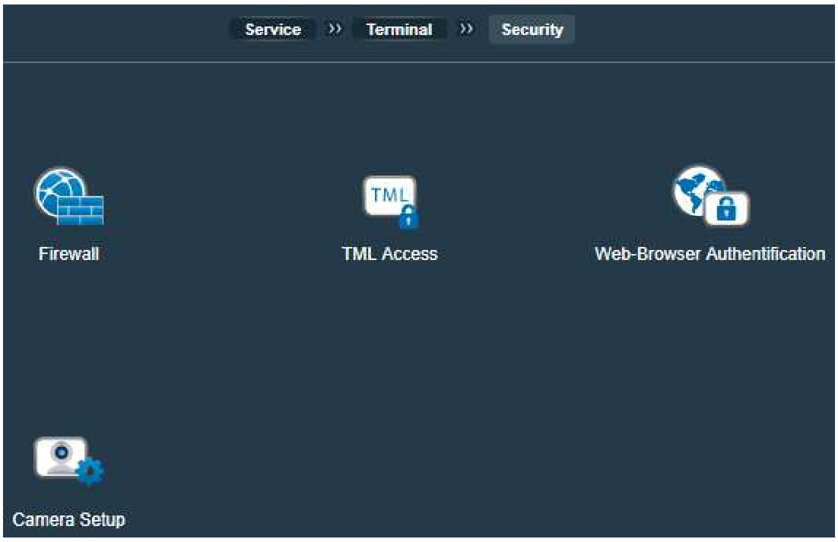
All s::can terminals are delivered with calibrated touch screens. Recalibration can sometimes become necessary due to environmental impacts (e.g. after the terminal is exposed to strong variations in temperature during operation).

When selecting this menu item the system will ask to touch the screen in the four corners (red points). Based on these inputs the screen will be recalibrated. While in *moni::tool* versions up to V2.5 this process is terminated automatically after some time, from V3.0 on it can be terminated only using an USB-keyboard.

⚠ In case the s::can terminal can no longer be operated via its touch screen, the touch calibration procedure can be started either remotely via a web browser or locally using a USB mouse. However, the touchscreen calibration itself can then be carried out only directly on the touch screen of the terminal.

6.4.9 Security

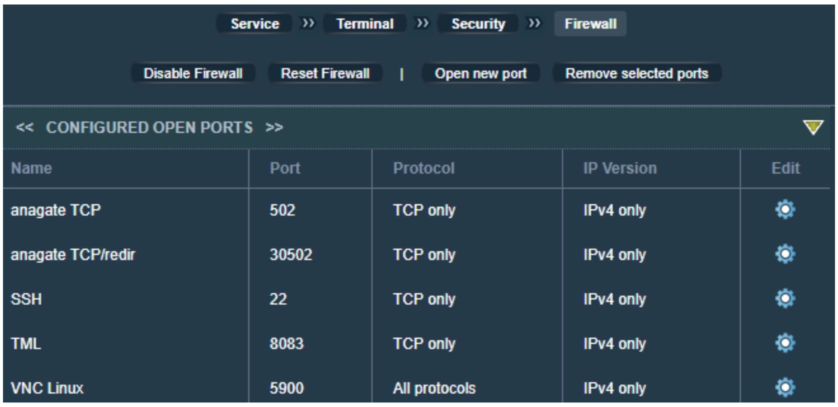
In this menu settings relevant for IT security of the *con::cube* monitoring system can be made.



Firewall

A so called firewall controls the way how a device can be accessed from the internet and how it can communicate to the internet.

For each communication path a specific port can be defined and configured in terms of port, protocol and IP version.



<< CONFIGURED OPEN PORTS >>

Name	Port	Protocol	IP Version	Edit
anagate TCP	502	TCP only	IPv4 only	⚙
anagate TCP/redir	30502	TCP only	IPv4 only	⚙
SSH	22	TCP only	IPv4 only	⚙
TML	8083	TCP only	IPv4 only	⚙
VNC Linux	5900	All protocols	IPv4 only	⚙

New ports can be opened and existing ports can be edited or removed by using the respective buttons.

Internet connectivity always bears the risk of unwanted manipulations. Accordingly, these settings should be used restrictively and any changes should be done by experienced staff only. Furthermore, disabling the firewall is NOT recommended.

*Available **Quick reference guides**:*

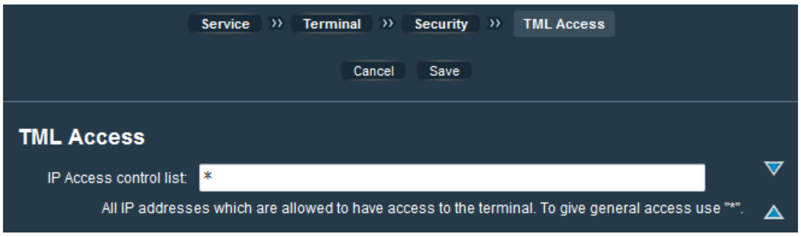
Manuals	*con::cube / Service_Guides*	note_moni-tool_Security

Please refer to the s::can Customer Portal!

TML Access

TML is a protocol which can be used to transfer data from the s::can terminal's database. For details on TML please refer to chapter 0).

An IP Access control list can be used to restrict access to the TML server to a list of specific IP addresses.



TML Access

IP Access control list: *

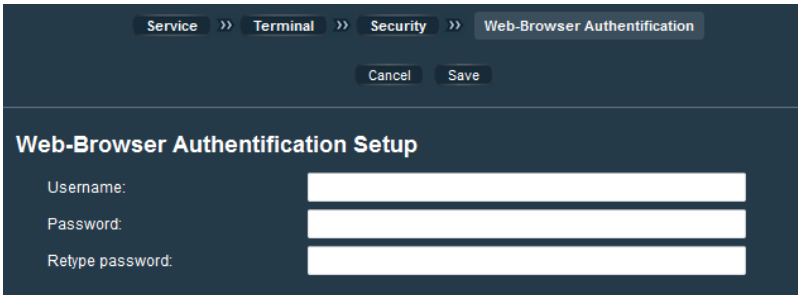
All IP addresses which are allowed to have access to the terminal. To give general access use "*".

The respective addresses can be entered in this window. The default configuration does not use access restrictions.

Web-Browser Authentification

This menu item provides the possibility to set a password for a user operating the s::can system via web browser.

If a user name and password are set here, connection to *moni::tool* from a remote computer is only possible after the correct username and password have been entered.


Service ›› Terminal ›› Security ›› Web-Browser Authentification
Cancel
Save

Web-Browser Authentification Setup

Username:

Password:

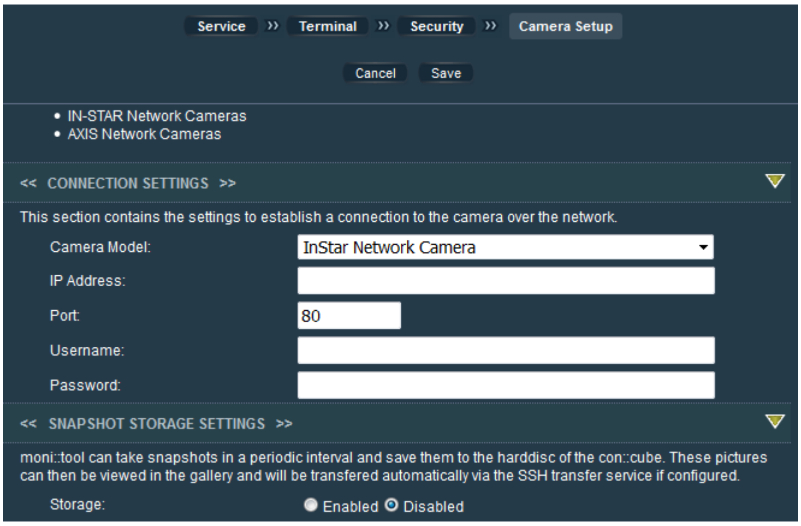
Retype password:

Once authentication is activated, until *moni::tool* V2.x local access to the system is possible but requires a USB keyboard connected to the *con::cube*. **From *moni::tool* V3.0 on, local access is not possible any longer. This might even prevent any further access to the system!**

Camera Setup

Cameras can be helpful for getting visual information from monitoring sites. *moni::tool* provides the option to connect to cameras accessible via the internet and to include pictures and videos in the collected information (see also chapter 4.4.2).

The information required for connecting to a given camera safely can be entered in the respective fields. Furthermore, it can be specified if camera snapshots shall be taken and stored automatically at certain intervals.


Service ›› Terminal ›› Security ›› Camera Setup
Cancel
Save
<< CONNECTION SETTINGS >>
<< SNAPSHOT STORAGE SETTINGS >>

- IN-STAR Network Cameras
- AXIS Network Cameras

This section contains the settings to establish a connection to the camera over the network.

Camera Model: InStar Network Camera

IP Address:

Port: 80

Username:

Password:

moni::tool can take snapshots in a periodic interval and save them to the harddisc of the con::cube. These pictures can then be viewed in the gallery and will be transfered automatically via the SSH transfer service if configured.

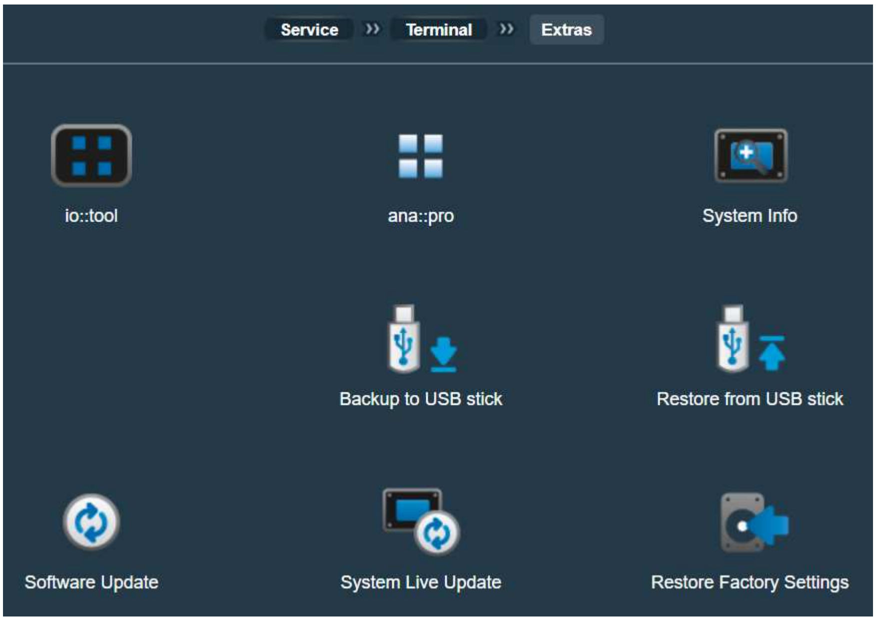
Storage: ○ Enabled ● Disabled

*Available **Quick reference guides**:*

Manuals	*con::cube / Service_Guides*	note_moni-toolV2_Camera_Integration

Please refer to the s::can Customer Portal!

6.4.10 Extras



In this menu issues dealing with system administration are addressed.

Io::tool

⚠ This menu provides the possibility to start the *Io::Too*l software for direct operation of the connected spectrometer probe V3. This is a local service and can be started only directly on the *con::cube*. When *Io::Tool* is started the *moni::tool* software will be shut down and after finishing the service task the complete monitoring system has to be rebooted.

ana::pro

This menu item provides the possibility to start the *ana::pro* software allowing the advanced configuration of spectrometer sensors V1 and V2.

⚠ This is a local service and can be started only directly on the *con::cube*. When *ana::pro* is started the *moni::tool* software will be shut down and after finishing the service task the complete monitoring system has to be rebooted.

After this menu item has been selected a screen will be displayed showing all service tasks currently running in the background. Selecting the entry *Continue* on top of the screen will pop up a warning that all services will be stopped. This message has to be confirmed by pushing *Yes*.

⚠ *For moni::tool versions up to V2.5*: Pushing the button *Permanent* will change the startup sequence of the terminal. It will deactivate *moni::tool* and will make ana::pro the active operating software. For undoing this setting the file *D:\Programme\s-can\monitool.bat.disabled* has to be renamed to *monitool.bat*.

Once started, *ana::pro* will search for spectrometers. This process should not be interfered with, etc. by touching the screen.

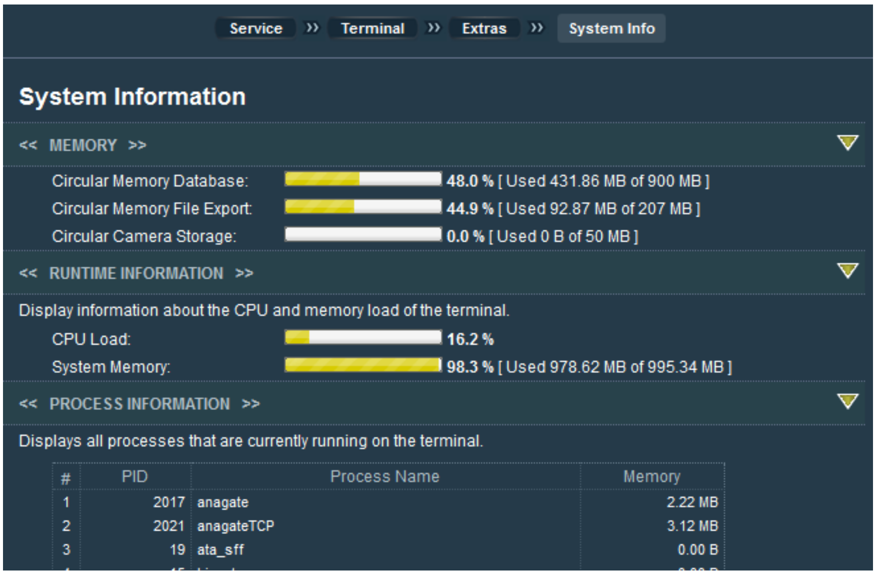
⚠ Please refer to the *ana::lyte* and *ana::pro* manuals for further details on how to work with *ana::pro*.

As soon as all service tasks in ana::pro have been finished, using the option *Exit windows and reboot* will trigger a complete system reboot and *moni::tool* will be started automatically.

System Info

Under this point information on the currently used terminal resources are provided, namely the used shares of various memory types as well as the CPU load.

Furthermore, all running processes can be listed.


Service ›› Terminal ›› Extras ›› System Info
<< MEMORY >>
<< RUNTIME INFORMATION >>
<< PROCESS INFORMATION >>

System Information

Circular Memory Database: 48.0 % [Used 431.86 MB of 900 MB]
Circular Memory File Export: 44.9 % [Used 92.87 MB of 207 MB]
Circular Camera Storage: 0.0 % [Used 0 B of 50 MB]

Display information about the CPU and memory load of the terminal.

CPU Load: 16.2 %
System Memory: 98.3 % [Used 978.62 MB of 995.34 MB]

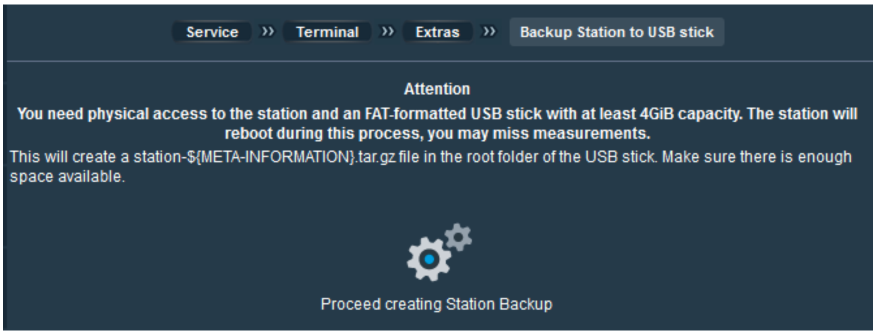
Displays all processes that are currently running on the terminal.

#	PID	Process Name	Memory
1	2017	anagate	2.22 MB
2	2021	anagateTCP	3.12 MB
3	19	ata_sff	0.00 B

Backup Station to USB Stick

With physical access to the *con::cube* this function facilitates creating a backup of the whole monitoring station on a USB memory stick. The memory stick must be FAT-formatted with at least 4 GB capacity.

As a result of the backup procedure an *xxx.tar.gz*-file will be created in the stick's root folder.


Service ›› Terminal ›› Extras ›› Backup Station to USB stick
Proceed creating Station Backup

Attention

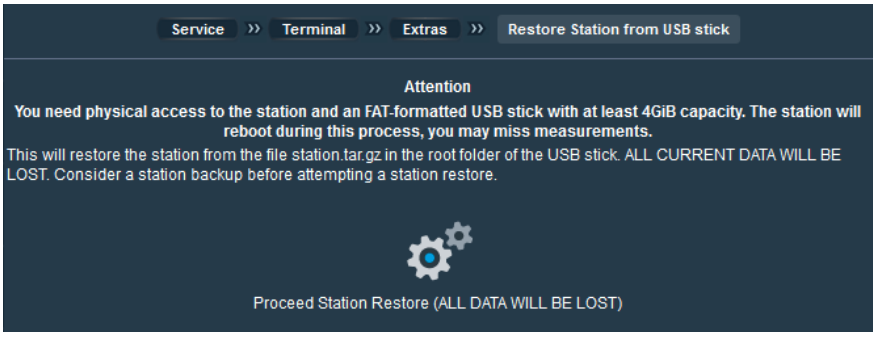
You need physical access to the station and an FAT-formatted USB stick with at least 4GiB capacity. The station will reboot during this process, you may miss measurements.

This will create a station-${META-INFORMATION}.tar.gz file in the root folder of the USB stick. Make sure there is enough space available.

Restore Station from USB-Stick

When a station's settings have been saved using the function described above, it can be restored with this respective function. The name of the backup-file has to be ***station.tar.gz*** and must be placed in the **root-directory of the USB-Stick**.

⚠ All settings will be overwritten during the restore process and a station backup should hence be considered.


Service ›› Terminal ›› Extras ›› Restore Station from USB stick
Proceed Station Restore (ALL DATA WILL BE LOST)

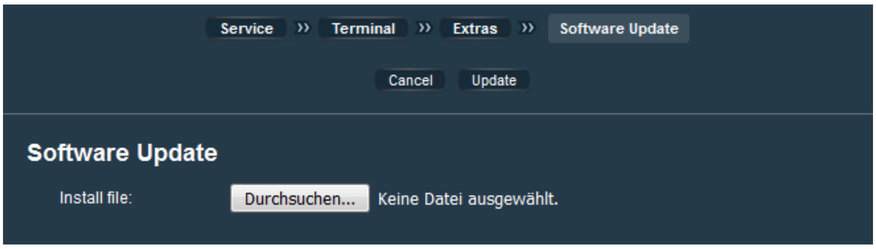
Attention

You need physical access to the station and an FAT-formatted USB stick with at least 4GiB capacity. The station will reboot during this process, you may miss measurements.

This will restore the station from the file station.tar.gz in the root folder of the USB stick. ALL CURRENT DATA WILL BE LOST. Consider a station backup before attempting a station restore.

Software Update

This menu item provides the possibility to run update-scripts (for example to update the firmware of sensors connected to the terminal).



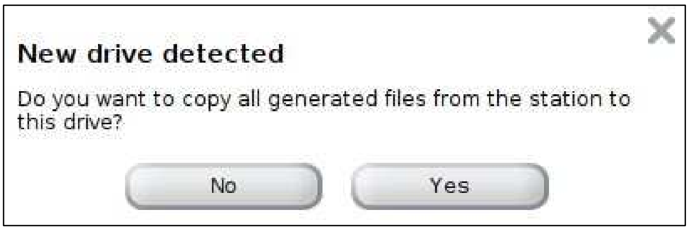
Software Update

Install file: Keine Datei ausgewählt.

The file containing the update-script can be selected by pushing the _Search_-button, _Update_ will start the software guided upgrade procedure.

Update of moni::tool software for Windows OS (V2.0) via this function is possible also.

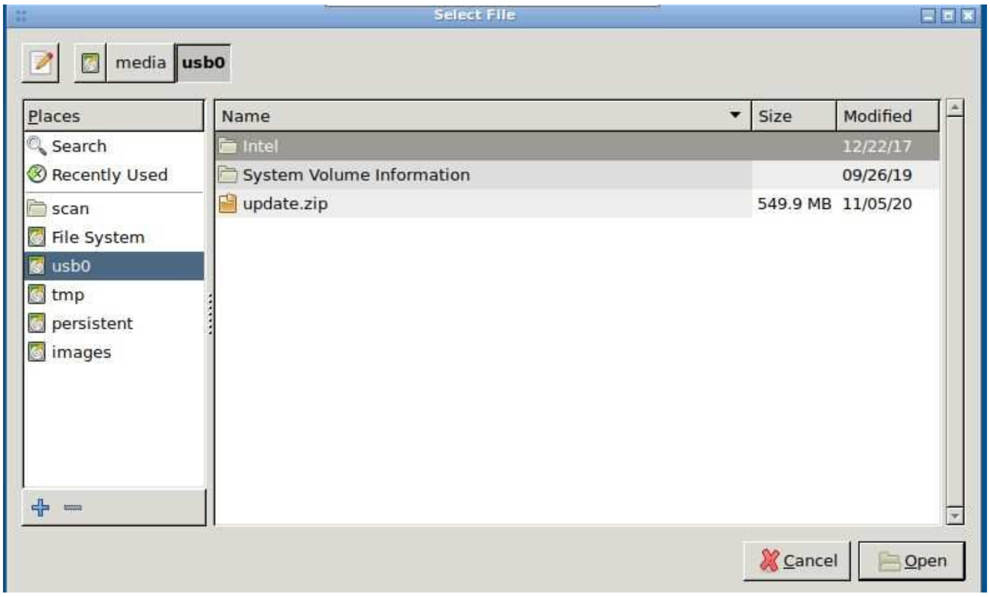
As soon as a USB stick is connected to the con::cube, a message pops up, asking if the result files shall be copied to the stick.



New drive detected

Do you want to copy all generated files from the station to this drive?

After pushing *No* you will see the *Select File* window. Select *usb0* on the left side first and then the needed update file in the right part of the window. Finally push *Open*.



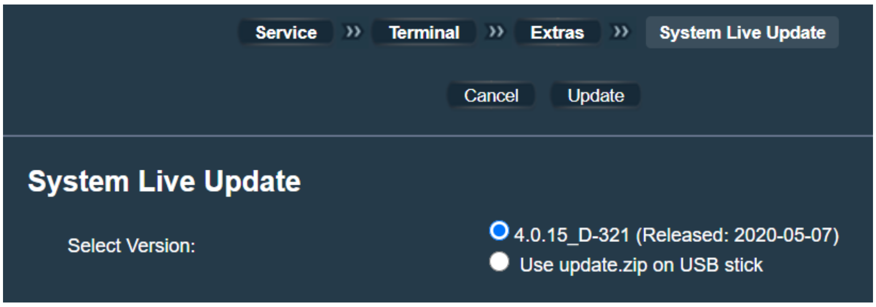
Name	Size	Modified
Intel		12/22/17
System Volume Information		09/26/19
update.zip	549.9 MB	11/05/20

System Live Update

This function provides a comfortable way for updating the *moni::tool* software when the *con::cube* is connected to the Internet.

All available updates will be listed and after selecting the appropriate packages and pushing "*Update*" they will be downloaded and installed automatically.

Alternatively also a USB-Memory-stick containing the update packages can be used accordingly.



System Live Update

Select Version:

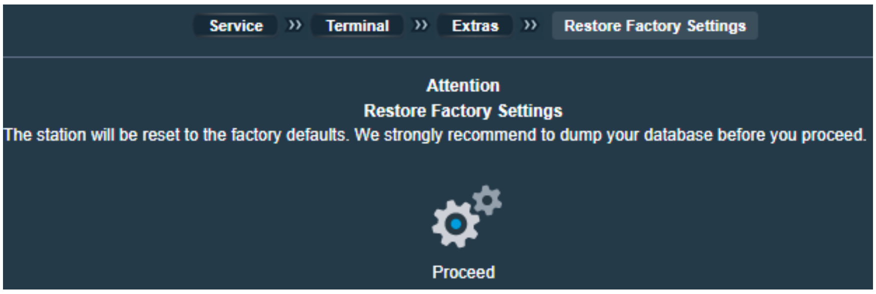
● 4.0.15_D-321 (Released: 2020-05-07)

○ Use update.zip on USB stick

⚠ The Update of *moni::tool* software for Linux OS (V3.0) can be performed within this function only. The name of the update package has to be *update.zip*.

Restore Factory Settings

This menu item provides the possibility to reset the internal *moni::tool* database to factory default (i.e. the original settings the terminal was delivered with).



Attention

Restore Factory Settings

The station will be reset to the factory defaults. We strongly recommend to dump your database before you proceed.

Restoring to factory settings includes measurement results as well as all settings related to parameters and sensors etc. and will hence lead to a loss of all data in the database as well as to a loss of all sensor information.

When the restore has been completed the s::can terminal should be rebooted before any configurations are performed.

⚠ It is strongly recommended to perform a *Backup Station to USB-Stick* as described above before factory settings are restored.

Task Manager

This menu item is available only for *moni::tool* versions up to V2.5 and will start the Windows XP task manager on the terminal itself (which is not available under the Linux operating system).

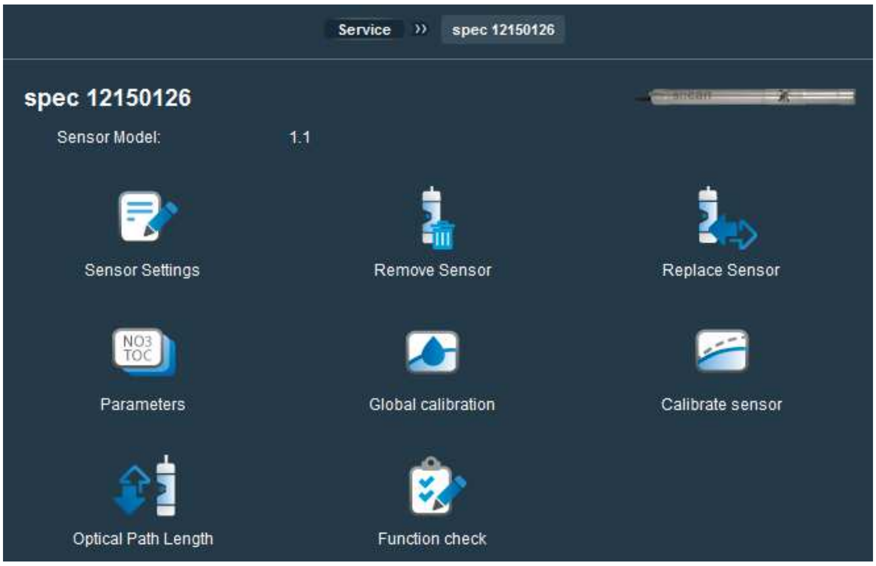
The launched task manager will be visible only on the screen of the s::can terminal and it will block the other applications from being visible.

6.5 Sensors

spec 14350047 - spectro::lyser
UV_R209FV21T

The sensor area of the *Service* tab provides an overview of all installed sensors.

Further configuration and maintenance options for each individual sensor are launched by pushing the respective sensor's icon.



spec 12150126

Sensor Model: 1.1

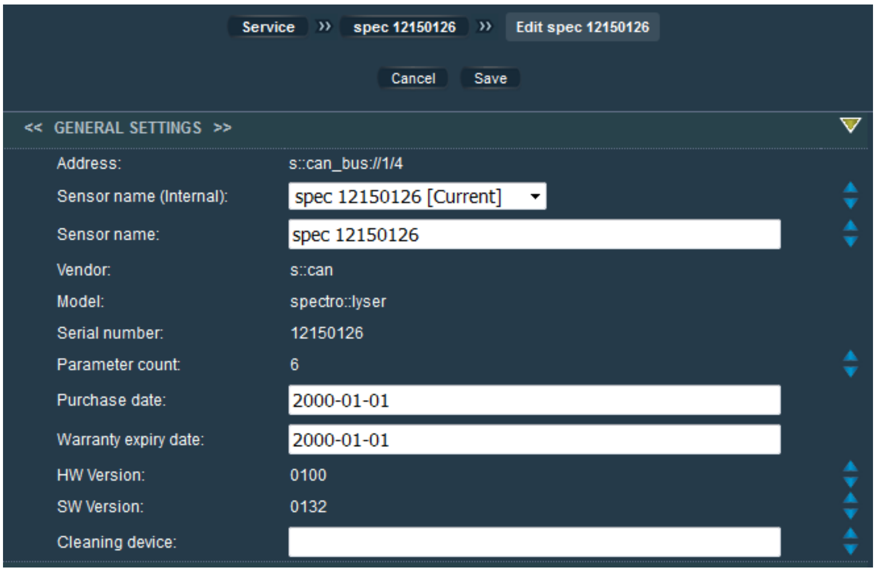
6.5.1 Sensor settings

This menu provides the possibility to edit the sensor settings that can be modified by the user.

Changeable settings include the *sensor name*, the *purchase date* and the *warranty expiry date*. Settings controlled by the system will also be displayed for information.

If a spectrometer is used in combination with a terminal which has an own cleaning valve (e.g. *con::nect*), entering a text in the field *Cleaning device* creates a new cleaning device (see 6.10) using the URL of this sensor.

Individual settings exist for the different sensor types. Please refer to the according sensor manuals



Address: s::can_bus://1/4
Sensor name (Internal): spec 12150126 [Current]
Sensor name: spec 12150126
Vendor: s::can
Model: spectro::lyser
Serial number: 12150126
Parameter count: 6
Purchase date: 2000-01-01
Warranty expiry date: 2000-01-01
HW Version: 0100
SW Version: 0132
Cleaning device:

6.5.2 Remove sensor

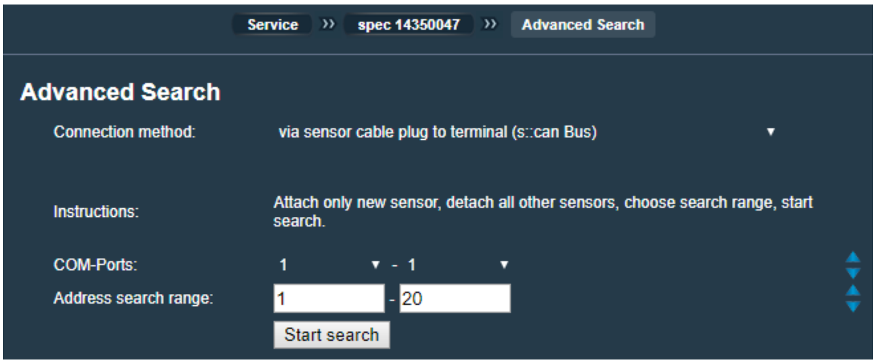
This menu removes the sensor and all associated parameters from the monitoring station configuration. Data collected by this sensor remain stored in the database and can still be displayed in Time Series and Fingerprint.

After selecting the menu item a user message will be displayed and *Delete all* has to be confirmed for removing the sensor.

6.5.3 Replace Sensor

This menu supports the exchange of a sensor with the same type of instrument. When using *Replace Sensor* all settings that can be configured in *moni::tool* remain unchanged and will be applied to the new sensor.

Time series of readings will be continued after sensor replacement as sensor name and parameter name are identical.



Advanced Search

Connection method: via sensor cable plug to terminal (s::can Bus)

Instructions: Attach only new sensor, detach all other sensors, choose search range, start search.

COM-Ports: 1 - 1

Address search range: 1 - 20

If it is not possible to exchange the sensor *moni::tool* will show the differences between the old and the new sensor and offer the possibility to install the replacement sensor as a new one (button *Install as new Sensor*).

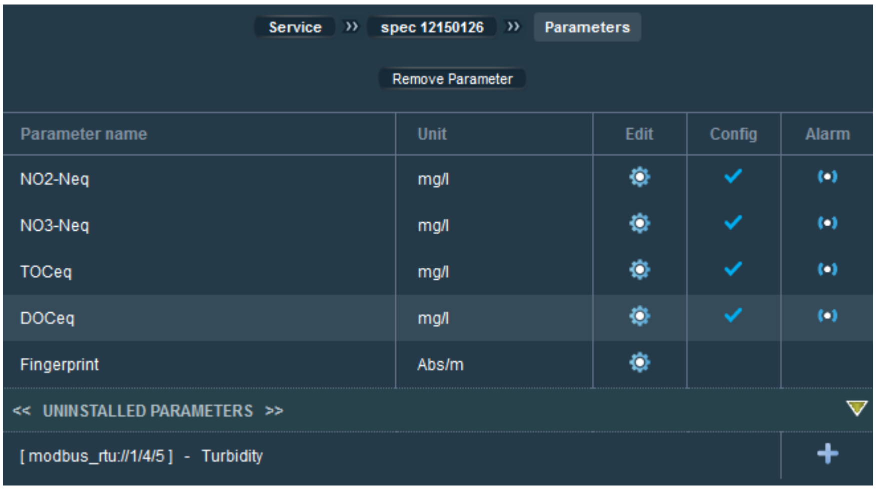
⇨ *Available **Quick reference guides**:*

Manuals	*con::cube / Service_Guides*	note_moni-toolV2_sensorinstall+replace

Please refer to the s::can Customer Portal!

6.5.4 Parameters

⚠ The information managed in this menu is closely linked and partly identical with the one described under Service / *Terminal* / *Parameters*. Please refer to chapter 6.4.5 for further details!


Service ›› spec 12150126 ›› Parameters
Remove Parameter
<< UNINSTALLED PARAMETERS >>

Parameter name	Unit	Edit	Config	Alarm
NO2-Neq	mg/l	⚙	✓	(•)
NO3-Neq	mg/l	⚙	✓	(•)
TOCeq	mg/l	⚙	✓	(•)
DOCeq	mg/l	⚙	✓	(•)
Fingerprint	Abs/m	⚙		

[modbus_rtu://1/4/5] - Turbidity +

The main window provides a list of all currently configured parameters measured by the respective sensor as well as the entry points for further configuration steps on the right of the table.

Furthermore, parameters which can be measured by the sensor but are currently not configured are listed in the lower part of the window. They can be installed by pushing the blue + on the right side.

Installed parameters can be selected by pushing their name and then be removed by pushing *Remove Parameter*. Thus they become available in the “uninstalled” list afterwards.

The table below provides an overview on the possibilities for customizing the various parameter settings as well as the manual page on which more detail are provided in the *Terminal* / *Parameters* chapter.

Edit	⚙	Configure general settings (name, unit, resolution)	p. 48
Config	✓	Configure vali::tool (sensitivity, noise detection)	p. 48
Alarm	(•)	Configure alarm settings (upper/lower limit, warning level)	p. 50

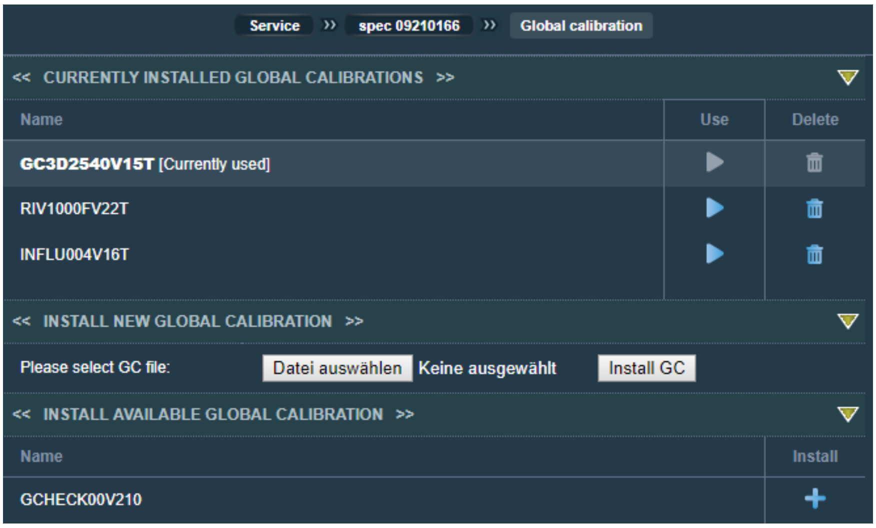
6.5.5 Global calibration

⚠ This point is valid for spectrometer sensors only.

A global calibration defines for a certain setting how measurements from a spectrometer are transformed into parameter readings. This transformation is influenced by the spectrometer type, by the path length and by the medium. Accordingly, global calibrations exist for a variety of settings.

The *Global calibration* menu provides the possibility to select the global calibration used by the spectrometer from calibrations actually stored on the sensor.

For activating one of the listed calibrations it is selected by pushing the blue triangle symbol on the right side.


Service ›› spec 09210166 ›› Global calibration
<< CURRENTLY INSTALLED GLOBAL CALIBRATIONS >>
<< INSTALL NEW GLOBAL CALIBRATION >>
Datei auswählen
Install GC
<< INSTALL AVAILABLE GLOBAL CALIBRATION >>

Name	Use	Delete
GC3D2540V15T [Currently used]	▶	🗑
RIV1000FV22T	▶	🗑
INFLU004V16T	▶	🗑

Please select GC file: Keine ausgewählt

Name	Install
GCHECK00V210	+

Also new global calibrations can be uploaded to the spectrometer. Push the button *Browse / Choose File…* for searching the global calibrations that are available on the terminal. The file name will be displayed beside the button.

When the correct one has been selected it can be uploaded to the spectrometer by pushing the *Install GC* button.

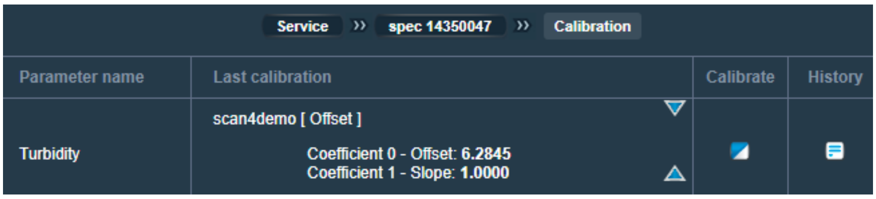
6.5.6 Calibrate sensor

⚠ The parameter calibration is closely linked to the taking of samples and relevant information can hence also be found in chapter 6.3. Since calibration approaches depend also on the type of sensor, please refer also to the respective sensor manual.

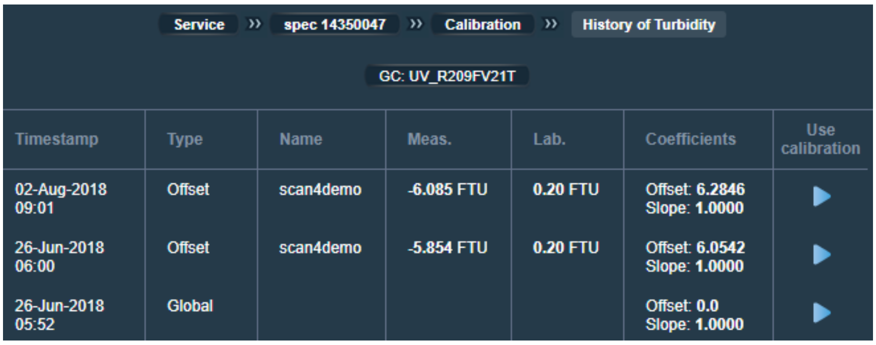
The main window shows a list of all parameters being measured by this sensor. Pushing the blue triangles will open more information about actual used calibration coefficients for this parameter.

The *History* icon opens a logbook showing date and time of all performed calibration procedures up to now, including the used sample readings and the corresponding laboratory values (see lower figure on the right).

Historic calibrations can be activated by pushing the *Use calibration* icon if this function is supported from the sensor.

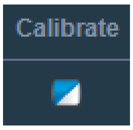


Parameter name	Last calibration	Calibrate	History
Turbidity	scan4demo [Offset] Coefficient 0 - Offset: **6.2845** Coefficient 1 - Slope: **1.0000**	◪	▤


Service ›› spec 14350047 ›› Calibration ›› History of Turbidity

GC: UV_R209FV21T

Timestamp	Type	Name	Meas.	Lab.	Coefficients	Use calibration
02-Aug-2018 09:01	Offset	scan4demo	-6.085 FTU	**0.20 FTU**	Offset: **6.2846** Slope: **1.0000**	▶
26-Jun-2018 06:00	Offset	scan4demo	-5.854 FTU	**0.20 FTU**	Offset: **6.0542** Slope: **1.0000**	▶
26-Jun-2018 05:52	Global				Offset: **0.0** Slope: **1.0000**	▶



Pushing the blue *Calibrate* icon opens the calibration window which allows actually performing calibrations on the basis of samples with sensor readings and corresponding laboratory measurements. Respective details have been provided in the chapter on *Sample & Calibration* (6.3). There also the various types of calibration are explained. For detailed information about the calibration of a specific sensor please refer also to the manual of this measuring device.

When the calibration window is displayed several options exist and a series of steps need to be made:

- The leftmost button in the headline allows toggling the graph view;
    - As *Status View* the continuously updated readings of the parameter will be displayed numerically and graphically which can be helpful to assess the stability of the measurement (e.g. of electrodes). If a quality number of the sensor is available additionally (e.g. *ammo::lyser*) this will also be displayed as a number and in a yellow time series;
    - As *Samples View* the currently selected samples for performing a calibration are displayed (sensor and laboratory measurements);
- A new measurement can be started by pushing the *Trigger Measurement* button;
- The button above the graph shows the currently selected calibration type and allows changing it.

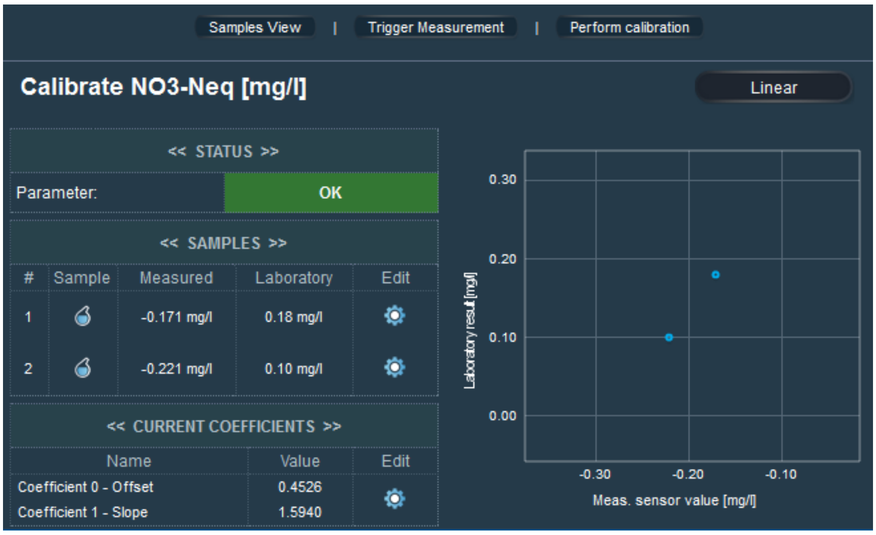
Basically two different groups of calibrations need to be distinguished as is described in the following sections.

Calibration with 1 or 2 samples (*Offset*, Slope, *Linear*)

The calibration types *Offset, Slope* and *Linear* make use of the sample values stored on the respective sensor (please refer to chapter 6.3).

The current values of the stored samples are displayed and can also be edited (e.g. for entering laboratory values). By pushing the *Sample* icon a new measurement can be triggered and stored onto the sensor. Please note that the displayed value is the Raw value (e.g. mV in case of electrodes) or based on the active global calibration (in case of spectrometer), respectively.

The result of the laboratory analysis can be entered into the field *Laboratory* by editing the respective sample. *Save* stores the sample values onto the sensor and hence replaces the old sample values.



Calibrate NO3-Neq [mg/l]

<< STATUS >>

Parameter: OK

<< SAMPLES >>

#	Sample	Measured	Laboratory	Edit
1		-0.171 mg/l	0.18 mg/l	
2		-0.221 mg/l	0.10 mg/l	

<< CURRENT COEFFICIENTS >>

Name	Value	Edit
Coefficient 0 - Offset	0.4526	
Coefficient 1 - Slope	1.5940	

Pushing *Perform Calibration* starts the selected calibration procedure with the two samples as displayed (select *Samples View* for checking graphically). When calibrating is finished a user message will inform if it was successful. In case of an error the reason will be displayed to the user in red letters (e.g. *Please enter at least lab values for 2 samples*).

Under *Current Coefficients* the actual values are displayed.

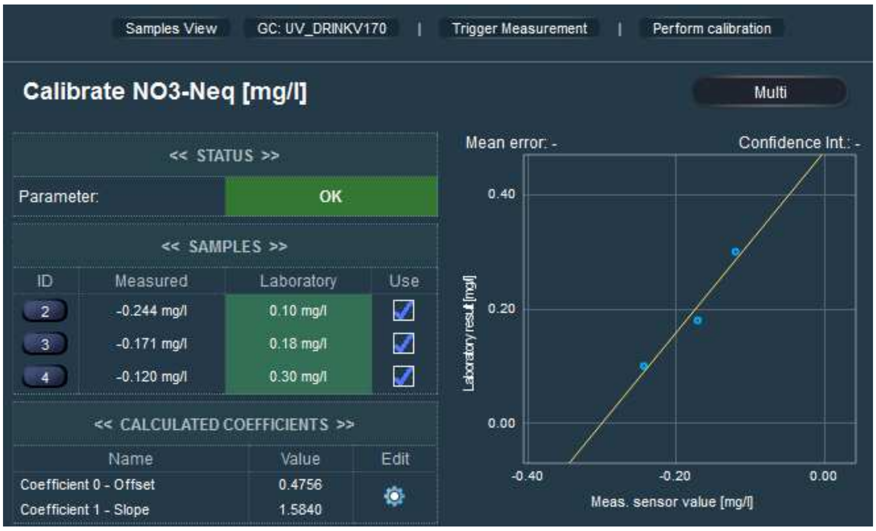
⚠ Some sensor types also support writing coefficients directly onto the sensor by pushing the *Edit* icon (none of the coefficients can be *NaN*). Please refer to the sensor manual for respective information.

Calibration with more than 2 samples (*Multi*)

⚠ Please note that only parameters from i::scan and spectrometer probes support *Multi* calibration.

The *Multi* calibration type makes use of several samples based on a statistical method. While the calibration types *Offset* and *Linear* use measurement results stored directly on the sensor itself and are therefore limited to two samples (as explained above), the *Multi* calibration builds on results stored in the *moni::tool* sample database (see also chapter 6.3).

The calibration type *Multi* uses a linear fit to obtain a calibration line with the smallest possible error between the stored sensor readings and the laboratory values. Accordingly, the calibration screen for *Multi* looks slightly different and offers some additional features.



Calibrate NO3-Neq [mg/l]

<< STATUS >>

Parameter: OK

<< SAMPLES >>

ID	Measured	Laboratory	Use
2	-0.244 mg/l	0.10 mg/l	☑
3	-0.171 mg/l	0.18 mg/l	☑
4	-0.120 mg/l	0.30 mg/l	☑

<< CALCULATED COEFFICIENTS >>

Name	Value	Edit
Coefficient 0 - Offset	0.4756	⚙
Coefficient 1 - Slope	1.5840	

In the *Samples* area the ID and values of all stored samples valid for the respective sensor / parameter are displayed. Pushing the ID number switches to the respective *Sample list* results as explained in chapter 6.3.3.

When preparing the calibration it is possible to decide which samples shall actually be used by ticking the individual check boxes. This has no impact on the samples database but influences only the on-going calibration. As samples are checked or unchecked the resulting correlation between laboratory results and raw values in the *Sample View* is updated automatically. Also the resulting values for *Mean error* and *Confidence Interval* above the graph are updated automatically. Once the calibration results are considered satisfying, pushing *Perform calibration* finalizes the process.

⇨ *Available **Quick reference guides**:*

Manuals	*con::cube / Service_Guides*	note_moni-toolV2.2_sensorcalibration

Please refer to the s::can Customer Portal!

6.5.7 Optical path length

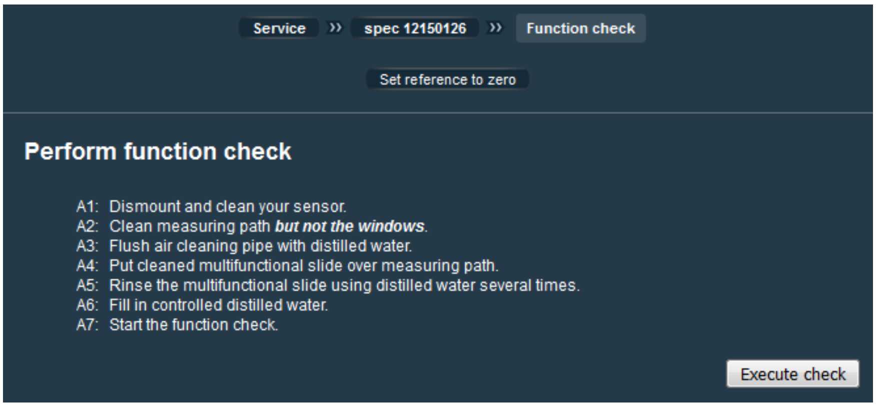
This function can be used to change the optical path length for spectrometer sensors V2. This function is available only when working on a *con::cube* terminal locally. Please get in contact with your s::can support in case of the need to change OPL.

6.5.8 Function Check

A detailed step-by-step explanation is displayed on the main screen.

Pushing the *Execute* button starts the checking procedure.

Please refer to the manual of the sensor for further details on possible results and consequences of functional checks.



Perform function check

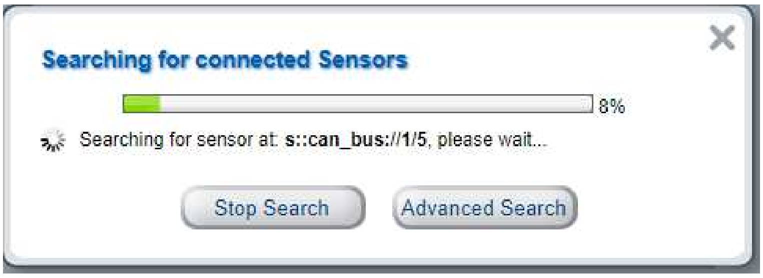
A1: Dismount and clean your sensor.
A2: Clean measuring path ***but not the windows***.
A3: Flush air cleaning pipe with distilled water.
A4: Put cleaned multifunctional slide over measuring path.
A5: Rinse the multifunctional slide using distilled water several times.
A6: Fill in controlled distilled water.
A7: Start the function check.

⚠ This function is available only for spectrometer probes and *i::scan* sensors.

6.6 Sensor installation

The installation of a new sensor is initiated by pushing a sensor symbol titled *Add new sensor* on the main *Service* window.

moni::tool will automatically initiate a search for connected devices.



Searching for connected Sensors

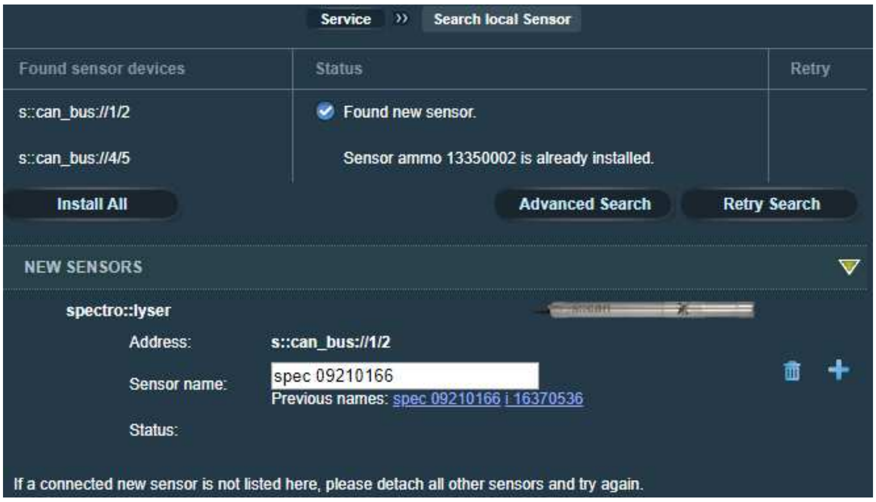
8%

Searching for sensor at: **s::can_bus://1/5**, please wait...

Once the search is completed, a list showing all connected sensors will be displayed and the sensors that need to be installed can be added using the blue *plus* symbols in the table.

Detected new sensors can be ignored / not installed by pushing the recycle bin icon. The search can be interrupted using *Stop Search*.

⚠ Basically it is possible to install several sensors at the same time if they are of different types. When installing several sensors of the same type they most probably have to be installed separately.



Found sensor devices	Status	Retry
s::can_bus://1/2	Found new sensor.	
s::can_bus://4/5	Sensor ammo 13350002 is already installed.	

spectro::lyser

Address: s::can_bus://1/2

Sensor name: spec 09210166

Previous names: spec 09210166 i 16370536

Status:

If a connected new sensor is not listed here, please detach all other sensors and try again.

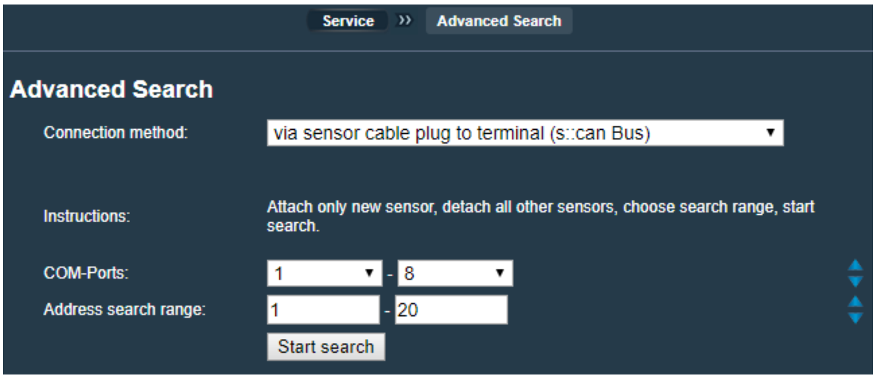
6.6.1 Installation of s::can sensors

As soon as *moni::tool* has completed the searched it lists up all found sensors (see image above). The Status column informs if the sensor is already installed or if it is new (*Found new sensor*). Pushing the blue *plus* icon or the *Install All* button installs the respective new sensors. Once *moni::tool* has finished the initialization of the new sensor (Status: *Installing sensor, please wait...*) it will switch back to the *Service* tab and show the new sensor in the system overview.

The automatic sensor installation will search for s::can sensors or s::can terminals connected to COM 1 (plug for spectrometer), to COM 4 (sys-plugs) and to COM 5 (terminal connection) (all modbusRTU only).

If the installation shall be performed manually (e.g. because a sensor has not been found during the automatic installation procedure) a manual / advanced installation is launched via *Advanced Search*.

After selecting the correct connection under *Connection method* (for s::can sensors this will be the default setting (*via sensor cable plug to terminal (s::can Bus)*) the correct COM-Port and Address have to be entered.



Advanced Search

Connection method: via sensor cable plug to terminal (s::can Bus)

Instructions: Attach only new sensor, detach all other sensors, choose search range, start search.

COM-Ports: 1 - 8

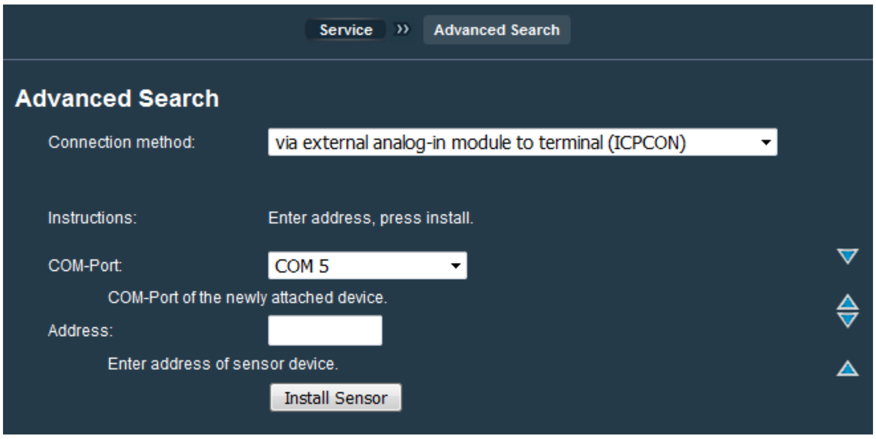
Address search range: 1 - 20

If this information is not available *moni::tool* will search the complete range as indicated on the screen and no other sensors should hence be connected. Pushing *Start* triggers the search.

6.6.2 Installation of non-s::can-sensors via an analog interface

Analog sensors producing a 0/4-20 mA output need to be connected to an analog input module of the *con::cube*. This can either be an internal module (D-315-in-mA) or an external analog input module (D-322-8) connected via COM-port.

Analog input devices are installed by implementing the following steps:



Advanced Search

Connection method: via external analog-in module to terminal (ICPCON)

Instructions: Enter address, press install.

COM-Port: COM 5

COM-Port of the newly attached device.

Address:

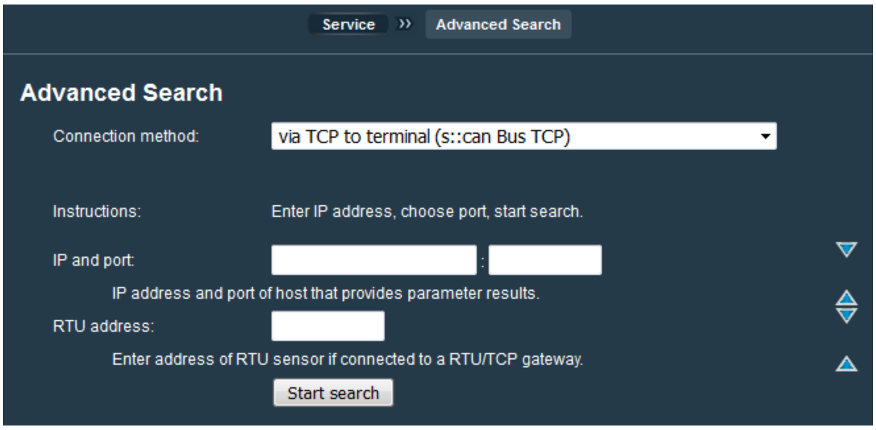
Enter address of sensor device.

- Selection of the correct *connection method* in *Advanced Search* (see image above; either *via internal analog-in module to terminal* or *via external analog-in module to terminal (ICPCON)*);
- Selection of the correct channel of the internal module or entering the correct COM-port and address of the external module (if no channel is displayed it needs to be checked if an internal module is installed in the menu *Service / Terminal / con::cube / Internal Modules*; see chapter 6.4.2,p. 40);
- Pushing *Install Sensor*;
- Entering a sensor name and pushing *Save*;
- Configuration of a parameter that shall display and record the data from the analog sensor in the menu *Service / Terminal / Parameter* (see chapter 6.4.5).

If multiple analog input devices need to be installed the steps above have to be repeated for each device.

6.6.3 Installation of Sensors and Spectrometer V3 via TCP

Parameters from other s::can terminals (e.g. another *con::cube or con::stat*), s::can sensors using Modbus TCP or sensors connected to a Modbus RTU/TCP gateway can be linked into *moni::tool* over an Ethernet (TCP) connection by the following steps:



Advanced Search

Connection method: via TCP to terminal (s::can Bus TCP)

Instructions: Enter IP address, choose port, start search.

IP and port: :

IP address and port of host that provides parameter results.

RTU address:

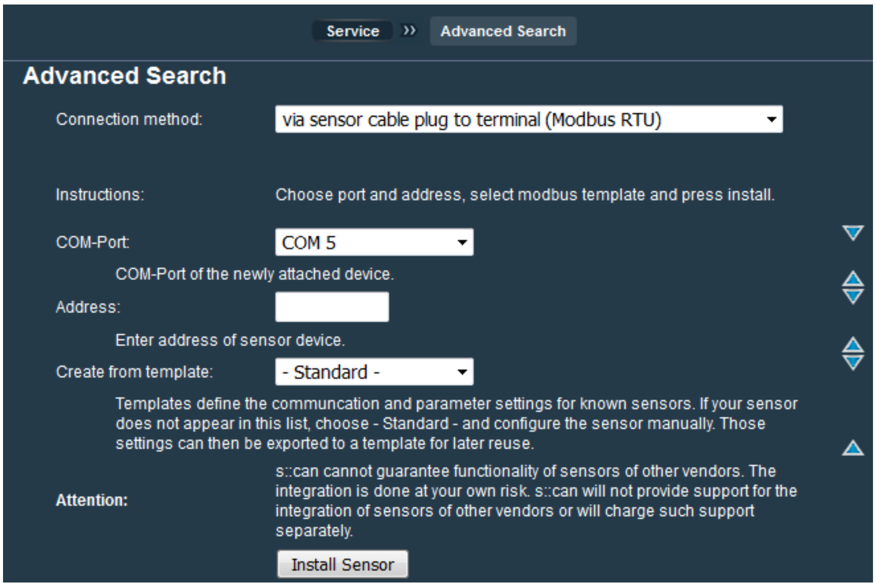
Enter address of RTU sensor if connected to a RTU/TCP gateway.

- Selection of the correct connection method in Advanced Search (see image above; via TCP to terminal (s::can Bus TCP));
- Entering the correct address of the sensor (a correct address for TCP communication always contains an IP address and a port number; an RTU address is needed in case of having an RTU sensor connected to a RTU/TCP gateway, only); For con::cube and con::stat the default TCP port used is 502.
- Pushing *Start search*;
- When the sensor has been found: checking sensor name and pushing *Save*.

When installing a spectrometer probe V3 the connection method *via TCP to spectro::lyser V3 (s::can REST)* has to be selected. For further details please refer to Spectrometer V3 manual.

6.6.4 Installation of non-s::can sensors via Modbus

It is also possible to connect third party sensors to the s::can terminal either via Modbus RTU or via Modbus TCP. In both cases the protocol “mapping” of the sensor has to be configured manually by the customer. The installation itself will be performed by the following steps:



Advanced Search

Connection method: via sensor cable plug to terminal (Modbus RTU)

Instructions: Choose port and address, select modbus template and press install.

COM-Port: COM 5

COM-Port of the newly attached device.

Address:

Enter address of sensor device.

Create from template: - Standard -

Templates define the communcation and parameter settings for known sensors. If your sensor does not appear in this list, choose - Standard - and configure the sensor manually. Those settings can then be exported to a template for later reuse.

Attention: s::can cannot guarantee functionality of sensors of other vendors. The integration is done at your own risk. s::can will not provide support for the integration of sensors of other vendors or will charge such support separately.

- Selection of the correct connection method in Advanced Search (via sensor cable plug to terminal (Modbus RTU) or via TCP to terminal (Modbus TCP));
- Entering correct COM-Port and Address of the sensor (for RTU connection) or the correct address of the sensor (a correct address for TCP communication always contains an IP address and a port number; an RTU address is needed in case of having an RTU sensor connected to a RTU/TCP gateway, only);
- Selecting the correct template for defining sensor communication (note that all templates are stored on the terminal and that templates can be selected, created or uploaded using the menu Service / Terminal / Settings / Templates; see chapter 6.4.4);
- If no suitable template is available for the sensor the option “– Standard –“ should be selected. Protocol “mapping” details can then be entered later on (additional information is available on the s::can Customer Portal);
- Pushing *Install Sensor*;
- When the sensors has been found: checking sensor name and communication settings (for RTU: Baud-rate, Parity, timeout, retries, waiting time; for TCP: timeout) and pushing *Save*.

⇨ *Available **Quick reference guides**:*

Manuals	*moni::tool / Service_Guides*	note_moni-tool_Install3rdParty_Modbus_Sensors.pdf

Please refer to the s::can Customer Portal!

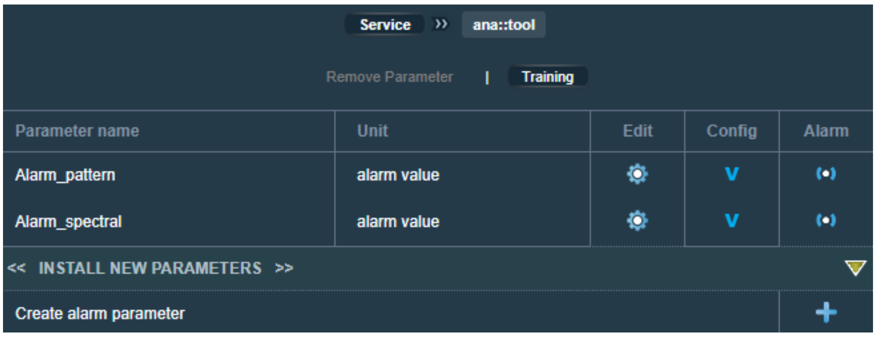
6.7 ana::tool

The *ana::tool* section of the *Service* tab provides access to all functions of the *ana::tool* software and to the respective virtual parameters.

6.7.1 General

The upper part of the main window lists all currently configured virtual parameters handled by *ana::tool* (for information on virtual parameters, please refer also to chapter 6.4.5).

As for all parameter three columns provide access to various settings and options (this is identical with the possibilities provided under *Service/Terminal/Parameters*!).



Parameter name	Unit	Edit	Config	Alarm
Alarm_pattern	alarm value	⚙	V	(•)
Alarm_spectral	alarm value	⚙	V	(•)

The lower part of the main window allows creating additional alarm parameters based on the principles of spectral or pattern alarms. This function corresponds to the *Add Parameter* function under *Service/Terminal/Parameters* as described in chapter 6.4.5.

Edit allows modifying the displayed parameter name, the displayed unit, the used resolution as well as the valid measurement range.

→*Service Level / Expert*

- Configure internal parameter name
- See configuration history information

Config focuses on adapting the automatic training function. Besides generally activating and deactivating it, also the used data interval as well as the interval in which automatic trainings will be triggered can be set.

→*Service Level / Expert*

trainAuto	0 1 (default)	OFF ON	Used to switch automatic training on and off.
trainAutoInterval	21 600 - 2 592 000 sec. 86 400 sec. (default)	equal to 6 hours - 30 days equal to 1 day	Time interval between automatic trainings.
trainDataInterval	0 - 2 592 000 sec. 1 209 600 sec. (default)	equal to 0 hours - 30 days equal to 14 days	Determines amount of historical data used for the training (interval in seconds).

Information on the settings can be displayed by pushing the blue arrows on the right side.

Furthermore, also special configurations can be used by either uploading a configuration file or by entering a respective command directly (all service levels).

Alarm is used to configure the conditions for actually triggering an alarm with the respective alarm parameter. The way the collected information is used is defined mainly by the proxy-indicator *sensitivity*. It can be set to one, two or three, where a higher number means that relatively many situations will be considered as alarms. Accordingly, it is very likely that all real alarms will be detected while at the same time the share of false alarms which need to be rejected (see 5.2) will increase.

The following configuration settings can be used for manually customizing the pattern alarm.

Name	Possible Settings	Effect	Function
sensitivity	0 1 2 (default) 3	Alarm switched off Low sensitivity Medium sensitivity High sensitivity	Used to control the sensitivity of the alarm parameter.

→*Service Level / Expert*

AutoSelectAlarmLimit	0 1 (default)	Upper alarm limit is controlled by option *upperAlarmLimit*. Upper alarm limit is determined automatically depending on the selected sensitivity	Determines whether the sensitivity settings override the settings for the upper alarm limit.
upperAlarmLimit	-infinity < upperAlarmLimit < +infinity 3 = default		When the alarm value exceeds the *upperAlarmLimit* the parameter triggers an alarm.
upperWarningLimitFactor	0 ≤ upperWarningLimitFactor ≤ 1 0.9 = default		When the alarm value exceeds the *upperWarningLimitFactor* the parameter triggers a warning.

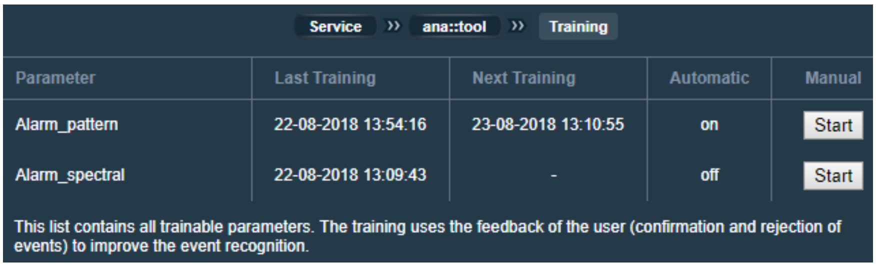
Besides, also the possibility for uploading information on a special alarm configuration exists.

6.7.2 Training

As mentioned already under *Alarm* (see chapter 5.5), virtual alarm parameters should usually be trained regularly on the basis of historical data. This is necessary to train alarm parameters in order to adapt the alarm response to a particular application on the basis of feedback given to the system by confirming, rejecting or adding missed events

Pushing *Training* opens an overview of all currently installed trainable alarm parameters.

Furthermore, for each parameter time and date of the last successful training as well as that of the next scheduled automatic training are shown.



Parameter	Last Training	Next Training	Automatic	Manual
Alarm_pattern	22-08-2018 13:54:16	23-08-2018 13:10:55	on	Start
Alarm_spectral	22-08-2018 13:09:43	-	off	Start

This list contains all trainable parameters. The training uses the feedback of the user (confirmation and rejection of events) to improve the event recognition.

Per default all alarm parameter algorithms are automatically trained once a day. However, the training frequency can be modified under *Config* as explained above.

If for an alarm parameter automatic training is disabled, the date and time fields for the next scheduled training will show only a dash and in the *Automatic* column it will be marked *off*.

Trainings can also be started manually by pushing *Start* in the row of the respective alarm parameter.

Parameters that are currently being training are marked with *training in progress* in the *Next Training* column.

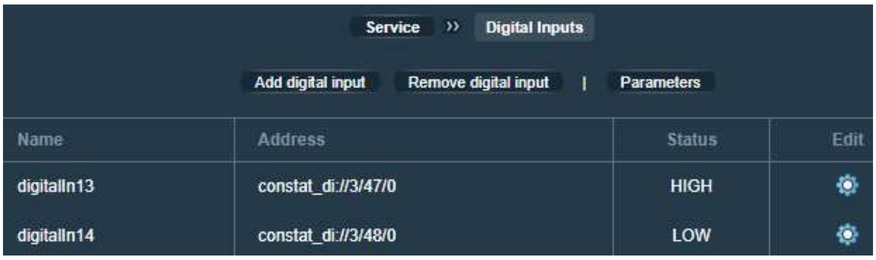
The comprehensive functionalities of ana::tool require well-trained staff for being used according to their full potential. Please contact your s::can partner for information on respective training courses!

6.8 Digital Inputs

The s::can terminal can be equipped with internal digital inputs or an external digital input module can be connected to it. Each digital input can be used as an independent sensor.

Internal digital inputs will be initialized automatically during initial start-up and will be listed by pushing the *Digital Inputs* icon beside the *Terminal* icon in the *Service* tab main window.

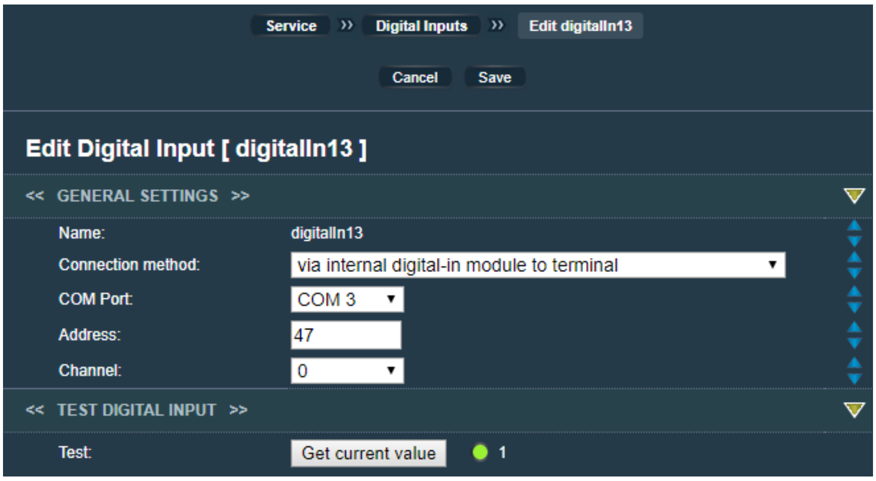
If internal digital input modules of the *con::cube* are not detected automatically or when external digital input modules shall be used, the inputs have to be initialized manually using the *Add digital input*-function.



Name	Address	Status	Edit
digitalIn13	constat_di://3/47/0	HIGH	⚙
digitalIn14	constat_di://3/48/0	LOW	⚙

The following steps are needed:

- Selecting the correct connection method (e.g. *via internal digital-in module to terminal*)
- Entering information on the used COM Port, Address and Channel (please refer to the manual of the external input module for the correct settings).
- All settings and modifications will be stored when pushing *Save*.



Edit Digital Input [digitalIn13]

<< GENERAL SETTINGS >>

Name: digitalIn13
Connection method: via internal digital-in module to terminal
COM Port: COM 3
Address: 47
Channel: 0

<< TEST DIGITAL INPUT >>

Test: Get current value ● 1

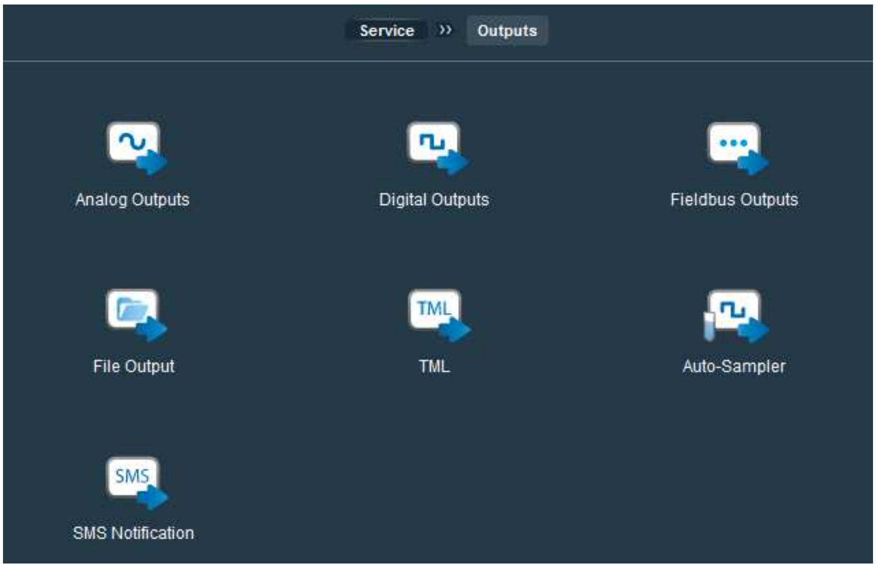
All settings can be modified later by pushing the Edit icon.

Once the digital input has been configured, it is possible to test the current state of the device by pushing *Get current value*. The state of the input is then shown by the LED icon and the number next to it where grey and 0 mean the state is LOW while bright green and 1 mean the input state is HIGH.

For each digital input a parameter can be defined by pushing *Parameter*, which will be used to read the input status.

A defined input can be deleted by selecting it in the overview and pushing *Remove digital input*.

6.9 Outputs

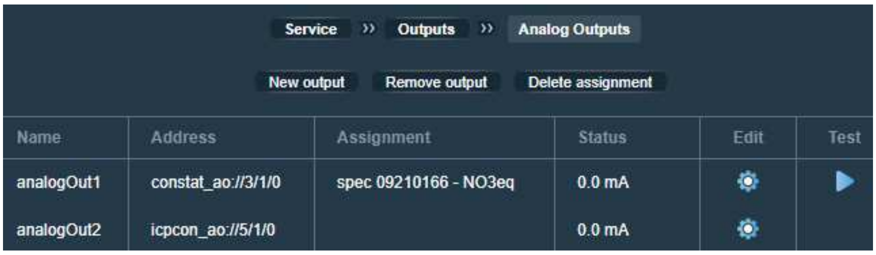


Depending on the used terminal, *moni::tool* provides several possibilities to transfer measurement results and other data and information to external devices.

6.9.1 Analog Outputs

The s::can terminal can be equipped with internal analog outputs or an external analog output module can be connected to it.

When *Analog Outputs* is selected, an overview shows all configured analog output channels.



Name	Address	Assignment	Status	Edit	Test
analogOut1	constat_ao://3/1/0	spec 09210166 - NO3eq	0.0 mA	⚙	▶
analogOut2	icpcon_ao://5/1/0		0.0 mA	⚙	

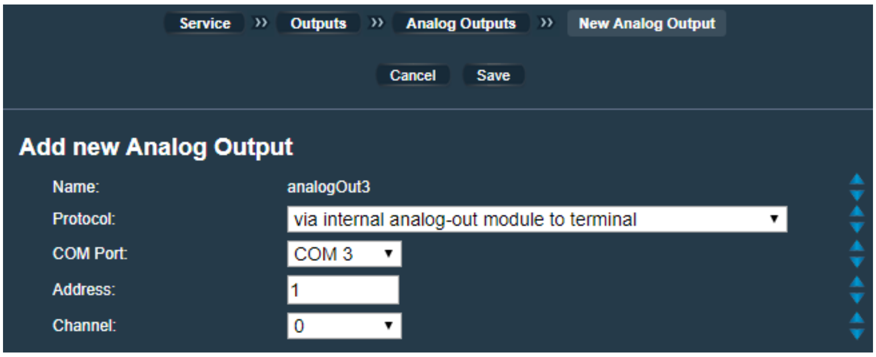
⚠ If the internal modules are not detected automatically the function *Service / Terminal / con::cube / Internal Modules / Search internal modules* (see chapter 6.4.2, p. 40) can be used.

→*Service Level / Expert*

- Outputs can be added by selecting *New output*.

In the configuration window firstly the protocol (internal or external module) has to be selected.

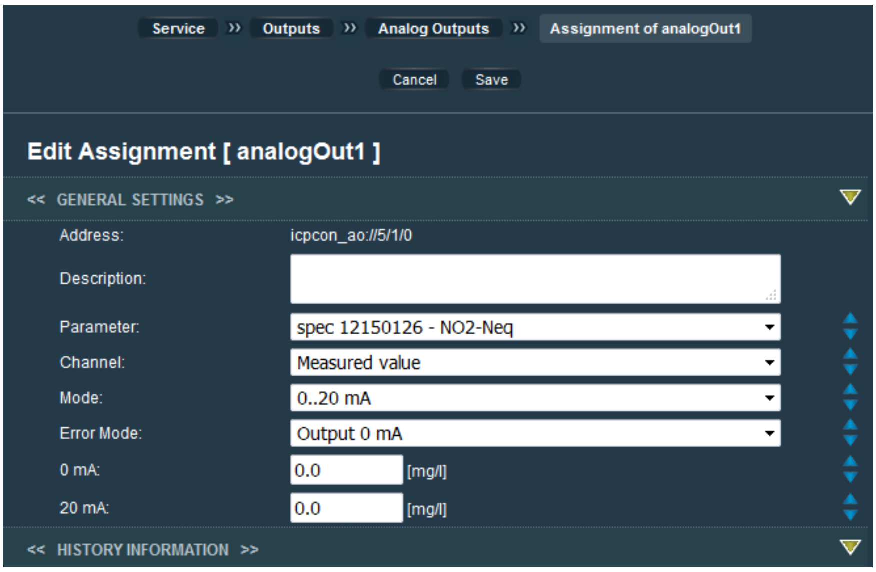
Afterwards the COM Port, the Address and the Channel have to be entered (refer to the information provided with the external output module for the correct settings).



