COAGULATION PH METER

LEFT BLANK

Technology For Solutions

GLI International

Data Sheet PRO-P3/1001
Supersedes PRO-P3/501

PRO-series pH/ORP Transmitter

(Model PRO-P3 measures pH or ORP)

CE

Certified Compliant to
European Community Standards

■ **Multiple Measurements.**
The PRO-P3 transmitter can be selected to measure pH or ORP (oxidation reduction potential). Measured pH and temperature values can be displayed separately or together. The corresponding 4-20 mA analog output can also be shown.

■ **Versatile Hookup Capability.**
PRO-series transmitters can be wired in a two, three or four-wire hookup arrangement to meet your application requirement.

■ **Compact Size and NEMA 4X Universal Mounting.**
The compact PRO-series transmitter can be panel, wall, pipe or integral sensor mounted.

■ **Electromagnetic Conformance.**
All PRO-series transmitters exceed U.S. and meet European standards for EMI and RFI emissions and immunity.

■ **Multiple Language Capability.**
All screens can be selected for display in English or Spanish. (Different languages such as French or German may also be substituted.)

■ **"Menu-guided" Operation.**
The simple keypad and logical menu structure make this transmitter easy to use. Menu screens guide you through setup, operation, calibration, and test/maintenance functions.

■ **Passcode-protected Access.**
For security, use the passcode feature to restrict configuration and calibration settings to only authorized personnel.

■ **Isolated 4-20 mA Output.**
The isolated 4-20 mA analog output can represent the measured pH or temperature (or ORP). During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.

■ **Versatile Sensor Capability.**
The PRO-P3 transmitter can be used with any GLI Differential Technique pH or ORP sensor, or any conventional combination pH or ORP electrode.

■ **Auto/Manual Temperature Compensation.**
Automatic temperature compensation is provided when using NTC 300 ohm thermistor, Pt 1000 RTD or Pt 100 RTD temperature elements. For applications requiring fixed temperature compensation, the PRO-P3 can be manually set to a desired temperature.

■ **Simple Interactive Diagnostics.**
Built-in diagnostics continuously test transmitter and sensor operation.

■ **OEM Versions Available.**
PRO-series transmitters can be packaged or configured to accommodate OEM-specific needs.

Specifications

Operational:

Display..... Two-line by 16 character LCD

NOTE: *The measured pH (or ORP) and temperature can be separately displayed or shown together on one screen. The corresponding 4-20 mA analog output value can also be shown.*

Measurement	Selectable Ranges
pH	-2.0 to 14.0 pH or -2.00 to 14.00 pH
ORP	-2100 to +2100 mV
Temperature	-4.0 to +392.0°F or -20.0 to +200.0°C
Analog Outputs	4.00-20.00 mA

Ambient Conditions..... Operation: -4 to +140°F (-20 to +60°C); 0 to 95% relative humidity, non-condensing
Storage: -22 to +158°F (-30 to +70°C); 0 to 95% relative humidity, non-condensing

Temperature Compensation ..... Automatic from 14.0 to 230.0°F (-10.0 to +110.0°C) with selection for NTC 300 ohm thermistor, Pt 1000 ohm RTD or Pt 100 ohm RTD temperature element, or manually fixed at a user-entered temperature; additional selectable temperature correction factors (ammonia, morpholine or user-defined pH/°C linear slope) available for pure water automatic compensation from 0.0-50.0°C

Sensor-to-Analyzer Distance:
- GLI Differential Technique Sensor ..... 3000 ft. (914 m) maximum
- Conventional Combination Electrode with Preamp ..... 985 ft. (300 m) maximum
- Conventional Combination Electrode without Preamp ..... 100 ft. (30 m) maximum with electrode cable capacitance of less than 30 pF/foot

Power Requirements ..... Two-wire Hookup: 16-30 VDC; Three-wire Hookup: 14-30 VDC*; Four-wire Hookup: 12-30 VDC*
(Class 2 Power Supply) *16 VDC minimum with RS-485 serial communication.

Calibration Methods:
- 2-point Buffer (pH only) ..... Automatic calibration and buffer recognition using two buffers from a selected buffer set*.
- 1-point Buffer (pH only) ..... Automatic calibration and buffer recognition using one buffer from a selected buffer set*.

**Buffer Sets: 4.00, 7.00, and 10.00 or DIN standard (1.09, 4.65, 6.79, 9.23, and 12.75)*

NOTE: *When using buffers that are not included in either buffer set, calibrate using only the Sample method (1 or 2).*

- 2-point Sample (pH only) ..... Enter two known sample values (determined by laboratory analysis or comparison reading) or two known pH buffer values.
- 1-point Sample (pH and ORP) ..... Enter one known sample value (determined by laboratory analysis or comparison reading), or one known pH buffer value (or, for ORP measurement, one known reference solution value)

Analog Output..... Isolated 4-20 mA output with 0.004 mA (12-bit) resolution

NOTE: *Output can represent the measured pH or temperature (or ORP). Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA output values are desired (range expand). During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.*

Maximum Loop Load..... Dependent on power supply voltage, transmitter hookup arrangement, and wire resistance:

Maximum Permissible Loads							
Transmitter Hookup Arrangement	Power Supply Voltage						
	12 VDC	14 VDC	16 VDC	20 VDC	24 VDC	28 VDC	30 VDC
Two-wire Hookup	- - - -	- - - -	100 ohms	300 ohms	500 ohms	700 ohms	800 ohms
Three-wire Hookup	- - - -	500 ohms	600 ohms	800 ohms	1000 ohms	1200 ohms	1300 ohms
Four-wire Hookup	400 ohms	500 ohms	600 ohms	800 ohms	1000 ohms	1200 ohms	1300 ohms

Memory (non-volatile)..... All user settings are retained indefinitely in memory without battery backup

EMI/RFI Conformance..... Exceeds U.S. and meets European standards for conducted and radiated emissions and immunity; certified CE compliant for applications as specified by EN 50081-2 for emissions and EN 50082-2 for immunity

Electrical Certifications:
- General Purpose (pending) ..... UL, C-UL, FM, and CENELEC
- Division 2 (pending) ..... UL, C-UL, and FM: Groups A, B, C, D, F, and G

Analyzer Performance(Electrical, Analog Outputs):

Accuracy**..... ± 0.1% of span
Sensitivity**..... ± 0.05% of span
Repeatability**..... ± 0.05% of span
Temperature Drift**..... Zero and Span: ± 0.02% of span per °C
Response Time ..... 1-60 seconds to 90% of value upon step change (with output filter setting of zero)

**These performance specifications are typical at 25°C.

Mechanical:

Enclosure..... Polycarbonate; NEMA 4X general purpose; choice of included mounting hardware
Mounting Configurations..... Panel, wall, pipe or integral sensor mounting
Dimensions..... With Back Cover: 3.75 in. W x 3.75 in. H x 2.32 in. D (95 mm W x 95 mm H x 60 mm D)
Without Back Cover for Panel Mount: 3.75 in. W x 3.75 in. H x 0.75 in. D (95 mm W x 95 mm H x 19 mm D)
Net Weight..... 10 oz. (280 g) approximately

Ordering Information

MODEL NUMBER (see Notes 1 and 3)

- **PRO-P3A** pH/ORP transmitter with wall/pipe/integral sensor mount kit (see Note 2)
- **PRO-P3B** pH/ORP transmitter with panel mount kit (includes gasket, retainer plate, and four screws)
- **PRO-P3C** Basic pH/ORP transmitter (without mounting hardware -- electronics only)

RESERVED CATEGORY

EQUIPMENT TAGGING (specify tag data)

- **N** None
- **P** Paper
- **S** Stainless steel

1 **Product Number**

Choose item from each category.

Ordering Notes:

1. The standard on-screen languages for PRO-series transmitter operation are English and Spanish. A different language (French, German, etc.) may be substituted for Spanish. Please specify the desired language.
2. This mounting kit includes all hardware needed to wall, pipe or integral sensor mount the transmitter. When integrally mounting the transmitter onto a GLI sensor, please specify the sensor part number with a "PRO1" suffix to ensure a correct sensor cable length and coupling. When the coupling is not required (replacement sensor), please specify the sensor part number with a "PRO2" suffix.
3. Each transmitter is supplied with a CD-ROM containing operating manuals (in PDF-file format) for all of the PRO-series transmitters. Paper manuals are also available (see Accessories at right).

Accessories (order separately):

- **Retrofit Wall/Pipe/Integral Sensor Mount Kit 1000A3457-001**

  This hardware kit enables an existing panel-mounted PRO-series transmitter to be wall, pipe or integral sensor mounted.

- **Retrofit Panel Mount Kit 1000A3455-001**

  This hardware kit enables an existing wall, pipe or integral sensor-mounted PRO-series transmitter to be panel mounted.

- **Couplings to Retrofit Transmitter onto Sensor**

Installed Sensor	Required Coupling	
	Part Number	Size
pHD™-series:		
Convertible (tee mount)	3P2120-125	1 x 1/2-inch
Convertible (union mount)	None required	- - - -
Sanitary	3P2120-125	1 x 1/2-inch
Insertion	Not available	- - - -
LCP-series:		
Convertible	3P2120-130	1-1/2 x 1/2-inch
Union mount	3P2120-130	1-1/2 x 1/2-inch
PC-series 3/4-inch Combination	3P2120-122	3/4 x 1/2-inch

- **Operating Manual No. PRO-P3**

  A paper booklet operating manual for the PRO-P3 pH/ORP transmitter.

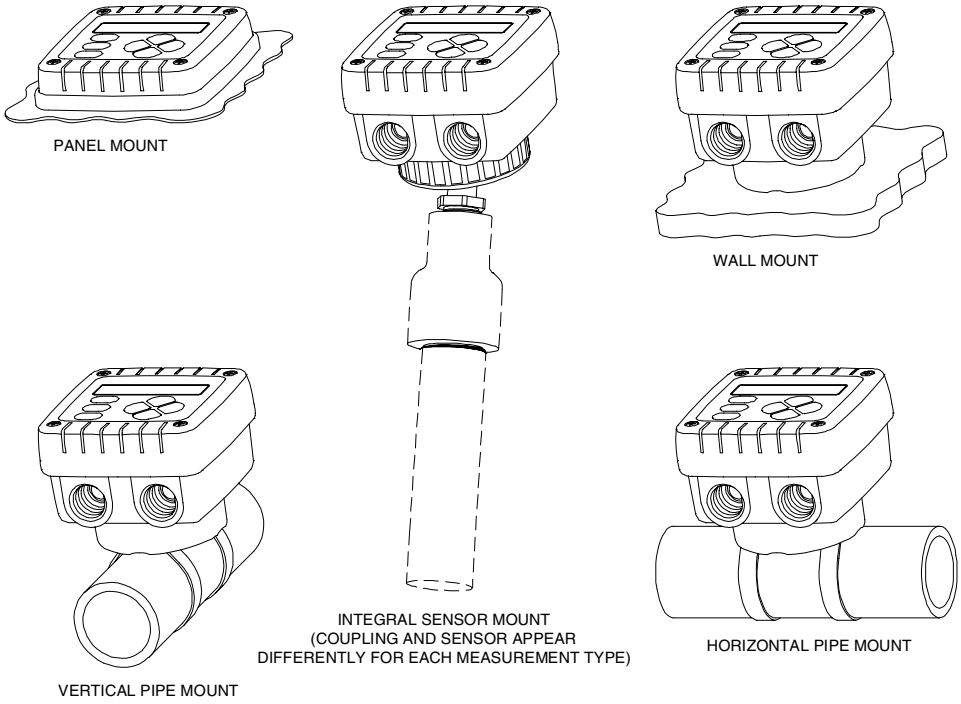
pH and ORP Sensors

For various styles of GLI pH and ORP sensors, refer to these data sheets for complete details: PD, LRE, 6000P0, FTA, HPW, PC or PR6300M.

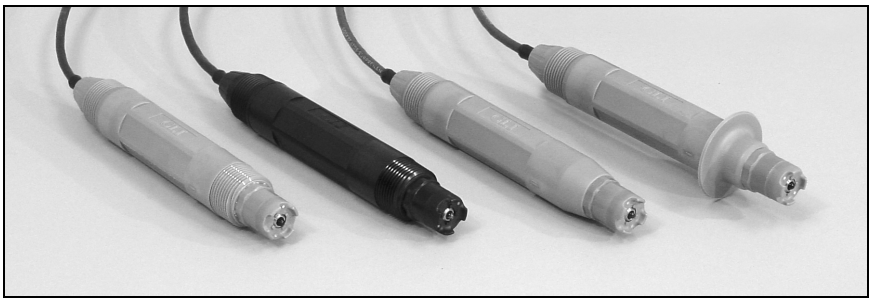
Engineering Specification

1. The microprocessor-based transmitter shall accept any GLI 5-wire Differential Technique pH or ORP sensor, or any conventional combination pH or ORP electrode.
2. The transmitter shall measure pH and process temperature or ORP.
3. The transmitter shall be operable in multiple languages.
4. The transmitter shall have a two-line by 16 character LCD. It shall display measured pH and temperature separately or together on a single screen. The corresponding 4-20 mA analog output value shall also be shown.
5. The transmitter shall have these calibration methods:
   a) 2-point Buffer Method (pH only): Automatic calibration and buffer recognition using two buffers from a selected buffer set.
   b) 1-point Buffer Method (pH only): Automatic calibration and buffer recognition using one buffer from a selected buffer set.
   c) 2-point Sample Method (pH only): Enter two known sample values (determined by laboratory analysis or comparison reading) or two known pH buffer values.
   d) 1-point Sample Method (pH and ORP): Enter one known sample value (determined by laboratory analysis or comparison reading) or one known pH buffer value (or, for ORP measurement, one known reference solution value).
6. The transmitter shall have a passcode to restrict configuration and calibration settings only to authorized personnel.
7. The transmitter shall have two temperature compensation methods:
   a) Automatic: When the pH sensor has an NTC 300 ohm thermistor, Pt 1000 RTD or Pt 100 RTD temperature element, the pH measurement is automatically compensated for process temperature.
   b) Manual: The transmitter can be set to compensate the pH measurement to a fixed, user-entered temperature.
8. The transmitter shall have user-test diagnostics for transmitter and sensor operation without requiring special test equipment.
9. The transmitter shall have an RS-485 data communication port.
10. The transmitter shall have an isolated 4-20 mA analog output that can be assigned to represent the measured pH or temperature (or ORP). Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA analog output values are desired (range expand). During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.
11. The transmitter shall be GLI International, Inc. Model PRO-P3.

Mounting Configurations



GLI pHD™ Differential pH and ORP Sensors
(for use with PRO-P3 Transmitter



For complete details and specifications, refer to Data Sheet PD.

Data Sheet PRO-P3

Worldwide Headquarters and Sales:

GLI International, Inc.
9020 West Dean Road
Milwaukee, Wisconsin 53224
U.S.A.

Phone: [414] 355-3601
Fax: [414] 355-8346
E-mail: info@gliint.com
Web: www.gliint.com

Represented By:

Differential pH and ORP Sensors

Hach Digital pHD sc sensors are available in convertible (PEEK® or Ryton®), insertion, and sanitary body styles. Three electrodes are used in these sensors to increase measurement accuracy and eliminate sensor ground loops.

Features and Benefits

Differential Electrode Measurement Technique

This field-proven technique uses three electrodes instead of the two normally used in conventional pH sensors. Process and reference electrodes measure the pH differentially with respect to a third ground electrode. The end result is unsurpassed measurement accuracy, reduced reference junction potential, and elimination of sensor ground loops. These sensors provide greater reliability, resulting in less downtime and maintenance.

Patented Technology

The former GLI, now a Hach Company brand, invented the Differential Electrode Technique for pH measurement in 1970. The pHD™ sensor series (U.S. Patent Number 6395158B1, dated May 28, 2002) takes this field-proven technology to a new level.

Replaceable Salt Bridge/Protector

The unique, replaceable salt bridge holds an extraordinary volume of buffer to extend the working life of the sensor by protecting the reference electrode from harsh process conditions. The salt bridge simply threads onto the end of the sensor if replacement is needed.

Built-in Encapsulated Preamp

Encapsulated construction protects the sensor's built-in preamp from moisture and humidity, ensuring reliable sensor operation. The preamp in the pHD analog sensor produces a strong signal, enabling the sensor to be located up to 1000 m (3280 ft.) from the analyzer.

Durable Body Materials

Both the digital and analog pH and ORP differential sensors feature a durable PEEK® body for chemical compatibility with most process solutions. For less aggressive solutions, Hach offers a Ryton® sensor in a convertible style for pH and ORP measurement. A sensor with a stainless steel body is available for immersion applications.

Digital Electronics Modules

Sensors are available with integral digital electronics or with a gateway module for high temperature (above 70°C) applications.

Versatile Mounting Styles

Sensors are available in four mounting styles—convertible, insertion, immersion, and sanitary. Please turn to page 5 for more information.

Full Featured "Plug and Play" sc100 Digital Controller

There's no complicated wiring or set up procedures with the Hach sc100 controller. Just plug in any Hach digital sensor and it's ready to use—it's "plug and play."

One or two sensors—Use the sc100 Digital Controller to receive data from up to two Hach digital sensors in any combination.

Communications—Multiple alarm/control schemes are available using three relays and two PID control outputs. Communications use analog 4-20 mA and digital MODBUS®/RS485, MODBUS®/RS232 protocols. (Other digital protocols are available. Contact your Hach representative for details.) Every sc100 controller is equipped with wireless communication through an infrared port.

Data logger—A built-in data logger collects measurement data, calibration, verification points, and alarm history for up to 6 months.

DW = drinking water WW = wastewater municipal PW = pure water / power
IW = industrial water E = environmental C = collections FB = food and beverage

Specifications*

pH Sensors

Most pH applications fall in the 2.5 to12.5 pH range. A Hach pHD sc Differential pH sensor with the wide-range glass process electrode performs exceptionally well in this range. Some industrial applications require accurate measurement and control below 2 or above 12 pH. In these special cases, please contact Hach Technical Support for further details.

Measuring Range
-2 to 14 pH

Sensitivity
± 0.01 pH

Stability
0.03 pH per 24 hours, non-cumulative

Operating Temperature
Digital Sensor: -5 to 70ºC (23 to 158ºF)
Analog Sensor with Digital Gateway: -5 to 105ºC (23 to 221ºF)
Immersion Sensor: 0 to 50ºC (32 to 122ºF)

Flow Rate
3 m (10 ft.) per second, maximum

Sensor Pressure/Temperature Limits
Digital: 6.9 bar at 70ºC (100 psi at 158ºF)
Analog: 6.9 bar at 105ºC (100 psi at 221ºF)

Built-in Temperature Element
NTC 300 ohm thermistor for automatic temperature compensation and analyzer temperature readout

Transmission Distance
100 m (328 ft.), maximum
1000 m (3280 ft.), maximum when used with a termination box

Sensor Cable (integral)
4 conductor cable with one shield and polyurethane jacket; rated to 105ºC (221ºF); 10 m (33 ft.) standard length

Wetted Materials
PEEK® or Ryton® (PVDF), salt bridge of matching material with Kynar® junction, glass process electrode, titanium ground electrode, and Viton® O-ring seals

(pH sensor with optional HF-resistant glass process electrode has 316 stainless steel ground electrode, and perfluoroelastomer wetted O-rings; consult factory for other available wetted O-ring materials)

ORP (Redox) Sensors

For best ORP measuring results in solutions containing zinc, cyanide, cadmium or nickel, Hach recommends using the pHD sc ORP sensor equipped with an optional gold electrode.

Measuring Range
-1500 to +1500 mV

Sensitivity
± 0.5 mV

Stability
2 mV per 24 hours, non-cumulative

Operating Temperature
Digital Sensor: -5 to 70ºC (23 to 158ºF)
Analog Sensor with Digital Gateway: -5 to 105ºC (23 to 221ºF)
Immersion Sensor: 0 to 50ºC (32 to 122ºF)

Flow Rate
3 m (10 ft.) per second, maximum

Sensor Pressure/Temperature Limits
Digital: 6.9 bar at 70ºC (100 psi at 158ºF)
Analog: 6.9 bar at 105ºC (100 psi at 221ºF)

Built-in Temperature Element
NTC 300 ohm thermistor for analyzer temperature readout only—no automatic temperature compensation necessary for ORP measurement

Transmission Distance
100 m (328 ft.), maximum
1000 m (3280 ft.), maximum when used with a termination box

Sensor Cable (integral)
4 conductor cable with one shield and polyurethane jacket; rated to 105ºC (221ºF); 10 m (33 ft.) standard length

Wetted Materials
PEEK® or Ryton® (PVDF), salt bridge of matching material with Kynar® junction, glass and platinum (or plastic and gold) process electrode, titanium ground electrode, and Viton® O-ring seals

**Specifications subject to change without notice.*

Engineering Specifications

PEEK® Sensor

1. The pH or ORP sensor shall be of Differential Electrode Technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.
2. The sensor shall have a hex-shaped body to facilitate mounting, and shall be constructed of PEEK® material for exceptional chemical resistance and mechanical strength. This material shall enable the sensor to be installed in metal fittings without leakage usually caused by heating and cooling cycles when dissimilar materials are threaded together.
3. The sensor shall have a:
   a) Convertible body style featuring 1-inch NPT threads on both ends to mount into a standard 1-inch pipe tee, into a Hach adapter pipe for union mounting with a standard 1-1/2 inch tee, or onto the end of a pipe for immersion into a vessel.
   b) Insertion body style featuring 1-inch NPT threads only on the cable end to mount into a Hach ball valve hardware assembly, enabling the sensor to be inserted into or retracted from the process without stopping the process flow.
   c) Sanitary body style featuring an integral 2-inch flange to mount into a Hach 2-inch sanitary tee. The sanitary body style sensor shall include a special cap and EDPM compound gasket for use with the Hach sanitary hardware.
4. The built-in electronics of the sensor shall be completely encapsulated for protection from moisture and humidity.
5. The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 100 m (328 ft.) with standard cabling and up to 1000 m (3280 ft.) with a termination box.
6. The sensor signal shall have an integral temperature sensor. The pH sensor shall automatically compensate measured values for changes in process temperature.
7. The ORP sensor shall include a titanium ground electrode (standard) to eliminate ground loop currents in the measuring electrodes.
8. The sensor shall be Hach Company Model pHD sc or pHD for pH or ORP measurement.

Ryton® Sensor

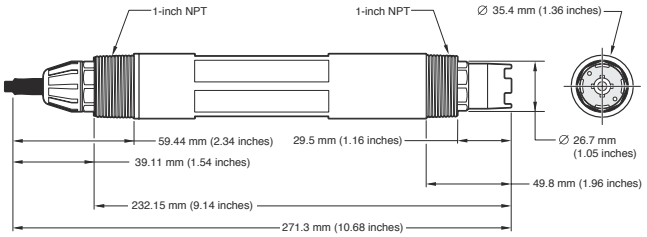
1. The pH or ORP sensor shall be of Differential Electrode Technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.
2. The sensor shall have a hex-shaped body to facilitate mounting, and shall be constructed of Ryton® material for exceptional chemical resistance and mechanical strength. This material shall enable the sensor to be installed in metal fittings without leakage usually caused by heating and cooling cycles when dissimilar materials are threaded together.
3. The sensor shall have a convertible body style featuring 1-inch NPT threads on both ends to mount into a standard 1-inch pipe tee, into a Hach adapter pipe for union mounting with a standard 1-1/2 inch tee, or onto the end of a pipe for immersion into a vessel.
4. The built-in electronics of the sensor shall be completely encapsulated for protection from moisture and humidity.
5. The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 100 m (328 ft.) with standard cabling and up to 1000 m (3280 ft.) with a termination box.
6. The sensor signal shall have an integral temperature sensor. The pH sensor shall automatically compensate measured values for changes in process temperature.
7. The ORP sensor shall include a titanium ground electrode (standard) to eliminate ground loop currents in the measuring electrodes.
8. The sensor shall be Hach Company Model pHD sc or pHD for pH or ORP measurement.