Add new Analog Output

Name: analogOut3
Protocol: via internal analog-out module to terminal
COM Port: COM 3
Address: 1
Channel: 0

To each output channel a single parameter can be assigned by pushing the edit icon (blue cogwheel) on the right hand side of the respective channel. The following configuration settings must be made:



Edit Assignment [analogOut1]

Address: icpcon_ao://5/1/0
Description:
Parameter: spec 12150126 - NO2-Neq
Channel: Measured value
Mode: 0..20 mA
Error Mode: Output 0 mA
0 mA: 0.0 [mg/l]
20 mA: 0.0 [mg/l]

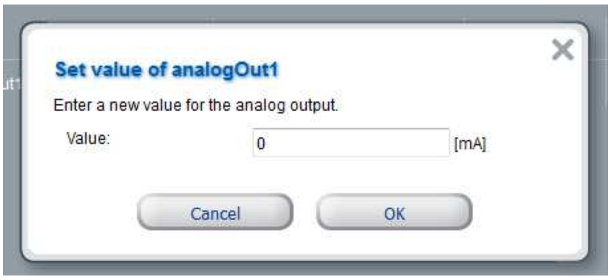
- *Parameter* defines which signal is being linked to the analog output (available parameters can be selected from a drop-down selection list);
- *Channel* defines which parameter information is linked to the analog output (e.g. measured or clean value);
- *Mode* defines if the output signal range is 0 - 20 mA or 4 - 20mA;
- Under *Error Mode* the mA signal for indicating an error (parameter value = NaN) can be selected. Possible settings are 0 mA, 3.5 mA, 4 mA, 20 mA or Hold (produces 4 mA if no valid measurement is available);
- The parameter results that correspond to an output of 0/4 mA and 20 mA can be set in the following two fields.
- All settings and modifications will be stored when pushing *Save.*

→*Service Level / Expert*

- In the field *Description* additional information can be entered
- Configuration history can be viewed

Assignments can be cancelled by marking the respective line and pushing *Delete assignment* in the *Analog Outputs* overview.

For testing the functionality of the analog data transmission a mA value can be set for each configured output by pushing *Test*.



Set value of analogOut1

Enter a new value for the analog output.

Value: 0 [mA]

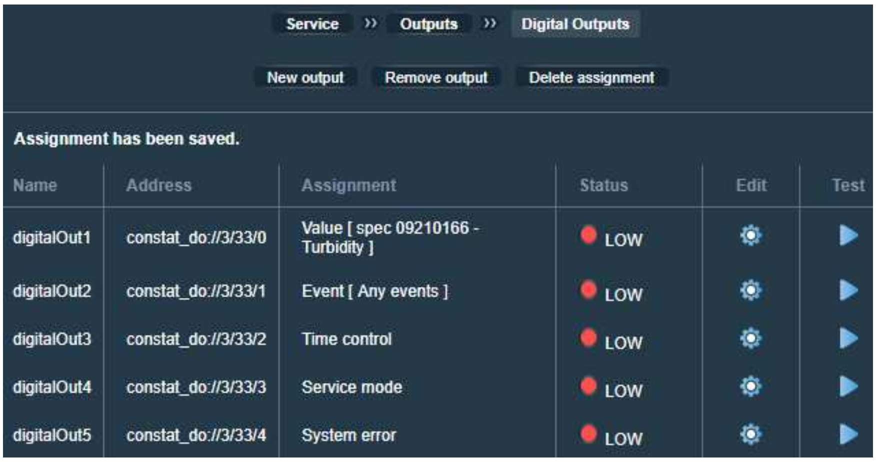
→*Service Level / Expert*

- An analog output can be deleted by selecting it in the overview and pushing the button *Delete Output*.

6.9.2 Digital Outputs

The s::can terminal can be equipped with internal digital outputs or an external digital output module can be connected to it.

When *Digital Outputs* is selected, an overview is displayed that lists all available digital output channels, together with information on their assignment and their current status.



Assignment has been saved.

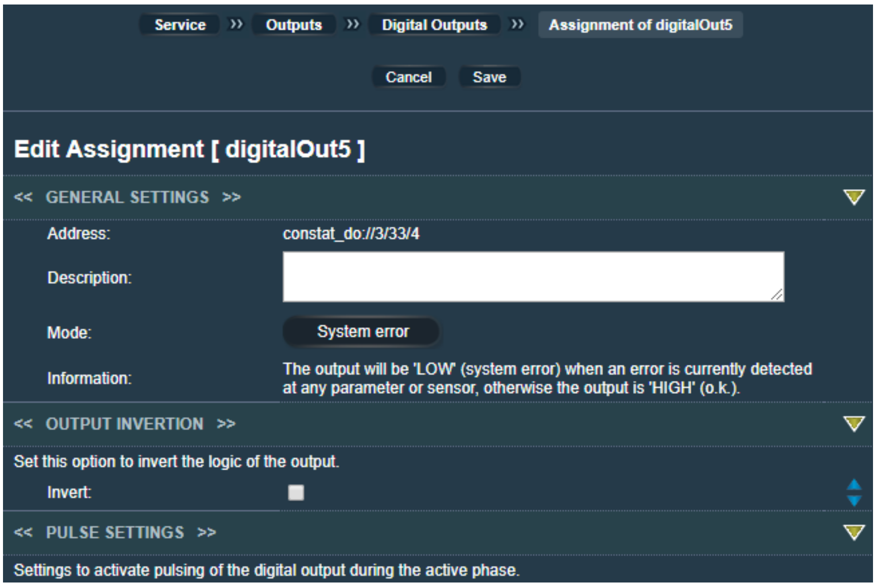
Name	Address	Assignment	Status	Edit	Test
digitalOut1	constat_do://3/33/0	Value [spec 09210166 - Turbidity]	● LOW	⚙	▶
digitalOut2	constat_do://3/33/1	Event [Any events]	● LOW	⚙	▶
digitalOut3	constat_do://3/33/2	Time control	● LOW	⚙	▶
digitalOut4	constat_do://3/33/3	Service mode	● LOW	⚙	▶
digitalOut5	constat_do://3/33/4	System error	● LOW	⚙	▶

→*Service Level / Expert*

- Outputs can be added by selecting *New output*.
- In the configuration window of the new output firstly the protocol (internal or external module) has to be selected. Afterwards the *COM Port*, the *Address* and the *Channel* have to be entered (Please refer to the information of the external module for the correct device settings).

Status functions can be assigned to the output channels by pushing the *Edit* icon (blue cogwheel) on the right hand side of the channel.

To each channel one of the following functions (*Mode*) can be assigned which will be used to set the status of the digital output, which can be either *High* or *Low*.


Service ›› Outputs ›› Digital Outputs ›› Assignment of digitalOut5
Cancel
Save

Edit Assignment [digitalOut5]

<< GENERAL SETTINGS >>

Address: constat_do://3/33/4

Description:

Mode: System error

Information: The output will be 'LOW' (system error) when an error is currently detected at any parameter or sensor, otherwise the output is 'HIGH' (o.k.).

<< OUTPUT INVERTION >>

Set this option to invert the logic of the output.

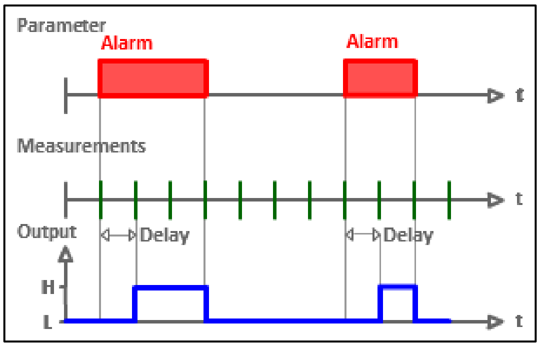
Invert: ☐

<< PULSE SETTINGS >>

Settings to activate pulsing of the digital output during the active phase.

The following modes are possible:

Mode	Output = LOW	Output = HIGH	*moni::tool* screen
System error	any error reported, system status = Error	Status of all devices (terminal, sensors, parameters) is Ok	*Status* tab blinking when status = LOW
Service mode	Service mode of monitoring system is active and measurements are interrupted	Service mode is not active, query of readings is running	*Service* tab blinking when status = LOW
Event	No alarms are pending	At least one alarm is pending	*Alarm* tab blinking when status = HIGH
Cleaning	Cleaning not active (i.e. cleaning valve closed)	Cleaning active (i.e. cleaning valve open)	Cleaning active indicated by *Activity*
Time control	During “interval” time	During “duration” time, 1. cycle starts whenever the service mode is left	
Value	Parameter reading within limits (within limits +/- hysteresis when it was outside limits before)	Parameter reading outside limits	



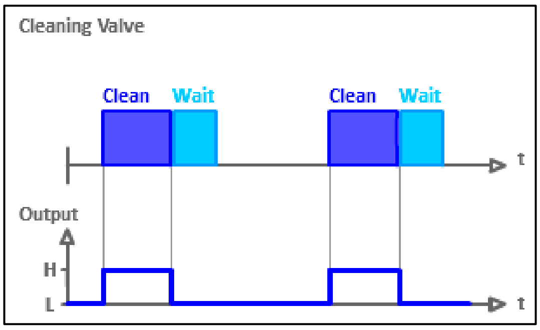
For the mode *Event* the type of the observed event can be specified. When *Any events* ... is selected all possible event types will be monitored.

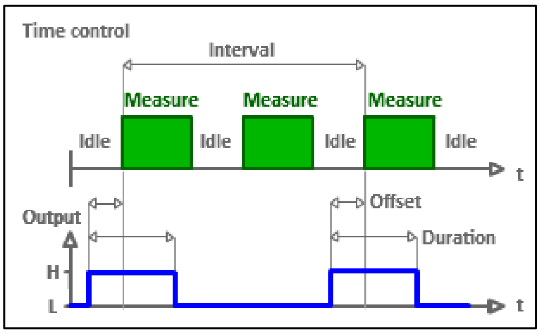
Also the number of measurements which will delay the triggering of the output has to be selected.

The logic for setting the output to high is shown on the right.

When the mode *Cleaning* is selected also the used *Cleaning device* has to be selected.

The logic for setting the output to high is shown on the right.





Time control is linked to the automatic measuring interval and will be configured by three parameters (refer to example on the left).

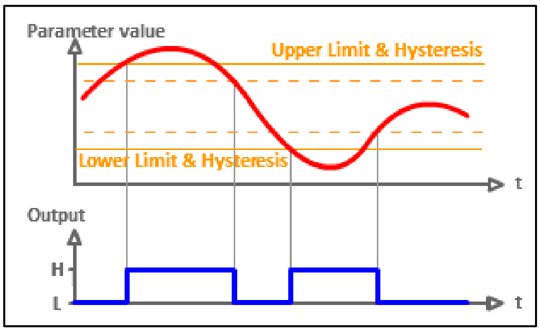
The *Interval* defines den number of measuring cycles before the output becomes active. The *Duration* defines for how long the output is HIGH. Outside this phase the status is LOW. Entering a *Start Time Offset* causes a time shift of the HIGH interval related to the start of the measurement.

The time control starts with the first measurement after saving the settings or after leaving the Service Mode.

The mode *Value* assigns the digital output to a parameter reading. If the value of the parameter transgresses a configured limit, the state of the output will change.

The following properties have to be set:

- *Parameter*: The parameter the output is assigned to;
- *Channel*: Whether the measurement result (value from sensor) or the clean result (value from *vali::tool*) will be used (the latter requires *vali::tool* and is not available for virtual parameters);
- *Upper Limit*: The value above which the output status is switched;
- *Upper Hysteresis*: The hysteresis defining when the output switches back again once the reading has surpassed the upper limit;
- *Lower Limit*: The value below which the output is switched;
- *Lower Hysteresis*: The hysteresis defining when the output switches back again once the reading has been below the lower limit.



→*Service Level / Expert*

- In the field *Description* additional information can be entered
- Under *Output Inversion* the checkbox can be used to invert the logic, i.e. instead of High the output will be Low.
- Options under *Pulse Settings* can be used to transform a constant *High* signal into a pulsed one.
- Configuration history can be viewed

All settings and modifications will be stored when pushing *Save*.

Individual assignments can be selected and cancelled in the overview by pushing *Delete assignment.* In this case the digital output will be assigned to “System error” with the next re-start.

The specifications of the assignment can be edited by pushing the blue cogwheel in the respective line. Pushing the *Test* icon switches the output status between *High* and *Low*.

→*Service Level / Expert*

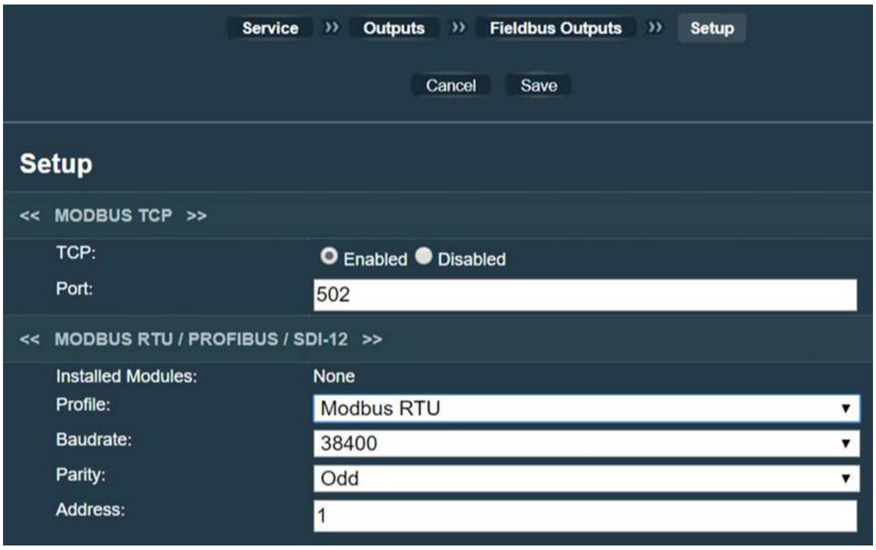
- An analog output can be deleted by selecting it in the overview and pushing the button *Delete Output*.

6.9.3 Fieldbus Outputs

moni::tool supports a fieldbus slave function which allows transferring up to 32 parameter readings, one fingerprint plus status information to an external receiver.

The following protocols are supported:

- Modbus TCP (per default active);
- Modbus RTU (RS485) or Profibus or SDI-12 (per default deactivated).



Setup

<< MODBUS TCP >>

TCP: ● Enabled ○ Disabled

Port: 502

<< MODBUS RTU / PROFIBUS / SDI-12 >>

Installed Modules: None

Profile: Modbus RTU

Baudrate: 38400

Parity: Odd

Address: 1

Only one of these protocols is supported at a time. For using Modbus RTU on con::cube the COM5 interface is needed which then cannot be used for connecting additional sensors.

For Profibus and SDI-12 optional internal modules are needed on the con::cube. These modules (Profibus and SDI-12) support the transfer of up to 8 parameter readings.

For Profibus a special firmware for transferring up to 16 parameter readings is available.
Please get in contact with your s::can support for further information on this option.

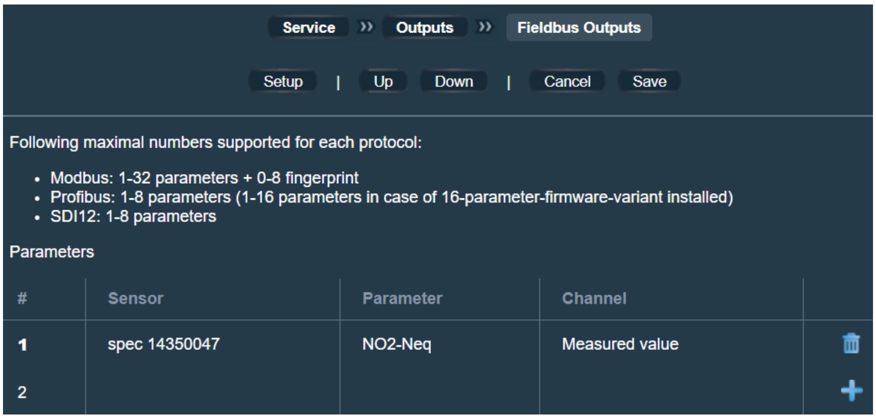
Configuring the protocol is initiated by pushing the *Setup* button.

The *Fieldbus Outputs* main window lists all available outputs.

Configuring a new assignment is initiated by pushing the blue *plus* icon which will open a dialogue window. There the parameter and the type of reading (measured or clean value) to be transferred can be selected. The process is finalized by pushing *Save*.

To change the positions of already defined parameters the buttons *Up* and *Down* can be used after selecting the parameter by pushing its name.

Pushing the trash icon on the right side of the parameter name removes a parameter from the list.



Following maximal numbers supported for each protocol:

- Modbus: 1-32 parameters + 0-8 fingerprint
- Profibus: 1-8 parameters (1-16 parameters in case of 16-parameter-firmware-variant installed)
- SDI12: 1-8 parameters

Parameters

#	Sensor	Parameter	Channel
1	spec 14350047	NO2-Neq	Measured value
2			

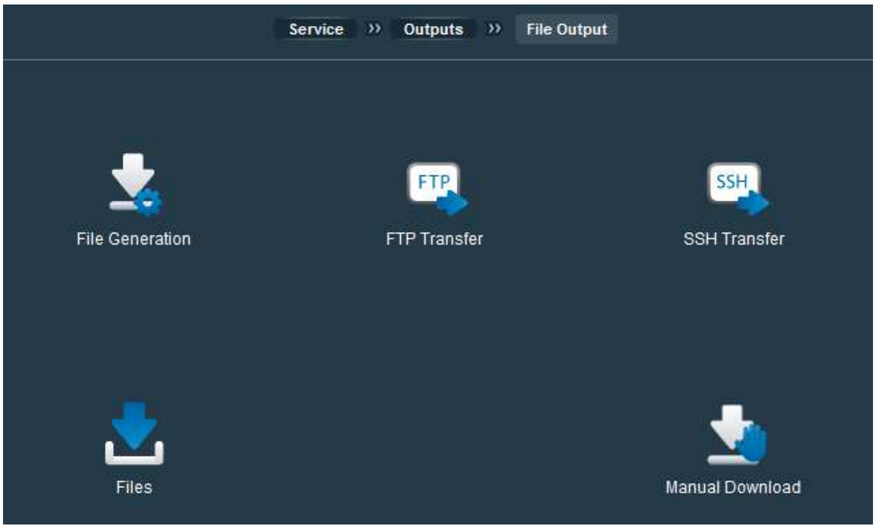
For more detailed protocol information please refer to the *con::cube* manual.

Available ***Quick reference guides****:*

Manuals	*con::cube / MODBUS*	MODBUS_Application_Protocol_V1_1A
Manuals	*con::cube / MODBUS*	MODBUS_Protocol_con-cube_BASIC_Datatypes
Manuals	*con::cube / MODBUS*	MODBUS_Protocol_con-cube_BASIC_Mapping

Please refer to the s::can Customer Portal!

6.9.4 File Output



The *File Output* function provides the possibility to configure how information stored in the *moni::tool* database is extracted to ASCII compatible files and how these files are transferred from the s::can terminal.

Information about the monitoring station and the connected sensors stored in the *moni::tool* database includes

- measurement results,
- information related to sensor and station status,
- data validation results as well as
- detected events.

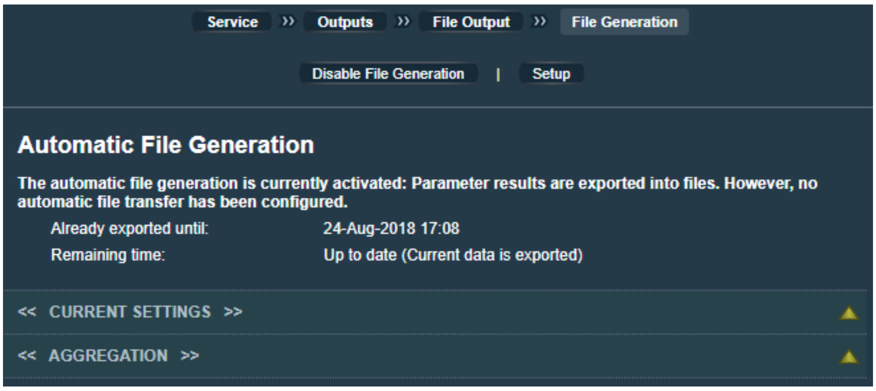
Furthermore, all maintenance activities that are logged by *moni::tool* are stored in this SQL-type database.

The data storage capacity is of limited size and can only store a certain amount of results. The available capacity is used as circular memory in that respect means that measurements do NOT stop when the maximum size is reached but that the oldest data will be removed automatically for making space available for the new measurement results. This concerns the database as well as storage for data transfer and storage of images.

Running a typical standard configuration (1 spectrometer, 3 other sensors, 120 sec. measurement interval) the *con::cube* D-315 can be operated 4 months without data loss The current status of the circular storage is shown in *Service/Terminal/Extras/System Info*.

⚠ As soon as an USB memory stick will be connected to the con::cube, moni::tool recognizes the external storage automatically. After confirming a user message all generated files will be copied onto the USB stick.

File Generation


Service ›› Outputs ›› File Output ›› File Generation
Disable File Generation | Setup
<< CURRENT SETTINGS >>
<< AGGREGATION >>

Automatic File Generation

The automatic file generation is currently activated: Parameter results are exported into files. However, no automatic file transfer has been configured.

Already exported until: 24-Aug-2018 17:08

Remaining time: Up to date (Current data is exported)

Exporting data from the database can be triggered manually or automatically. In the overview window of file generation the actual status of the settings is displayed.

When *File Generation* is activated, the software will write measurement results into files automatically, hence ensuring that the results are available for immediate download and data transfer.

→*Service Level / Expert*

- See also aggregation status

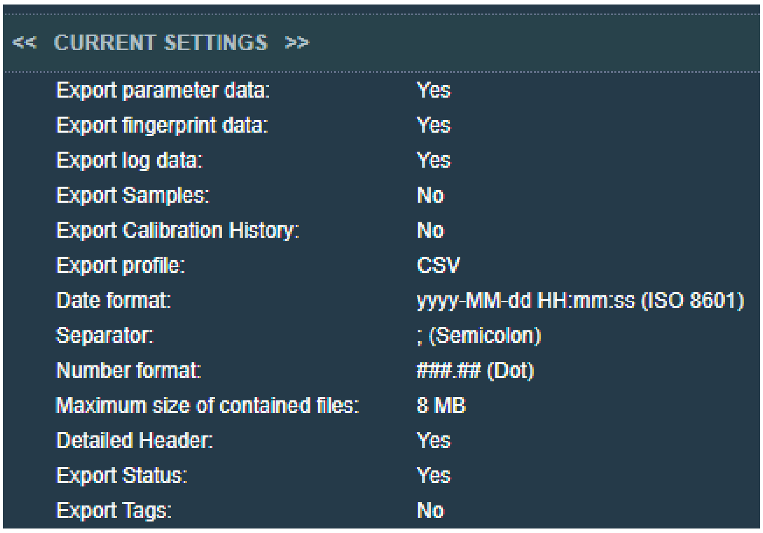
⚠ Before it is possible to change the settings using the *Setup* button, automatic file generation must be disabled. After that all existing files within the transfer folder must be removed (since all readings are still stored within the database and can be re-exported anytime using the new setup, no data will get lost by removing these files).

For transferring results by FTP or SSH automatically, *Automatic File Generation* must be activated (button *Enable Export*), which is the default setting. The automatic export function can be stopped via the button *Disable Export*.

After (downloading and) deleting the files which have been produced with the old settings, *File Generation* must be started again and *Setup* can be initiated and the available options for generating files as listed below can be configured.

Options:

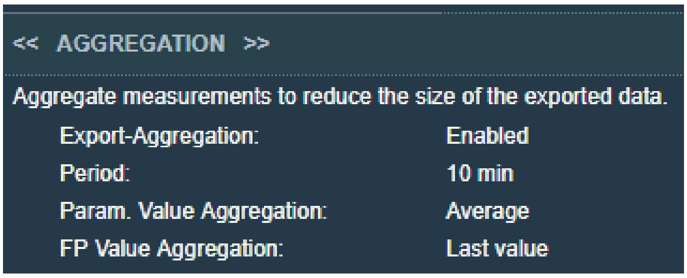
- Types of data (parameter, fingerprints, logbook, samples);
- Timestamp from when the file export will start;
- Data file profile (either CSV or *ana::pro* or a customized profile);
- Date format (ISO 8601 or *ana::pro*);
- Separator between columns (tab, comma or semicolon);
- Decimal separator (Number format *dot* or *comma*);
- Maximum file size of a single file (1MB, 2MB, 8MB, Per day);
- Detailed header (includes also the calibration coefficients, i.e. a new file will be created whenever any coefficient has changed);
- Export of status data;
- Export of tag information;



<< CURRENT SETTINGS >>

Export parameter data:	Yes
Export fingerprint data:	Yes
Export log data:	Yes
Export Samples:	No
Export Calibration History:	No
Export profile:	CSV
Date format:	yyyy-MM-dd HH:mm:ss (ISO 8601)
Separator:	; (Semicolon)
Number format:	###.## (Dot)
Maximum size of contained files:	8 MB
Detailed Header:	Yes
Export Status:	Yes
Export Tags:	No

Using the Aggregation options will reduce the amount of exported data compared to the number of real measurements performed.



<< AGGREGATION >>

Aggregate measurements to reduce the size of the exported data.

Export-Aggregation:	Enabled
Period:	10 min
Param. Value Aggregation:	Average
FP Value Aggregation:	Last value

→*Service Level / Expert*

- Function for aggregating exported data.

After saving the new setup by pushing *Save* the writing of the files needs to be started by pushing *Enable File Generation*. As all data from the selected starting point will be immediately exported the system can be busy for some time. *Remaining time* shows when the most recent data will be exported. After that new information will be checked and added to the respective files in a 60 seconds cycle.

The generated files will be stored within the transfer folder of the terminal and can be downloaded anytime manually via Service / Outputs / File Output / *Files* or automatically transferred (see following sections regarding FTP- and SSH transfer).

⚠ The structure of the files names generated automatically and the file contents depend on the used version of *moni::tool*. The differences between version 3.0 (or older) and 3.1 are pointed out below.

Filename:

The file name is created from the station name and the time stamp of the first measurement in the file as well as an extension depending on the file content. The file name extension depends on the generated data type.
Example for filename: stationname_YYYY-MM-DD_hh-mm-ss***_xx.extension***

_xx:

- ***_fp*** for files containing fingerprint results of a spectro::lyser
- ***_log*** for files containing logbook entries

In addition since *moni::tool* V3.1:

- ***_par*** for files containing parameter results
- ***_ch*** for files containing the calibration history
- ***_sample*** for files containing the sample data

Extension:

- ***csv*** with moni::tool V3.1 fix; for older versions when export profiles *CSV* or *customized* have been configured

Only *moni::tool* V3.0 or older:

- ***par/fp*** when export profile *ana::pro* has been configured

A new file will be generated each time

- an entry of the file header changes
- the maximum file size is reached (in the case of a fingerprint file reaches the maximum file size first, also a new parameter file is created at the same time)
- a re-start of *moni::tool*

Fingerprint Result Files

The fingerprint results files show in their first line the serial number (always 8 places) as well as the identifier for the length of the optical path (mm * 10) of the used *spectro::lyser*.

Optical path length	0.5 mm	1.0 mm	2.0 mm	5.0 mm	15 mm	35 mm	100 mm
Identifier in file	_5	_10	_20	_50	_150	_350	_1000

Also the sensor type (format 0xXXXX), the type name (max. 20 places), the used *Global Calibration* and the sensor name are shown.

The second line of the files state the column titles (date, time, status, wavelength) while actual readings are stored from the third line on. Measurements are recorded as absorbance values for the respective wavelengths. The description ***Source*** within the Status column identifies the type of the stored fingerprint (0 = measured, 1 = turbidity compensated),

12150126_350_0x1.1_spectro::lyser_UV_DRINKV170											
Measurement interval=120[sec] (Export-Aggregation disabled)	Tag	Status (Source:0)	200 nm	201 nm	202 nm	...	220 nm	221 nm	222 nm	223 nm	...
16.12.2016 17:34	*Tag-name*	Ok 0x0000.0000	NaN	NaN	NaN		31.892	31.620	31.496	31.767	
16.12.2016 17:36		Ok 0x0000.0000	NaN	NaN	NaN		31.788	31.335	31.328	31.592	
16.12.2016 17:38		Ok 0x0000.0000	NaN	NaN	NaN		31.748	31.576	31.356	31.592	

Parameter Result Files

The parameter result files show in their first line, starting at the 4. column, the name of the sensor that measured the respective parameter.

For each parameter up to four columns are reserved.

- Measured value (Header line: name of the parameter (e.g. DOCeq), unit (e.g. [mg/l]), upper and lower limit of measuring range limit and the precision of display.
- Status of the parameter and calibration coefficients (offset and slope) used for the parameter in case of a local calibration (if the parameter is not locally calibrated the values are 0.0000 and 1.0000).
- Cleaned value of the parameter as calculated by *vali::tool* (Header line same as above).
- Status of the cleaned value.

In case a parameter status is not Ok the error code will be displayed.

The values themselves are stored from the third line on, where the first column states the time of measurement.

Timestamp	testing		spec 12150126	spec 12150126	spec 12150126	spec 12150126
Measurement interval=120[sec] (Export-Aggregation disabled)	Status	Tag	DOCeq - Measured value [mg/l] (Limit:0.00-17.14)	Status [DOCeq - Measured value]	DOCeq - Clean value [mg/l] (Limit:0.00-17.14)	Status [DOCeq - Clean value]
16.12.2016 17:34	Error 0x0010		0.34	Ok 0x0000.0000.0000.0000	0.34	Ok 0x0000.0000
16.12.2016 17:36	Error 0x0010		0.34	Ok 0x0000.0000.0000.0000	0.34	Ok 0x0000.0000
16.12.2016 17:38	Error 0x0010		0.34	Ok 0x0000.0000.0000.0000	0.34	Ok 0x0000.0000

In the second column the system status at the time of measurement and in the third column an optional remark (Tag), which was created by the operator is stored.

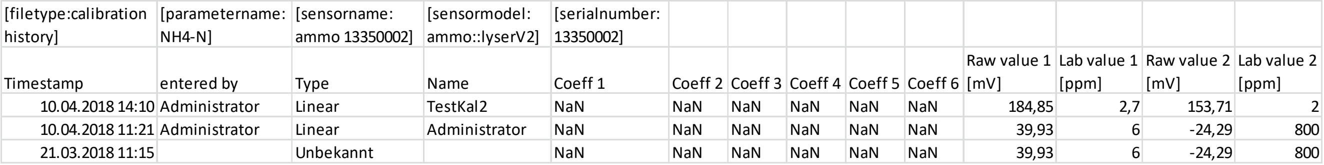
As long as the service mode is active, only the timestamp and the system Status Error 0x0002 in the second column will be entered. Within the fingerprint file there are no entries during active service mode.

Calibration-History Files

Information of all stored samples and of all performed calibrations are stored within these files. The first line contains the header of the columns when using *moni::tool* V3.0 or an older version. Since *moni::tool* V3.1 the first line contains the information for „filetype“, „parametername“, „sensormodel“ and „serialnumber“.

In the first four columns the time stamp, the user, the calibration type and the entered remark for the calibration are stored. The following six columns are reserved for the calibration coefficients, at which only the first two for *Offset* and *Slope* are used actually. The last four columns contain the measured value and the laboratory value for sample 1 and sample 2.

⚠ After each modification (e.g. sampling, performing a calibration) the complete history will be exported into a new file.

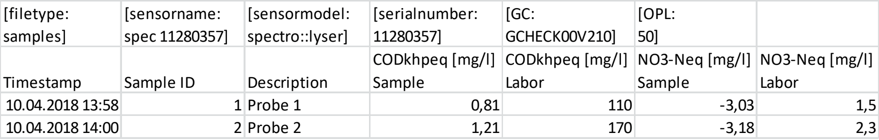


[filetype:calibration history]	[parametername: NH4-N]	[sensorname: ammo 13350002]	[sensormodel: ammo::lyserV2]	[serialnumber: 13350002]									
Timestamp	entered by	Type	Name	Coeff 1	Coeff 2	Coeff 3	Coeff 4	Coeff 5	Coeff 6	Raw value 1 [mV]	Lab value 1 [ppm]	Raw value 2 [mV]	Lab value 2 [ppm]
10.04.2018 14:10	Administrator	Linear	TestKal2	NaN	NaN	NaN	NaN	NaN	NaN	184,85	2,7	153,71	2
10.04.2018 11:21	Administrator	Linear	Administrator	NaN	NaN	NaN	NaN	NaN	NaN	39,93	6	-24,29	800
21.03.2018 11:15		Unbekannt		NaN	NaN	NaN	NaN	NaN	NaN	39,93	6	-24,29	800

Sample Files

These files contain information of the samples taken. The first line contains the header of the columns when using *moni::tool* V3.0 or an older version. Since *moni::tool* V3.1 the first line contains the information for „filetype“, „paramername”, „sensormodel“ and „serialnumber“. Furthermore the used Global Calibration and the optical path length are stored for spectrometer probes.

In the first three columns the time stamp, the sample-ID and the sample description are stored. Then for each parameter two columns are reserved containing the value measured by the sensor and the value of the reference measurement. The fingerprints belonging to the samples are stored in a separate file.

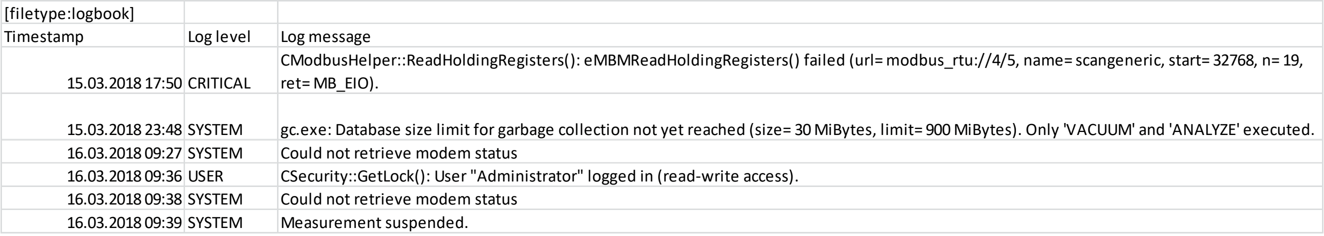


[filetype: samples]	[sensorname: spec 11280357]	[sensormodel: spectro::lyser]	[serialnumber: 11280357]	[GC: GCHECK00V210]	[OPL: 50]	
Timestamp	Sample ID	Description	CODkhpeq [mg/l] Sample	CODkhpeq [mg/l] Labor	NO3-Neq [mg/l] Sample	NO3-Neq [mg/l] Labor
10.04.2018 13:58	1	Probe 1	0,81	110	-3,03	1,5
10.04.2018 14:00	2	Probe 2	1,21	170	-3,18	2,3

Log File

The first line contains the header of the columns (Timestamp, Log level, Log message) when using *moni::tool* V3.0 or an older version. Since *moni::tool* V3.1 the first line contains the information for „filetype“.

The logbook entries themselves are stored after the header of the columns.



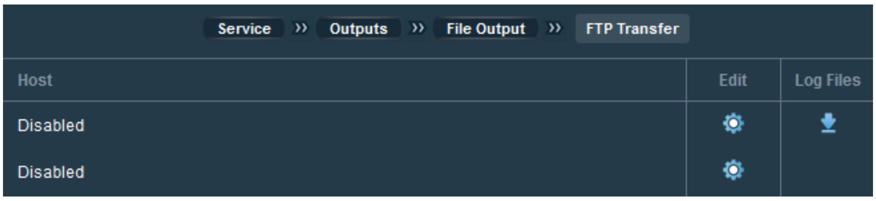
[filetype:logbook]		
Timestamp	Log level	Log message
15.03.2018 17:50	CRITICAL	CModbusHelper::ReadHoldingRegisters(): eMBMReadHoldingRegisters() failed (url= modbus_rtu://4/5, name= scangeneric, start= 32768, n= 19, ret= MB_EIO).
15.03.2018 23:48	SYSTEM	gc.exe: Database size limit for garbage collection not yet reached (size= 30 MiBytes, limit= 900 MiBytes). Only 'VACUUM' and 'ANALYZE' executed.
16.03.2018 09:27	SYSTEM	Could not retrieve modem status
16.03.2018 09:36	USER	CSecurity::GetLock(): User "Administrator" logged in (read-write access).
16.03.2018 09:38	SYSTEM	Could not retrieve modem status
16.03.2018 09:39	SYSTEM	Measurement suspended.

Log levels are defined as follows:

System:	Information regarding the complete system (SW maintenance and integrity checks)
User:	Information regarding user login and logout
Critical:	Information regarding errors in measurements, configuration and security related issues
User-Interface:	Information regarding the user-interface (frontend).
TML:	Information regarding data-transfer using TML
Training:	Information regarding training of alarm parameters in ana::tool

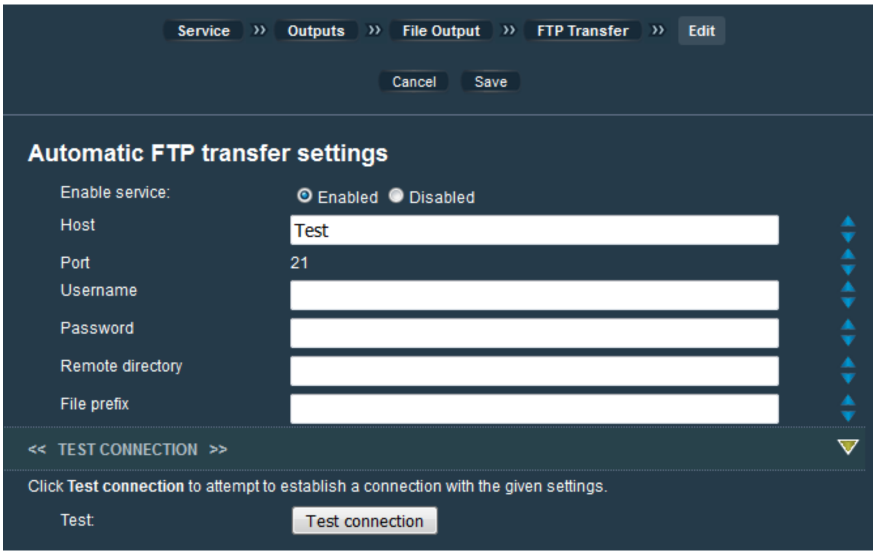
FTP Transfer

⚠ For using this function *Auto-Export* must be activated under *File Generation*.



Host	Edit	Log Files
Disabled	⚙	⬇
Disabled	⚙	

This menu provides the possibility to define up to three FTP transfer processes for transferring the generated files to another computer automatically. Each of the FTP processes can be configured by pushing its *Edit* icon. The Log-Files for already active processes can be stored externally by pushing the according icon.



Automatic FTP transfer settings

Enable service: ● Enabled ○ Disabled

Host: Test

Port: 21

Username:

Password:

Remote directory:

File prefix:

Click **Test connection** to attempt to establish a connection with the given settings.

Test:

As a first set-up step the automatic FTP transfer function needs to be enabled for the respective host.

After that the configuration screen provides several fields to enter the required login data for the target FTP server (Host IP address, Username and Password). Also a target directory can be set.

Furthermore a file prefix can be entered to add a fixed text block to the filename. This can be used to make it possible to recognize the origin of the files when data is being transferred from multiple stations to the same FTP server.

Additional information on the individual settings can be displayed by pushing the blue arrows on the right hand side.

The name of a file transferred via FTP consists of prefix, date, time, filename and -number (if several files will be transferred; x is the number, starting with 2) as well as the original filename extension (PREFIX_DDMMYY_hhmmss_x.EXT). Since *moni::tool* V3.1 the file type is displayed before the extension (PREFIX_YYMMDD_hhmmss_x_TYPE.EXT).

If all required data have been entered correctly, the connection can be tested by pushing *Test connection*.

Pushing the button *Save* will store all settings and start the automatic FTP transfer.

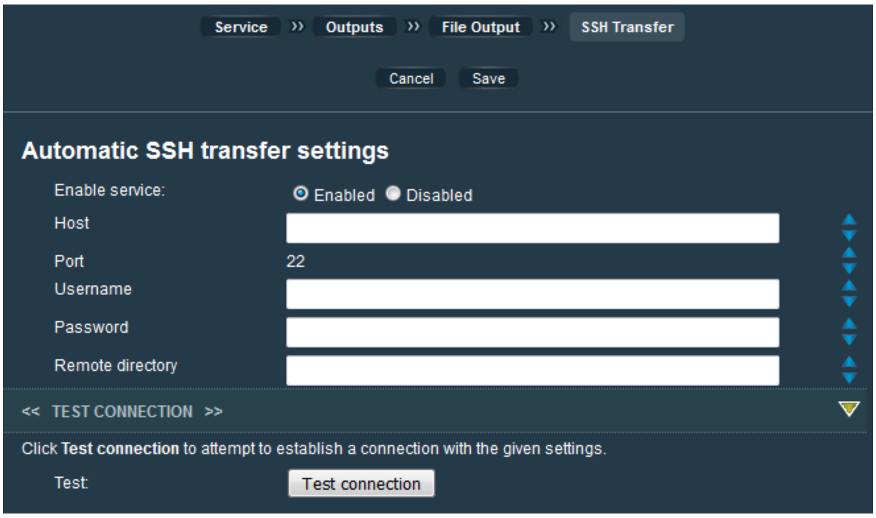
Once the process has been initialized, data will be transferred after the end of each measurement if new readings are available within the transfer folder. Such new readings will be put into a new file with the current system time in the file name and which will then be transferred.

Only after a successful transfer the respective timestamp will be marked as transferred and will hence not be sent again. If *moni::tool* detects a failure during the transfer (e.g. the FTP-Server is not available) all readings which have not been transferred will be re-transmitted automatically when the FTP service is available again. Details on the file transfer process are recorded in a log-file which can be downloaded by pushing the *download* icon and then be used for analyzing the reasons of failures.

The FTP Transfer can be interrupted by editing the respective host entry and selecting *Disable* on top of the screen.

SSH Transfer

For using this function *Auto-Export* must be activated under *File Generation*.



Automatic SSH transfer settings

Enable service: ● Enabled ○ Disabled
Host
Port 22
Username
Password
Remote directory

Click **Test connection** to attempt to establish a connection with the given settings.

Test

This menu item provides the possibility to configure the SSH transfer process which will transfer result-files to another computer.

The configuration window provides several fields for entering the required data for login on the target SSH server (Host IP address, Username and Password). Furthermore a Remote directory to which the result files will be transferred can be defined. The target directory needs full right access (read, write, execute). The user needs write access to .ssh/authorized_keys also.

If all data are set up correctly, the connection can be tested by pushing the button *Test connection*. If the LED is red either host or user or password is not correct. A green LED indicates a working connection to the SSH Server.

Pushing the button *Save* will store all settings and start the automatic SSH transfer.

SSH Transfer uses the function “rsync” which will synchronize the *moni::tool* transfer folder with the target folder on the SSH Server after the end of each measurement. The function “rsync” must be available for the user on the SSH-Server. Rsync will automatically transfer any differences between these two folders so that a 1:1 copy of the *moni::tool* transfer folder is built on the server. SSH transfer can hence be used for producing an automatic backup of all *moni::tool* results on a remote server.

When the transferred data shall be removed or deleted from the server target directory, FTP transfer should be used. Otherwise SSH would continuously transfer all data from the terminal.

The SSH Transfer can be interrupted by editing it and selecting *Disabled* on top of the screen.

Available ***Quick reference guides****:*

Manuals	con::cube / Service_Guides	note_SSH_transfer

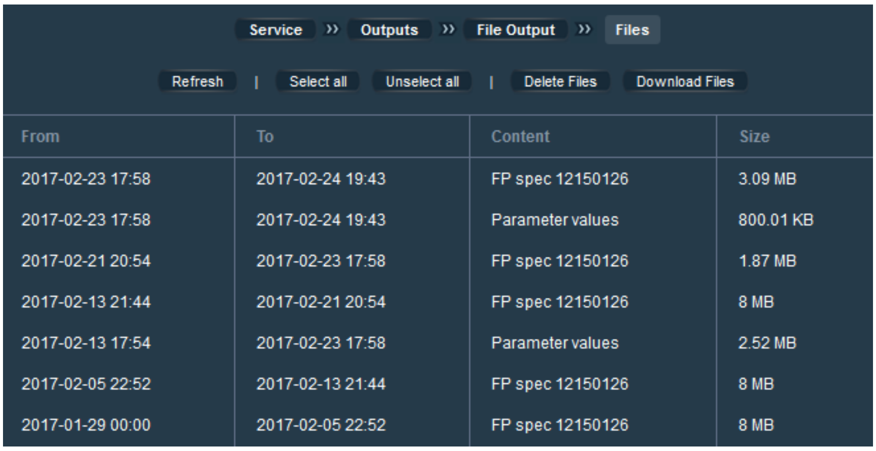
Please refer to the s::can Customer Portal!

Files

In this menu all files generated automatically so far are listed. Pushing *Refresh* will actualize the display.

All (pushing *Select all*) or single files (pushing individual lines) can be selected.

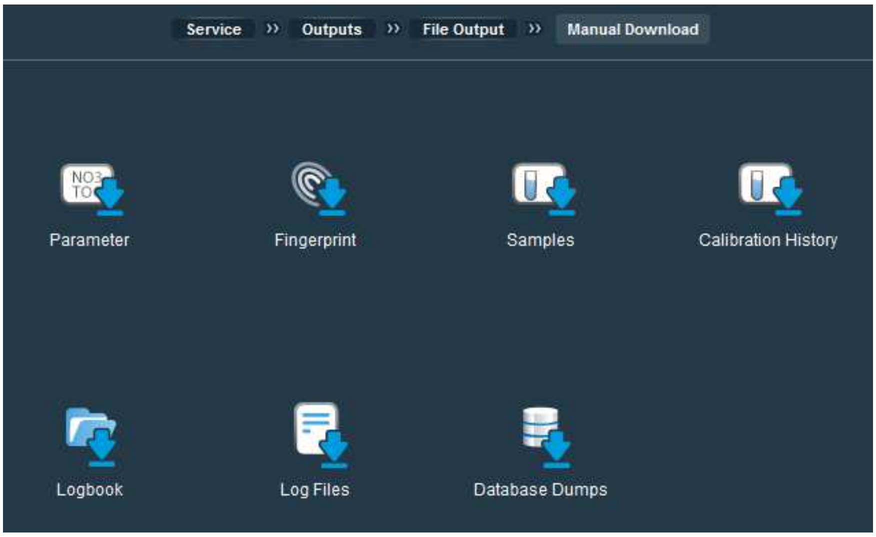
Selected files can be downloaded within one zip archive (*Download Files*) to an external medium (connected USB-memory-stick or local PC when using a remote browser) or they can be deleted (*Delete Files*).



From	To	Content	Size
2017-02-23 17:58	2017-02-24 19:43	FP spec 12150126	3.09 MB
2017-02-23 17:58	2017-02-24 19:43	Parameter values	800.01 KB
2017-02-21 20:54	2017-02-23 17:58	FP spec 12150126	1.87 MB
2017-02-13 21:44	2017-02-21 20:54	FP spec 12150126	8 MB
2017-02-13 17:54	2017-02-23 17:58	Parameter values	2.52 MB
2017-02-05 22:52	2017-02-13 21:44	FP spec 12150126	8 MB
2017-01-29 00:00	2017-02-05 22:52	FP spec 12150126	8 MB

Manual Download

As an alternative to automatic *File Generation*, this menu provides the possibility to select specific data to be exported from the *moni::tool* database into ASCII files for download on demand.



Parameter

This item can be used to export parameter results from the database to a text file on the basis of a list of criteria:

- Period (Start and End date / time using calendar icon and entry fields)
- Parameters (*Select all* button or selecting parameters individually using the tick box - also historic parameters can be selected)
- Export profile (Pull-down menu)
- Separator for columns
- Export Aggregation (Enabled / Disabled)

Fingerprint

This item can be used to export fingerprints from the database to a text file on the basis of a list of criteria:

- Period (Start and End date / time using calendar icon and entry fields)
- Parameters (*Select all* button or selecting fingerprints individually using the tick box - also historic fingerprints can be selected)
- Export profile (Pull-down menu)
- Separator for columns
- Export Aggregation (Enabled / Disabled)

Samples

This item can be used to export all sample data from the database to a text file on the basis of a list of criteria:

- Export profile (Pull-down menu)
- Separator for columns

Calibration History

This item can be used to export the calibration history of parameters from the database to a text file on the basis of a list of criteria:

- Period (Start and End date / time using calendar icon and entry fields)
- Parameters (*Select all* button or selecting parameters individually using the tick box - also historic parameters can be selected)
- Export profile (Pull-down menu)
- Separator for columns

Logbook

This item can be used to export the system logbook from the database to a text file on the basis of a list of criteria:

- Period (Start and End date / time using calendar icon and entry fields)
- Log levels (*Select all* button or selecting parameters individually using the tick box)
  - *System*: Information regarding the complete system (SW maintenance and integrity checks)
  - *User*: Information regarding user login and logout
  - *Critical*: Information regarding errors in measurements, configuration and security related issues
  - *User-Interface*: Information regarding the user-interface (frontend).
  - *TML*: Information regarding data transfer using TML
  - *Training*: Information regarding training of alarm parameters in ana::tool

- Export profile (Pull-down menu)
- Separator for columns

In all the cases described above pushing the respective *Download* button on the top of the screen will download an archive file (_.*zip*) to the web browser. Depending on the web browser setup either a file dialog will pop-up (e.g. for the *con::cube* browser) or files will be downloaded automatically. In the case of a file dialog the archive file will be compiled and transferred after selecting the target drive.

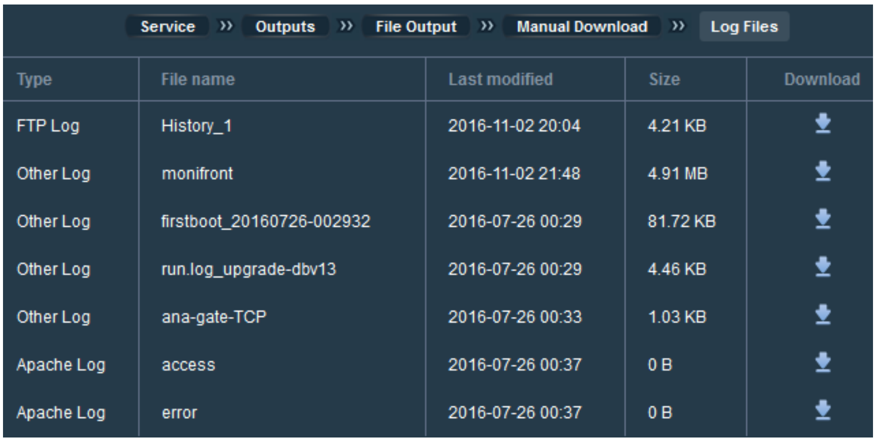
⚠ Please note that depending on the amount of selected data this process might last several minutes.

Log Files

This item can be used to download log-files which have been created by the system on specific issues automatically.

When Log Files is selected a list of available files is displayed.

Single files can be downloaded by pushing the respective *Download* icon.


Service ›› Outputs ›› File Output ›› Manual Download ›› Log Files

Type	File name	Last modified	Size	Download
FTP Log	History_1	2016-11-02 20:04	4.21 KB	⬇
Other Log	monifront	2016-11-02 21:48	4.91 MB	⬇
Other Log	firstboot_20160726-002932	2016-07-26 00:29	81.72 KB	⬇
Other Log	run.log_upgrade-dbv13	2016-07-26 00:29	4.46 KB	⬇
Other Log	ana-gate-TCP	2016-07-26 00:33	1.03 KB	⬇
Apache Log	access	2016-07-26 00:37	0 B	⬇
Apache Log	error	2016-07-26 00:37	0 B	⬇

Database Dumps

This item can be used to copy the complete database content into a single file, referred to as a *dump*. The copying process is triggered by pushing the button *Dump now* on top of the screen. After a dump file has been created it is shown in the respective list.

⚠ Since *moni::tool V3.1* this function is not available anymore but replaced by the function *Backup to USB stick*.

6.9.5 TML

TML is a protocol which can be used to transfer data from the database on the s::can terminal to an external database or server. Only data requested from outside is supported, that means the s::can terminal only responds to an external request for data by sending an appropriate TML stream.

For communicating via TML port 8083 is needed. TML data can be obtained by http-requests using the GET or PUT method. The s::can terminal prepares the requested static data (system configuration) and dynamic data (measured parameters) for a specified interval defined by start and end timestamp (ISO8601). A data request has the form:

https://<station>/cgi-bin/data?start=2008-08-01T10:35:00Z&end=2008-08-01T11:35:00Z&hash=0123456789abcdef0123456789abcdefmoni

For further information please refer also to chapter 6.4.9 on security aspects of TML access and on the information provided directly in *moni::tool*!

6.9.6 Auto-Sampler

The *moni::tool* function “Auto-Sampler” allows taking samples automatically from a medium using a minimum of additional devices (just valves and bottles). All needed hardware, intelligence and the user interface will be supported by the *con::cube* running *moni::tool*. Practically, the *Auto-Sampler* function cascades a number of digital outputs, each representing the status “full” or “empty”. Consequently, only the state of the digital out-put with the status “empty” on the top of the list will be checked.

If the condition is fulfilled, a valve connected to this digital output will be powered on for the configured duration. A sample collection delay can be set to avoid getting multiple samples for the same event.

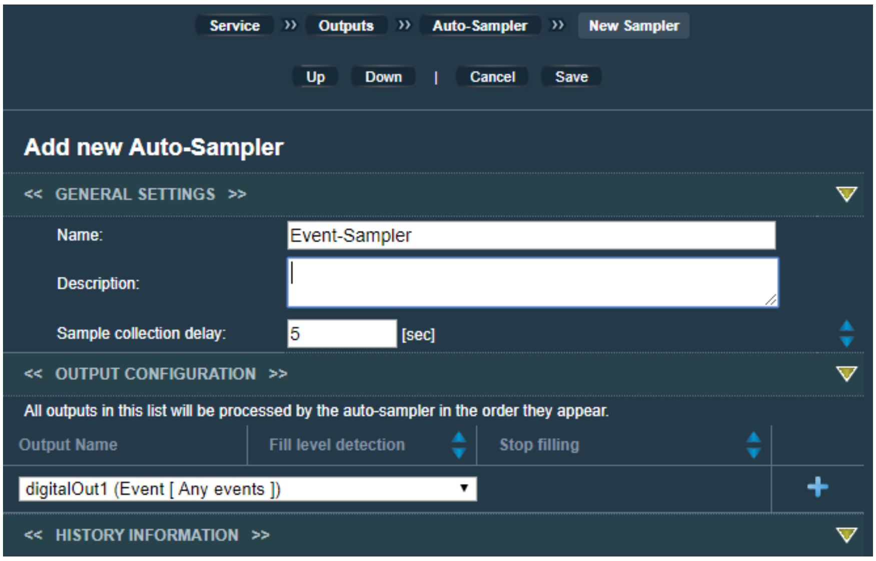
Additionally, automatic level detection can be used if the *con::cube* internal digital input module is available. In that case the filling of the bottle ends automatically when the level detector indicates that the bottle is full. Using a digital input for level detection will change a bottle’s filling status automatically from “full” to “empty” when the bottle is emptied.

Before an auto-sampler can be added it is necessary to make sure that at least one digital output assignment has been defined (see chapter 6.9.2)

When digital output(s) have been configured appropriately, the process New Auto-Sampler can be launched and some configuration settings can be made:

- Name of the auto-sampler
- Sample collection delay
- Digital outputs (“+” symbol)
- Duration for *Stop filling* or use *Fill level detection*.
  - o The maximal filling duration is limited by *Sample collection delay*
  - o If fill level detection is used, a digital input and its behaviour must be configured
- Pushing *Up* and *Down* can be used to bring the selected digital outputs in a correct order
- Save settings

Online help for the individual options can be displayed by pushing the blue arrows.



Add new Auto-Sampler

<< GENERAL SETTINGS >>

Name: Event-Sampler

Description:

Sample collection delay: 5 [sec]

<< OUTPUT CONFIGURATION >>

All outputs in this list will be processed by the auto-sampler in the order they appear.

Output Name	Fill level detection	Stop filling
digitalOut1 (Event [Any events])		

<< HISTORY INFORMATION >>

6.9.7 SMS Notification

With the help of the *SMS Notification* function a *con::cube* can use the SMS mobile service for informing about programmable conditions directly from the monitoring site in real time.

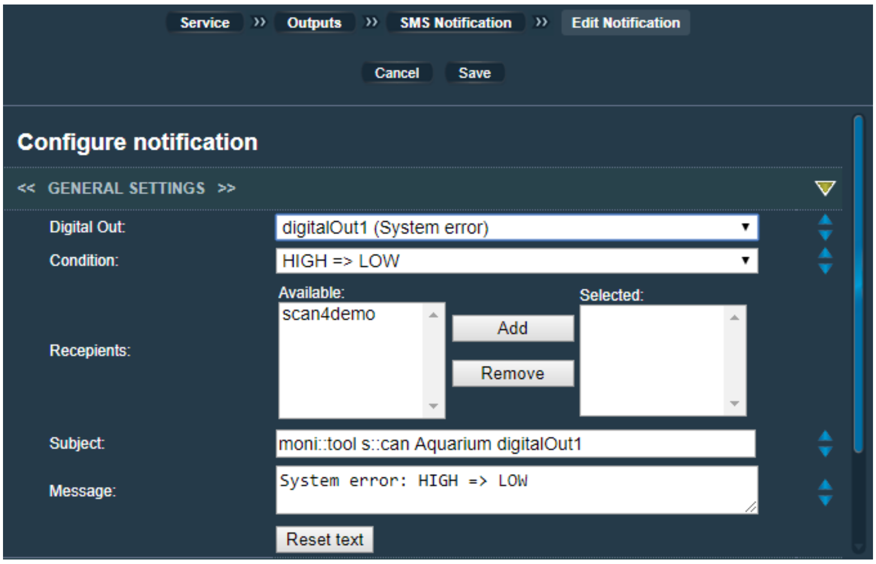
Requirements:

- *con::cube* with internal modem (s::can item No. D-315-3GLX) running *moni::tool* V2.0 or higher
- *moni::tool* SMS notification license (s::can item No. S-11-SMS)
- SIM card with active SMS service
- User profile with configured mobile phone number

All modes which can be assigned to a digital output (see chapter 6.9.2) can be used to trigger SMS notifications. This provides a variety of possibilities for staying informed about the condition of monitoring systems. Typical examples for triggering SMS notification are parameter values exceeding a configured value, parameter alarms, system errors or activation of the *moni::tool Service Mode*.

⚠ *moni::tool* can also be controlled by SMS remote control using specific messages.

For details on how to configure SMS functions please refer to the respective reference guides!



Configure notification

<< GENERAL SETTINGS >>

Digital Out: digitalOut1 (System error)

Condition: HIGH => LOW

Recepients: Available: scan4demo Selected:

Subject: moni::tool s::can Aquarium digitalOut1

Message: `System error: HIGH => LOW`

⇨ *Available **Quick reference guides**:*

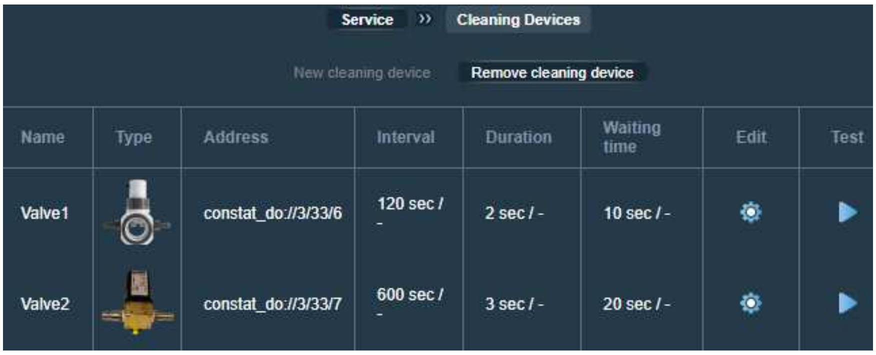
Manuals	*moni::tool / Service_Guides*	note_moni-toolV2.2_SMS_Notification
Manuals	*con::cube / Service_Guides*	note_concube_SMS_remoteControl_moniV3

Please refer to the s::can Customer Portal!

6.10 Cleaning Devices

Cleaning devices manage the automatic cleaning of sensors.

All existing cleaning devices can be configured with their individual settings. All configured cleaning processes are performed in sequence before the measurement. The process will start with the cleaning device that is displayed highest in the list. As the list is ordered alphabetically, the configured name of a cleaning device defines when it will be activated.



Name	Type	Address	Interval	Duration	Waiting time	Edit	Test
Valve1		constat_do://3/33/6	120 sec / -	2 sec / -	10 sec / -	⚙	▶
Valve2		constat_do://3/33/7	600 sec / -	3 sec / -	20 sec / -	⚙	▶

An example of a complete cleaning cycle is given below:

Duration Valve1 → Waiting Valve1 → Duration Valve2 → Waiting Valve2 → Measurement

The currently running process (e.g. *Waiting*) is shown as activity in the bottom menu of the *moni::tool* screen (see also chapter 0.2.5).

If the total duration of all actions as displayed above (i.e. cleaning + measurement) is longer than the measurement interval, the next cycle will not be started immediately but the beginning will be delayed until the next measuring time point. This means that fewer measurements are performed than specified by the measurement interval. The window for setting the Measurement Interval (see chapter 6.4.1) will be displayed when this is likely to occur.

New cleaning devices are installed and configured by pushing the *New cleaning device* button above the list which is available when an unassigned cleaning device address exists. This opens a window where the *Name* and the *Type* of the device can be entered.

→*Service Level / Expert*

- Add an individual *Description*
- Select the *Address* of the used valve (*constat_do://3/33/6* for *con::cube* cleaning output “Valve 1“ and *constat_do://3/33/7* for *con::cube* cleaning output “Valve 2”)

The configuration of already installed devices is shown in the list and can be changed by pushing the respective *Edit* icon. For configuring cleaning devices the following information needs to be provided:

Interval [sec]	Time between starts of cleaning	As cleaning is always triggered before the measurement, the minimum setting is the measurement interval. Interval 0 = device disabled
Duration [sec]	Time of active cleaning	Duration 0 = device disabled
Waiting time [sec]	Time between end of cleaning cycle and start of next process (next cleaning process or measurement)	

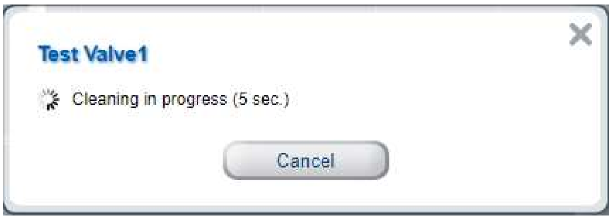
All settings listed above are available both for the measurement modes “Standard” and “Intensive”. Different values for “Intensive” can be set for an intensified cleaning during certain conditions (see also chapter 6.4.1).

→*Service Level / Expert*

- Durations for pulsed operations (0 = pulsing disabled)
- Configuration history

All settings and modifications will be stored when pushing *Save*. Regarding the electrical connection of the cleaning device please refer to the s::can manual of the terminal.

Configured cleaning devices can be tested by pushing the *Test* icon in the respective row which will activate the automatic cleaning until the button *Cancel* is pushed.



Test Valve1

Cleaning in progress (5 sec.)

Pushing *Delete cleaning device* removes the marked device which will then not be available until it is re-installed.

7 Help

This tab might have been replaced by using the Custom Screen function (see chapter 6.4.8, p. 53)

7.1 Version Info

Pushing *Version Info* will open a window showing several information.

Version:	version of the software that is installed actually
Contact:	official possibility to contact s::can
Terminal:	model and serial number of the operating terminal
LAN:	information of local network connection
WLAN:	information of local wireless network connection

As an option also information of modem and VPN connection are displayed.

This information can also be accessed directly at any time by pushing the s::can logo in the *Bottom Menu* (see chapter 0.2.6).

7.2 Software License

The Software *moni::tool* consists of basic functionalities that are available to all users and of additional features that are only available when the appropriate license has been obtained. In the License window the additional features are listed as well as the information on whether they are unlocked and until when.

It is also possible to select (button *Browse*) and upload (button *Enter license*) a new license key (file ending ".lic", you receive from s::can). Once the key has been loaded, the additional features are immediately unlocked.

License keys are specific for the serial number or MAC address of your terminal. They can be found in the License window right above the Choose License file field. If you want to acquire a new license key, which can be done via the s::can Customer Portal directly, these IDs need to be provided to your s::can sales partner.

7.3 License Agreement

Pushing *License Agreement* will open a window showing the license agreement.

7.4 New Features

Pushing *New Features* will open a window showing a list of all modifications until the currently used version of *moni::tool*. Via the *Edit* icon more detailed information about new features provided by new versions can be displayed.

7.5 Open Source License Information

Under this point the valid Open Source License Information can be viewed.

7.6 Function Index

This index lists all *moni::tool* functions, structured according to their respective tab and menu hierarchy and hence corresponds to the structure of this manual.

A search function is included allowing to find the correct position within *moni::tool*.

PART D – ADDITIONAL INFORMATION

1 Function Checks

Checking the correct function of the monitoring system is useful in situations such as

- initial startup,
- suspected monitoring system malfunction,
- modification of the monitoring system (e.g. integration of additional sensor or device) or
- changed measuring location.

Besides, a regular functional check with weekly to monthly intervals depending on the application (e.g. composition of the medium), the types of connected sensors as well as on the environmental conditions is recommended. The following table provides an overview of the activities that should be performed for checking the integrity of the individual system components as well as possible reasons / countermeasures for frequently happening situations.

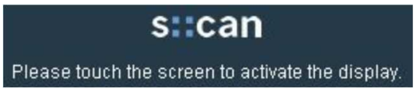
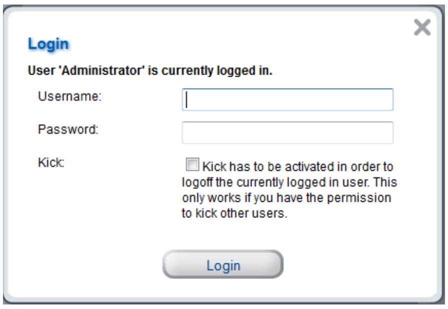
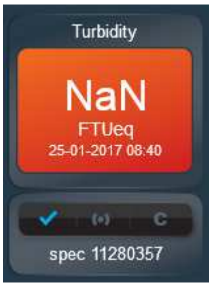
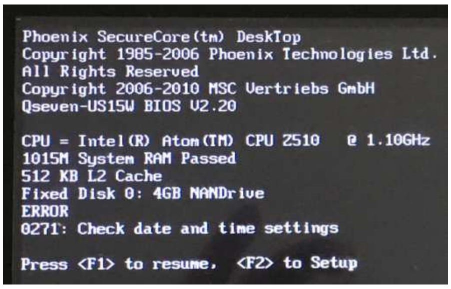
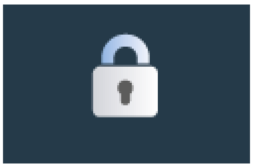
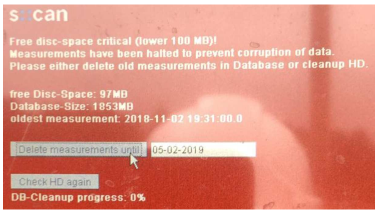
Component	Checks	Measures
Power supply	• The LED on the housing cover is on? • The *moni::tool* screen is displayed after touching the screen?	• Check power supply
Running system	• The server time and the time stamp of the last measurement displayed when pushing the clock at the center of the *Bottom Menu* are correct? • Current activity displayed on the right of the *Bottom Menu* is changing?	• Check *Measurement* setting (see chapter 6.4.1) • Check *Date & Time* setting (see chapter 0.2.4 and 6.4.6)
System status	• The *con::cube* LED is blue? • The icon of the *Status* tab is NOT blinking yellow?	• Open the *Status* tab and push the symbol of the affected component for more information (see chapter 4).
Alarm status	• The icon of the *Alarm* tab is NOT blinking yellow?	• Open the *Alarm* tab for confirming or rejecting pending alarms and for clearing all warnings (see chapter 5).
Service mode	• The icon of the *Service* tab is Not blinking yellow?	• If the *Service* icon is blinking, the measuring process has been interrupted (see chapter 6.2).
Automatic cleaning	• Air bubbles are visible when cleaning is activated? • Sound of the rotating cleaning brush is heard when cleaning is activated?	• Check the *Cleaning* settings (see chapter 6.10) and wait for next cleaning cycle • Use function *Test cleaning device* (see chapter 6.10).
Compressed air main	• No hissing sounds audible? • No uncontrolled air bubbles visible?	• Check tightness of tubes and fittings
Compressor and air storage tank	• Pressure of compressed air is correct?	• Check pressure setting • Drain condensed water from the compressor's storage tank (not necessary for s::can compressor B-32).
Monitoring by-pass	• All tubes and fittings are tight? • All sensors are supplied with medium? • No air bubbles within the tubes?	• Check valves and pumps • Check the geometry of the by-pass tubes (e.g. diameter, air traps)
In-situ installation (submersed)	• Mounting equipment of all devices is ok? • All sensors are submersed?	• Maintain and repair mounting material • Adapt installation
Data transfer	• Readings on the local terminal correspond to readings on the external system.	• Check settings for the used *Outputs* (see chapter 6.8 and 6.9)

⚠ For the plausibility of measurement results please refer to the respective information provided for the *Values* (chapter 1) and *Status* (chapter 4) tabs. In cases of doubt regarding the integrity of a sensor, please refer to the section *Sensor Integrity* in the manual of the respective instrument.

2 Troubleshooting

2.1 Known issues

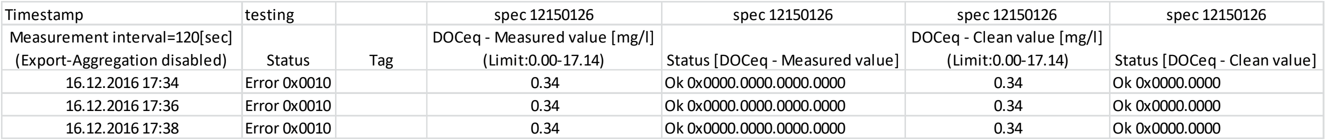
The following situations have occasionally caused difficulties in the past.

	Reason	Reaction
 s::can Please touch the screen to activate the display.	The screen saver has been activated.	Touching the screen with a finger or the mouse pointer will activate the display again.
 **Login** **User 'Administrator' is currently logged in.** Username: Password: Kick: ☐ Kick has to be activated in order to logoff the currently logged in user. This only works if you have the permission to kick other users. Login	Another user is currently logged in (eventually directly on the terminal itself).	Login might be possible at a later time. If the user to be newly logged in has the appropriate right, the current user can be kicked out by ticking the respective check box and pushing *Login*.
 Turbidity NaN FTUeq 25-01-2017 08:40 spec 11280357	Parameter reading = *NaN* ("*Not a Number*")	Use the *Status*-Tab for identifying the reason for the error in clear text. Pushing the text or the blue arrows on the right displays information on resolving the issue.
	If the issue remains:	Download the zip-file from the con::cube (*Status\Terminal\Logbook\Export all…*) and send it to your s::can Customer Support.
 Phoenix SecureCore(tm) DeskTop Copyright 1985-2006 Phoenix Technologies Ltd. All Rights Reserved Copyright 2006-2010 MSC Vertriebs GmbH Qseven-US15W BIOS V2.20 CPU = Intel(R) Atom(TM) CPU Z510 @ 1.10GHz 1015M System RAM Passed 512 KB L2 Cache Fixed Disk 0: 4GB NANDrive ERROR 0271: Check date and time settings Press <F1> to resume, <F2> to Setup	Internal con::cube battery empty. Do not use con::cube ana more to avoid loss of data.	Replace con::cube battery. Instruction is available on s::can Customer Portal.
	con::cube is protected against unauthorized usage by customer specific password (Web Authentification see section 6.4.9)	Connect to con::cube via Web-Browser and enter customer password.
 s::can Free disc-space critical (lower 100 MB)! Measurements have been halted to prevent corruption of data. Please either delete old measurements in Database or cleanup HD. free Disc-Space: 97MB Database-Size: 1853MB oldest measurement: 2018-11-02 19:31:00.0 Delete measurements until 05-02-2019 Check HD again DB-Cleanup progress: 0%	Free disc space on con::cube too low for safe operation.	Delete old data from con::cube. Enter date by which all data can be deleted.

2.2 Error and Status Messages

As has already been shown at various occasions (e.g. chapters 1.3.5, 4) *moni::tool* has the ability to monitor and document its own performance as well as that of the system's various hardware components. The results of this permanent quality control are communicated as status messages, both within *moni::tool* and in the various output files (see below and chapter 6.9.4).

Status messages basically consist of a status code which is the aggregated result of all status information available for the respective component as is shown in the example below.



Timestamp	testing		spec 12150126	spec 12150126	spec 12150126	spec 12150126
Measurement interval=120[sec] (Export-Aggregation disabled)	Status	Tag	DOCeq - Measured value [mg/l] (Limit:0.00-17.14)	Status [DOCeq - Measured value]	DOCeq - Clean value [mg/l] (Limit:0.00-17.14)	Status [DOCeq - Clean value]
16.12.2016 17:34	Error 0x0010		0.34	Ok 0x0000.0000.0000.0000	0.34	Ok 0x0000.0000
16.12.2016 17:36	Error 0x0010		0.34	Ok 0x0000.0000.0000.0000	0.34	Ok 0x0000.0000
16.12.2016 17:38	Error 0x0010		0.34	Ok 0x0000.0000.0000.0000	0.34	Ok 0x0000.0000

The specific meaning of the code format depends on the type of the respective system component as shown below.
The meaning of the different code sections within the code formats is as follows:

Symbol	Type
TTTT	System status
tttt	Terminal status
SSSS	Sensor status
PPPP	Parameter status
pppp	Parameter status (type-specific)
VVVV	*vali::tool* status
vvvv	*vali::tool* status (extension)

As documented below, status codes start with "0x", followed by dot-separated groups of four digits. The leading "0x" indicates that the following number is displayed in the hexadecimal system. Each of the following four-digits-groups represents the status of 16 positions called "bits". Each bit indicates the status of one specified condition (yes: condition is met, bit is set, value 1; no: condition is not met, bit is not set, value 0) and thus it is possible to aggregate the overall information and to show all covered aspects simultaneously. The results are sequences of 16 positions, each showing 0 or 1 for the respective condition (binary system).

However, displaying codes with up to 96 digits would not be convenient and hence the complete binary code is converted into the hexadecimal system. The result is a number consisting of groups of four digits for each covered status type because the highest hexadecimal number which can be expressed with 16 digits is FFFF. Accordingly, a system status code 0xFFFF would (theoretically) mean that all monitored system status properties are active while 0xFFFF.FFFF for a fingerprint parameter would indicate that all respective system status and all covered sensor status properties are active simultaneously.

For understanding the situation which led to a certain status code it is necessary to understand which positions have been set to 1 because the respective condition has been met. For this purpose the hexadecimal code needs to be transformed back into the corresponding binary number which can be done by scientific calculators or even by the calculator included in MS Windows.

Status type	Name in file header	Code format within file	Examples
System	*Status*	0xTTTT	*Ok 0x0000;* *Error 0x0010* (Bit 4 is set => System error)
Parameter	*“parameter name” – Measured value [unit] (Limit: LL – UL)*	0xtttt.SSSS.PPPP.pppp	*Ok 0x0000.0000.0000.0000;* *Error 0x0001.0000.0000.0000* (Bit 0 is set => no communication between sensor and terminal)
Clean value	*“parameter name” – Clean value [unit] (Limit: LL – UL)*	0xVVVV.vvvv	Ok 0x0000.0000; Error 0x0800.0000 (Bit 11 is set => maintenance necessary)
Virtual parameter	*“parameter name” – Result [unit] (Limit: LL – UL)*	0xtttt.PPPP.pppp	*Ok 0x0000.0000.0000;* *Error 0x0001.0000.0000* (Bit 0 is set => virtual parameter reports an error)
Fingerprint	*Status (Source:0)*	0xtttt.SSSS	*Ok 0x0000.0000;* *Error 0x0001.0000* (Bit 0 is set => no communication between sensor and terminal)

Example:

- “*Error 0x1801.00a0*” has been documented in the status file for “*NO3-Neq clean value*”.
- “Clean Value” has the code format V*VVV.vvvv*
- VVVV = 0x1801 (hex) = b0001 1000 0000 0001 (binary) => b12, b11 and b0 set.

In general the meaning of a status code 0000 is “OK” – no error has been detected and hence no bit has been set.

The interpretation of error codes generated by set bits as well as the consequent deeper analysis will usually be done by s::can service staff. However, for facilitating a basic understanding of the underlying process the following tables show the meaning of the individual status bits for various status types as well as the displayed user message and possible reactions.

System Status (*TTTT*)

Bit no.	System Message	Reason	Removal
b1	*Service mode is active - all measurements are stopped*	No error - service mode is entered and measurements are stopped.	Leave service mode.
b3	*ALARM*	At least one unconfirmed alarm is active.	Confirm all pending alarms.
b4	*System error*	Error - at least one internal check failed.	For more information see all additional status messages. After activating or deactivating vali::tool the effect will be visible until end of the next measurement.
b6	*Left free disk space is below ALARM limit*	Error – no free disk space available anymore - measurements are stopped.	Check and free disk space or perform database maintenance.
b7	*Left free disk space is below WARN limit*	Warning – little free disk space available – measurements will be stopped soon.	Check and free disk space or do database maintenance.
b8	*Invalid measurement interval*	The current measurement interval is too short for the current system configuration. Measurements might be skipped.	Raise the measurement interval in order to ensure continuous measurement. Reduce time used for automatic cleaning (cleaning duration or waiting time between end of cleaning and begin of measurement).
b9	*Feature not included*	This feature is not included in the current license of moni::tool.	Please contact your s::can sales partner and acquire a license in order to use this feature.

Terminal Status (tttt)

Bit no.	System Message	Reason	Removal
b0	*No communication between probe and controller* *Virtual parameter reports an error*	Error - Communication between sensor and controller failed. Error – Virtual parameter do not work.	Check probe cable and connector. Dis- and reconnect sensor. Try the same sensor with another terminal and another sensor on the same terminal. Check all inputs (if still available). Delete and reinstall virtual parameter.
b1	*Invalid Sensor*	Error - Serial number of sensor has changed.	Disconnect new sensor and connect the original sensor. Use "Replace" function to replace the old sensor by the new sensor. Install the new sensor (and remove old sensor).
b2	*Dependencies error*	Error – For example parameter still exists, but sensor has been removed.	See logbook for more information. Undo the last change before this failure occurred the first time. Remove parameter. Reset all settings to default (if allowed).
b3	*Manual measurement*	No error - Measurements are triggered manually.	Switch to automatic mode.
b4	*Input NaN*	One or more inputs are NaN.	Check these input parameters.
b6	*mA input signal is outside of the allowed input range*		Check the functionality of the input device. Check the selected input range.
b7	*Device update required*		Device software version (firmware) is outdated. An update has to be performed.
b9	*Feature not included*	Error - this feature needed is not included in the current license of moni::tool.	Please contact your s::can sales partner and acquire a license in order to use this feature.

Sensor Status General (SSSS)

Bit no.	*System Message*	Reason	Removal
Any other bit is set	All possible errors regarding the device status incl. the user messages, the reason for the error and notes for trouble shooting can be found in the manual of the specific sensor.	Sensor status not o.k. or the sensor is used outside the specification, for example within too hot or too cold medium or supplied with too high or too low voltage.	Check installation and perform sensor function check.
B13	*Device busy*	Measurement on sensor is still running.	Increase measurement interval or speed-up measurement duration on sensor.