Stainless Steel Sensor

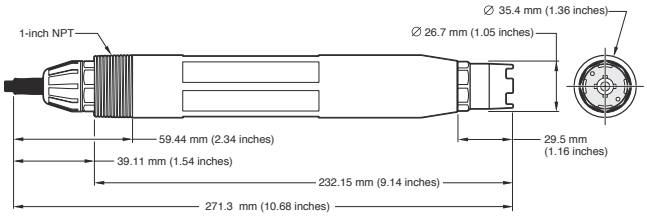
1. The pH or ORP sensor shall be of differential electrode technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.
2. The sensor shall be capable of chain mounting for immersion applications, and shall be constructed of 316 stainless steel.
3. The built-in electronics of the sensor shall be completely encapsulated for protection from moisture and humidity.
4. The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 100 m (328 ft.) with standard cabling and up to 1000 m (3280 ft.) with a termination box.
5. The sensor signal shall have an integral temperature sensor to automatically compensate measured values for changes in process temperature.
6. The sensor shall include a titanium ground electrode (standard) to eliminate ground loop currents in the measuring electrodes.
7. The sensor shall be Hach Company Model pHD sc or pHD for pH or ORP measurement.

Dimensions

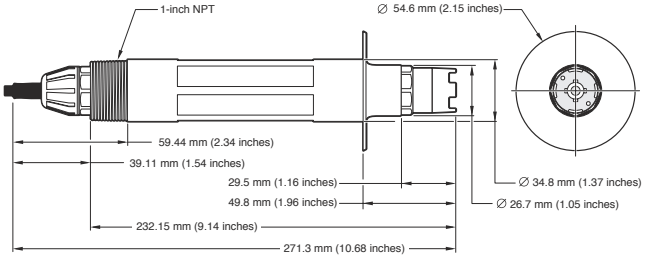
Convertible Style



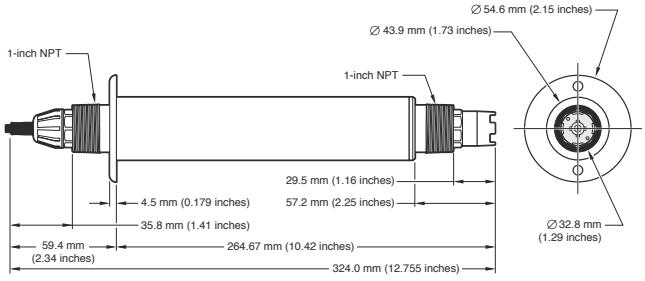
Insertion Style



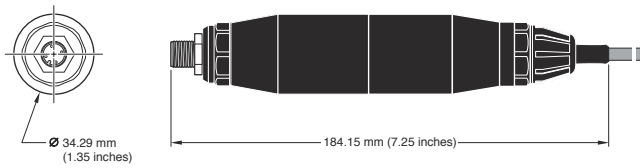
Sanitary Style



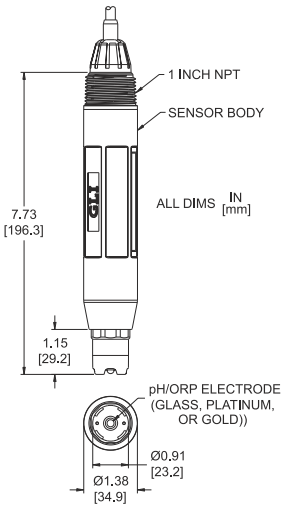
Immersion Style



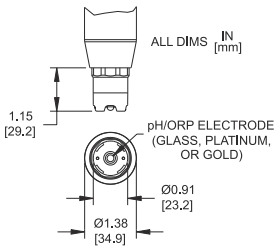
Digital Gateway



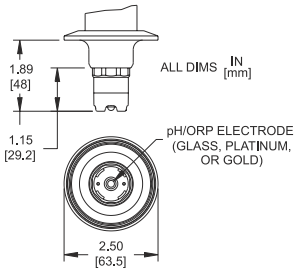
Analog Convertible Style



Analog Insertion Style



Analog Sanitary Style



Ordering Information

pHD sc Digital Differential pH/ORP Sensors

All digital sensors include built-in digital electronics and integral 10 m (33 ft.) cable terminated with connector for the sc100 digital controller. Body styles:

- *Convertible – 1-inch NPT threads at both ends, designed for tee-mounting or other flow through mountings, and pipe mounting for immersion*
- *Insertion – no threads on the electrode end, designed for use with insertion valve assembly*
- *Sanitary – 2-inch flange for a tri-clover style fitting*
- *Immersion – used with chain mounting or pipe mounting*

pH Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
DPD1P1	PEEK[1]	Convertible	Glass, General Purpose	70°C (158°F)
DPD1P3	PEEK[1]	Convertible	Glass, HF-resistant	70°C (158°F)
DPD2P1	PEEK[1]	Insertion	Glass, General Purpose	70°C (158°F)
DPD3P1	PEEK[1]	Sanitary	Glass, General Purpose	70°C (158°F)
DPD1R1	Ryton[2]	Convertible	Glass, General Purpose	70°C (158°F)
DPD1R3	Ryton[2]	Convertible	Glass, HF-resistant	70°C (158°F)
DPS1	Stainless Steel	Immersion	Glass, General Purpose	50°C (122°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

ORP Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
DRD1P5	PEEK[1]	Convertible	Platinum	70°C (158°F)
DRD1P6	PEEK[1]	Convertible	Gold	70°C (158°F)
DRD2P5	PEEK[1]	Insertion	Platinum	70°C (158°F)
DRD1R5	Ryton[2]	Convertible	Platinum	70°C (158°F)
DRD1R6	Ryton[2]	Convertible	Gold	70°C (158°F)
DRS5	Stainless Steel	Immersion	Platinum	50°C (122°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

Digital Gateway

6120500 Digital Gateway, convert pHD analog sensors to digital output for connecting to sc100 digital controller

pHD Analog Sensors

All analog sensors include built-in preamplifier and integral 4.5 m (15 ft.) cable terminated with stripped and tinned wires.

Definitions of body styles:

- *Convertible – 1-inch NPT threads at both ends, designed for tee-mounting or other flow through mountings, and pipe mounting for immersion*
- *Insertion – has no threads on the electrode end, designed for use with insertion valve assembly*
- *Sanitary – has a 2-inch flange for a Tri-Clover style fitting*

pH Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
PD1P1	PEEK[1]	Convertible	Glass, General Purpose	95°C (203°F)
PD1P3	PEEK[1]	Convertible	Glass, HF-resistant	95°C (203°F)
PD2P1	PEEK[1]	Insertion	Glass, General Purpose	95°C (203°F)
PD3P1	PEEK[1]	Sanitary	Glass, General Purpose	95°C (203°F)
PD1R1	Ryton[2]	Convertible	Glass, General Purpose	95°C (203°F)
PD1R3	Ryton[2]	Convertible	Glass, HF-resistant	95°C (203°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

ORP Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
RD1P5	PEEK[1]	Convertible	Platinum	95°C (203°F)
RD1P6	PEEK[1]	Convertible	Gold	95°C (203°F)
RD2P5	PEEK[1]	Insertion	Platinum	95°C (203°F)
RD1R5	Ryton[2]	Convertible	Platinum	95°C (203°F)
RD1R6	Ryton[2]	Convertible	Gold	95°C (203°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

Ordering Information *continued*

pHD sc Digital and pHD Analog Sensor Accessories

Cables

Extension cables are used only with digital sensors or digital gateways when connecting to the sc100 Digital Controller.

61224-00 Digital Extension Cable, 1 m (3.2 ft.)

57960-00 Digital Extension Cable, 7.7 m (25 ft.)

57961-00 Digital Extension Cable, 15 m (50 ft.)

57962-00 Digital Extension Cable, 31 m (100 ft.)

Interconnect cables are used only with analog sensors, junction box, and controller.

1W11-00 Analog Interconnect Cable, order per foot

Digital Termination Box

Required when the length of cable between the digital sensor/digital gateway and sc100 Digital Controller is between 100 m (328 ft.) and 1000 m (3280 ft.)

58670-00 Digital Termination Box

Analog Junction Box

Required when the length of cable between the analog sensor and analog controller is greater than standard length of sensor cable. Each junction box includes terminal strip and gasket.

60A2053 Junction Box, Surface-mount, aluminum (includes mounting hardware)

60A9944 Junction Box, Pipe-mount, PVC (for 1/2-inch diameter pipe, includes mounting hardware)

60G2052 Junction Box, Pipe-mount, PVC (for 1-inch diameter pipe, includes mounting hardware)

76A4010-001 Junction Box, NEMA 4X (no mounting hardware included)

Protector for Convertible style sensor

1000F3374-002 PEEK protector

1000F3374-003 Ryton protector

Salt Bridges

The double junction salt bridge on the standard cell of all Hach pHD sensors is field-replaceable. Each salt bridge has a ceramic inner junction, Viton® O-ring, and contains binary, equi-transferrant fill solution. Salt bridges are shipped in a salt solution.

Product Number	*pHD sc and pHD Sensor Body Material*	*Salt Bridge Materials*	
		Body	*Outer Junction*
SB-P1SV	PEEK	PEEK	Kynar (PVDF)
SB-P2SV	PEEK	PEEK	Ceramic
SB-P1SP[1]	PEEK	PEEK	Kynar (PVDF)
SB-R1SV	Ryton	Ryton	Kynar (PVDF)

[1]*Special perfluoroelastomer O-ring in place of the Viton® O-ring*

Cleaning Systems for pHD sc and pHD Sensors

Self-Contained Air Blast Cleaning System
Includes Kynar® (PVDF) washer head with 7.6 m (25 ft.) tubing for air delivery, a quick-disconnect tube fitting, and a compressor housed in a NEMA 4X enclosure.

1000A3335-005 For 115 VAC operation
1000A3335-006 For 230 VAC operation

Air/Water Blast Cleaning Washer Head
Intended only for immersion applications with a user-supplied air or water wash system.

1000A3335-004 Kynar (PVDF) washer head includes 1/4-inch barb fitting

pHD sc Digital and pHD Analog Sensor Reagents and Standards

25M1A1025-115 Standard Cell Solution, to replenish standard cell chamber in Hach pHD sensors while replacing salt bridge, 500 mL

25M8A1002-101 Gel Powder, for high temperature applications, 2 g

pH Buffers

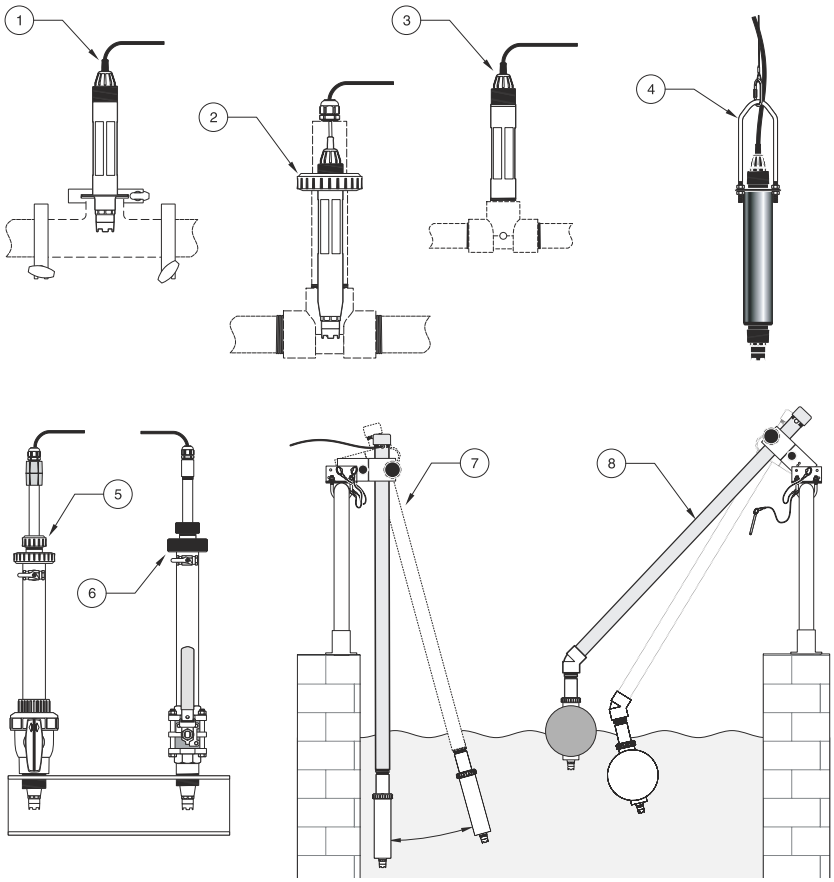
Product Number	*Description*	*Volume*
22835-49	pH 7	500 mL (1 pint)
22834-49	pH 4	500 mL (1 pint)
22836-49	pH 10	500 mL (1 pint)

ORP Reference Solutions (in resealable plastic bottles)

Product Number	*Description*	*Volume*
25M2A1001-115	200 mV	500 mL (1 pint)
25M2A1002-115	600 mV	500 mL (1 pint)

Ordering Information *continued*

Mounting Hardware for pHD sc Differential Sensors



1. Sanitary mount
2. Union mount
3. Flow-through mount
4. Hanging stainless steel sensor with the bail
5. PVC Insertion mount
6. Stainless steel insertion mount
7. Immersion mount
8. Immersion mount, ball float

Sanitary Mount

MH018S8SZ 316 SS
Includes 2-inch sanitary tee and heavy-duty clamp. Special cap and EPDM compound gasket are supplied with sensor but can be separately ordered.

Union Mount

61313-00 CPVC
61314-00 316 SS
Includes standard 1-1/2 inch tee, special union pipe with adapter, sealing hub, and lock ring in respective material, and Viton® O-ring.

Flow-through Mount

MH334N4NZ CPVC
MH314N4MZ 316 SS
Includes a standard 1-inch tee in respective material.

Insertion Mount

Digital		*Analog*	
61367-00	CPVC	**MH736M4MZ**	CPVC
61368-00	316 SS	**MH716M4MZ**	316 SS

Includes a 1-1/2 inch ball valve in respective material, 1-1/2 inch NPT close nipple, sensor adapter with two Viton® O-rings and wiper, extension pipe, pipe adapter, back tube, and lock ring.

Immersion Mount

Standard Hardware

Digital		*Analog*	
61364-00	CPVC	**MH434A00B**	CPVC
61365-00	316 SS	**MH414A00B**	316 SS

Includes 1-inch diameter by 4 ft. long pipe and 1-inch x 1-inch NPT coupling in respective material. (Pipe-mount junction box with terminal strip included in analog hardware.)

Handrail Hardware

MH236B00Z CPVC
Includes 1-1/2 inch diameter by 7.5 ft. long CPVC pipe, and a unique swivel/pivot/ pipe clamp assembly.

Chain Mount Hardware

2881900 316 ss
Includes stainless steel bail, nuts, and washers. Does not include chain. To be used with stainless steel immersion sensor only.

NOTE

Contact Hach Technical Support or your Hach representative for information about retro fit hardware for existing installations.

To complete your pH and ORP measurement system, choose the sc100 Controller...

Model sc100 Controller

(see Lit. #2463)

There's no complicated wiring or set up procedures with the Hach sc100 controller. Just plug in any Hach digital sensor and it's ready to use—it's "plug and play" with one or two sensors. A built-in data logger collects measurements at user selectable intervals of one to 15 minutes. Local display, recall, graphing and trending in CSV format make chart recorders redundant. No analog/digital conversion is required—it communicates via MODBUS® or IR port. Two PID controllers and three form 'C' relay contacts for alarm or control are available.

LXV401.52.00002 sc100 Controller Standard

LXV401.52.01002 sc100 Controller with RS-232 MODBUS®

LXV401.52.02002 sc100 Controller with RS-485 MODBUS®

At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water—it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

For current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area.

In the United States, contact:

HACH COMPANY World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 800-227-4224
Fax: 970-669-2932
E-mail: orders@hach.com
www.hach.com

U.S. exporters and customers in Canada, Latin America, sub-Saharan Africa, Asia, and Australia/New Zealand, contact:

HACH COMPANY World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 970-669-3050
Fax: 970-461-3939
E-mail: intl@hach.com
www.hach.com

In Europe, the Middle East, and Mediterranean Africa, contact:

HACH + LANGE Europe
Dr. Bruno Lange GmbH & Co. KG
Willstätterstraße 11
D-40549 Düsseldorf
GERMANY
Tel: +49 (0) 211 5288-0
Fax: +49 (0) 211 5288-143
E-mail: kundenservice@drlange.de
www.drlange.com

Lit. No. 2467
XXXX Printed in U.S.A.

HACH®

Be Right™

OPERATING MANUAL

PRO-series Model P3
pH/ORP Transmitter

(for pH and ORP measurement)

Worldwide Headquarters and Sales:

GLI International, Inc.
9020 West Dean Road
Milwaukee, Wisconsin 53224
U.S.A.

Phone: [414] 355-3601
Fax: [414] 355-8346
E-mail: info@gliint.com
Web: www.gliint.com

A2852 UL REGISTERED FIRM ISO 9001
GLI INTERNATIONAL, INC.

This operating manual and other GLI operating manuals are available on GLI's web site at gliint.com when viewed using Adobe's free Acrobat reader. To get this reader, link to Adobe through GLI's web site or visit Adobe's web site at adobe.com.

WARRANTY

GLI International, Inc. warrants the PRO-series Model P3 to be free from defects in material or workmanship for a period of 2 years (24 months) from the date of shipment of this product from our facility. A warranty claim will not be honored if defects are not reported within the warranty period, or if GLI International determines that defects or damages are due to normal wear, misapplication, lack of maintenance, abuse, improper installation, alteration, or abnormal conditions. GLI International's obligation under this warranty shall be limited to, at its option, replacement or repair of this product. The product must be returned to GLI International, freight prepaid, for examination. The product must be thoroughly cleaned and any process chemicals removed before it will be accepted for replacement or repair. GLI International's liability shall not exceed the cost of the product. Under no circumstances will GLI International be liable for any incidental or consequential damages, whether to person or property. GLI International will not be liable for any other loss, damage or expense of any kind, including loss of profits, resulting from the installation, use, or inability to use this product.

Declaration of Conformity

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: GLI International, Inc.

Manufacturer's Address: 9020 West Dean Road
P.O. Box 245022
Milwaukee, Wisconsin 53224, USA

declares that the products:

Product Names:
PRO-series pH/ORP Transmitter
PRO-series Dissolved Oxygen Transmitter
PRO-series Electrodeless Conductivity Transmitter
PRO-series Contacting Conductivity Transmitter
PRO-series Flow Transmitter

Model Numbers: PRO-P3xxx, PRO-D3xxx, PRO-E3xxx, PRO-C3xxx, PRO-F3xxx

conforms to the following Product Specifications:

EMC: **EN 50081-2 : 1993**
Generic Emission Standard (Industrial Environment)

EN 55011 : 1998 / CISPR 11 : 1999		Group 1, Class A

EN 61000-6-2 : 1999
Generic Immunity Standard (Industrial Environment)

EN 61000-4-2 : 1995 -	ESD Immunity	4 kV CD, 8kV AD
EN 61000-4-3 : 1997 -	Radiated Immunity	10 V/m, 80% AM (1 kHz)
EN 61000-4-4 : 1995 -	EFT/B Immunity	1.0 kV Signal & Power Lines
EN 61000-4-6 : 1996 -	Conducted Immunity	10 V, 80% AM (1 kHz)

Supplementary Information:

The products herewith comply with the requirements of the following directives and carry the CE marking accordingly:

EMC Directive 89/336/EEC

Products were tested in typical configurations. Specific test configurations and results are published in L.S. Compliance's Test Report Numbers: 301140, 301222, 301256 and EMC Testing Wisconsin's Test Report Number 00340.

These devices comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

These devices comply with U.S. UL Standard 1604 (USL) and Canadian National Standard C22.2 No. 213-M1987 (CNL). All devices are UL Listed (Control Number 9NX6) and hold a Class I, Division 2, Groups A, B, C, and D Hazardous Locations rating.

For Compliance Information ONLY, contact:

Product Regulations Manager
GLI International
9020 West Dean Road
Milwaukee, Wisconsin 53224, USA

IMPORTANT SAFETY INFORMATION

Please read and observe the following:

- The transmitter can be located in a Class 1, Division 2, Group A, B, C or D hazardous area.
- Since the transmitter is powered by only low DC voltage, it is completely safe to handle.
- Install the transmitter in accordance with relevant local codes and instructions contained in this operating manual. Also, note and comply with the transmitter's technical specifications and ratings.
- Whenever it appears that transmitter safety is questionable, disable the transmitter to ensure against any unintended operation. For example, an unsafe condition is likely when:
    1) The transmitter appears visibly damaged.
    2) The transmitter fails to operate properly or provide the intended measurements.
    3) The transmitter has been stored for long periods at temperatures above 158°F (70°C).
- Only qualified personnel should perform wiring or repairs, and only when the transmitter is not powered.

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may contain WARNINGS pertaining to user safety, CAUTIONS regarding possible instrument malfunction, and NOTES on important, useful operating guidelines.

WARNING:

A WARNING LOOKS LIKE THIS. IT WARNS YOU OF THE POTENTIAL FOR PERSONAL INJURY.

CAUTION:

A CAUTION LOOKS LIKE THIS. IT ALERTS YOU TO POSSIBLE INSTRUMENT MALFUNCTION OR DAMAGE.

☞ ***NOTE:*** *A note looks like this. It alerts you to important operating information.*

CONDENSED OPERATING INSTRUCTIONS

This manual contains details for all operating aspects of the instrument. The following condensed instructions are provided to assist you in getting the instrument started up and operating as quickly as possible. **These condensed instructions only pertain to basic pH measurement operation using a GLI Differential pH sensor.** To measure ORP, or use a conventional combination electrode or specific features of the instrument, refer to the appropriate sections in this manual for instructions.

A. CONNECTING SENSOR/CONFIGURING SENSOR TYPE AND TEMPERATURE ELEMENT

1. After properly mounting the transmitter (PART TWO, Section 2), connect the GLI Differential Technique pH sensor, matching wire colors to terminals as indicated:

Sensor Wire Colors	Connect to TB2
White	Terminal 1
- - - -	Terminal 2 (unused)
Inner Shield and Black	Terminal 3
Yellow	Terminal 4
Green	Terminal 5
- - - -	Terminal 6 (unused)
Red	Terminal 7
Outer Shield (see Note)	Earth Ground

NOTE: *For GLI Differential sensors with only one shield wire, always connect it to Terminal 3 on TB2.*

For systems not requiring CE compliance and lacking an earth ground, connect the outer shield to Terminal 3 on TB2.

2. The transmitter is factory-set for use with a GLI Differential Technique pH sensor. To use another type of pH sensor or an ORP sensor, change the sensor type. For details, see PART THREE, Section 3.2, subheading “SELECT SENSOR Type.”

3. The transmitter is factory-set for automatic temperature compensation using the 300 ohm (NTC300) temperature element built into all GLI Differential sensors (except GLI 6006P4-2000 pure water pH sensor system which uses a PT 1000 RTD). To use a sensor with a different temperature element, or if you want fixed MANUAL temperature compensation, change the temperature element type. For details, see PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type.”

B. CONNECTING DC POWER

Refer to PART TWO, Section 3.2, 3.3, 3.4, or 3.5 to connect DC power to the transmitter.

C. CONFIGURING BUFFER TYPE/CALIBRATING THE TRANSMITTER

The transmitter must be calibrated so that measured values will correspond to actual process values. Before calibrating for the first time, select the buffer set you intend to use. Then, calibrate using the recommended “2 POINT BUFFER” method which provides the most accurate pH measurements.

1. The transmitter is factory-set for the common 4.00, 7.00, and 10.00 pH buffer set. To use DIN 19267 standard value buffers, change the buffer set. For details, see PART THREE, Section 3.2, subheading “SELECT BUFFER Set for pH Calibration.”

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE TRANSMITTER -- (continued)

NOTE: *When using buffers that are not included in either of these buffer sets, use only the "2 POINT SAMPLE" method for calibration. Refer to that subheading in PART THREE, Section 4.2 for instructions.*

2. Immerse the sensor in the first buffer (preferably pH 7). **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

   NOTE: *An in-progress calibration can always be aborted by pressing the **ESC key**. After the "ABORT: YES?" screen appears, do <u>one</u> of the following:*

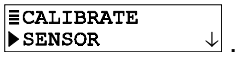
   - *Press **ENTER key** to abort. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).*
   - *Use ⇧ **or** ⇩ **key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.*

   Calibration Tip! *If, at any time during calibration, the "2 POINT BUFFER: CONFIRM FAILURE?" screen appears, press **ENTER key** to confirm. Then, use the ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do <u>one</u> of the following:*

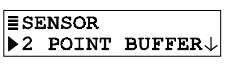
   - *With the "2 POINT BUFFER? (CAL: EXIT)" screen selected, press **ENTER key**. Then, after the "2 POINT BUFFER: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).*
   - *With the "2 POINT BUFFER? (CAL: REPEAT)" screen selected, press **ENTER key** to repeat calibration of this point.*

3. Press **MENU key** to display a "MAIN MENU" screen. If the 

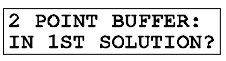
screen is not showing, use ⇧ **or** ⇩ **key** to display it.