Parameter Status General (PPPP)

Bit no.	*System Message*	Reason	Removal
b0	*General parameter error*	Parameter error	Check if another bit is set in addition. If no other bit is set: check installation, run sensor function check.
b1	*Parameter error, Hardware error*	Sensor/Electrode signal not OK. An electrode is missing, too old or defect.	Check the electrode (remove air bubbles), run sensor function check and/or replace electrode.

b2	*Parameter error, Configuration error*		Change the local calibration or switch back to the global calibration. Change the global calibration. Inform s::can service.
b3	*Parameter error, wrong medium*	The probe is outside of the medium or in incorrect medium, for example too high concentration.	Check water supply und check whether the probe is fully submersed. If medium OK, perform system check for further information.
b4	*Parameter error, Incorrect calibration*	Most probably something went wrong during last user calibration.	Check readings and lab values, repeat calibration. If the values are OK and repeating the calibration gives the same error: restart the probe (by disconnecting and reconnecting the probe). If the problem still persists, switch back to Global (factory) calibration and repeat local calibration.
b5	*Parameter not ready*	Parameter not activated on the sensor or sensor still warming up.	Activate parameter on probe or wait until start-up is completed.
b11	*Maintenance recommended*		Check installation and sensor condition, perform maintenance if necessary.
b12	*Marked as not trustable*	Do not use the parameter reading for calibration!	Check correlation to reference measurement.
b15	*Reading out of measuring range*	In case of parameter reading is given, this is a warning and so linearity to reference measurement maybe is not as expected anymore. In case of parameter reading is NaN, this is an error indicating not possible to generate a reading anymore.	Check whether sensor is in the medium and clean. If yes, perform functional check of the instrument and/or recalibrate sensor using samples with higher and / or lower concentrations.

⚠ The sensor specific messages of the parameter status (pppp) are described in the according sensor manuals.

vali::tool **Status (VVVV)**

Bit no.	System Message	Reason	Removal
b2	*Configuration error*	Failure within configuration of vali::tool	Check vali::tool configuration
b6	*Not ready*	Clean value cannot be calculated	Wait until initialisation of vali::tool has been completed. The duration depends on the settings.
b11	*Maintenance necessary*	Sensor / installation needs to be checked. Alternative: *vali::tool* setup is not adapted correctly or *vali::tool* sensitivity is too strict (too high).	Check sensor and installation according to the instruction in the manual. Perform maintenance if necessary. If sensor / installation is ok, adapt *vali::tool* setup to the application / sensor / parameter or reduce the sensitivity of *vali::tool*.
b12	*Marked as not trustable*	Do not use this measurement for calibration!	Wait for the next measurement without status bit.
b13	*Event Alarm*	Alarm condition is fulfilled. No failure of monitoring system. Measured medium is outside the adjusted alarm limits.	Confirm or reject alarm. Change alarm limits if needed.

vali::tool **Status (vvvv)**

Bit no.	System Message	Reason	Removal
b0	*Configuration error*	Error in configuration	Reinstall parameter
b1	*Abnormally high noise level*	The noise of the validated parameter is too high. An abnormally high noise level can indicate instrumental problems. DO NOT USE FOR CALIBRATIONS! If the noise level is OK, adjust the vali::tool configuration.	You can either increase the value of 'NOISEinstrumentNoiseThreshold', to selectively increase the tolerance with respect to instrument noise or decrease the value of 'sensitivity', to decrease the overall sensitivity of vali::tool.
b2	*Abnormally low noise level*	The noise of the validated parameter is too low. This can be an indicator of lost communication or sensors operating outside the medium. DO NOT USE FOR CALIBRATIONS! If the noise level is OK, adjust the vali::tool configuration.	Decrease the value of 'NOISE minimum NoiseLevel', to selectively increase the tolerance with respect to sensor noise. If you see this message although the parameter performance is OK and the value of 'NOISEminimum NoiseLevel' is already 0, this is due to the fact that there are periods of very small dynamics in the medium, compared to the resolution of the parameter. In this case increase the values of 'NOISEthresholdRatio' and/or 'NOISE evaluationPeriod'. If problems persist, deactivate the low noise level check by setting the value of 'NOISE minimumNoiseLevel' to a negative number.
b3	*No results available*		Wait until vali::tool startup is finished.
b4	*Outlier detected*	Sporadic outliers are a normal feature in a parameter time series, which are usually due to real fluctuations in the medium. Nevertheless, higher frequency or clusters of outliers usually indicate an installation problem such as air bubbles. If this message appears, although the current measurement should not be seen as an outlier, adjust the vali::tool configuration.	Increase the value of 'OUTLIER tolerance Factor' and/or 'OUTLIER absolute Tolerance' to selectively increase the tolerance with respect to outliers or decrease the value of 'sensitivity' to decrease the overall sensitivity of vali::tool.
b5	*Input was NaN*		Check input parameter
b6	*Static alarm*		Check medium
b8	*Out of reasonable range*		Parameter readings out of a reasonable range are often due to a sensor malfunction or due to a bad calibration. DO NOT USE FOR CALIBRATIONS! If this problem persists, please check sensor and calibration.
b9	*Too many NaN in input history*		
b10	*Static warning*		Check medium

3 Using VNC for Remote Control

One of the software components available on a *con::cube* running *moni::tool* is a so called *VNC server*.

VNC stands for *Virtual Network Computing* and means a platform-independent system for transferring keyboard and mouse events as well as screen content between two computers, a *VNC server* and a *VNC client*, over a network.

The *VNC server* is the VNC program on the machine that shall share its screen and will passively allow a VNC client to take control of it and such a program is part of *con::cube*.

The *VNC client* (or *viewer*) is the program that watches, controls, and interacts with a VNC server, i.e. the client controls the server.

It is hence possible to control the *con::cube* remotely via a network or modem connection using the terminal program *VNC-Viewer* which is available for free over the internet. Once the VNC connection has been established, keyboard, mouse and monitor of the computer running the VNC client can be used for remotely operating the *con::cube*.

After starting the VNC-Viewer in the appearing dialog window the correct IP address of the *con::cube* (Server) which shall be controlled from remote has to be entered. Please be aware that the IP address of a *con::cube* can either be fixed or dynamically allocated.

In case of a slow connection a reduction of the color depth to minimum is recommended.

After confirming the connection details by pushing *Ok* the password for the VNC server has to be entered in the pop-up window. As a standard for the *con::cube* this is „scan“ (case-sensitive) but it might have been changed for security reasons.

⚠ For *moni::tool* V3 with OS Linux the Port 5900 has to be opened in the firewall configuration (see section 6.4.9)

After the VNC session has been successfully established the screen content of the *con::cube* will be displayed on the remote notebook / PC in an extra window. As long as the mouse pointer of this computer is located inside this window of the VNC application, all mouse-controlled actions will impact directly on the remotely controlled *con::cube*. However, any action taken outside the VNC window will still control the local computer. All available buttons and input boxes in *moni::tool* can hence be operated via the keyboard and mouse of the remote notebook / PC.

When the required activities (such as configuration settings, measurements readings) have been completed the VNC-Viewer may be closed using the button x top-right.

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Intelligent. Optical. Online.

pH::lyser / redo::lyser V2
Manual January 2010 Release

pH::lyser / redo::lyser V2
Handbuch Ausgabe Jänner 2010

1 Table of Contents

2 General

2.1 About this Document

This manual contains, firstly, general information, safety guidelines and hazard warnings as well as information regarding transport and storage of the product. In further chapters the installation, mounting, initial operation and calibration of the pH::lyser / redo::lyser are explained. Furthermore, a technical description as well as technical specifications of the device itself can be found in this manual. Information regarding functional check, maintenance and trouble shooting complete the document.

For proper initial operation of complete s::can measuring systems, the s::can manuals for the controller (con::lyte, con::stat or PC / notebook with con::nect), the operating software (ana::lyte and ana::pro) as well as the connected probes and sensors have to be consulted.

2.2 Guidelines for this Document

All cross references in the text are marked in blue as follows: [Reference]. Each term in this document that is marked *italic and underlined,* can be found on the display of your controller or as lettering on your s::can product.

In spite of careful elaboration this manual may contain errors or incompletion. s::can does not assume liability for errors or loss of data due to such faults in the manual.

The original manual is published in English (part 1 of this document) and German (part 2 of this document) language by s::can. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into third languages.

2.3 Author's Rights (Copyright) und Product Names

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The reproduction of product names, registered trade names, designation of goods etc. in this manual does not imply that these names can be used freely by everyone; often these are registered trade marks, even if they are not marked as such.

2.4 Validity of this Document

This manual, at the time of its publication (see release date printed on the top right/left of this document), concerns the following s::can products:

Designation	**Item no as listed in the s::can price list**
pH::lyser II eco	E – 514 – 2 (please refer to section [4.6])
pH::lyser II pro	E – 514 – 3 (please refer to section [4.6])
redo::lyser II eco	E – 513 – 2 (please refer to section [4.6])
redo::lyser II pro	E – 513 – 3 (please refer to section [4.6])
pH and reference electrode	E – 514 – 2 pH
redox and reference electrode	E – 513 – 2 ORP
pH standard solution 4.01	E – 514 – 4.01
pH standard solution 6.86	E – 514 – 6.86
pH standard solution 9.18	E – 514 – 9.18
Redox standard solution 456 mV	E – 513 – 456
Tool for simple electrode replacement	E – 532 – tool
Pressure connection set	B – 41
10 m extension cable	C – 210 – sensor
20 m extension cable	C – 220 – sensor
pH::lyser / redo::lyser carrier	F – 12 – sensor
pH::lyser / redo::lyser flow cell setup tap water	F – 44 – three
pH::lyser / redo::lyser flow cell setup waste water	F – 47 – ise
System panel basis pro for sensor and controller	F – 50 – 1 – pro
System panel pro pH::lyser / redo::lyser	F – 50 – x – pro (x = 2, 3, 4)
System panel basis eco for sensor and controller	F – 50 – 1 – eco

Designation	Item no as listed in the s::can price list
System panel eco pH::lyser / redo::lyser	F – 50 – x – eco (x = 2, 3, 4)

Information and technical specifications regarding these items in s::can manuals from earlier release dates are herewith replaced by this manual.

2.5 Declaration of Conformity

English
Deutsch
Appendix

The s::can pH::lyser / redo::lyser has been developed, tested and manufactured for electromagnetic compatibility (EMC) and according to applicable European standards, as defined in the declaration of conformity.

The declaration of conformity related to this marking can be requested from s::can or your local s::can sales partner.

2.6 Product Updates, Other

The manufacturer reserves the rights to implement, without prior notice, technical developments and modifications in the light of continuous product care.

3 Safety Guidelines and Hazard Warnings

3.1 General Advice

Installation, electrical connection, initial operation, operation and maintenance of the pH::lyser / redo::lyser as well as complete s::can measuring systems must only be performed by qualified personnel. This qualified personnel has to be trained and authorised by the plant operator or s::can for these activities. The qualified personnel must have read and understood this manual and have to follow the instructions contained in this manual.

Any kind of manipulation of the instrument is strictly prohibited (except for the activities described in this document, such as connection of the sensor to the s::can controller, replacement of electrodes).

3.2 Special Hazard Warnings

Because the s::can measuring systems are frequently installed in industrial and communal waste water applications, one has to take care during mounting and demounting of the system, as parts of the device can be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one’s health during work with the measuring device.

3.3 Improper Usage / Guarantee / Warranty

All s::can pH::lyser / redo::lyser are leaving our factory in immaculate technical and safety conditions. Inappropriate or not intended use of the sensor, however, can cause danger!

The manufacturer is not responsible for damage caused by incorrect or unauthorised use. Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid.

For details regarding guarantee and warranty please refer to our general conditions of business.

3.4 Duties of the Operator

The operator has to obtain the local operating permits and has to comply with the joint constraints associated with these. Additionally, the local legal requirements have to be observed (e.g. regarding safety of personnel and means of labour, disposal of products and materials, cleaning, environmental constraints).

Before putting the measuring device into operation, the operator has to ensure that during mounting and initial operation – in case they are executed by the operator himself – the local legislation and requirements (e.g. regarding electrical connection) are observed.

4 Technical Description

4.1 Intended Use

The pH::lyser is an ion-selective measuring device designed for continuous monitoring of the logarithmic concentration of dissolved hydrogen ions (H^+). The instrument also continuously measures the temperature of the medium and corrects the measured concentration accordingly.

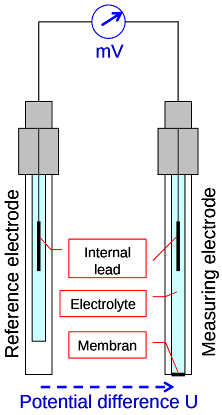
The redo::lyser measures the reduction potential of an aqueous solution. The instrument also provides the temperature of the medium as an additional parameter.

For proper usage the s::can pH::lyser / redo::lyser has to be connected to an s::can controller, i.e. a con::stat (item no. D-314-x) or con::lyte (item no D-318-x or D-319-x).

In all types of applications, the respective acceptable limits, which are provided in the Technical Specifications sections in the respective s::can manuals, have to be observed. All applications falling outside of these limits, and which are not authorised by s::can Messtechnik GmbH in written form, do not fall under the manufacturer's liability.

The device must only be used for the purpose mentioned above. Use in applications not described in this s::can manual, or modification of the device without written agreement from s::can, is not allowed. s::can is not liable for claims following from such unauthorised use. In such a case, the risks are the sole responsibility of the operator.

4.2 Functional Principle pH::lyser



Measurements conducted pH::lyser are called potentiometric measurements. This is due to the fact that the quantity to determine is related to the potential difference between a reference electrode and the measuring pH electrode. The pH::lyser quantifies the logarithmic activity of H^+ ions in an aqueous solution. The principal schema of any potentiometric measurement is displayed on the right hand side.

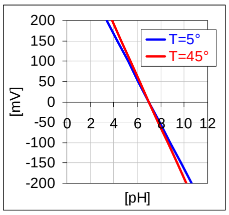
The potential measured between the reference electrode and the measurement electrode is simply the sum of all potential differences which occur on all liquid-liquid and liquid-solid interfaces. For the measurements to be accurate all such potential differences should be constant with the exception of the potential difference between the inner reference electrolyte of the measurement electrode and the solution. This potential difference U correlates with the activity (concentration c) of the H^+ ions and can be described by the Nernst equation:

$$U = U_0 + S * \log (c)$$

S .... temperature dependent slope of the electrode
U_0 .... a constant voltage

$$pH = (U_0 - U) / S$$

A typical curve for the pH and potential difference relationship is shown on the right hand side.



Additional factors are very important for accurate pH measurement and will be taken into account automatically by the pH::lyser:

- The temperature dependence of the slope
- The isothermic intersection point is the point where the potential difference for a given pH value is independent of the temperature.
- Depending on the pH range the slope exhibits a non linear relationship. This is called the alkaline and acid error.
- The possibility for calibration has to be added to the above equations.
- For auto diagnosis the sensor also provides the temperature and the raw voltage signal as well as a quality value validating the stability of the signals.
- The pH::lyser pro even monitors the impedance of the pH and reference electrode for advanced auto diagnosis, e.g. prediction of remaining life time and more.

4.3 Functional Principle redo::lyser

The Oxidation Reduction Potential (ORP), or also called redox potential, is a quantity for the tendency of the measuring medium to gain or lose electrons. ORP is measured in mV and the readings are not corrected for temperature. If the ORP value is positive the medium has the tendency to gain electrons (e.g. chlorinated water) and it will oxidise new species that are dissolved in it. If the ORP-value is negative, it has the tendency to lose electrons (e.g. hydrogen sulfide) and thus reduce new species dissolved in it.

The basic setup of the redo::lyser is similar to the one for the pH::lyser, but instead of the pH electrode a platinum electrode is used. When the ORP electrode is immersed into aqueous solution it will gain or lose electrons until it has developed a potential which is equal to the ORP of the solution. The reference electrode is the same as for the pH measurement.

4.4 Functional Principle Reference Electrode

The most important task for a reference electrode is to provide a stable reference potential independent of temperature and media over a long period of time. The most widely used reference electrodes are Ag/AgCl reference electrodes filled with a KCl electrolyte (“single junction electrode”). A porous diaphragm on one end allows contact between the solution and the electrolyte.

For pH::lyser / redo::lyser a more advanced “double junction electrode” (solid state body) is used. In this case the inner cell (the reference) is inserted in an outer tube containing a different electrolyte which is then in contact with the solution. The potential difference over the reference layer is minimized and constant by ensuring a constant and equal exchange of ions across the interface.

The used solid state reference electrode does not contain any porous junctions and therefore provides long term stability, maintenance free and will not suffer from problems like electrolyte leaking and contamination.

4.5 Device Typification

Each instrument is typified by the type labels (item number and type) and the serial number (8-digits), which are located on the end of the sensor cable.

4.6 Device Variants

The following device variants of the pH::lyser / redo::lyser are available:

		pH	**ORP**	**Temp**	**Advanced diagnosic**
E-514-2	pH::lyser II eco	X		X	
E-514-3	pH::lyser II pro	X		X	X
E-513-2	redo::lyser II eco		X	X	
E-513-2	redo::lyser II pro		X	X	X

4.7 Device Parts - Overview

1	Sensor housing
2	Sensor cable
3	Electrode guard with automatic cleaning connection
4	pH- or ORP-electrode including reference electrode
5	Temperature sensor

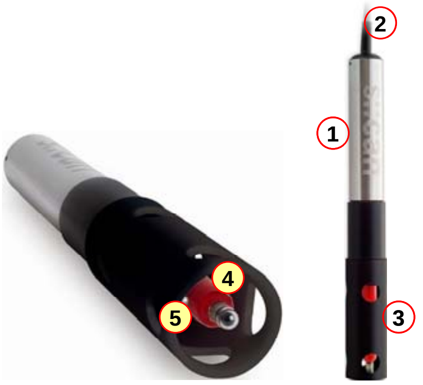


Fig. 4-1: pH::lyser / redo::lyser device parts

4.8 Device Dimensions

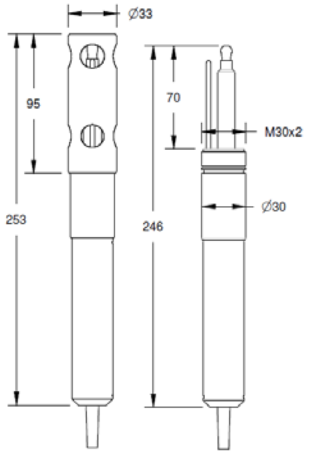


Fig. 4-2: pH::lyser / redo::lyser dimensions (dimensions in mm)

5 Storage and Transport

The temperature limits for device storage and transport, which are described in the section Technical Specifications [11], are to be observed at all times. The device shall not be exposed to strong impacts, mechanical loads or vibrations. The device should be kept free of corrosive or organic solvent vapours, nuclear radiation as well as strong electromagnetic radiation.

The electrode has to be stored with the protective cap, included in delivery. The cap needs to be filled with KCl (approx. 2 molar) or tap water (don't use distilled water). **Drying out of the electrode** will reduce measuring quality and life time of the electrode significantly. If the electrode is stored on air for longer time (> 48 hours) it **will become inoperable**.

Transport should be done in the original packaging if possible.

5.1 Check upon Receipt

Immediately upon receipt, please check the received consignment for completeness on the basis of the delivery note and check for any possible evident damage incurred during shipping. Please inform the delivering dispatcher and s::can immediately in case of any damages in transit.

Following parts should be included in delivery:

- s::can pH::lyser (item-no. E-514-2 or E-514-3) or
  s::can redo::lyser (item-no. E-513-2 or E-513-3)
- Connection set for automatic cleaning (item-no. B-41)
- Tool for simple electrode replacement (E-532-tool)
- s::can manual

Following parts optional be included in delivery:

- Replacement electrode pH and reference (item-no. E-514-2-pH) or
  Replacement electrode redox and reference (item-no. E-513-2-ORP)
- pH standard solution for calibration (item-no. E-514-x.xx)
  redox standard solution for calibration (item-no. E-513-456)
- Extension cable (item-no. C-210-sensor or C-220-sensor)
- Probe carrier (item-no. F-12-sensor)
- Flow cell setup tap water (item-no. F-44-three)
- Flow cell setup waste water (item-no. F-47)

In case of incompleteness please contact your s::can sales partner immediately!

5.2 Return Consignment

Return consignments of the s::can measuring system, or parts of the system, shall be done in the original packaging. Before returning a consignment, you have to contact your s::can sales partner or s::can (sales@s-can.at).

In case servicing of your s::can system is required, you also have to contact your s::can sales partner or s::can (service@s-can.at) in advance. You will be assigned an RMA number, without which return consignments for service will not be accepted.

The customer has always to bear the costs for return consignment.

6 Installation and Mounting

6.1 Tool- and Material List

For mounting and electrical installation of the pH::lyser / redo::lyser, the following tools and materials are necessary:

- Screwdriver cross and slot (for opening s::can controller and connecting the analogue / digital data transfer)
- Compressed-air hose (ID 8 to 9 mm) – when using automatic sensor cleaning
- Probe carrier for pH::lyser / redo::lyser
- Extension pipe for probe carrier and drill bit 2.5 mm
- Fixing adapter for extension pipe (item-no. F – 15)

6.2 Choice of the Installation Site

As the correct installation of measuring instruments is an important prerequisite for satisfactory operation, s::can has prepared a checklist for the installation. This list can be used to ensure that all sources for potential operational problems can be ruled out to the greatest possible extent during installation, allowing the s::can monitoring system to operate properly.

Installation site:

- Favourable flow conditions (little turbulence, acceptable flow rate, etc.)
- Unadulterated measuring medium, no intrusion of contaminating substances (due to nutrient dosage or flocculants)
- Representative composition of sample with respect to the medium (process, thorough mixing etc.)
- Measuring medium is in equilibrium state, e.g. no gas release, no precipitation etc.
- No external interferences (i.e. no electric and electro-magnetic interferences by leakage current, earth fault of pumps, electric motors, high voltage currents, etc.)
- Easy accessibility (mounting, sampling, functional check, demounting)
- Sufficient availability of space (pH::lyser / redo::lyser, installation fitting, controller, etc.)
- Adherence to limit values (see Technical Specifications [11])

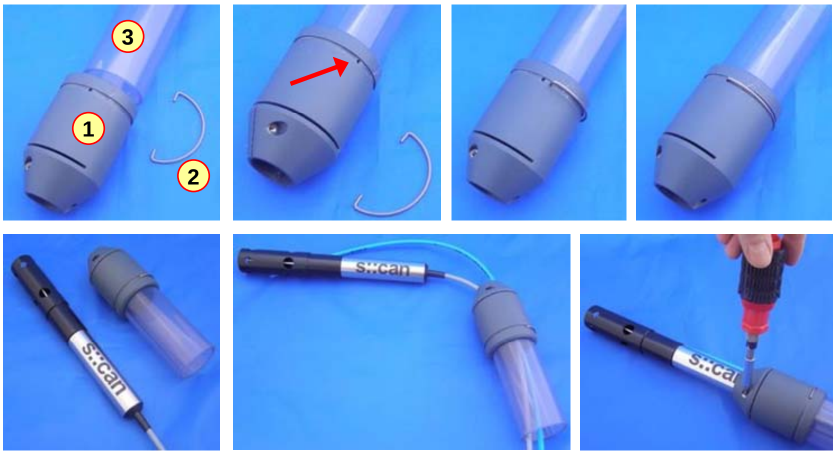
Infrastructure (energy, data and compressed air):

- Oil- and particle free compressed-air supply
- Power supply for controller (operational reliability, voltage, power)
- Best possible weather and splash water proof set-up
- Minimum distances between system components (probe – controller – compressed-air connection – energy supply)
- Best possible layout of cables (non-buckling, working dependability, no damage etc.)

6.3 Special Advice for Installation of the pH::lyser / redo::lyser

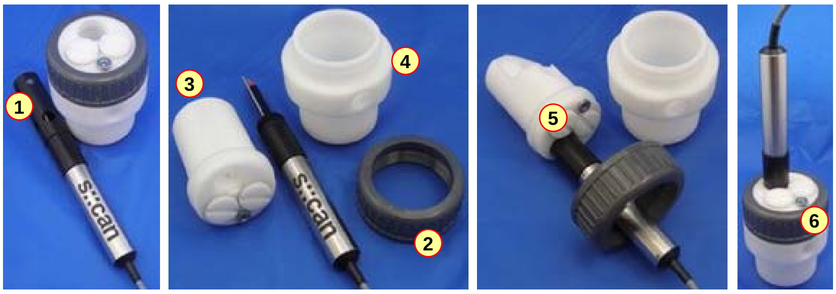
- Remove protection covering from the electrode carefully and store them.

6.3.1 Installation of pH::lyser / redo::lyser using Probe Carrier



- Remove retaining clip (2) from the probe carrier (1).
- Put extension pipe OD 50mm (3) – to be provided by the customer – into the probe carrier.
- Drill two holes into the correctly positioned extension pipe. Use the two existing holes for the retaining clip in the probe carrier as guiding help (see red arrow in figure on right hand side).
- Snap the retaining clip into both holes. Doing this the probe carrier will be fixed onto the extension pipe.
- Properly layout the sensor cable and the air hose for automatic probe cleaning within the probe carrier.
- Push the pH::lyser / redo::lyser into the probe carrier as shown in the picture above.
- Tight the screw on the probe carrier using a screw driver until the ph::lyser / redo::lyser is firmly fixed.

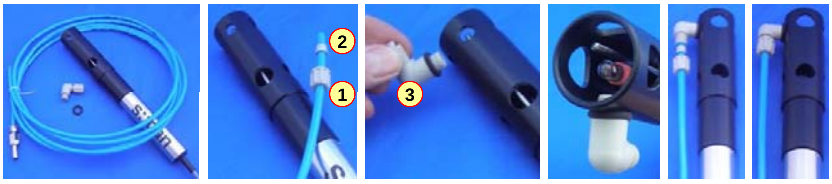
6.3.2 Installation of pH::lyser / redo::lyser in Flow Cell Setup Tap Water



- Remove the electrode guard (1) from the pH::lyser / redo::lyser and store it.
- Remove the inner part (3) of the flow cell setup (4) by unscrewing the grey connecting nut (2).
- Screw the pH::lyser / redo::lyser into the inner part of the flow cell setup.
- Make sure that not used holes for further sensors are closed with a blanking plug (5) included in delivery.
- Insert the inner part again into the flow cell setup and place it that way the draining screw (6) is situated on the outlet side. Finally fasten the inner part by screwing the grey connecting nut (2).

6.4 Connection of Automatic Cleaning Appliance

The compressed air connection set supplied with the system contains all components necessary for connector for the probe cleaning located on electrode guard of the pH::lyser / redo::lyser to the cleaning valve of the s::can controller. The compressed air connection is performed by the following steps (see pictures below):



- Put the connecting nut (1) and the conical part (2) over the cleaning hose.
- Screw the connection fitting (3) with O-ring sealing into the thread hole on the lower end of the electrode guard.
- Turn the electrode guard in that way the opening of the fitting is pointing towards the electrode.
- Push the cleaning hose over the connection fitting (warm up with hot water if necessary).
- Fasten connecting nut by hand.
- The compressed air hose (provided by customer, ID 8mm to 9mm, UV- / ozone resistance) used for connection cleaning appliance to the cleaning valve can be fastened to the connecting fitting on the cleaning valve by means of a commercial hose clamp.
- Another air hose and DIN 7.2 compressed air coupling are required to hook up the compressed air supply to the cleaning valve.

The cleaning valve should never be connected to the compressed air coupling of your compressor directly, i.e. without a pressure hose in between. The total length of hoses should be as short as possible to avoid unnecessary pressure loss. In special occasions, drinking water may be used to operate the hydraulic-pneumatic cleaning appliance instead or compressed air – for more information please contact your local s::can sales agent.

Any foreign matter in the compressed air supply may impair the hydraulic-pneumatic cleaning process. If you have any doubts about the purity of the air used (contamination by particles, oil, etc.), please install an appropriate filter upstream from the solenoid valve.

In areas with extremely low outside air temperature, s::can recommends laying the compressed air hoses such that they remain frost-free to prevent freezing of condensed water in the compressed air hose.

Please note that depending on the s::can probe and sensor type you are using, different maximum allowed pressures may be specified. In case a central pressurised air supply is used in such a case the lowest maximum allowed pressure amongst those specified for the individual instruments is to be used to supply all instruments or the use of pressure reducing valves to supply each instrument with the correct pressure is necessary.

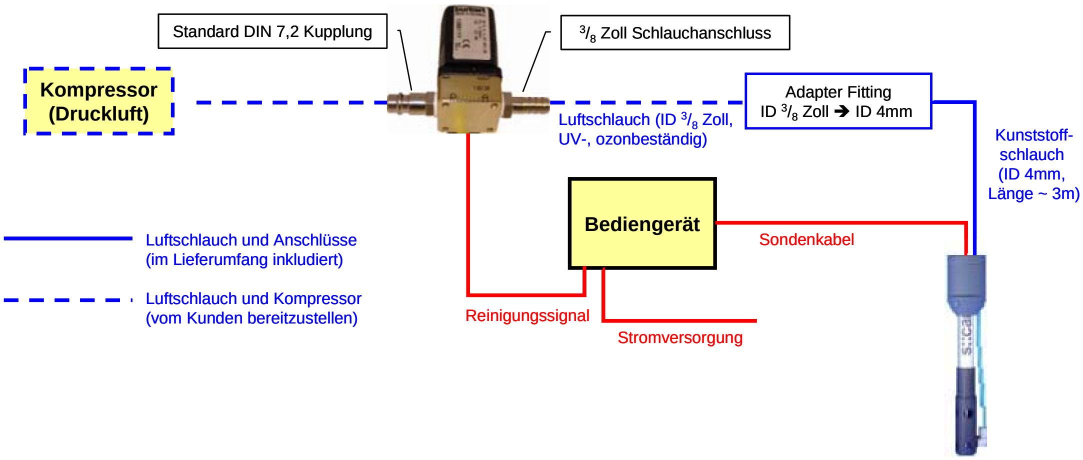

Standard DIN 7,2 Kupplung
3/8 Zoll Schlauchanschluss
Kompressor (Druckluft)
Luftschlauch (ID 3/8 Zoll, UV-, ozonbeständig)
Adapter Fitting ID 3/8 Zoll → ID 4mm
Kunststoff-schlauch (ID 4mm, Länge ~ 3m)
Bediengerät
Sondenkabel
Luftschlauch und Anschlüsse (im Lieferumfang inkludiert)
Luftschlauch und Kompressor (vom Kunden bereitzustellen)
Reinigungssignal
Stromversorgung
s::can

Fig. 6-1: Schematic representation of automatic cleaning system

6.5 Connection of pH::lyser / redo::lyser to the Controller

The pH::lyser / redo::lyser will be delivered with a plug that can be connected to a compatible socket provided on the controller.

Ensure that the sensor plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.

Using an older version of controller the pH::lyser / redo::lyser can either be connected via an adapter cable (s::can item number C-40) or directly in the terminal compartment of the controller. Regarding definition of cable strands please refer to the Technical Specifications in chapter [11], see figure [Fig. 11-1].

7 Initial Operation

Once the mounting and installation of the pH::lyser / redo::lyser have been completed and checked (see section [6]) the initial operation of the s::can monitoring system will require the following actions, in the order presented below:

- Connect s::can controller to the power supply (see s::can manual con::stat or con::lyte) and wait for the software to boot.
- Perform probe initialisation and parameterisation of pH::lyser / redo::lyser (refer to [7.2] regarding con::lyte and refer to [7.3] regarding con::stat and con::nect. Additional information can be found in the respective s::can con::lyte or ana::lyte manuals).
- Parameterisation of automatic cleaning (see s::can manual con::lyte or ana::lyte and chapter [11] regarding cleaning duration and cleaning interval).
- Check whether the cleaning system works properly.
- In case required, configure the digital and analogue outputs of the controller.
- Check the readings obtained for plausibility after sufficient running-in time (at least 15 minutes).
- If necessary calibrate the pH::lyser / redo::lyser in stable water quality (see chapter [8] as well as s::can manual con::lyte or ana::lyte).

7.1 Measuring Parameter pH::lyser / redo::lyser

The first table (right hand) is an overview of the parameters that can be measured with the pH::lyser.

Parameter	Parameterindex	Name	Unit	Decimal places (default)
pH	0	pH		2
pH-mV	1	pH-mV	mV	1
Temperature	2	Temp.	°C	1

The second table (right hand) is an overview of the parameters that can be measured with the redo::lyser. Please note that parameter with index 0 and index 1 are identical.

Parameter	Parameterindex	Name	Unit	Decimal places (default)
ORP	0	ORP	mV	0
ORP-mV	1	ORP-mV	mV	0
Temperature	2	Temp.	°C	1

s::can recommends to check configuration of any digital and analogue output should the number of decimal places of the parameters be reconfigured.

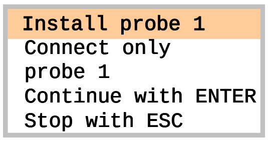
7.2 Probe Operation using the Controller con::lyte (from Version V4.15)

7.2.1 Probe Search and Probe Initialisation

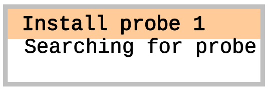
For operating of one or several probes using the con::lyte it is necessary to allocate an individual address to every probe. This can be done manually (supported by the software) as explained below. The corresponding address will be stored on the respective probe. For s::can probes and sensors, respectively the address can be set between 1 and 10. Be aware the procedures required will depend on the configuration of your s::can monitoring system.

The con::lyte should not be powered down or switched off during the initialisation process. In case of rebooting of the con::lyte during the initialisation process (e.g. caused by loss of power supply) the complete procedure of sensor initialisation has to be repeated.

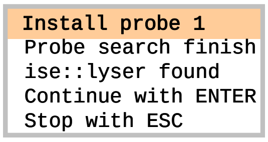
- Establish the power supply to the con::lyte and select the entry *Settings / Parameterconfig / Install Probes* in the main menu.
- Connect the pH::lyser / redo::lyser to the con::lyte (please refer to section [0]).
- Push the button *Enter* , which starts the automatic search procedure for the connected probe. Once the probe is found, address 1 will be allocated. This procedure can last several seconds (see figures on right hand side).
- The successful completion of the initialisation will be displayed over a user message. If this message is displayed the initialisation procedure can be finished by pushing the button *Esc*.



```
Install probe 1
Connect only
probe 1
Continue with ENTER
Stop with ESC
```



```
Install probe 1
Searching for probe
```



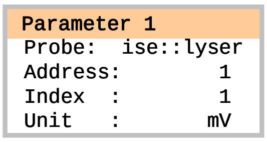
```
Install probe 1
Probe search finish
ise::lyser found
Continue with ENTER
Stop with ESC
```

A user message will also be displayed when no probe is detected. In this case please check the following before repeating the procedure for sensor initialisation:

- Is only one probe connected to the con::lyte?
- Is the probe connected in properly (see the s::can manual of your probe)?

7.2.2 Parameterisation

After successful probe initialisation the measuring parameters of the pH::lyser / redo::lyser will be displayed on the display of the con::lyte automatically. If needed the measuring parameters can be configured individually using the menu item *Settings / Parameterconfig / Parameter n*.



```
Parameter 1
Probe:   ise::lyser
Address:          1
Index   :         1
Unit    :        mV
```

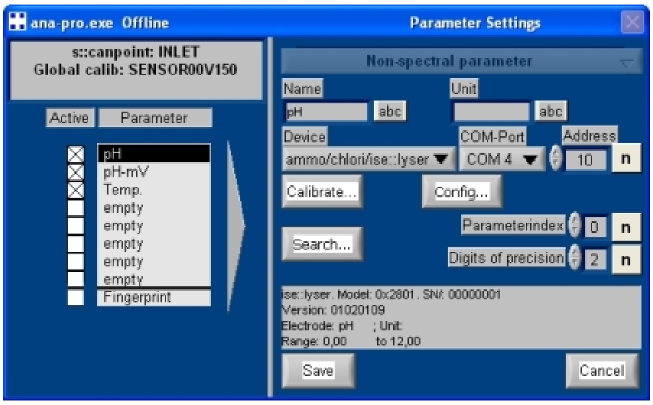
The name of the *Probe* or sensor used as a source of the parameter is displayed in the upper line (e.g. ise::lyser). If several probes or sensors are installed the instrument from which a parameter needs to be displayed can be selected here. Under the entry Probe the *Address* that has been allocated to that probe is displayed as an additional information. The *Index* specifies the place of the corresponding parameter onto the allocated probe. The *Unit* of the selected parameter can be chosen in the line below (see section [7.1]).

7.3 Probe Operation using the Operating Software ana::lyte / ana::pro (from Version V5.9)

7.3.1 Probe Search / Parameterisation

If only an pH::lyser / redo::lyser will be operated the Global Calibration *SENSOR00V150.glb* can be used.

In the operating software ana::xxx the parameters of the pH::lyser / redo::lyser can be selected and parameterised. This is done in the advanced mode of ana::lyte or in ana::pro over the menu item *Parameter / Settings*. In case the parameters of interest are not yet displayed by default in the Parameter Settings window, they can be selected as follows: double click on the parameter field that you want to correspond with the parameter to be displayed. After double clicking, the window will enlarge and show detailed information belonging to this parameter. Now select *Non-spectral parameter* in the upper selection bar and select *ammo/chlori/ise::lyser* under *Device*. The *COM-Port* is the interface to which the pH::lyser / redo::lyser is connected. The appropriate port should be selected here (COM 4 in case of con::stat D-314-x with plug connection). Finally, under the entry *Address* the address allocated to the instrument in the RS 485 network has to be entered (default setting = 10).



s::canpoint: INLET
Global calib: SENSOR00V150

☒ pH
☒ pH-mV
☒ Temp.
☐ empty
☐ empty
☐ empty
☐ empty
☐ empty
☐ Fingerprint

Name: pH
Device: ammo/chlori/ise::lyser
COM-Port: COM 4
Address: 10
Parameterindex: 0
Digits of precision: 2

```
ise::lyser. Model: 0x2801 . SN#: 00000001
Version: 01020109
Electrode: pH     ; Unit:
Range: 0,00       to 12,00
```

When the button *Search…* is pressed, the software will search for the instrument at the selected COM-Port and when the instrument is found information about the instrument will be shown in the grey text field in the lower part of the dialogue window (model and serial number, version, electrodes and measuring range).

When an incorrect COM port and / or sensor address are selected, the *Search…* function will still find the probe if only one instrument is connected to the controller.

Under *Parameterindex* the parameter read out from the pH::lyser / redo::lyser is selected (regarding allocation of the parameter please refer to the table in section [7.1]). Under *Digits of precision* the number of decimal places for displaying the parameter readings can be set.

The button *Calibrate…* provides access to the windows that will guide you through the calibration process of the parameters measured by the pH::lyser / redo::lyser (please refer to chapter [8] for details about calibration). The button *Config…* provides access to the dialogue window where basic settings of the pH::lyser / redo::lyser can be changed. As this can affect the performance of your instrument, changes in these settings should only be made after consulting s::can or your local s::can sales partner (see section [12.2]).

8 Calibration

The pH::lyser / redo::lyser is precalibrated in the factory and as such can be used immediately after delivery. However, for the best possible results, s::can recommends to check the calibration when commencing operation in the specified application and subsequently perform a check for validity and correctness on a regular basis (please refer to section [9.1]).

8.1 General Notes for Performing the Calibration

- The pH::lyser / redo::lyser is equipped with different types of sensors (see section [4.6]), which have to be calibrated individually.
- Because of the dependence of the measuring parameters the temperature sensor has to be calibrated at first.
- For all measuring parameters a single point calibration (*OFFSET*) can be performed. Therefor only sample 1 will be used.

- For all measuring parameters (except for the ORP sensor) also a 2-point calibration (*LINEAR*) can be performed. Therefor sample 1 and sample 2 will be used.
- For each parameter both samples i.e. the two measuring values and the two corresponding reference values (laboratory values) as well as the actual calibration coefficients (offset and slope) are stored onto the pH::lyser / redo::lyser.
- The measurement results of pH and ORP shown during the calibration procedure and stored onto the sensor are the raw signals (mV values) of the electrodes. Therefore they can be negative numbers.
- Check if the protective covering has been removed from the electrode before the calibration and clean the pH::lyser / redo::lyser carefully if necessary (see section [9.2]).
- During calibration the entire measuring head has to be submersed in the calibration medium, even when only a single electrode is calibrated.
- The flow- and temperature conditions shall be constant during calibration procedure and the temperature shall correspond to that on the installation site if possible.
- A sample measurement shall only be done when the pH::lyser / redo::lyser is adapted to the calibration medium and the displayed quality value is larger than 0.9 (greater than 0.95 in case of laboratory measurements).
- Existing (stored) readings (Samples) are overwritten whenever a new sample measurement is triggered.
- The corresponding value (laboratory value) can also be entered later.
- The calibration will not be executed till the menu item *Calibrate!* is selected.
- A calibrated parameter can be reset to the factory settings (Global). This is recommended after exchange of an aged electrode until a new calibration is performed. This can also be helpful in case of an improper local calibration.
- Regarding further information for checking the calibration please refer to section [9.1].

8.2 Sensor Specific Notes for Performing the Calibration

8.2.1 Temperature

Adjustment of the temperature calibration is best performed in-situ against a suitable reference thermometer. The temperature sensor is the only one that can also be calibrated on air.

For most of the applications a single point calibration of the temperature sensor is adequate.

8.2.2 pH Sensor

Adjustment of the pH calibration is best in s::can standard solutions (please refer to section [0]).

The pH::lyser automatically detects the used buffer and proposes a value for the most common buffer solutions. In case of a wrong detection or the availability of lab values the laboratory value can be overwritten.

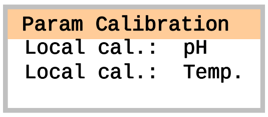
The recommended calibration type is a single point calibration at the mean value of the application. For higher accuracy a 2-point calibration can be performed where on pH buffer should have a pH value of 7.

8.2.3 ORP Sensor

As the ORP value is displayed as mV normally no calibration is needed. In case a calibration is desired a single point calibration is recommended. This is best performed using s::can standard solution (please refer to section [0]).

8.3 Calibration using the Controller con::lyte (from Version V4.15)

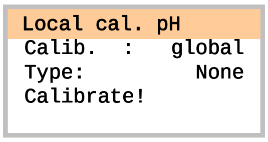
The *Calibration* entry in the con::lyte main menu leads you into the menu that enables the calibration of the pH::lyser / redo::lyser. When *Calibration* is selected a password must be entered (password = 1) before the calibration can be started. The next step is selection of the parameter to be calibrated (e.g. pH) in the selection field *Param Calibration*.



```
Param Calibration
 Local cal.:  pH
 Local cal.:  Temp.
```

Now the menu for local calibration will appear as displayed on the right hand side.

The entry *Calib.* shows whether the parameter is local calibrated (*local*) or the factory setting (*global*) is used. A modification of this setting will only become active after confirming the entry *Calibrate!*

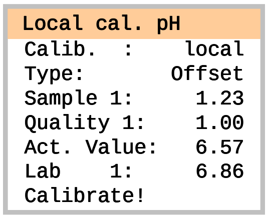


```
Local cal. pH
 Calib.   :    global
 Type:           None
 Calibrate!
```

For single-point calibration of the sensor the entry *Offset* has to be selected from the calibration menu (*Type*).

The display shows the reading actually stored onto the sensor and used for the single-point calibration (*Sample 1*). If no measurement was carried out or if the measurement was invalid, the display will show dashes.

The actual reading will be displayed on the entry *Act. Value* and the quality of this reading will be displayed on the entry *Quality 1*. Both values will be actualised continuously. When *Enter* is pushed, the actual measured value (raw value) will be stored on the sensor and displayed on the entry *Sample 1*.



```
Local cal. pH
 Calib.   :     local
 Type:         Offset
 Sample 1:       1.23
 Quality 1:      1.00
 Act. Value:     6.57
 Lab     1:      6.86
 Calibrate!
```

On the entry *Lab 1* the results corresponding to the readings stored under *Sample 1* can be entered here. The unit has to be in accordance with the measuring parameter.

```
Local cal. pH
Calib.   :    local
Type:        Linear
Sample 1:      1.23
Quality 1:     0.99
Act. Value:    9.54
Lab    1:      6.86
Sample 2:    128.13
Quality 2:     0.99
Act. Value:    9.54
Lab    2:      9.18
Calibrate!
```

When the entry *Calibrate!* is confirmed by pushing *Enter*, a calibration is performed. Successful calibration is shown in a user message (*o.k.*). If the calibration was not successful (user message *Error*) the calibration used up to now will be used further on.

For 2-point calibration of the sensor the entry *Linear* has to be selected from the calibration menu (*Type*).

The display shows the values of the 2nd calibration point (*Sample 2* and *Lab 2*) additionally to the information for the single-point calibration.

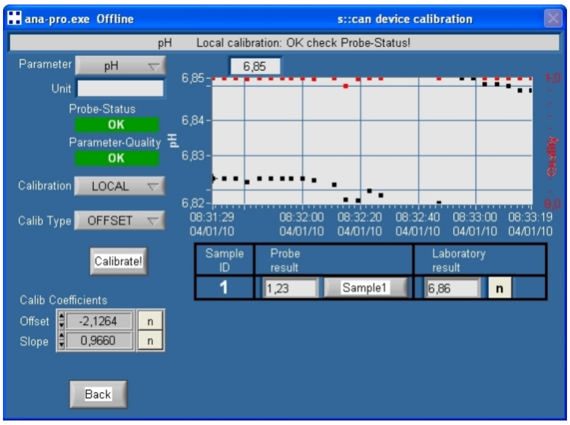
To switch back to factory default on the entry *Calib.* the option *global* has to be selected and the entry *Calibrate!* has to be confirmed.

8.4 Calibration using the Operating Software ana::lyte / ana::pro (from Version V5.9)

The calibration of the measuring parameters of the pH::lyser / redo::lyser can be performed directly in the measuring screen via the menu entry *Local Calibration*. After selecting this menu entry, a user window appears which shows all parameters. Besides the parameter name (*Name*) also the unit of the parameter (*Unit*), the probe used to measure this parameter (*Device*), the *COM port* to which the probe is connected and the address of the probe (*Address*) are displayed. The parameter selected for calibration has a blue background and can be confirmed with the *Ok* button.

Furthermore the local calibration can also be started in advanced mode of ana::lyte and ana::pro, respectively using the menu entry *Parameter / Settings*. Access to the calibration screens is achieved by selecting the parameter to be calibrated by double clicking on it. In the window that opens, the button *Calibrate…* should be selected to start the calibration procedure.

Once the calibration window is opened the current readings of the selected parameter will be displayed in the upper right hand side of the calibration screen. The values are actualised automatically and furthermore, the readings are displayed graphically in the time series (black line) as an indication of the measurement stability.



pH Local calibration: OK check Probe-Status!

Parameter: pH
Probe-Status: OK
Parameter-Quality: OK
Calibration: LOCAL
Calib Type: OFFSET
6,85

Sample ID	Probe result		Laboratory result	
1	1,23	Sample1	6,86	n

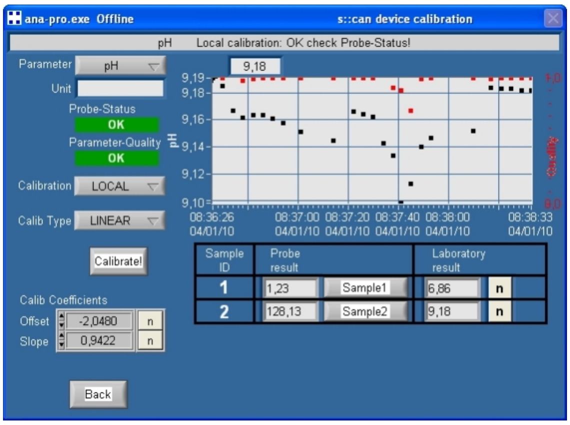
Calib Coefficients
Offset: -2,1264 n
Slope: 0,9660 n

In addition to the measured values in this figure a red line will indicate the quality of the measurements (labelled *Quality*). The value for the quality can vary from 0 (bad) to 1 (good). As soon as quality has reached a value larger than 0.9 the *Parameter-Quality* indication switches from *FAILURE* to *OK*.

Via the selection bar *Calibration* either factory default (*GLOBAL*) or local calibration (*LOCAL*) can be selected. Please be aware that changes in this selection bar will only modify the display of the calibration screen. The selected calibration will be performed after pushing the button *Calibrate!*

With the pull-down menu *Calib Type* the type of calibration (*OFFSET* or *LINEAR*) can be selected.

When selecting *OFFSET* for single-point calibration a table with the columns *Sample ID*, *Probe result* and *Laboratory result* is displayed on the right lower side of the calibration screen.



pH Local calibration: OK check Probe-Status!

Parameter: pH
Probe-Status: OK
Parameter-Quality: OK
Calibration: LOCAL
Calib Type: LINEAR
9,18

Sample ID	Probe result		Laboratory result	
1	1,23	Sample1	6,86	n
2	128,13	Sample2	9,18	n

Calib Coefficients
Offset: -2,0480 n
Slope: 0,9422 n

Now the actual reading will be stored when pushing the button *Sample 1*. The corresponding value (*Laboratory result*) can be entered using the *n*-button on the right hand of the reading display. Pushing the button *Calibrate!* will start the calibration procedure.

When selecting *LINEAR* for 2-point calibration the table on the right lower side will be expanded with the second calibration point (*Sample2*). Repeat the procedure for *sample2* as already explained above for single-point calibration.

The coefficients of the actual used calibration will be displayed in the lower left after the calibration has finished (*Offset* and *Slope*). Using the *Back* button the calibration window is closed.

9 Functional Check / Maintenance

Depending on the application (water composition) a regular functional check (every week after initial operation, later every month) is recommended. The following list provides an overview of all the actions that have to be performed in a functional check.

Using ana::lyte / ana::pro:	- System status displayed on measuring screen ok? - Activate "*Show context help*" if not ok and find reason. - Time stamp of the last measurement is current? - Parameter status of displayed parameters ok? - Activate "*Show context help*" if grey background or NaN and find reason.
Using con::lyte:	- The system time displayed is current and is updated every second? - Error messages (symbol !) displayed? - Check *logbook* entries since last functional check
Displayed readings:	- Readings displayed completely? - Readings actualised on regularly base? (consider measuring interval and smoothing) - Readings plausible? Check historical data (time series)
Automatic probe cleaning:	- Function of automatic probe cleaning - Function of compressed air supply (compressor) - Tubes and fittings are tight

9.1 Check of Calibration

To verify the accuracy of the displayed readings only a reliable comparison method shall be used. In case of a significant difference between the laboratory values and the readings of the pH::lyser / redo::lyser, a single-point calibration (offset) has to be performed (please refer to chapter [8]).

On a half year interval the slope of the pH::lyser should be checked and – if necessary – calibrated (please refer to chapter [8]). To do this the pH::lyser has to be demounted and cleaned carefully before a calibration will be performed in pH standards. During this calibration the electrode slope will be recalculated and the function of the electrode will be checked.

9.2 Cleaning

During routine operation the cleaning of the pH::lyser / redo::lyser is performed using the automatic pressurised air system. To clean the sensor manually the following is recommended:

- Rinse sensor with hand-hot drinking water to remove course deposits.
- Put the sensor in a bucket of hand-hot drinking water for several minutes to remove deposits on the electrode.
- To clean the electrode screw off the electrode guard and use a soft cloth, tissue or a soft brush.
- Resistant deposits can be treated with a 2% aqueous solution of hydrochloric acid (HCl) or a 2% aqueous solution of sodium hydroxide (NaOH).
- Closing the sensor has to be rinsed with drinking water.
- The demounted electrode itself can be cleaned as following in case of extreme deposits:
  Max. 30 minutes in 10% HCl and then max. 30 minutes in NaOH 0.1 mol/l (=4g/l).
  Finally the electrode has to be rinsed in drinking water for at least one hour before being calibrated.

When using concentrated cleaning solutions be aware of safety precautions (safty gloves, safty glasses, etc.).
Ultrasonic cleaning is not recommended

9.3 Replacement of Electrode

When electrodes do need to be replaced, special care has to be taken not to damage the sensor. It is of the utmost importance that the complete part of the electrode holder and especially the electrode plugs of the pH::lyser / redo::lyser remain dry and clean during the replacement operation.

Any damage to the instrument due to ingress of moisture or water after failing to observe the required precautions during electrode change is not covered by manufacturer guarantee and warranty.

Do not tilt the tool for electrode replacement when unscrewing and screwing the electrode because the temperature sensor can be damaged!

Regarding replacement of electrode please have also a look to the pictures in the appendix, which illustrate the complete replacement procedure (see section [13]).

10 Spare Parts / Accessories

10.1 Replacement Electrode

The pH electrode for pH::lyser as well as the ORP electrode for redo::lyser are available as spare parts. Both electrodes are combined electrodes which means they already include the reference electrode.

Name	Specification	Remark
Item-no.	E – 514 – 2 pH	
Item-no.	E – 513 – 2 ORP	

10.2 Tool for Electrode Replacement

For demount and re-assembly of complete electrodes of the pH::lyser / redo::lyser a specific tool is available.

Name	Specification	Remark
Item-no.	E – 532 – tool	

10.3 pH Standard Solution for Calibration

For calibration of the pH::lyser three specific standard solutions in three different concentrations are available (according DIN 19266). One bottle of standard solution (item-no. E – 514 – x.xx) contains 500 ml of calibration standard. In the table on the right hand side the different concentrations against the temperature are displayed.

°C	E – 514 – 4.01	E – 514 – 6.86	E – 514 – 9.18
5	4.00	6.95	9.40
10	4.00	6.92	9.33
20	4.00	6.87	9.23
25	4.01	6.86	9.18
30	4.02	6.85	9.14
40	4.04	6.84	9.07

10.4 Redox Standard Solution for Calibration

For calibration of redo::lyser a specific standard solution (Ag/AgCl) is available.

Name	Specification	Remark
Item-no.	E – 513 – 456	
Standard	456 mV	at 25 °C
Accuracy	+ / - 5 mV	
Volume	500 ml	

10.5 Pressure Connection Set

For connection of the automatic air cleaning system of the pH::lyser / redo::lyser a specific pressure connection set is available.

Name	Specification	Remark
Item-no.	B – 41	
Cable length	3 m	
Assembling	ex works	
Material	PU Nickel-plated brass	tube connection fitting
Process connection	$^3/_8$ inch	
Operating pressure	14.5 to 87 psi	1 to 6 bar

10.6 Extension Cable

The cable of the pH::lyser / redo::lyser can be elongated when necessary with an extension cable (10 m or 20 m length). The extension cable is attached using the sensor connector plug.

Name	Specification	Remark
Item-no.	C – 210 – sensor C – 220 – sensor	
Cable length	10 m 20 m	C – 210 – sensor C – 220 – sensor
Assembling	ex works	
Material	PU	cable sheathing
Housing environment rating	IP 68	
Interface connection	IP 68, RS485, 12 VDC	to s::can sensors

10.7 pH::lyser / redo::lyser Probe Mounting

For proper and easy submersed installation of the pH::lyser / redo::lyser a separate probe mounting is available. This part can be fixed to the probe directly and can be extended by a pipe (to be provided by the customer).

Name	Specification	Remark
Item-no.	F – 12 – sensor	
Material	PVC, stainless steel	
Dimensions	60 / 91 mm	diameter / height
Weight	approx. 150 g	
Process connection	DN 50 inside	for extension pipe
Installation / mounting	submersed	

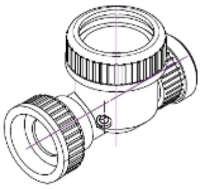
10.8 Flow Cell Setup Tap Water

For measurement of sample stream outside the medium a separate flow – through installation is available.

Name	Specification	Remark
Item-no.	F – 44 – three	
Material	POM-C	
Dimensions	106 / 106 / 155 mm	L / W / H
Weight	mind. 600 g	
Process connection	½ inch inside	
Installation / mounting	flow-through	
Operating temperature	0 to + 50 °C	32 to + 122 °F
Operating pressure	0 to 145 psi	0 to 10 bar
Accessories	Hose nozzle 12 mm	F – 47 – process

10.9 Flow Cell Setup Waste Water

For measurement of waste water sample stream outside the medium a separate flow-through installation is available.



Name	Specification	Remark
Item-no.	F – 47 – sensor	
Material	PVC	
Dimensions	170 / 177 mm	height / length
Process connection	ID 40 mm	
Installation / mounting	Flow-through	

10.10 System Panel Basis

For easy attachment of a complete s::can monitoring system (Controller con::stat or con::lyte with pH::lyser / redo::lyser in flow cell setup) a separate system panel is available.

Name	Specification	Remark
Item-no.	F – 50 – 1 – pro F – 50 – 1 – eco	pro: incl. by-pass pipes
Material	PP	
Dimensions	400 / 750 / 103 mm	W / H / D
Weight	mind. 3.5 kg	

10.11 System Panel s::can Sensor

For easy attachment of s::can sensor in flow-through installation (F-44-three) or for extension of the System Panel Basis a separate system panel is available.

Name	Specification	Remark
Item-no.	F – 50 – x – pro F – 50 – x – eco	incl. by-pass pipes
Housing material	PP	
Dimensions	195 / 750 / 103 mm	W / H / D
Weight	mind. 2.3 kg	

11 Technical Specifications

Name	Specification	Remark
Item-no.	E – 513 – 2 (redo::lyser eco) E – 513 – 3 (redo::lyser pro) E – 514 – 2 (pH::lyser eco) E – 514 – 3 (pH::lyser pro)	see section [4.6]
Measuring parameter	ORP, temperature pH, temperature	redo::lyser pH::lyser
Measuring principle	potentiometric, non-porous reference electrode	 combined
Temperature sensor	Pt100 (class B)	stainless steel
Measuring range application	pH: 2 to 12 pH 0 to 14 pH ORP: -2000 to +2000 mV Temp.: 0 to 70 °C (32 to 158 °F) 0 to 90 °C (32 to 194 °F)	eco pro eco pro
Resolution	pH: 0.01 pH ORP: 1 mV Temp.: 0.1 °C	
Response time	30 seconds	
Accuracy	pH: +/- 0.01 pH ORP: +/- 10 mV Temp.: +/- 0.3 °C	in standard solution
Automatic compensation	Temperature	only for pH::lyser
Power supply	9 to 18 VDC	
Power consumption	< 1 W	
Length of sensor cable	10 m	
Type of sensor cable	polyurethane jacket, 2 x 2 x 0.25	
Interface connection	System plug, IP 68, RS 485, 12 VDC	to s::can controller
Minimum MODBUS request timeout	400 ms	
Housing material	stainless steel 1.4571, POM-C glass electrode	detailled list of chemical resistance of the electrode can be ordered by s::can sales partner.
Weight	min. 0.4 kg	
Dimensions	33 / 253 mm	diameter / length
Operating temperature limits	0 to +70 °C (32 to +158 °F) 0 to +90 °C (32 to +194 °F)	eco pro
Operational pressure limits Submersed depth	max. 10 bar (max. 145 psi) max. 100 m	
Storage temperature limits	0 to +90 °C (32 to + 194 °F)	
Mounting	F-11-ise or M 30x2	
Flow rate	min. 0.01 m/s max. 3.0 m/s	Measurement in non flowing water (e.g. lakes) possible.
Housing environment rating	IP 68	
Automatic cleaning (medium)	compressed air	
Automatic cleaning (connection probe)	G $^1/_8$ inch for air hose OD 6 mm	
Automatic cleaning (allowed pressure)	min. 3 bar (43.5 psi) max. 6 bar (87 psi)	at probe's cleaning connection
Automatic cleaning (duration)	2 to 12 sec.	
Automatic cleaning (interval)	5 minutes to 4 hours	depending on application
Automatic cleaning (delay)	10 to 30 sec.	Time between end of cleaning and first correct reading

Name	Specification	Remark
Conformity EMC	EN 50011: 2007, Class EN 61326-1: 2006 EN 61000-4-2: 1995+A1:1998+A2:2001 EN 61000-4-3: 2006 EN 61000-4-4: 2004 EN 61000-4-5: 2006 EN 61000-4-6: 2007	
Conformity - safety	EN 61010-1: 2001, UL508	
Typ. lifespan (application)	2 years	
Max. shelf time (storage)	2 years	with filled protective cap absolute

Fig. 11-1:

Assignment
of sensor cable

Pin	1	2	3	4	6
Colour cable strand	Green	Yellow	White	Brown	Blank
Assignment	Data -	Data +	9 to 18 VDC	Ground	Shielding

The wiring should be done in the following order; the shielding and grounding wires first, followed by the RS 485 wires and finally the power supply.

12 Trouble Shooting / Service

12.1 General Error Messages

During execution of a measurement or a parameter calibration the device itself and the result will be checked for possible errors and for plausibility. In case of an error a user message will be displayed to the operator. There are error- and status messages belonging to the device itself (*device status*) as well as error- and status messages belonging to the individual parameter (*Para status*). The parameter status is seperated into a general part (public, valid for all sensors) and an individual part (private, valid for the respective sensor). In case of faulty calibration an error message will be displayed to the operator.

Depending on the used controller this message will be shown on the display (*Show Context Help* and *System-Status* in case of ana::xxx or *logbook* in case of con::lyte) and stored in the logfile (in case of ana::xxx). Additional to the general error reason the detailled error code (status code) will be displayed in binary form or as a hex number.

If several errors occur at the same time the con::lyte will add up all the status codes (status code 0003 0000 means that error 0001 0000 and error 0002 0000 have occured at the same time).

The table below shows all possible errors incl. the user message, the reason of the error and notes for trouble shooting. If the error can’t be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Error	Display con::lyte	Message ana::xxx	Reason	Removal
ES 006	Protocol failure. Code: Probe with RS485? Reset your probe!		Communication error between sensor and controller.	Check compatibility of sensor and controller. Check sensor cable and plug connection. Dis- and reconnect sensor.
ES 007	Probe not detected. Check power-supply and connection cable	Unknown on Com…, address…, Com_Status d5000, MB no answer	No communication between sensor and controller. Replacement sensor was not installed correctly.	Check sensor cable and plug connection. Dis- and reconnect sensor.
ES 100	0001 yyyy zzzz (b0)	Device error 0000 0000 0000 0001	Hardware error	Dis- and reconnect sensor.
ES 100	0002 yyyy zzzz (b1)	Device misuse 0000 0000 0000 0010	Device operation outside the specification (temperature too low / too high or power supply too low / too high)	Check measuring medium. Check power supply of sensor (specification limits see section [11]).

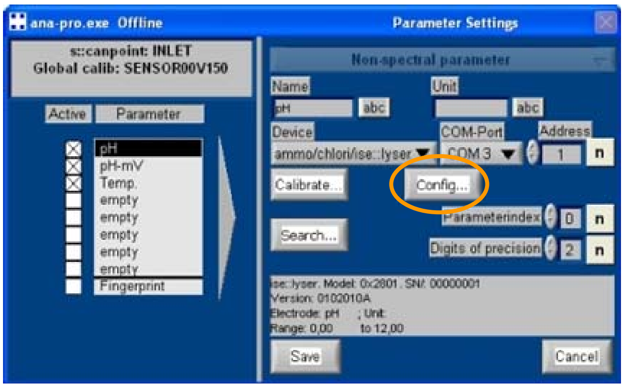
Error	Display con::lyte	Message ana::xxx	Reason	Removal
ES 100	0004 yyyy zzzz (b2)	Device replace 0000 0000 0000 0011	Device error (e.g. temperature sensor, electronic)	Dis- and reconnect sensor.
ES 100	0008 yyyy zzzz (b3)	Logger error 0000 0000 0000 0100	Internal data logger corrupt.	Deactivate data logger and reactivate again if necessary. Perform firmware update.
ES 100	8000 yyyy zzzz (b15)	Device maintenance required 1000 0000 0000 0000	General device error. At least one internal system check faulty.	Note error code and additional message.
EP 100	xxxx 0001 zzzz (b0) Param.Status error. Status Code: …. ….	Parameter error: general 0000 0000 0000 0001	General parameter error. At least one internal parameter check faulty.	Note error code and additional message.
EP 100	xxxx 0002 zzzz (b1)	Parameter error: hardware error 0000 0000 0000 0010	Temperature sensor defect or ISE electrode faulty.	Check temperature sensor for damage. In case of ISE electrode: Note error code and additional message. Perform new calibration or repeat calibration. Replace electrode.
EP 100	xxxx 0010 zzzz (b4)	Parameter error: calibration not o.k. 0000 0000 0001 0000	At least one calibration coefficient faulty (NaN).	Set back to factory settings (Global). Perform new calibration.
EP 100	xxxx 8000 zzzz (b15)	out of range 1000 0000 0000 0000	Reading outside the measuring range.	Check measuring medium and calibration.
EP 100	xxxx yyyy 0001 (b0)	Electronic failed 0000 0000 0000 0001	ISE hardware error	Dis- and reconnect sensor.
EP 100	xxxx yyyy 0002 (b1)	Electrode replacement 0000 0000 0000 0010	ISE electrode defect	Replace electrode.
EP 100	xxxx yyyy 0004 (b2)	Electrode cleaning 0000 0000 0000 0011	ISE electrode contaminated	Clean electrode (see section [9.2]).
EP 100	xxxx yyyy 0008 (b3)	Ion selective electrode missing 0000 0000 0000 0100	ISE electrode not detected	Check ISE electrode. Demount electrode, check electrode plug and remount electrode again.

xxxx ….. Device Status (bmDeviceStatus)
yyyy ….. Parameter Status general (bmParaXStatus)
zzzz ….. Parameter Status individual (bmParaXPrivStatus)

12.2 Check / Modification of advanced Sensor Settings

The ana-xxx operation software enables you to reconfigure internal sensor settings. This should only be done by s::can Service or after instruction from s::can.

- Push button *Config…* in menu entry *Parameter / Settings*.
- Push button *Search* in register card *Com*. As soon as probe will be detected the status source is ok (green check mark) and register card *Device desc* can be selected.
- Now the other register cards become visible also (*Results*, *Device config*, *Para config* and *ise::status*).
- In register card *Device config* the sensor type (*abModel*), the serial number of the sensor (*abSerialNumber*) and the actual software version (*abSWRelease*) is displayed.
- You can finish the configuration menu by pushing the button *Exit*.



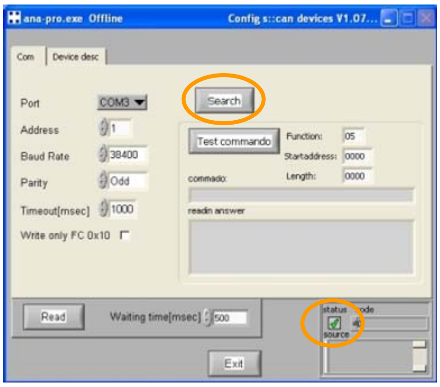
s::canpoint: INLET
Global calib: SENSOR00V150

Name: pH
Device: ammo/chlori/ise::lyser
COM-Port: COM 3
Address: 1
Parameterindex: 0
Digits of precision: 2

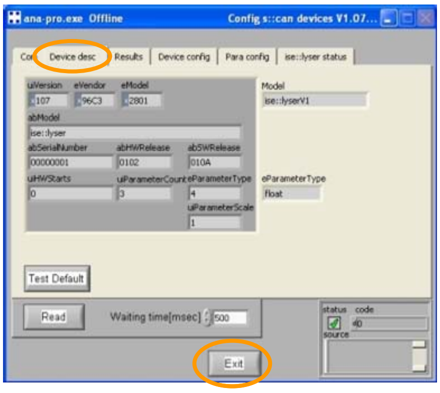
ise::lyser. Model: 0x2801 . SN: 00000001
Version: 0102010A
Electrode: pH ; Unit:
Range: 0,00 to 12,00

All changes in the register card (e.g. new address) shall be done directly in the display field using the mouse and the keyboard. The scrollbar labelled with two small triangles beside the display field shall not be used.

After a value has been changed the mouse cursor has to be positioned outside the according entry field onto any place of the register card before selecting another register card. Only then the modifications will be stored onto the probe automatically. This procedure can also be recognized by the user message "*Please wait while settings will be written to the sensor…*" on top of the selected register card.



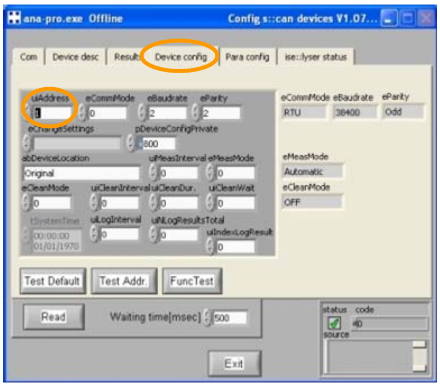
Port: COM3
Address: 1
Baud Rate: 38400
Parity: Odd
Timeout[msec]: 1000
Write only FC 0x10 ☐
Function: 05
Startaddress: 0000
Length: 0000
Waiting time[msec]: 500



uiVersion: 107
eVendor: 96C3
eModel: 2801
abModel: ise::lyser
abSerialNumber: 00000001
abHWRelease: 0102
abSWRelease: 010A
uiHWStarts: 0
uiParameterCount: 3
eParameterType: 4
uiParameterScale: 1
Model: ise::lyserV1
eParameterType: float
Waiting time[msec]: 500
code: 40

12.2.1 Changing Sensor Address

- Enter the configuration menu as explained in section [12.2].
- Select the register card *Device config*.
- Enter the new address in field *uiAddress* on top left hand side using the connected keyboard. Using the scrollbar labelled with two small triangles besides will only enalbe you to increase or decrease the number by one.
- As soon as the address has been changed the new address will be stored onto the sensor automatically.
- Select the register card *Com*, enter the new address in the field *Address* and connect to the sensor by pushing the button *Search*.
- Push button *Exit* to finish the configuration menu.

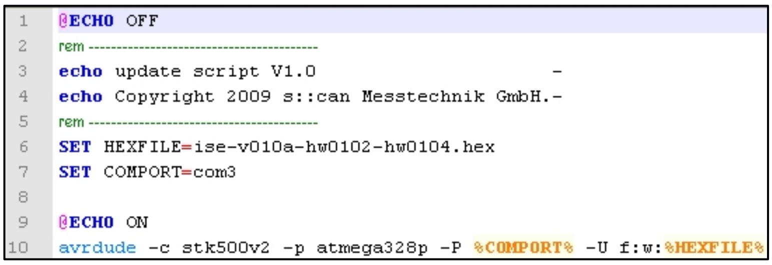


uiAddress: 1
eCommMode: 0
eBaudrate: 2
eParity: 2
eChangeSettings
pDeviceConfigPrivate: 800
abDeviceLocation: Original
uiMeasInterval: 0
eMeasMode: 0
eCleanMode: 0
uiCleanInterval: 0
uiCleanDur.: 0
uiCleanWait: 0
tSystemTime: 00:00:00 01/01/1970
uiLogInterval: 0
uiNLogResultsTotal: 0
uiIndexLogResult: 0
eCommMode: RTU
eBaudrate: 38400
eParity: Odd
eMeasMode: Automatic
eCleanMode: OFF
Waiting time[msec]: 500
code: 40

12.3 Instruction for Sensor Software Update (Firmware update)

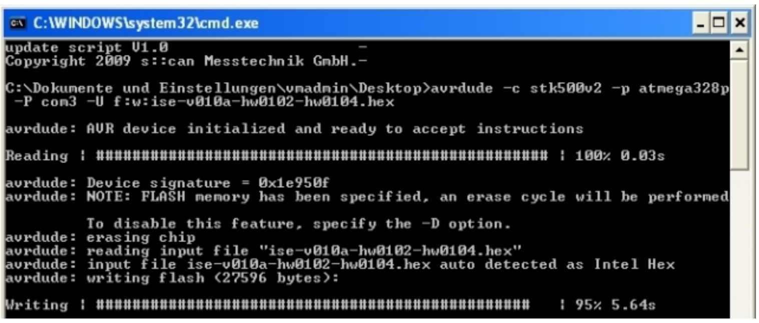
The following section explains the procedure for updating the operating software of the pH::lyser / redo::lyser using a PC / notebook and a s::can connect.

- Connect the con::nect to the power supply.
- Connect the con::nect to your host computer using the supplied USB cable.
- Connect the pH::lyser / redo::lyser to the con::nect.
- Check to which COM-port the con::nect has been allocated (e.g. via Start / Settings / Control Panel / Device Manager).
- Copy the supplied firmware update file (file with extension **.hex*) to your desktop.
- Copy the firmware update-utility called *avrdude.exe* and *avrdude.conf* to your desktop.
- Start a command line shell by executing *Start / Execute* and enter "*cmd*" and confirm with *Enter*.
- Change to your desktop directory by entering "*cd Desktop*".
- Start the firmware update utility with the command "*avrdude -c stk500v2 -p atmega328p -P com3 -U f:w:ise.hex*". Please replace *com3* by the COM-port number you are using.
- As an alternative you can use the batchfile *.bat (see upper figure on the right hand side). Before executing the file replace the *COMPORT* in the file by the correct one you are using.
- The firmware update-utility will then recognize the sensor and will start the update. This will take approx. 10-20 seconds (see lower figure on the right hand side).
- After the firmware update the sensor has to be power cycled by dis- and reconnecting the sensor.
- Then close the windows command line and start ana::xxx. Search the sensor and continue normal operation.



```
@ECHO OFF
rem ---------------------------------------
echo update script V1.0                   -
echo Copyright 2009 s::can Messtechnik GmbH.-
rem ---------------------------------------
SET HEXFILE=ise-v010a-hw0102-hw0104.hex
SET COMPORT=com3

@ECHO ON
avrdude -c stk500v2 -p atmega328p -P %COMPORT% -U f:w:%HEXFILE%
```



C:\WINDOWS\system32\cmd.exe

```
update script V1.0                    -
Copyright 2009 s::can Messtechnik GmbH.-

C:\Dokumente und Einstellungen\vmadmin\Desktop>avrdude -c stk500v2 -p atmega328p
 -P com3 -U f:w:ise-v010a-hw0102-hw0104.hex

avrdude: AVR device initialized and ready to accept instructions

Reading | ################################################## | 100% 0.03s

avrdude: Device signature = 0x1e950f
avrdude: NOTE: FLASH memory has been specified, an erase cycle will be performed

         To disable this feature, specify the -D option.
avrdude: erasing chip
avrdude: reading input file "ise-v010a-hw0102-hw0104.hex"
avrdude: input file ise-v010a-hw0102-hw0104.hex auto detected as Intel Hex
avrdude: writing flash (27596 bytes):

Writing | ################################################   | 95% 5.64s
```

In case of any problems during the software update or any other questions please contact your local s::can sales partner.

1 Inhaltsverzeichnis

2 Allgemeines

2.1 Zweck dieses Dokuments

Dieses Handbuch enthält zu Beginn allgemeine Hinweise, Sicherheits- und Gefahrenhinweise sowie Informationen zu Transport und Lagerung des Produktes. In weiterer Folge werden die Installation bzw. Montage, die Inbetriebnahme und die Kalibration des pH::lyser / redo::lyser beschrieben. Eine Technische Beschreibung inkl. aller technischen Daten des Gerätes selbst befindet sich ebenfalls im Handbuch. Hinweise zur Funktionskontrolle / Wartung und zur Behebung von Störungen ergänzen das Dokument.

Zur ordnungsgemäßen Inbetriebnahme von kompletten s::can Messsystemen sind auch die s::can Handbücher der Bediengeräte (con::lyte, con::stat oder PC / Notebook mit con::nect), der Bediensoftware (ana::lyte und ana::pro) sowie aller angeschlossenen Sonden und Sensoren einzusehen.

2.2 Hinweise zu diesem Dokument

Alle Querverweise im Text sind wie folgt blau markiert: [Verweis]. Jeder Ausdruck, der in diesem Dokument *kursiv und unterstrichen* dargestellt wird, ist am Display Ihres Bediengerätes oder als Beschriftung Ihres s::can Produktes zu finden.

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2.4 Gültigkeit dieses Dokuments

Dieses Bedienhandbuch bezieht sich auf folgende s::can Produkte zum Zeitpunkt der Veröffentlichung (siehe Versionsdatum dieses Dokumentes rechts/links oben):

Bezeichnung	**Artikelnummer lt. s::can Preisliste**
pH::lyser II eco	E – 514 – 2 (siehe Kapitel [4.6])
pH::lyser II pro	E – 514 – 3 (siehe Kapitel [4.6])
redo::lyser II eco	E – 513 – 2 (siehe Kapitel [4.6])
redo::lyser II pro	E – 513 – 3 (siehe Kapitel [4.6])
pH und Referenz Elektrode	E – 514 – 2 – pH
Redox und Referenz Elektrode	E – 513 – 2 – ORP
pH Standardlösung 4,01	E – 514 – 4.01
pH Standardlösung 6,86	E – 514 – 6.86
pH Standardlösung 9,18	E – 514 – 9.18
Redox Standardlösung 456 mV	E – 513 – 456
Werkzeug zum einfachen Elektrodentausch	E – 532 – tool
Druckanschluss Set	B – 41
10 m Verlängerungskabel	C – 210 – sensor
20 m Verlängerungskabel	C – 220 – sensor
Halterung pH::lyser / redo::lyser	F – 12 – sensor
Durchfluss Vorrichtung pH::lyser / redo::lyser Reinwasser	F – 44 – three
Durchfluss Vorrichtung pH::lyser / redo::lyser Abwasser	F – 47 – ise
System Panel Basis pro für Sensor und Bediengerät	F – 50 – 1 – pro

Bezeichnung	**Artikelnummer lt. s::can Preisliste**
System Panel pro pH::lyser / redo::lyser	F – 50 – x – pro (x = 2, 3, 4)
System Panel Basis eco für Sensor und Bediengerät	F – 50 – 1 – eco
System Panel eco pH::lyser / redo::lyser	F – 50 – x – eco (x = 2, 3, 4)

Angaben aus s::can Handbüchern und technischen Dokumentationen früheren Erscheinungsdatums werden durch dieses Handbuch ersetzt.

English
Deutsch
Appendix

2.5 Konformitätserklärung

Der s::can pH::lyser / redo::lyser ist entwickelt, getestet und produziert auf elektromagnetische Verträglichkeit (EMV) und entsprechend der anzuwendenden Europäischen Standards, wie in der Konformitätserklärung beschrieben.

Die Konformitätserklärung kann bei s::can oder dem lokalen s::can Vertriebspartner angefordert werden.

2.6 Produktpflege, Sonstiges

Der Hersteller behält sich das Recht vor, technische Entwicklungen und Änderungen im Rahmen der kontinuierlichen Produktpflege auch ohne vorherige Bekanntgabe durchzuführen.

3 Sicherheits- und Gefahrenhinweise

3.1 Allgemeine Hinweise

Montage, elektrischer Anschluss, Inbetriebnahme, Bedienung und Wartung des pH::lyser / redo::lyser sowie des gesamten s::can Messsystems dürfen nur durch ausgebildetes Fachpersonal erfolgen. Dieses Fachpersonal muss vom Anlagenbetreiber bzw. s::can für die genannten Tätigkeiten ausgebildet und autorisiert sein. Das Fachpersonal muss dieses Handbuch gelesen und verstanden haben und die Anweisungen des Handbuches befolgen.

Jede Art der Manipulation am Gerät ist verboten (ausgenommen die in diesem Dokument beschriebenen Tätigkeiten wie z.B. Anschluss des Sensors an das s::can Bediengerät, Austausch der Elektroden).

3.2 Spezielle Gefahrenhinweise

Auf Grund der häufigen Anwendung des s::can Messsytems im industriellen und kommunalen Abwasserbereich ist bei Montage und Demontage des Systems zu beachten, dass Geräteteile mit gefährlichen Chemikalien oder Krankheitskeimen belastet sein können. Es sind entsprechende Vorsichtsmaßnahmen zu treffen, um gesundheitliche Gefährdungen beim Arbeiten mit der Messtechnik auszuschließen.

3.3 Unsachgemäße Verwendung / Garantie

Alle s::can pH::lyser / redo::lyser verlassen unsere Produktion in sicherheitstechnisch einwandfreiem Zustand. Unsachgemäße oder nicht vorgesehene Verwendung des Sensors kann Gefahren verursachen!