4. Press **ENTER key** to display 

.

5. Press **ENTER key** again to display 

.

6. Press **ENTER key** again to display 

. With the sensor in the first buffer, press **ENTER key** again to confirm this.

   NOTE: *During calibration, the analog output is automatically "held" at the last measured value.*

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE ANALYZER -- (continued)

7. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like this `2 POINT BUFFER: PT1 = 7.00 pH` appears for 5 seconds to confirm calibration of this point.

   NOTE: *Any time the "PLEASE WAIT" screen appears during calibration you can manually complete calibration of the point by pressing the* ***ENTER key****. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

8. After the `2 POINT BUFFER: IN 2ND SOLUTION?` screen appears, remove the sensor from the first buffer, rinse it with clean water, and immerse it in the second buffer (typically pH 4). Then press **ENTER key** to confirm this.

9. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like this `2 POINT BUFFER: PT2 = 4.00 pH` appears for 5 seconds to confirm calibration of this point.

10. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to gauge sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance.

11. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

12. Install the sensor into the process.

13. Press **ENTER key** to display the active measurement reading on the "2 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "2 POINT BUFFER" calibration. The transmitter is now ready to measure pH.

D. COMPLETING TRANSMITTER CONFIGURATION

To further configure the transmitter to your application requirements, use the appropriate CONFIGURE screens to make selections and "key in" values. Refer to PART THREE, Section 3 for complete configuration details.

T A B L E O F C O N T E N T S

P A R T O N E - I N T R O D U C T I O N

P A R T T W O - I N S T A L L A T I O N

P A R T T H R E E - O P E R A T I O N

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

ILLUSTRATIONS

TABLES

PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Capability Highlights

Sensor Input

The transmitter can be used with any GLI Differential Technique pH or ORP sensor, or any conventional combination electrode. The transmitter accepts the common temperature compensator elements used in these sensors (NTC 300 ohm thermistor, Pt 1000 RTD or Pt 100 RTD).

MEASURE Screen

The MEASURE screen (normal display mode) can provide different readouts of measured data. With the MEASURE screen displayed, press ⇦ **and** ⇨ **key** to show:

When Used as pH Transmitter	When Used as ORP Transmitter
• Measured pH • Measured temperature (°C or °F) • Measured pH and temperature • Measured analog output value (mA)	• Measured ORP • Measured analog output value (mA)

Passcode-protected Access

For security, you can enable a passcode feature to restrict access to configuration and calibration settings to authorized personnel only. See PART THREE, Section 3.5 for details.

Calibration Methods

Four methods are available to calibrate the transmitter for pH. See PART THREE, Section 4.2 for details. For ORP calibration, refer to Section 4.3. The analog output loop can also be calibrated (Section 4.4).

Analog Output

The transmitter's isolated 4-20 mA analog output can be assigned to represent the measured pH or temperature. (When measuring ORP, the output only represents ORP.)

Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA analog output values are desired (range expand). For analog output setup details, see PART THREE, Section 3.4.

☞ ***NOTE:*** *During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.*

1.2 Transmitter Safety

The transmitter is completely safe to handle. Only low DC voltage is present.

NOTE: *The transmitter can be located in a Class 1, Div. 2 hazardous area.*

1.3 Retained Configuration Values

All user-entered configuration values are retained indefinitely, even if power is lost or turned off. The non-volatile transmitter memory does not require battery backup.

1.4 Transmitter Serial Number

A label with the transmitter model number, serial number, and build date is located between the terminal blocks.

1.5 EMC Conformance

The transmitter is designed to provide protection from most normally encountered electromagnetic interference. This protection exceeds U.S. standards and meets European IEC 1000 (EN 61000) series testing for electromagnetic and radio frequency emissions and immunity. Refer to Figure 1-1 and the specifications in Section 2.1 for more information.

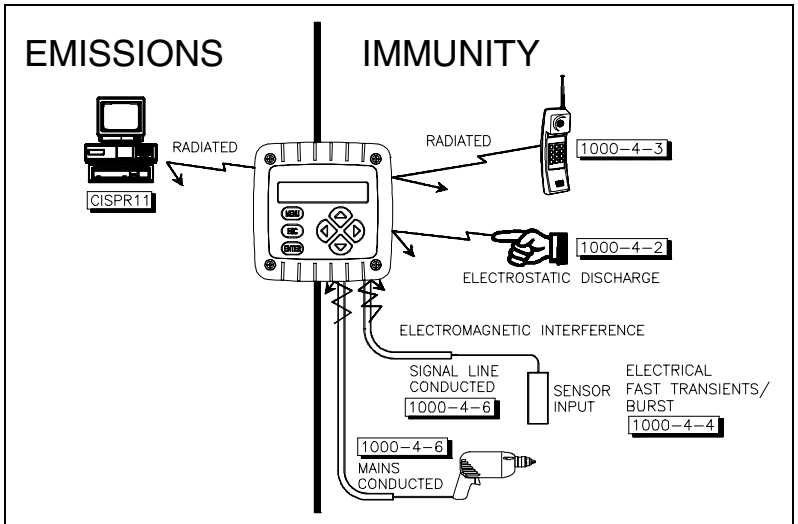


FIGURE 1-1 EMC Diagram

SECTION 2
SPECIFICATIONS

2.1 Operational

Display..... Two-line by 16 character LCD

NOTE: *The measured pH and temperature can be displayed separately or shown together on a single screen. The corresponding 4-20 mA analog output value can also be shown.*

Measurement	Ranges
pH	-2.0 to 14.0 pH or -2.00 to 14.00 pH
ORP	-2100 to +2100 mV
Temperature	-4.0 to +392.0°F or -20.0 to +200.0°C
Analog Output	4.00-20.00 mA

Ambient Conditions:
- Operation..... -4 to +140°F (-20 to +60°C); 0-95% relative humidity, non-condensing
- Storage..... -22 to +158°F (-30 to +70°C); 0-95% relative humidity, non-condensing

Temperature Compensation ..... Automatic from 14.0 to 230.0°F (-10.0 to +110.0°C) with selection for NTC 300 ohm thermistor, Pt 1000 ohm RTD or Pt 100 ohm RTD temperature element; or manually fixed at a user-set temperature; additional selectable temperature correction factors (ammonia, morpholine or user-defined pH/°C linear slope) available for pure water automatic compensation from 0.0-50.0°C

Sensor-to-Transmitter Distance:
- GLI Differential
  - Technique Sensor ..... 3000 ft. (914 m) maximum
- Conventional Combination
  - Electrode with preamp ..... 985 ft. (300 m) maximum
- Conventional Combination
  - Electrode w/o preamp ..... 100 ft. (30 m) maximum with electrode cable capacitance of less than 30 pF per foot

Power Requirements (Class 2 Power Supply):
- Two-wire Hookup ..... 16-30 VDC
- Three-wire Hookup..... 14-30 VDC (16 VDC min. with RS-485 comm.)
- Four-wire Hookup..... 12-30 VDC (16 VDC min. with RS-485 comm.)

Calibration Methods:
- 2 POINT BUFFER (for pH only)..... Automatic calibration and buffer recognition using two buffers from a selected buffer set*.

  NOTE: *When using buffers that are not included in either transmitter buffer set, use only the "2 POINT SAMPLE" method for calibration.*

  **Buffer Sets: 4.00, 7.00, and 10.00 or DIN 19267 standard (1.09, 4.65, 6.79, 9.23, and 12.75)*

- 1 POINT BUFFER (for pH only)..... Automatic calibration and buffer recognition using one buffer from a selected buffer set*.

  NOTE: *When using a buffer that is not included in either transmitter buffer set, use only the "1 POINT SAMPLE" method for calibration.*

- 2 POINT SAMPLE (for pH only)..... Enter two known sample values (determined by laboratory analysis or comparison reading) or two known pH buffer values

1 POINT SAMPLE (for pH or ORP) ..... Enter one known sample value (determined by laboratory analysis or comparison reading) or one known pH buffer value (or, for ORP measurement, one known reference solution value)

Analog Output ..... Isolated 4-20 mA output with 0.004 mA (12-bit) resolution

NOTE: *The output can be assigned to represent the measured pH or temperature (or ORP). Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA output values are desired (range expand). During calibration, the output is automatically held at the last measured value and, upon completion, returned to its active state.*

Maximum Loop Load ..... Dependent on power supply voltage, transmitter hookup arrangement, and wire resistance (see load resistance charts for respective hookup diagrams in PART TWO, Section 3.2, 3.3 or 3.4)

Memory (non-volatile) ..... All user settings are retained indefinitely without battery backup

Certifications:
- European Community EMC ..... Certified CE compliant for conducted and radiated emissions (EN 50081-2) and immunity (EN 61000-6-2)
- General Purpose ..... UL, C-UL, and FM
- Class I, Div. 2 ..... UL, C-UL, and FM

2.2 Transmitter Performance (Electrical, Analog Outputs)

Accuracy* ..... ± 0.1% of span
Sensitivity* ..... ± 0.05% of span
Repeatability* ..... ± 0.05% of span
Temperature Drift ..... Zero and Span: ± 0.02% of span per °C
Response Time ..... 1-60 seconds to 90% of value upon step change (with sensor filter setting of zero)

*These performance specifications are typical at 25°C.

2.3 Mechanical

Enclosure ..... Polycarbonate, NEMA 4X general purpose; choice of included mounting hardware

Mounting Configurations ..... Panel, wall, pipe or integral sensor mounting

Dimensions ..... With Back Cover:
3.75 in. W x 3.75 in. H x 2.32 in. D
(95 mm W x 95 mm H x 60 mm D)
Without Back Cover for Panel Mount:
3.75 in. W x 3.75 in. H x 0.75 in. D
(95 mm W x 95 mm H x 19 mm D)

Net Weight ..... 10 oz. (280 g) approximately

PART TWO - INSTALLATION

SECTION 1
UNPACKING

Unpack and examine the equipment even if you do not use it immediately. If there is evidence of damage, notify the transit carrier immediately. **Recommendation: Save the shipping carton and packing materials in case the instrument must be stored or re-shipped.**

SECTION 2
MECHANICAL REQUIREMENTS

2.1 Location

1. It is recommended to locate the transmitter as close as possible to the installed sensor. Depending on the sensor type, the maximum allowable distance between the sensor and transmitter is:

GLI Differential Technique Sensor	Conventional Combination Electrode **with** Preamp	Conventional Combination Electrode **without** Preamp
3000 feet (914 m)	985 feet (300 m)	*100 feet (30 m)

*An external GLI Model 714 preamp can be used to extend this distance to 3000 feet (914 m), but the preamp must be located within 100 feet (30 m) of the electrode.

☞ ***NOTE:*** *The transmitter is suitable for use in a Class 1, Div. 2 hazardous area.*

2. Mount the transmitter in a location that is:

   - ➥ Clean and dry where there is little or no vibration.
   - ➥ Protected from corrosive fluids.
   - ➥ Within ambient temperature limits (-4 to +140°F or -20 to +60°C).

CAUTION:

EXPOSING THE TRANSMITTER TO DIRECT SUNLIGHT MAY INCREASE THE OPERATING TEMPERATURE ABOVE ITS SPECIFIED LIMIT, AND DECREASE DISPLAY VISIBILITY.

2.2 Wall and Pipe Mounting

Figure 2-1 illustrates how to wall or pipe mount the transmitter using the supplied GLI hardware kit. Determine the mounting method, and attach the hardware as shown.

1. Fasten the wall/pipe adapter to the wall or pipe.
2. Using a blunt tool, open both cable entry knockout holes in the back cover.
3. Insert-and-twist the back cover onto the installed wall/pipe adapter, and tighten its two screws to lock back cover onto the adapter.
4. Attach transmitter to back cover using its four captive screws.