Der Hersteller ist nicht verantwortlich für Schäden durch unsachgemäße oder unbefugte Verwendung. Umbauten und Änderungen am Gerät dürfen nicht durchgeführt werden; andernfalls erlöschen sämtliche Zertifizierungen, Garantien und Gewährleistungen.

Details zu Garantie und Gewährleistung entnehmen Sie bitte unseren allgemeinen Geschäftsbedingungen (AGB).

3.4 Pflichten des Betreibers

Der Betreiber muss sich die örtliche Betriebserlaubnis einholen und die damit verbundenen Auflagen beachten. Zusätzlich muss es die örtlichen gesetzlichen Bestimmungen einhalten (z.B. Sicherheit des Personals und der Arbeitsmittel, Produkt- bzw. Materialentsorgung und Reinigung, Umweltschutzauflagen).

Vor dem Betrieb des Messgerätes ist vom Betreiber sicherzustellen, dass bei der Montage und Inbetriebnahme, sofern diese vom Betreiber selbst durchgeführt werden, die örtlichen Vorschriften (z.B. für den Elektroanschluss) beachtet werden.

4 Technische Beschreibung

4.1 Bestimmungsgemäße Verwendung

Der pH::lyser ist ein ionen-selektives Messgerät welches zur kontinuierlichen Messung der logarithmischen Konzentration von gelösten Wasserstoffionen (H^+) dient. Für die automatische Korrektur der Konzentration wird zudem die Mediumstemperatur erfasst.

Der redo::lyser misst das Reduktionspotential einer wässrigen Lösungen. Zusätzlich wird die Temperatur des Mediums als weiterer Parameter geliefert.

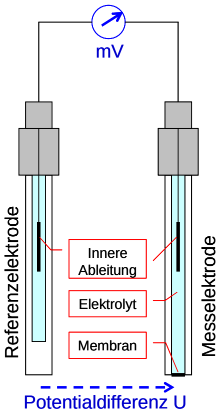
Zum ordnungsgemäßen Betrieb ist der pH::lyser / redo::lyser entweder an einen s::can con::stat (Artikel Nr. D-314-x) oder einen s::can con::lyte (Artikel Nr. D-318-x oder D-319-x) anzuschließen.

In allen Applikationsfällen sind die in den jeweiligen s::can Handbüchern unter Kapitel Technische Daten angeführten, zulässigen maximalen Grenzwerte unbedingt zu beachten. Sämtliche von diesen Grenzwerten abweichenden Einsatzfälle, die nicht von s::can Messtechnik GmbH in schriftlicher Form freigegeben sind, entfallen aus der Haftung des Herstellers.

Das Gerät ist ausschließlich zum oben angeführten Zweck bestimmt. Eine andere, darüber hinausgehende Benutzung oder ein Umbau des Gerätes ohne schriftliche Absprache mit s::can gilt als nicht bestimmungsgemäß. Für hieraus resultierende Schäden haftet s::can nicht. Das Risiko trägt allein der Betreiber.

4.2 Funktionsprinzip pH::lyser

Das angewandte Prinzip entspricht einer potentiometrischen Messung. Zur quantitativen Messung der logarithmischen Aktivität der H^+ Ionen in einer wässrigen Lösung wird die Potentialdifferenz zwischen einer Referenzelektrode und der Messelektrode ermittelt. Der schematische Aufbau einer potentiometrischen Messung ist rechts abgebildet.



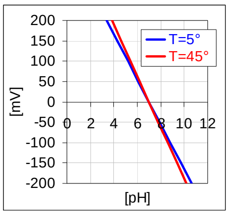
Das gemessene Potential entspricht der Summe aller Potentialdifferenzen, die an den Phasengrenzen flüssig-flüssig bzw. flüssig-fest ausgebildet werden. Idealerweise sind alle Potentialdifferenzen mit Ausnahme jener zwischen der Messlösung und dem inneren Elektrolyten der Messelektrode konstant. Diese Potentialdifferenz U entspricht der Aktivität (Konzentration c) der H^+ Ionen und kann mittels der Nernst'schen Gleichung beschrieben werden:

$U = U_0 + S * \log (c)$

S .... temperaturabhängige Steilheit der Elektrode
U_0 .... konstante Spannung

$pH = (U_0 - U) / S$

Eine typische Beziehung zwischen pH-Wert und Potentialdifferenz ist im Diagramm rechts dargestellt.



Folgende Faktoren sind für eine genaue pH Messung zu beachten und werden vom pH::lyser automatisch berücksichtigt:

- Temperaturabhängigkeit der Steilheit.
- Der Isothermenschnittpunkt ist jener Punkt, an welchem die Potentialdifferenz für einen gegebenen pH-Wert unabhängig von der Temperatur ist.
- Die Steilheit zeigt eine nicht-lineare Abhängigkeit vom pH Bereich. Man spricht vom so genannten Basen- bzw. Säurefehler.
- Die oben genannten Gleichungen müssen um die Möglichkeit der Kalibration erweitert werden.
- Als Selbstdiagnose-Funktion werden außerdem die Temperatur, das Rohspannungssignal sowie die Qualitätszahl zur Beschreibung der Stabilität des Signals angegeben.
- Überwachung der Impedanz der pH- und Referenzelektrode zur erweiterten Selbstdiagnose, z.B. zur Vorhersage der restlichen Lebensdauer (nur bei pro-Variante).

4.3 Funktionsprinzip redo::lyser

Das Oxidations – Reduktions – Potential (ORP), auch Redoxpotential genannt, ist ein Maß für die Tendenz des Messmediums Elektronen aufzunehmen oder abzugeben. Das ORP wird in mV gemessen, wobei der Messwert nicht Temperatur kompensiert ist. Bei positivem ORP Wert hat das Messmedium die Tendenz zur Aufnahme von Elektronen (z.B. in chloriertem Wasser) und oxidiert in ihm gelöste Substanzen. Bei negativem ORP Wert besteht die Tendenz zur Abgabe von Elektronen (z.B. Schwefelwasserstoff) und daher werden gelöste Substanzen reduziert.

Der Aufbau des redo::lyser ist mit jenem des pH::lyser vergleichbar, anstelle der pH Elektrode befindet sich jedoch ein Platinstift (Platinelektrode). Bei Eintauchen des Sensors in das Messmedium werden so viele Elektroden von ihm aufgenommen oder abgegeben, bis sich ein Potential gebildet hat, welches dem des Messmediums entspricht. Als Referenzelektode wird die gleiche wie für die pH Messung verwendet.

4.4 Funktionsprinzip Referenzelektrode

Die Referenzelektrode soll ein langzeitstabiles Potential liefern, das unabhängig von Temperatur und Messmedium ist. Die typische Ag/AgCl-Referenzelektrode besitzt einen KCl-Innenelektrolyten („single junction“ Elektrode). Der Kontakt zwischen der Elektrode und dem Messmedium wird über ein poröses Diaphragma hergestellt.

Beim pH::lyser / redo::lyser werden s.g. „double junction“ Elektroden (Festkörperelektroden) verwendet. Dabei befindet sich die eigentliche Referenzelektrode, in einer ebenfalls mit einem Elektrolyten gefüllten äußeren Hülse, welche in Kontakt mit der Messlösung steht. Da der Innenelektrolyt sein Potential nicht ändert, bleibt dieses konstant. Die Potentialdifferenz über die Referenzschicht ist minimiert und konstant, da ein gleichmäßiger Austausch von Ionen gewährleistet wird.

Bei der verwendeten Festkörperelektrode wird kein poröses Diaphragma verwendet, was Langzeitstabilität und Wartungsfreiheit garantiert und Probleme wie Ausbluten des Elektrolyten und Verunreinigung ausschließt.

4.5 Gerätekennzeichnung

Die Gerätebezeichnung (Artikelnummer bzw. Typ) und die Seriennummer (8-stellig) sind am Ende des Sensorkabels angebracht.

4.6 Gerätevarianten

Der pH::lyser / redo::lyser ist in folgenden Gerätevarianten erhältlich:

		pH	ORP	Temp	Selbstdiagnosefunktion
E-514-2	pH::lyser II eco	X		X	
E-514-3	pH::lyser II pro	X		X	X
E-513-2	redo::lyser II eco		X	X	
E-513-3	redo::lyser II pro		X	X	X

4.7 Geräteteile Übersicht

1	Sensorgehäuse
2	Sensorkabel
3	Elektrodenschutzkorb mit Anschluss für automatische Reinigung
4	pH- oder ORP-Elektrode mit integrierter Referenzelektrode
5	Temperatursensor

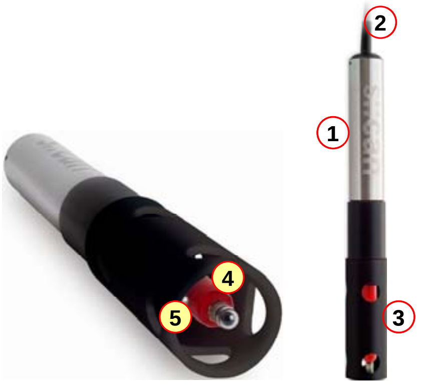


Fig. 4-1: pH::lyser / redo::lyser Geräteteile

4.8 Geräteabmessungen

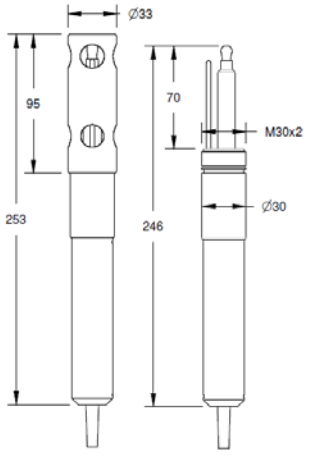


Fig. 4-2: Abmessungen pH::lyser / redo::lyser (Maße in mm)

English
Deutsch
Appendix

5 Lagerung und Transport

Die in den Technischen Daten [11] angeführten maximal zulässigen Grenzwerte hinsichtlich Temperatur sind einzuhalten. Das Gerät sollte keinen starken Stößen, Schlägen, Erschütterungen oder Vibrationen ausgesetzt werden. Das Gerät ist vor korrosiven oder organischen Lösungsmitteldämpfen, radioaktiver Strahlung sowie starken elektromagnetischen Strahlungen geschützt aufzubewahren.

Die Elektrode soll immer mit der mitgelieferten Schutzkappe gelagert werden. Diese ist mit KCl (ca. 2 molar) oder Trinkwasser (kein destilliertes Wasser verwenden!) zu befüllen. Ein **Austrocknen der Elektrode** reduziert die Messqualität und Lebensdauer der Elektrode deutlich. Eine längerer Lagerung der Elektrode im Trockenen (> 48 Stunden) **führt zur Funktionsunfähigkeit** die Elektrode.

Der Transport sollte nach Möglichkeit in der Originalverpackung erfolgen.

5.1 Eingangskontrolle

Bitte kontrollieren Sie die empfangene Lieferung anhand des Lieferscheines unmittelbar nach Erhalt auf Vollständigkeit und augenscheinliche Unversehrtheit. Eventuell festgestellte Transportschäden bitten wir unverzüglich dem anliefernden Transportunternehmen und s::can zu melden.

Folgende Teile sind in Ihrer Lieferung enthalten:	- s::can pH::lyser (Artikel Nr. E-514-2 oder E-514-3) s::can redo::lyser (Artikel Nr. E-513-2 oder E-513-3) - Set für Spülanschluss (Artikel Nr. B-41) - Werkzeug zum einfachen Elektrodentausch (E-532-tool) - s::can Handbuch
Folgende Teile sind optional enthalten:	- Ersatzelektrode pH und Referenz (Artikel Nr. E-514-2-pH) Ersatzelektrode redox und Referenz (Artikel Nr. E-513-2-ORP) - pH Standardlösung zur Kalibration (Artikel Nr. E-514-x.xx) Redox Standardlösung zur Kalibration (Artikel Nr. E-513-456) - Verlängerungskabel (Artikel Nr. C-210-sensor oder C-220-sensor) - Sensorhalterung (Artikel Nr. F-12-sensor) - Durchfluss Vorrichtung Reinwasser (Artikel Nr. F-44-three) - Durchfluss Vorrichtung Abwasser (Artikel Nr. F-47)

Bei Unvollständigkeit kontaktieren Sie bitte umgehend Ihren s::can Vertriebpartner!

5.2 Rücksendungen

Die Rücksendung des s::can Messsystems oder Teilen davon sollte in der Originalverpackung erfolgen. Vorab ist immer mit Ihrem s::can Vertriebspartner oder s::can direkt (sales@s-can.at) Kontakt aufzunehmen.

Im Servicefalle ist, zur Vergabe einer RMA Nummer, ebenfalls mit Ihrem s::can Vertriebspartner oder s::can direkt (service@s-can.at) Kontakt aufzunehmen. Rücksendungen zur Reparatur ohne ausgefülltes RMA Formular können nicht angenommen werden.

Der Kunde hat immer die Kosten der Rücksendung zu übernehmen.

6 Installation und Montage

6.1 Werkzeug- und Materialliste

Zur Montage und elektrischen Installation des pH::lyser / redo::lyser benötigen Sie folgendes Werkzeug bzw. Material:

- Schraubendreher Kreuz u. Schlitz (zum Öffnen des Bediengerätes u. Anschluss der analogen / digitalen Signalübertragung)
- Druckluftschlauch (ID 8 bis 9 mm) - bei Verwendung der automatischen Sensorreinigung
- Sondenhalterung für pH::lyser / redo::lyser
- Verlängerungsrohr für Sondenhalterung und 2,5 mm Bohrer
- Befestigungsadapter für Verlängerungsrohr (Artikel Nr. F – 15)

English
Deutsch
Appendix

6.2 Auswahl der Einbaustelle

Da der korrekte Einbau von Messgeräten für deren zufrieden stellende Funktion eine wichtige Voraussetzung ist, stellt Ihnen s::can eine Checkliste für die Installation zur Verfügung. Damit soll sichergestellt werden, dass im Rahmen der Installation alle denkbaren Fehlerquellen soweit als möglich ausgeschlossen werden und das s::can Messsystem ordnungsgemäß seinen Betrieb aufnehmen kann.

Einbaustelle:

- Günstige Strömungsverhältnisse (keine Turbulenzen, zulässige Fließgeschwindigkeit, etc.)
- Unverfälschtes Messmedium, kein Stoffeintrag (durch Nährstoffdosierung oder Flockungsmittel)
- Repräsentative Zusammensetzung des Mediums (Prozess, Durchmischung etc.)
- Messmedium im Gleichgewichtszustand, kein Ausgasen, kein Ausfällen etc.
- Keine externen Störungseinflüsse (d.h. keine elektrische und elektromagnetische Störungen durch Kriechströme, Erdschlüsse von Pumpen, Elektromotoren, Starkstromleitungen, etc.)
- Gute Zugänglichkeit (Montage, Probenahme, Kontrolle, Demontage)
- Ausreichendes Raumangebot (pH::lyser / redo::lyser, Einbauarmatur, Bediengerät, etc.)
- Grenzwerte werden eingehalten (siehe Technische Daten [11])

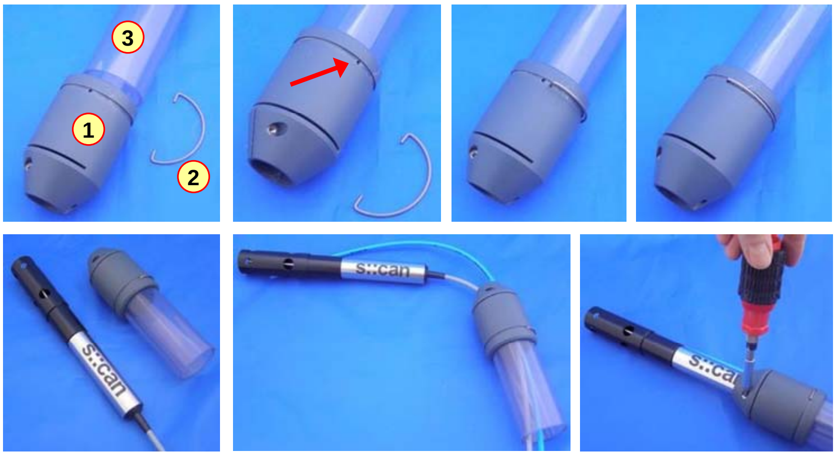
Infrastruktur (Energie, Daten und Druckluft):

- Öl- und partikelfreie Druckluftversorgung
- Stromversorgung für Bediengerät (Betriebssicherheit, Spannung, Leistung)
- Witterungs- und Spritzwasserschutz soweit als möglich
- Distanzen (Sonde – Bediengerät – Druckluftanschluss – Energieversorgung)
- Günstiger Leitungsverlauf (knickfrei, Arbeitssicherheit, Beschädigung etc.)

6.3 Spezielle Einbauhinweise für pH::lyser / redo::lyser

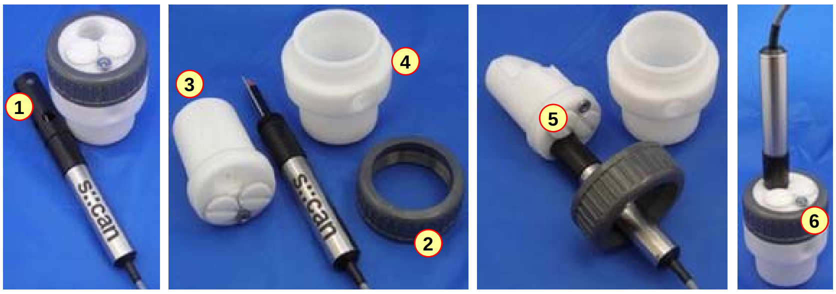
- Schutzkappe von Elektrode vorsichtig entfernen und aufbewahren.

6.3.1 Einbau des pH::lyser / redo::lyser mit Sondenhalterung



- Sicherungsbügel (2) aus Sondenhalterung (1) entfernen.
- Verlängerungsrohr AD 50mm (3) – dieses ist vom Kunden bereitzustellen – in Sondenhalterung schieben.
- 2 Löcher in das korrekt positionierte Verlängerungsrohr bohren. Als Führungshilfe werden die vorhandenen Löcher für den Sicherungsbügel in der Sondenhalterung verwendet (siehe roter Pfeil in Abb. rechts).
- Sicherungsbügel auf beiden Seiten einrasten. Dadurch wird Sondenhalterung fix mit dem Verlängerungsrohr verbunden.
- Das Sensorkabel u. den Druckluftschlauch für die automatische Sondenreinigung mittig durch die Sondenhalterung führen.
- pH::lyser / redo::lyser bis zum Anschlag in die Sondenhalterung stecken (siehe Abbildung oberhalb).
- Die Schraube an der Sondenhalterung mit einem Schraubenzieher anziehen, sodass der Sensor gut fixiert ist.

6.3.2 Einbau des pH::lyser / redo::lyser in Durchflussvorrichtung Reinwasser

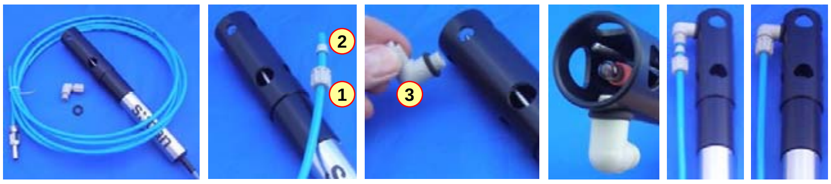


- Schutzkorb (1) vom pH::lyser / redo::lyser abschrauben und aufbewahren.
- Innenteil (3) durch lösen der grauen Überwurfmutter (2) aus Durchflussvorrichtung (4) herausnehmen.
- pH::lyser / redo::lyser in den Innenteil der Durchflussarmatur einschrauben.
- Nicht benutzte Bohrungen für weitere Sensoren sind durch die mitgelieferten Blindstopfen (5) abzudichten.

- Innenteil wieder in Durchflussvorrichtung stecken und so positionieren, dass Entwässerungsschraube (6) auf Seite des Ablaufes zu liegen kommt. Anschließend graue Überwurfmutter (2) festziehen.

6.4 Anschluss der automatischen Reinigung

Das mitgelieferte Druckanschluss-Set enthält notwendige Komponenten für den Anschluss der Sondenreinigung an den Schutzkorb des pH::lyser / redo::lyser einerseits und an das Reinigungsventil des s::can Bediengerätes andererseits. Der Anschluss erfolgt wie nachfolgend beschrieben (siehe auch Bilder unterhalb):



- Überwurfmutter (1) und konisches Zwischenstück (2) über den Spülschlauch stecken.
- Anschlussfitting (3) mit O-Ring in Gewindebohrung am unteren Ende des Schutzkorbes drehen.
- Schutzkorb so verdrehen, dass Öffnung des Anschlussfittings auf Elektrode gerichtet ist.
- Spülschlauch über Anschlussfitting schieben (falls erforderlich Spülschlauch mit heißem Wasser erwärmen).
- Überwurfmutter von Hand festziehen.
- Druckschlauch (kundenseitig, ID 8mm bis 9mm, UV- / ozonbeständig) zwischen dem Übergangsfitting des Druckanschluss-Set und dem Reinigungsventil mit handelsüblichen Schlauchklemmen befestigen.
- Die Verbindung der Druckluftversorgung mit dem Reinigungsventil erfolgt ebenfalls über einen Druckluftschlauch mittels DIN 7,2 Druckluftkupplung.

Das Reinigungsventil sollte nie direkt an die Druckluftkupplung des Kompressors angeschlossen werden. Die Gesamtlängen der Schläuche ist so kurz wie möglich zu halten, um unnötige Druckverluste zu vermeiden. Alternativ zur Druckluft kann im Ausnahmefall auch Trinkwasser zum Betrieb der hydraulisch-pneumatischen Reinigungsvorrichtung herangezogen werden – wenden Sie sich diesbezüglich bitte an Ihren s::can Vertriebspartner.

Alle Fremdkörper in der Druckluftversorgung können die Funktion der hydraulisch-pneumatischen Reinigung herabsetzen. Falls bezüglich der Reinheit der verwendeten Druckluft Zweifel bestehen, empfehlen wir entsprechend geeignete Filter (Partikel, Öl etc.) dem Reinigungsventil vorzuschalten.

In Regionen mit extrem niedrigen Außentemperaturen empfiehlt s::can eine frostfreie Verlegung des Druckluftschlauches, um ein Gefrieren allfällig vorhandenen Kondenswassers im Druckluftschlauch zu vermeiden.

Bitte beachten Sie, dass für verschiedene s::can Sonden und Sensoren unterschiedliche max. zulässige Drücke für die automatische Reinigung spezifiziert sein können. Deshalb ist bei Verwendung einer zentralen Druckluftversorgung im Bedarfsfall die kleinste Druckangabe maßgeblich oder es sind entsprechende Druckreduzierungen zu verwenden um die Instrumente mit dem korrekten Druck versorgen zu können.

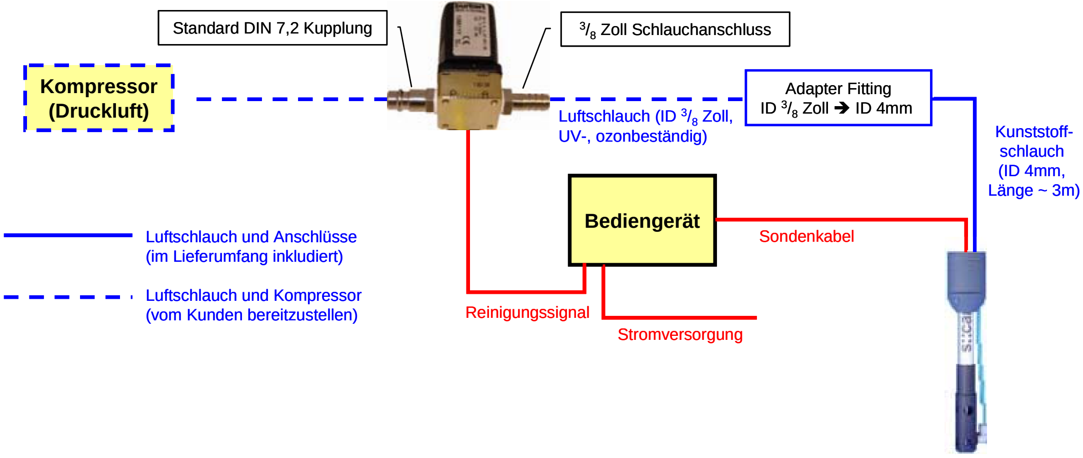

Standard DIN 7,2 Kupplung
$^{3}/_{8}$ Zoll Schlauchanschluss
Kompressor (Druckluft)
Adapter Fitting ID $^{3}/_{8}$ Zoll → ID 4mm
Luftschlauch (ID $^{3}/_{8}$ Zoll, UV-, ozonbeständig)
Kunststoff-schlauch (ID 4mm, Länge ~ 3m)
Bediengerät
Sondenkabel
Luftschlauch und Anschlüsse (im Lieferumfang inkludiert)
Luftschlauch und Kompressor (vom Kunden bereitzustellen)
Reinigungssignal
Stromversorgung

Fig. 6-1: Prinzipskizze Anschluss automatische Reinigung

6.5 Anschluss an das Bediengerät

Der pH::lyser / redo::lyser wird mit Stecker ausgeliefert. Dieser kann in die kompatible Buchse des Bediengerätes gesteckt werden.

Vor dem Anstecken ist sicherzustellen, dass Sondenstecker und Buchse trocken und sauber sind. Andernfalls besteht die Gefahr von Kommunikationsfehlern und / oder Geräteschäden.

Bei Verwendung eines Bediengerätes älterer Bauart kann der pH::lyser / redo::lyser entweder über ein Adapterkabel (s::can Artikelnummer C-40) angeschlossen oder direkt im Anschlussraumes der Bediengerätes verdrahtet werden. Die Belegung des Sensorkabels kann den Technischen Spezifikationen in Kapitel [11] entnommen werden (siehe Abbildung [Fig. 11-1]).

7 Inbetriebnahme

Die Inbetriebnahme des s::can Messsystems erfolgt nach Fertigstellung und Prüfung der Montage und Installation des pH::lyser / redo::lyser (siehe Kapitel [6]) in folgender Reihenfolge.

- Anschluss des s::can Bediengerätes an die Stromversorgung (siehe s::can Handbuch con::stat bzw. con::lyte) und warten bis die Betriebssoftware hochgefahren ist.
- Sondeninitialisierung und Parametrierung des pH::lyser / redo::lyser (siehe Kapitel [7.2] für con::lyte, siehe Kapitel [7.3] für con::stat bzw. con::nect. Weitere Informationen sind in den s::can Handbüchern con::lyte bzw. ana::lyte enthalten).
- Parametrierung der Druckluftreinigung (siehe s::can Handbuch con::lyte oder ana::lyte und Kapitel [11] hinsichtlich Reinigungsdauer und Reinigungsintervall).
- Kontrolle der Funktionsfähigkeit des Reinigungssystems.
- Konfiguration der digitalen und analogen Ausgänge des Bediengerätes falls erforderlich.
- Beurteilung der Messwerte auf Plausibilität nach ausreichender Einlaufzeit (mind. 15 Minuten).
- Falls erforderlich Kalibration des pH::lyser / redo::lyser wenn die Wasserqualität stabil ist (siehe Kapitel [8] sowie s::can Handbuch con::lyte oder ana::lyte).

7.1 Messparameter pH::lyser / redo::lyser

Die Tabelle rechts gibt einen Überblick der möglichen Messparameter des pH::lyser.

Parameter	Parameterindex	Name	Einheit	Dezimalstellen (Default)
pH	0	pH		2
pH-mV	1	pH-mV	mV	1
Temperatur	2	Temp.	°C	1

Die Tabelle rechts gibt einen Überblick der möglichen Messparameter des redo::lyser. Bitte beachten Sie, dass Parameter Index 0 und Index 1 hierbei ident sind.

Parameter	Parameterindex	Name	Einheit	Dezimalstellen (Default)
ORP	0	ORP	mV	0
ORP-mV	1	ORP-mV	mV	0
Temperatur	2	Temp.	°C	1

s::can empfiehl nach Änderung der Anzahl der angezeigten Dezimalstellen eines Parameters die Einstellungen der digitalen und analogen Ausgänge zu kontrollieren.

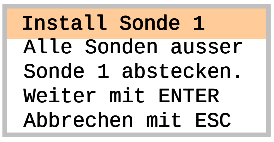
7.2 Sondenbetrieb mit Bediengerät con::lyte (ab Version V4.15)

7.2.1 Sondensuche und Sondeninitialisierung

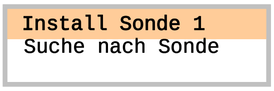
Für den Betrieb des con::lyte mit einer oder mehreren Sonden ist es notwendig, dass jeder Sonde eine eigene Adresse zugewiesen wird. Dies erfolgt softwareunterstützt wie unterhalb beschrieben. Die entsprechende Adresse wird auf der jeweiligen Sonde gespeichert. Für die s::can Sonden bzw. Sensoren können Adressen von 1 bis 10 vergeben werden. Die erforderlichen Vorgänge erfolgen in Abhängigkeit der Konfiguration Ihres s::can Messsystems.

Während des Installationsvorganges darf der con::lyte nicht abgeschaltet werden. Falls während des Installationsvorganges der con::lyte z.B. auf Grund eines Stromausfalles neu startet, muss der gesamte Vorgang zur Sensorinitialisierung wiederholt werden.

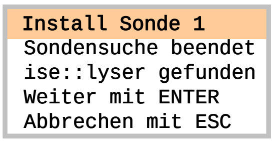
- Nachdem der con::lyte mit der erforderlichen Betriebsspannung versorgt wird, muss im Hauptmenü der Eintrag *Einstellungen / Parameterkonfig / Install Sonden* ausgewählt werden.
- Schließen Sie nun den pH::lyser / redo::lyser an den con::lyte an (siehe Kapitel [6.5]).
- Ein Tastendruck auf *Enter* startet die automatische Suche nach der angeschlossenen Sonde. Wird diese gefunden, wird ihr die Adresse 1 zugewiesen. Dieser Vorgang kann einige Sekunden dauern (siehe Abbildungen rechts).
- Der erfolgreiche Abschluss der Initialisierung wird in einer eigenen Benutzermeldung angezeigt. Nun kann die Sondeninitialisierung mit einem Tastendruck auf *Esc* beendet werden.



```
Install Sonde 1
Alle Sonden ausser
Sonde 1 abstecken.
Weiter mit ENTER
Abbrechen mit ESC
```



```
Install Sonde 1
Suche nach Sonde
```



```
Install Sonde 1
Sondensuche beendet
ise::lyser gefunden
Weiter mit ENTER
Abbrechen mit ESC
```

Eine Benutzermeldung wird auch angezeigt, wenn kein Sensor gefunden wird. In diesem Fall prüfen Sie bitte folgende Punkte bevor Sie den Vorgang zur Sensorinitialisierung wiederholen:

- Ist nur eine Sonde an den con::lyte angeschlossen?
- Ist diese Sonde ordnungsgemäß angeschlossen (siehe entsprechendes s::can Handbuch)?

7.2.2 Parametrierung

Nach erfolgreich durchgeführter Sondeninitialisierung werden die Messparameter des pH::lyser / redo::lyser automatisch am Display des con::lyte angezeigt. Bei Bedarf können die Messparameter über den Menüeintrag *Einstellungen / Parameterkonfig / Parameter n* individuell konfiguriert werden.

```
Parameter 1
Sonde:   ise::lyser
Adresse:          1
Index  :          1
Einheit:         mV
```

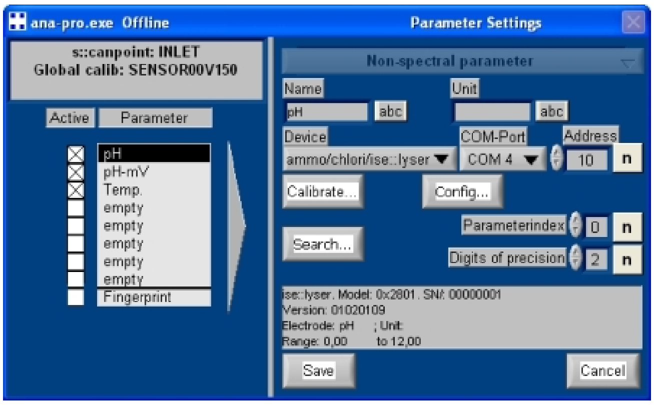
Der Name der *Sonde* oder des Sensors der als Quelle des Parameters dient wird in der obersten Zeile angezeigt (z.B. ise::lyser). Sind mehrere Sonden oder Sensoren installiert, kann hier das gewünschte Messgerät von dem ein Parameter angezeigt werden soll, ausgewählt werden. Darunter wird - als zusätzliche Information - die der ausgewählten Sonde zugewiesene *Adresse* angezeigt. Der *Index* gibt die Reihenfolge des Parameters auf der zugewiesenen Sonde an. Die *Einheit* für den gewählten Parameter wird in der Zeile darunter angezeigt (siehe Kapitel [7.1]).

7.3 Sondenbetrieb mit der Bediensoftware ana::lyte / ana::pro (ab Version V5.9)

7.3.1 Sondensuche / Parameterierung

Beim alleinigen Betrieb eines pH::lyser / redo::lyser kann die Globale Kalibration *SENSOR00V150.glb* verwendet werden.

Mit der Bediensoftware ana::xxx können die Parameter des pH::lyser / redo::lyser ausgewählt und parametrisiert werden. Dies erfolgt in ana::lyte advanced mode bzw. ana::pro über den Menüeintrag *Parameter / Settings*. Falls der entsprechende Parameter nicht im Parameter Settings Fenster angezeigt wird kann er wie folgt gewählt werden: Nach einem Doppelklick auf den Parameter, an dessen Stelle der entsprechende Parameter angezeigt werden soll vergrößert sich das Fenster. Im oberen Auswahlfeld ist *Non-spectral parameter* und als *Device* der Eintrag *ammo/chlori/ise::lyser* auszuwählen. Unter *COM-Port* ist die entsprechende Schnittstelle, an der der pH::lyser / redo::lyser angeschlossen ist, auszuwählen (COM 4 im Falle eines con::stat D-314-x mit Steckverbindung) und unterhalb von *Address* ist die im RS 485 Netzwerk zugewiesene Adresse des pH::lyser / redo::lyser einzutragen (Werkseinstellung = 10).


ana-pro.exe Offline — Parameter Settings

s::canpoint: INLET
Global calib: SENSOR00V150

Active | Parameter
☒ pH
☒ pH-mV
☒ Temp.
☐ empty
☐ empty
☐ empty
☐ empty
☐ empty
☐ Fingerprint

Non-spectral parameter
Name: pH
Unit:
Device: ammo/chlori/ise::lyser
COM-Port: COM 4
Address: 10
Parameterindex: 0
Digits of precision: 2

ise::lyser. Model: 0x2801 . SN/: 00000001
Version: 01020109
Electrode: pH ; Unit:
Range: 0,00 to 12,00

Bei Betätigung der Schaltfläche *Search…* wird von der Software am eingestellten COM-Port nach der Sonde gesucht und im grauen Feld unten eine entsprechende Benutzermeldung angezeigt (Model und Seriennummer, Version, Elektrode und Messbereich).

Falls ein anderes COM Port und / oder eine falsche Sensoradresse angegeben werden, kann die *Search…* Funktion trotzdem die Sonde finden sofern keine andere Sonde an das Bediengerät angesteckt ist.

Über den *Parameterindex* wird festgelegt, welcher Messparameter des pH::lyser / redo::lyser übertragen wird (Zuordnung der Parameter siehe Tabelle in Kapitel [7.1]). Neben der Anzeige *Digits of precision* kann die Anzahl der Dezimalstellen eingestellt werden, mit der die Messergebnisse angezeigt werden.

Die Schaltfläche *Calibrate…* ermöglicht Zugriff auf ein Benutzerfenster in dem die vom pH::lyser / redo::lyser gemessenen Parameter lokal kalibriert werden können (siehe Kapitel [8] für nähere Details zur Kalibration). Über die Schaltfläche *Config…* können grundlegende Einstellungen auf dem pH::lyser / redo::lyser durchgeführt werden. Da dies die Funktion des Messgerätes beeinflusst, sollten derartige Änderungen nur nach Absprache mit s::can bzw. Ihrem s::can Vertriebspartner erfolgen (siehe Kapitel [12.2]).

8 Kalibration

Der pH::lyser / redo::lyser ist ab Werk vorkalibriert und somit sofort einsatzbereit. s::can empfiehlt zur Erzielung optimaler Messergebnisse die Kalibration des pH::lyser / redo::lyser zu Beginn der Messung in der vorgesehenen Applikation zu prüfen. Eine Überprüfung der Gültigkeit und Fehlerfreiheit sollte dann in regelmäßigem Abstand erfolgen (siehe Kapitel [9.1]).

8.1 Allgemeine Hinweise zur Durchführung der Kalibration

- Der pH::lyser / redo::lyser enthält, abhängig vom Gerätetyp (siehe Kapitel [4.64.6]), verschiedene Messsensoren, die individuell zu kalibrieren sind.
- Aufgrund der gegenseitigen Abhängigkeit der Messparameter muss der Temperatursensor immer zuerst kalibriert werden.
- Für alle Messparameter kann eine Einpunkt Kalibration (*OFFSET*) durchgeführt werden. Dabei wird immer Sample 1 verwendet.

English
Deutsch
Appendix

- Für alle Messparameter, mit Ausnahme des ORP Sensors, kann auch eine 2-Punkt Kalibration (*LINEAR*) durchgeführt werden. Dabei werden Sample 1 und Sample 2 verwendet.
- Die beiden Samples, d.h. die zwei Messwerte und die zwei dazugehörigen Vergleichswerte (Laborwerte) sowie die aktuell verwendeten Kalibrationskoeffizienten (Offset und Slope) werden pro Parameter auf dem pH::lyser / redo::lyser abgespeichert.
- Bei den im Kalibrationsablauf angezeigten und auf dem Sensor abgespeicherten Messwerten für pH und ORP handelt es sich um die Rohsignale (mV Werte) der Sensoren. Daher können dies auch negative Zahlenwerte sein.
- Vor Durchführung einer Kalibration prüfen, ob die Schutzkappe von der Elektrode entfernt ist und den pH::lyser / redo::lyser falls erforderlich gründlich reinigen (siehe Kapitel [9.2]).
- Zur Kalibration muss immer der gesamte Messkopf in das Kalibrationsmedium getaucht werden, auch wenn nur ein einzelner Sensor kalibriert wird.
- Die Strömungs- und Temperaturverhältnisse während der Kalibration sollen möglichst konstant sein und die Temperatur wenn möglich jener an der Messstelle entsprechen.
- Vor Durchführung eine Sample-Messung muss der pH::lyser / redo::lyser ausreichend an das Kalibriermedium angepasst und die angezeigte Qualitätszahl größer als 0,9 (im Falle von Labormessungen größer als 0,95) sein.
- Ein bereits bestehender (abgespeicherter) Messwert (Sample) wird mit jeder neuen Auslösung einer Sample-Messung überschrieben.
- Die Vergleichswerte (Laborwerte) können auch zu einem späteren Zeitpunkt eingetragen werden.
- Die Kalibration wird erst durch Auswahl der Menüeintrages *Kalibriere!* durchgeführt.
- Ein kalibrierter Parameter kann auf die Werkseinstellung (Global) zurückgestellt werden. Dies wird nach Austausch einer Elektrode empfohlen bis eine neue Kalibration durchgeführt wird. Es kann auch im Falle einer ungeeigneten lokalen Kalibration hilfreich sein.
- Weitere Hinweise zur Überprüfung der Kalibration entnehmen Sie bitte Kapitel [9.1].

8.2 Sensorspezifische Hinweise zur Durchführung der Kalibration

8.2.1 Temperatur

Die Temperaturkalibration erfolgt am Besten in-situ mit einem geeichten Vergleichsthermometer. Der Temperatursensor kann als einziger Sensor auch an Luft kalibriert werden.

Für die meisten Anwendungen ist eine Einpunkt Kalibration des Temperatursensors ausreichend.

8.2.2 pH Sensor

Die pH Kalibration erfolgt am Besten mit s::can Standard Lösungen (siehe Kapitel [0]).

Der pH::lyser erkennt selbstständig bei der Verwendung von gängigen Buffern dessen Wert und macht einen Vorschlag für den Laborwert. Dieser Wert kann im Falle einer Fehlerkennung oder bei vorliegen von Vergleichsergebnissen überschrieben werden.

Für den pH Sensors wird eine Einpunkt Kalibration im Bereich des zu erwartenden Messwertes des Mediums empfohlen. Bei erhöhten Genauigkeitanforderungen kann auch eine 2-Punkt Kalibration durchgeführt werden, wobei ein pH Buffer den pH Wert 7 haben sollte.

8.2.3 ORP Sensor

Da der ORP Wert in mV angegeben wird ist normalerweise keine Kalibration notwendig. Falls dennoch eine Kalibration gewünscht wird ist lediglich eine Einpunkt Kalibration durchzuführen. Diese erfolgt am Besten mit s::can Standard Lösungen (siehe Kapitel [0]).

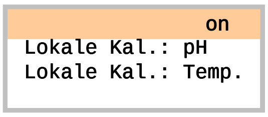
8.3 Kalibrierung mit Bediengerät con::lyte (ab Version V4.15)

Über den Punkt *Kalibration* im con::lyte Hauptmenü gelangt man in die Menüauswahl zur Kalibration des pH::lyser / redo::lyser. Nach Auswahl des Eintrages *Kalibration* erfolgt zunächst eine Passwortabfrage (Passwort = 1) bevor die Kalibration gestartet werden kann. Der nächste Schritt ist die Auswahl des Parameters, der kalibriert werden soll (z.B. pH) im Auswahlfeld *Param Kalibration*.

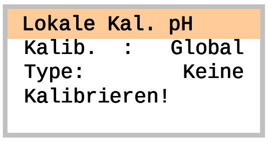
Nun erscheint das Menü zur lokalen Kalibration wie rechts abgebildet.

Neben dem Eintrag *Kalib.* wird angezeigt, ob der Parameter lokal kalibriert ist (*Lokal*) oder die Werkseinstellung (*Global*) verwendet wird. Eine Änderung dieser Einstellung erfordert auch die Bestätigung des Eintrages *Kalibrieren!* damit die neue Kalibration tatsächlich zur Anwendung kommt.

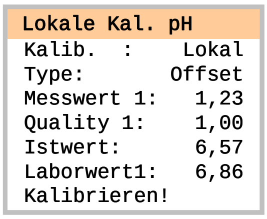
Zur Durchführung einer Einpunkt Kalibration ist der Eintrag *Offset* im Kalibrationsmenü (*Type*) auszuwählen.



```
                 on
Lokale Kal.: pH
Lokale Kal.: Temp.
```



```
Lokale Kal. pH
Kalib.  :   Global
Type:        Keine
Kalibrieren!
```



```
Lokale Kal. pH
Kalib.  :    Lokal
Type:       Offset
Messwert 1:   1,23
Quality 1:    1,00
Istwert:      6,57
Laborwert1:   6,86
Kalibrieren!
```

Nun wird am Display der aktuell auf dem Sensor abgespeicherte Messwert angezeigt, der für die Einpunkt Kalibration verwendet wird (*Messwert 1*). Wurde noch keine Messung ausgeführt oder ist die Messung ungültig, erscheinen an Stelle eines Zahlenwertes nur Striche.

Der aktuelle Messwert wird neben dem Eintrag *Istwert* und die Qualität dieser Messung neben dem Eintrag *Quality 1* angezeigt und laufend aktualisiert. Mit einem Tastendruck auf *Enter* wird der aktuelle Messwert (Rohwert) auf dem Sensor abgespeichert und neben dem Eintrag *Messwert 1* angezeigt.

Neben dem Eintrag *Laborwert 1* wird der zugehörige Vergleichswert für *Messwert 1* eingetragen. Die Einheit hat dabei dem Messparameter zu entsprechen.

Bei Bestätigung des Eintrages *Kalibrieren!* mit *Enter* wird die Kalibration durchgeführt. Die erfolgreiche Durchführung der Kalibration wird über eine Benutzermeldung (*o.k.*) angezeigt. Falls die Durchführung der Kalibration fehlerhaft war (Benutzermeldung *Fehler*) wird die bisher verwendete Kalibration weiter verwendet.

Zur Durchführung einer 2-Punkt Kalibration ist der Eintrag *Linear* im Kalibrationsmenü (*Type*) auszuwählen.

Nun werden am Display zusätzlich zu den Informationen zur Durchführung einer Einpunkt Kalibration auch die Werte für den 2. Kalibrationspunkt (*Messwert 2* und *Laborwert 2*) angezeigt.

Zur Rückstellung auf der Werkseinstellung ist im Anzeigefeld *Kalib.* der Eintrag *Global* auszuwählen und diese Änderung mit *Kalibrieren!* zu betätigen.

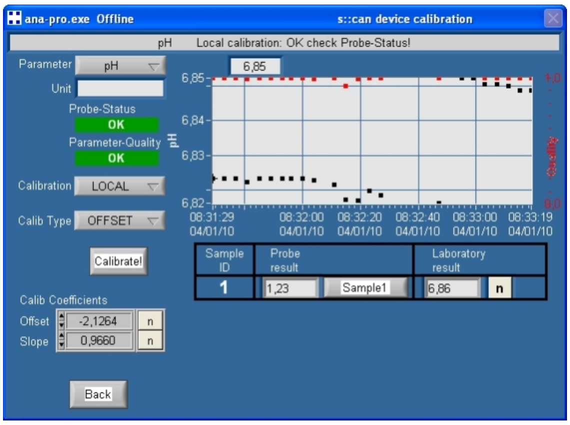
```
Lokale Kal. pH
Kalib.  :     Lokal
Type:        Linear
Messwert 1:    1,23
Quality 1:     0,99
Istwert:       9,54
Laborwert1:    6,86
Messwert 2:  128,13
Quality 2:     0,99
Istwert:       9,54
Laborwert2:    9,18
Kalibrieren!
```

8.4 Kalibrierung mit der Bediensoftware ana::lyte / ana::pro (ab Version V5.9)

Die Kalibrierung der Messparameter des pH::lyser / redo::lyser erfolgt direkt im Messbildschirm über den Menüeintrag *Local Calibration*. Nach Auswahl des Menüeintrages erscheint ein Übersichtsfenster in dem alle Parameter aufgelistet sind. Neben dem Parameternamen (*Name*) sind auch die Einheit (*Unit*) des Parameters, die Sonde mit der dieser Parameter gemessen wird (*Device*), das *COM Port* an dem die Sonde angeschlossen ist und die Adresse der Sonde (*Address*) angegeben. Der zur Kalibration ausgewählte Parameter ist blau hinterlegt und ist mit *Ok* zu bestätigen.

Außerdem kann die Kalibration in ana::lyte advanced mode bzw. ana::pro auch im Hauptmenü über den Menüeintrag *Parameter / Settings* aufgerufen werden. Der Zugriff zum Kalibrationsmenü erfolgt in diesem Fall durch einen Doppelklick auf den zu kalibrierenden Parameter. In den sich öffnenden Benutzerfenster ist die Schaltfläche *Calibrate…* zu drücken.

Sobald der Kalibrationsbildschirm geöffnet wird, werden die aktuellen Messwerte des ausgewählten Parameters im rechten oberen Bereich des Bildschirmes angezeigt. Die Werte werden automatisch aktualisiert und darüber hinaus als Zeitreihe (schwarze Linie) dargestellt, um die Stabilität der Messung besser beurteilen zu können.



pH Local calibration: OK check Probe-Status!

Parameter: pH
Unit:
Calibration: LOCAL
Calib Type: OFFSET
Offset: -2,1264 n
Slope: 0,9660 n

Sample ID	Probe result		Laboratory result	
1	1,23	Sample1	6,86	n

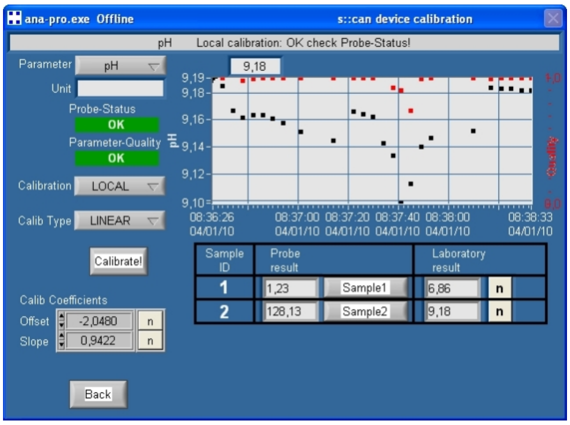
Zusätzlich zu den Messwerten wird in diesem Diagramm als rote Linie die Qualität des Parameters (*Quality*) angezeigt. Diese kann zwischen 0 (schlecht) und 1 (gut) schwanken. Sobald die Qualität des Parameters einen Wert > 0,9 erreicht hat, wechselt die Anzeige *Parameter-Quality* von *FAILURE* auf *OK*.

Über das Auswahlfeld *Calibration* kann zwischen Werkseinstellung (*GLOBAL*) und lokaler Kalibration (*LOCAL*) gewechselt werden. Ein Wechsel in diesem Auswahlfeld führt zunächst nur zu einer veränderten Anzeige des Kalibrationsbildschirmes. Die tatsächliche Durchführung der Kalibration erfolgt erst mit Betätigung der Schaltfläche *Calibrate!*

Über die Schaltfläche *Calib Type* links kann die Art der Kalibration (*OFFSET* oder *LINEAR*), die durchgeführt werden soll ausgewählt werden.

Bei Auswahl von *OFFSET* zur Einpunkt Kalibration erscheint im rechten unteren Bereich des Kalibrationsbildschirmes eine Tabelle mit den Spalten *Sample ID*, *Probe result* und *Laboratory result*.

Nun kann der aktuelle Messwert über die Schaltfläche *Sample1* abgespeichert werden. Rechts davon kann über die Schaltfläche *n* der Vergleichswert (Laborwert) eingegeben werden. Mit Betätigung der Schaltfläche *Calibrate!* wird der Kalibrationsprozess gestartet.



pH Local calibration: OK check Probe-Status!

Parameter: pH
Unit:
Calibration: LOCAL
Calib Type: LINEAR
Offset: -2,0480 n
Slope: 0,9422 n

Sample ID	Probe result		Laboratory result	
1	1,23	Sample1	6,86	n
2	128,13	Sample2	9,18	n

Bei Auswahl von *LINEAR* zur 2-Punkt Kalibration wird die Tabelle im rechten unteren Bereich um einen zweiten Kalibrationspunkt (*Sample2*) erweitert. Wiederholen Sie nun den Vorgang für *Sample2* so wie bereits oberhalb für die Einpunkt Kalibration beschrieben.

Die Koeffizienten der aktuell verwendeten Kalibration werden links unten angezeigt (Offset und Slope). Über die Schaltfläche Back wird der Kalibrationsbildschirm verlassen.

9 Funktionskontrolle / Wartung

In Abhängigkeit der Applikation (Wasserinhaltsstoffe) wird eine regelmäßige Funktionskontrolle (zu Beginn der Inbetriebnahme wöchentlich, dann monatlich) empfohlen. Die folgende Liste gibt eine Übersicht aller im Zuge einer Funktionskontrolle / Wartung durchzuführenden Tätigkeiten an.

Verwendung von ana::lyte / ana::pro:	- Systemstatusanzeige im Bildschirm ok? - „*Show context help*“ aktivieren falls nicht ok und Ursache feststellen. - Zeitstempel der letzten Messung aktuell? - Parameterstatus der angezeigten Parameter ok? - „*Show context help*“ aktivieren falls grau hinterlegt od. NaN und Ursache feststellen.
Verwendung von con::lyte:	- Angezeigte Systemzeit ist aktuell und läuft in Sekundenschritten weiter? - Fehlermeldungen (Symbol !) angezeigt? - *Logbuch* Einträge seit letzter Funktionskontrolle kontrollieren
Angezeigte Messwerte:	- Messwerte vollständig angezeigt? - Messwerte regelmäßig aktualisiert? (Messintervall und gleitende Mittelung beachten) - Messwerte plausibel? Historische Messwerte (Zeitreihen) kontrollieren
Automatische Sondenreinigung:	- Funktion der Sondenreinigung - Funktion der Druckversorgung (Kompressor) - Dichtheit der Schläuche und Anschlüsse

9.1 Kontrolle der Kalibration

Eine Überprüfung der Genauigkeit des angezeigten Messwertes sollte immer mittels zuverlässiger Vergleichsmethoden erfolgen. Im Falle einer unzulässig großen Abweichung zwischen dem Laborergebnis und den Messwerten des pH::lyser / redo::lyser ist eine Einpunkt Kalibration (Offset) direkt im Medium durchzuführen (siehe Kapitel [8]).

In ca. halbjährlichem Abstand sollte beim pH::lyser die Elektrodensteigung überprüft und – falls erforderlich - neu kalibriert werden (siehe Kapitel [8]). Dazu ist der pH::lyser auszubauen und gründlich zu reinigen bevor die Kalibration in pH-Standards durchgeführt wird. Dadurch wird die Elektrodensteigung neu festgelegt und gleichzeitig die Funktion der Elektrode selbst überprüft.

9.2 Reinigung

Im Prozess erfolgt die Reinigung des pH::lyser / redo::lyser durch die automatische Druckluftreinigung. Zur manuellen Reinigung des Sensors wird folgendes empfohlen:

- Sensorgehäuse mit Hand warmen Trinkwasser von groben Verunreinigungen abspülen.
- Sensor für einige Minuten in einen Kübel mit Hand warmen Trinkwasser stellen um Verschmutzungen an der Elektrode zu entfernen.
- Zur Reinigung der Elektrode kann der Elektrodenschutzkorb abgeschraubt und ein weiches Tuch oder eine weiche Bürste verwendet werden.
- Starke Verschmutzungen können mit milden Reinigungsmittel, 2% iger Salzsäure (HCl) oder schwacher Lauge (2% ige NaOH), entfernt werden.
- Abschließend ist der Sensor ausgibig mit reinem Wasser zu spülen.
- Die ausgebaute Elektrode selbst kann bei extremer Verschmutzung wie folgt gereinigt werden:
  Max. 30 Minuten in 10% iger HCl und dann max. 30 Minuten in NaOH 0,1 mol/l (=4g/l).
  Anschließend ist die Elektrode für mind. 1 Stunde im fließenden Reinwasser zu spülen und anschließend zu kalibrieren.

Bei Anwendung konzentrierter Reinigungsmittel sind unbedingt die Sicherheitsvorkehrungen (Schutzhandschuhe, Schutzbrille, etc.) zu beachten. Ultraschallbäder sind zur Reinigung nicht geeignet.

9.3 Austausch der Elektrode

Beim Austausch von Elektroden ist sorgfältig vorzugehen um eine Beschädigung des Sensors zu vermeiden. Es ist unbedingt sicherzustellen, dass der gesamte Bereich zur Aufnahme der Elektrode und im besonderen die Elektrodenanschlüsse des pH::lyser / redo::lyser während dieser Tätigkeit trocken und sauber bleiben.

Schäden durch Eintritt von Feuchtigkeit oder Wasser auf Grund von nicht Beachtung der Anweisungen beim Austausch von Elektroden fallen nicht unter die Garantie.

Beim Ein- und Ausschrauben der Elektrode darf das Werkzeug zum Elektrodentausch auf keinen Fall verkanten, da sonst der Temperatursensor beschädigt werden kann!

Bezüglich Austausch der Elektroden beachten Sie bitte auch die Abbildungen im Anhang (Appendix), die den gesamten Austauschvorgang bildlich darstellen (siehe Kapitel [13]).

10 Ersatzteile / Zubehör

10.1 Austauschelektroden

Die pH-Elektrode des pH::lyser und die ORP-Elektrode des redo::lyser sind komplett als Austauschelektrode erhältlich. Beide sind kombinierte Elektroden, d.h. sie beinhalten bereits die Referenzelektrode.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	E – 514 – 2 pH	
Artikelnummer	E – 513 – 2 ORP	

10.2 Werkzeug zum Elektrodentausch

Zum einfachen Aus- und wieder Einbau einer kompletten Elektrode des pH::lyser / redo::lyser ist ein eigenes Werkzeug erhältlich.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	E – 532 – tool	

10.3 pH Standard Lösung zur Kalibration

Zur Kalibration des pH::lyser sind Standard Lösungen in drei verschiedenen pH Konzentrationen nach DIN 19266 erhältlich. Eine Standard Lösung (Artikel Nr. E – 514 – x.xx) enthält 500 ml Kalibrierstandard. Die unterschiedlichen Konzentrationen können, in Abhängigkeit der Temperatur, der Tabelle rechts entnommen werden.

°C	E – 514 – 4.01	E – 514 – 6.86	E – 514 – 9.18
5	4,00	6,95	9,40
10	4,00	6,92	9,33
20	4,00	6,87	9,23
25	4,01	6,86	9,18
30	4,02	6,85	9,14
40	4,04	6,84	9,07

10.4 Redox Standard Lösung zur Kalibration

Zur Kalibration des redo::lyser ist eine Standard Lösungen (Ag/AgCl) erhältlich.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	E – 513 – 456	
Standard	456 mV	bei 25 °C
Genauigkeit	+ / - 5 mV	
Menge	500 ml	

10.5 Druckanschluss Set

Zum Anschluss der automatischen Druckluft Reinigung des pH::lyser / redo::lyser ist ein eigenes Druckanschluss Set erhältlich.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	B – 41	
Kabellänge	3 m	
Konfektionierung	ab Werk	
Material	PU Messing vernickelt	Schlauch Anschlussfitting
Prozessanschluss	$^{3}/_{8}$ Zoll	
Einsatzbereich Druck	1 bis 6 bar	

10.6 Verlängerungskabel

Das Kabel des pH::lyser / redo::lyser kann im Bedarfsfall mit einem Verlängerungskabel (Länge 10 m oder 20 m) verlängert werden. Der Anschluss des Verlängerungskabels erfolgt über die Steckverbindung des Sensors.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	C – 210 – sensor C – 220 – sensor	
Kabellänge	10 m 20 m	C – 210 – sensor C – 220 – sensor
Konfektionierung	ab Werk	
Material	PU	Mantel
Schutzart	IP 68	
Steckverbindung	IP 68, RS485, 12VDC	zu s::can Sensoren

10.7 Halterung pH::lyser / redo::lyser

Zur ordnungsgemäßen und einfachen, getauchten Installation des pH::lyser / redo::lyser ist eine eigene Sondenhalterung erhältlich. Diese kann direkt auf die Sonde geschraubt und mit einem vom Kunden bereitgestellten Rohr verlängert werden.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	F – 12 – sensor	
Material	PVC, Edelstahl	
Abmessungen	60 / 91 mm	Durchmesser / Höhe
Gewicht	ca. 150 g	
Prozessanschluss	DN 50 innen	für Halterohr
Installation	getaucht	

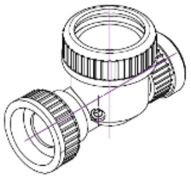
10.8 Durchfluss Vorrichtung Reinwasser

Zur Messung eines Probenstromes außerhalb des Messmediums ist eine eigene Durchflussarmatur erhältlich.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	F – 44 – three	
Material	POM-C	
Abmessungen	106 / 106 / 155 mm	L / B / H
Gewicht	mind. 600 g	
Prozessanschluss	½ Zoll innen	
Installation / Montage	Durchfluss	
Einsatzbereich Temperatur	0 bis + 50 °C	
Einsatzbereich Druck	0 bis 10 bar	
Zubehör	Schlauchtülle 12 mm	F – 47 – process

10.9 Durchfluss Vorrichtung Abwasser

Zur Messung eines Abwasserstromes außerhalb des Messmediums ist eine eigene Durchfluss Vorrichtung erhältlich.



Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	F – 47 – sensor	
Material	PVC	
Abmessungen	170 / 177 mm	Höhe / Länge
Prozessanschluss	ID 40 mm	
Installation / Montage	Durchfluss	

10.10 System Panel Basis

Zur einfachen Befestigung des kompletten s::can Mess-Systems (Bediengerät con::stat oder con::lyte mit pH::lyser / redo::lyser in Durchfluss Vorrichtung) ist ein eigenes System Panel erhältlich.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	F – 50 – 1 – pro F – 50 – 1 – eco	pro: inkl. by-pass Verrohrung
Material	PP	
Abmessungen	400 / 750 / 103 mm	B / H / T
Gewicht	mind. 3,5 kg	

10.11 System Panel s::can Sensor

Zur einfachen Befestigung der s::can Sensor Durchfluss Vorrichtung (F-44-three) oder zur Erweiterung des System Panel Basis ist ein eigenes System Panel erhältlich.

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	F – 50 – 3 – pro F – 50 – 3 – eco	pro: inkl. by-pass Verrohrung
Material	PP	
Abmessungen	195 / 750 / 103 mm	B / H / T
Gewicht	mind. 2,3 kg	

11 Technische Daten

Bezeichnung	Spezifikation	Anmerkung
Artikelnummer	E – 513 – 2 (redo::lyser) E – 513 – 3 (redo::lyser) E – 514 – 2 (pH::lyser) E – 514 – 3 (pH::lyser)	Siehe Kapitel [4.6]
Messparameter	ORP, Temperatur pH, Temperatur	redo::lyser pH::lyser
Messprinzip	Potentiometrisch, nicht poröse Referenzelektrode	kombiniert
Temperaturfühler	Pt100 (Klasse B)	Edelstahl
Messbereich in Anwendung	pH: 2 bis 12 pH 0 bis 14 pH ORP: -2000 bis +2000 mV Temp.: 0 bis 70 °C 0 bis 90 °C	eco pro eco pro
Auflösung	pH: 0,01 pH ORP: 1 mV Temp.: 0,1 °C	
Antwortzeit	30 Sekunden	
Genauigkeit	pH: +/- 0,01 pH ORP: +/- 10 mV Temp.: +/- 0,3 °C	in Standardlösung
Automatische Kompensation	Temperatur	nur bei pH::lyser
Stromversorgung	9 bis 18 VDC	
Leistungsaufnahme	< 1 W	
Länge Sensorkabel	10 m	
Type Sensorkabel	Polyurethanmantel, 2 x 2 x 0,25	
Steckverbindung	Systemstecker, IP 68, RS 485, 12 VDC	zu s::can Bediengeräten
Minimale MODBUS Antwortzeit	400 ms	
Gehäusematerial	Edelstahl 1.4571, POM-C Glaselektroden	Detaillierte Liste zur chemischen Beständigkeit der Elektrode ist bei s::can Vertriebspartner erhältlich.
Gewicht	mind. 0,4 kg	
Abmessung	33 / 253 mm	Durchmesser / Länge
Einsatzbereich – Temperatur	0 bis +70 °C 0 bis +90 °C	eco pro
Einsatzbereich – Druck Tauchtiefe	max. 10 bar max. 100 m	
Lagerung – Temperatur	0 bis + 90 °C	
Montage	F-11-ise oder M 30x2	
Fließgeschwindigkeit	min. 0,01 m/s max. 3,00 m/s	Messung in stehendem Gewässer möglich
Schutzart	IP 68	
Automatische Reinigung (Medium)	Druckluft	
Automatische Reinigung (Anschluss Sonde)	G $^{1}/_{8}$ Zoll für Luftschlauch AD 6 mm	
Automatische Reinigung (zul. Druck)	min. 3 bar max. 6 bar	
Automatische Reinigung (Dauer)	2 – 12 Sek.	
Automatische Reinigung (Häufigkeit)	5 Min. bis 4 Std.	abhängig von Anwendung
Automatische Reinigung (Verzögerung)	10 bis 30 Sek.	Zeit zwischen Ende der Reinigung und erstem korrekten Messwert

Bezeichnung	**Spezifikation**	**Anmerkung**
Konformität - EMV	EN 50011: 2007, Class EN 61326-1: 2006 EN 61000-4-2: 1995+A1:1998+A2:2001 EN 61000-4-3: 2006 EN 61000-4-4: 2004 EN 61000-4-5: 2006 EN 61000-4-6: 2007	
Konformität - Sicherheit	EN 61010-1: 2001, UL508	
Typ. Lebensdauer (Einsatz)	2 Jahre	
Max. Lagerzeit	2 Jahre	unbedingt mit gefüllter Schutzkappe

Fig. 11-1:

Belegung Sondenkabel

Anschluss (PIN)	1	2	3	4	6
Farbe Kabellitze	Grün	Gelb	Weiß	Braun	Blank
Zuordnung	Data -	Data +	9 bis 18 VDC	Masse	Schirmung

s::can empfiehlt, zuerst die Schirmung und die Erdung, dann die RS 485 und zuletzt die Stromversorgung anzuschließen.

12 Behebung von Störungen / Service

12.1 Allgemeine Fehlermeldungen

Bei Durchführung einer Messung oder einer Parameterkalibration werden das Messgerät selbst und das Ergebnis auf mögliche Fehler und auf Plausibilität überprüft. Im Fehlerfall wird eine Meldung an den Benutzer ausgegeben, wobei zwischen Fehler- bzw. Statusmeldungen die das Messgerät selbst betreffen (*Device Status*) und Fehler- bzw. Statusmeldungen die den einzelnen Messparameter betreffen (*Para Status*) zu unterscheiden ist. Der Parameter Status (*Para Status*) wird in einen allgemeinen Teil (public, für alle Sensoren gültig) und einen individuellen Teil (private, nur für den jeweiligen Sensor gültig) aufgeteilt.

Abhängig vom verwendeten Bediengerät werden diese Meldungen am Display (*Show Context Help* und *System-Status* bei ana::xxx bzw. *Logbuch* bei con::lyte) angezeigt und im Logfile (ana::xxx) abgespeichert. Neben der allgemeinen Fehlerursache wird auch der detaillierte Fehler Code (Status Code) in binärer Form bzw. als Hex-Zahl angezeigt.

Treten mehrere Fehlermeldungen gleichzeitig auf, so wird beim con::lyte der Status Code aufsummiert (Status Code 0003 0000 bedeutet, dass Fehler 0001 0000 und Fehler 0002 0000 gleichzeitig aufgetreten sind).

In der folgenden Tabelle sind alle möglichen Fehler inkl. Benutzermeldung, deren Ursache und Hinweise zur Behebung angeführt. Sollte sich ein Fehler trotz mehrfacher Durchführung der empfohlenen Massnahmen nicht beheben lassen kontaktieren Sie bitte Ihren s::can Vertriebspartner.

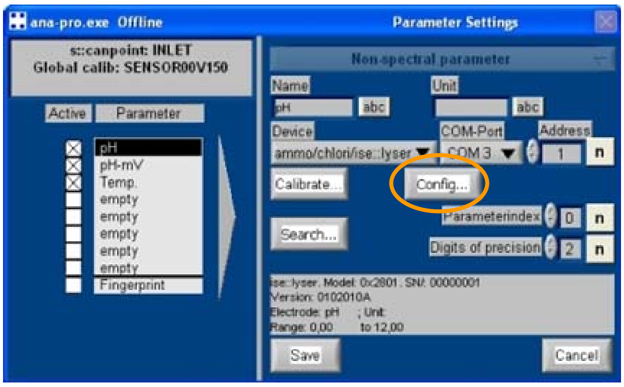
Fehler	**Anzeige con::lyte**	**Meldung ana::xxx**	**Ursache**	**Behebung**
ES 006	Protokoll Fehler. Code: Sonde RS485? Sonde Ab/Anstecken		Kommunikationsfehler zwischen Sensor und Bediengerät.	Kompatibilität Sensor Bediengerät prüfen. Sensorkabel und Steckverbindung prüfen. Sensor ab- und wieder anstecken.
ES 007	Sonde nicht gefunden Stromversorgung und Sonden/Verbindungskabel prüfen.	Unknown on Com…, address…, Com_Status d5000, MB no answer	Keine Kommunikation zwischen Sensor und Bediengerät. Austausch- / Ersatzsensor wurde nicht neu initialisiert.	Sensorkabel und Steckverbindung prüfen. Sensor ab- und wieder anstecken.
ES 100	0001 yyyy zzzz (b0)	Device error 0000 0000 0000 0001	Hardwarefehler	Sensor ab- und wieder anstecken.
ES 100	0002 yyyy zzzz (b1)	Device misuse 0000 0000 0000 0010	Gerät wird außerhalb der Spezifikation betrieben (Temperatur zu gering / zu hoch oder Stromversorgung zu gering / zu hoch).	Temperatur des Messmedium prüfen. Versorgungsspannung Sensor prüfen (zul. Werte siehe Kapitel [11]).
ES 100	0004 yyyy zzzz (b2)	Device replace 0000 0000 0000 0011	Gerätefehler (z.B. Temperatursensor, Elektronik)	Sensor ab- und wieder anstecken.

Fehler	Anzeige con::lyte	Meldung ana::xxx	Ursache	Behebung
ES 100	0008 yyyy zzzz (b3)	Logger error 0000 0000 0000 0100	Interner Datenspeicher defekt	Datenlogger deaktivieren und falls erforderlich wieder reaktivieren. Firmware update durchführen.
ES 100	8000 yyyy zzzz (b15)	Device maintenance required 1000 0000 0000 0000	Allgemeiner Gerätefehler. Zumindest eine interne Systemprüfung fehlerhaft.	Fehlercode und Zusatzmeldung beachten.
EP 100	xxxx 0001 zzzz (b0) Param.Status Fehler. Status Code: …. ….	Parameter error: general 0000 0000 0000 0001	Allgemeiner Parameter Fehler. Zumindest eine interne Parameterprüfung fehlerhaft.	Fehlercode und Zusatzmeldung beachten.
EP 100	xxxx 0002 zzzz (b1)	Parameter error: hardware error 0000 0000 0000 0010	Temperatursensor defekt oder ISE Elektrode fehlerhaft.	Temperatursensor auf Beschädigung überprüfen. Bei ISE Elektrode: Fehlercode und Zusatzmeldung beachten. Neue Kalibration durchführen bzw. Kalibration wiederholen. Elektrode tauschen.
EP 100	xxxx 0010 zzzz (b4)	Parameter error: calibration not o.k. 0000 0000 0001 0000	Zumindest ein Kalibrationskoeffizienten fehlerhaft (NaN).	Rückschalten auf Werkseinstellung (Global). Neue Kalibration durchführen.
EP 100	xxxx 8000 zzzz (b15)	out of range 1000 0000 0000 0000	Parameterwert außerhalb des Messbereiches.	Medium und Kalibration prüfen.
ES 100	xxxx yyyy 0001 (b0)	Electronic failed 0000 0000 0000 0001	ISE Hardwarefehler	Sensor ab- und wieder anstecken.
EP 100	xxxx yyyy 0002 (b1)	Electrode replacement 0000 0000 0000 0010	ISE Elektrode defekt	Elektrode austauschen.
EP 100	xxxx yyyy 0004 (b2)	Electrode cleaning 0000 0000 0000 0011	ISE Elektrode verschmutzt	Elektrode reinigen (siehe Kapitel [9.2]).
EP 100	xxxx yyyy 0008 (b3)	Ion selective electrode missing 0000 0000 0000 0100	ISE Elektrode wurde nicht gefunden	ISE Elektrode prüfen. Elektrode ausbauen, Elektrodenstecker prüfen und Elektrode wieder einbauen.

xxxx ….. Device Status (bm DeviceStatus)
yyyy ….. Parameter Status allgemein (bmParaXStatus)
zzzz ….. Parameter Staus individuell (bmParaXPrivStatus)

12.2 Kontrolle / Änderungen der erweiterte Sensoreinstellungen

Mit der Bediensoftware ana-xxx können interne Einstellungen des Sensors rekonfiguriert werden. Dies sollte nur durch s:.can Service oder nach Anweisung von s::can erfolgen.



s::canpoint: INLET
Global calib: SENSOR00V150

☒ pH
☒ pH-mV
☒ Temp.
☐ empty
☐ empty
☐ empty
☐ empty
☐ empty
☐ Fingerprint

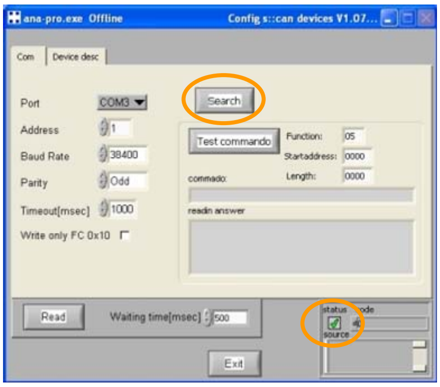
Name: pH
Device: ammo/chlori/ise::lyser
COM-Port: COM 3
Address: 1
Parameterindex: 0
Digits of precision: 2

ise::lyser. Model: 0x2801 . SN: 00000001
Version: 0102010A
Electrode: pH ; Unit:
Range: 0,00 to 12,00

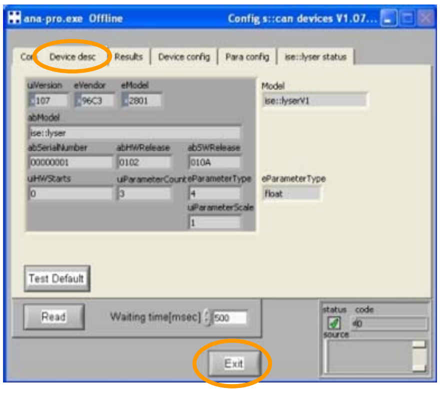
- Schaltfläche *Config…* im Menü *Parameter / Settings* betätigen.
- Im Registerfenster *Com* Schaltfläche *Search* drücken. Sobald Sonde gefunden wurde ist *status source* auf ok (grüner Haken) und es kann auf Registerblatt *Device desc* gewechselt werden.
- Nun werden auch die anderen Registerblätter (*Results*, *Device config*, *Para config* und *ise::status*) angezeigt.
- Im Registerfenster *Device desc* wird u.a. der Sensortyp (*abModel*), die Seriennummer des Sensors (*abSerialNumber*) und die aktuelle Softwareversion (*abSWRelease*) angezeigt.
- Das Konfigurationsmenü kann über die Schaltfläche *Exit* verlassen werden.

Alle Änderungen in den Registerkarten (z.B. neue Adresse) sind direkt in den Anzeigefeldern über Maus und Tastatur durchzuführen. Die mit zwei kleinen Dreiecken markierten Auswahlbalken neben den Anzeigefeldern sollen nicht verwendet werden.

Nachdem ein Wert geändert wurde, ist der Maus-Cursor außerhalb des entsprechenden Eingabefeldes an einer beliebigen Stelle des Registerblattes zu positionieren, bevor in ein anderes Registerblatt gewechselt wird. Erst dann wird die durchgeführte Änderung auf dem Sensor automatisch abgespeichert. Dieser Vorgang ist auch an der Benutzermeldung „*Please wait while settings will be written to the sensor…*“ am oberen Ende des Registerblattes erkennbar.

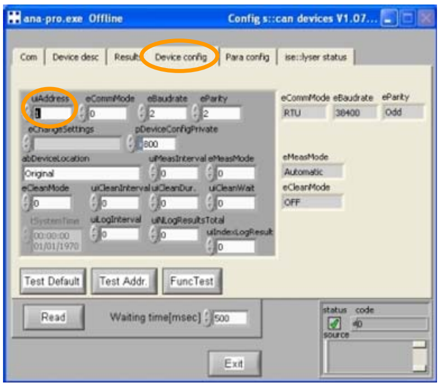


Port: COM3
Address: 1
Baud Rate: 38400
Parity: Odd
Timeout[msec]: 1000
Write only FC 0x10 ☐
Function: 05
Startaddress: 0000
Length: 0000
Waiting time[msec]: 500
code: 40



uVersion: 107
eVendor: 96C3
eModel: 2801
Model: ise::lyserV1
abModel: ise::lyser
abSerialNumber: 00000001
abHWRelease: 0102
abSWRelease: 010A
uiHWStarts: 0
uiParameterCount: 3
eParameterType: 4
eParameterType: float
uiParameterScale: 1
Waiting time[msec]: 500
code: 40

12.2.1 Änderung Sensoradresse



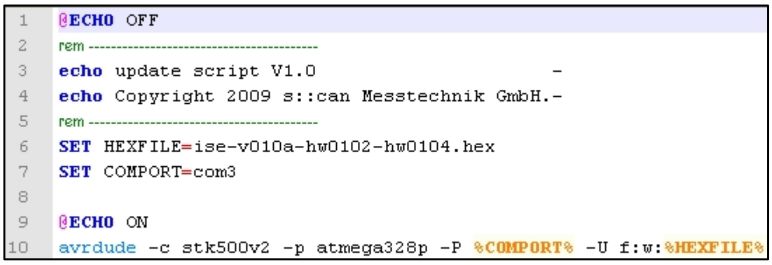
uiAddress: 1
eCommMode: 0
eBaudrate: 2
eParity: 2
eChangeSettings
pDeviceConfigPrivate: 800
abDeviceLocation: Original
uiMeasInterval: 0
eMeasMode: 0
eCleanMode: 0
uiCleanInterval: 0
uiCleanDur.: 0
uiCleanWait: 0
tSystemTime: 00:00:00 01/01/1970
uiLogInterval: 0
uiNLogResultsTotal: 0
uiIndexLogResult: 0
eCommMode: RTU
eBaudrate: 38400
eParity: Odd
eMeasMode: Automatic
eCleanMode: OFF
Waiting time[msec]: 500
code: 40

- Einstieg in das Konfigurationsmenü, wie in Kapitel [12.2] beschrieben.
- Registerblatt *Device config* auswählen.
- Im Feld *uiAddress* links oben die neue Adresse über die angeschlossene Tastatur eingeben. Mit Hilfe der kleinen Pfeiltasten links vom Eingabefeld kann die aktuelle Adresse nur um jeweils eine Stelle erhöht oder erniedrigt werden.
- Sobald die Adresse geändert wurde, wird die neue Adresse automatisch am Sensor gespeichert.
- In das Registerblatt *Com* wechseln, die neue Adresse im Feld *Address* eingeben und die Verbindung zum Sensor durch Betätigung der Schaltfläche *Search* wieder herstellen.
- Konfigurationsmenü über die Schaltfläche *Exit* beenden.

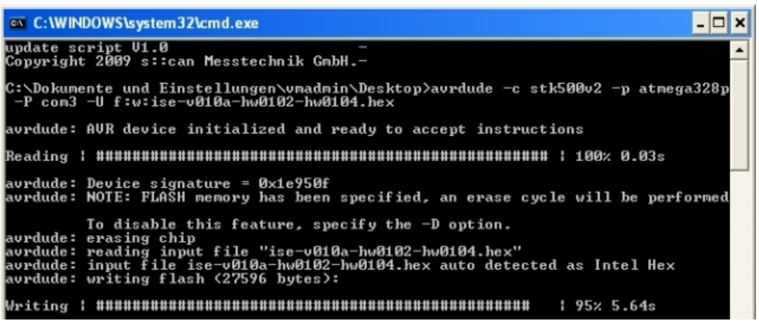
12.3 Anleitung für Update der Sensorsoftware (Firmware Update)

In diesem Kapitel wird erläutert, wie ein Update der Betriebssoftware des pH::lyser / redo::lyser mittels PC oder Notebook und s::can con::nect durchgeführt werden kann.