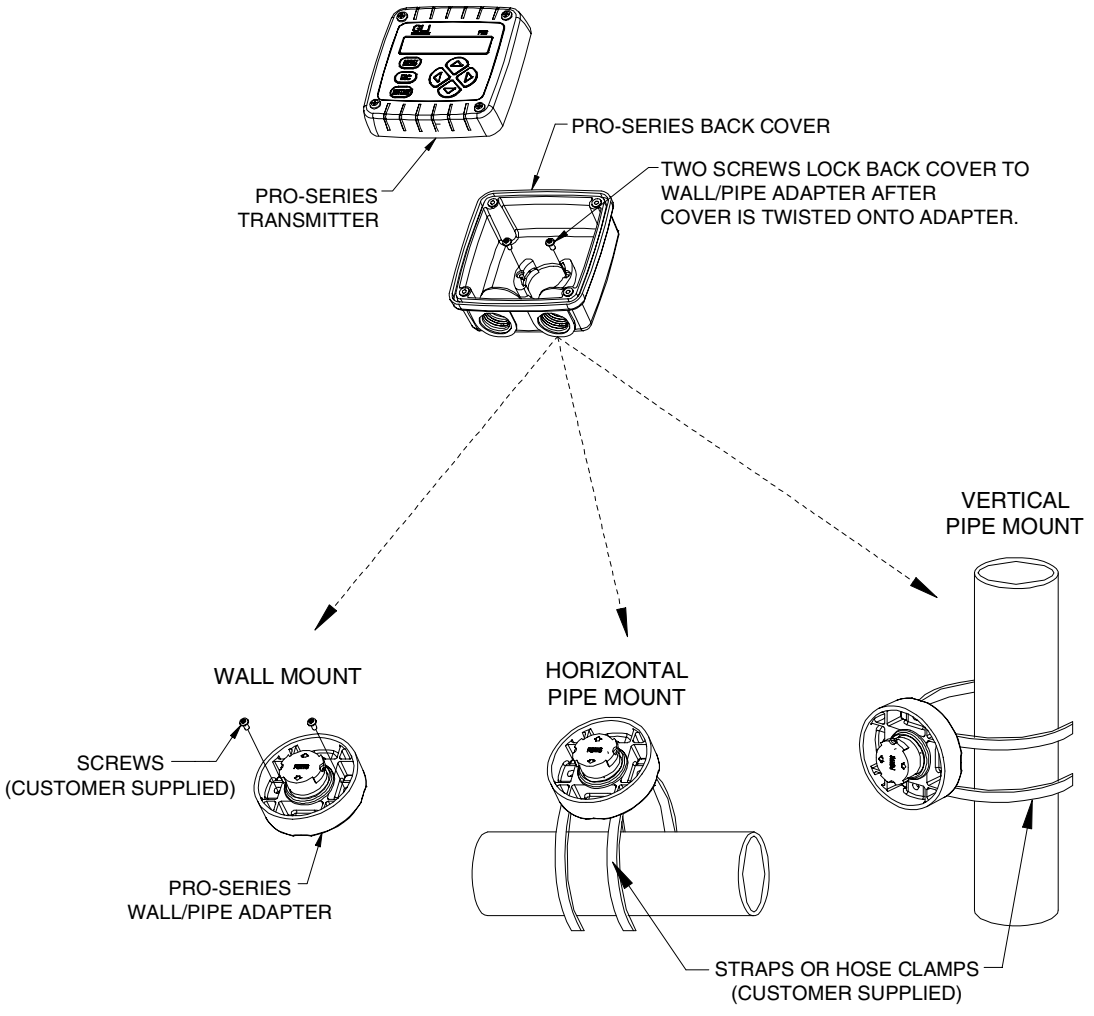


FIGURE 2-1 Wall and Pipe Mounting Details

2.3 Panel Mounting

Figure 2-2 illustrates how to panel mount the transmitter using the supplied GLI panel mount hardware kit.

1. Cut a 3.30-inch (84 mm) square cutout hole in panel.
2. Position panel-mount gasket over cutout in front of panel, and place retainer plate behind panel with its four threaded inserts facing away from back of panel.
3. Attach transmitter to retainer plate using its four captive screws.

NOTE: *If panel is too thick, remove captive screws from transmitter, and use longer screws provided in hardware kit.*

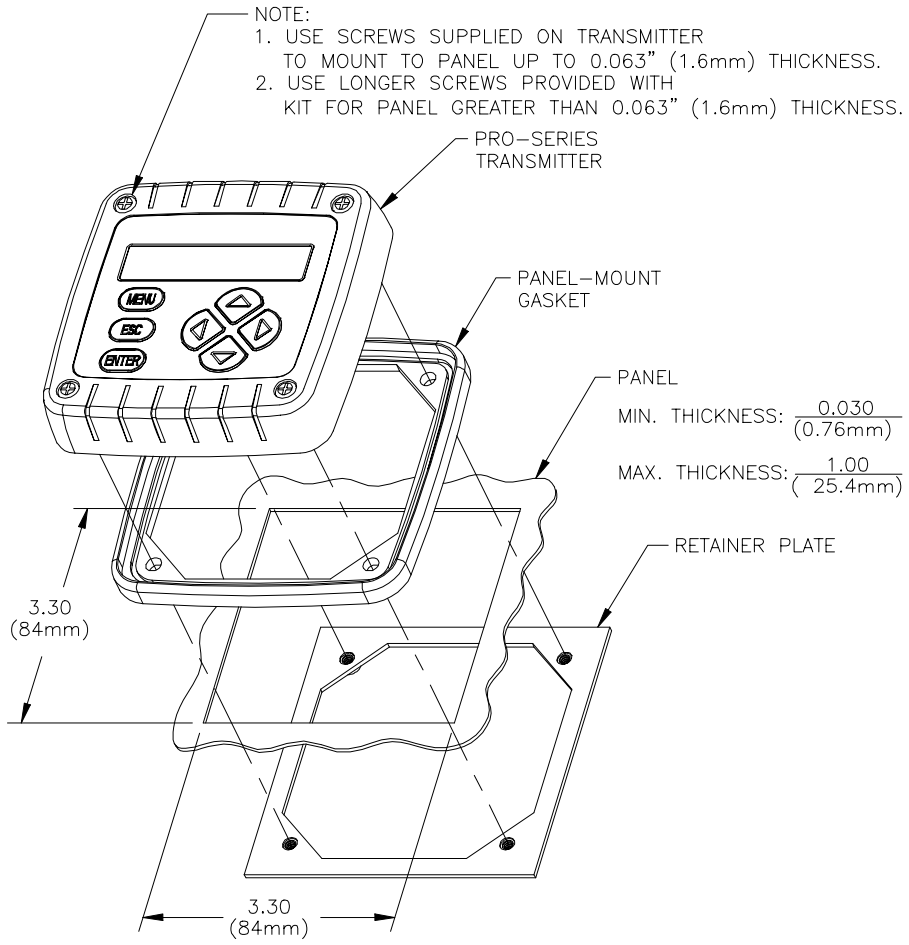


FIGURE 2-2 Panel Mounting Details

2.4 Integral Sensor Mounting

Figure 2-3 illustrates how to integrally mount the transmitter onto a sensor using the supplied GLI mounting hardware kit.

1. Using a blunt tool, open knockout hole in bottom of swivel ball for routing the sensor cable.

2. Attach swivel-mount assembly onto back end of sensor using coupling provided with GLI sensor (only sensors with “PRO1” suffix in their part number) or an appropriately-sized coupling that you provide.

3. Insert-and-twist the back cover onto the installed swivel-mount assembly. Tighten its two screws to lock the back cover onto the swivel-mount assembly.

NOTE: *To change mounting angle, loosen swivel-mount assembly by lifting tab on bottom of swivel nut. Position to desired angle and re-tighten swivel nut.*

4. Attach transmitter to back cover using its four captive screws.

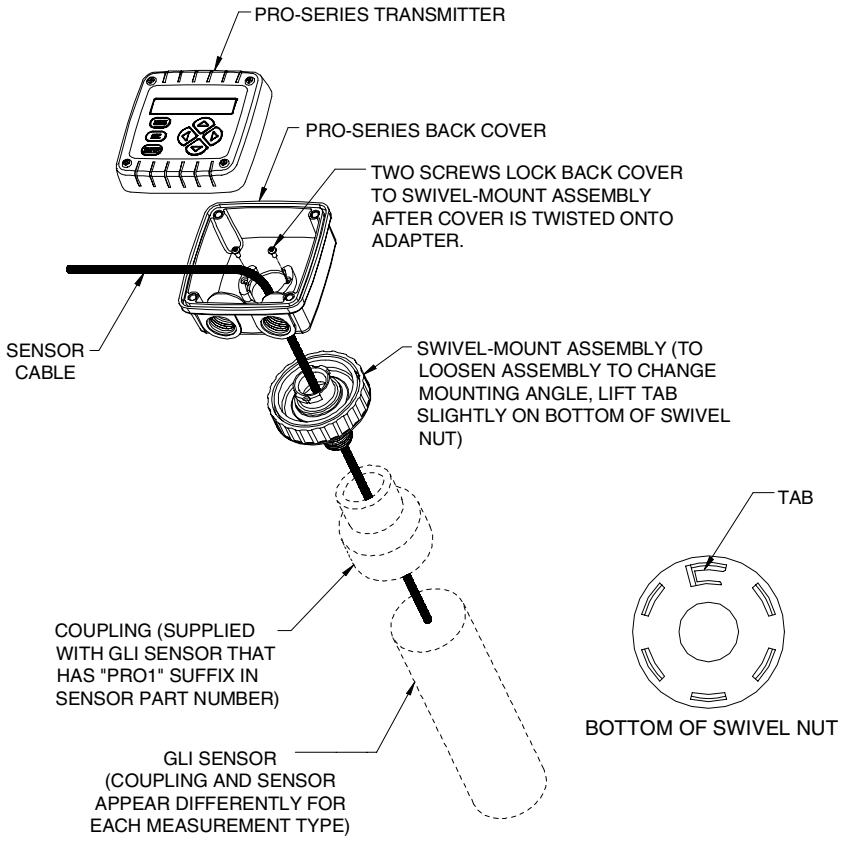


FIGURE 2-3 Integral Sensor Mounting Details

SECTION 3
ELECTRICAL CONNECTIONS

Figure 2-4 shows the terminal block arrangement and terminal designations for the transmitter.

☞ ***NOTE:*** *All terminals are suitable for single wires up to 14 AWG (2.5 mm^2).*

☞ **Wiring Tip!** To comply with European Community (CE) electromagnetic compatibility requirements, follow these general wiring guidelines:

1. Locate transmitter as far as possible from motors and other non-CE certified devices with excessive electromagnetic emissions.
2. Use GLI-specified ferrites and cables. Failure to do so may eliminate compliance. **Locate all ferrites as close as possible to the transmitter.**
   - ◆ DC Power Supply Cable (GLI 1W0980 two-conductor plus shield): Connect cable shield to earth ground at the supply end. Loop cable 2-1/2 times through ferrite (Steward #28B0686-200, Fair-Rite Corp. #2643665702, or equivalent).
   - ◆ Sensor Cable: Keep cable shields as short as possible. At the transmitter end, connect the outer shield to earth ground, and the inner shield to the SHIELD terminal. If sensor cable has one shield, connect it to the SHIELD terminal. In either case, clamp ferrite (Steward #28A2025-OAO, Fair-Rite Corp. #0431164281, or equivalent) on sensor cable.
   - ◆ Analog mA Output Cable (four-wire hookup only -- GLI 1W0980 two-conductor plus shield): Connect cable shield to earth ground at the supply end. Loop cable 2-1/2 times through ferrite (Steward #28B0686-200, Fair-Rite Corp. #2643665702, or equivalent).

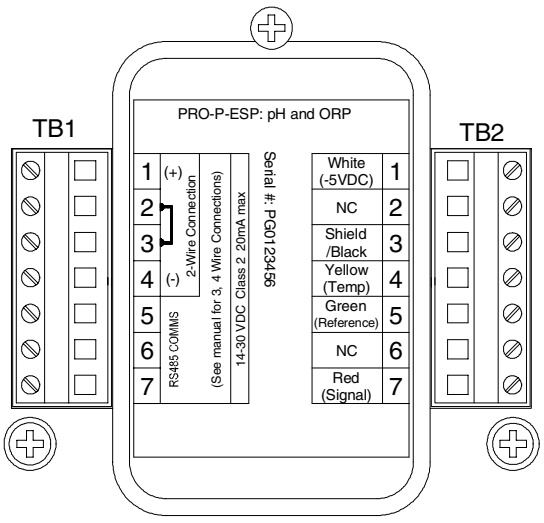


FIGURE 2-4 Transmitter Terminal Designations

3.1 pH or ORP Sensor

Depending on how transmitter is mounted, route the sensor (or interconnect) cable into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through left side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB2 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through swivel ball knockout hole and center hole in back cover. (Do not open left side cable entry knockout hole in back cover.)