- Schließen Sie das con::nect an die Stromversorgung an.
- Schließen Sie das con::nect mit dem mitgelieferten USB Kabel an den PC / Notebook an.
- Schließen Sie den pH::lyser / redo::lyser an das con::nect an.
- Überprüfen Sie welcher COM-Port dem s::can con::nect zugeordnet wurde (z.B. über *Start / Einstellungen / Systemsteuerung / Gerätemanager*).
- Kopieren Sie das Firmware Update (File mit Erweiterung **.hex*) auf Ihren Desktop.
- Kopieren Sie das Firmware Update-Utility *avrdude.exe* und *avrdude.conf* auf Ihren Desktop.
- Starten Sie eine Eingabeaufforderung durch “*Start / Ausführen*” und der Eingabe von “*cmd*” gefolgt von *Enter*.
- Wechseln Sie auf Ihren Desktop durch die Eingabe von “*cd Desktop*”.
- Starten Sie das Firmware Update-Utility durch Eingabe von „*avrdude -c stk500v2 -p atmega328p -P com3 -U f:w:ise.hex*“. Ersetzen Sie in diesem Schritt *com3* durch Ihren tatsächlichen COM Port.
- Alternativ können Sie auch das Batchfile **.bat* (siehe obere Abbildung rechts) verwenden und vor dessen Ausführung den *COMPORT* im File entsprechend editieren.
- Nun erkennt das Firmware Update-Utility, dass ein Sensor angeschlossen ist und startet das Firmware Update. Dies dauert ca. 10-20 Sekunden (siehe untere Abbildung rechts).
- Nachdem die Firmware aktualisiert ist starten Sie den Sensor neu durch ab- und wieder anstecken.
- Schließen Sie die Eingabeaufforderung (cmd) und starten sie ana::xxx. Suchen Sie dort den Sensor und nehmen Sie den normalen Betrieb wieder auf.



```
@ECHO OFF
rem ----------------------------------------
echo update script V1.0                   -
echo Copyright 2009 s::can Messtechnik GmbH.-
rem ----------------------------------------
SET HEXFILE=ise-v010a-hw0102-hw0104.hex
SET COMPORT=com3

@ECHO ON
avrdude -c stk500v2 -p atmega328p -P %COMPORT% -U f:w:%HEXFILE%
```

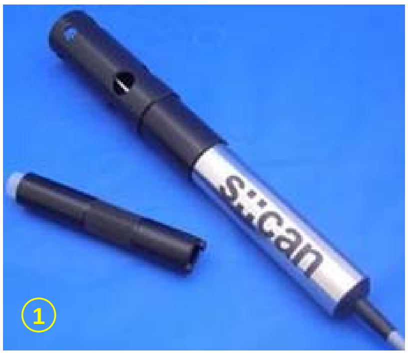


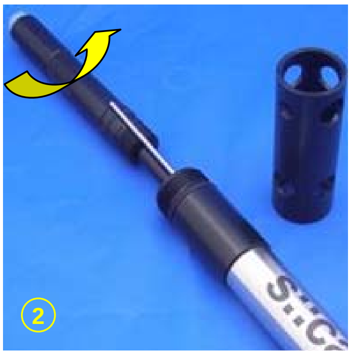
```
update script V1.0                    -
Copyright 2009 s::can Messtechnik GmbH.-

C:\Dokumente und Einstellungen\vmadmin\Desktop>avrdude -c stk500v2 -p atmega328p
 -P com3 -U f:w:ise-v010a-hw0102-hw0104.hex

avrdude: AVR device initialized and ready to accept instructions

Reading | ################################################## | 100% 0.03s

avrdude: Device signature = 0x1e950f
avrdude: NOTE: FLASH memory has been specified, an erase cycle will be performed

         To disable this feature, specify the -D option.
avrdude: erasing chip
avrdude: reading input file "ise-v010a-hw0102-hw0104.hex"
avrdude: input file ise-v010a-hw0102-hw0104.hex auto detected as Intel Hex
avrdude: writing flash (27596 bytes):

Writing | ################################################   | 95% 5.64s
```

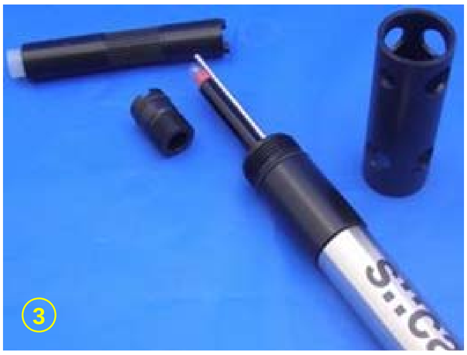
Sollte es im Zuge des SW-Update zu Problemen kommen oder Fragen auftreten kontaktieren Sie Ihren lokalen s::can Partner.

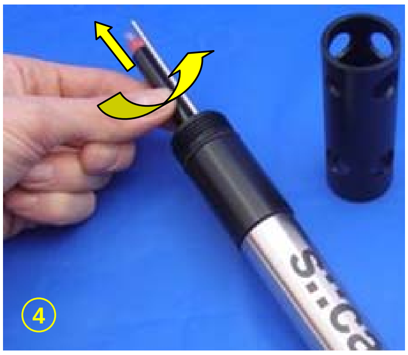
13 Appendix

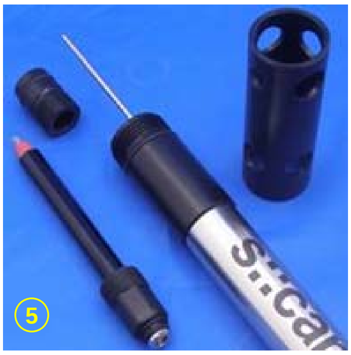
Anhang

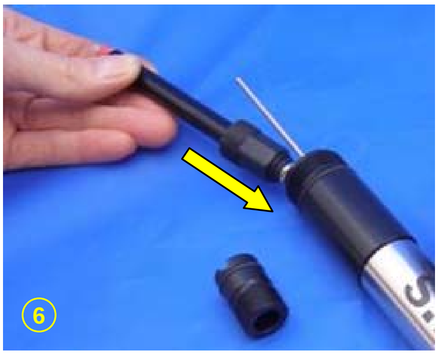


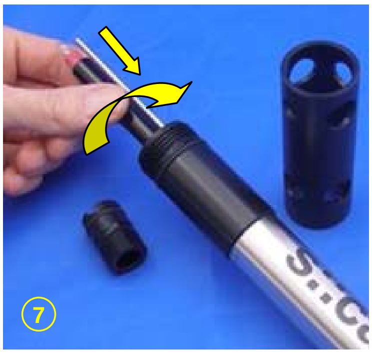


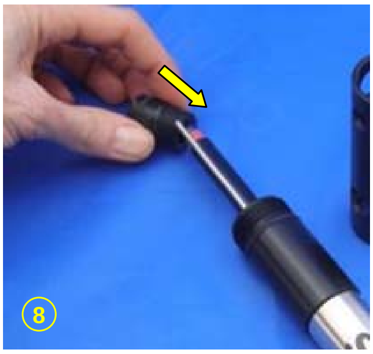


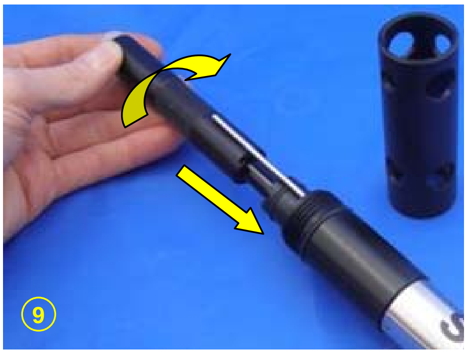












14 Contact Address

Please do not hesitate to contact your local s::can sales partner or s::can if you have any questions:

s::can

Email: office@s-can.at
Phone.: +43 1 219 73 93 – 0
Fax: +43 1 219 73 93 – 12
Web : www.s-can.at
Brigittagasse 22 – 24
1200 Vienna, AUSTRIA

Local s::can sales partner

Kontaktadresse

Bei Fragen kontaktieren Sie bitte Ihren lokalen s::can Vertriebspartner oder direkt s::can

s::can

Email: office@s-can.at
Tel.: +43 1 219 73 93 – 0
Fax: +43 1 219 73 93 – 12
Web : www.s-can.at
Brigittagasse 22 – 24
1200 Wien, AUSTRIA

Lokaler s::can Vertriebspartner

s::can
Intelligent. Optical. Online.

Manual

ammo::lyser V2.1

fluor::lyser V2.1

August 2019 Release

S-23-M

Table of Contents

1 General

This manual contains, firstly, general information (chapter 1) and safety guidelines (chapter 2). The next chapter (chapter 3) provides a technical description of the s::can product itself as well as information regarding transport and storage of the product. In further chapters the installation (chapter 4) and the initial startup (chapter 5) are explained. Furthermore information regarding calibration of the device (chapter 6), data management (chapter 7), how to perform a functional check (chapter 8) and maintenance (chapter 9) can be found in this manual. Information regarding troubleshooting (chapter 10), the available accessories (chapter 11) and the technical specifications (chapter 12) complete the document.

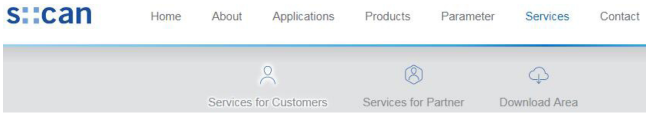
Each term in this document that is marked *italic and underlined*, can be found on the display of your controller for operation or as lettering on your s::can product.

In spite of careful elaboration this manual may contain errors or incompletion. s::can does not assume liability for errors or loss of data due to such faults in the manual. The original manual is published in English and German by s::can. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into third languages.

This manual and all information and figures contained therein are copyrighted. All rights (publishing, reproduction, printing, translation, storage) are reserved by s::can Messtechnik GmbH. Each reproduction or utilisation outside the permitted limits of the copyright law is not allowed without previous written consent from s::can Messtechnik GmbH. The reproduction of product names, registered trade names, designation of goods etc. in this manual does not imply that these names can be used freely by everyone; often these are registered trade marks, even if they are not marked as such.

This manual, at the time of its publication (see release date printed on the top of this document), concerns the s::can products listed in chapter 3. Information and technical specifications regarding these items in s::can manuals from earlier release dates are herewith replaced by this manual.

The electronic version (pdf-document) of this manual is available on the Customer Portal (Services for Customers) of the s::can website (www.s-can.at).



2 Safety Guidelines

Installation, electrical connection, initial startup, operation and maintenance of any s::can product as well as complete s::can measuring systems must only be performed by qualified personnel. This qualified personnel has to be trained and authorised by the plant operator or by s::can for these activities. The qualified personnel must have read and understood this manual and have to follow the instructions contained in this manual.

For proper initial startup of complete s::can measuring systems, the manuals for the controller and software used for operation (e.g. con::lyte, con::cube, con::nect, moni::tool), the connected probes and sensors as well as the used additional devices (e.g. compressor) have to be consulted.

The operator has to obtain the local operating permits and has to comply with the joint constraints associated with these. Additionally, the local legal requirements have to be observed (e.g. regarding safety of personnel and means of labour, disposal of products and materials, cleaning, environmental constraints). Before putting the measuring device into operation, the operator has to ensure that during mounting and initial startup – in case they are executed by the operator himself – the local legislation and requirements (e.g. regarding electrical connection) are observed.

All s::can products are leaving our factory in immaculate technical and safety conditions. Inappropriate or not intended use of the product, however, can cause danger! The manufacturer is not responsible for damage caused by incorrect or unauthorised use. Any kind of manipulation of the instrument is strictly prohibited - except for the activities described in this document. Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid. For details regarding guarantee and warranty please refer to our general conditions of business.

2.1 Declaration of Conformity

This s::can product has been developed, tested and manufactured for electromagnetic compatibility (EMC) and according to applicable European standards, as defined in the declaration of conformity.

CE-marks are applied on the device. The declaration of conformity related to this marking can be requested from s::can or your local s::can sales partner or can be downloaded from the s::can Customer Portal.

2.2 Special Hazard Warning

⚠ Because the s::can measuring systems are frequently installed in industrial and communal waste water applications, one has to take care during mounting and demounting of the system, as parts of the device can be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one’s health during work with the measuring device.

3 Technical Description

3.1 Intended Use

The ammo::lyser / fluor::lyser is an ion selective sensor designed for the continuous monitoring of dissolved Ammonium Nitrogen (NH4-N) or Fluoride (F) respectively in waste water, surface water or drinking water. Depending on the sensor type different electrodes will be used. The measured value is displayed in mg/l.

Optional the sensor can be equipped with additional ion selective electrodes that measure the concentration of Nitrate Nitrogen (NO3-N), Chloride (Cl), Potassium (K) or the pH-value. The last two parameters (K, pH) can be used to compensate cross sensitivities of the ammonium measurement. In that way a higher measuring accuracy can be reached compared to traditional ion selective sensors without such compensations for cross sensitivities.

The temperature of the medium will be measured continuously and is available as an additional parameter. Temperature will be used for correction of measured readings during the local calibration process.

In all types of applications, the respective acceptable limits, which are provided in the technical specifications in the respective s::can manuals, have to be observed. All applications falling outside of these limits, and which are not authorised by s::can Messtechnik GmbH in written form, do not fall under the manufacturer's liability.

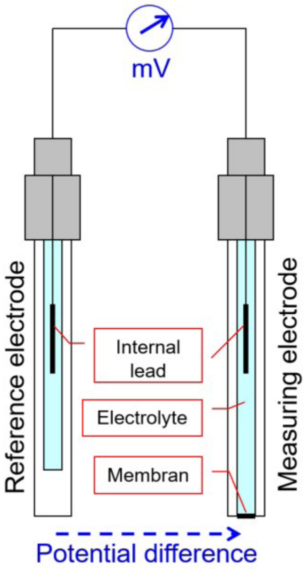
The device must only be used for the purpose described in this manual. Use in applications not described in this manual, or modification of the device without written agreement from s::can, is not allowed. s::can is not liable for claims following from such unauthorised use. In such a case, the risks are the sole responsibility of the operator.

3.2 Functional Principle

The ammo::lyser / fluor::lyser measures the potential difference between the ion selective measuring electrode (ISE) and the reference electrode (see figure on the right). The voltage circuit is closed via the measuring medium.

The measuring electrode is equipped with a selective membrane (polymer, single crystal or glass) which measures changes of specific ion activity. The difference in specific ion activities generates a potential at the membrane interface. This potential is then measured against the stable potential of the reference electrode.

According to the Nernst equation the measured potential [mV] is proportional to the concentration of the specific ion.

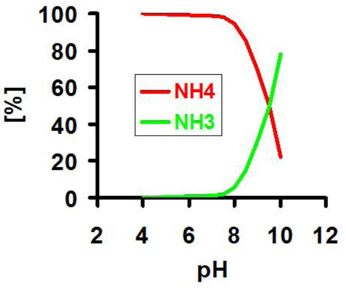


In addition, the ammo::lyser can be equipped with functionalities to compensate the Ammonium measurement for pH and Potassium.

- pH compensation:

  Increasing concentrations of NH3-N (Ammonia) at pH > 7.5 (see figure on the right) cannot be detected by the ion selective electrode. Therefore the NH4-N reading is below the real concentration. In order to eliminate this effect, the ammo::lyser can be equipped with a pH electrode.

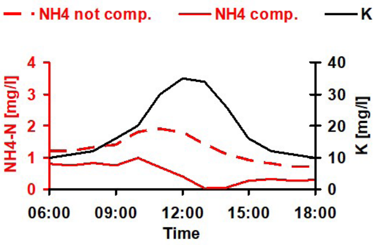
$$NH_4^+ + OH^- \leftarrow\rightarrow NH_3 + H_2O$$



- Potassium compensation:

  The ion selective electrodes are specific for only one type of ion. Potassium ion has the same charge and similar size as Ammonium, therefore it will be detected by the measuring electrode and give less accurate, increased readings (see figure on the right).

  In case of high and / or fluctuating Potassium concentration, the usage of a seperate Potassium electrode for compensation of Ammonium reading can be used.


NH_4^+ membrane is cross sensitive to K^+ ion (1:25)

3.3 Product

The following device variants of the ammo::lyser / fluor::lyser are available. Regarding detailed information of the device variants please refer to the technical specifications located at the end of this manual.

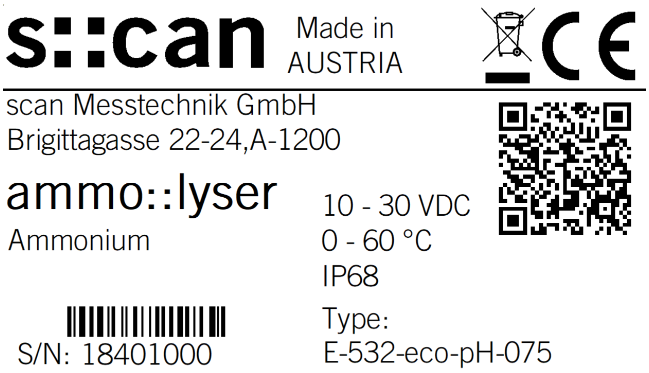
Type	Specification	NH4-N	NO3-N	K	Cl	F	pH	Temp.
E-532-PRO-075	ammo::lyser with 7.5m fixed cable and Potassium compensation	X		X				X
E-532-PRO-000	ammo::lyser with plug connection and Potassium compensation	X		X				X
E-532-PRO-pH-075	ammo::lyser with 7.5m fixed cable, Potassium- and pH-compensation	X		X			X	X
E-532-PRO-pH-000	ammo::lyser with plug connection, Potassium- and pH-compensation	X		X			X	X
E-532-PRO-NO3-075	ammo::lyser with 7.5m fixed cable, Potassium compensation and Nitate electrode	X	X	X				X
E-532-PRO-NO3-000	ammo::lyser with plug connection, Potassium compensation and Nitate electrode	X	X	X				X
E-532-ECO-075	ammo::lyser with 7.5m fixed cable	X						X
E-532-ECO-000	ammo::lyser with plug connection	X						X
E-532-ECO-pH-075	ammo::lyser with 7.5m fixed cable and pH-compensation	X					X	X
E-532-ECO-pH-000	ammo::lyser with plug connection and pH-compensation	X					X	X
E-532-ECO-NO3-075	ammo::lyser with 7.5m fixed cable and Nitate electrode	X	X					X
E-532-ECO-NO3-000	ammo::lyser with plug connection and Nitate electrode	X	X					X
E-532-ECO-CL-075	ammo::lyser with 7.5m fixed cable and Chloride electrode	X			X			X
E-532-ECO-CL-000	ammo::lyser with plug connection and Chloride electrode	X			X			X
E-532-ECO-NO3-pH-075	ammo::lyser with 7.5m fixed cable, pH- and Nitate electrode	X	X				X	X
E-532-ECO-NO3-pH-000	ammo::lyser with plug connection, pH- and Nitate electrode	X	X				X	X
E-532-ECO-CL-pH-075	ammo::lyser with 7.5m fixed cable, pH- and Chloride electrode	X			X		X	X
E-532-ECO-CL-pH-000	ammo::lyser with plug connection, pH- and Chloride electrode	X			X		X	X
E-542-075	fluor::lyser with 7.5m fixed cable					X		X
E-542-000	fluor::lyser with plug connection					X		X

Single electrodes (spare part)	New Version V2	Refurbished Version V2	New Version V1 1)	Refurbished Version V1 1)
Ammonium NH4-N	E-533-ISE-NH4	E-633-ISE-NH4	E-532-ISE-NH4	E-632-ISE-NH4
Ammonium NH4-N 2)	E-535-ISE-NH4	E-635-ISE-NH4	E-534-ISE-NH4	E-634-ISE-NH4
Nitrate NO3	E-533-ISE-NO3	E-633-ISE-NO3	E-532-ISE-NO3	E-632-ISE-NO3
Potassium K	E-533-ISE-K	E-633-ISE-K	E-532-ISE-K	E-632-ISE-K
Chloride CL	E-533-ISE-CL		E-532-ISE-CL	
Fluoride F	E-543-ISE-F		E-542-ISE-F	
pH	E-533-ISE-pH		E-532-ISE-pH	
Reference	E-533-ISE-ref		E-532-ISE-ref	

1) Previous version V1 of ammo::lyser (was delivered by s::can until 2006)
2) Current membrane version (delivered since 2018)

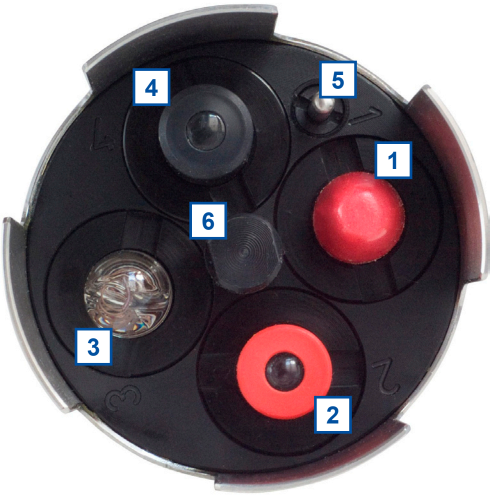
The device is typified by a type label, as shown on the right, that contains the following information:

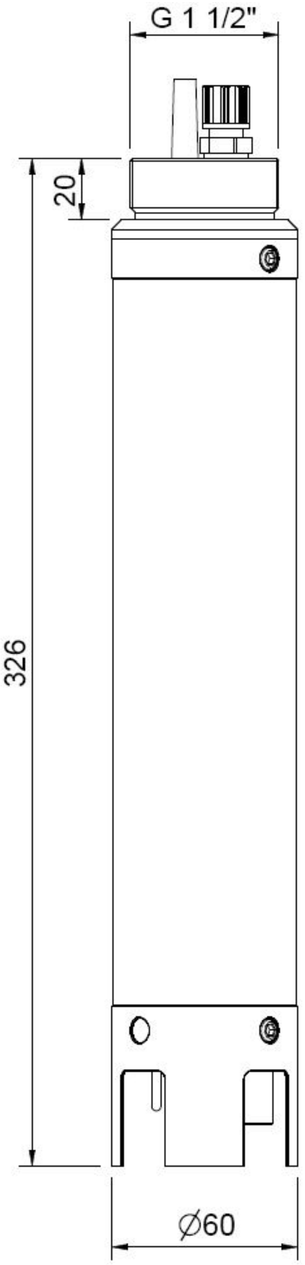
- Manufacturer‘s name and country of origin
- Several certification marks
- Device name
- Bar code
- Device serial number (S/N)
- Information on power supply
- Acceptable temperature limits
- Environment rating (IP)
- Item number (Type)
- QR code to s::can Support



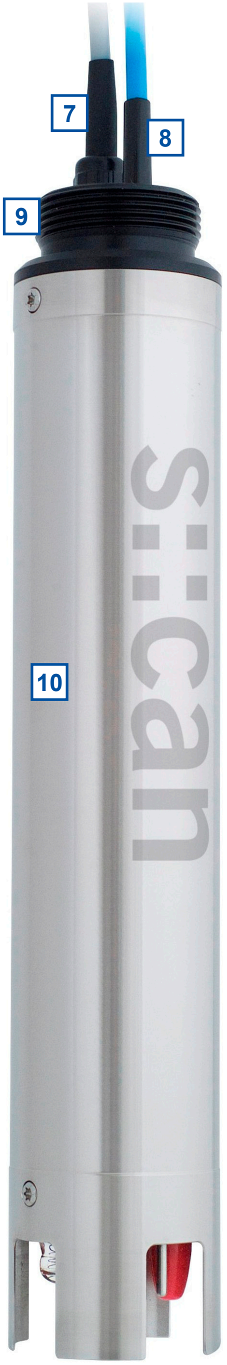
s::can Made in AUSTRIA
scan Messtechnik GmbH
Brigittagasse 22-24,A-1200
ammo::lyser
Ammonium
10 - 30 VDC
0 - 60 °C
IP68
S/N: 18401000
Type:
E-532-eco-pH-075

1	Reference electode (always slot position 1)
2	Ammonium or Fluoride electrode (in most cases slot position 2)
3	pH electrode, ISE-electrode or empty (depending on type)
4	Potassium or another ISE-electrode or empty (depending on type)
5	Temperature sensor
6	Cleaning nozzle
7	Sensor cable
8	Connection for automatic cleaning
9	Connection thread for sensor mounting ($1^1/_2$ inch outside)
10	Sensor housing





Dimensions of ammo::lyser / fluor::lyser in mm



3.4 Storage and Transport

The temperature limits for device storage and transport, which are described in the section technical specifications, have to be observed at all times. The device shall not be exposed to strong impacts, mechanical loads or vibrations. The device should be kept free of corrosive or organic solvent vapours, nuclear radiation as well as strong electromagnetic radiation.

The reference- and pH-electrode have to be protected from drying out. Drying out of both electrode types will result in reduced measuring quality at the beginning and reduced life span up to complete loss of function (> 48 hours). For wetted storage of the reference and pH-electroden the delivered protective cap can be used. Moreover both electrode types should be stored vertically with the membrane downwards and the plug upwards, to ensure complete wetting of the inside.

For long term storage without reducing the life time of the electrode, a 3 M Potassiumchloride solution (KCl) has to be used. For short term the electrode storage can be done in drinking or tap water (never use distilled or demineralised water!). In this case an aging of the electrode occurs similar to the normal operation.

The Ammonium-, Fluoride-, Potassium-, Chloride- and Nitrate electrode will be stored on air dry. Before initial startup a conditioning is needed.

For information about maximal storage duration please refer to the technical specifications located at the end of this manual.

Damage to the sensor and the electrodes caused by wrong storage will not be covered by warranty.

Transport should be done in a packaging that protects the device (original packaging or protective covering if possible).

This product is marked with the WEEE symbol to comply with the European Union’s Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EC. The symbol indicates that this product should not be treated as household waste. It must be disposed and recycled as electronic waste. Please assist to keep our environment clean.

3.5 Scope of Delivery

Immediately upon receipt, please check the received consignment for completeness on the basis of the delivery note and check for any possible damage incurred during shipping. Please inform the delivering dispatcher and s::can immediately in case of any damages in transit.

The following parts should be included in the delivery:

- s::can ammo::lyser / fluor::lyser (part-no. E-532-x-0xx or E-542-x-0xx)
- Connection cable (part-no. C-1-010-SENSOR) in case of plug version (-000)
- Tool for electrode replacement (part-no. E-532-TOOL)
- s::can manual ammo::lyser / fluor::lyser (part-no. S-23-M)

The following parts could be included in the delivery if ordered as an option:

- Set for cleaning connection (part-no. B-41-SENSOR)
- Extension cable (part-no. C-210-SENSOR, C-220-SENSOR or C-230-SENSOR)
- Mounting for ammo::lyser / fluor::lyser (part no. F-11-OXI-AMMO)
- Flow cell setup tap water for ammo::lyser / fluor::lyser (part-no. F-45-AMMO)
- Flow cell setup waste water for ammo::lyser / fluor::lyser (part-no. F-48-AMMO)

In case of incompleteness please contact your s::can sales partner immediately!

3.6 Product Updates and Other

The manufacturer reserves the rights to implement, without prior notice, technical developments and modifications in the light of continuous product care.

4 Installation

4.1 Environment

The correct installation of measuring instruments is an important prerequisite for satisfactory operation. Therefore the following checklist for the installation can be used to ensure that all sources for potential operational problems can be ruled out to the greatest possible extent during the installation, allowing the monitoring system to operate properly.

- Favourable flow conditions (little turbulence, acceptable flow rate, pressure, etc.)
- Unadulterated, representative measuring medium
- Measuring medium is in equilibrium state (no gas release, no precipitation, etc.)
- No external interferences (no electric and electro-magnetic interferences by leakage current, earth fault of pumps, electric motors, electric power lines, etc.)
- Easy accessibility (mounting, sampling, functional check, demounting)
- Availability of sufficient space (probe / sensor, installation fitting, controller, etc.)
- Adherence to limit values (see technical specifications located at the end of this manual)

- Power supply for controller (operational reliability, voltage, power, peak free)
- Oil- and particle free compressed-air supply (optional for automatic probe / sensor cleaning)
- Best possible weather and splash water proof conditions
- Shortest possible distances between system components (probe / sensor – controller – compressed-air supply – energy supply)
- Correct dimensioning, mounting and protection of all cables and lines (non-buckling, no risk of stumbling, no damage etc.)

4.2 Installation Notes for ammo::lyser / fluor::lyser

For correct and low-maintenance operation of the sensor please keep the following notes in mind.

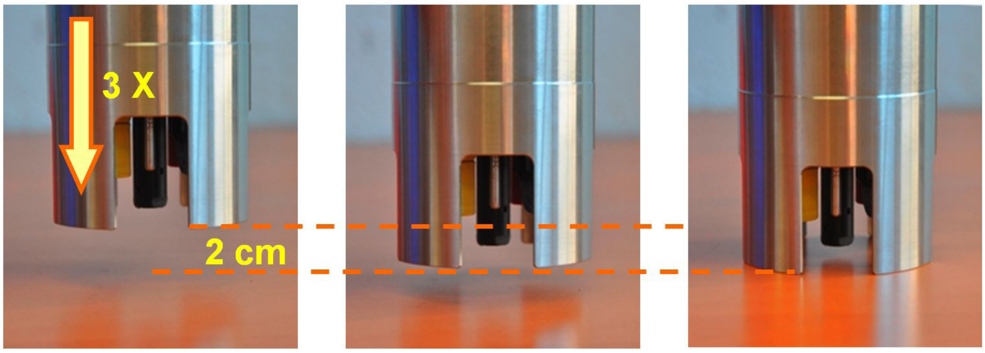
- Never hang the sensor into the water on the sensor cable only or pull it out on the cable only.

- Protective caps have to be removed from the reference- and pH-electrode before installation and shall be stored for later storage or shipment.

- Because each measured medium has a different ion composition and ion concentration, the electrodes need time to adapt to the particular medium (conditioning). Therefore storage of the sensorhead (or of the replacement electrodes) in the measured medium is recommended already several hours before initial startup. Too short conditioning time of the electrodes can result in drifting readings.

- The sensor head has to point downwards when installed. This ensures that no air bubbles inside the electrode will falsify the measured readings. Air bubbles that accumulate on the membrane (both inside and outside) will lead to false, sometimes unstable or jumping readings.

- To remove air bubbles inside the electrodes caused by transport or handling, the sensor has to be knocked onto a flat and hard surface several times carefully straight before installation or any reinstallation (see figures on the right).

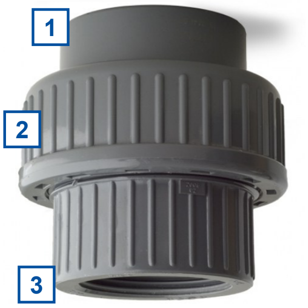


4.3 Mounting with Sensor Carrier

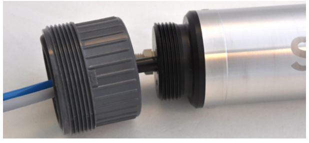
This section explains how the ammo::lyser / fluor::lyser can be installed in the sensor carrier (part-no. F-11-OXI-AMMO). Regarding the dimensions of this installation accessories please refer to section 11.1.3.

The installation of the sensor with this carrier is performed by the following steps:

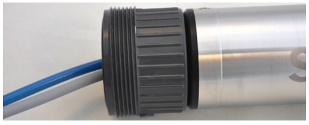
- Separate the sensor carrier into different parts by unscrewing the union nut [2].



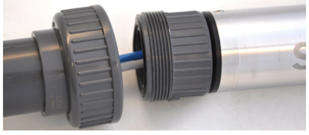
- Fix the insert part of the sensor carrier without thread [1] to the extension pipe [4] (OD 50 mm or $1^{1}/_{2}$ inch - has to be provided by customer) firmly (e.g. using a PVC glue).
- Lead the sensor cable and the air hose for automatic sensor cleaning through the sensor carrier.



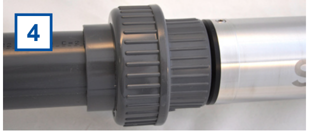
- The part of the sensor carrier with double thread [3] will be screwed on top of the sensor (cable side).



- Lead the sensor cable and the air hose for automatic sensor cleaning through the prepared extension pipe.



- Mount the ammo::lyser / fluor::lyser onto the sensor carrier with the extension pipe using the union nut [2].



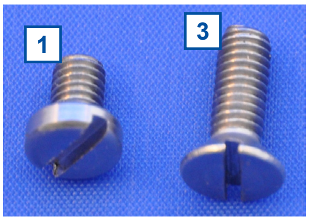
4.4 Mounting in Flow Cell

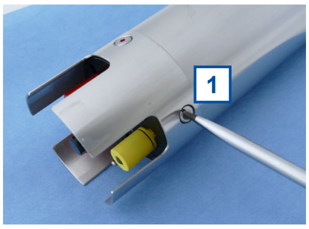
The following sections explain how the ammo::lyser / fluor::lyser can be installed in a flow cell. There are two types of flow cell available, one for tap water (part-no. F-45-AMMO) and one for waste water (part-no. F-48-AMMO). For both flow cells a specific adapter has to be mounted onto the ammo::lyser / fluor::lyser (see section 4.4.1). Regarding the dimensions of these flow cells please refer to section 11.1.4 and 11.1.5.

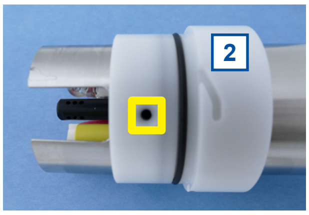
4.4.1 Mounting Adapter of Flow Cell

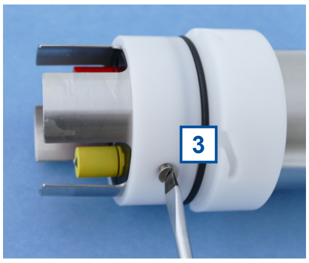
The mounting of the flow cell adapter on the sensor is performed by the following steps:

- Unscrew both slotted screws [1] from the measuring head. Do not screw out the red, sealed, hex socked screws.
- Place the adapter [2] over the measuring head. Align the holes for the fixing screws with the holes in the sensor (see yellow mark in the figure below). Also ensure the correct fit of the o-ring sealing.
- Fix the sensor with two flat head slotted screws [3] which are included in the delivery of the flow cell setup.



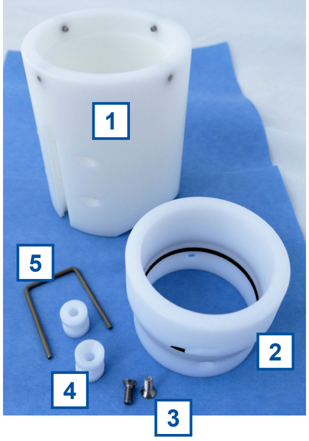






4.4.2 Mounting in Flow Cell for Tap Water

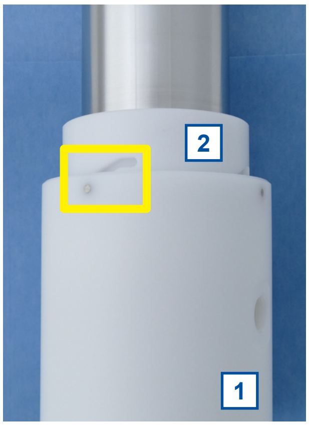
The following parts are included in the delivery of the flow cell F-45-AMMO:

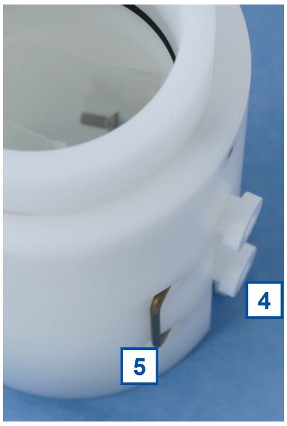


1 Flow cell for tap water
2 Adapter for flow cell
3 2 screws for adapter mounting
4 2 fixing holders for panel mounting
5 Metal bracket for flow cell fixation on panel

Once the flow cell adapter is fixed on the sensor (see section 4.4.1) the installation of the flow cell is performed by the following steps:

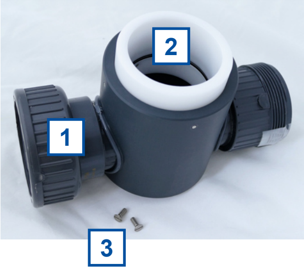
- Place the sensor in the opening of the flow cell in that way, the grooves of the flow cell adapter are aligned with the four metal pins of the flow cell (see yellow mark in the figure on the right).
- Now push the sensor down and turn it clockwise to fix it into the bayonet lock.
- If needed the flow cell can be mounted onto an s::can panel or a flat wall using the 2 fixing holders and the metal bracket.





4.4.3 Mounting in Flow Cell for Waste Water

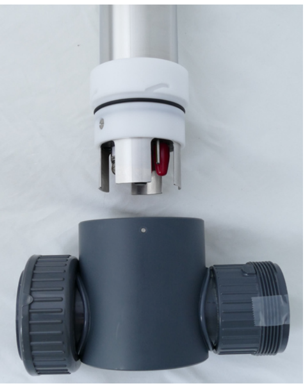
The following parts are included in the delivery of the flow cell F-48-AMMO:

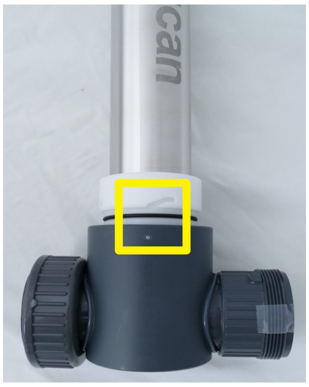


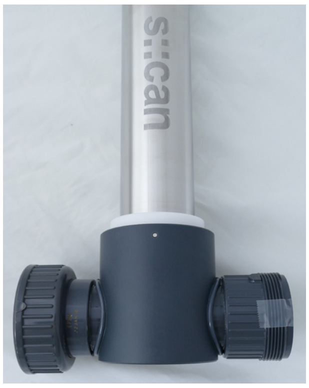
1 Flow cell for waste water
2 Adapter for flow cell
3 2 screws for adapter mounting

Once the flow cell adapter is fixed onto the sensor (see section 4.4.1) the installation of the flow cell is performed by the following steps:

- Place the sensor in the opening of the flow cell in that way, the grooves of the flow cell adapter are aligned with the four metal pins of the flow cell (see yellow mark in the figure on the right).
- Now push the sensor down and turn it clockwise to fix it into the bayonet lock.



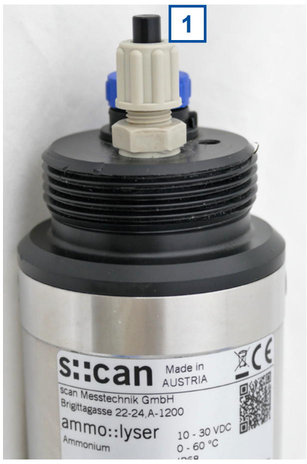


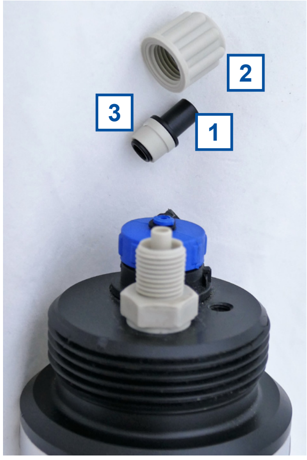


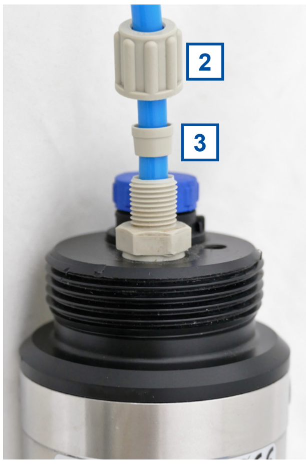
4.5 Connection of automatic Cleaning

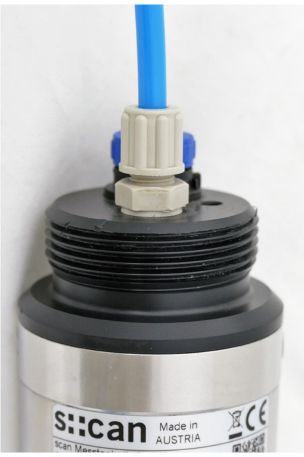
The compressed air connection set (B-41) contains components necessary to connect the sensor cleaning located on top of the ammo::lyser / fluor::lyser to the cleaning valve. The compressed air connection is performed by the following steps (see figures below also):

- Remove dummy insert [1] from pressure connection on top of the sensor by unscrewing the union nut [2] and removing the conical part [3].
- Put the union nut [2] and the conical part [3] over the cleaning hose.
- Push the cleaning hose over the pressure connection (warm up with hot water if necessary).
- Fasten union nut [2] by hand.

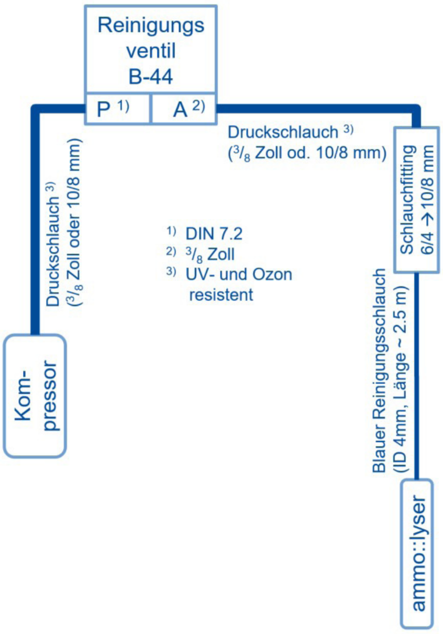








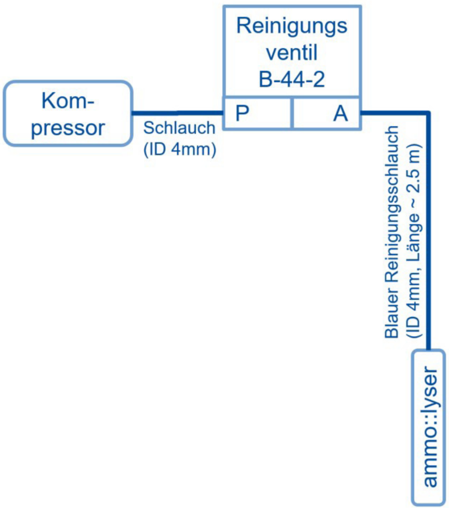
The connection to the cleaning valve depends on the used type of cleaning valve.



- Cleaning valve B-44

A compressed air hose (to be provided by customer, ID 8 mm to 9 mm, UV- / ozone resistant) must be used to connect the adapter fitting of the pressure connection set to the output side of the cleaning valve (marked with A). Fasten the air hose with hose clamps.

Another air hose and DIN 7.2 compressed air coupling are required to hook up the compressed air supply to the input side of the cleaning valve (marked with P).



- Cleaning valve B-44-2

The adapter fitting of the pressure connection set can be removed to connect the blue tube directly to the push-pull fitting of the cleaning valve. The same type of tube can be used to connect the cleaning valve to the s::can compressor.

The cleaning valve should never be connected to the compressed air coupling of your compressor directly, i.e. without a pressure hose in between. The total length of hoses should be as short as possible to avoid unnecessary pressure loss. In special occasions, drinking water may be used to operate the hydraulic-pneumatic cleaning appliance instead or compressed air.

Any foreign matter in the compressed air supply may impair the hydraulic-pneumatic cleaning process. If you have any doubts about the purity of the air used (contamination by particles, oil, etc.), please install an appropriate filter upstream from the solenoid valve.

In areas with extremely low ambient air temperature, s::can recommends laying the compressed air hoses such that they remain frost-free to prevent freezing of condensed water in the compressed air hose.

Please note that depending on the s::can probe and sensor type you are using, different maximum allowed pressures may be specified. In case a central pressurised air supply is used in such a case the lowest maximum allowed pressure amongst those specified for the individual instruments is to be used to supply all instruments or the use of pressure reducing valves to supply each instrument with the correct pressure is necessary.

In order to ensure proper operation of the automatic cleaning s::can highly recommends to use s::can compressor optimized for compressed air supply of all probes and sensors.

5 Initial Startup

Once the assembling, mounting and installation of the sensor have been completed and checked (see chapter 4) the initial startup of the s::can monitoring system will require the following actions, in the order presented below:

- Connect the sensor to the controller used for operation (see section 5.1 and 5.2).
- Establish power supply to the controller (please refer to the manual of the controller) and wait until the operation software has started up.
- Perform initialisation of the sensor. Refer to section 5.3.1 in case of using a con::lyte D-31x, refer to section 5.3.2 in case of using con::lyte D-320 and refer to section 5.3.3 in case of using con::cube with moni::tool.
- Perform parameterisation of the sensor. Refer to section 5.4.1 in case of using a con::lyte D-31x, refer to section 5.4.2 in case of using con::lyte D-320 and refer to section 5.4.3 in case of of using con::cube with moni::tool.
- Configure the measuring interval; additional information can be found in the respective manual of the controller.
- If required, configure the digital, analogue and fieldbus outputs of the controller.
- Check the readings obtained for plausibility after sufficient running-in time (see section 12 regarding running-in time).
- If required, calibrate the readings of the sensor in stable water quality (see chapter 6).

5.1 Controller for Operation

For proper operation of the sensor you will need one of the following controller and operating software respectively.

Controller	Type	Software
con::lyte	D-318, D-319	V5.01 or higher
con::lyte	D-320	V7 or higher
con::cube	D-315	moni::tool V2 or higher

⚠ s::can recommends to use the most current version of the operating software on the controller. For service operation with ana::pro please refer to section 10.4.2.

5.2 Connection to the Controller for Operation

The sensor will be delivered either with fixed cable or with a plug connection on the sensor itself. In case of plug connection the connection cable C-1-010 has to be used to connect the sensor to a compatible socket provided on the controller. Ensure that the sensor plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.

In case the controller does not supply enough sockets, the distribution box for sensors C-41-HUB can be used.

5.3 Probe Initialisation

For operating one or several probes using one operation terminal it is necessary to allocate an individual address to every probe. This can be done during probe initialisation at which the probe has to be recongnized first by the ontroller for operation and then a modification of the actual (preset) probe address might be performed. The corresponding address will be stored on the respective probe. For s::can probes and sensors of the same type the same address is preset ex factory.

5.3.1 Probe Initialisation using con::lyte D-31x

⚠ The con::lyte should not be powered down or switched off during the initialisation process. In case of rebooting of the con::lyte during the initialisation process (e.g. caused by loss of power supply) the complete procedure of probe initialisation has to be repeated.

- Establish the power supply to the con::lyte and select entry *Settings / Parameter settings / Install Probes* in the main menu.
- Connect the sensor to the con::lyte (see section 5.2).
- Push the button *Enter*, which starts the automatic search procedure for the connected probe. Once the probe is found, address 1 will be allocated. This procedure can last several seconds (see figures below).
- The successful completion of the initialisation will be displayed over a user message. If this message is displayed the initialisation procedure can be finished by pushing the button *Esc*.

```
Install probe 1
Connect only
probe 1
Continue with ENTER
Stop with ESC
```

```
Install probe 1
Searching for probe
```

```
Install probe 1
Probe search finished
ammo::lyser found
Continue with ENTER
Stop with ESC
```

A user message will also be displayed when no sensor is detected. In this case please check the following before repeating the procedure for probe initialisation:

- Is only one sensor connected to the con::lyte?
- Is the sensor connected properly?
- Are all wires of the con::lyte socket in the terminal compartment tight?

```
Install probe 1
Probe search finished
No probe found
Continue with ENTER
Stop with ESC
```

5.3.2 Probe Initialisation using con::lyte D-320

At the initial start-up the con::lyte D-320 provides an automatic probe and sensor initialisation procedure (see screen on the right). After connecting all probes and sensors to the appropriate plugs of the con::lyte (see section 5.2) and pushing the *OK* button, the probe and sensor initialisation starts.

```
Add s::can sensor...
Please connect all
sensors and press
OK to continue...
```

If sensor will be initialized at a later date, the following steps are needed:

- Switch to Status display by using the *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select menu *Add sensor ...* and confirm with *OK*.
- Connect sensor to the D-320 (see section 5.2).
- Select menu *Add s::can sensor ...* and confirm with *OK*.

```
Add new Sensor
Add 0/4-20mA...
Add digital in...
Add s::can sensor...
```

As soon as the entry is confirmed by pushing the *OK* button, the con::lyte will automatically search the Modbus port for a new sensor and will add the new sensor to the sensor list.

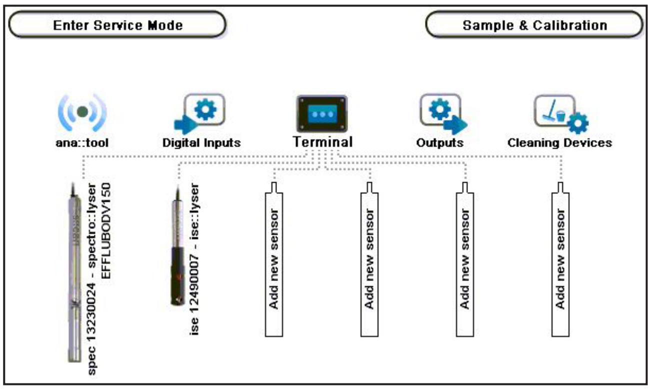
```
Add s::can Sensor...
Searching    17/20
F:    ammo::lyser/0/9
A:    ammo::lyser/0/9
```

After adding a new probe or sensor, the parameters will be displayed in the parameter screen. Furthermore single parameter can be added manually (see section 5.4.2 and menu *Add parameters...*). In case the installation failed, the message *Error adding!* will be displayed.

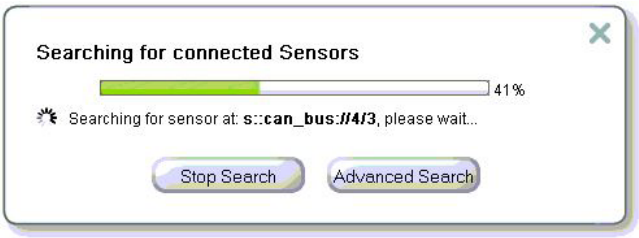
```
Add s::can Sensor...
Done. Press OK...
Added sensors:      1
Replaced sensors:   0
```

5.3.3 Probe Initialisation using moni::tool

- Click the *Service* tab of the moni::tool screen and logon as *Administrator*.
- Click on an empty sensor icon (*Add new Sensor*) to initiate the initialisation process.



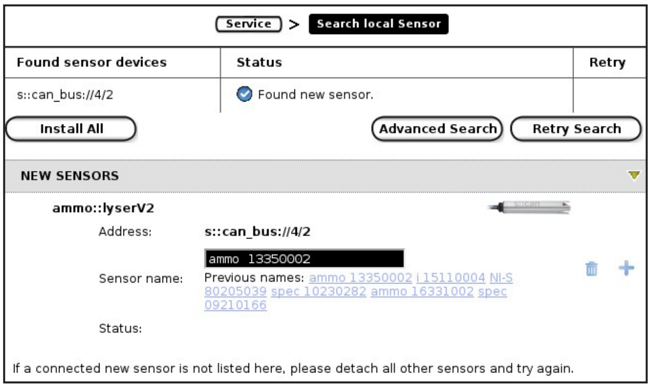
- An automatic search procedure will start, searching for the connected sensor.


Searching for connected Sensors

41 %

Searching for sensor at: **s::can_bus://4/3**, please wait...

- When the automatic search prodedure is finished, moni::tool will display all connected probes and sensors. Those sensors that are connected for the first time will have the Status *Found new sensor* (also listed as *New Sensors* below).
- If needed *Sensor name* can be modified now, which can be any descriptive name you desire or select one of the previous names listed below this entry field.
- To install the new sensor click on the blue *+* sign on the right side of the sensor or push the button *Install All*.
- moni::tool will install the sensor and switch to the *Service* tab showing the new sensor in the system overview. Now pushing the button *Leave Service Mode* located on the upper left side to start the measuring process.



Found sensor devices	Status	Retry
s::can_bus://4/2	Found new sensor.	

NEW SENSORS

ammo::lyserV2

Address: **s::can_bus://4/2**

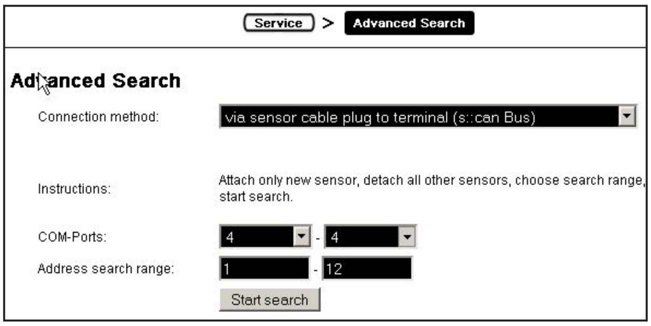
Sensor name: ammo 13350002

Previous names: ammo 13350002 i 15110004 NI-S 80205039 spec 10230282 ammo 16331002 spec 09210166

Status:

If a connected new sensor is not listed here, please detach all other sensors and try again.

- When pushing the button *Advanced Search* (see 2nd and 3rd figure from the top), the method you connected the sensor (*Connection methode)*, the used *COM-Port* and the *Address* can be defined. A click on button *Start search* will start search procedure within the defined range.



Advanced Search

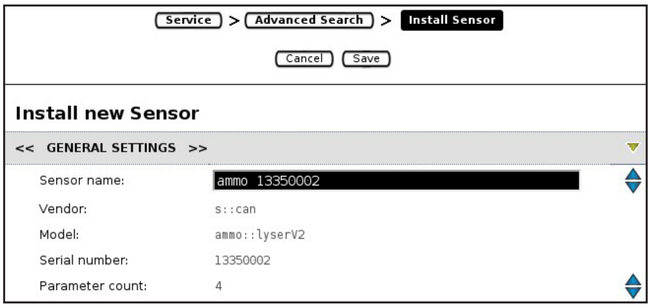
Connection method: via sensor cable plug to terminal (s::can Bus)

Instructions: Attach only new sensor, detach all other sensors, choose search range, start search.

COM-Ports: 4 - 4

Address search range: 1 - 12

- After the *Advanced Search* is finished, the *Install Sensor* screen is displayed. Depending on the used *Service Level* (*Basic*, *Advanced* or *Expert*) only the basic or all information received from the sensor are listed up.
- To install the new sensor push the button *Save* in the upper part of the window.



Install new Sensor

<< GENERAL SETTINGS >>

Sensor name: ammo 13350002

Vendor: s::can

Model: ammo::lyserV2

Serial number: 13350002

Parameter count: 4

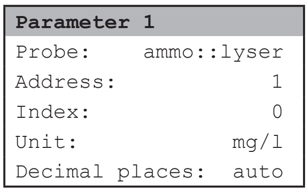
5.4 Probe Parameterisation

An overview of the parameters that can be measured with the different types of ammo:lyser / fluor::lyser can be found in section 3.3.

5.4.1 Probe Parameterisation using con::lyte D-31x

After successful probe initialisation (see section 5.3.1) the measuring parameters of the ammo::lyser / fluor::lyser will be displayed on the display of the con::lyte automatically. If needed the measuring parameters can be configured individually using the menu item *Settings / Parameter settings / Parameter n* (*Settings / Parameterconfig / Parameter n* with older versions).

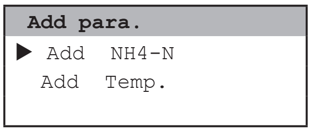
The name of the *Probe* or sensor used as a source of the parameter is displayed in the upper line (e.g. ammo::lyser). If several probes or sensors are installed the instrument from which a parameter needs to be displayed can be selected here. Under the entry Probe the *Address* that has been allocated to that probe is displayed as an additional information. The *Index* specifies the place of the corresponding parameter onto the allocated probe. The *Unit* of the selected parameter is displayed in the line below. The item *Decimal places* enables settings of the number of displayed decimal places (between *0* and *4*). With the default setting *auto* the number of decimal places will be automatically set by the sensor.


```
Parameter 1
Probe:    ammo::lyser
Address:            1
Index:              0
Unit:            mg/l
Decimal places:  auto
```

5.4.2 Probe Parameterisation using con::lyte D-320

After successful probe initialisation (see section 5.3.2) the needed measuring parameters of the ammo::lyser / fluor::lyser have to be added to the parameter display. This is performed by the following steps:

- Switch to status display with *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select *ammo::lyser/0/x* and confirm with *OK*.
- Select menu *Add parameters...* and confirm with *OK*.
- Select needed parameter and confirm with *OK*.

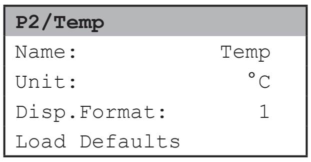

```
Add para.
▶ Add  NH4-N
  Add  Temp.
```

The selected parameter will be displayed now on the next free position of the parameter display. The default display configuration is used. Changing the display format is performed by the following steps:

- Select the parameter in the parameter display using *Up-* or *Down* button.
- Push *Function* button, select menu *Display settings...* and confirm with *OK*.
- Select *ammo::lyser/0/x* and confirm with *OK*.
- Select menu *Add parameters...* and confirm with *OK*.
- Select needed parameter and confirm with *OK*.

In the displayed parameter configuration the following settings can be modified.

- *Name* Displays the actual name of the paramter.
- *Unit* Displays the actual unit of the paramter.


```
P2/Temp
Name:            Temp
Unit:              °C
Disp.Format:        1
Load Defaults
```

To change the name or unit of the parameter, select the entry with *Up-* and *Down* buttons and by pushing the *OK* button the name can be changed with *Up-*, *Down-*, *Left-* and *Right* buttons. Pushing the *OK* button confirms the new name.

Please note that change of parameter name or unit will not change the parameter configuration itself (e.g. if you change the parameter name NO_3-N to NO_3 the reading will still be NO_3-N).

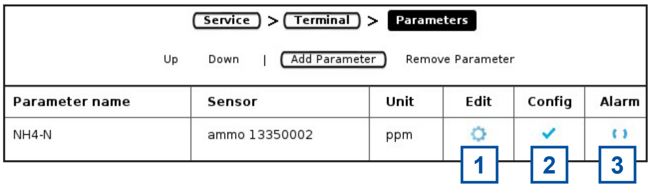
- *Disp.Format* Within this line the number of displayed decimal places (between 0 and 5) can be set. Please note that in case of too many digits high values can not be displayed and the parameter reading will switch to plus signs (++.+++++).

- *Load Defaults* Confirming this entry by pushing the *Ok* button will restore the default display settings from the sensor.

All modifications performed by the operator within these settings menu will be documented in the configfile of the con::lyte (see manual con::lyte D-320).

5.4.3 Probe Parameterisation using moni::tool

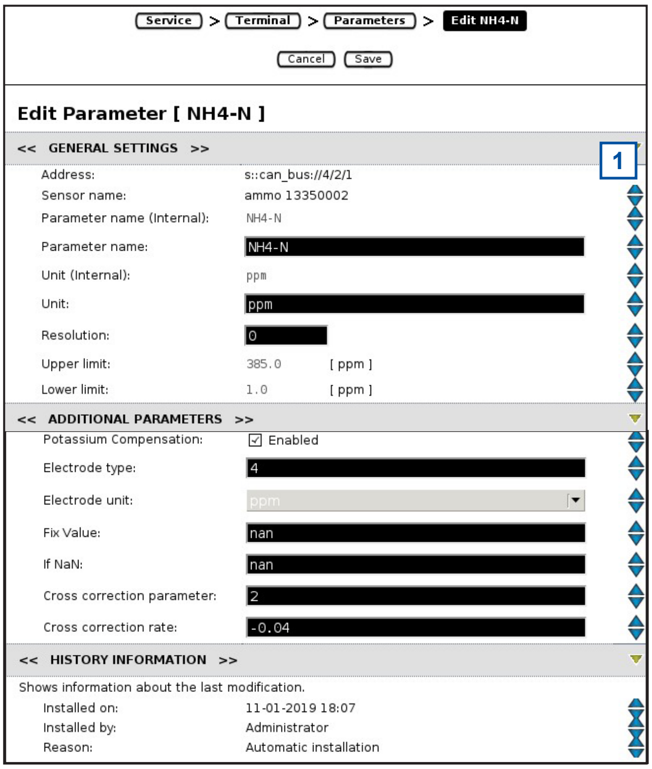
After successful probe initialisation (see section 5.3.3) all parameters available on the probe will be installed and automatically displayed on the *Value* screen of moni::tool. If not all new parameters are displayed, please check the maximum number of parameters of your monit::tool license. If you want to configure the measuring parameters induvidually this can be done using the menu item *Service / Terminal / Parameter*.



Parameter name	Sensor	Unit	Edit	Config	Alarm
NH4-N	ammo 13350002	ppm	⚙	✓	( )

After selecting that menu item a list of all installed parameters is displayed. After selecting one or several parameters by clicking on them the following activities can be performed:

- Moving the selected parameter to a higher position in the *Value* display by pushing the entry *Up*.
- Moving the selected parameter to a lower position in the *Value* display by pushing the entry *Down*.
- Deleting the selected parameter from *Value* display by pushing the entry *Remove Parameter*.
- A new parameter can be added by pushing the entry *Add Parameter*.
- Click on the blue wheel (*Edit*) on the right hand side of the parameter will display the actual parameter settings. Depending on the actual *Service Level* different settings are displayed and can be edited. *Parametername*, *Unit* and *Resolution* can be modified in the *Basic* level.
- On a higher *Service Level* (*Advanced*, *Expert*) the *Additional Parameters* can be configured.



Edit Parameter [NH4-N]

<< GENERAL SETTINGS >>

Address: s::can_bus://4/2/1
Sensor name: ammo 13350002
Parameter name (Internal): NH4-N
Parameter name: NH4-N
Unit (Internal): ppm
Unit: ppm
Resolution: 0
Upper limit: 385.0 [ppm]
Lower limit: 1.0 [ppm]

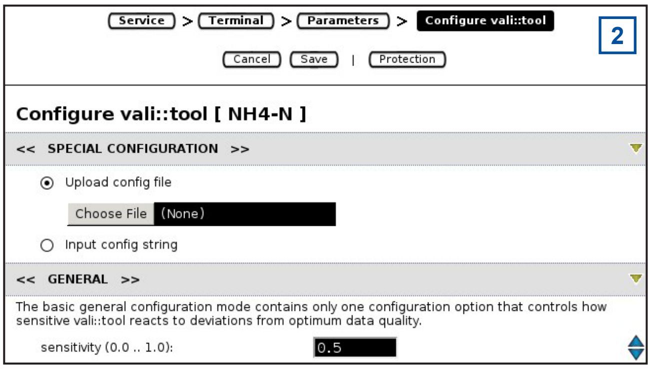
<< ADDITIONAL PARAMETERS >>

Potassium Compensation: ☑ Enabled
Electrode type: 4
Electrode unit: ppm
Fix Value: nan
If NaN: nan
Cross correction parameter: 2
Cross correction rate: -0.04

<< HISTORY INFORMATION >>

Shows information about the last modification.
Installed on: 11-01-2019 18:07
Installed by: Administrator
Reason: Automatic installation

- Click on the blue check mark (*Config*) on the right hand side of the parameter to check or modify the settings for vali::tool of this parameter. The *Basic* screen is displayed on the right. Please refer to the manual moni::tool for further information.



Configure vali::tool [NH4-N]

<< SPECIAL CONFIGURATION >>

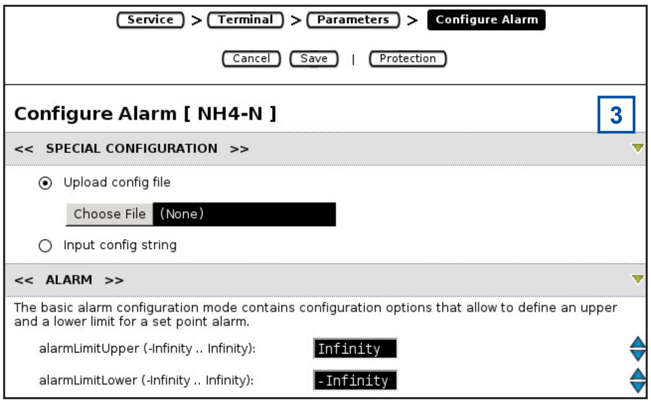
● Upload config file
Choose File (None)
○ Input config string

<< GENERAL >>

The basic general configuration mode contains only one configuration option that controls how sensitive vali::tool reacts to deviations from optimum data quality.

sensitivity (0.0 .. 1.0): 0.5

- Click on the next blue sign (*Alarm*) on the right hand side of the parameter to check or modify the alarm settings for this parameter. The basic screen is displayed on the right. Please refer to the manual moni::tool for further information.



Configure Alarm [NH4-N]

<< SPECIAL CONFIGURATION >>

● Upload config file
Choose File (None)
○ Input config string

<< ALARM >>

The basic alarm configuration mode contains configuration options that allow to define an upper and a lower limit for a set point alarm.

alarmLimitUpper (-Infinity .. Infinity): Infinity
alarmLimitLower (-Infinity .. Infinity): -Infinity

6 Calibration

The ammo::lyser / fluor::lyser is equipped with quality certified measuring electrodes and ready for use. Because the electrodes have to adapt to the composition of the measured medium (background matrix), a certain time for conditioning is needed (see technical specifications). As soon as the measurement is stable, a matrix adaption (local calibration) can be performed if needed.

6.1 Types of Calibration

The ammo::lyser / fluor::lyser is equipped with a global calibration (factory setting) for each installed electrode. A reset to this global calibration is possible at any time. The table below can be used as assistance, to decide which calibration type shall be used:

Global Calibration	Local Calibration	
	Offset Calibration with 1 Sample	Linear Calibration with 2 Samples
■ At initial startup ■ During conditioning ■ After electrode replacement ■ In case of failed (not accepted) linear calibration	■ At initial startup, in case reading does not correlate with reference value after completed conditioning (matrix adaption). ■ If sensor displays zero, although concentration in measured medium is > 0.3 mg/l ■ If sensor displays stable reading > 0.3, although concentration in measured medium = 0. ■ During routine functional check to adapt the reading to the reference value. ■ If readings are drifting to higher concentrations. ■ After electrode replacement, in case reading does not correlate with reference value after completed conditioning and activated global calibration.	■ If reading correlates with reference value at lower concentrations, but differs at higher concentration. ■ If higher accuracy of measurements is required. ■ If measurement range shall be changed. ■ When the electrode is aged, but shall not be replaced yet (adaption of electrode slope).

6.2 Notes for Calibration Procedure

- The local calibration can be performed either directly in the measured medium without removing the sensor from the installation place (recommended) or outside in a beaker (min. 250 ml) with calibration solution.

- First the temperature, then pH and Potassium and finally the other ISE electrodes shall be calibrated.

- Before performing any kind of calibration ensure appropriate conditioning time of the sensor (see technical specifications).

- Before performing a local calibration ensure the correct function of the sensor (see section 8).

- During calibration ensure that the complete measuring head (i.e. all electrodes) are submersed into the measuring medium and protective caps are removed.

- The temperature sensor can be calibrated on air or in the measuring medium towards a reference thermometer.

- If a linear calibration was performed outside the measuring medium successfully and there is still a difference between the real concentration in the measuring medium and the sensor reading after installation, an offset calibration shall be performed directly in the measuring medium additionally.

A local calibration is performed by the following steps:

1 Check sensor readings:

- Check on the controller for operation, if the sensor readings are stable (no jumps, no scattering, no drift) for at least 5 consecutive measurements.
- Open calibration menu and wait until displayed quality number is > 0.9.

2 Take sample & store actual reading:

- Push button *Sample* to store the actual reading on the sensor. The previous sample value will be overwritten.
- Take a sample for reference measurement at the same time close-by the measuring electrode.
- Now you can switch the controller for operation back to normal measuring mode.

3 Analyze reference sample:

- If required, filtrate and stabilise the reference sample.
- Analyse the reference sample as soon as possible.

4 Performing local calibration:

- Open calibration menu on controller for operation.
- Enter the reference value of the appropriate sample.
- Check if the desired calibration type (offset, linear) is selected.
- Perform the calibration by pushing the calibrate button.

5 Check sensor readings:

- Wait if any error message is displayed.
- Wait for next measurement.
- Check if reading is plausible and no status error is displayed.

6.3 Special Notes for Calibration of ISE Electrodes

Ion type, ionic strength and other characteristics of the measuring medium will significantly affect the results obtained with the ion selective electrodes. For highest accuracy the same environment conditions (temperature, flow velocity, pH) shall be ensured during the calibration procedure like during the normal operation. Therefore it is recommended to perform calibration directly in the measured medium with sensor installed. Ideally, two samples are used which were taken at different times, and represent the high and low values of the measuring range that is expected in the application.

If standard solutions are needed for calibration, never use normal standards ready for use, because these are made with distilled water and will never represent a natural ion background matrix. Standard solutions can be made quickly and easily with the real measured medium or drinking water by adding high concentrated standards (spiking).

The table on the right shows a selection of possible standards that can be used for spiking the samples.

Name	Concentration 1)
Ammonium Standard Solution	1000 mg/l NH4-N
Potassium Standard Solution	1000 mg/l K
Nitrate Standard Solution	1000 mg/l NO3-N
Chloride Standard Solution	1000 mg/l Cl
Fluoride Standard Solution	1000 mg/l F

1) The Ammonium concentration of 1 liter sample can be increase by 10 mg/l by adding 10 ml of standard.

- The samples used for a two point calibration should represent the total measuring range, but the concentration difference must not be more than a factor 100.

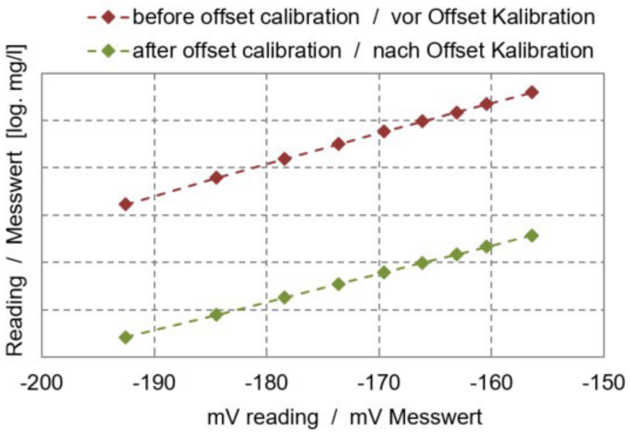
- As a general rule sample 1 should be approx. 2.5 % and sample 2 should be approx. 90 % of the max. measured concentration.

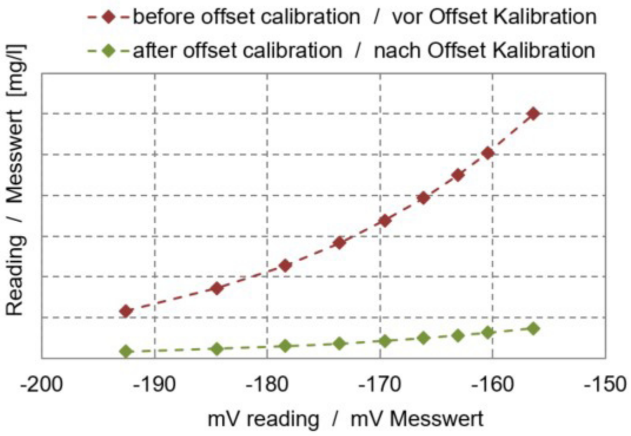
- The upper measuring range will be redefined by a linear calibration (higher lab value + 10%). Higher values will be displayed but System Status will be set to Warning. That means, if high sample with NH4-N = 18 mg/l is used, the upper measuring range will be 18 + 10% = 19.8 mg/l.

Within the table below you will find two further examples for sample spiking with 1000 mg/l standard:

Sample 1	Concentration	Standard added	Concentration of Sample 2	New Measuring Range
1.0 liter	0.3 mg/l	5 ml	5.3 mg/l	0 - 5.83 mg/l
0.5 liter	2.8 mg/l	10 ml	22.8 mg/l	0 - 25.08 mg/l

The local calibration is applied to the raw value (mV readings) and not to the calculated concentration (mg/l value). The correlation between mV and mg/l value is not linear but logarithmic. That means performing an offset calibration will not change the mg/l readings by a constant factor. The two figures below are showing the effect of an offset calibration.

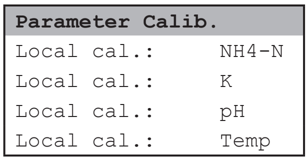




6.4 Performing a Calibration

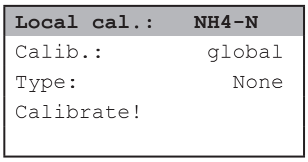
6.4.1 Calibration using con::lyte D-31x

The *Calibration* entry in the con::lyte main menu leads you into the menu that enables the calibration of the sensor. When *Calibration* is selected a password must be entered (password = 1) before the calibration can be started. The next step is selection of the parameter to be calibrated (e.g. NH4-N) in the selection field *Parameter Calib*.



```
Parameter Calib.
Local cal.:      NH4-N
Local cal.:      K
Local cal.:      pH
Local cal.:      Temp
```

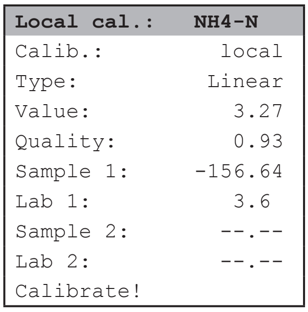
Now the menu for local calibration will appear. As long as the sensor is working with factory calibration (default) the entry *Calib.* shows *global* and no *Type* can be selected (as displayed on the right hand side). The entry *Calibrate!* has to be confirmed by pushing *Enter* if the actual used local calibration shall be replaced by the global one.



```
Local cal.:    NH4-N
Calib.:       global
Type:           None
Calibrate!
```

To perform a local calibration the entry *Calib.* has to be changed from *global* to *local*. Then below the entry *Type* will show *Offset* as one possible type of calibration. The *Type* can be changed to *Linear* also.

The display shows the sensor reading of the parameter actually measured and displayed (*Value*) as well as the quality number of this reading (*Quality*). The quality can vary between 0 (bad) and 1 (perfect) and should be > 0.9 when storing the displayed value as a sample.



```
Local cal.:    NH4-N
Calib.:        local
Type:         Linear
Value:          3.27
Quality:        0.93
Sample 1:    -156.64
Lab 1:           3.6
Sample 2:      --.--
Lab 2:         --.--
Calibrate!
```

In the next line the parameter concentration stored on the sensor as first sample for offset calibration (*Sample 1*) is displayed. As long as no sample is stored on the sensor the display will show dashes. When confirming the entry *Sample 1* by pushing *Enter* the raw signal of the actually measured (displayed) parameter concentration will be stored as new sample on the sensor.

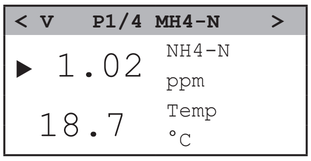
On the entry *Lab 1* the result (real parameter concentration) corresponding to the reading stored under *Sample 1* can be entered here.

Only if calibration type *linear* is selected, the values for *Sample 2* and *Lab 2* are visible on the display and can be modified.

⚠ When the entry *Calibrate!* is confirmed by pushing *Enter*, the calibration is performed. Successful calibration is shown in a user message (*Please wait* and then *Local calib. saved*). If the calibration was not successful (user message *Local calib. Error!*) the previous calibration will be used further on.

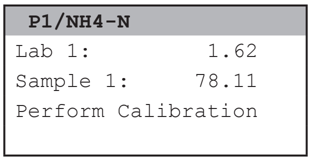
6.4.2 Calibration using con::lyte D-320

This operating controller provides, beside normal calibration procedure (see further down), the possibility for a quick calibration call directly from the parameter view. This is performed by following steps:



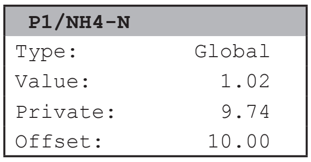
```
< V    P1/4 MH4-N      >
▶ 1.02    NH4-N
          ppm
  18.7    Temp
          °C
```

- Select the parameter in the parameter display with *Up-* or *Down* button.
- Push *OK* button, which directly displays the calibration screen.
- Select *Sample 1* and confirm with *OK* to store the raw signal of the actual reading.
- Take a water sample to analyse real parameter concentration.
- Enter the result from laboratory analyse into the field *Lab 1*.
- Select entry *Perform Calibration* and confirm with *OK*.
- Leave the calibration screen with *Back* button.



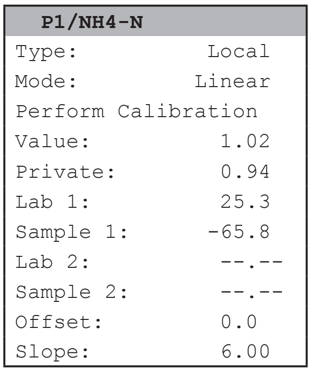
```
 P1/NH4-N
Lab 1:          1.62
Sample 1:      78.11
Perform Calibration
```

The advanced local calibration provides extensive possibilities for calibration of measurement parameter. After selecting the parameter in the parameter display, pushing the *Function* button, selecting the menu *Calibrate expert...* and pushing the *OK* button, the calibration screen is displayed.



```
 P1/NH4-N
Type:          Global
Value:           1.02
Private:         9.74
Offset:         10.00
```

- *Type* Two different types of calibration are available: *Local* or *Global*. By default *Local* is selected. This is the normal calibration performed by the operator. As soon as *Global* is selected an confirmed with OK a reset of this parameter to factory calibration is performed and the actual reading (*Value*), the raw signal (*Private*) and the default offset (*Offset*) will be displayed.
- *Mode* As available local calibration variants either *Offset* or *Linear* can be selected.



```
  P1/NH4-N
Type:           Local
Mode:          Linear
Perform Calibration
Value:           1.02
Private:         0.94
Lab 1:           25.3
Sample 1:       -65.8
Lab 2:          --.--
Sample 2:       --.--
Offset:           0.0
Slope:           6.00
```

- *Perform Calibration* Confirming this entry by pushing the *Ok* button will execute the local calibration, using the *Lab* and *Sample* values displayed on the calibration screen.
- *Value* Displays the measured value of the sensor like on the parameter screen also (i.e. using the actual calibration). The value will be updated permanently.
- *Private* Displays the quality number of this reading. The quality can vary between 0 (bad) and 1 (perfect) and should be > 0.9 when storing the displayed value as a sample.The value will be updated permanently.
- *Lab 1* Within this line the correct value for the measured *Sample 1* has to be entered. The entered *Lab* value can be either the laboratory result of the sample taken or the concentration of the standard solution, which is used for calibration. The unit of the lab value has to be in accordance with the measuring parameter.

  An entered *Lab* value can be deleted by selecting it and pushing the *Function* button so that it will not be used in the calibration.
- *Sample 1* When confirming this entry by pushing the *Ok* button, a measurement will be performed and stored as sample 1 for the local calibration. The sample for the laboratory should be taken at the same time. The displayed and stored value, which will be used for the calibration might be a raw value (e.g. mV value) and therefore might also be negative.

  Existing readings (*Sample 1* or *Sample 2*) are overwritten whenever a new measurement was performed or if the measurement was invalid, the message *Measure!* will be displayed instead of a numerical value.
- *Slope* Displays the used slope of the actual calibration. It is not possible to edit this value.

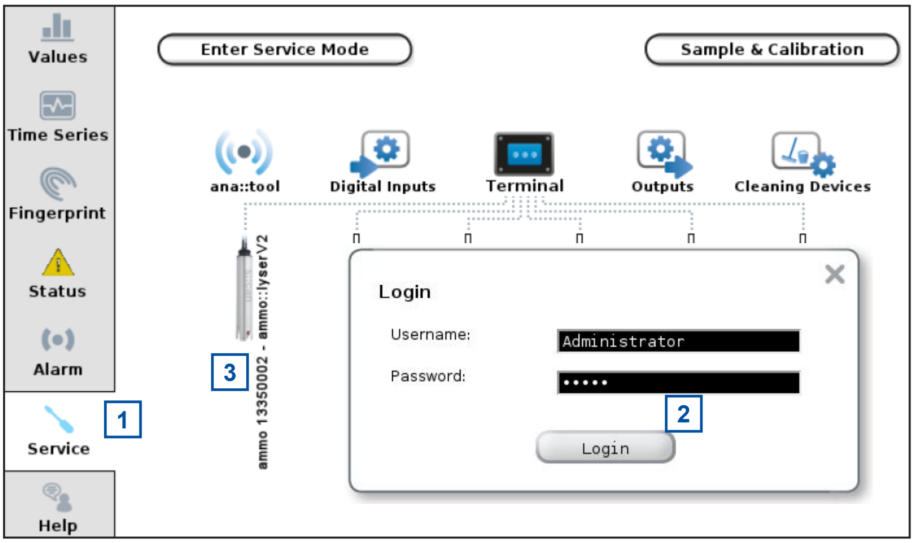
6.4.3 Calibration using moni::tool

1 Click the *Service* tab on the moni::tool screen.

2 Logon as *Administrator* with password *admin1* or your individual username.

3 Click the icon of the sensor you want to calibrate in the displayed system overview.

4 Click the icon *Calibrate sensor* in the next screen.



Username: Administrator

Password: •••••

Now the screen shows a list of all parameters being measured by this sensor (*Parameter name*).

5 Clicking on the blue triangles will open more information about actual used calibration for this parameter.

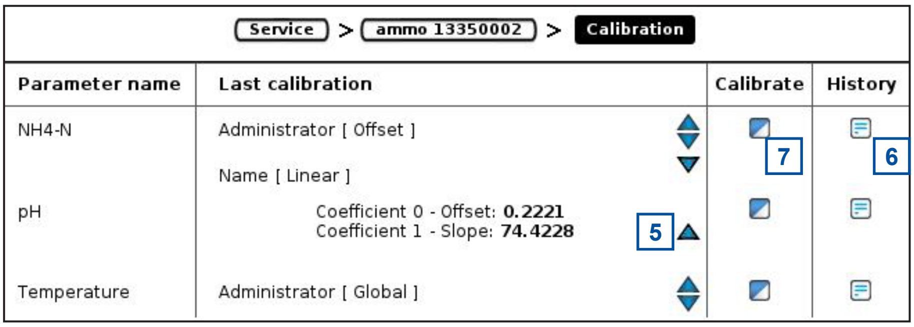
6 Furthermore a click on the *History* icon rightmost opens a logbook showing all up to now with this con::cube performed calibration procedures.

7 Open the calibration screen by clicking on the *Calibrate* icon on the right side of the parameter you want to calibrate.

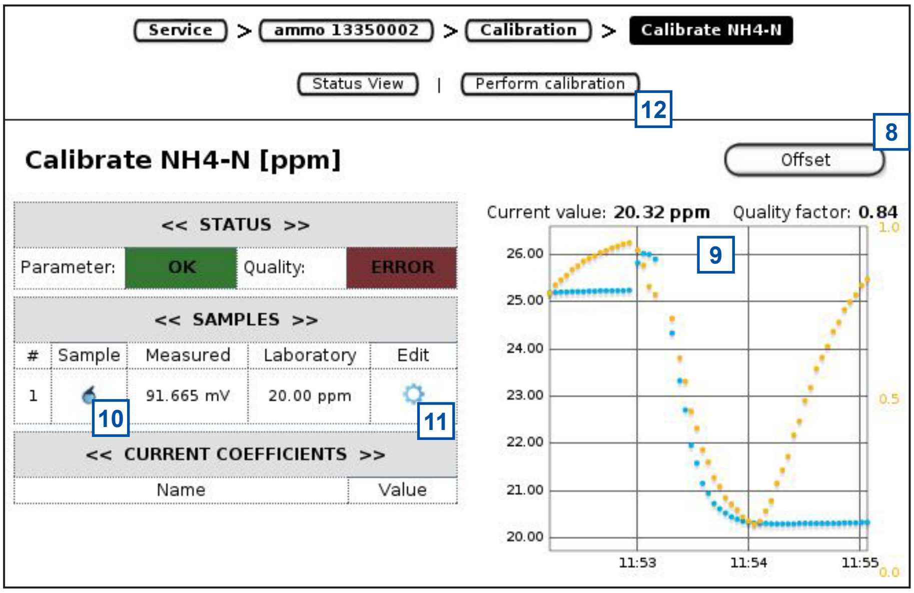
8 This button displays the actual used calibration (*Global*, *Offset* or *Linear*). Push this button to select the type of calibration you want to perform.

9 Watch the current readings and the quality being displayed numerically and graphically on the calibration screen. Wait until readings are stable (*Quality OK*).

10 Push the *Sample* icon to store the actual reading on the sensor. Please note that the displayed value is the raw value (mV reading).



Parameter name	Last calibration	Calibrate	History
NH4-N	Administrator [Offset]		
pH	Name [Linear] Coefficient 0 - Offset: **0.2221** Coefficient 1 - Slope: **74.4228**		
Temperature	Administrator [Global]		



Calibrate NH4-N [ppm]

Parameter: OK Quality: ERROR

#	Sample	Measured	Laboratory	Edit
1		91.665 mV	20.00 ppm	

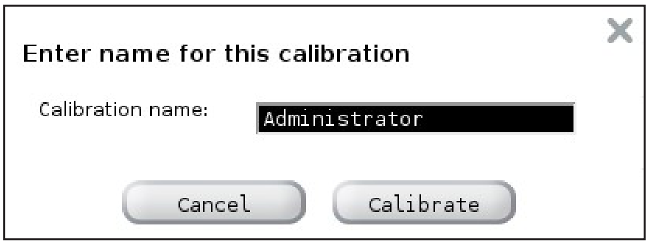
Name	Value

Current value: **20.32 ppm** Quality factor: **0.84**

11 Push the *Edit* icon to enter the result of the laboratory analysis and store it on the sensor.

12 Push the button *Perform calibration* to start the calibration procedure.

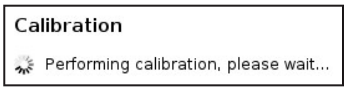
- After pushing the *Perform Calibration* button an individual name can be entered to describe the calibration (*Calibration name*).



Enter name for this calibration

Calibration name: Administrator

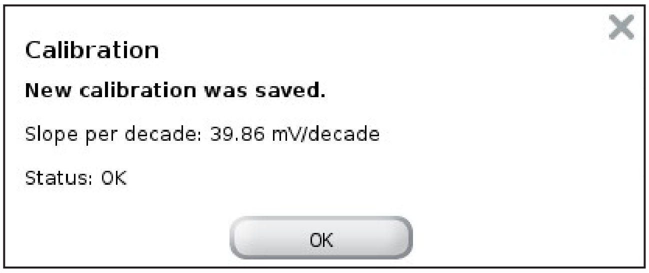
- During the calibration process a message is displayed on the screen (see figure on the left).



Calibration

Performing calibration, please wait...

- After the calibration procedure is finished a user message will inform the operator, if the local calibration was successful (see figure on the right) or not (see figures below).



Calibration

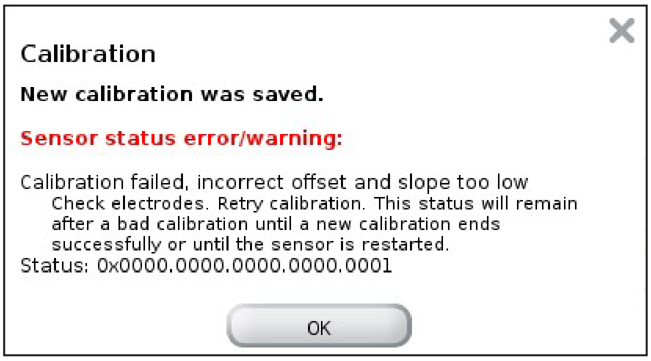
New calibration was saved.

Slope per decade: 39.86 mV/decade

Status: OK

⚠ The calculated *Slope per decade* will be displayed in case of a linear calibration. This might help to judge the electrode quality (see section 8.5).

- If the offset of the local calibration is incorrect or the slope is too low, the displayed user message will look as shown on the right.



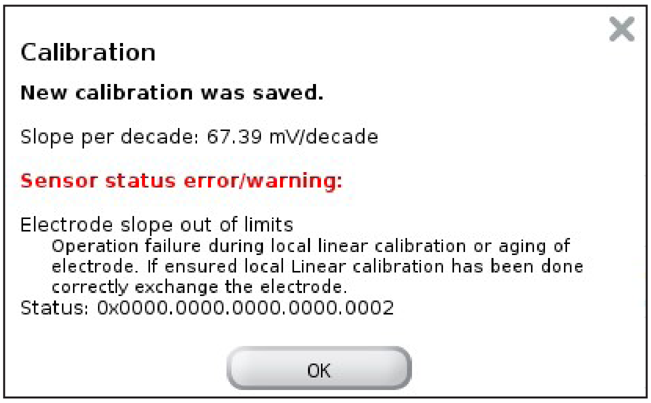
Calibration

New calibration was saved.

Sensor status error/warning:

Calibration failed, incorrect offset and slope too low
Check electrodes. Retry calibration. This status will remain after a bad calibration until a new calibration ends successfully or until the sensor is restarted.
Status: 0x0000.0000.0000.0000.0001

- If the slope of the local calibration is too high, the user message will look as shown on the right.



Calibration

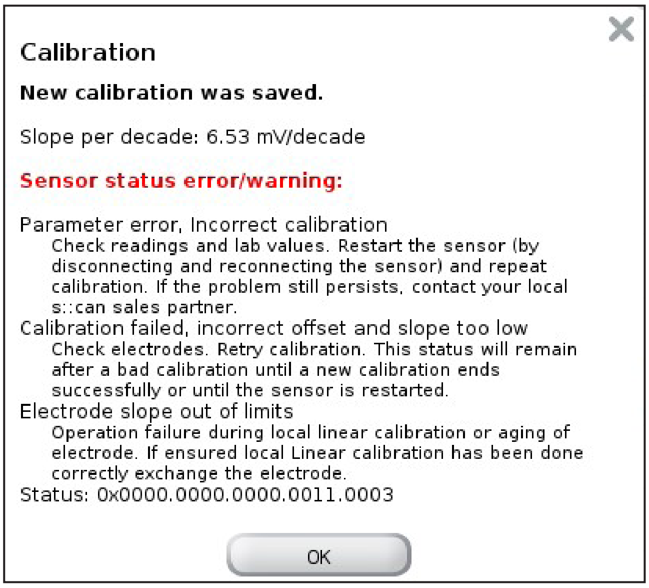
New calibration was saved.

Slope per decade: 67.39 mV/decade

Sensor status error/warning:

Electrode slope out of limits
Operation failure during local linear calibration or aging of electrode. If ensured local Linear calibration has been done correctly exchange the electrode.
Status: 0x0000.0000.0000.0000.0002

- If several calibration failures have occured, all of them will be displayed in the user message (see figure on the right).



Calibration

New calibration was saved.

Slope per decade: 6.53 mV/decade

Sensor status error/warning:

Parameter error, Incorrect calibration
Check readings and lab values. Restart the sensor (by disconnecting and reconnecting the sensor) and repeat calibration. If the problem still persists, contact your local s::can sales partner.
Calibration failed, incorrect offset and slope too low
Check electrodes. Retry calibration. This status will remain after a bad calibration until a new calibration ends successfully or until the sensor is restarted.
Electrode slope out of limits
Operation failure during local linear calibration or aging of electrode. If ensured local Linear calibration has been done correctly exchange the electrode.
Status: 0x0000.0000.0000.0011.0003

⚠ In case a *Sensor status error / warning* is displayed, the performed local calibration will be refused and the ammo::lyser / fluor::lyser will stay unchanged.

7 Data Management

7.1 Data Storage

The following information is stored directly on the sensor:

- Result of offset or linear calibration
- Factory settings (Global Calibration)
- Two measured samples and the according reference values for comparison
- Information for compensation
- Device information (e.g. electrode type for each slot, serialnumber, address, please refer to section 10.3)

The sensor readings can be stored on the controller used for operation. There is no possibility to store readings on the sensor itself.

7.2 Data Transfer

The measurements are performed on the sensor and the readings are transfered to the controller used for operation via the sensor cable using RS 485.

The reading can be transfered from the sensor either as parameter concentration [e.g. mg/l] or as raw value [mV]. Transfer and storage of mg/l and mV at the same time is not possible.

7.3 Data Visualisation

For visualisation of the sensor readings one of the following s::can controller can be used:

- con::lyte
- con::cube
- con::nect with PC

8 Functional Check

A functional check might be required for one of the following reasons:

- Initial startup
- Routine functional check
- Suspicion of monitoring system malfunction
- Modification of monitoring system (e.g. integration of additional sensor or device)
- Change of measuring location

Depending on the application (water composition), the probes and sensors connected and the environmental conditions a regular functional check (weekly to monthly) is recommended. The following sections provide an overview of all the actions that have to be performed to check the monitoring system quickly (see section 8.1), to check the plausibility of the collected readings (see section 8.2) and to check the integrity of a single probe or sensor (see section 8.3). Finally sections 8.4 and 8.5 explain how to check the measurement accuracy and the electrode aging.

8.1 Check of Monitoring Station

Check	con::lyte	moni::tool / con::cube	What to do if check failed
Power supply controller	Green LED is on? Text is visible on the display?	LED on housing cover is on or at least flashing? moni::tool screen is displayed after touching the screen?	Check power supply of controller. Power off controller for 5 minutes and power on again.
System running (up-to-date)	Displayed system time is current and is updated every second?	Click on system clock at the bottom of the screen shows current time and last measurement. Both are current?	Check for displayed error messages. Check if Service mode is acitvated or automatic measurement is paused.
System status	No error messages or error symbols are displayed?	LED of con::cube is blue and *Status* icon of moni::tool is not blinking yellow?	See section 10 for Troubleshooting.
Reason for bad system status	Check logbook entries since last functional check.	Open *Status* tab and select symbol of affected sensor for more information.	See section 10 for Status- and Errorcodes.

Check	Remark
Function of automatic cleaning	Use function *Clean now* or wait for next cleaning cycle. Watch for air bubbles when cleaning is activated.
Compressed air supply for automatic cleaning	All tubes and fittings are tight?
Function of compressor and storage tank	Drain condensed water from storage tank of compressor (not necessary for s::can compressor B-32). Check pressure.
Monitoring station (by-pass)	All tubes and fittings are tight and all probes and sensors are supplied with medium? No air bubbles within the tubes?
Installation submersed (in-situ)	Mounting equipment of all devices is ok and all probes and sensors are submersed?
Data transfer	Check if displayed readings on local controller are equal with displayed readings on customer display system.

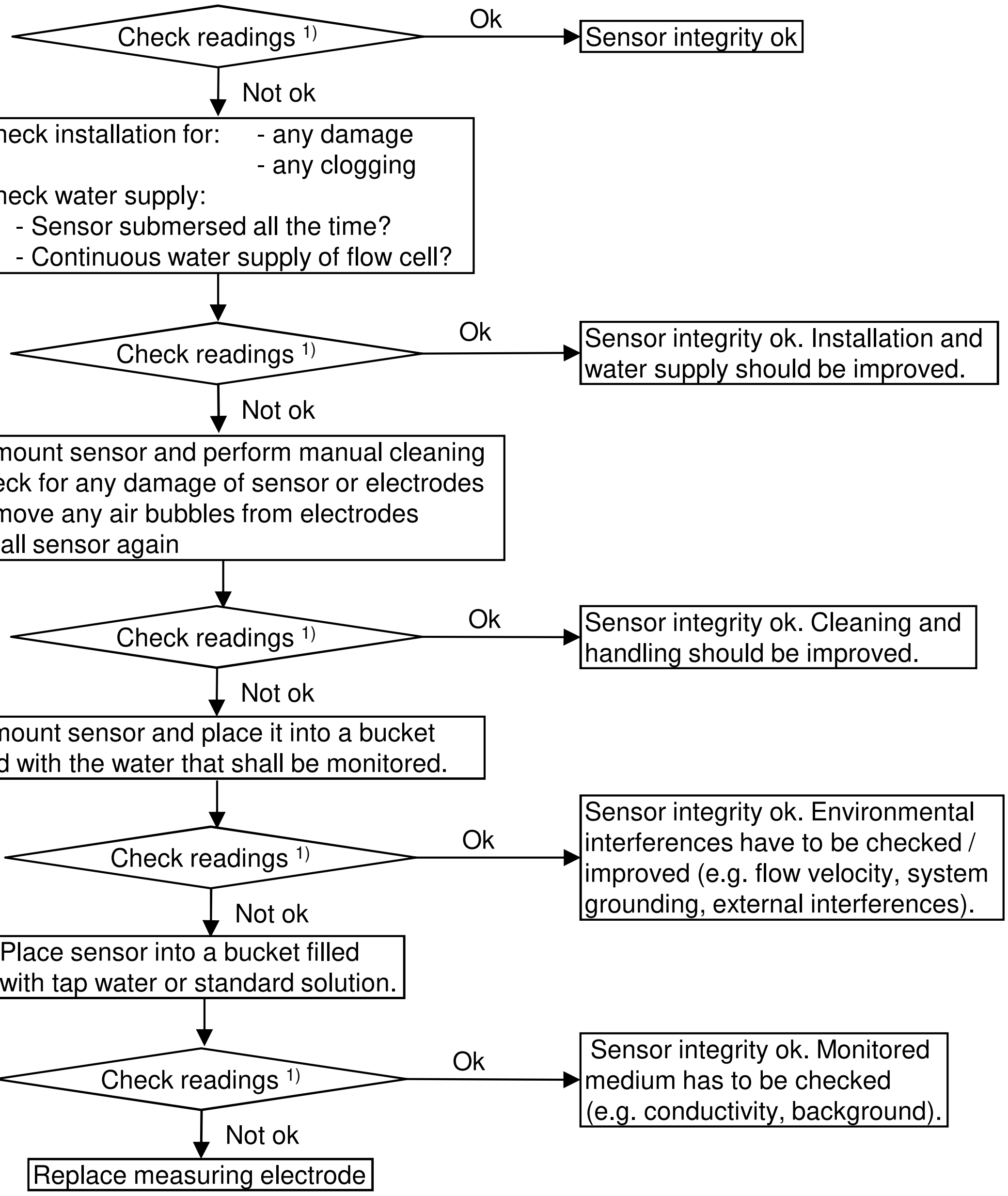
8.2 Check of Readings

Check	con::lyte	moni::tool / con::cube	What to do if check failed
Current readings displayed completely	No *NaN* and no dashes (- - - -,- -) or plus sign (++++,++) are displayed. Use arrow buttons to scroll through all displayed parameters.	No *NaN* displayed.	Check if parameter is outside the measuring range. Check parameter display settings (number of digits).
Current parameter status of displayed readings	D-31x: Check logbook entries since last functional check. D-320: Parameter name is flashing in case of any error.	Red background for parameter indicates an error or alarm. Grey background indicates reading is not current.	See section 10 for Status- and Errorcodes. D-320: Use menu function *Monitore...* to check actual parameter status.

Check	Reason / possible error	Remark
Up-to-date: Readings actualised on regulary base?	- Measuring interval is too long - Automatic measurement has been stopped manually - Service mode activated	Consider measuring interval and smoothing.
Continuity: Check historical data (timeseries) for interruptions or discontinuities	- Change of monitored medium - Local calibration - Maintenance of sensor (cleaning, etc.) - Readings out of range - System failure (loss of power, communication error, etc.)	Only possible if timeseries are availbale.
Plausibility: Timeseries look plausible with daily or seasonal fluctuation	- Drift of readings (can be caused by aging of electrodes or fouling). - Increasing noise (can be caused by flow conditions or external interference). - Fixed readings / no fluctuation	Check logbook of plant operator if possible. Refer to section 10 for Troubleshooting.
Measuring range: Readings are within the specified and calibrated measuring range?		Quality of results might be reduced outside the specified range.
Accuracy: Difference between laboratory values and readings of the sensor	In case of significant difference a calibration has to be performed (please refer to section 6).	To verify the accuracy of the displayed readings, only a reliable and validated comparison method has to be used.

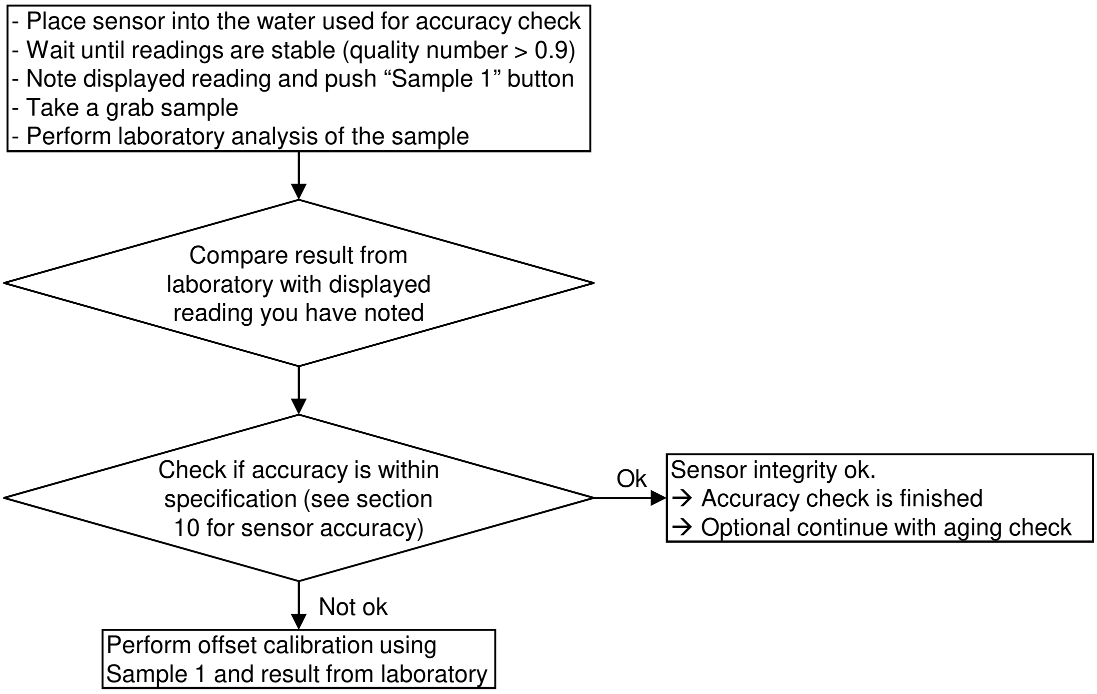
8.3 Check of Sensor Integrity

When there is any doubt regarding the integrity of the sensor, please use the following flowchart to check sensor and installation:


Check readings 1)
Ok
Sensor integrity ok
Not ok
Check installation for: - any damage
- any clogging
Check water supply:
- Sensor submersed all the time?
- Continuous water supply of flow cell?
Check readings 1)
Ok
Sensor integrity ok. Installation and water supply should be improved.
Not ok
- Demount sensor and perform manual cleaning
- Check for any damage of sensor or electrodes
- Remove any air bubbles from electrodes
- Install sensor again
Check readings 1)
Ok
Sensor integrity ok. Cleaning and handling should be improved.
Not ok
Demount sensor and place it into a bucket filled with the water that shall be monitored.
Check readings 1)
Ok
Sensor integrity ok. Environmental interferences have to be checked / improved (e.g. flow velocity, system grounding, external interferences).
Not ok
Place sensor into a bucket filled with tap water or standard solution.
Check readings 1)
Ok
Sensor integrity ok. Monitored medium has to be checked (e.g. conductivity, background).
Not ok
Replace measuring electrode

1) Check if the sensor readings are plausible and stable (no jumps, no scattering, no drift) for at least 5 consecutive measurements.

8.4 Check of Reading Accuracy


- Place sensor into the water used for accuracy check
- Wait until readings are stable (quality number > 0.9)
- Note displayed reading and push "Sample 1" button
- Take a grab sample
- Perform laboratory analysis of the sample
Compare result from laboratory with displayed reading you have noted
Check if accuracy is within specification (see section 10 for sensor accuracy)
Ok
Sensor integrity ok.
→ Accuracy check is finished
→ Optional continue with aging check
Not ok
Perform offset calibration using Sample 1 and result from laboratory

8.5 Check of Electrode Aging

Aging of an ISE electrode means the sensitivity decreases. This can be quantified by checking the electrode slope. The electrode slope of a new electrode is 56 mV per decade at 20°C (54 mV at 10°C and 58 mV at 30 °C). Once the electrode slope has reached the lower limit (i.e. 20% of original slope, see table below also), the electrode needs to be replaced.

Slope per decade	% of original slope	Electrode Status	Comment
25 - 59 mV	45 - 105 %	fully operational	electrode ok [1]
12 - 25 mV	20 - 45 %	already aged	reduced accuracy, electrode can be replaced
< 12 mV	< 20 %	dead	electrode has to be replaced

[1] The electrode slope of a new or refurbished electrode depends on the background matrix of the measured water. High amount of interfering ions and / or high conductivity will reduce the slope.

The actual electrode slope (i.e. the actual electrode status) can be checked by using one of the following possibilities:

- Performing a linear calibration. Whenever a linear calibration is performed, the electrode slope is checked internally. The linear calibration will be rejected in case the electrode slope is too low.
- When the con::cube is used to perform the linear calibration, the electrode slope (slope per decade) will be displayed as additional information. Using the table above the operator can judge the actual electrode status.
- The electrode slope can be calculated by the operator himself based on the two sample readings in different standards with known concentrations (see formula for calculation below). If the difference of the used standards is a factor of 10 (e.g. 2 mg/l and 20 mg/l) the slope per decade is simply the difference of the mV readings.

  Slope per decade [mV] = (mV Sample1 - mV Sample 2) / (LOG (mg/l Sample 1 / mg/l Sample 2))

9 Maintenance

9.1 Cleaning

During routine operation the cleaning of the ammo::lyser / fluor::lyser, i.e. the measuring electrodes of the sensor, is performed automatically via compressed air. To clean the sensor manually the following is recommended:

⚠ Before demounting the sensor be sure that automatic air cleaning is deactivated via operating software and air supply line is depressurised to avoid dirt and / or injury by suddenly escaping pressurized air.

- Rinse sensor with hand-hot (lukewarm) drinking water to remove course deposits from the sensor housing. To clean the sensor housing (not the electrodes themselves) a soft cleaning agent (e.g. dishwashing detergent) can be used.
- Put the sensor in a bucket of hand-hot drinking water for several minutes to remove deposits on and in between the measuring electrodes.
- The cleaning of the measuring electrodes is performed by using a soft cloth (one that does not leave behind fibres), cotton swabs or paper tissues that are moistened with tap water before they are applied.

⚠ When cleaning the measuring electrodes, care has to be taken that the membranes are not damaged (do not use abrasive materials such as scouring sponges or stiff brushes).

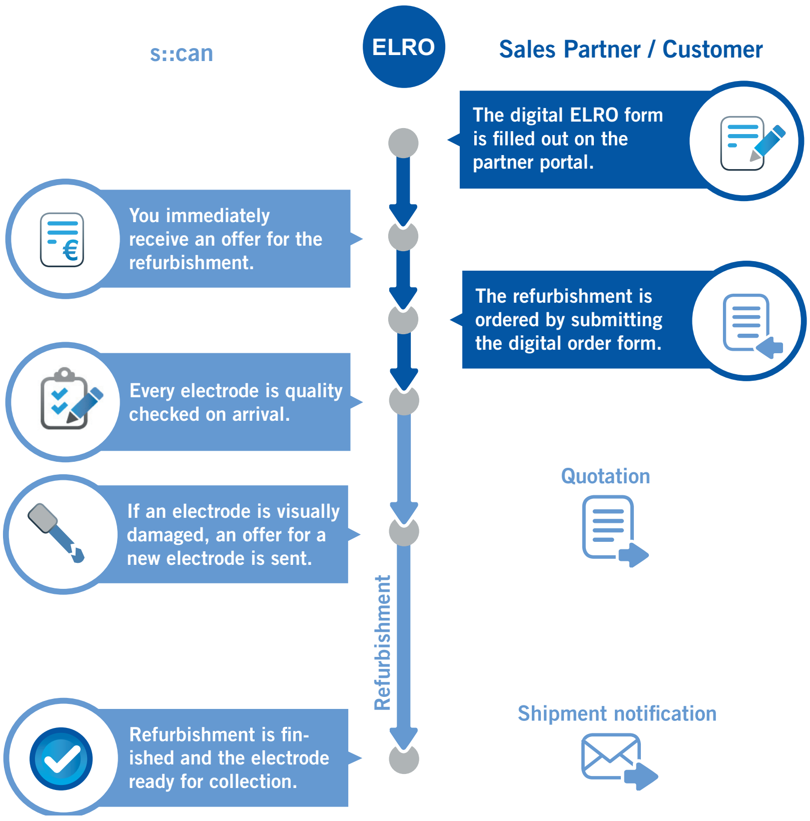
Never use tenside or surfactant containing cleaning agents (washing liquid) to clean the electrodes or the membranes.

9.2 Refurbishment of Electrodes

The ISE electrode is a typical spare part and has to be replaced regularly. Some types of electrodes (NH4-N, K, NO3-N) can be refurbished at s::can. That means that all aged components (membrane cap, electrolyte) will be replaced and the refurbished electrode will be tested for it's quality by s::can.

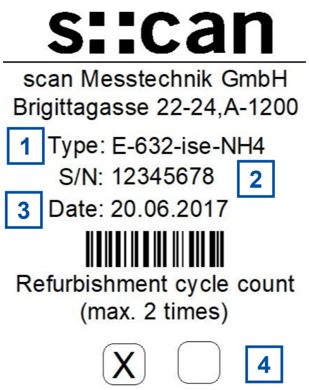
This refurbishment can be ordered directly on the s::can homepage within the section *Services* using the ELRO-form.

The ELRO process is displayed below:


s::can
ELRO
Sales Partner / Customer
The digital ELRO form is filled out on the partner portal.
You immediately receive an offer for the refurbishment.
The refurbishment is ordered by submitting the digital order form.
Every electrode is quality checked on arrival.
Quotation
If an electrode is visually damaged, an offer for a new electrode is sent.
Refurbishment
Shipment notification
Refurbishment is finished and the electrode ready for collection.

On all electrodes is a label assigned that provides the following information:

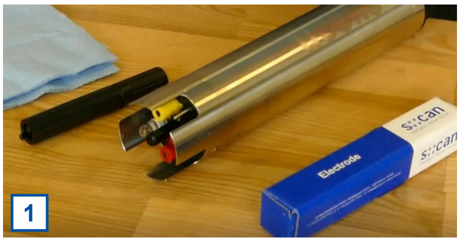
1. Type of electrode
2. Serial number (S/N)
3. Production date
4. Number of refurbishment (2 refurbishments are possible)



9.3 Replacement of Electrodes

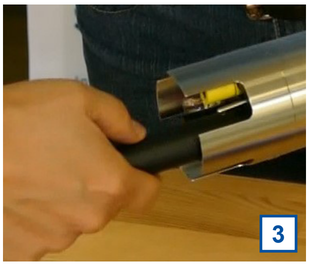
The electrodes need to be replaced regularly (see technical specifications regarding life time). The replacement is performed by the following steps:

1 For replacement of the electrodes you need the ammo::lyser / fluor::lyser itself, replacement electrode, tool for electrode replacement (E-542-TOOL) and paper tissue for cleaning.



2 Clean the sensor as explained in section 9.1.Finally dry the electrodes and electrode head with an absorbant paper tissue.

3 Screw out the electrode that needs to be replaced using the tool for electrode replacement (E-542-TOOL). Doing this, hold the sensor slightly inclined to ensure no moisture can enter the electrode slot.

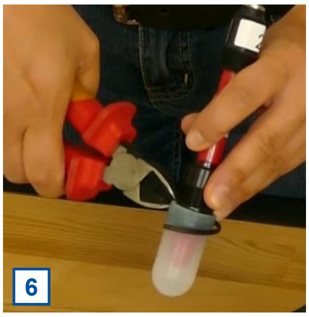


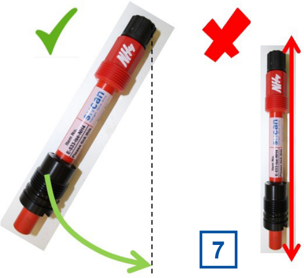
4 Remove the old electrode from the slot and check if there is any dirt or moisure within the electrode slot. Whipe it clean and dry with a paper tissue if needed.

5 Unpack the new electrode carefully.

6 The pH- and reference electrodes are protected with a cap. Before removing the cap cut the cable strap that fixes the cap.

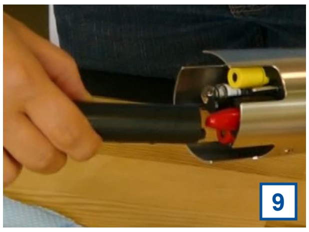
7 Take the new or refurbished ISE electrode and shake it like a mercury thermometer to remove air bubbles from the internal side of the membran.





8 Make sure that the threads, all sealing O-rings and the electrode plug are clean and undamaged before putting the electrode carefully into the slot.

9 Putting a thin film of vasiline onto the O-ring makes it easier to screw in the electrode.

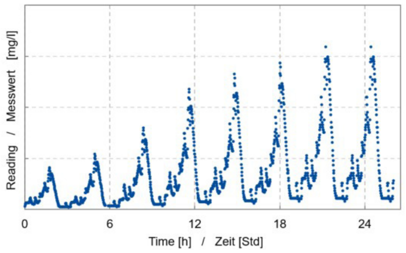
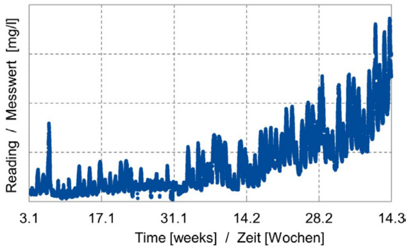
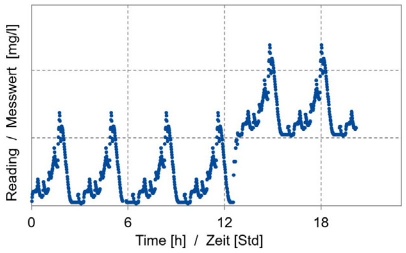
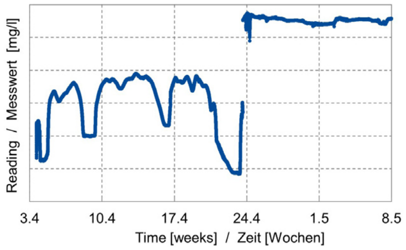
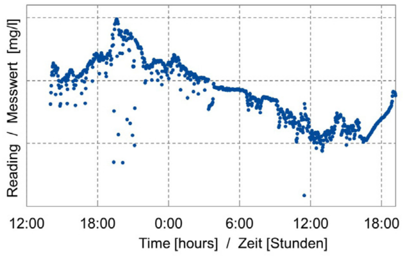


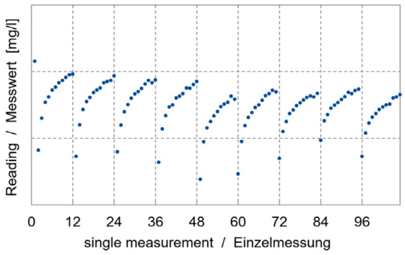
10 Carefully screw the electrode into the sensor using the electrode key (E-542-TOOL) until hand tight.

Finally install of the ammo::lyser / fluor::lyser according to the procedure described in section [5] and perform a local calibration of the new electrode according to the procedure described in section [6].

10 Troubleshooting

10.1 Typical Error Pattern

Error	Reason	Removal
Drift of readings (after startup or electrode replacement) 	■ New electrodes need time to adapt to the measuring medium (conditioning time).	■ Conditioning of electrode before the installation. ■ Perform local calibration after the electrodes are completely conditioned.
Drift of readings (during operation) 	■ Change in the measuring medium (e.g. interference of ions) ■ Air bubbles ■ ISE electrode aged ■ Electrode used for NH4-N compensation aged ■ Reference electrode aged	■ Check measuring medium ■ Remove air bubbles ■ Clean the sensor / electrodes ■ Perform linear calibration ■ Replace electrode
Shift / jump of readings (offset) but still changes in concentration visible 	■ Small air bubbles sticking to the membrane ■ Dirt / deposition on the electrode ■ Sudden change in measuring medium composition	■ Remove air bubbles ■ Clean the sensor / electrodes ■ Check mV reading of sensor in tap water or standard ■ Perform check of accuracy (see section 8.4)
Shift / jump of readings (offset) and no changes in concentration visible 	■ Large air bubbles sticking near the membrane surface ■ Fouling of the electrode caused by organics present in the measuring medium (chemical / mechanical damage) ■ Membrane mechanical damaged / destroyed	■ Remove air bubbles ■ Clean the sensor / electrode ■ Check mV reading of sensor in tap water ■ Perform linear calibration ■ Replace electrode
Noisy readings (sudden periodical jumps) on single or all parameters 	■ Electromagnetic interference caused by other equipment installed nearby ■ Moisture or water ingress	■ Ensure that measuring medium is grounded correctly ■ Check if electrode slots are clean and dry ■ Check sensor integrity

Error	Reason	Removal
Regular jumps of readings synchronized with automatic cleaning  	■ Too intensive air pressure cleaning ■ Wrong automatic cleaning settings (waiting time between end of cleaning and measurement too short)	■ Reduce intensity / frequency of automatic cleaning. ■ Check if cleaning pressure is max. 4 bar. ■ Increase waiting time before measurement
Low accuracy of readings (readings too low or too high compared to laboratory values)		■ Check sensor integrity ■ Check reading accuracy (see section 8.4)
One reading is NaN	■ Reading out of measuring range ■ Parameter not calibrated correctly ■ Electrode defective	■ Check sensor integrity ■ Check reading accuracy (see section 8.4)
All displayed readings are NaN	■ Communication problem between sensor and operation terminal ■ Sensor not installed correctly	■ Check connection plug and sensor cable ■ Reinstall sensor
Quality factor < 0.90 permanently	■ Unstable measuring medium conditions (e.g. concentration, flow, temperature) ■ Damaged ISE or reference electrode	■ Check electrode readings in stable flow and temperature (use bucket filled with measuring medium if needed). ■ Visual inspection of electrodes for mechanical damage.

10.2 Error Messages and Status Messages

During execution of a measurement the monitoring system (system status), the measuring device itself (device status) and the result (parameter status) will be checked for possible errors and for plausibility. In case of an error (status bit will be set from 0 to 1) a user message will be displayed to the operator.

Depending on the used operation controller these messages will be shown on the display (Menu *Logbook & data* in case of con::lyte D-31x, function *Monitor...* in case of con::lyte D-320, *Status* tab in case of moni::tool and *Show Context Help* and *System-Status* in case of ana::pro) and also stored within the result files or logfiles. Additional to the user message (general error reason and recommendations for removal) the detailled status code will be displayed either in binary form (0000, 0001, 0010, 0011, 0100, etc.) or as a hex number (0x0001, 0x0002, 0x0004, 0x0008, 0x0010, etc).

⚠ Up to 16 status bits are used for different errors. If several errors occur at the same time the con::lyte and moni::tool will add up all the status bits. This detailed information might be important if you request s::can support. Below you will find examples how to translate these combined hex codes:

Hex	Bin	Bits
0x8000	1000 0000 0000 0000	b15
0x8001	1000 0000 0000 0001	b0, b15
0x4011	0100 0000 0001 0001	b0, b4, b14

Within moni::tool the complete status code of a simple parameter has the following format:
0xTTTT.SSSS.PPPP.pppp.VVVV.vvvv.

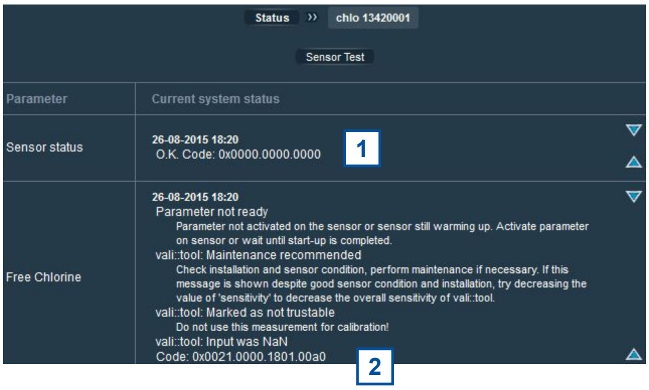
Code	Status Type	Remark
0xTTTT	System status sensor	visible in the second column of all moni::tool parameter result files (e.g. Error 0x0010 or Ok 0x0002)
0xSSSS	Sensor status general	valid for all sensors
0xssss	Sensor status private	valid for respective sensor
0xPPPP	Parameter status general	valid for all parameters
0xpppp	Parameter status private	valid for respective parameter
0xVVVV	vali::tool status general	valid for all clean values of vali::tool software
0xvvvv	vali::tool status private	valid for respective clean values of vali::tool software

1 Within the moni::tool *Status* tab of the sensor you will see the system status sensor and the sensor status as clear text and as status code (0xTTTT.SSSS.ssss).

2 Within the moni::tool *Status* tab of the parameter you will see the parameter status and in case of activated vali::tool the vali::tool status also (0xPPPP.pppp.VVVV.vvvv).

3 Within the moni::tool results file of the sensor parameter the status (0xTTTT.SSSS.PPPP.pppp) will be stored in the column beside the measured value.

4 If vali::tool is active, the result file contains also the vali::tool status (0xVVVV.vvvv) in the column beside the cleaned value.



Sensor status

26-08-2015 18:20
O.K. Code: 0x0000.0000.0000

Free Chlorine

26-08-2015 18:20
Parameter not ready
Parameter not activated on the sensor or sensor still warming up. Activate parameter on sensor or wait until start-up is completed.
vali::tool: Maintenance recommended
Check installation and sensor condition, perform maintenance if necessary. If this message is shown despite good sensor condition and installation, try decreasing the value of 'sensitivity' to decrease the overall sensitivity of vali::tool.
vali::tool: Marked as not trustable
Do not use this measurement for calibration!
vali::tool: Input was NaN
Code: 0x0021.0000.1801.00a0

Timestamp	Station 1	ammo::lyser	**3** ammo::lyser	ammo::lyser	**4** ammo::lyser
Measurement interval	Status	NH4-N - Measured value [ppm]	Status [NH4-N - Measured value]	NH4-N - Clean value [ppm]	Status [NH4-N - Clean value]
31.05.2019 12:32	Ok 0x0000	4.25	Ok 0x0000.0000.0000.0000	3.33	Ok 0x0000.0000
31.05.2019 12:34	Ok 0x0000	4.78	Ok 0x0000.0000.0000.0000	3.43	Ok 0x0000.0000
31.05.2019 12:36	Ok 0x0000	6.05	Ok 0x0000.0000.0000.0000	3.61	Ok 0x0000.0000
31.05.2019 12:38	Ok 0x0000	58.24	Ok 0x0000.0000.0000.0000	3.84	Ok 0x1001.0010
31.05.2019 12:40	Ok 0x0000	123.67	Ok 0x0000.0000.0000.0000	8.64	Ok 0x0000.0000
31.05.2019 12:42	Ok 0x0000	139.51	Ok 0x0000.0000.0000.0000	18.57	Ok 0x0000.0000
31.05.2019 12:44	Ok 0x0000	136.43	Ok 0x0000.0000.0000.0000	28.85	Ok 0x0000.0000

The table below shows all errors regarding the operation terminal (system status) the user message, the reason of the error and notes for troubleshooting. If the error can't be removed although the suggested procedure was executed several times, please contact your s::can sales partner.

System Status Error 0xTTTT	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	ES007 / COMM! Probe not detected. Check power-supply and connection cable.	No communication between sensor and terminal.	No communication between sensor and operation terminal. Replacement sensor was not installed correctly.	Check sensor cable and connector. Disconnect and reconnect sensor.
0x0002 - b1	0002	Invalid sensor	Sensor serial number has changed.	Connect the previously installed sensor or perform sensor replacement (moni::tool) or new sensor installation (con::lyte).

The table below shows all errors regarding the used sensor incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Sensor Status Error 0xSSSS	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	ES100 / 0001 Probe reports an error. Call service! Param.Status error. Status Code:	General sensor error	Sensor reports error during internal check. At least one internal sensor check failed.	For details see additional status message below. In case no further messages are shown, note the error code and contact your s::can sales partner.
0x0002 - b1	ES101 / 0002 MISUSE Medium temperature. Take probe out of medium, immediately!	SENSOR MISUSE	Operation outside the specification (e.g. temperature too high). This can damage the device permanently.	Take the sensor out of the medium immediately and check environmental conditions.
0x8000 - b15	ES115 / 8000 Device maintenance required Code 8000 0000	Sensor maintenance required	At least one internal sensor check reports a warning.	Perform function check of the sensor according the manual.

The table below shows all errors regarding the measured parameters incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Parameter Status Error 0xPPPP	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	EP 100 / 0001 Status error. Code: 0001.0000 Details in following log messages.	General parameter error	At least one internal parameter check failed.	Note additional status message below. If no further message is displayed, note the error code and contact your local s::can sales partner.
0x0002 - b1	EP 100 / 0002 Parameter failure, hardware failure	Parameter error, Hardware error	Electrode signal not ok. An electrode is missing, too old or defective.	Check the electrode or replace the electrode.
0x0004 - b2		Parameter error, configuration error	Parameter error, configuration error	Change the local calibration or switch back to global calibration.
0x0008 - b3		Parameter error, Wrong medium	Sensor outside of the medium or in incorrect medium.	Check supply of medium and medium itself.
0x0010 - b4	EP 100 / 0010 Parameter failure, calibration failure	Parameter error, Incorrect calibration	Invalid sensor configuration. At least one calibration coefficient is invalid.	Check readings and lab values. Restart sensor by un- and replugging. Set back to factory settings. Repeat local calibration.
0x0020 - b5	EP 100 / 0020	Parameter not ready	Parameter not activated on the sensor or sensor still warming up.	Activate parameter or wait until sensor is fully operational.
0x8000 - b15	EP 115 / 8000 Out of range Code 8000 0000 The parameter is out of measurement range	Reading out of measuring range	Measured parameter is outside the defined measuring range.	Check if sensor is in the medium. Perform functional check.

The table below shows all errors regarding the measured parameters incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Parameter Status Error 0xpppp	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	EP 100 / 0001 Electrode slope too low. Check calib or replace electrode. Reduced quality of measurement possible. P-Status(Pri): 0001	Calibration failed, incorrect offset and slope too low	Offset of local calibration out of limits and / or slope of electrode too low.	Check sample and laboratory values. Repeat local calibration. Replace Electrode if slope too low.
0x0002 - b1	EP 100 / 0002 Electrode slope too low. Check calib or replace electrode. Reduced quality of measurement possible. P-Status(Pri): 0002	Electrode slope out of limits	Slope of local calibration out of limits (too high or too low).	Check sample and laboratory values. Repeat local calibration. Replace Electrode if slope too low.

The table below shows all errors regarding clean parameters of the vali::tool software incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

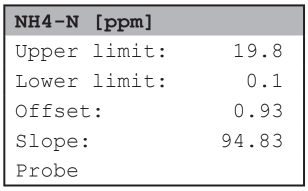
Parameter Status Error 0xVVVV	Message moni::tool	Reason	Removal
0x0001 - b0	vali::tool reports an error	At least one internal check reports a warning.	Check further status messages.
0x0800 - b11	Maintenance recommended	Parameter check reports a warning.	Check system and sensor, perform functional check.
0x1000 - b12	Marked as not trustable	Parameter check reports a warning.	Do not use this value for calibration.

10.3 Check of Device Settings

In case detailed sensor information or configuration settings have to be checked, the following sections will explain how to find these information when operating the sensor with a s::can controller.

10.3.1 Check of Device Settings using con::lyte D-31x

The main menu entry *Information* of the con::lyte operation software enables you to check internal sensor settings. After selecting the parameter of your interest by pushing the *Enter* button, the display will show the *upper limit* and the *lower limit* of the selected parameter.



```
NH4-N [ppm]
Upper limit:     19.8
Lower limit:      0.1
Offset:          0.93
Slope:          94.83
Probe
```

When confirming the lowest entry *Probe* with *Enter* all internal settings of the sensor will be displayed. The most important ones are:

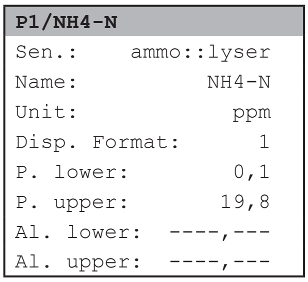
- Internal sensor identifier (*M-Version* and *Model*)
- Sensor name (*ammo::lyser*)
- Serialnumber of the sensor (*S/N*)
- Hardware version of the sensor (*H/W-Version*)
- Software version of the sensor (*S/W-Version*)

10.3.2 Check of Device Settings using con::lyte D-320

Select the entry *Manage sensors...* in the main menu of the status screen. Select the name *ammo::lyser/0/1* in the list of installed sensors, in which the second number (*1*) indicates the address assigned to the sensor. After confirming the entry *Configure...* as well as the entry *Probesettings* in the next view, the following information of the sensor will be displayed:

- Internal sensor identifier (*M-Version* and *Model*)
- Sensor name (*ammo::lyser*)
- Serialnumber of the sensor (*S/N*)
- Hardware version of the sensor (*H/W-Version*)
- Software version of the sensor (*S/W-Version*)

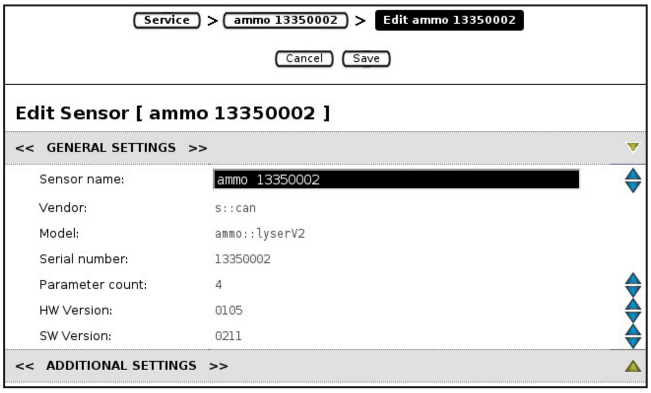
Information of the single measuring parameter can be retrieved via the entry *Parameter info...* from the main menu of the parameter display. In addition to the parameter name (*Name*), the unit of measurement (*Unit*) the number of decimal places (*Disp. Format*), also the lower and upper limit of the parameter range (*P. lower* / *P. upper*) and the adjusted alarm range (*Al. lower* / *Al. upper*) are displayed.



```
P1/NH4-N
Sen.:      ammo::lyser
Name:            NH4-N
Unit:              ppm
Disp. Format:        1
P. lower:          0,1
P. upper:         19,8
Al. lower:    ----,---
Al. upper:    ----,---
```

10.3.3 Check of Device Settings using moni::tool

Selecting *Service / ammo / Edit ammo* will list up internal settings of the ammo::lyser / fluor::lyser. Depending on the *Service Level* (figure below is *Service Level Advanced*) some or all of the following information will be displayed:



Edit Sensor [ammo 13350002]

<< GENERAL SETTINGS >>

Sensor name: ammo 13350002
Vendor: s::can
Model: ammo::lyserV2
Serial number: 13350002
Parameter count: 4
HW Version: 0105
SW Version: 0211

<< ADDITIONAL SETTINGS >>

- Interface (COM-port, *Address*) of the sensor
- *Sensor name (Internal)* allocated to the device. Should not be changed by the operator.
- *Sensor name* for the display allocated to the device by the operator at installation.
- Manufacturer name of the sensor (*Vendor*)
- Type of the sensor (*Model*)
- Serial number of the sensor (*Serial Number*)
- Number of internal parameters of the sensor (*Parameter count*)
- Information regarding the purchase (*Purchase date*, *Warranty expiry date*). Can to be entered by the operator at initial startup.
- Actual hardware and software version of the sensor (*HW Version* *SW Version*).
- Internal type number of the sensor (*Sensor Model*) and information regarding cleaning and logging (not available for the ammo::lyser / fluor::lyser).
- Information regarding the installation and last modification of the sensor (date, name and reason).

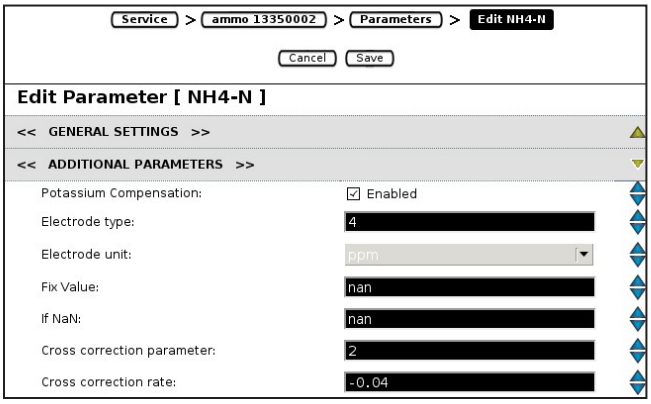
10.4 Modification of Device Settings

⚠ Any modification of the device settings must be performed by trained service staff or after confirmation of your local s::can Sales Partner. In general the following device settings can be modified:

- Activation or deactivation of potassium compensation
- Modification of fixed values for parameter (with ana::pro only)
- Modification of device address (with ana::pro only)
- Modification of electrode type

10.4.1 Modification of Device Settings using moni::tool

Selecting *Service / ammo / Parameter / Edit Parameter* will list the parameter settings. The *Service Level* *Expert* has to be used to see all information as displayed below:



Edit Parameter [NH4-N]

<< GENERAL SETTINGS >>

<< ADDITIONAL PARAMETERS >>

Potassium Compensation: ☑ Enabled
Electrode type: 4
Electrode unit: ppm
Fix Value: nan
If NaN: nan
Cross correction parameter: 2
Cross correction rate: -0.04

- *Potassium Compensation* is active when the checkbox is marked. A click on the checkbox will disable the compensation.
- The entry *Electrode type* defines, which ISE electrode is used in this slot. The following types are supported:
  0 ..... Temperature
  2 ..... pH
  4 ..... Ammonium (NH4-N)
  5 ..... Nitrate (NO3-N)
  6 ..... Potassium (K)
  10 ... Chloride (Cl)
  11 ... Fluoride (F)

- The *Electrode unit* is selected in accordance to the parameter and can be changed to the raw signal (mV).

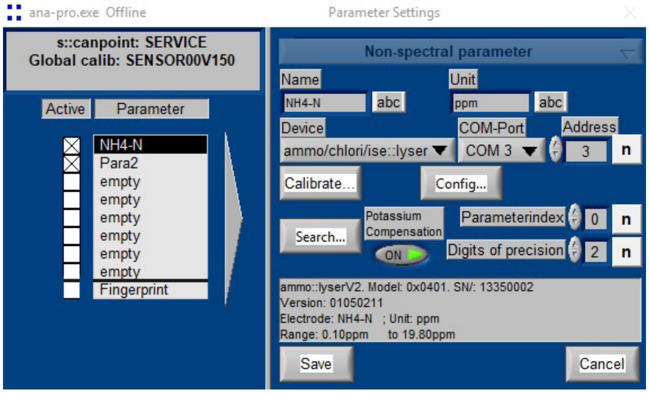
- The parameter output can be set permanently to a *Fix value*, which will be displayed and used instead of the real reading. This feature can be used, if an electrode, which is used for compensation, is defective until it is replaced.
- Any value that will be entered in the field *If NaN* will be displayed if the electrode will not delivery a reading.

- The entry *Cross correction parameter* defines the slot of the electrode that will be used for compensation of the actual selected parameter.
- The entry *Cross correction rate* defines the coefficient used for the compensation of cross sensitivity.

10.4.2 Modification of Device Settings using ana::pro

In the operating - and service software ana::pro the sensor can be initialised over the menu item *Parameter / Settings*. In case the parameter of interest is not yet displayed by default in the Parameter Settings window, they can be selected as explained below:

- Double click on the parameter field that you want to correspond with the parameter to be displayed.
- After double clicking, the window will enlarge and show detailed information belonging to this parameter.
- Select *Non-spectral parameter* in the upper selection bar.
- Select *ammo/chlori/ise::lyser* under *Device*.
- The *COM-Port* is the interface to which the sensor is connected (e.g. COM-Port of the con::nect).
- Enter the address allocated to the sensor in the RS 485 network in the entry *Address.*
- Push the button *Search…* (when an incorrect COM-Port and / or sensor address are selected, the *Search…* function will still find the sensor if only one instrument is connected).



s::canpoint: SERVICE
Global calib: SENSOR00V150

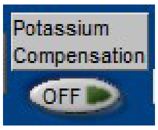
☒ NH4-N
☒ Para2
☐ empty
☐ empty
☐ empty
☐ empty
☐ empty
☐ empty
☐ Fingerprint

Name: NH4-N
Unit: ppm
Device: ammo/chlori/ise::lyser
COM-Port: COM 3
Address: 3
Parameterindex: 0
Digits of precision: 2

ammo::lyserV2. Model: 0x0401. SN/: 13350002
Version: 01050211
Electrode: NH4-N ; Unit: ppm
Range: 0.10ppm to 19.80ppm

As soon as the sensor has been detected, information will be shown in the grey text field in the lower part of the dialogue window (model and serial number, version, electrodes and measuring range).

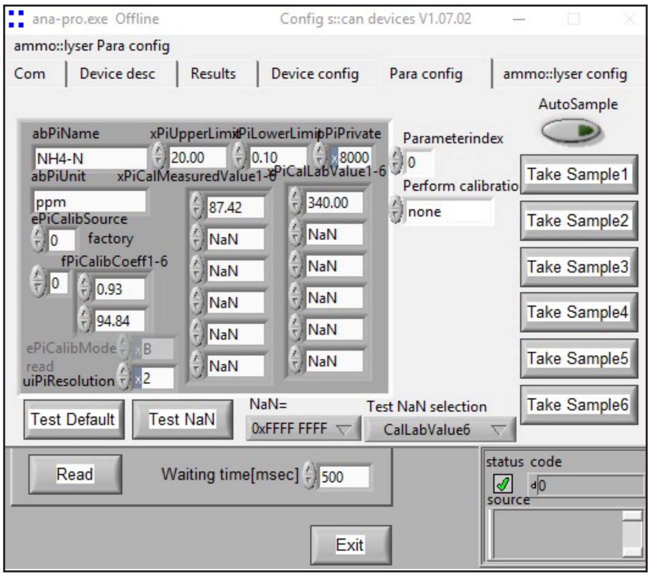
Furthermore information that *Potassium Compensation* is activated will be displayed by the green *ON* button. To deactivate the compensation simply push this buton which will switch to *OFF*.



- Push button *Config...* in menu *Parameter / Settings*.
- Push button *Search...* in register card *Com*. As soon as the sensor will be detected, the checkbox (*status source*) in the lower right corner switches to ok (green check mark) and further register cards become visible.
- In register card *Device desc* the sensor type (*abModel*), the serial number of the sensor (*abSerialNumber*), the actual hardware (*abHWRelease*) and software (*abSWRelease*) are displayed.

In register card *Para config* the complete configuration of each measured parameter is displayed (see figure below).

- Within the entry *Parameterindex* the internal number of the electrode position can be entered. According to the figure in section 3.3 and the numbers on the electrode head index 0 = position 2, index 1 = position 3 and index 2 = positition 4. To ensure you have the correct index, always check if the parameter name, which is displayed in field *abPiName* is correct.
- Besides the parameter name the actual used measuring range (*xxxLimitPi*) and the unit (*abPiUnit*) is displayed. Also actual used offset and slope (*fPiCalibCoeff*) and number of digits (*uiPiResolution*) are displayed.
- In the right part of the configuration screen the stored sample readings (mV) and laboratory values (ppm) are displayed. Only the first two samples can be used for local calibration. A new sample measurement can be triggered by pushing the *Take Sample* button. Furthermore both sample and laboratory values can be entered into the display field directly.



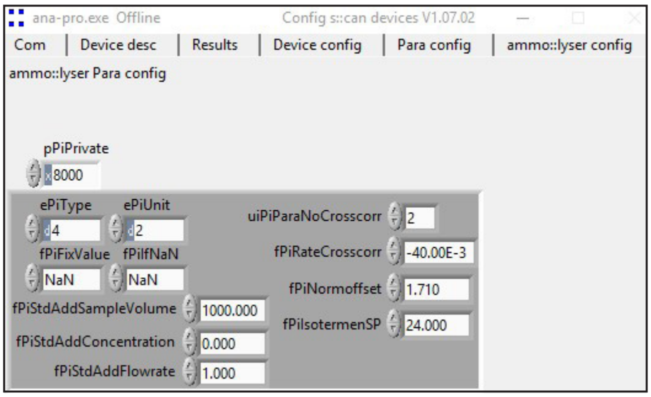
abPiName: NH4-N
xPiUpperLimit: 20.00
xPiLowerLimit: 0.10
bPiPrivate: 8000
Parameterindex: 0
abPiUnit: ppm
ePiCalibSource: 0 factory
fPiCalibCoeff1-6: 0 0.93 94.84
xPiCalMeasuredValue1-6: 87.42 NaN NaN NaN NaN NaN
xPiCalLabValue1-6: 340.00 NaN NaN NaN NaN NaN
Perform calibratio: none
ePiCalibMode read: B
uiPiResolution: 2
NaN= 0xFFFF FFFF
Test NaN selection: CalLabValue6
Waiting time[msec]: 500
status ☑ code 0
source

You can finish the configuration menu by pushing the button *Exit* or you can switch to the register card *ammo::lyser Para config*, which will display further configuration settings (see following figure).

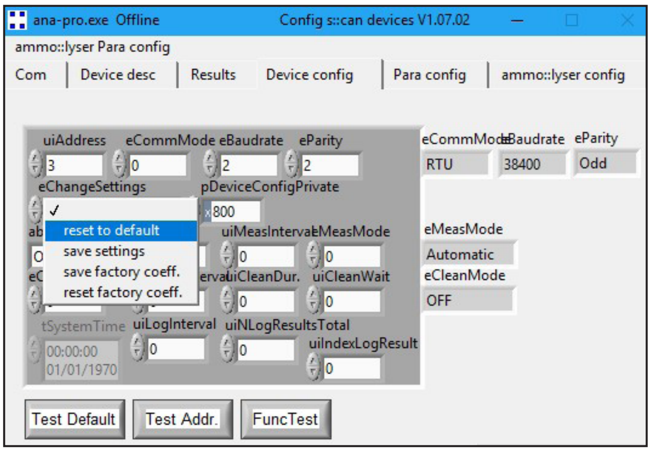
- Within the field *ePiType* the electrode type used on this position is defined. Refer to section 10.4.1 to see which electrode types are supported. Besides the actual unit is displayed (2 = ppm and 3 = mV).
- Within the fields *fPiFixValue* and *fPiifNaN* the output can be set to a fixed value and also display of NaN readings can be changed (see section 10.4.1)
- In the right part of the configuration window the information needed to compensate and calculate the parameter readings are displayed.

All changes in any register card shall be done directly in the display field using the mouse and the keyboard. The scrollbar labelled with two small triangles beside the display field shall not be used.

After any change of the configuration, switch to register card *Device config* and select entry *save settings* in the selection field *eChangeSettings*. Then close configuration menu by pushing *Exit* and reboot ammo::lyser by powering off and on again. Finally check within the configuration menu if modifications have been stored correctly in the register card.



pPiPrivate 8000
ePiType 4
ePiUnit 2
fPiFixValue NaN
fPiIfNaN NaN
fPiStdAddSampleVolume 1000.000
fPiStdAddConcentration 0.000
fPiStdAddFlowrate 1.000
uiPiParaNoCrosscorr 2
fPiRateCrosscorr -40.00E-3
fPiNormoffset 1.710
fPiIsotermenSP 24.000



uiAddress 3
eCommMode 0
eBaudrate 2
eParity 2
eChangeSettings
pDeviceConfigPrivate 800
uiMeasInterval 0
eMeasMode 0
uiCleanDur. 0
uiCleanWait 0
tSystemTime 00:00:00 01/01/1970
uiLogInterval 0
uiNLogResultsTotal 0
uiIndexLogResult 0
eCommMode RTU
eBaudrate 38400
eParity Odd
eMeasMode Automatic
eCleanMode OFF

10.5 Return Consignment (RMA - Return Material Authorization)

Return consignments of the s::can monitoring system, or parts of the system, shall be done in a packaging that protects the device (original packaging or protective covering if possible). Before returning a consignment, you have to contact your s::can sales partner or s::can customer support (support@s-can.at). A RMA number will be assigned for each device, independent if the reason of the return consignment is service, repair or demo equipment.

RMA numbers can be requested from the s::can Costomer Portal available on the s::can webpage directly. Return consignments without an RMA number will not be accepted. The customer always has to bear the costs for return consignment.

11 Accessories

11.1 Installation

11.1.1 Connection Cable

For operation of ammo::lyser / fluor::lyser with plug a connection cable is necessary. This is included in the standard order.

Name	Specification	Remark
Part-no.	C-1-010-SENSOR	
Cable lenght	1 m	
Assembling	ex works	
Dimensions plug	20 mm	outer diameter
Material	PU	Cable sheathing
Housing environment rating	IP 68	
Interface connection	IP 67, RS 485, 12 VDC	to s::can sensors

11.1.2 Extension Cable

The cable of the ammo::lyser / fluor::lyser can be elongated when necessary with an extension cable (10 m or 20 m length). The extension cable is attached using the sensor cable connector plug.

Name	Specification	Remark
Part-no.	C-210-SENSOR C-220-SENSOR	
Cable lenght	10 m 20 m	C-210-SENSOR C-220-SENSOR
Assembling	ex works	
Dimensions plug	20 mm	outer diameter
Material	PU	Cable sheathing
Housing environment rating	IP 68	
Interface connection	IP 67, RS 485, 12 VDC	to s::can sensors

11.1.3 Sensor Mounting

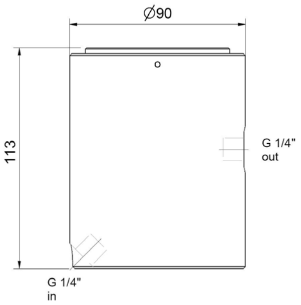
For proper and easy submersed installation of the ammo::lyser / fluor::lyser a separate sensor carrier is available. This part can be fixed to the sensor directly and can be extended by a pipe (to be provided by the customer).

Name	Specification	Remark
Part-no.	F-11-OXI-AMMO	
Material	PVC	
Dimensions	85 / 86 mm	Diameter / height
Weight	approx. 300 g	
Process connection	DN 50 inside	for extension pipe
Installation / mounting	submersed	

11.1.4 Flow Cell Setup Tap Water

For not submersed measurement of drinking / tap water sample stream in a bypass installation (e.g. monitoring station) with ammo::lyser / fluor::lyser, a separate flow cell is available.

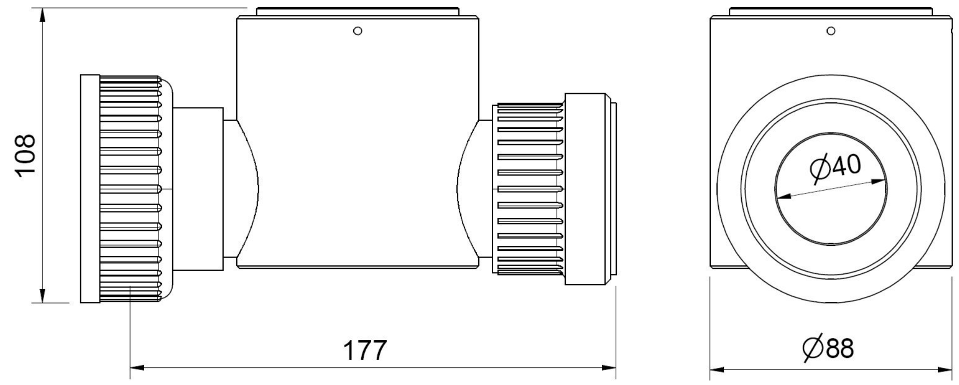
Name	Specification	Remark
Part-no.	F-45-AMMO	
Housing material	POM-C	
Dimensions	90 / 113 mm	
Weight	xxx	
Process connection	$^{1}/_{4}$ inch inside	for inlet and outlet
Installation	flow-through	
Mounting	2 mounting holders	
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	



11.1.5 Flow Cell Setup Waste Water

For not submersed measurement of a waste / raw water sample stream in a bypass installation (e.g. monitoring station) with ammo::lyser / fluor::lyser, a separate flow cell is available.

Name	Specification	Remark
Part-no.	F-48-AMMO	
Housing material	PVC	
Dimensions	177 / 108 / 83 mm	W / H / D
Weight	~ 0,5 kg	
Process connection	1 inch inside (G 1“) 40 mm ID	via F-48-process direct connection to G 1“
Installation	flow-through (by-pass)	
Discharge	< 40 l/min	recommended
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	



Dimension of flow cell setup in mm (F-48-AMMO)

11.1.6 System Panel micro::station / nano::station

For easy attachment of a complete s::can monitoring system (s::can operation terminal, flow cell setup, sensor) different types of mounting panels are available. The process connections of these panels can be ordered in DIN standard (EU) or in National Pipe Standard (US).

Name	Specification	Remark
Part-no.	F-501-ECO-xx F-506-PANEL-xx F-508-PANEL	Main panel micro::station Main panel nano::station Waste water panel
Material	PP PE	F-501, F-508 F-506
Dimensions W / H / D	450 / 750 / 10 mm 280 / 750 / 10 mm 375 / 690 / 10 mm (per part)	F-501-eco F-506-panel F-508-panel (2 parts)
Weight	~ 4.9 kg	

11.1.7 Pressure Connection Set

For connection of the ammo::lyser to the optional pressurized air cleaning system, a specific connection set is available.

Name	Specification	Remark
Part-no.	B-41	
Material	PU Nickel-plated-brass	tube connection fitting
Dimensions	3 m ID 4 mm / OD 6 mm	tube
Process connection	$^3/_8$ inch	connection fitting
Operating pressure	0 to 6 bar (0 to 87 psi)	

11.2 Spare Parts

11.2.1 Reference Electrode

The reference electrode needs to be replaced by a new one regulary. Please refer to the technical specification (section 12) regarding life time of electrode.

Name	Specification	Remark
Part-no.	E-532-ISE-REF E-533-ISE-REF	für Sensorversion V1 für Sensorversion V2
Scope of delivery	Electrode with protective cap	
Storage duration	max. 2 years	with protective cap
Storage temperature	2 to 40 °C (35 to 104 °F)	Storage in fridge recommended

11.2.2 pH Electrode

The pH electrode needs to be replaced by a new one regulary. Please refer to the technical specification (section 12) regarding life time of electrode.

Name	Specification	Remark
Part-no.	E-532-ISE-PH E-533-ISE-PH	für Sensorversion V1 für Sensorversion V2
Scope of delivery	Electrode with protective cap	
Storage duration	max. 2 years	with protective cap
Storage temperature	2 to 40 °C (35 to 104 °F)	Storage in fridge recommended

11.2.3 Ammonium Electrode (NH4-N)

The Ammonium electrode needs to be replaced either by a new or a refurbished one regulary. Please refer to the technical specification (section 12) regarding life time of electrode.

Name	Specification	Remark

Part-no.
new electrode
	E-532-ISE-NH4
	E-534-ISE-NH4
	E-533-ISE-NH4
	E-535-ISE-NH4
		for sensor version V1
		successor model for V1
		for sensor version V2
		successor model for V2

Part-no.
refurbished electrode
	E-632-ISE-NH4
	E-634-ISE-NH4
	E-633-ISE-NH4
	E-635-ISE-NH4
		for sensor version V1
		successor model for V1
		for sensor version V2
		successor model for V2

Storage duration	max. 1 year	see production date
Storage temperature	2 to 40 °C (35 to 104 °F)	Storage in fridge recommended

11.2.4 Potassium Electrode (K)

The Potassium electrode needs to be replaced either by a new or a refurbished one regulary. Please refer to the technical specification (section 12) regarding life time of electrode.

Name	Specification	Remark

Part-no.
new electrode
	E-532-ISE-K
	E-533-ISE-K
		for sensor version V1
		for sensor version V2

Part-no.
refurbished electrode
	E-632-ISE-K
	E-633-ISE-K
		for sensor version V1
		for sensor version V2

Storage duration	max. 1 year	see production date
Storage temperature	2 to 40 °C (35 to 104 °F)	Storage in fridge recommended

11.2.5 Nitrate Electrode (NO3-N)

The Nitrate electrode needs to be replaced either by a new or a refurbished one regulary. Please refer to the technical specification (section 12) regarding life time of electrode.

Name	Specification	Remark

Part-no.
new electrode
	E-532-ISE-NO3
	E-533-ISE-NO3
		for sensor version V1
		for sensor version V2

Part-no.
refurbished electrode
	E-632-ISE-NO3
	E-633-ISE-NO3
		for sensor version V1
		for sensor version V2

Storage duration	max. 1 year	see production date
Storage temperature	2 to 40 °C (35 to 104 °F)	Storage in fridge recommended

11.2.6 Chloride Electrode (Cl)

The Chloride electrode needs to be replaced by a new one regulary. Please refer to the technical specification (section 12) regarding life time of electrode.

Name	Specification	Remark

Part-no.
new electrode
	E-532-ISE-CL
	E-533-ISE-CL
		for sensor version V1
		for sensor version V2

Storage duration	max. 1 year	see production date
Storage temperature	2 to 40 °C (35 to 104 °F)	Storage in fridge recommended

11.2.7 Fluoride Electrode (F)

The Fluoride electrode needs to be replaced by a new one regulary. Please refer to the technical specification (section 12) regarding life time of electrode.

Name	Specification	Remark

Part-no.
new electrode
	E-532-ISE-F
	E-533-ISE-F
		for sensor version V1
		for sensor version V2

Storage duration	max. 1 year	see production date
Storage temperature	2 to 40 °C (35 to 104 °F)	Storage in fridge recommended

12 Technical Specifications

Name	Specification	Remark
Part-no.	E-532-PRO-nnn E-532-PRO-xxx-nnn E-532-ECO-nnn E-532-ECO-xxx-nnn E-542-nnn	PRO ... with Potassium compensation ECO ... without Potassium compensation xxx ... additional measuring parameter nnn ... plug (000) or cable (075)
Measuring parameter	Ammoniumnitrogen - NH$_4$-N Potassium - K Nitratenitrogen - NO$_3$-N Chloride - Cl Fluoride - F pH Temperature	on all E-532 on E-532-PRO only optional optional on E-542 optional on all versions
Measuring principle	Ion selective electrode (ISE)	
Compensation	Temperature pH Potassium	for all electrodes during calibration for NH4-N measurement for NH4-N measurement with pro version
Measuring range	NH$_4$-N: 0.1 - 1000 mg/l K: 1 - 1000 mg/l NO$_3$-N: 0.3 - 1000 mg/l Cl: 1 - 1000 mg/l F: 0.1 - 1000 mg/l pH: 2 - 12 pH Temp: 0 - 60 °C	readings displayed up to 1500 readings displayed up to 3900
Resolution	0.02 - 19.99: 0.01 mg/l 20.0 - 99.9: 0.10 mg/l 100 - 1000: 1.0 mg/l pH: 0.01 pH Temp: 0.1 °C	after linear calibration after linear calibration after linear calibration
Accuracy	ISE: < 5 % of measurement or +/- 0.2 mg/l pH: < 0.3 pH	the greater of the two values is valid
Response time	< 2 min	T_{90} between 10^{-3} and 10^{-2} mol/l
Running in time (start up)	4 - 24 h	can be reduced by conditioning (e.g. in tap water)
Installation	submersed or in flow cell	
Environment rating	IP 67 (plug version -000) IP 68 (cable version -075)	due to connection plug on sensor
Operating temperature	0 to 45 °C (32 to 113 °F)	
Operating pressure	0 to 1 bar (0 to 14.5 psi)	
Operating flow	> 0.01 m/s < 3.00 m/s	Measurement in non flowing water (e.g. lakes) possible, max. value reduced in abrasive media.
Operating pH range	NH4-N: < 8 (without pH compensation) NO3-N: 2 - 12 K: 2 - 12 F: 5 - 8 (without pH compensation)	
Cross sensitivity NH4-N	K: 1 : 25 Na: 1 : 100 Li: 1 : 2000	
Cross sensitivity NO3-N	Cl: 1 : 200 Br: 1 : 1 I: 10 : 1	

Name	Specification	Remark
Cross sensitivity K	NH4-N: 1 : 200	
Cross sensitivity F	OH: 10 : 1	
Power supply	9 to 30 VDC	
Power consumption	0.72 W (typical)	
Dimension	60 / 350 mm 23.62 / 137.8 inch	Diameter / length (see section 3.3)
Weight	approx. 2.7 kg	
Housing material	POM-C, stainless steel 1.4571	Medium contacted
Interface connection	sys plug (IP 67), RS 485	to s::can operation controller, plug fits through 20 mm hole
Sensor cable lenght	7.5 m fixed cable (-075) or 1.0 m connection cable with plug connection on top of sensor (-000)	
Sensor cable specification	PUR (polyurethane jacket), 22 AWG, 6.3 mm (outside diameter); -30 to 80 °C (-22 to 176 °F)	older versions with grey sensor cable
Sensor cable assignment	Pin 1: Data - (green cable strand) Pin 2: Data + (pink cable strand) Pin 3: +12 VDC (red cable strand) Pin 4: Ground (black cable strand) Pin 5: not used Pin 6: Shielding (blank cable strand)	green (grey cable version) yellow (grey cable version) white (grey cable version) brown (grey cable version) black (grey cable version)
Storage temperature	Sensor incl. electrodes: 2 to 40 °C (35.6 to 104 °F)	for longterm storage of replacement electrodes 4 °C (39.2 °F) recommended.
Storage of sensor	dry, reference- and pH-electrode with protective cap filled with 3M potassium chloride solution	
Typical lifespan (application)	ISE electrode: $^1/_2$ - 1 year pH-electrode: 1 year Reference electrode: 1 year	depending on application
Typical lifespan (storage)	ISE electrode: max. 1 year pH-electrode: max. 2 years Reference electrode: max. 2 years	at 4 °C (39.2 °F) with protective cap filled with KCl with protective cap filled with KCl
Refurbishment electrodes	for NH4-N, K, NO3-N only	max. 2 times per electrode possible
Automatic cleaning - sensor connection	G $^1/_8$ inch for air hose OD 6 mm	
Automatic cleaning - specification	Pressure: 2 - 4 bar (29 - 58 psi) Duration: 2 - 6 Sek. Frequency: 10 min. - 6 hours	pressurized air free of oil and particles
Conformity - EMC	EN 50081-1, EN 50082-1 EN 60555-2, EN 60555-3	
Conformity - Security	EN 61010-1	

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Intelligent. Optical. Online.

Manual

chlori::lyser V1.1

October 2017 Release

S-295-m

Table of Contents

1 General

This manual contains, firstly, general information (chapter 1) and safety guidelines (chapter 2). The next chapter (chapter 3) provides a technical description of the s::can product itself as well as information regarding transport and storage of the product. In further chapters the installation (chapter 4) and the initial startup (chapter 5) are explained. Furthermore information regarding calibration of the device (chapter 6), data management (chapter 7), how to perform a functional check (chapter 8) and maintenance (chapter 9) can be found in this manual. Information regarding troubleshooting (chapter 10), the available accessories (chapter 11) and the technical specifications (chapter 12) complete the document.

Each term in this document that is marked *italic and underlined*, can be found on the display of your controller or as lettering on your s::can product.

In spite of careful elaboration this manual may contain errors or incompletion. s::can does not assume liability for errors or loss of data due to such faults in the manual. The original manual is published in English and German by s::can. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into third languages.

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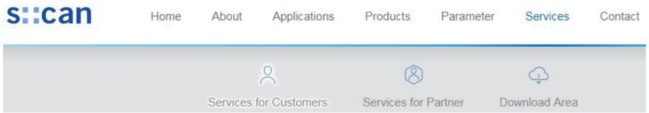
This manual, at the time of its publication (see release date printed on the top of this document), concerns the s::can products listed in chapter 3. Information and technical specifications regarding these items in s::can manuals from earlier release dates are herewith replaced by this manual.

The electronic version (pdf-document) of this manual is available on the Customer Portal (Services for Customer) of the s::can Homepage (www.s-can.at).



2 Safety Guidelines

Installation, electrical connection, initial startup, operation and maintenance of any s::can product as well as complete s::can measuring systems must only be performed by qualified personnel. This qualified personnel has to be trained and authorised by the plant operator or by s::can for these activities. The qualified personnel must have read and understood this manual and have to follow the instructions contained in this manual.

For proper initial startup of complete s::can measuring systems, the manuals for the controller and software used for operation (e.g. con::lyte, con::cube, con::nect, moni::tool), the connected probes and sensors as well as the used additional devices (e.g. compressor) have to be consulted.