GLI Differential Technique Sensor

All GLI Differential Technique sensors have a built-in temperature element for automatic temperature compensation and for measuring process temperature.

☞ **Wiring Tip!** Route the sensor cable in 1/2-inch, grounded metal conduit to protect it from moisture, electrical noise, and mechanical damage.

For installations where the distance between sensor and transmitter exceeds the sensor cable length, indirectly connect the sensor to the transmitter using a junction box and interconnect cable.

☞ ***NOTE:*** *Do not route the sensor cable in any conduit containing AC or DC power wiring ("electrical noise" may interfere with the sensor signal).*

Refer to Figure 2-5 and connect the sensor (or interconnect) cable wires as shown, matching colors as indicated.

☞ ***NOTE:*** *For GLI Differential sensors with only one shield wire, always connect it to Terminal 3 on TB2.*

For systems not requiring CE compliance and lacking an earth ground, connect the outer shield to Terminal 3 on TB2.

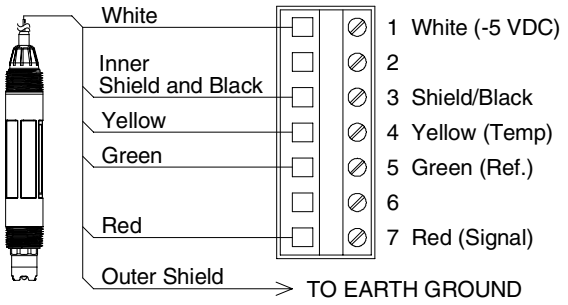


FIGURE 2-5
Connecting GLI Differential Technique Sensor

Conventional Combination Electrode

The electrode must be within 100 ft. (30 m) of the transmitter (985 ft./300 m for electrode with preamp). Refer to Figure 2-6 and directly connect the electrode's coaxial cable to the transmitter.

1. Connect the electrode's reference signal -- braided shield wire of coaxial cable (black insulated wire for GLI electrode) -- to Terminal 5 on TB2.

2. Connect the electrode's active signal -- center wire of coaxial cable (clear insulated wire for GLI electrode) -- to Terminal 7 on TB2.

3. Connect a jumper between Terminals 3 and 5 on TB2.

4. Connect the electrode's temperature element (typically white and red insulated wires for GLI electrode) to Terminals 3 and 4 on TB2, attaching either wire to either terminal.

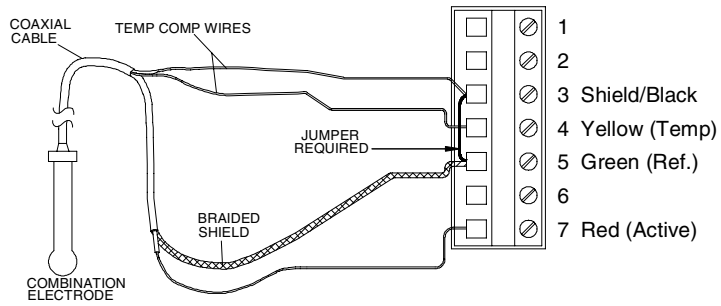


FIGURE 2-6
Connecting Conventional Combination Electrode

Conventional Combination Electrode with Ground Rod

Some applications require that an external ground rod be used with the combination electrode. The electrode must be within 100 ft. (30 m) of the transmitter (985 ft./300 m for electrode with preamp). Refer to Figure 2-7 and directly connect the electrode's coaxial cable to the transmitter.

Connect the electrode and temperature element wires in the same way as described in the previous "Conventional Combination Electrode" subheading -- and also connect the ground rod wire to Terminal 3 on TB2.

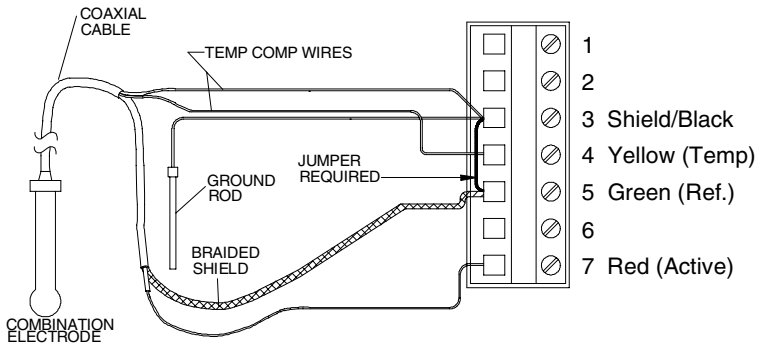


FIGURE 2-7
Connecting Conventional Combination Electrode with Ground Rod

3.2 Two-wire Hookup

In a two-wire hookup, at least 16 VDC is required for operation. A load device can be connected in the current loop (see Figure 2-8 for details).

Depending on how the transmitter is mounted, route the DC power/analog output wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

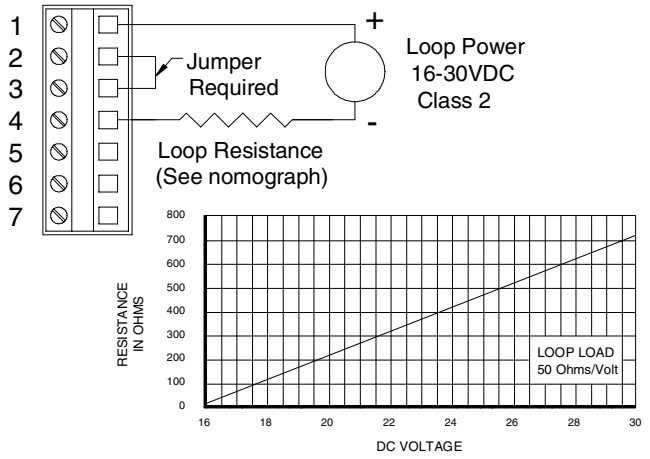


FIGURE 2-8
Two-wire Hookup

3.3 Three-wire Hookups

In a three-wire hookup, the transmitter can be wired four ways depending on load “sinking” or “sourcing” and whether or not RS-485 serial communication is used. At least 14 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power, analog output, and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

Refer to the three-wire hookup that meets your application requirements, and connect the transmitter accordingly.

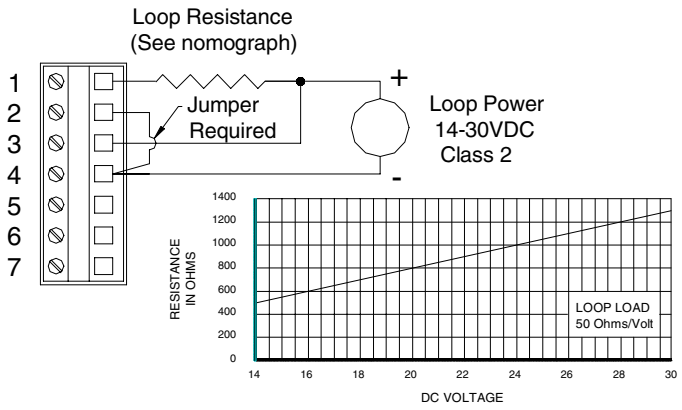


FIGURE 2-9
Three-wire Hookup -- Load Sinking

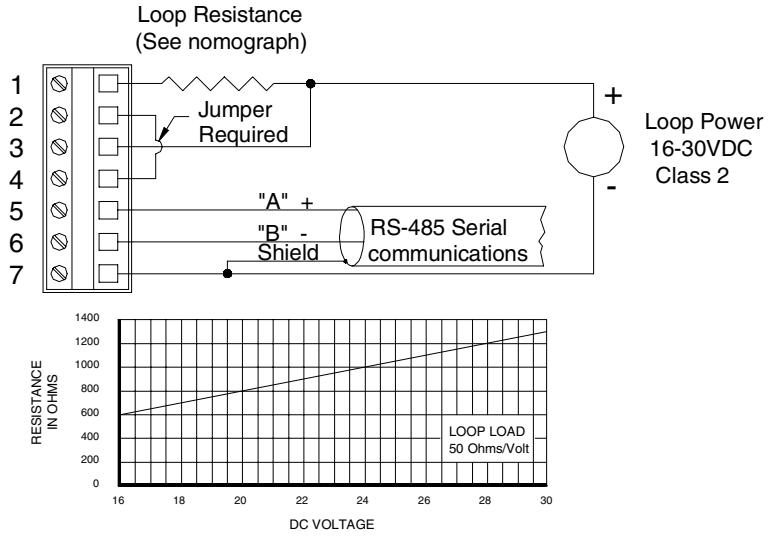


FIGURE 2-10
Three-wire Hookup -- Load Sinking with RS-485 Serial Communication

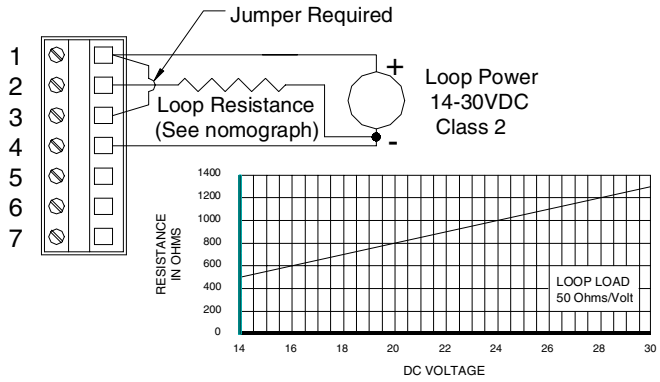


FIGURE 2-11
Three-wire Hookup -- Load Sourcing

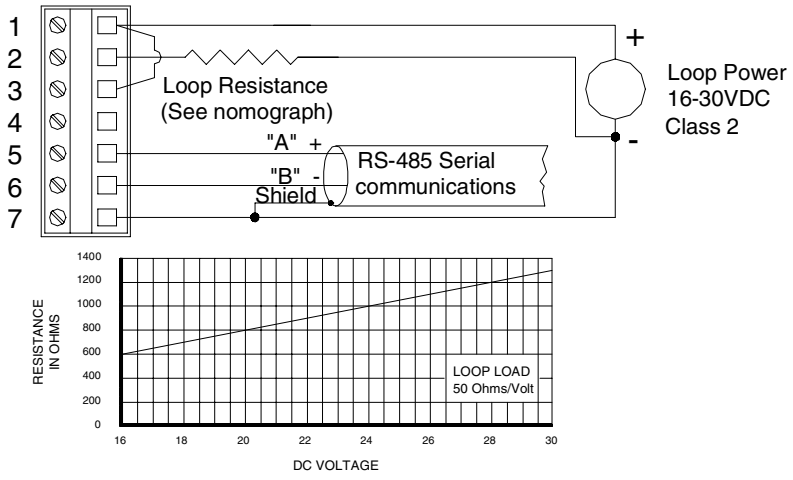


FIGURE 2-12
Three-wire Hookup -- Load Sourcing with RS-485 Serial Communication

3.4 Four-wire Hookups

In a four-wire hookup, the transmitter can be wired two ways depending on whether or not RS-485 serial communication is used. At least 12 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power, analog output, and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.

- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

Refer to the four-wire hookup that meets your application requirements, and connect the transmitter accordingly.