The operator has to obtain the local operating permits and has to comply with the joint constraints associated with these. Additionally, the local legal requirements have to be observed (e.g. regarding safety of personnel and means of labour, disposal of products and materials, cleaning, environmental constraints). Before putting the measuring device into operation, the operator has to ensure that during mounting and initial startup – in case they are executed by the operator himself – the local legislation and requirements (e.g. regarding electrical connection) are observed.

All s::can products are leaving our factory in immaculate technical and safety conditions. Inappropriate or not intended use of the product, however, can cause danger! The manufacturer is not responsible for damage caused by incorrect or unauthorised use. Any kind of manipulation of the instrument is strictly prohibited - except for the activities described in this document. Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid. For details regarding guarantee and warranty please refer to our general conditions of business.

2.1 Declaration of Conformity

This s::can product has been developed, tested and manufactured for electromagnetic compatibility (EMC) and according to applicable European standards, as defined in the declaration of conformity.

CE-marks are applied on the device. The declaration of conformity related to this marking can be requested from s::can or your local s::can sales partner or can be downloaded from the s::can Customer Portal.

2.2 Special Hazard Warning

⚠ Because the s::can measuring systems are frequently installed in industrial and communal waste water applications, one has to take care during mounting and demounting of the system, as parts of the device can be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one’s health during work with the measuring device.

⚠ Some electrolytes contain diluted acids. Do not swallow the electrolyte. Avoid contact of the electrolyte with skin and eyes. Otherwise wash with a lot of water. In case of eye inflammation, contact a doctor.

3 Technical Description

3.1 Intended Use

The chlori::lyser is an electrochemical based sensor designed for the continuous monitoring of free or total chlorine in water. For this purpose two different sensor types are available. The value is expressed in mg/l. All sensor types provide the measured temperature as an additional parameter.

The sensors are not suitable for checking the absence of chlorine.

These sensors were developed for use in drinking water, pool water and different types of water treatment. The usage in waste water is possible, but has to be evaluated in the specific application. These sensors have only a low dependence on fluctuations of the measuring flow. Nevertheless a constant flow of the measuring medium is recommended.

In all types of applications, the respective acceptable limits, which are provided in the technical specifications in the respective s::can manuals, have to be observed. All applications falling outside of these limits, and which are not authorised by s::can Messtechnik GmbH in written form, do not fall under the manufacturer's liability.

The device must only be used for the purpose described in this manual. Use in applications not described in this manual, or modification of the device without written agreement from s::can, is not allowed. s::can is not liable for claims following from such unauthorised use. In such a case, the risks are the sole responsibility of the operator.

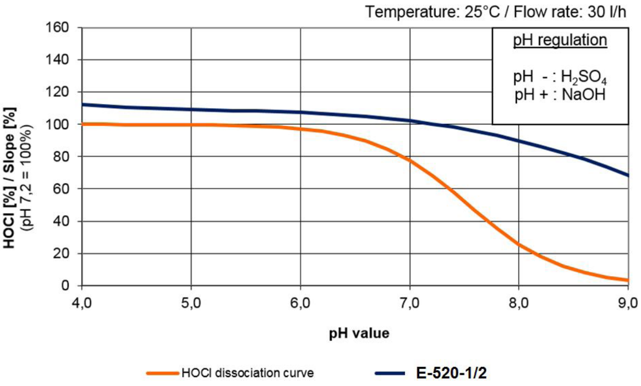
3.2 Functional Principle

The chlori::lyser is a membrane covered amperometric 3 electrode sensor. The hydrophilic membrane, which is not ion specific but permeable to ionic species in general, is stretched over a gold cathode (working electrode). A reference electrode (silver / silver chloride) and a counter electrode (stainless steel), that is special placed on the outside measuring cell, complete the electric circuit.

Free chlorine is defined as the concentration of residual chlorine in water present as dissolved gas (Cl_2), hypochlorous acid (HOCl), and / or hypochlorite ion (OCl^-). These three forms of free chlorine are existent in a pH-dependent equilibrium (see orange line in the figure on the right). The sensor can be used in applications where chlorine gas Cl_2(g), sodium hypochlorite NaClO, calcium hypochlorite $Ca(OCl)_2$ or electrically generated chlorine are used as disinfectants.

Total chlorine is the sum of free chlorine and combined chlorine (e.g. chloramines).

Due to an internal pH correction, the chlori::lyser reduces the pH dependence of the measurements. As a result, variations of the pH value only have a small influence on the measured value (see blue line in the figure on the right).



3.3 Product

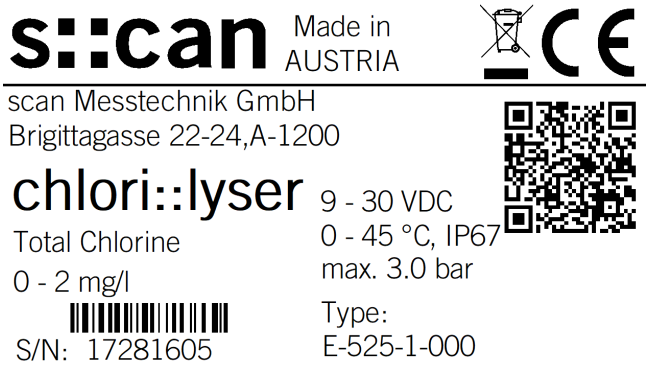
The following device variants of the chlori::lyser are available. Regarding detailed information of the device variants please refer to the technical specifications located at the end of this manual.

Type	Specification	Range
E-520-1-000 [E-507-1-000 1)]	chlori::lyser for free chlorine (FCL) with plug connection	0 - 2 mg/l
E-520-2-000 [E-507-2-000 1)]	chlori::lyser for free chlorine (FCL) with plug connection	0 - 20 mg/l
E-525-1-000 [E-507-3-000 1)]	chlori::lyser for total chlorine (TCL) with plug connection	0 - 2 mg/l
E-525-2-000 [E-507-4-000 1)]	chlori::lyser for total chlorine (TCL) with plug connection	0 - 20 mg/l
E-520-1/2-KIT	Electrolyte and membrane cap for free chlorine (spare part for E-520-x-000)	
E-525-1/2-KIT	Electrolyte and membrane cap for total chlorine (spare part for E-525-x-000)	
E-507-1/2-EL	Electrolyte for free chlorine (spare part for E-507-1-xxx and E-507-2-xxx)	
E-507-3/4-EL	Electrolyte for total chlorine (spare part for E-507-3-xxx and E-507-4-xxx)	
E-507-1/2-SET	Membrane cap for free chlorine (spare part for E-507-1-xxx and E-507-2-xxx)	
E-507-3/4-SET	Membrane cap for total chlorine (spare part for E-507-3-xxx and E-507-4-xxx)	

1) Previous version of chlori::lyser (has been delivered from s::can until April 2017)

The device is typified by a type label, as shown on the right, that contains the following information:

- Manufacturer‘s name and country of origin
- Several certification marks
- Device name
- Measuring range
- Bar code
- Device serial number (S/N)
- Information on power supply
- Acceptable temperature limits
- Environment rating (IP)
- Acceptable pressure limits
- Item number (Type)
- QR code to s::can Support



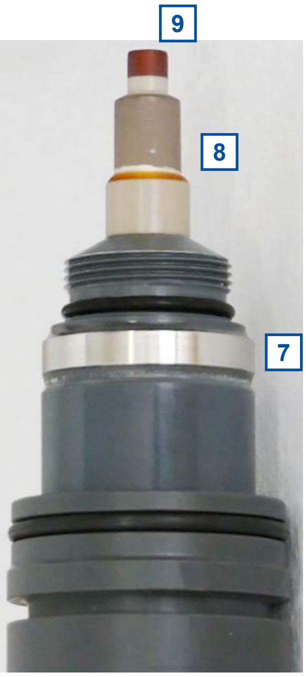
s::can Made in AUSTRIA

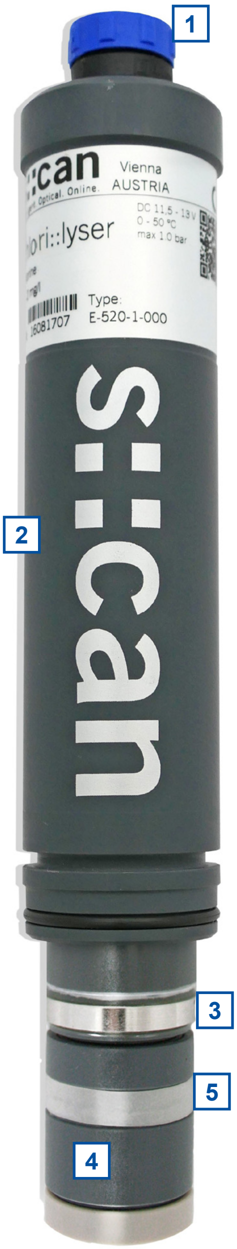
scan Messtechnik GmbH
Brigittagasse 22-24,A-1200

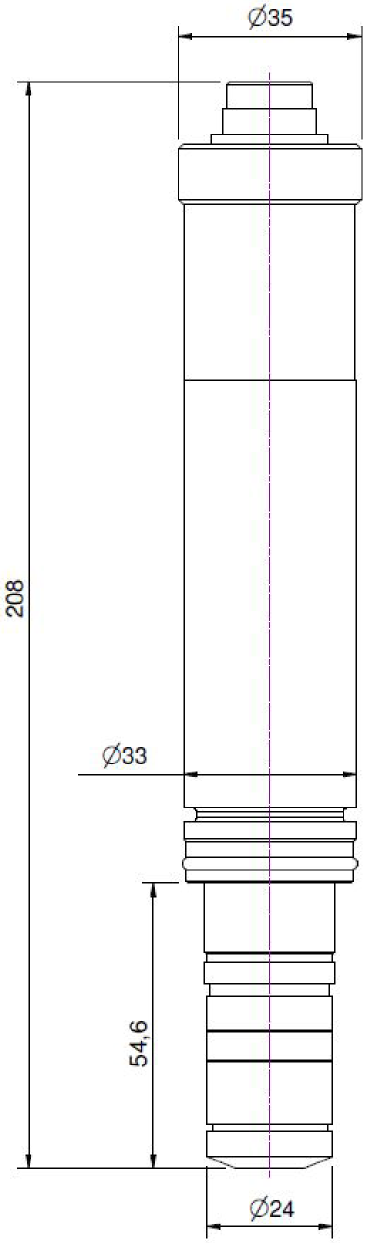
chlori::lyser
Total Chlorine
0 - 2 mg/l
S/N: 17281605

9 - 30 VDC
0 - 45 °C, IP67
max. 3.0 bar
Type:
E-525-1-000

1	Connector for sensor cable
2	Sensor housing
3	Counter electrode
4	Membrane cap
5	Rubber band (to protect vent hole)
6	Membrane
7	Reference electrode
8	Electrode finger
9	Goldelectrode







Dimensions of chlori::lyser in mm

3.4 Storage and Transport

The temperature limits for device storage and transport, which are described in the section technical specifications, have to be observed at all times. The device shall not be exposed to strong impacts, mechanical loads or vibrations. The device should be kept free of corrosive or organic solvent vapours, nuclear radiation as well as strong electromagnetic radiation.

For short term storage (up to 24 hours) the sensor can stay in the flow cell with water or can be covered with the protective cap filled with water to prevent the sensor from drying out.

For long term storage the membrane cap has to be unscrewed. Then the membrane cap, the spacer and electrode must be rinsed with clean water. Finally the dry membrane is screwed onto the sensor loosely, to protect the electrode finger. The membrane itself should not touch the electrode finger. For recommissioning after long term storage please refer to section 9.2.

Damage to the sensor caused by wrong storage will not be covered by warranty.

Membrane caps that have been in operation for more than one day cannot be used again after storage.

Transport should be done in a packaging that protects the device (original packaging or protective covering if possible).

This product is marked with the WEEE symbol to comply with the European Union’s Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EC. The symbol indicates that this product should not be treated as household waste. It must be disposed and recycled as electronic waste. Please assist to keep our environment clean.

3.5 Scope of Delivery

Immediately upon receipt, please check the received consignment for completeness on the basis of the delivery note and check for any possible damage incurred during shipping. Please inform the delivering dispatcher and s::can immediately in case of any damages in transit.

The following parts should be included in the delivery:

- s::can chlori::lyser (part-no. E-520-x-000 or E-525-x-000), electrolyte and membrane cap are packed seperately
- Connection cable (part-no. C-1-010-sensor),
- s::can manual chlori::lyser (part-no. S-295-m)

The following parts could be included in the delivery if ordered as an option:

- Extension cable (part-no. C-210-sensor, C-220-sensor or C-230-sensor)
- Flow cell setup tap water for single sensor (part-no. F-45-sensor)
- Flow cell setup tap water for four sensors (part-no. F-45-four)
- Flow cell setup tap water for i::scan and three sensors (part-no. F-46-four-iscan)
- Carrier for single sensor (part-no. F-12-sensor)
- Automatic flow restrictor (part-no. F-45-flow-1)
- Maintenance set for free chlorine (part-no. E-520-1/2-KIT)
- Maintenance set for total chlorine (part-no. E-525-1/2-KIT)

In case of incompleteness please contact your s::can sales partner immediately!

3.6 Product Updates, Other

The manufacturer reserves the rights to implement, without prior notice, technical developments and modifications in the light of continuous product care.

4 Installation

4.1 Environment

The correct installation of measuring instruments is an important prerequisite for satisfactory operation. Therefore the following checklist for the installation can be used to ensure that all sources for potential operational problems can be ruled out to the greatest possible extent during the installation, allowing the monitoring system to operate properly.

- Favourable flow conditions (little turbulence, acceptable flow rate, pressure, etc.)
- Unadulterated, representative measuring medium
- Measuring medium is in equilibrium state (no gas release, no precipitation, etc.)
- No external interferences (no electric and electro-magnetic interferences by leakage current, earth fault of pumps, electric motors, electric power lines, etc.)
- Easy accessibility (mounting, sampling, functional check, demounting)
- Availability of sufficient space (probe / sensor, installation fitting, controller, etc.)
- Adherence to limit values (see technical specifications located at the end of this manual)

- Power supply for controller (operational reliability, voltage, power, peak free)
- Best possible weather and splash water proof conditions
- Shortest possible distances between system components (probe / sensor – controller – compressed-air supply – energy supply)
- Correct dimensioning, mounting and protection of all cables and lines (non-buckling, no risk of stumbling, no damage etc.)

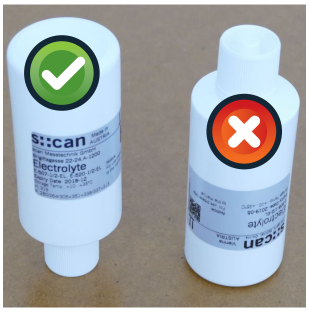
4.2 Assembling of chlori::lyser

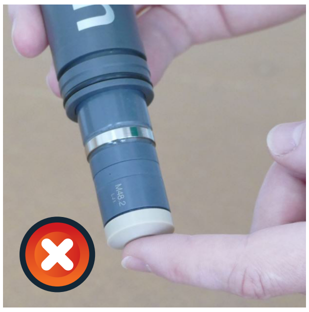
The chlori::lyser is not ready for use after shipment. This sections will guide you through the steps needed to prepare chlori::lyser for measurment. Please mind the following important notes when handling with the chlori::lyser:

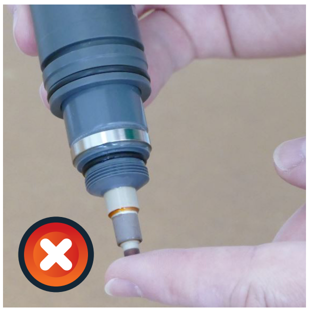
- Never touch the surface of the membrane, the electrode finger or the gold electrode at the tip of it with your fingers.

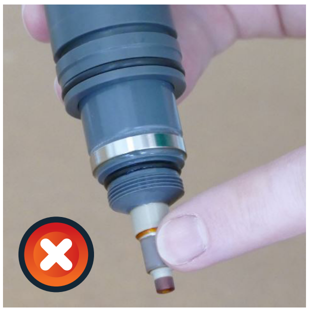
- Do not shake the electrolyte bottle, store it always upside-down and fill the membrane cap slowly to avoid air bubbles within the electrolyte. Air bubbles between gold electrode and membrane will falsify your readings.

- Do not cover the vent hole with your fingers, when the membrane cap is screwed on or off.







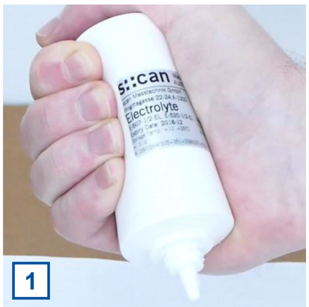


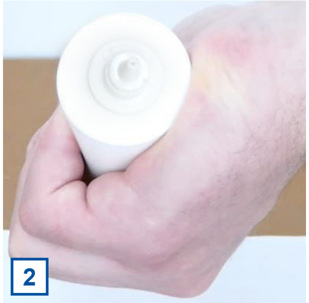
- Please note the correct handling of electrolyte bottle during filling, to avoid air bubbles entering the electrolyte

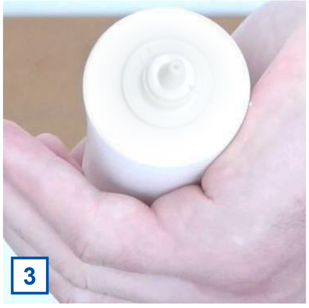
1 Press bottle when upside down for filling.

2 Turn your hand to brings the bottle upright.

3 Only now open hand to let air flow into the bottle.



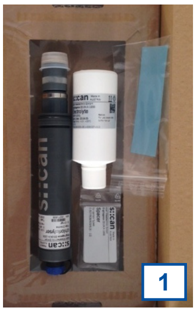


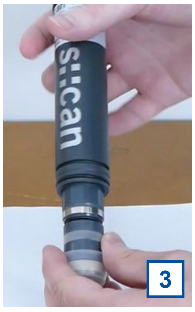


1 Place the sensor package and a clean plastic sheet onto a flat table. Carefully put the provided parts (sensor with membrane cap and protective cap, electrolyte and, if included, spacer) onto the clean plastic sheet.

2 Place the bottle of electrolyte upside down. Ideally some days before.

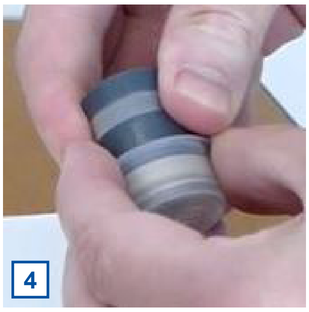
3 Unscrew the membrane cap from the sensor body.

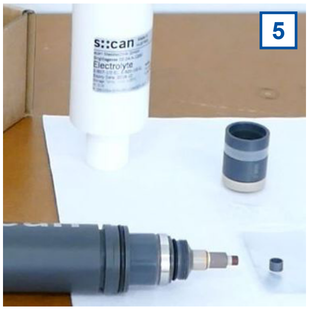




4 Remove the protective cap carefully. Don‘t touch the membrane.

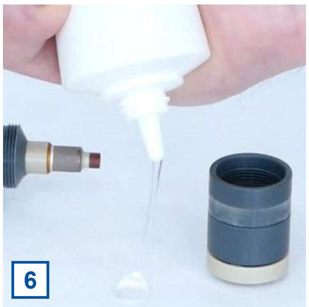
5 Place the membrane cap onto the clean plastic with the opening upwards.

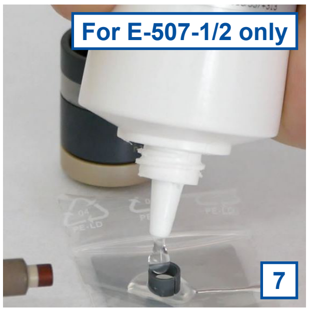




6 Take the bottle with electrolyte and open it and keep it always upside down. Let the electrolyte flow onto the plastic sheet. Don‘t stop the flow.

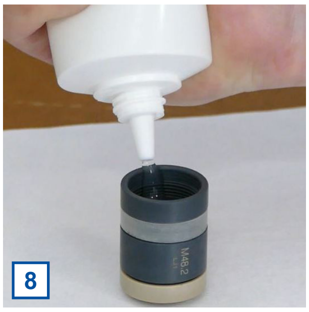
7 For previous sensor version E-507-1/2 only the following step is needed:
Put a drop of the electrolyte on the plastic sheet, place the spacer on it and fill the spacer with electrolyte.

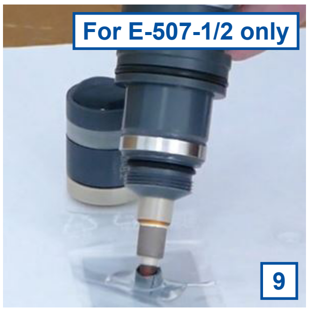




8 Now move the bottle over the membrane cap without stopping the flow. Let the electrolyte flow slowly along the edge into the membrane cap up to the top. This procedure will avoid air bubbles within the electrolyte.

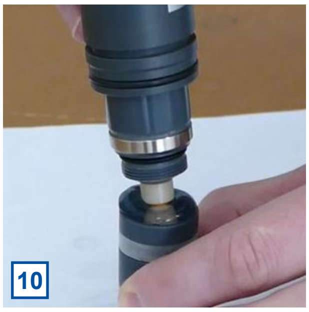
9 For previous sensor version E-507-1/2 only the following step is needed:
Hold the sensor body upright and push the electrode tip carefully into the filled spacer to take it up.

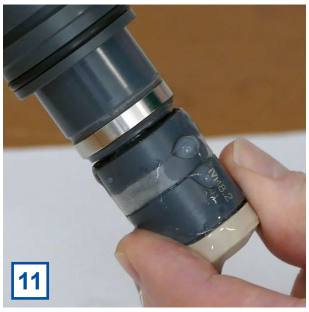




10 Hold the sensor upright and immerge the electrode tip slowly into the filled membrane cap.

11 Screw the membrane cap onto the sensor body. Electrolyte will escape through the vent hole while screwing. Be careful not to block this vent with your fingers.



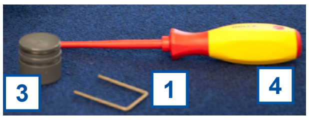


12 Spill the excessive electrolyte from the sensor body with clean tap water or distilled water.

⚠ Once the sensor has been assembled, it should be supplied with power as soon as possible and ensure that the sensor is always wetted with disinfected water.

4.3 Mounting in Flow Cell Tap Water

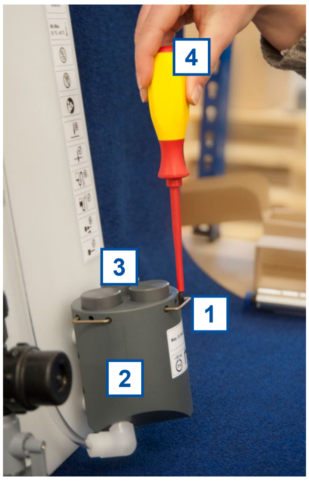
This section explains how the chlori::lyser can be installed in a flow cell using either the single sensor flow cell setup (part-no. F-45-sensor) or the four sensor flow cell setup (part-no. F-45-four or part-no. F-46-four-iscan). Regarding the dimensions of these flow cells please refer to section 11.1.4.



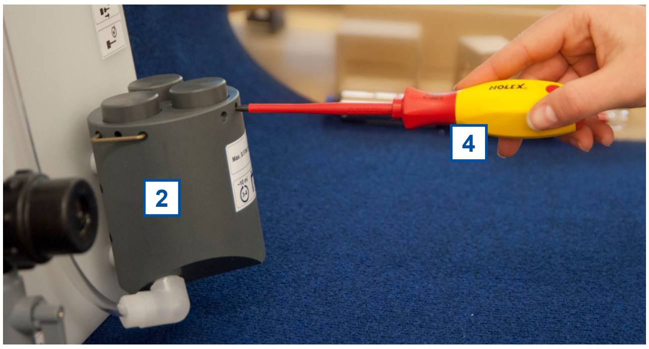
After the chlori::lyser is prepared as described in section 4.2 the installation in this flow cell is performed by the following steps:

⚠ Please note the chlori::lyser has to be placed into an opening located after the flow restrictor (i.e. position 3 or 4 in case of F-46-four-iscan).

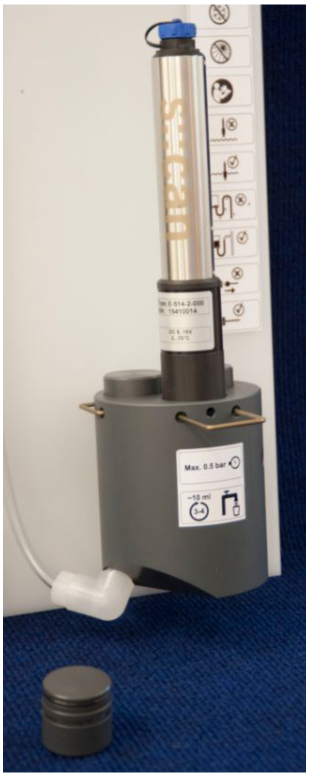
- Pull out the metal bracket [1] from the flow cell [2] that fixes the plug [3]. A flat screw driver [4] can be used to do this, if needed.



- Remove the plug [3] from the flow cell [2].To remove the plug insert a flat screw driver [4] into the small hole on the side of the flow cell and move the plug out by moving the screw driver downwards.



- Insert sensor [5] in the opening of the flow cell [2] and push sensor down carefully until O-ring snaps into the correct sensor position.
- Push the metal bracket [1] back into the flow cell [2] to secure the sensor [5] in place. The metal bracket can only be inserted if sensor is in the correct position.
- Ensure that all other openings of the flow cell [2] are covered with plugs [3] before putting the monitoring station into operation.
- To demount the sensor [5] use a flat screw driver [4] to remove the metal bracket [1] first and pull the sensor out.



The flow cell [2] is mounted onto the panel [7] of the micro- / nano::station with two fixing holders [6]. The position of the flow cell is secured by a metal bracket [1].

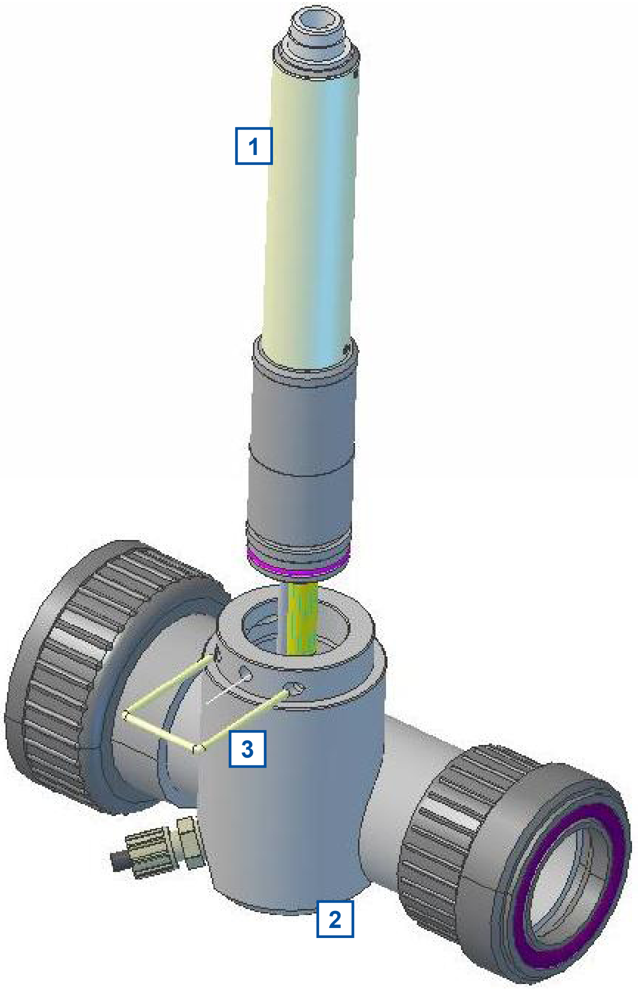
4.4 Mounting in Flow Cell Waste Water

This section explains how the chlori::lyser can be installed in the flow cell for waste water (part-no. F-48-sensor). Regarding the dimensions of this flow cell please refer to section 11.1.5.

⚠ Please note that all specifications regarding flow conditions are kept in mind to receive good measurements

After the chlori::lyser is prepared as described in section 4.2 the installation in this flow cell is performed by the following steps:

- Remove the protective cap from the membrane.
- Pull out the metal bracket with a screw driver as explained in section 4.3.
- Insert sensor [1] in the opening of the flow cell setup [2] and push sensor down carefully until O-ring snaps into the correct sensor position.
- Push the metal bracket [3] into the two holes on the side of the flow cell setup to secure the sensor in place. The metal bracket can only be inserted if sensor is in the correct position.
- Connect pipes / tubes for medium supply to the inlet and to the outlet of the flow cell setup (please refer to section 11.1.5 for dimension of fittings).
- To demount the sensor use a flat screw driver to remove the metal bracket first and pull the sensor out.

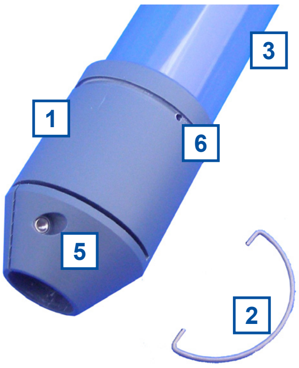


4.5 Mounting with Probe Carrier

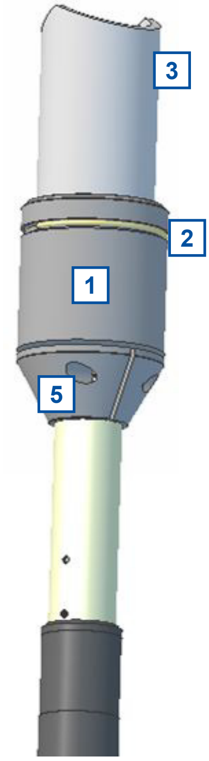
This section explains how the chlori::lyser can be installed in the probe carrier (part-no. F-12-sensor). Regarding the dimensions of this installation accessories please refer to section 11.1.3.

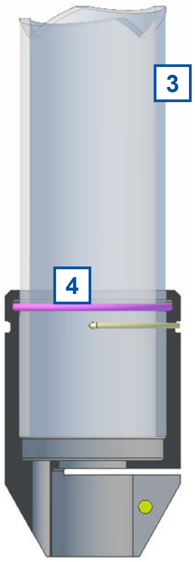
Please note that all specifications regarding flow conditions are kept in mind to receive good measurements.

After the chlori::lyser is prepared as described in section 4.2 the installation in this flow cell is performed by the following steps:



- Remove retaining clip [2] from the probe carrier [1].





- Put extension pipe OD 50 mm or $1^{1}/_{2}$ inch [3] - to be provided by the customer - into the probe carrier [1].
- Drill two holes into the correctly positioned extension pipe [3]. Use the two existing holes [6] for the retaining clip [2] in the probe carrier [1] as guiding help.
- Snap the retaining clip [2] into both holes [6]. Doing this the probe carrier [1] will be fixed onto the extension pipe [3].

Depending on the extension pipe's OD you can use one of the two O-rings [4], included in delivery, to stabilize the position of the pipe. O-ring 50 x 2.5 mm can be used for 50 mm and O-ring 50 x 3.5 mm can be used for $1^{1}/_{2}$ inch.

- Lead the probe cable and the air hose for automatic probe cleaning through the probe carrier (see left figure below).
- Push the sensor into the probe carrier (see middle figure below).
- Tight the screw [5] on the probe carrier using a screw driver until the sensor is firmly fixed (see right figure below).

5 Initial Startup

Once the assembling, mounting and installation of the chlori::lyser have been completed and checked (see chapter 4) the initial startup of the s::can monitoring system will require the following actions, in the order presented below:

- Connect the chlori::lyser to the controller used for operation (see section 5.1 and 5.2).
- Establish power supply to the controller (please refer to the manual of the controller) and wait until the operation software has started up.
- Perform probe initialisation of the chlori::lyser. Refer to section 5.3.1 in case of using a con::lyte D-31x, refer to section 5.3.2 in case of using con::lyte D-320 and refer to section 5.3.3 in case of using moni::tool.
- Perform parameterisation of the chlori::lyser. Refer to section 5.4.1 in case of using a con::lyte D-31x, refer to section 5.4.2 in case of using con::lyte D-320 and refer to section 5.4.3 in case of of using moni::tool.
- Configure the measuring interval; additional information can be found in the respective manual of the controller.
- In case required, configure the digital, analogue and fieldbus outputs of the controller.
- Check the readings obtained for plausibility after sufficient running-in time (see section 12 regarding running-in time).
- If necessary calibrate the readings of the chlori::lyser in stable water quality (see chapter 6).

5.1 Controller for Operation

For proper operation of the chlori::lyser you will need one of the following controller and operating software respectively.

Controller	Type	Software
con::lyte	D-318, D-319	V5.01 or higher
con::lyte	D-320	V6 or higher
con::cube	D-315	moni::tool V1.3 or higher

s::can recommends to use the most actual version of the operating software on the controller. For service operation with ana::pro please refer to section 10.3.4.

5.2 Connection to the Controller

The chlori::lyser will be delivered with a plug connection on the sensor itself only, the connection cable C-1-010 has to be used to connect the chlori::lyser to a compatible socket provided on the controller. Ensure that the sensor plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.

In case the controller does not supply enough sockets the distribution box for sensors C-41-hub can be used.

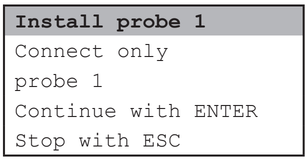
5.3 Probe Initialisation

For operating one or several probes using one operation terminal it is necessary to allocate an individual address to every probe. This can be done during probe initialisation at which the probe has to be recongnized first by the ontroller for operation and then a modification of the actual (preset) probe address might be performed. The corresponding address will be stored on the respective probe. For s::can probes and sensors of the same type the same address is preset ex factory.

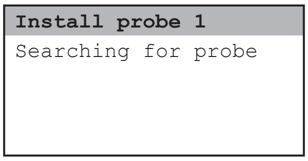
5.3.1 Probe Initialisation using con::lyte D-31x

The con::lyte should not be powered down or switched off during the initialisation process. In case of rebooting of the con::lyte during the initialisation process (e.g. caused by loss of power supply) the complete procedure of probe initialisation has to be repeated.

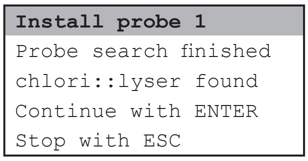
- Establish the power supply to the con::lyte and select entry *Settings / Parameter settings / Install Probes* in the main menu.
- Connect the chlori::lyser to the con::lyte (see section 5.2).
- Push the button *Enter*, which starts the automatic search procedure for the connected probe. Once the probe is found, address 1 will be allocated. This procedure can last several seconds (see figures below).
- The successful completion of the initialisation will be displayed over a user message. If this message is displayed the initialisation procedure can be finished by pushing the button *Esc*.



```
Install probe 1
Connect only
probe 1
Continue with ENTER
Stop with ESC
```



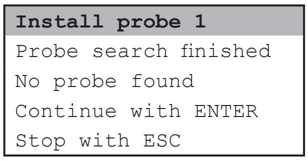
```
Install probe 1
Searching for probe
```



```
Install probe 1
Probe search finished
chlori::lyser found
Continue with ENTER
Stop with ESC
```

A user message will also be displayed when no probe is detected. In this case please check the following before repeating the procedure for probe initialisation:

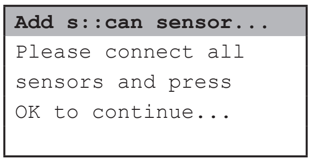
- Is only one probe connected to the con::lyte?
- Is the probe connected properly?
- Are all wires of the con::lyte socket in the terminal compartment tight?



```
Install probe 1
Probe search finished
No probe found
Continue with ENTER
Stop with ESC
```

5.3.2 Probe Initialisation using con::lyte D-320

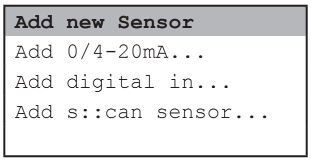
At the initial start-up the con::lyte D-320 provides an automatic probe and sensor initialisation procedure (see screen on the right). After connecting all probes and sensors to the appropriate plugs of the con::lyte (see section 5.2) and pushing the *OK* button, the probe and sensor initialisation starts.



```
Add s::can sensor...
Please connect all
sensors and press
OK to continue...
```

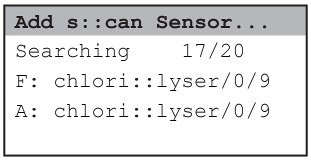
If chlori::lyser will be initialized at a later date, the following steps are needed:

- Switch to Status display by using the *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select menu *Add sensor ...* and confirm with *OK*.
- Connect chlori::lyser to the D-320 (see section 5.2).
- Select menu *Add s::can sensor ...* and confirm with *OK*.



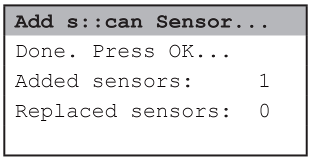
```
Add new Sensor
Add 0/4-20mA...
Add digital in...
Add s::can sensor...
```

As soon as the entry is confirmed by pushing the *OK* button, the con::lyte will automatically search the Modbus port for a new sensor and will add the new sensor to the sensor list.



```
Add s::can Sensor...
Searching    17/20
F: chlori::lyser/0/9
A: chlori::lyser/0/9
```

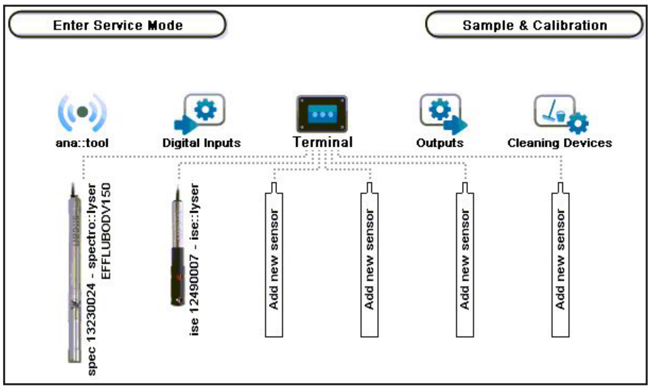
After adding a new probe or sensor, the parameters will be displayed in the parameter screen. Furthermore single parameter can be added manually (see section 5.4.2 and menu *Add parameters...*). In case the installation failed, the message *Error adding!* will be displayed.

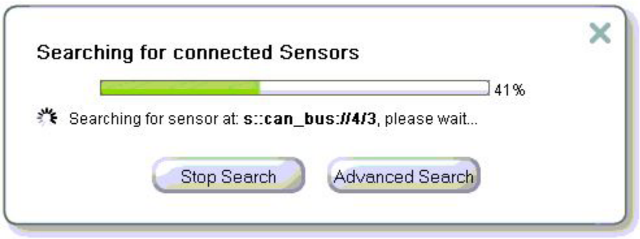


```
Add s::can Sensor...
Done. Press OK...
Added sensors:     1
Replaced sensors:  0
```

5.3.3 Probe Initialisation using moni::tool

- Click the *Service* tab of the moni::tool screen and logon as *Administrator*.
- Click on an empty sensor icon (*Add new Sensor*) to initiate the initialisation process.
- An automatic search procedure will start, searching for the connected sensor.

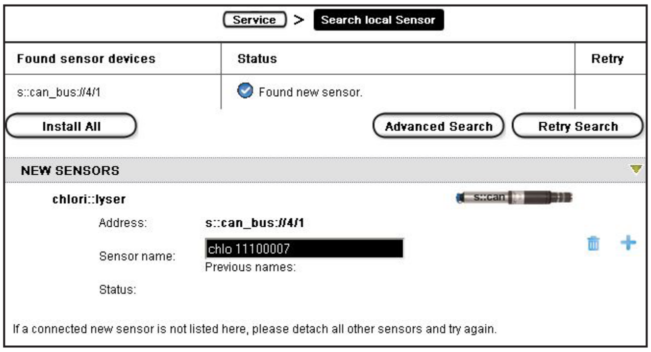



Searching for connected Sensors

41 %

Searching for sensor at: **s::can_bus://4/3**, please wait...

- When the automatic search prodedure is finished, moni::tool will display all connected probes and sensors. Those sensors that are connected for the first time will have the Status *Found new sensor* (also listed as *New Sensors* below).
- If needed *Sensor name* can be modified now, which can be any descriptive name you desire or select one of the previous names listed below this entry field.
- To install the new sensor click on the blue + sign on the right side of the sensor or push the button *Install All*.
- moni::tool will install the sensor and switch to the *Service* tab showing the new sensor in the system overview. Now pushing the button *Leave Service Mode* located on the upper left side to start the measuring process.



Found sensor devices	Status	Retry
s::can_bus://4/1	Found new sensor.	

chlori::lyser

Address: s::can_bus://4/1

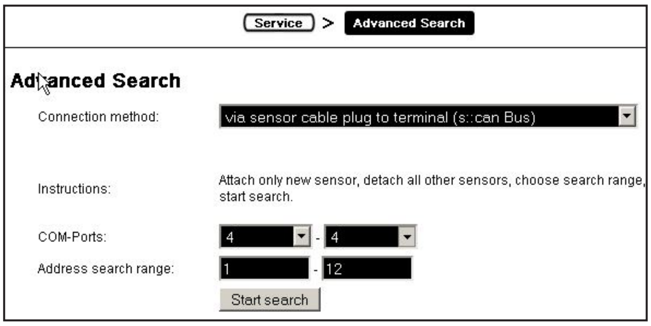
Sensor name: chlo 11100007

Previous names:

Status:

If a connected new sensor is not listed here, please detach all other sensors and try again.

- When pushing the button *Advanced Search* (see 2nd and 3rd figure from the top), the method you connected the sensor (*Connection methode)*, the used *COM-Port* and the *Address* can be defined. A click on button *Start search* will start search procedure within the defined range.



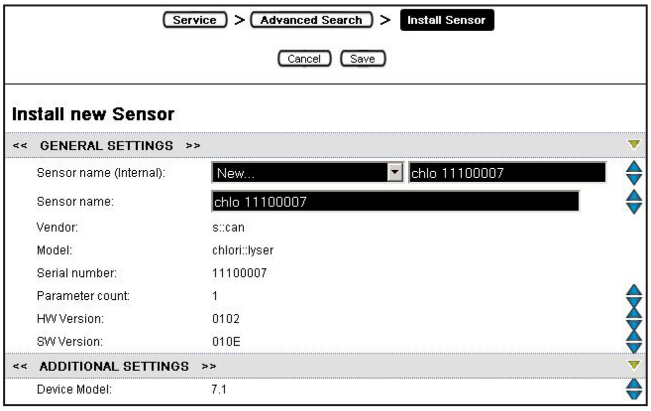
Connection method: via sensor cable plug to terminal (s::can Bus)

Instructions: Attach only new sensor, detach all other sensors, choose search range, start search.

COM-Ports: 4 - 4

Address search range: 1 - 12

- After the *Advanced Search* is finished, the *Install Sensor* screen is displayed. Depending on the used *Service Level* (*Basic*, *Advanced* or *Expert*) only the basic or all information received from the sensor are listed up.
- To install the new sensor push the button *Save* in the upper part of the window.


Service > Advanced Search > Install Sensor
Cancel
Save
Install new Sensor
<< GENERAL SETTINGS >>
<< ADDITIONAL SETTINGS >>

Sensor name (Internal): New... chlo 11100007

Sensor name: chlo 11100007

Vendor: s::can

Model: chlori::lyser

Serial number: 11100007

Parameter count: 1

HW Version: 0102

SW Version: 010E

Device Model: 7.1

5.4 Probe Parameterisation

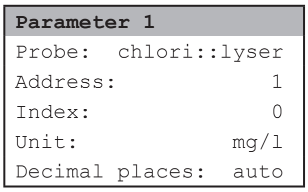
The following table is an overview of the parameters that can be measured with the chlori::lyser:

Sensor / Part-no.	Previous Version	Parameter	Parameter-index	Name [Unit]	Decimal places
chlori::lyser E-520-1	E-507-1	Free chlorine	0	FCL [mg/L]	3
		Temperature	1	Temp. [°C]	1
chlori::lyser E-520-2	E-507-2	Free chlorine	0	FCL [mg/L]	2
		Temperature	1	Temp. [°C]	1
chlori::lyser E-525-1	E-507-3	Total chlorine	0	TCL [mg/L]	3
		Temperature	1	Temp. [°C]	1
chlori::lyser E-525-2	E-507-4	Total chlorine	0	TCL [mg/L]	2
		Temperature	1	Temp. [°C]	1

5.4.1 Probe Parameterisation using con::lyte D-31x

After successful probe initialisation (see section 5.3.1) the measuring parameters of the chlori::lyser will be displayed on the display of the con::lyte automatically. If needed the measuring parameters can be configured individually using the menu item *Settings / Parameter settings / Parameter n* (*Settings / Parameterconfig / Parameter n* with older versions).

The name of the *Probe* or sensor used as a source of the parameter is displayed in the upper line (e.g. chlori::lyser). If several probes or sensors are installed the instrument from which a parameter needs to be displayed can be selected here. Under the entry Probe the *Address* that has been allocated to that probe is displayed as an additional information. The *Index* specifies the place of the corresponding parameter onto the allocated probe. The *Unit* of the selected parameter is displayed in the line below. The item *Decimal places* enables settings of the number of displayed decimal places (between *0* and *4*). With the default setting *auto* the number of decimal places will be automatically set by the sensor.

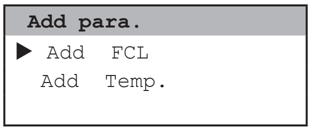


```
Parameter 1
Probe:   chlori::lyser
Address:             1
Index:               0
Unit:             mg/l
Decimal places:   auto
```

5.4.2 Probe Parameterisation using con::lyte D-320

After successful probe initialisation (see section 5.3.2) the needed measuring parameters of the chlori::lyser have to be added to the parameter display. This is performed by the following steps:

- Switch to status display with *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select *chlori::lyser/0/x* and confirm with *OK*.
- Select menu *Add parameters...* and confirm with *OK*.
- Select needed parameter and confirm with *OK*.

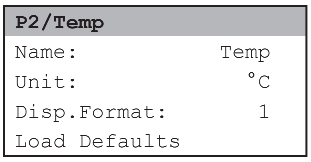


```
Add para.
▶ Add  FCL
  Add  Temp.
```

The selected parameter will be displayed now on the next free position of the parameter display. The default display configuration is used. Changing the display format is performed by the following steps:

- Select the parameter in der parameter display with *Up-* or *Down* button.
- Push *Function* button, select menu *Display settings...* and confirm with *OK*.
- Select *chlori::lyser/0/x* and confirm with *OK*.
- Select menu *Add parameters...* and confirm with *OK*.
- Select needed parameter and confirm with *OK*.

In the displayed parameter configuration the following settings can be modified.



P2/Temp

Name: Temp
Unit: °C
Disp.Format: 1
Load Defaults

- *Name* Displays the actual name of the paramter.
- *Unit* Displays the actual unit of the paramter.

To change the name or unit of the parameter, select the entry with *Up-* and *Down* buttons and by pushing the *OK* button the name can be changed with *Up-*, *Down-*, *Left-* and *Right* buttons. Pushing the *OK* button confirms the new name. Please note that change of parameter name or unit will not change the parameter configuration itself (e.g. if you change the parameter name NO_3-N to NO_3 the reading will still be NO_3-N).

- *Disp.Format* Within this line the number of displayed decimal places (between 0 and 5) can be set. Please note that in case of too many digits high values can not be displayed and the parameter reading will switch to plus signs (++.+++++).

- *Load Defaults* Confirming this entry by pushing the *Ok* button will restore the default display settings from the sensor.

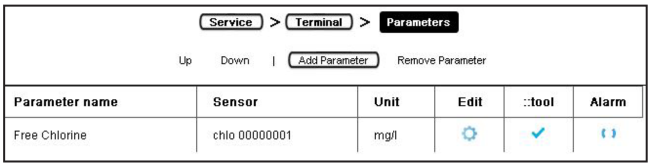
All modifications performed by the operator within these settings menu will be documented in the logfile of the con::lyte (see manual con::lyte D-320).

5.4.3 Probe Parameterisation using moni::tool

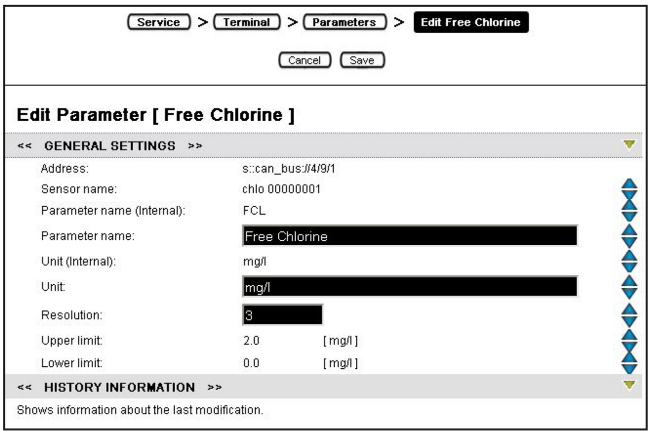
After successful probe initialisation (see section 5.3.3) all parameters available on the probe will be installed and automatically displayed on the *Value* screen of moni::tool. If not all new parameters are displayed, please check maximal number of parameters of your monit::tool license. If you want to configure the measuring parameters induvidually this can be done using the menu item *Service / Terminal / Parameter*.

After selecting that menu item a list of all installed parameters is displayed. After selecting one or several parameters by clicking on them the following activities can be performed:

- Moving the selected parameter to a higher position in the *Value* display by pushing the entry *Up*.
- Moving the selected parameter to a lower position in the *Value* display by pushing the entry *Down*.
- Deleting the selected parameter from *Value* display by pushing the entry *Remove Parameter*.
- A new parameter can be added by pushing the entry *Add Parameter*.
- Click on the blue wheel (*Edit*) on the right hand side of the parameter will display the actual parameter settings. Depending on the actual *Service Level* different settings are displayed and can be edited (*Parametername*, *Unit* and *Resolution*).
- Click on the blue check mark (*::tool*) or on the blue sign (*Alarm*) on the right hand side of the parameter to check or modify the settings for vali::tool and parameter alarm. Please refer to manual moni::tool for further information.



Parameter name	Sensor	Unit	Edit	::tool	Alarm
Free Chlorine	chlo 00000001	mg/l	⚙	✓	( )



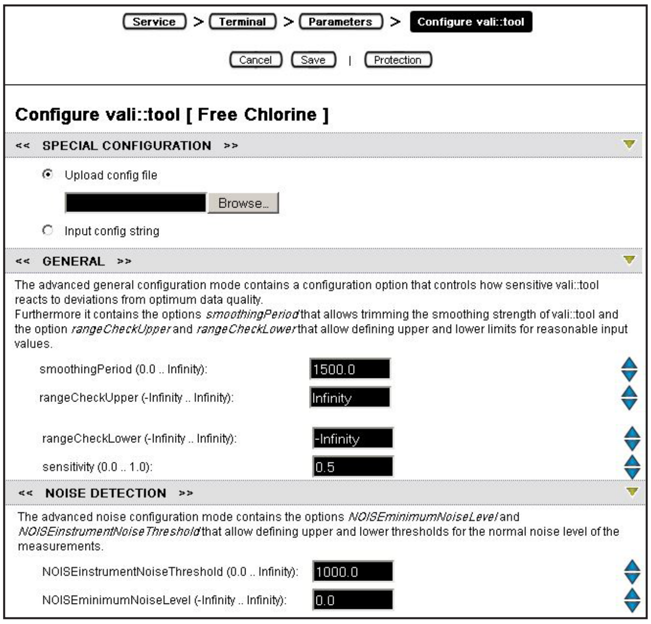
Edit Parameter [Free Chlorine]

<< GENERAL SETTINGS >>

Address: s::can_bus://4/9/1
Sensor name: chlo 00000001
Parameter name (Internal): FCL
Parameter name: Free Chlorine
Unit (Internal): mg/l
Unit: mg/l
Resolution: 3
Upper limit: 2.0 [mg/l]
Lower limit: 0.0 [mg/l]

<< HISTORY INFORMATION >>

Shows information about the last modification.



Configure vali::tool [Free Chlorine]

<< SPECIAL CONFIGURATION >>

● Upload config file
○ Input config string

<< GENERAL >>

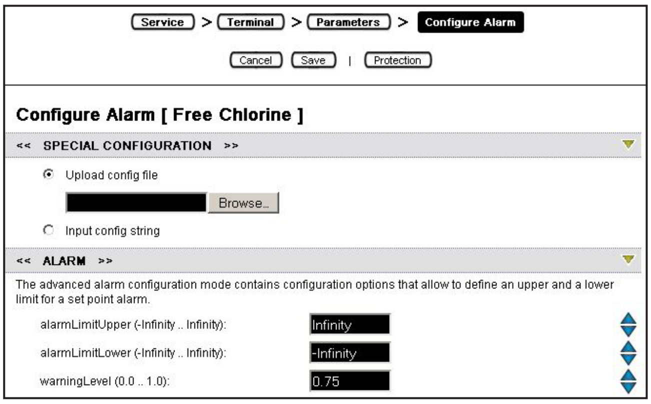
The advanced general configuration mode contains a configuration option that controls how sensitive vali::tool reacts to deviations from optimum data quality.
Furthermore it contains the options *smoothingPeriod* that allows trimming the smoothing strength of vali::tool and the option *rangeCheckUpper* and *rangeCheckLower* that allow defining upper and lower limits for reasonable input values.

smoothingPeriod (0.0 .. Infinity): 1500.0
rangeCheckUpper (-Infinity .. Infinity): Infinity
rangeCheckLower (-Infinity .. Infinity): -Infinity
sensitivity (0.0 .. 1.0): 0.5

<< NOISE DETECTION >>

The advanced noise configuration mode contains the options *NOISEminimumNoiseLevel* and *NOISEinstrumentNoiseThreshold* that allow defining upper and lower thresholds for the normal noise level of the measurements.

NOISEinstrumentNoiseThreshold (0.0 .. Infinity): 1000.0
NOISEminimumNoiseLevel (-Infinity .. Infinity): 0.0



Configure Alarm [Free Chlorine]

<< SPECIAL CONFIGURATION >>

● Upload config file
○ Input config string

<< ALARM >>

The advanced alarm configuration mode contains configuration options that allow to define an upper and a lower limit for a set point alarm.

alarmLimitUpper (-Infinity .. Infinity): Infinity
alarmLimitLower (-Infinity .. Infinity): -Infinity
warningLevel (0.0 .. 1.0): 0.75

6 Calibration

The chlori::lyser is delivered with membrane cap and electrolyte separately. Therefore the electrode slope needs to be calibrated after initial startup (see chapter 5). Subsequently a calibration is needed whenever maintenainces activities (changing the electrolyte or the membrane cap) have been performed.

- Before performing any kind of calibration ensure appropriate conditioning time (at least 2 hour after initial operation).
- Before performing any kind of calibration the correct function of the sensor should be ensured (sensor is clean and properly assembled - see section 8 also).
- For highest accuracy the same environment conditions (temperature, flow velocity, pH) have to be ensured during the calibration as for the normal operation. Therefore the calibration should always be performed with the installed sensor directly in the medium and only in exeptional cases outside the flow cell.
- When calibration is performed outside the flow cell in a small beaker, ensure that the sensor is not in direct contact with the wall or bottom and the outer steel ring of the sensor is submersed in the medium.

- Take a sample from the medium at the same time when pushing the sample button in the calibration menu (actual measurement will be stored).
- Perform laboratory analysis for actual chlorine concentration of the sample as fast as possible.
- s::can recommends to use DPD methodes for free chlorine or total chlorine with liquid reagents as reference methode.
- For highest accuracy usage of a photometer for measuring chlorine concentration of the sample is recommended. Perform zero-point calibration of the photometer before usage.
- The calibration will not be executed and used till the corresponding menu item (e.g. *Calibrate!*) is confirmed.
- When performing a parameter calibration the result will be checked for plausibility. In case of faulty calibration an error message will be displayed to the operator. Please refer to section 10.2 regarding possible error messages and notes for removal.

6.1 Types of Calibration

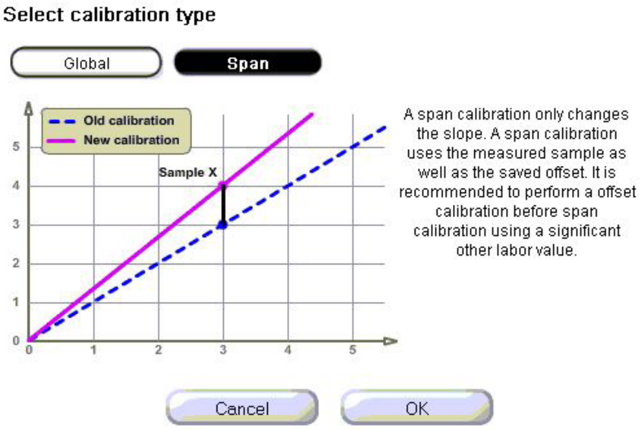
For calibration of the free (FCL) or total (TCL) chlorine parameter a slope calibration (SPAN) can be performed. This local calibration adapts the global calibration to the actual monitored medium.

The zero point is precalibrated in the factory and does not need to be recalibrated in the field.

The temperature value of the internal compensation cannot be calibrated.

6.1.1 Slope Calibration

- The chlori::lyser is equipped with a global calibration (reference slope) ex factory. You can switch back to this factory setting at any time.
- The local calibration shall either be performed directly in the medium or in a calibration standard.
- When using a calibration standard the chlorine value of the used standard shall be closed to the measuring range of the application.
- For slope calibration only one sample is needed. This sample will be stored onto the sensor.
- The result of the slope calibration will be stored directly onto the sensor and will be used until a new slope calibration is performed successfully or you switch back to the default slope.
- The slope calibration will be acepted if the global calibration is changed not more than 70% of the original value (*Reference Slope*).

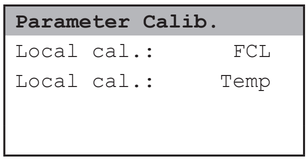


A span calibration only changes the slope. A span calibration uses the measured sample as well as the saved offset. It is recommended to perform a offset calibration before span calibration using a significant other labor value.

6.2 Performing a Calibration

6.2.1 Calibration using con::lyte D-31x

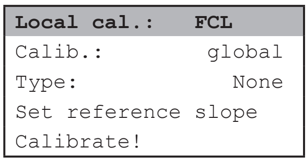
The *Calibration* entry in the con::lyte main menu leads you into the menu that enables the calibration of the chlori::lyser. When *Calibration* is selected a password must be entered (password = 1) before the calibration can be started. The next step is selection of the parameter to be calibrated (e.g. FCL) in the selection field *Parameter Calib*.



```
Parameter Calib.
Local cal.:       FCL
Local cal.:      Temp
```

Now the menu for local calibration will appear as displayed on the right hand side.

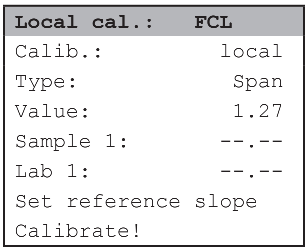
As long as chlori::lyser is working with factory calibration (default) the entry *Calib.* shows *global* and no *Type* can be selected.



```
Local cal.:    FCL
Calib.:         global
Type:             None
Set reference slope
Calibrate!
```

To perform a local calibration the entry *Calib.* has to be changed to *local*. Then below the entry *Type* will show *Span* as possible type of calibration.

The display shows the reading for chlorine actually measured (*Value*) as well as the chlorine concentration stored on the sensor for calibration (*Sample 1*). As long as no sample is stored on the sensor the display will show dashes. When confirming the entry *Sample 1* by pushing *Enter* the raw signal of the actually measured (displayed) chlorine concentration will be stored as new sample on the sensor. On the entry *Lab* the results corresponding (real chlorine concentration) to the readings stored under *Sample 1* can be entered here.



```
Local cal.:    FCL
Calib.:          local
Type:             Span
Value:            1.27
Sample 1:        --.--
Lab 1:           --.--
Set reference slope
Calibrate!
```

When the entry *Calibrate!* is confirmed by pushing *Enter*, a calibration is performed. Successful calibration is shown in a user message (*Please wait* and then *PLocal calib. saved*). If the calibration was not successful (user message *Local calib. Error!*) the calibration used up to now will be used further on.

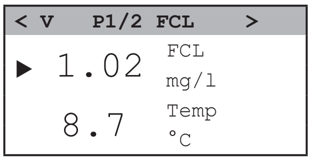
When selecting the entry *Set reference slope* after performing a local calibration, the new slope will be stored as a reference. This reference can be used to compare further slope calibrations and to document aeging of the membrane / electrolyte. The procedure is confirmed by the message *Reference slope was set successfully. Continue with ENTER*.

⚠ The possibility to store a new reference slope is only supported by this s::can operation controller. Therefore it is disadviced to use of this possibility for internal check of electrode ageing and keep the slope set ex factory instead.

For temperature reading no local calibration is possible.

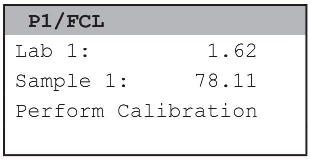
6.2.2 Calibration using con::lyte D-320

This operating controller provides, beside normal calibration procedure (see further down), the possibility for a quick calibration call directly from the parameter view. This is performed by following steps:



```
< V   P1/2 FCL    >
▶ 1.02  FCL
        mg/l
  8.7   Temp
        °C
```

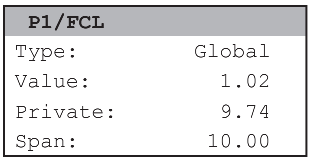
- Select the parameter in der parameter display with *Up-* or *Down* button.
- Push *OK* button, which directly displays the calibration screen.
- Select *Sample 1* and confirm with *OK* to store the raw signal of the actual reading.
- Take a water sample to analyse real chlorine concentration.
- Enter the result from laboratory analyse into the field *Lab 1*.
- Select entry *Perform Calibration* and confirm with *OK*.
- Leave the calibration screen with *Back* button.



```
 P1/FCL
Lab 1:          1.62
Sample 1:      78.11
Perform Calibration
```

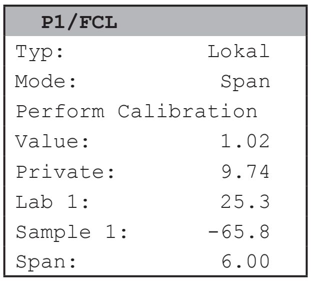
The advanced local calibration provides extensive possibilities for calibration of measurement parameter. After selecting the parameter in the parameter display, pushing the *Function* button, selecting the menu *Calibrate expert...* and pushing the *OK* button, the calibration screen is displayed.

- *Type* Two different types of calibration are available: *Local* or *Global*. By default *Local* is selected. This is the normal calibration performed by the operator. As soon as *Global* is selected an confirmed with OK a reset of the sensor to factory calibration is performed and the actual reading (*Value*), the raw signal (*Private*) and the default slope (*Span*) will be displayed.



```
 P1/FCL
Type:         Global
Value:          1.02
Private:        9.74
Span:          10.00
```

- *Mode* The only mode available is *Span* which is preset.



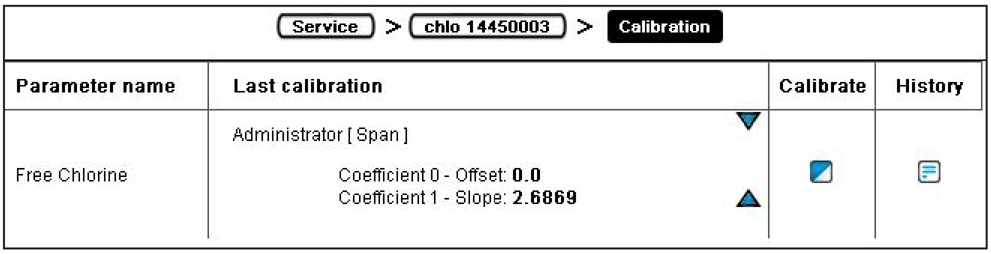
```
  P1/FCL
Typ:           Lokal
Mode:           Span
Perform Calibration
Value:          1.02
Private:        9.74
Lab 1:          25.3
Sample 1:      -65.8
Span:           6.00
```

- *Perform Calibration* Confirming this entry by pushing the *Ok* button will execute the local calibration, using the *Lab* and *Sample* values displayed on the calibration screen.
- *Value* Displays the measured value of the probe or sensor like on the parameter screen also (i.e. using the actual calibration). The value will be updated permanently.
- *Private* Displays the according raw value (measured power signal of the sensor) of the displayed reading. The value will be updated permanently.
- *Lab 1* Within this line the correct value for the measured *Sample 1* has to be entered. The entered *Lab* value can be either the laboratory result of the sample taken or the concentration of the standard solution, which is used for calibration. The unit of the lab value has to be in accordance with the measuring parameter.

  An entered *Lab* value can be deleted by selecting it and pushing the *Function* button so that it will not be used in the calibration.
- *Sample 1* When confirming this entry by pushing the *Ok* button, a measurement will be performed and stored as sample 1 for the local calibration. The sample for the laboratory should be taken at the same time. The displayed and stored value, which will be used for the calibration might be a raw value (e.g. mV value) and therefore might also be negative. Existing readings (*Sample 1* or *Sample 2*) are overwritten whenever a new measurement is triggered by pushing the *Ok* button. If no sample measurement was performed or if the measurement was invalid, the message *Measure!* will be displayed instead of a numerical value.
- *Span* Displays the used slope of the actual calibration. It is not possible to edit this value.

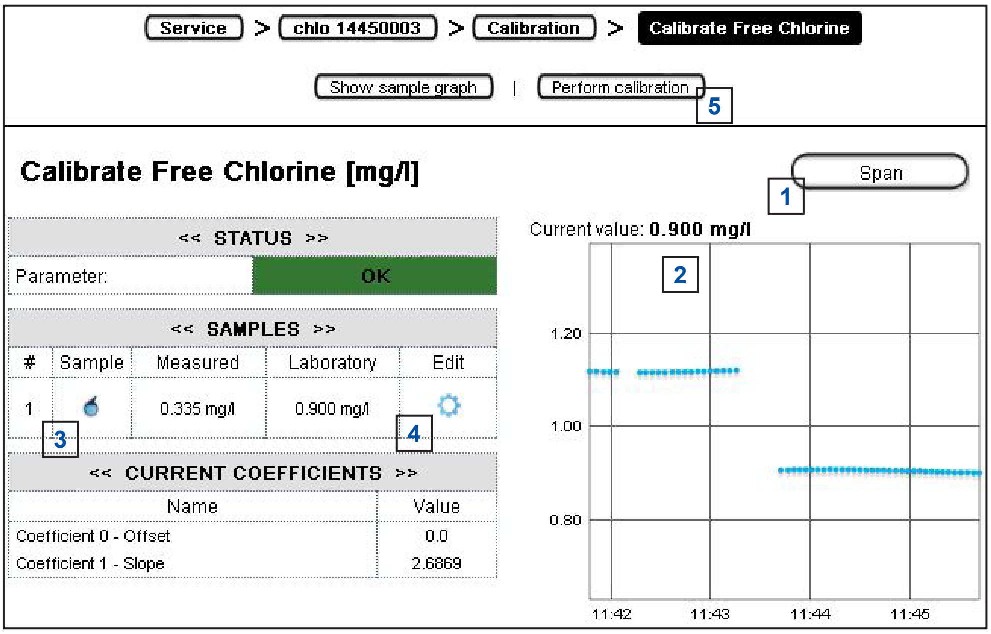
6.2.3 Calibration using moni::tool

- Click the *Service* tab of the moni::tool screen and logon as *Administrator*.
- Click the icon of the probe / sensor you want to calibrate in the displayed system overview.
- Click the icon *Calibrate sensor* in the next screen.
- Now the screen shows a list of all parameters being measured by this probe / sensor. Clicking on the blue triangles will open more information about actual used calibration for this parameter.



Parameter name	Last calibration	Calibrate	History
Free Chlorine	Administrator [Span] Coefficient 0 - Offset: **0.0** Coefficient 1 - Slope: **2.6869**		

- Furthermore a click on the *History* icon rightmost opens a logbook showing all up to now with this con::cube performed calibration procedures.
- Open the calibration screen by clicking on the *Calibrate* icon on the right hand side of the parameter you want to calibrate.



Calibrate Free Chlorine [mg/l]

Current value: **0.900 mg/l**

<< STATUS >>

Parameter: OK

<< SAMPLES >>

#	Sample	Measured	Laboratory	Edit
1		0.335 mg/l	0.900 mg/l	

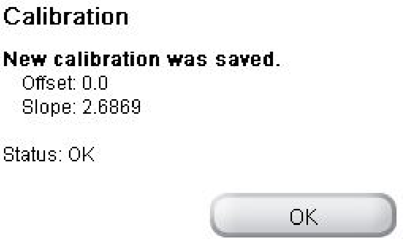
<< CURRENT COEFFICIENTS >>

Name	Value
Coefficient 0 - Offset	0.0
Coefficient 1 - Slope	2.6869

1 This button displays the actual used calibration (*Global* or *Span*). Push this button to select the type of calibration you want to perform (see section 6.1).

2 Watch the current readings being displayed numerically and graphically on the calibration screen. Wait until readings are stable.

3 Push the *Sample* icon to store the actual reading onto the sensor. Please note that the displayed value is the raw value (mV reading).



Calibration

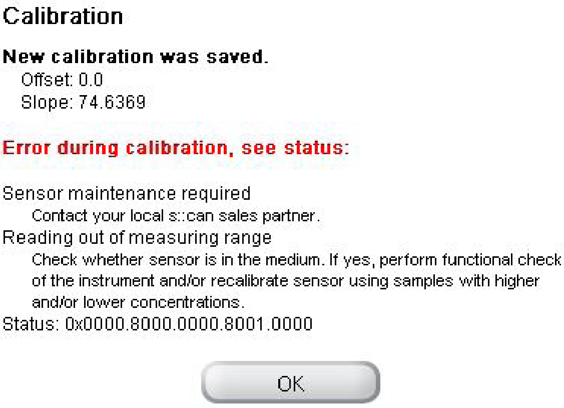
New calibration was saved.
Offset: 0.0
Slope: 2.6869

Status: OK

4 Push the *Edit* icon to enter the result of the laboratory analysis and store it onto the sensor.

5 Push the button *Perform calibration* to start the calibration procedure.

After the calibration procedure is finished a user message will inform you, if the local calibration was successful. The new calibration coefficients will be displayed also. In case of an error the reason will be displayed as well as possible solutions and the detailed error code.



Calibration

New calibration was saved.
Offset: 0.0
Slope: 74.6369

Error during calibration, see status:

Sensor maintenance required
Contact your local s::can sales partner.
Reading out of measuring range
Check whether sensor is in the medium. If yes, perform functional check of the instrument and/or recalibrate sensor using samples with higher and/or lower concentrations.
Status: 0x0000.8000.0000.8001.0000

7 Data Management

7.1 Data Storage

The following information are stored directly on the sensor:

- Result of slope calibration
- Default slope
- Measured sample used for slope calibration
- Device information (e.g. type, serialnumber, address, please refer to section 10.3)

There is no possibility to store readings onto the sensor itself.

7.2 Data Transfer

The measurements are performed on the sensor and the readings are transfered to the controller via the sensor cable using RS 485.

7.3 Data Visualisation

For visualisation of the sensor readings one of the following s::can controller can be used:

- con::lyte
- con::cube
- con::nect with PC

8 Functional Check

A functional check might be required for one of the following reasons:

- Initial startup
- Routine functional check
- Suspicion of monitoring system malfunction
- Modification of monitoring system (e.g. integration of additional sensor or device)
- Change of measuring location

Depending on the application (water composition), the probes and the sensors connected and the environmental conditions a regular functional check (weekly to monthly) is recommended. The following sections provide an overview of all the actions that have to be performed to check the monitoring system quickly (see section 8.1), to check the plausibility of the collected readings (see section 8.2) and to check the integrity of a single probe or sensor (see section 8.3).

8.1 Check of System / Monitoring Station

Check	con::lyte	moni::tool / con::cube	What to do if check failed
Power supply controller	Green LED is on and text is visible on the display?	LED on housing cover is on or at least flashing? moni::tool screen is displayed after touching the screen?	Check power supply of controller. Power off controller for 5 minutes and power on again.
System running (up-to-date)	Displayed system time is current and is updated every second?	Click on system clock at the bottom of the screen shows current time and last measurement. Both are current?	Check for displayed error messages. Check if Service mode is acitvated or automatic measurement is paused.
System status	No error messages or error symbols are displayed?	LED of con::cube is blue and *Status* icon of moni::tool is not blinking yellow?	See section 10 for Troubleshooting.
Reason for bad system status	Check logbook entries since last functional check.	Open *Status* tab and select symbol of affected sensor for more information.	See section 10 for Status- and Errorcodes.

Check	Remark
Function of automatic cleaning	Use function *Clean now* or wait for next cleaning cycle. Watch for air bubbles when cleaning is activated.
Compressed air supply for automatic cleaning	All tubes and fittings are tight?
Function of compressor and storage tank	Drain condensed water from storage tank of compressor (not necessary for s::can compressor B-32). Check pressure.
Monitoring station (by-pass)	All tubes and fittings are tight and all probes and sensors are supplied with medium? No air bubbles within the tubes?
Installation submersed (in-situ)	Mounting equipment of all devices is ok and all probes and sensors are submersed?
Data transfer	Check if displayed readings on local controller are equal with displayed readings on customer display system.

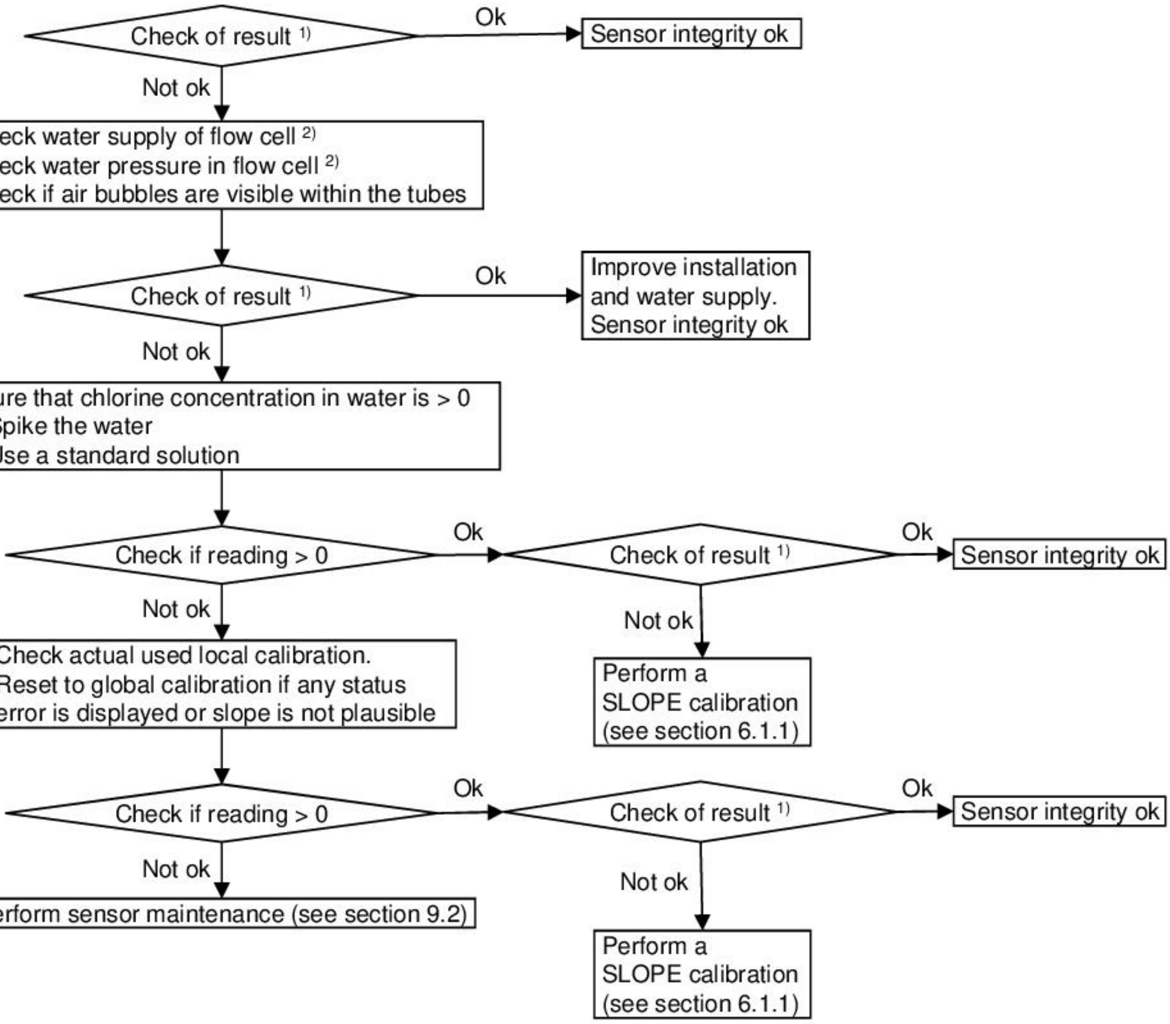
8.2 Check of Results

Check	con::lyte	moni::tool	ana::xxx
Current readings displayed completely	No *NaN* and no dashes (- - - -,- -) or plus sign (++++,++) displayed. Use arrow buttons to scroll through all displayed parameters.	No *NaN* displayed.	No *NaN* displayed.
Current parameter status of displayed readings	Check logbook entries since last functional check.	Red background for parameter indicates an error or alarm. Grey background indicates reading is not current.	Activate *Show context help* if grey background or *NaN* and move cursor over displayed reading.

Check	Reason	Remark
Up-to-date: Readings actualised on regulary base?	- Measuring interval is too long - Automatic measurement has been stopped manually	Consider measuring interval and smoothing.
Continuity: Check historical data (timeseries) for interruptions or discontinuities	- Change of medium - Local calibration - Maintenance of probe / sensor (cleaning, etc.) - Readings out of range - System failure (loss of power, communication error, etc.)	Only possible if timeseries are availbale.
Plausibility: Timeseries look plausible with daily or seasonal fluctuation	- Drift of readings (can be caused by fouling) - Increasing noise (can be caused by flow conditions or fouling) - Fixed readings / no fluctuation	Check logbook of plant operator if possible.
Measuring range: Readings are within the specified and calibrated measuring range?		Quality of results might be reduced outside the specified range.
Accuracy: Difference between laboratory values and readings of the chlori::lyser	In case of significant difference a slope calibration (span) has to be performed (please refer to section 6.1.2)	To verify the accuracy of the displayed readings only a reliable and validated comparison method has to be used.

8.3 Check of Probe - Sensor Integrity

When there is any doubt regarding the integrity of the sensor, please use the following flowchart to check sensor and installation:


Check of result 1)
Ok
Sensor integrity ok
Not ok
Check water supply of flow cell 2)
Check water pressure in flow cell 2)
Check if air bubbles are visible within the tubes
Check of result 1)
Ok
Improve installation and water supply. Sensor integrity ok
Not ok
Ensure that chlorine concentration in water is > 0
- Spike the water
- Use a standard solution
Check if reading > 0
Ok
Check of result 1)
Ok
Sensor integrity ok
Not ok
Check actual used local calibration. Reset to global calibration if any status error is displayed or slope is not plausible
Not ok
Perform a SLOPE calibration (see section 6.1.1)
Check if reading > 0
Ok
Check of result 1)
Ok
Sensor integrity ok
Not ok
Perform sensor maintenance (see section 9.2)
Not ok
Perform a SLOPE calibration (see section 6.1.1)

(1) Use DPD methods for check of real chlorine concentration

(2) Note the technical specifications in section 12

9 Maintenance

Please note that during any cleaning or maintenance activity of the chlori::lyser the following important notes have to be obtained:

- Never touch the surface of the membrane, the electrode finger or the gold electrode at the tip of it with your fingers.
- Do not use any acids on the electrode finger, the spacer or the housing.
- Do not power off the sensor for more than 24 hours when it is in operation.
- Do not shake the electrolyte bottle, store it always upside-down and fill the membrane cap slowly to avoid air bubbles within the electrolyte. Air bubbles between gold electrode and membrane will falsify your readings.
- Do not cover the vent hole with your fingers, when the membrane cap is screwed on or off.
- Please note the correct handling of electrolyte bottle during filling, to avoid air bubbles entering the electrolyte (see section 4.2)

9.1 Cleaning of Membrane Cap

If the membrane has a coating or is covered with organic material, it can be cleaned with hand warm tap water carefully. Please ensure that the rubber band is positioned correctly to avoid any dilution of the electrolyte. If this cleaning procedure will not improve the measurement, the membrane cap and the electrolyte have to be replaced.

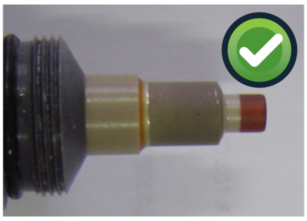
9.2 Replacement of Electrolyte and Membrane Cap

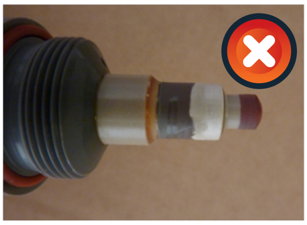
Electrolyte and membrane cap have to be replaced on regular interval. The maintenance interval depends on the sensor type and the measured medium. The typical maintenance intervals are:

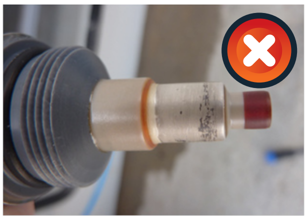
- Replacement of membran cap once per year
- Replacement of electrolyte for actual version (E-520 and E-525) once per year
- Replacement of electrolyte for previous version (E-507) every 3 - 6 months

In case of troubles outside the scheduled maintenance interval (see section 9) the following step by step procedure is recommended:

- Cleaning of membrane cap (see section 9.1).
- Visual check of the electrode finger (see figures below). If electrode finger looks not ok, please check your application for unexpected aggressive substances.
- Replacement of electrolyte and cleaning of gold electrode (tip of electrode finger), as describes afterwards.
- Replacement of electrolyte and membran cap and cleaning of gold electrode (tip of electrode finger), as described afterwards.

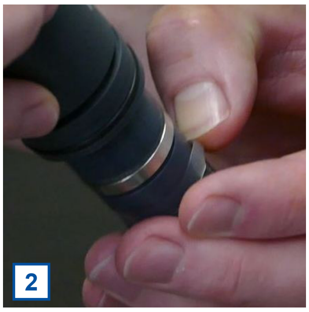


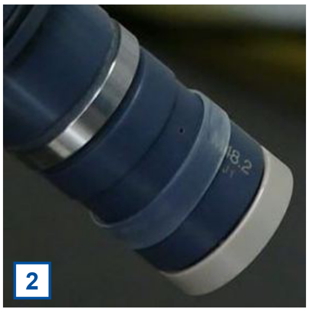




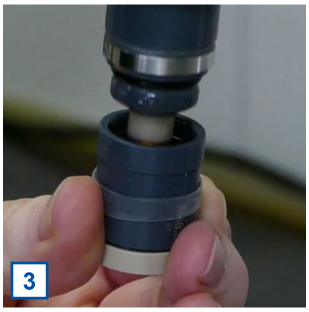
The electrolyte and membrane cap need to be replaced every 12 months or if the local calibration failed (see section 6). The replacement is performed by the following steps:

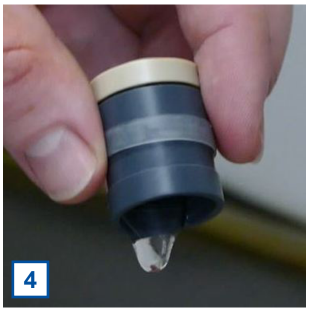
1. Clean the sensor as explained in section 9.1.
2. Lift the rubber band so that the vent hole is not covered when unscrewing the cap.





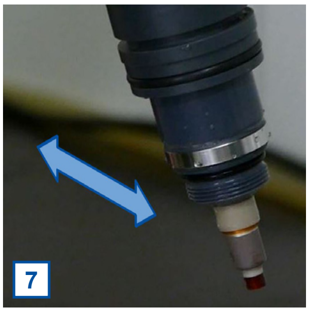
3. Unscrew the membrane cap.
4. Empty the used electrolyte. For previous sensor version E-507-1/2 only take care not to loose the spacer in case only electrolyte will be replaced.

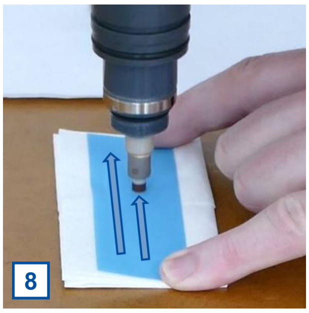




5. In case the electrolyte has to be changed only, spill the membrane cap with clean tap water or distilled water before refilling.
6. Clean the electrode finger by rinsing with clean tap water or distilled water without touching it directly.

7. Shake excessive water off the electrode finger. Do not use tissues to dry the electrode finger or the inner of the membrane cap.
8. Place the supplied fine polishing paper onto a soft surface (e.g. a paper tissue) and fix it with your fingers. Clean the gold electrode by softly wiping the electrode finger three times over the fine polishing paper. Keep the sensor upright.





9. Perform refilling with electrolyte and fixing of the membrane cap as explained in section 4.2.

10 Troubleshooting

10.1 Typical Error Pattern

Error	Reason	Removal
Drift of readings	Change in the medium	Check measuring medium for plausibility (reference method)
	Fouling of the membrane	Check sensor head for cleanliness
	Electrolyte aged	Replace electrolyte
	Membrane aged	Replace membrane cap
Drift of readings after change of electrolyte or membrane cap or after loss of power supply	Sensor not fully conditioned	Condition sensor after recommissioning in the medium (see section 12 for conditioning time)
	Medium flow insufficient	Check water supply, check inlet strainer
	Membrane not clean	Check membrane cap for cleanliness
	Air bubbles in electrolyte	Replace electrolyte
	Electrolyte aged (e.g. due to wrong storage conditions)	Use a new bottle of electrolyte and store it correctly
Periodical deviation of the readings (outliers of readings)	Periodical fluctuation of pressure	Ensure pressure conditions are stable (use flow restrictor F-45-flow-1)
	Attaching and detaching of air bubbles on the membrane	Ensure no air bubbles are within the tubes and flow cells
	Periodical fluctuation of flow	Check medium supply and installation
Unstable readings (scattering of readings)	Air bubbles on the membrane	Increase flow rate for short time to remove all air bubbles and ensure stable medium flow without bubbles
	Air bubbles in the electrolyte	Replace electrolyte and do refilling carefully
	Membrane destroyed	Check membrane visually and replace it
No response to changes in concentration	No power supply for more that 24 hours	Clean membrane cap and replace electrolyte
	Longterm measurement in medium without chlorine	Store sensor in chlorine medium and check it again after 20 minutes
	Flow too low	Check water supply, check inlet strainer
	Electrolyte aged	Perform calibration or replace electrolyte
	Membrane aged	Perform calibration or replace membrane cap
Measurement results deviate from laboratory results	Cross-sensitivity of the reference method (e.g. ammonium)	Obey limits of the reference method regarding pH and cross sensitivities
	Incorrect calibration	Perform calibration again
	Different pH value during calibration and measurement	Calibration should be done on the expected mean of the pH value.
	Reference methode	Be aware that all reference methodes are limited in accuracy (e.g. accuracy of DPD methode for free chlorine up to +/- 0.23 mg/l FCL)
	Too low or too high flow	Check water flow
Sensor cannot be calibrated	Start-up time too short	See section 12 for start-up / conditioning time
	No electrolyte in the membrane cap	Perform correct sensor assembly according to manual
	Protective cap still on the sensor head	Remove protectice cap from the sensor head
	Measurement with reference method performed incorrect	Perform lab measurement according the instruction
	Sensor with filled membrane cap without power for longer time	Repeat calibration after 24 hours of operation

10.2 Error Messages and Status Messages

During execution of a measurement the monitoring system (system status), the measuring device itself (device status) and the result (parameter status) will be checked for possible errors and for plausibility. In case of an error (status bit will be set from 0 to 1) a user message will be displayed to the operator.

Depending on the used operation controller these messages will be shown on the display (Menu *Logbook & data* in case of con::lyte D-31x, function *Monitor...* in case of con::lyte D-320, *Status* tab in case of moni::tool and *Show Context Help* and *System-Status* in case of ana::pro) and also stored within the result files or logfiles. Additional to the user message (general error reason and recommendations for removal) the detailled status code will be displayed either in binary form (0000, 0001, 0010, 0011, 0100, etc.) or as a hex number (0x0001, 0x0002, 0x0004, 0x0008, 0x0010, etc).

⚠ Up to 16 status bits are used for different errors. If several errors occur at the same time the con::lyte and moni::tool will add up all the status bits. This detailed information might be important if you request s::can support. Below you will find examples how to translate these combined hex codes:

Hex	Bin	Bits
0x8000	1000 0000 0000 0000	b15
0x8001	1000 0000 0000 0001	b0, b15
0x4011	0100 0000 0001 0001	b0, b4, b14

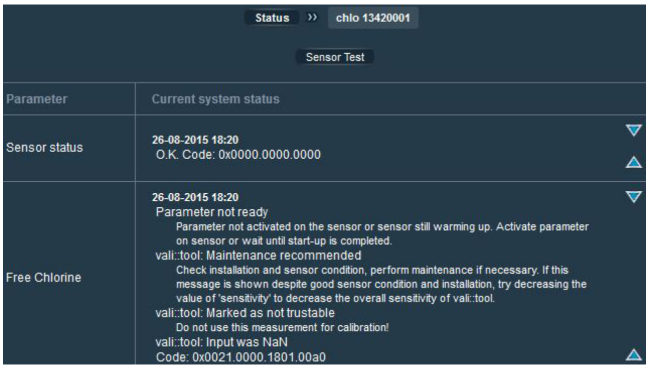
Within moni::tool the complete status code of a simple parameter has the following format: 0xTTTT.SSSS.PPPP.pppp.VVVV.vvvv.

Code	Status Type	Remark
0xTTTT	System status sensor	visible in the second column of all moni::tool parameter result files (e.g. Error 0x0010 or Ok 0x0002)
0xSSSS	Sensor status general	valid for all sensors
0xssss	Sensor status private	valid for respective sensor
0xPPPP	Parameter status general	valid for all parameters
0xpppp	Parameter status private	valid for respective parameter
0xVVVV	vali::tool status general	valid for all clean values of vali::tool software
0xvvvv	vali::tool status private	valid for respective clean values of vali::tool software

Within the moni::tool *Status* tab of the sensor you will see the system status sensor and the sensor status as clear text and as status code (0xTTTT.SSSS.ssss).

Within the moni::tool *Status* tab of the parameter you will see the parameter status and in case of activated vali::tool the vali::tool status also (0xPPPP.pppp.VVVV.vvvv).

Within the moni::tool results file of the sensor parameter the status (0xTTTT.SSSS.PPPP.pppp) will be stored in the column beside the measured value and the vali::tool status (0xVVVV.vvvv) in the column beside the cleaned value.



Parameter	Current system status
Sensor status	**26-08-2015 18:20** O.K. Code: 0x0000.0000.0000
Free Chlorine	**26-08-2015 18:20** Parameter not ready Parameter not activated on the sensor or sensor still warming up. Activate parameter on sensor or wait until start-up is completed. vali::tool: Maintenance recommended Check installation and sensor condition, perform maintenance if necessary. If this message is shown despite good sensor condition and installation, try decreasing the value of 'sensitivity' to decrease the overall sensitivity of vali::tool. vali::tool: Marked as not trustable Do not use this measurement for calibration! vali::tool: Input was NaN Code: 0x0021.0000.1801.00a0

The table below shows all errors regarding the operation terminal (system status) when a chlori::lyser is connected incl. the user message, the reason of the error and notes for troubleshooting. If the error can't be removed although the suggested procedure was executed several times, please contact your s::can sales partner.

System Status Error 0xTTTT	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	ES007 / COMM! Probe not detected. Check power-supply and connection cable.	No communication between sensor and terminal.	No communication between sensor and operation terminal. Replacement sensor was not installed correctly.	Check sensor cable and connector. Disconnect and reconnect sensor.
0x0002 - b1	0002	Invalid sensor	Sensor serial number has changed.	Connect the previously installed sensor or perform sensor replacement (moni::tool) or new sensor installation (con::lyte).

The table below shows all errors regarding the used sensor incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Sensor Status Error 0xSSSS	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	ES100 / 0001 Probe reports an error. Call service! Param.Status error. Status Code:	General sensor error	Sensor reports error during internal check. At least one internal sensor check failed.	For details see additional status message below. In case no further messages are shown, note the error code and contact your s::can sales partner.
0x0002 - b1	ES101 / 0002 MISUSE Medium temperature. Take probe out of medium, immediately!	SENSOR MISUSE	Operation outside the specification (e.g. temperature too high). This can damage the device permanently.	Take the sensor out of the medium immediately and check environmental conditions.
0x8000 - b15	ES115 / 8000 Device maintenance required Code 8000 0000	Sensor maintenance required	At least one internal sensor check reports a warning.	Perform function check of the sensor according the manual.

The table below shows all errors regarding the measured parameters incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Parameter Status Error 0xPPPP	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	EP 100 / 0001 Status error. Code: 0001.0000 Details in following log messages.	General parameter error	At least one internal parameter check failed.	Note additional status message below. If no further message is displayed, note the error code and contact your local s::can sales partner.
0x0002 - b1	EP 100 / 0002 Parameter failure, hardware failure	Parameter error, Hardware error	Electrode signal not ok. An electrode is missing, too old or defect.	Check the electrode or replace the electrode.
0x0004 - b2		Parameter error, configuration error	Parameter error, configuration error	Change the local calibration or swirch back to global calibration.
0x0008 - b3		Parameter error, Wrong medium	Sensor outside of the medium or in incorrect medium.	Check supply of medium and medium itself.
0x0010 - b4	EP 100 / 0010 Parameter failure, calibration failure	Parameter error, Incorrect calibration	Invalid sensor configuration. At least one calibration coefficient is invalid.	Check readings and lab values. Set back to factory settings. Repeat local calibration.
0x0020 - b5	EP 100 / 0020	Parameter not ready	Parameter not activated on the sensor or sensor still warming up.	Activate parameter or wait until sensor is fully operational.
0x8000 - b15	EP 115 / 8000 Out of range Code 8000 0000 The parameter is out of measurement range	Reading out of measuring range	Measured parameter is outside the defined measuring range.	Check if sensor is in the medium. Perform functional check.

The table below shows all errors regarding clean parameters of the vali::tool software incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Parameter Status Error 0xVVVV	Message moni::tool	Reason	Removal
0x0001 - b0	vali::tool reports an error	At least one internal check reports a warning.	Check further status messages.
0x0800 - b11	Maintenance recommended	Parameter check reports a warning.	Check system and sensor, perform functional check.
0x1000 - b12	Marked as not trustable	Parameter check reports a warning.	Do not use this value for calibration.

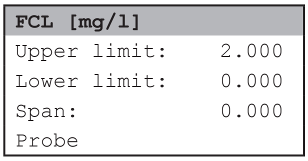
10.3 Device Settings

In case detailed sensor information or configuration settings have to be checked, the following sections will explain how to find these information when operating the sensor with a s::can operation controller.

There is no need to modify any device settings of the chlori::lyser.

10.3.1 Check of Device Settings using con::lyte D-31x

The main menu entry *Information* of the con::lyte operation software enables you to check internal sensor settings. After selecting the parameter of your interest by pushing the *Enter* button the display will show the *upper limit* and the *lower limit* of the selected parameter.



```
FCL [mg/l]
Upper limit:    2.000
Lower limit:    0.000
Span:           0.000
Probe
```

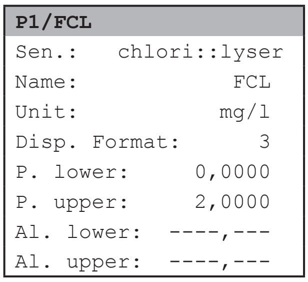
When confirming the lowest entry *Probe* with *Enter* all internal settings of the chlori::lyser will be displayed. The most important are:

- Internal sensor identifier (*M-Version* and *Model*)
- Sensor name (*chlori::lyser*)
- Serialnumber of the chlori::lyser (*S/N*)
- Hardware version of the chlori::lyser (*H/W-Version*)
- Software version of the chlori::lyser (*S/W-Version*)

10.3.2 Check of Device Settings using con::lyte D-320

Select the entry *Manage sensors...* in the main menu of the status screen. Select the name *chlori::lyser/0/1* in the list of installed sensors, in which the second number (*1*) indicates the address assigned to the sensor. After confirming the entry *Configure...* as well as the entry *Probesettings* in the next view the following information of the sensor will be displayed:

- Internal sensor identifier (*M-Version* and *Model*)
- Sensor name (*chlori::lyser*)
- Serialnumber of the chlori::lyser (*S/N*)
- Hardware version of the chlori::lyser (*H/W-Version*)
- Software version of the chlori::lyser (*S/W-Version*)



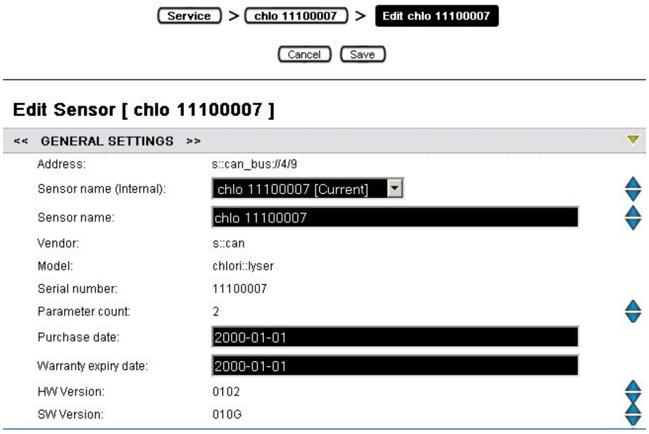
```
P1/FCL
Sen.:    chlori::lyser
Name:              FCL
Unit:             mg/l
Disp. Format:        3
P. lower:       0,0000
P. upper:       2,0000
Al. lower:    ----,---
Al. upper:    ----,---
```

Information of the single measuring parameter can be retrieved via the entry *Parameter info...* from the main menu of the parameter display. In addition to parameter name (*Name*), unit of measurement (*Unit*) the number of decimal places (*Disp. Format*), also the lower and upper limit of the parameter range (*P. lower* / *P. upper*) and the adjusted alarm range (*Al. lower* / *Al. upper*) is displayed.

10.3.3 Check of Device Settings using moni::tool

Selecting *Service / chlo / Edit chlo* will list up internal settings of the chlori::lyser. Depending on the *Service Level* some or all of the following information will be displayed:

- Interface (COM-port, *Address*) of the sensor
- *Sensor name (Internal)* allocated to the device. Should not be changed by the operator.
- *Sensor name* for the display allocated to the device by the operator at installation.
- Manufacturer name of the sensor (*Vendor*)
- Type of the sensor (*Model*)
- Serial number of the sensor (*Serial Number*)
- Number of internal parameters of the sensor (*Parameter count*)
- Information regarding the purchase (*Purchase date*, *Warranty expiry date*). Can to be entered by the operator at initial start-up.
- Actual hardware and software version of the sensor (*HW Version SW Version*)
- Internal type number of the sensor (*Sensor Model*) and information regarding cleaning and logging (not available for the chlori::lyser)
- Information regarding the installation and last modification of the sensor (date, name and reason)



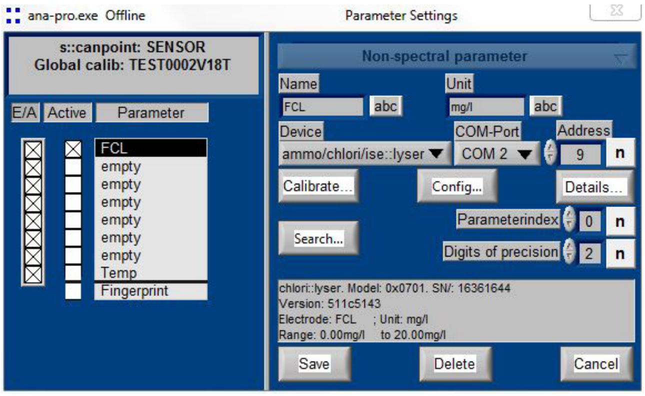
Edit Sensor [chlo 11100007]

Address: s::can_bus://4/9
Sensor name (Internal): chlo 11100007 [Current]
Sensor name: chlo 11100007
Vendor: s::can
Model: chlori::lyser
Serial number: 11100007
Parameter count: 2
Purchase date: 2000-01-01
Warranty expiry date: 2000-01-01
HW Version: 0102
SW Version: 010G

10.3.4 Check of Device Settings using ::pro

In the operating - and service software ::pro the chlori::lyser can be initialised over the menu item *Parameter / Settings*. In case the parameters of interest are not yet displayed by default in the Parameter Settings window, they can be selected as follows:

- Double click on the parameter field that you want to correspond with the parameter to be displayed.
- After double clicking, the window will enlarge and show detailed information belonging to this parameter.
- Select *Non-spectral parameter* in the upper selection bar.
- Select *ammo/chlori/ise::lyser* under *Device*.
- The *COM-Port* is the interface to which the chlori::lyser is connected (e.g. COM-Port of the con::nect).
- Enter the address allocated to the sensor in the RS 485 network (default setting = 9). connection) in the entry *Address.*
- Push the button *Search…* (when an incorrect COM-Port and / or sensor address are selected, the *Search…* function will still find the sensor if only one instrument is connected).



s::canpoint: SENSOR
Global calib: TEST0002V18T

Name: FCL
Unit: mg/l
Device: ammo/chlori/ise::lyser
COM-Port: COM 2
Address: 9
Parameterindex: 0
Digits of precision: 2

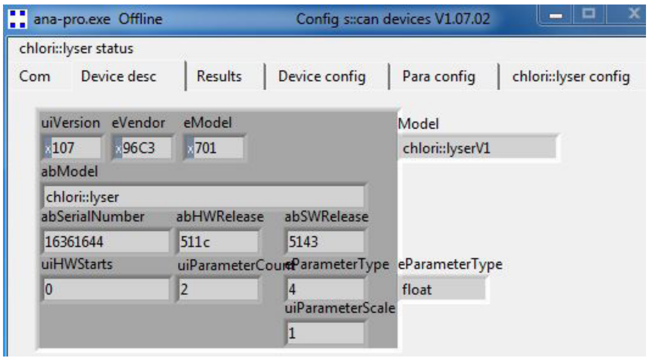
chlori::lyser. Model: 0x0701. SN/: 16361644
Version: 511c5143
Electrode: FCL ; Unit: mg/l
Range: 0.00mg/l to 20.00mg/l

As soon as the sensor has been detected, information will be shown in the grey text field in the lower part of the dialogue window (model and serial number, version, electrodes and measuring range).

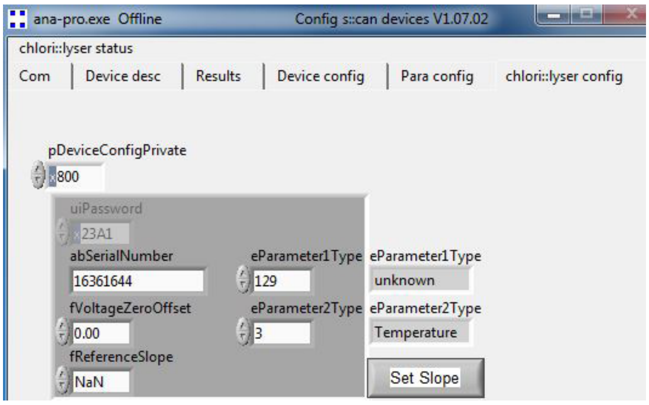
Now the internal settings of the chlori::lyser sensor can be checked, but this should be done by s::can Service or after instruction from s::can only.

- Push button *Config...* in menu *Parameter / Settings*.
- Push button *Search...* in register card *Com*. As soon as the sensor will be detected, the checkbox (*status source*) in the lower right corner switches to ok (green check mark) and further register cards become visible.
- In register card *Device desc* the sensor type (*abModel*), the serial number of the sensor (*abSerialNumber*), the actual hardware (*abHWRelease*) and software (*abSWRelease*) are displayed.
- In register card *chlori::lyser config* the reference slope (*fReferenceSlope*) is displayed. This entry should be set to NaN.
- You can finish the configuration menu by pushing the button *Exit*.

There is no need to modify any device settings of the chlori::lyser.



uiVersion: x107
eVendor: x96C3
eModel: x701
Model: chlori::lyserV1
abModel: chlori::lyser
abSerialNumber: 16361644
abHWRelease: 511c
abSWRelease: 5143
uiHWStarts: 0
uiParameterCou: 2
eParameterType: 4
eParameterType: float
uiParameterScale: 1



pDeviceConfigPrivate: x800
uiPassword: x23A1
abSerialNumber: 16361644
ePararameter1Type: 129
eParameter1Type: unknown
fVoltageZeroOffset: 0.00
eParameter2Type: 3
eParameter2Type: Temperature
fReferenceSlope: NaN

10.4 Return Consignment (RMA)

Return consignments of the s::can monitoring system, or parts of the system, shall be done in a packaging that protects the device (original packaging or protective covering if possible). Before returning a consignment, you have to contact your s::can sales partner or s::can customer support (support@s-can.at). An RMA number will be assigned for each device, independent if the reason of the return consignment is service, repair or demo equipment.

RMA numbers can be requested from the s::can Costomer Portal available on the s::can homepage directly. Return consignments without an RMA number will not be accepted. The customer always has to bear the costs for return consignment.

11 Accessories

11.1 Installation

11.1.1 Connection Cable

For operation of chlori::lyser a connection cable is necessary. This is included in the standard order.

Name	Specification	Remark
Part-no.	C-1-010-sensor	
Cable lenght	1 m	
Assembling	ex works	
Dimensions plug	20 mm	outer diameter
Material	PU	Cable sheathing
Housing environment rating	IP 68	
Interface connection	IP 67, RS 485, 12 VDC	to s::can sensors

11.1.2 Extension Cable

The cable of the chlori::lyser can be elongated when necessary with an extension cable (10 m or 20 m length). The extension cable is attached using the sensor cable connector plug.

Name	Specification	Remark
Part-no.	C-210-sensor C-220-sensor	
Cable lenght	10 m 20 m	C-210-sensor C-220-sensor
Assembling	ex works	
Dimensions plug	20 mm	outer diameter
Material	PU	Cable sheathing
Housing environment rating	IP 68	
Interface connection	IP 67, RS 485, 12 VDC	to s::can sensors

11.1.3 Sensor Mounting

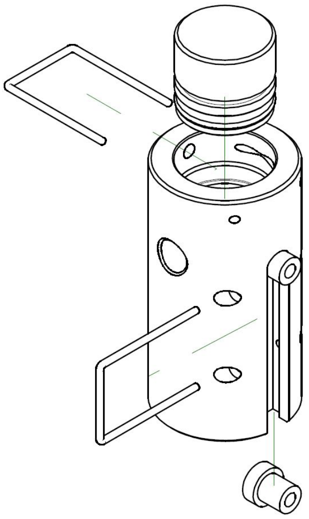
For proper and easy submersed installation of the chlori::lyser a separate sensor carrier is available. This part can be fixed to the sensor directly and can be extended by a pipe (to be provided by the customer).

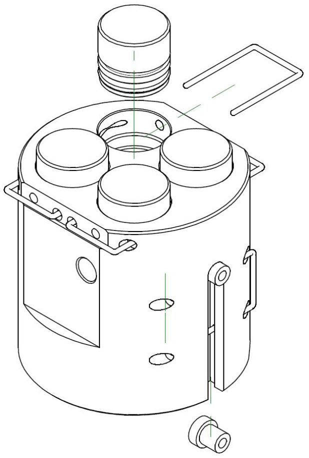
Name	Specification	Remark
Part-no.	F-12-sensor	
Material	PVC, stainless steel	
Dimensions	60 / 91 mm	Diameter / height
Weight	approx. 150 g	
Process connection	DN 50 inside	for extension pipe
Installation / mounting	submersed	

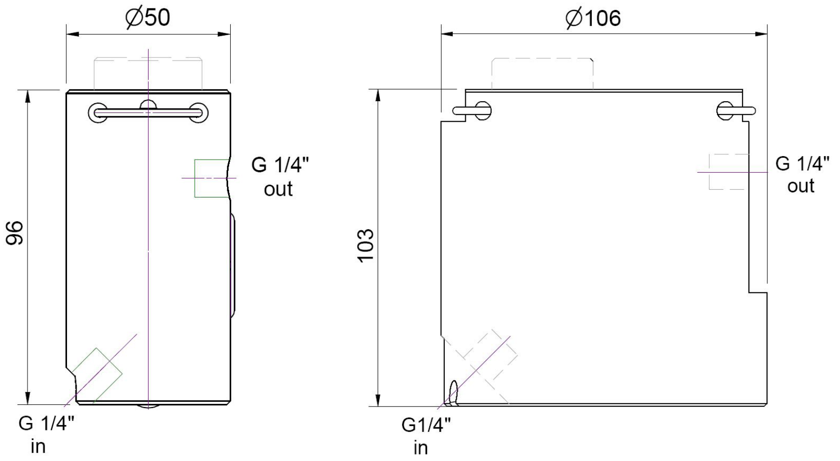
11.1.4 Flow Cell Setup Tap Water

For recommended standard installation of chlori::lyser outside the medium, different types of flow cells are available.

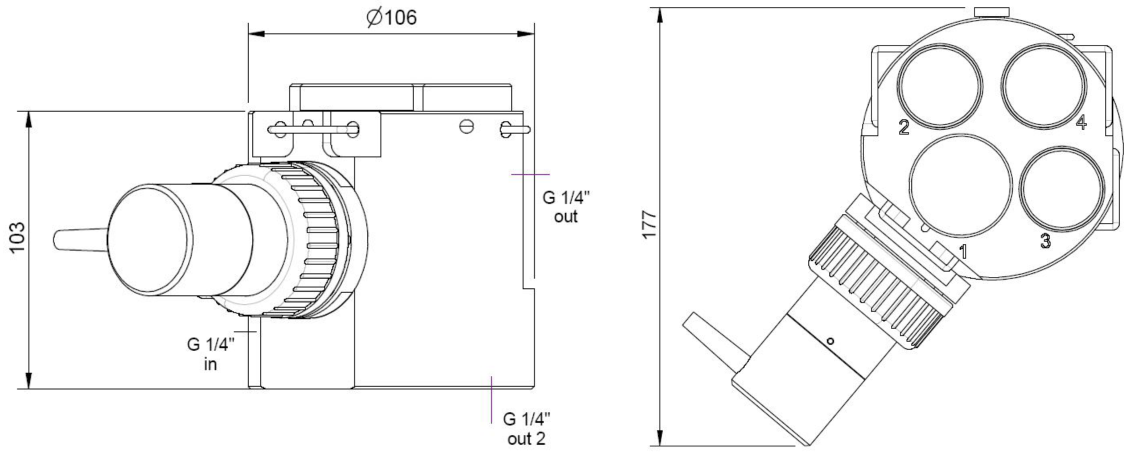
Name	Specification	Remark
Part-no.	F-45-sensor F-45-four F-46-four-iscan	for one single sensor for up to four sensors for one i::scan and up to three sensors
Housing material	POM-C	
Dimensions	F-45-sensor: 50 / 96 mm F-45-four: 106 / 103 mm F-46-four-iscan:106/103mm	Diameter / lenght 177/103 mm with autobrush
Weight	F-45-sensor: ~ 0,25 kg F-45-four: ~ 1.0 kg F-46-four-iscan: ~ 1.0 kg	 without autobrush
Process connection	$^1/_4$ inch inside	for inlet and outlet
Installation	flow-through	
Mounting	2 mounting holders	
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	







Dimension of flow cell setup in mm (F-45-sensor left side, F-45-four right side)

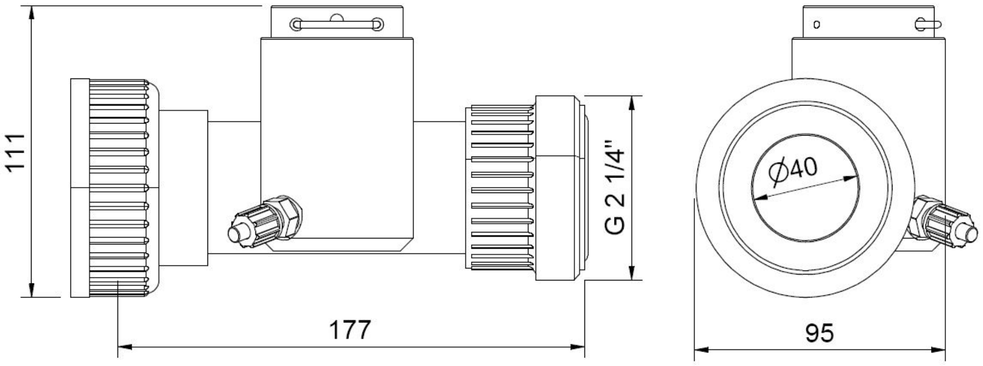


Dimension of flow cell setup in mm (F-46-four-iscan)

11.1.5 Flow Cell Setup Waste Water

For measurement of a waste / raw water sample stream outside the medium with chlori::lyser a separate flow –through installation is available.

Name	Specification	Remark
Part-no.	F-48-sensor	for one single sensor
Housing material	PVC	
Dimensions	177 / 95 / 111 mm	W / H / D
Weight	~ 0,5 kg	
Process connection	1 inch inside (G 1“) 40 mm ID	via F-48-process direct connection to G 1“
Installation	flow-through (by-pass)	
Discharge	< 40 l/min	recommended
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	



Dimension of flow cell setup in mm (F-48-sensor)

11.1.6 Systemp Panel micro::station / nano::station

For easy attachment of a complete s::can monitoring system (s::can operation terminal, flow cell setup, sensor) different types of separate system panels are available. The process connections of these panels can be ordered in DIN standard (EU) or in National Pipe Standard (US).

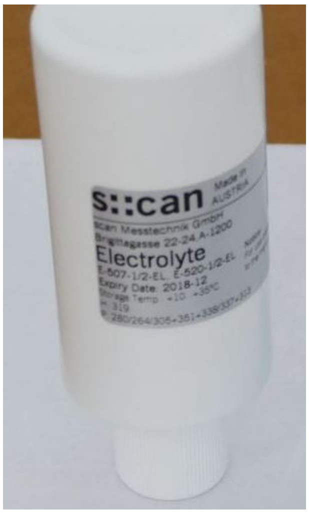
Name	Specification	Remark
Part-no.	F-501-eco-xx F-506-panel-xx F-508-panel	Main paneel micro::station Main panel nano::station Waste water panel
Material	PP PE	F-501, F-508 F-506
Dimensions W / H / D	450 / 750 / 10 mm 280 / 750 / 10 mm 375 / 690 / 10 mm (per part)	F-501-eco F-506-panel F-508-panel (2 parts)
Weight	~ 4.9 kg	

11.2 Spare Parts

11.2.1 Serviceset for free Chlorine (E-520-1/2-KIT)

For maintenance of actual version of chlori::lyser for measuring free chlorine, a complete replacement set (electrolyte and membrane cap) is available.

Name	Specification	Remark
Part-no.	E-520-1/2-KIT	for E-520-1 and E-520-2
Scope of delivery	Electrolyte (100ml) Memrane cap (1 pcs.) Polishing paper	
Storage duration		check date of expiry
Storage temperature	10 to 35 °C (50 to 95 °F)	



11.2.2 Serviceset for total Chlorine (E-525-1/2-KIT)

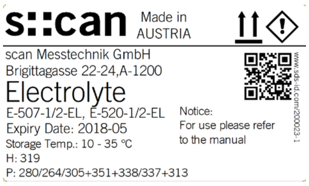
For maintenance of actual version of chlori::lyser for measuring total chlorine, a complete replacement set (electrolyte and membrane cap) is available.

Name	Specification	Remark
Part-no.	E-525-1/2-KIT	for E-525-1 and E-525-2
Scope of delivery	Elektrolyte (100ml) Memrankappe (1 pcs.) Schleifpapier	
Storage duration		check date of expiry
Storage temperature	10 to 35 °C (50 to 95 °F)	

11.2.3 Electrolyte for free Chlorine (E-507-1/2-EL)

For the actual version (E-520) as well as the previous version (E-507) of the chlori::lyser for measurement of free chlorine, the electrolyte is available in a refill bottle as spare part.

Name	Specification	Remark
Part-no.	E-507-1/2-EL	for E-507-1, E-507-2, E-520-1 and E-520-2
Volume	100 ml	approx. 5 times refilling
Storage duration		check date of expiry
Storage temperature	10 to 35 °C (50 to 95 °F)	



s::can Made in AUSTRIA

scan Messtechnik GmbH
Brigittagasse 22-24,A-1200
Electrolyte
E-507-1/2-EL, E-520-1/2-EL
Expiry Date: 2018-05
Storage Temp.: 10 - 35 °C
H: 319
P: 280/264/305+351+338/337+313

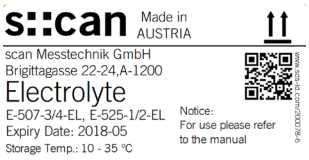
Notice:
For use please refer to the manual

www.sds-id.com/200023-1

11.2.4 Electrolyte for total Chlorine (E-507-3/4-EL)

For the actual version (E-525) as well as the previous version (E-507) of the chlori::lyser for measurement of total chlorine, the electrolyte is available in a refill bottle as spare part.

Name	Specification	Remark
Part-no.	E-507-3/4-El	for E-507-3, E-507-4, E-525-1 and E-525-2
Volume	100 ml	approx. 5 times refilling
Storage duration		check date of expiry
Storage temperature	10 to 35 °C (50 to 95 °F)	



s::can Made in AUSTRIA

scan Messtechnik GmbH
Brigittagasse 22-24,A-1200
Electrolyte
E-507-3/4-EL, E-525-1/2-EL
Expiry Date: 2018-05
Storage Temp.: 10 - 35 °C

Notice:
For use please refer to the manual

www.sds-id.com/200078-6

11.2.5 Membrane Cap for free Chlorine (E-507-1/2-SET)

For maintenance of the previous version of chlori::lyser for measuring free chlorine the replaceable membrane cap is available as spare part.

Name	Specification	Remark
Part-no.	E-507-1/2-SET	for E-507-1 and E-507-2
Scope of delivery	Memrane cap (1 pcs.) Spacer (1 pcs.) Polishing paper	
Volume membrane cap	approx. 8 ml Electrolyte	
Storage		only new caps or cleaned caps with max. 24 operating hours can be stored

11.2.6 Membrane Cap for total Chlorine (E-507-3/4-SET)

For maintenance of the previous version of the chlori::lyser for measuring free chlorine the replaceable membrane cap is available as spare part.

Name	Specification	Remark
Part-no.	E-507-3/4-SET	for E-507-3 and E-507-4
Scope of delivery	Memrane cap (1 pcs.) Polishing paper	
Volume membrane cap	approx. 8 ml Electrolyte	
Storage		only new caps or cleaned caps with max. 24 operating hours can be stored

12 Technical Specifications

Name	Specification E-520-x	Specification E-525-x	Remark
Part-no.	E-520-1 E-520-2	E-525-1 E-525-2	Previous version E-507-x
Measuring parameter	Free chlorine (FCL) Temperature	Total chlorine (TCL) Temperature	see section 5.4
Measuring principle	amperometric 3 electrode sensor, membrane covered		
Compensation	Temperature and pH	Temperature and pH	
Measuring range	E-520-1: 0 - 2 mg/l E-520-2: 0 - 20 mg/l	E-525-1: 0 - 2 mg/l E-525-2: 0 - 20 mg/l	
Resolution	E-520-1: 0.001 mg/l E-520-2: 0.01 mg/l	E-525-1: 0.001 mg/l E-525-2: 0.01 mg/l	
Accuracy	E-520-1: +/- 0.02 at 0.4 +/- 0.02 at 1.6 E-520-2: +/- 0.2 at 4 +/- 0.6 at 16	E-525-1: +/- 0.04 at 0.4 +/- 0.04 at 1.6 E-525-2: +/- 0.2 at 4 +/- 0.6 at 16	in [mg/l] after calibration in drinking water at 25°C and pH 7.2
Reference measurement	DPD-1	DPD-4	for span calibration, zero point factory calibrated
Response time	2 min	2 min	(T_{90})
Running in time (start up)	2 h	2 h	
Installation	in flow cell	in flow cell	
Environment rating	IP 67	IP 67	due to connection plug on sensor
Operating temperature	0 to 45 °C (32 to 113 °F)	0 to 45 °C (32 to 113 °F)	
Operating pressure	0 to 3 bar (0 to 43.5 psi)	0 to 3 bar (0 to 43.5 psi)	no pressure peaks and / or pressure fluctuation
Operating flow	15 to 30 l/h	15 to 30 l/h	low discharge dependency
Operating pH range	4 to 9	4 to 12	
Cross sensitivity	75 % ClO_2 80 % O_3 Combined chlorine can increase FCL reading	100 % ClO_2 130 % O_3	reducing and oxidizing agents, corrosion inhibitors and stabilisers for water hardness might influence the measurment
Absence of disinfectant	max. 24 h	max. 24 h	biofilm will clog membrane
Power supply	9 to 30 VDC	9 to 30 VDC	permanent supply and output signal galvanically isolated
Power consumption	0.5 W (typ)	0.5 W (typ)	
Dimension	35 / 208 mm 1.38 / 8.19 inch	35 / 208 mm 1.38 / 8.19 inch	Diameter / length (see section 3.3)
Weight	approx. 150 g	approx. 150 g	
Housing material	PVC-U, stainless steel 1.4571		Medium contacted
Interface connection	sys plug (IP 67), RS 485	sys plug (IP 67), RS 485	to s::can operation controller
Sensor cable lenght	1.0 m	1.0 m	plug connector on top of sensor

Name	Specification E-520-x	Specification E-525-x	Remark
Sensor cable specification	PUR (polyurethane jacket), 22 AWG, 6.3 mm (outside diameter); -30 to 80 °C (-22 to 176 °F)		
Sensor cable assignment	Pin 1: Data - (green cable strand) Pin 2: Data + (pink cable strand) Pin 3: +12 VDC (red cable strand) Pin 4: Ground (black cable strand) Pin 5: not used Pin 6: Shielding (blank cable strand)		
Storage temperature	Sensor: 0 to 45 °C (32 to 113 °F) Electrolyte: 10 to 35 °C (50 to 95 °F)		frost free in original bottle
Storage of sensor	dry, without electrolyte and cleaned membrane cap only		with protective cap to avoid contamination of membrane
Typical lifespan (application)	Membrane: 12 months Electrolyte: 12 months	Membrane: 12 months Electrolyte: 12 months	depending on medium
Typical lifespan (storage)	1 -2 year electrolyte in original bottle, protected from sunlight		check date of expiry on package
Conformity - EMC	EN 61326-1:2013 EN 61326-2-3:2013		General requirements Particular requirements

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Appendix B

Domestic Supply Pumps

CITY OF IQALUIT – WATER
TREATMENT PLANT - HEATING
SYSTEMS UPGRADE
Project No. 201-09487-01 – PCR 001
City of Iqaluit

WSP
March 2022

Count	Description
1	**CRN 15-4 A-FGJ-A-E-HQQE**

Product No.: 96127005

Vertical, multistage centrifugal pump with inlet and outlet ports on same the level (inline). Pump materials in contact with the liquid are in high-grade stainless steel. A cartridge shaft seal ensures high reliability, safe handling, and easy access and service. Power transmission is via a rigid split coupling. Pipe connection is via combined DIN-ANSI-JIS flanges.

Further product details

Steel, cast iron and aluminium components have an epoxy-based coating made in a cathodic electro-deposition (CED) process.

CED is a high-quality dip-painting process where an electrical field around the products ensures deposition of paint particles as a thin, well-controlled layer on the surface.

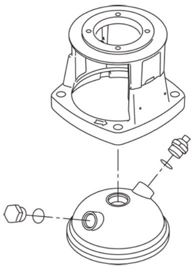
An integral part of the process is a pretreatment.

The entire process consists of these elements:
1) Alkaline-based cleaning.
2) Zinc phosphating.
3) Cathodic electro-deposition.
4) Curing to a dry film thickness 18-22 my m.

The colour code for the finished product is NCS 9000/RAL 9005.

Pump

The pump head and flange for motor mounting is made in one piece (cast iron). The pump head cover is a separate component (stainless steel). The pump head has a combined 1/2" priming plug and vent screw.



The pump is fitted with a balanced O-ring seal unit with a rigid torque-transmission system.

This seal type is assembled in a cartridge unit which makes replacement safe and easy.

Due to the balancing, this seal type is suitable for high-pressure applications.

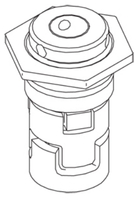
The cartridge construction also protects the pump shaft from possible wear from a dynamic O-ring between pump shaft and shaft seal.

Primary seal:
- Rotating seal ring material: silicon carbide (SiC)
- Stationary seat material: silicon carbide (SiC)

This material pairing is used where higher corrosion resistance is required. The high hardness of this material pairing offers good resistance against abrasive particles.

Secondary seal material: EPDM (ethylene-propylene rubber)

EPDM has excellent resistance to hot water. EPDM is not suitable for mineral oils.



The shaft seal is screwed into the pump head.

The chambers and impellers are made of stainless-steel sheet. The chambers are provided with a PTFE neck ring offering improved sealing and high efficiency. The impellers have smooth surfaces, and the shape of the blades ensure a high efficiency.

The pump has a stainless steel base mounted on a separate base plate.
This base and base plate are kept in position by the tension of the staybolts which hold the pump together.
The outlet side of the base has a combined drain plug and bypass valve.
The pump is secured to the foundation by four bolts through the base plate.
The flanges and base are cast in one piece and prepared for connection by means of DIN, ANSI or JIS.

Motor

The pump is sold without motor.

Technical data

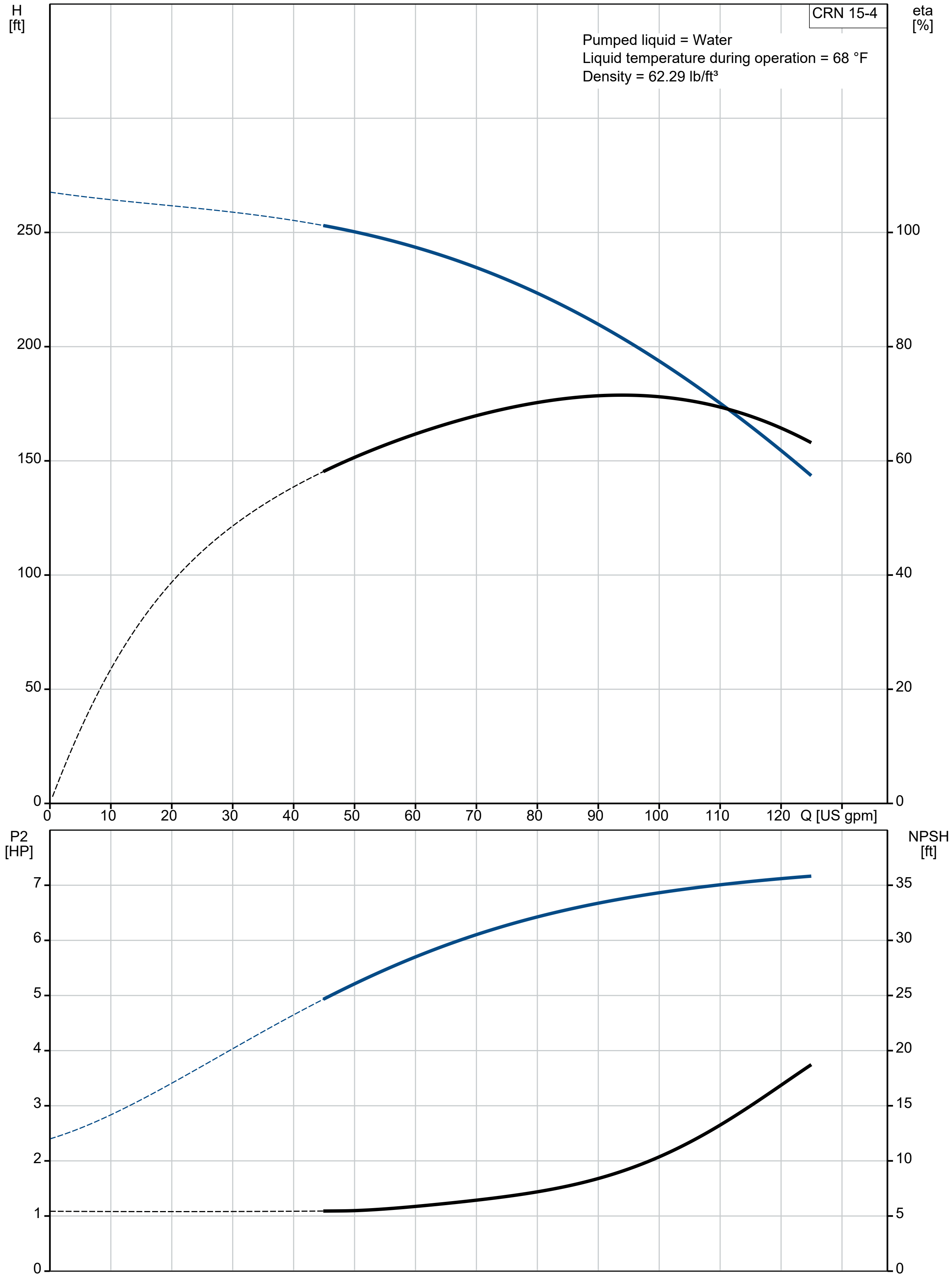
Liquid:	
Pumped liquid:	Water
Liquid temperature range:	-4 .. 248 °F
Selected liquid temperature:	68 °F
Density:	62.29 lb/ft³
Technical:	
Rated pump speed:	3467 rpm
Rated flow:	90.3 US gpm
Rated head:	206 ft
Actual impeller diameter:	4.13 in
Pump orientation:	Vertical
Shaft seal arrangement:	Single
Code for shaft seal:	HQQE
Approvals:	CE
Approvals for drinking water:	NSF/ANSI 61
Curve tolerance:	ISO9906:2012 3B
Materials:	
Base:	Stainless steel EN 1.4408 AISI 316
Impeller:	Stainless steel EN 1.4401 AISI 316
Bearing:	SIC
Installation:	
Maximum operating pressure:	362.59 psi
Max pressure at stated temperature:	363 psi / 250 °F 363 psi / -4 °F
Type of connection:	DIN / ANSI / JIS
Size of inlet connection:	DN 50
Size of outlet connection:	DN 50
Pressure rating for connection:	PN 25
Flange rating inlet:	300 lb

Count	**Description**	
	Flange size for motor:	213TC
	Electrical data:	
	Motor standard:	NEMA
	Controls:	
	Frequency converter:	NONE
	Others:	
	DOE Pump Energy Index CL:	0.91
	Net weight:	90.4 lb
	Gross weight:	108 lb
	Shipping volume:	4.94 ft³
	Country of origin:	US
	Custom tariff no.:	8413.70.90.20

Company name:
Created by:
Phone:

Date: 1/28/2022

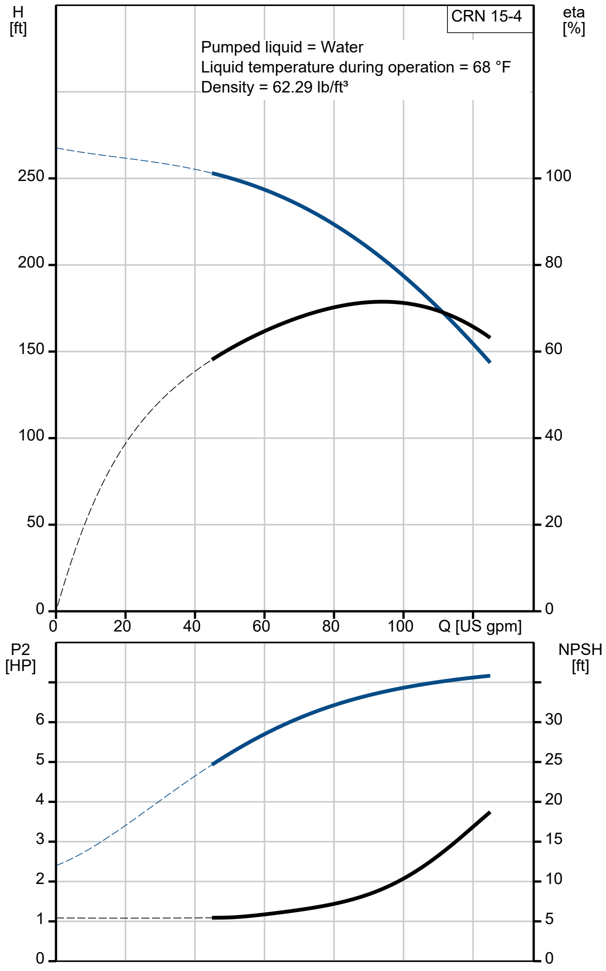
96127005 CRN 15-4 A-FGJ-A-E-HQQE 60 Hz

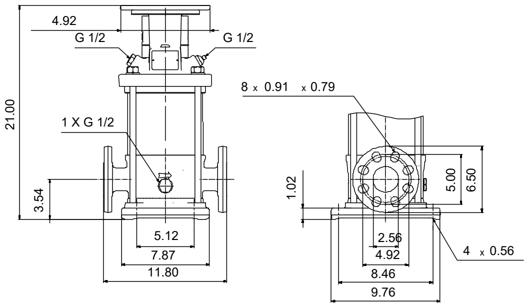


Company name:
Created by:
Phone:

Date: 1/28/2022

Description	Value
General information:	
Product name:	CRN 15-4 A-FGJ-A-E-HQQE
Product No.:	96127005
EAN:	5700397002094
Technical:	
Rated pump speed:	3467 rpm
Rated flow:	90.3 US gpm
Rated head:	206 ft
Maximum head:	266.4 ft
Actual impeller diameter:	4.13 in
Stages:	4
Impellers:	4
Number of reduced-diameter impellers:	0
Low NPSH:	N
Pump orientation:	Vertical
Shaft seal arrangement:	Single
Code for shaft seal:	HQQE
Approvals:	CE
Approvals for drinking water:	NSF/ANSI 61
Curve tolerance:	ISO9906:2012 3B
Pump version:	A
Model:	A
Materials:	
Base:	Stainless steel
Base:	EN 1.4408
Base:	AISI 316
Impeller:	Stainless steel
Impeller:	EN 1.4401
Impeller:	AISI 316
Material code:	A
Code for rubber:	E
Bearing:	SIC
Installation:	
Maximum operating pressure:	362.59 psi
Max pressure at stated temperature:	363 psi / 250 °F
Max pressure at stated temperature:	363 psi / -4 °F
Type of connection:	DIN / ANSI / JIS
Size of inlet connection:	DN 50
Size of outlet connection:	DN 50
Pressure rating for connection:	PN 25
Flange rating inlet:	300 lb
Flange size for motor:	213TC
Connect code:	FGJ
Liquid:	
Pumped liquid:	Water
Liquid temperature range:	-4 .. 248 °F
Selected liquid temperature:	68 °F
Density:	62.29 lb/ft³
Electrical data:	
Motor standard:	NEMA
Controls:	
Frequency converter:	NONE
Others:	
DOE Pump Energy Index CL:	0.91
Net weight:	90.4 lb
Gross weight:	108 lb
Shipping volume:	4.94 ft³



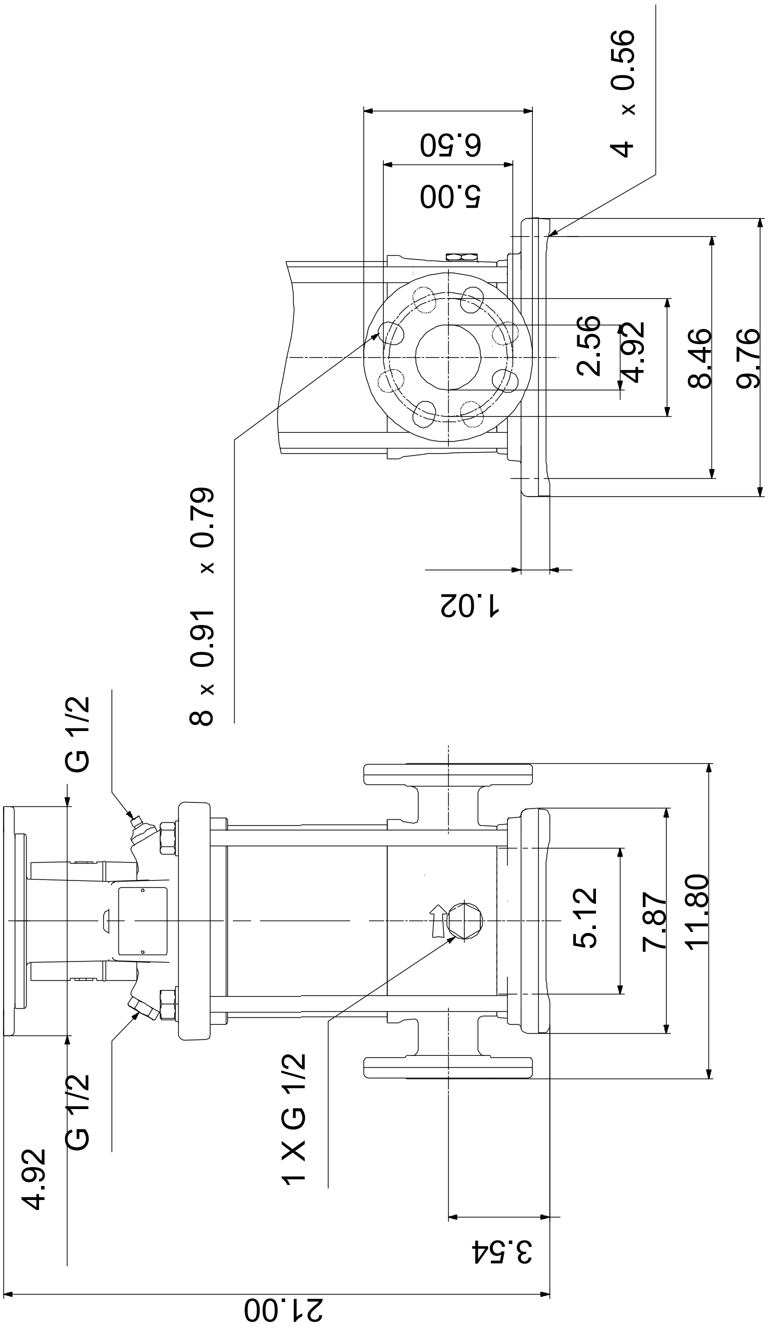


Description	Value
Country of origin:	US
Custom tariff no.:	8413.70.90.20

Company name:
Created by:
Phone:

Date: 1/28/2022

96127005 CRN 15-4 A-FGJ-A-E-HQQE 60 Hz



Note! All units are in [in] unless otherwise stated.
Disclaimer: This simplified dimensional drawing does not show all details.

DATA SHEET

Nr.: 016380/2005

Date: 28-APR-2005

Singlephase Induction Motor - Squirrel Cage

Customer	: V.J. PAMENSKY CANADA INC.
Product code	:
Product line	: MONOFÁSICO - NEMA 56 - IP55

Frame	: W213/5TC
Output	: 7.5 HP (5.5 kW)
Frequency	: 60 Hz
Poles	: 2
Rated speed	: 3495 rpm
Slip	: 2.92 %
Rated voltage	: 208-230V
Rated current	: 34.0-30.9 A
L. R. Amperes	: 216 A
Il/In	: 7.0 Code H
No load current	: 11.5 A
Rated torque	: 11.3 ft.lb
Locked rotor torque	: 280 %
Breakdown torque	: 260 %
Insulation class	: F
Locked rotor time	: 6 s (hot)
Service factor	: 1.15 (1.00 at 208V)
Duty cycle	: S1
Ambient temperature	: 40℃
Altitude	: 1000 m.a.s.l

Enclosure	: IP55
Mounting	: V18
Rotation	: Both
Aprox. weight*	: 126 lb
Moment of inertia	: 0.5766 sq.ft.lb
Sound Pressure Level	: 60.0 dB(A) (global)

Load	Power factor	Efficiency (%)
100%	0.92	84.0
75%	0.89	83.0
50%	0.82	79.0

	Bearing	Quantity (lubricant)
Front	6309-ZZ	-----
Rear	6206-ZZ	-----

Lubrication interval: -----

Grease - MOBIL POLYREX EM

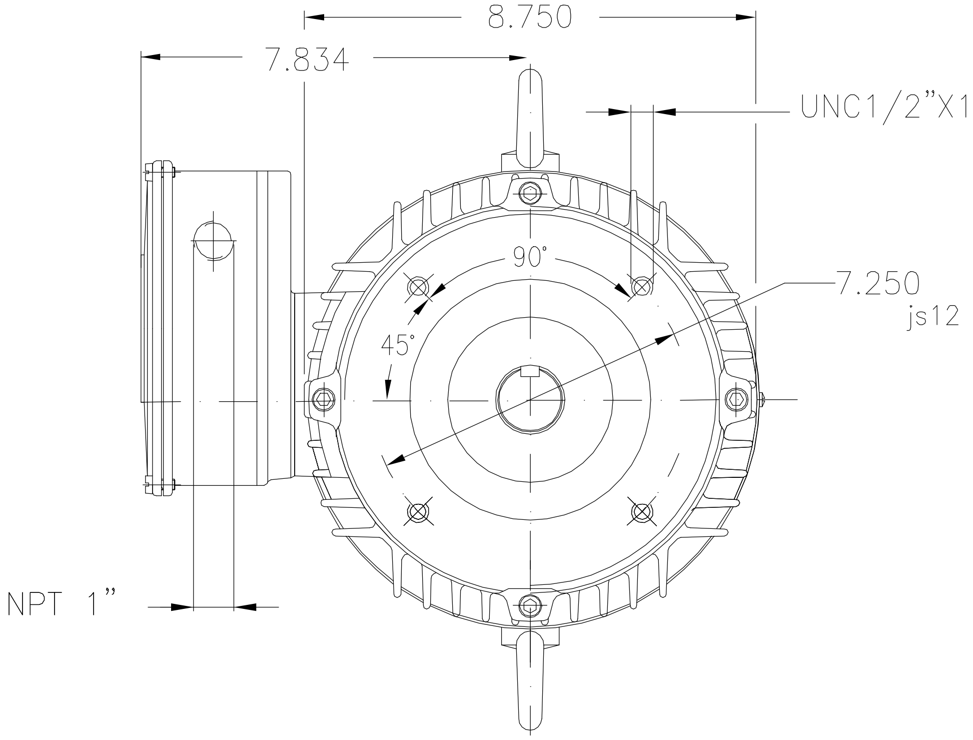
Notes:

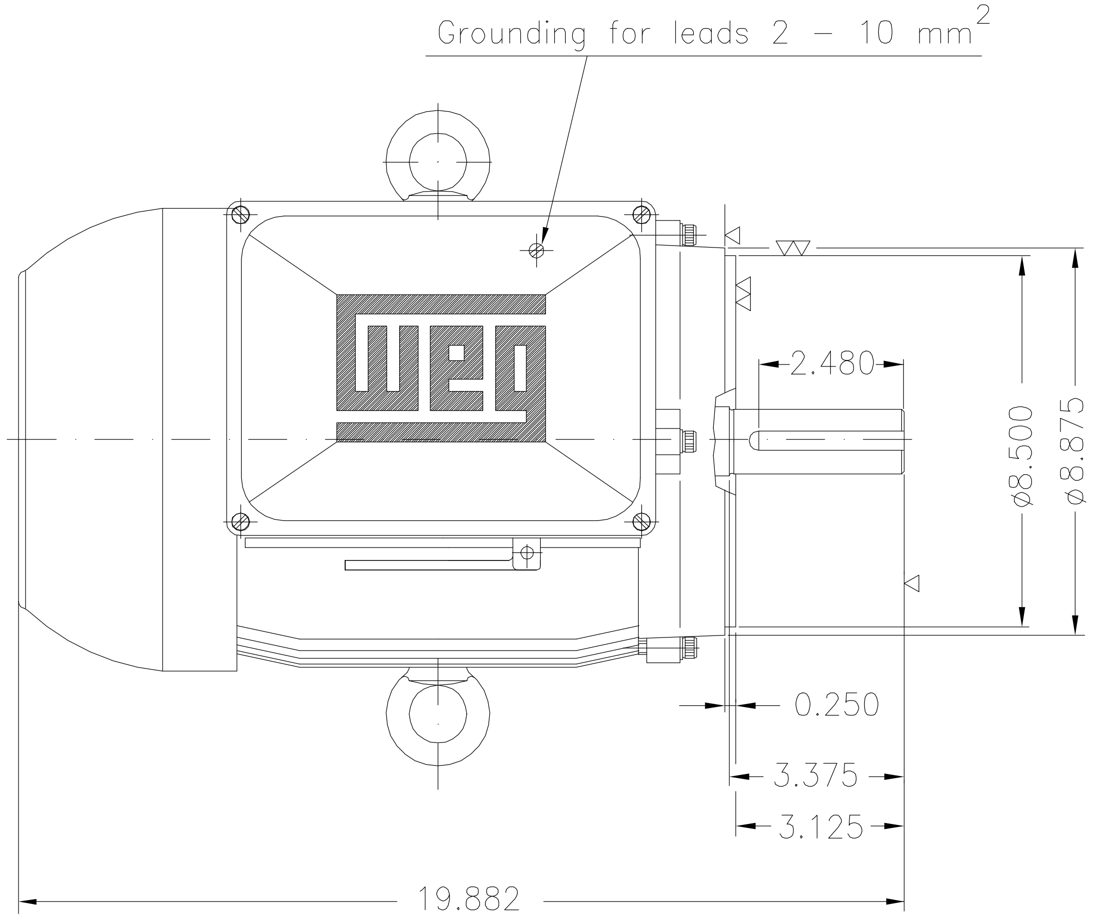
The figures given herewith are regarded as estimated values based on calculation and applied to sinusoidal power supplied motors, within permissible tolerances under NEMA MG 1-12. Noise level with tolerance of +3 dB(A). (*) Weight value can be changed without previous notification.

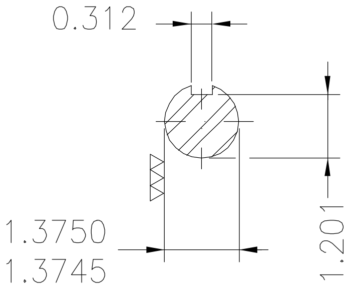
Performed	Checked	Revision	Approved
RAFAELLOPES	JUCELIOG	Nr.: 0 Date: 28-APR-2005	

A MENOS QUE HAJA AUTORIZAÇÃO PREVIA NAO SERÁ PERMITIDO A REPRODUÇÃO DESTE DESENHO DE PROPRIEDADE DA WEG MOTORES	EIXO	
	PADRÃO	
	OPCIONAL	
	ESPECIAL	X

THIS IS AN UPDATED REVISION, THE PREVIOUS ONE MUST BE DISREGARDED.







Placa de identificação CSA UL / CSA UL nameplate

Anel de Retenção no Rolamento Dianteiro / Circlip in the D.E. Bearing

Rolamento dianteiro 6309ZZ e traseiro 6206ZZ / D.E. bearing 6309ZZ and N.D.E. 6206ZZ

Fornecido sem chaveta / Supplied without key

Forma Construtiva V18 / Mounting - V18

RLM	LOC	ENGINEERING CHANGES	DRAWN	REVIEWED	RELEASED	DATE	IND
-----	---	Ret. nota intervalo de relubrificação	DEISE		MARCIO	14.07.06	02
SAC19068	E-5	Alt. Nota Anel de Retenção era Anel Fixação	DEISE		VALDIR	24.11.05	01

DRAWN	TIAGOB		
REVIEWED	Baggio		
RELEASED		CUSTOMER	
DATE	26/2/2004	V.J.PAMENSKY CANADA INC.	SCALE: %

7.5 HP 2 POLE 60 Hz X1042.04.01

A

SINGLE PHASE MOTOR
FRAME W213/5TC IP55

E4012041 ME

CÓPIA SEM CONTROLE

LIBERADO

CAD

Appendix C

H Style Bypass Strainer

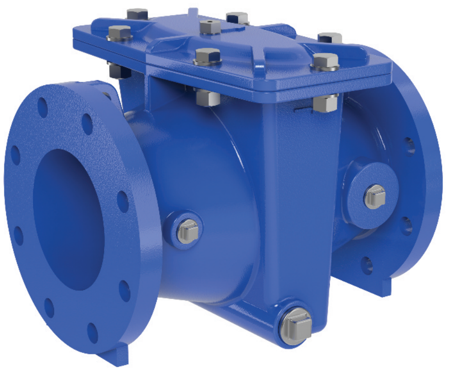
CITY OF IQALUIT – WATER
TREATMENT PLANT - HEATING
SYSTEMS UPGRADE
Project No. 201-09487-01 – PCR 001
City of Iqaluit

WSP
March 2022

CLA-VAL™

— MODEL — **X43H**

H Style Strainer

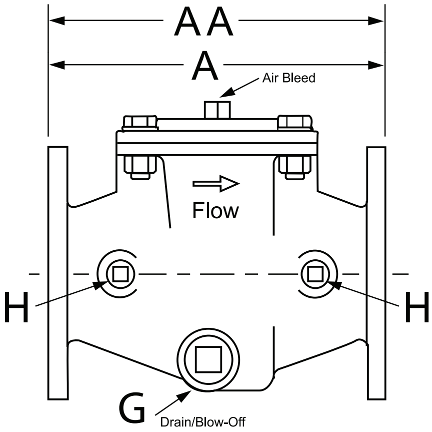


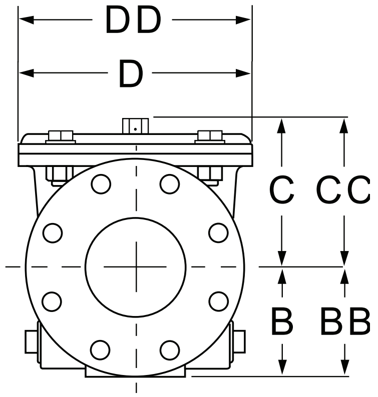
- **Low Pressure Drop**
- **Ductile Iron with NSF/ANSI 61 Fusion Bonded Epoxy Coating Construction with a 316 Stainless Steel Strainer**
- **Large Flow Area H-Style Design**
- **Service Without Removal From Line**

The Cla-Val Model X43H Strainer offers an effective means of removing unwanted solid particles in pipeline flow. These strainers are ideal for preventing fouling, debris and particle buildup in Cla-Val Automatic Control Valves. The large flow area design, with a flat stainless steel strainer mesh perpendicular to flow, is optimized for low pressure drop applications.

Optional accessories that can be added to the X43H Strainer include the Differential Pressure Switch and the X141DP Differential Pressure Gauge Assembly.

Maintenance is fast and easy with the compact H-pattern, requiring only top cover removal. Though the strainer may be installed in any position, installation with the cover up is recommended.





Dimensions

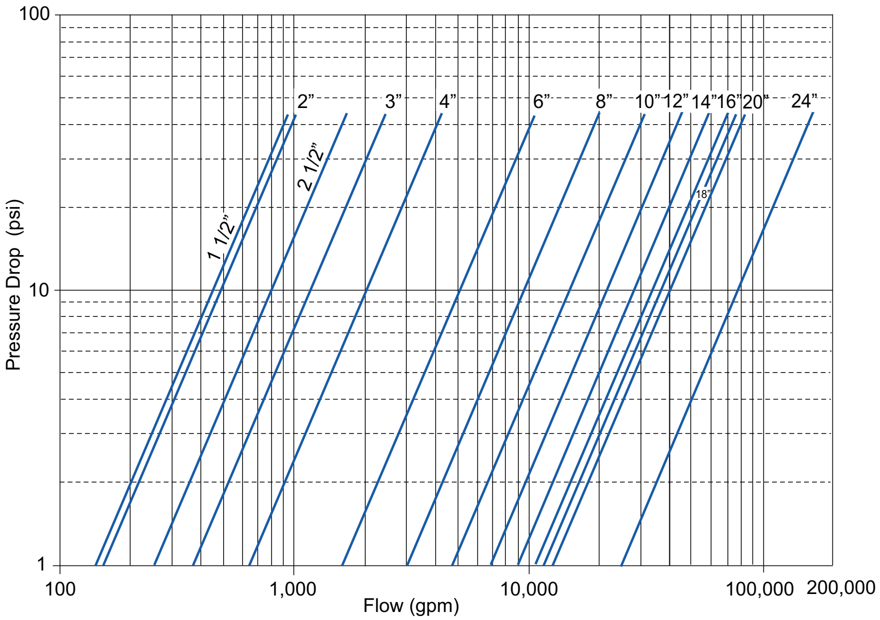
Strainer Size (inches)	**1 ½**	**2**	**2 ½**	**3**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**30**	**36**	**48**
A 150 ANSI	9.06	9.06	9.06	11.81	11.81	15.75	19.69	22.83	24.02	25.59	31.50	31.50	37.40	43.31	45.27	45.67	45.67
AA 300 ANSI	9.13	9.13	9.13	11.89	11.89	15.83	19.76	22.91	24.09	25.67	31.57	31.57	37.48	43.39	- -	- -	- -
B 150 ANSI	2.50	3.26	3.66	4.06	4.33	5.63	6.69	8.40	9.40	10.24	12.20	13.18	19.09	19.09	22.49	26.00	34.00
BB 300 ANSI	3.26	3.26	3.66	4.06	5.02	5.63	7.50	8.86	10.20	10.94	12.70	15.00	19.09	19.09	- -	- -	- -
C Max. 150 ANSI	3.78	3.78	3.78	5.91	5.91	7.52	8.82	11.61	15.16	14.96	19.69	19.69	23.98	23.98	25.10	36.20	34.11
CC Max. 300 ANSI	5.20	5.20	5.35	6.22	6.22	7.99	9.33	12.79	15.67	15.67	19.69	19.69	23.98	23.98	- -	- -	- -
D Dia. 150 ANSI	7.87	7.87	7.87	9.25	9.25	15.74	18.11	22.05	26.77	26.77	35.43	35.43	46.85	46.85	46.85	61.65	61.65
DD Dia. 300 ANSI	7.99	7.99	7.99	9.37	9.37	15.86	18.23	22.17	26.85	26.85	35.43	35.43	46.85	46.85	- -	- -	- -
H Inlet/Outlet Plugs NPT	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½
G Drain/Blow-off Plug NPT	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	2	2	2	2	2	2	2	2	2
Approx. Ship Wt. Lbs.	33	36	39	59	73	143	212	432	626	683	970	1073	1175	1962	2249	4123	4828

Strainer Size (mm)	**40**	**50**	**65**	**80**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**600**	**750**	**900**	**1200**
A 150 ANSI	230	230	230	300	300	400	500	580	610	650	800	800	950	1100	1150	1160	1160
AA 300 ANSI	232	232	232	302	302	402	502	582	612	652	802	802	952	1102	- -	- -	- -
B 150 ANSI	64	83	93	103	110	143	170	213	240	260	310	335	485	485	571.5	660.5	862.5
BB 300 ANSI	83	83	93	103	128	143	191	225	259	278	321	380	485	486	- -	- -	- -
C Max. 150 ANSI	96	96	96	150	150	191	224	295	385	380	500	500	609	609	637.5	919.5	866.5
CC Max. 300 ANSI	132	132	136	158	158	203	237	325	398	398	500	500	609	609	- -	- -	- -
D Dia. 150 ANSI	200	200	200	235	235	400	460	560	680	680	900	900	1190	1190	1190	1566	1566
DD Dia. 300 ANSI	203	203	203	238	238	403	463	563	682	682	900	900	1190	1190	- -	- -	- -
H Inlet/Outlet Plugs NPT	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½
G Drain/Blow-off Plug NPT	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	2	2	2	2	2	2	2	2	2
Approx. Ship Wt. (kg)	15	16	18	27	33	65	96	196	284	310	440	600	810	890	1020	1870	2190

Specifications

Sizes (Inches):	1½, 2, 2½, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 36 and 48
Sizes (mm):	40, 50, 65, 80,100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 750, 900, 1200
Ends:	Flanged, ANSI Class 150 and 300 (**Note:** 300# Flanges are Raised Face)
Max Pressure Rating:	150# - 250 psi • 300# - 400 psi
Temperature:	Maximum 175°F
Materials:	
Body & Cover:	Ductile Iron ANSI B16.42; Fusion Bonded Epoxy Coating Standard
Cover Seal:	Buna-N® Synthetic Rubber
Strainer:	316 Stainless Steel; Ductile Iron, Epoxy Coated Frame
Strainer Mesh Sizes:	Standard 10 mesh / 2000 Micron / Openings 0.078 inch • Optional .039 and .059 inch openings available
Drain/Blow-Off:	Connection furnished with Standard Stainless Steel Plug
Cover Fasteners:	Stainless Steel

Model X43H Flow Chart



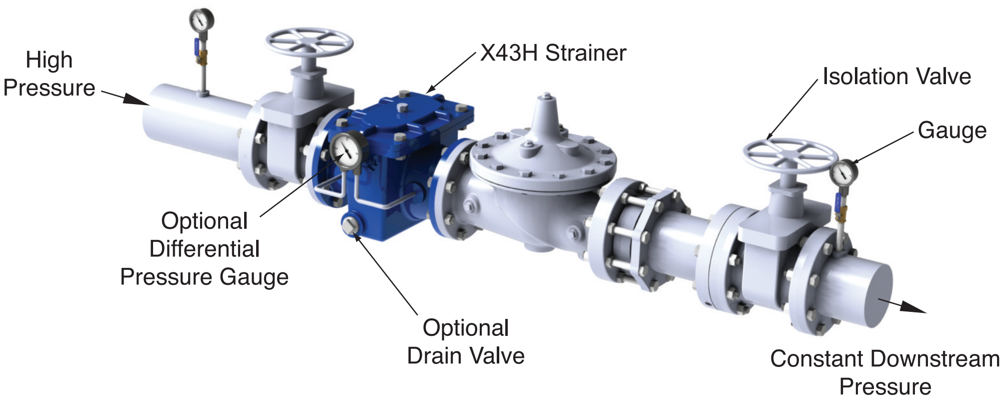
C_V Factor

Size (inches)	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24	*30	*36	*48
Size (millimeters)	**40**	**50**	**65**	**80**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**600**	**750**	**900**	**1200**
C_V (Gal/Min. - gpm.)	96	150	254	367	654	1644	3922	4566	6800	8949	11692	12796	18264	26302	CF	CF	CF
C_V (Litres/Sec - l/s.)	23	36	61	88	157	395	942	1097	1634	2150	2809	3074	4388	6319	CF	CF	CF

C_V in gpm = gpm @ 1psid head loss • C_V in l/s = l/s @ 1bar head loss

*Consult factory to confirm flow data for 30-inch/750mm and larger strainers

Model X43H Strainer Typical Application



Strainer Options

X141DP
Differential
Pressure Gauge

Differential
Pressure Switch

E-X43H Strainer (R-06/2019)