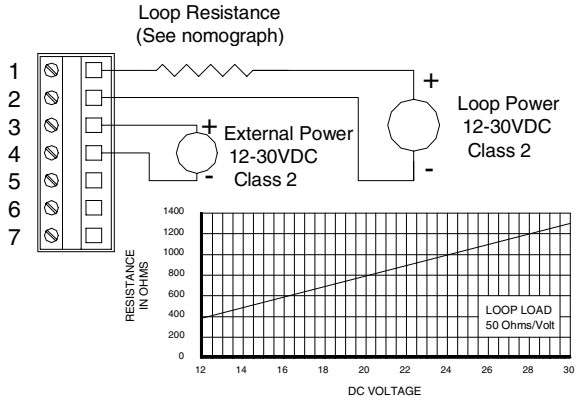


FIGURE 2-13
Four-wire Hookup without RS-485 Serial Communication

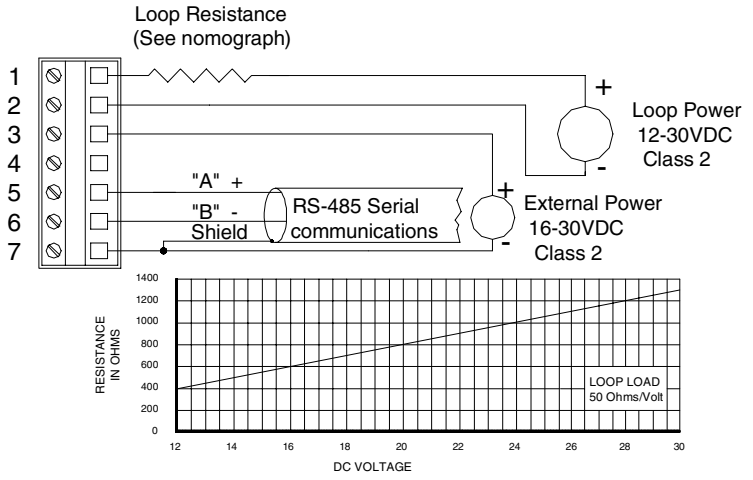


FIGURE 2-14
Four-wire Hookup with RS-485 Serial Communication

3.5 Monitor Mode Hookups (without current loop)

The transmitter can be wired two ways in a monitor mode hookup (without current loop), depending on whether or not RS-485 serial communication is used. At least 12 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

Refer to the monitor mode hookup that meets your application requirements, and connect the transmitter accordingly.

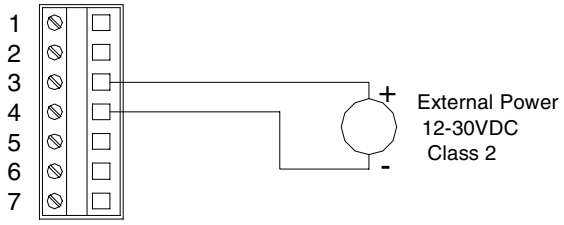


FIGURE 2-15
Monitor Mode Hookup (without Current Loop) -- without RS-485 Serial Communication

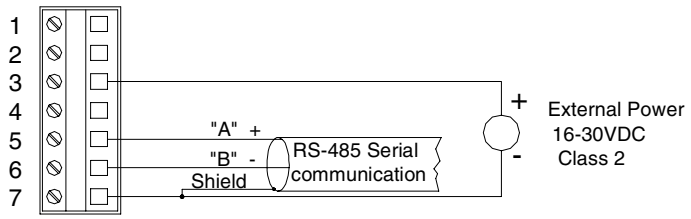


FIGURE 2-16
Monitor Mode Hookup (without Current Loop) -- with RS-485 Serial Communication

PART THREE - OPERATION

SECTION 1
USER INTERFACE

The user interface consists of a two-line LCD display and a keypad with **MENU**, **ENTER**, **ESC**, ⇦, ⇨, ⇧, **and** ⇩ **keys**.

1.1 Display

By using the keypad, you can display three types of screens:

- **MEASURE Screens:** The normal display mode shows the measured pH (or ORP). Pressing the ⇨ **key** sequentially scrolls through these other measurement readouts:
  - ✓ Measured process temperature
  - ✓ Measured pH and temperature

  } not provided when using transmitter to measure ORP
  - ✓ Measured analog output mA value
- **MENU Screens:** These top-level and lower-level (sub-menu) screens within the three main branches of the menu tree are used to access edit/selection screens for configuration. (EXIT screens at the end of each menu branch enable you to move up one level in the menu tree by pressing the **ENTER key**. This is functionally the same as pressing the **ESC key**.)
- **Edit/Selection Screens:** These screens enter values/choices to calibrate, configure, and test the transmitter.

1.2 Keypad

The keypad enables you to move throughout the transmitter menu tree. The keys and their related functions are:

1. **MENU key:** Pressing this key with the MEASURE screen displayed shows the "MAIN MENU ▶ CALIBRATE" screen. To display the CONFIGURE or TEST/MAINT top-level main branch screen, press the ⇩ **key**. Pressing the **MENU key** with a menu screen displayed always shows the top-level screen in that branch. (Pressing the **MENU key** also "aborts" the procedure to change values or selections.)

2. **ENTER key:** Pressing this key does two things: it displays submenu and edit/selection screens, and it enters (saves) configuration values/selections.

3. **ESC key:** Pressing this key always takes the display up one level in the menu tree. (Example: With the "MAIN MENU" screen displayed, pressing the **ESC key** once takes the display up one level to the MEASURE screen.) The **ESC key** can also "abort" the procedure to change a value or selection.

4. ⇦ **and** ⇨ **keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE Screen: Changes readout (in continuous loop sequence) to show different measurements.
   - Menu Screens: These keys are non-functional.
   - Edit/Selection Screens: Moves cursor left or right to select digit for adjustment with ⇧ **and** ⇩ **keys**.

5. ⇧ **and** ⇩ **keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE Screen: These keys are non-functional.
   - Menu Screens: Moves up or down respectively between other same-level menu screens.
   - Edit/Selection Screens: Adjusts selected digit value up or down, or moves up or down between choices.

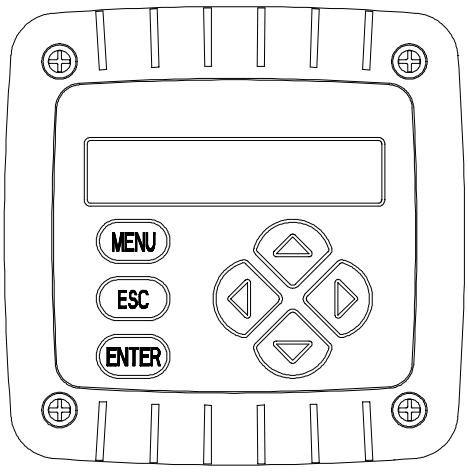
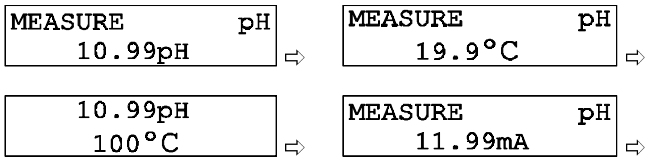


FIGURE 3-1 Transmitter Keypad

1.3 MEASURE Screen (normal display mode)

The MEASURE screen is normally displayed. Pressing the **MENU key** temporarily replaces the MEASURE screen with the top-level "MAIN MENU ▶ CALIBRATE" branch selection screen. Using the keypad, you can then display other screens to calibrate, configure or test the transmitter. **If the keypad is not used within 30 minutes, except during calibration or while using specific transmitter test/ maintenance functions, the display will automatically return to the MEASURE screen.** To display the MEASURE screen at any time, press the **MENU key** once and then press the **ESC key** once.

When using the transmitter to measure pH, the MEASURE screen can show four different readout versions. To select between them, in continuous loop sequence, press the ⇦ **or** ⇨ **key**. These are examples of the different versions:



☞ ***NOTE:*** *If pure water temperature compensation was selected (PART THREE, Section 3.2, subheading "Select PURE H2O COMP") the MEASURE screen will show an asterisk after the pH reading to indicate it is being applied.*

When using the transmitter to measure ORP, only two readouts are shown: measured mV and the mA output. The two screens showing temperature are not available.

☞ ***NOTE:*** *When the transmitter returns to its normal MEASURE screen mode, the appearing readout is always the version last selected.*

Note that three MEASURE screen readout examples show the factory-default "PH" notation on their top lines, illustrating the transmitter notation feature. To create your own notation, refer to PART THREE, Section 3.2, subheading "ENTER NOTE (top line of MEASURE screen)."

When the measured value is beyond the transmitter measuring range, a series of " + " or " - " screen symbols appear, respectively indicating that the value is above or below range.

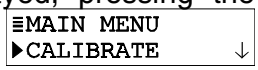
SECTION 2
MENU STRUCTURE

The transmitter menu tree is divided into three main branches: CALIBRATE, CONFIGURE, and TEST/MAINT. Each main branch is structured similarly in layers with top-level screens, related lower-level submenu screens and, in many cases, sub-submenu screens.

Each layer contains an EXIT screen to return the display up one level to the previous layer of screens.

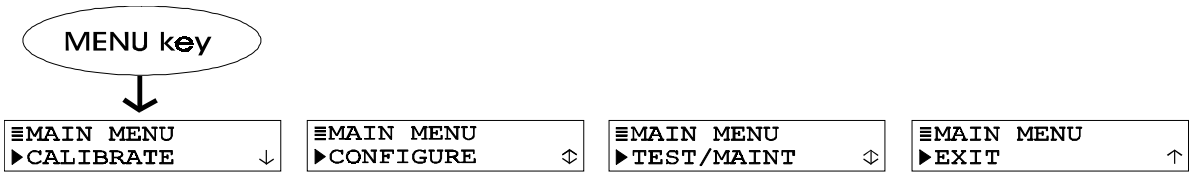
☞ **Menu Structure Tip!** For operating convenience, the layers within each main branch are organized with the most frequently used function screens at their beginning, rather than the function screens used for initial startup.

2.1 Displaying Main Branch Selection Screens

1. With the MEASURE screen displayed, pressing the **MENU key** always shows the 

branch selection screen. (Pressing the **MENU key** with any other type of screen displayed always returns the display to the top of that respective menu branch).

2. Press ⇩ **and** ⇧ **keys** to select between the three MAIN MENU branch selection screens (CALIBRATE, CONFIGURE or TEST/MAINT), or the EXIT screen:

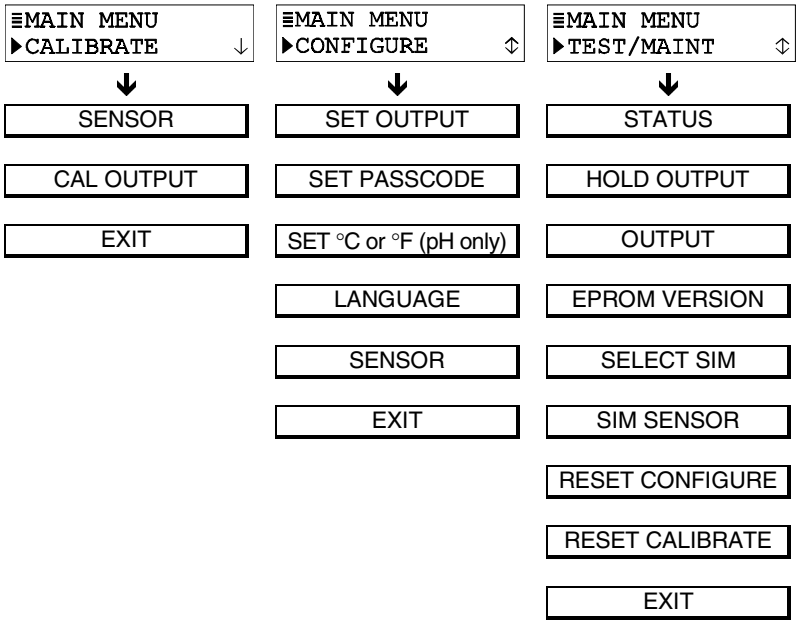


3. With the desired MAIN MENU branch selection screen displayed, press **ENTER key** to display the first top-level menu screen within that branch.

2.2 Displaying Top-level Menu Screens

With the first top-level menu screen of the desired main branch displayed, use the ⇩ **and** ⇧ **keys** to scroll through other top-level screens to access a desired screen.

The top-level menu screens for each main branch are:



☞ **Menu Structure Tip!** A menu screen with a horizontal bar symbol (≣) at the start of its first line indicates there is a related submenu or edit/selection screen.

A menu screen with a "▶" symbol at the start and a "↓" symbol at the end of its second line indicates that you can select other screens within the same layer by pressing the ⇩ **key**. A "↕" symbol at the end of the second line indicates that you can move up or down between screens by respectively pressing the ⇧ **or** ⇩ **key**. When a "↑" symbol appears, it indicates you have reached the end of the screens in that layer. You can select previous screens using the ⇧ **key**.

2.3 Displaying Submenu Screens

After selecting a top-level menu screen, press the **ENTER key** to display a related submenu or edit/selection screen:

- **Submenu Screens** are usually linked to other related same-level screens. Pressing the ⇩ **key** displays these other related menu screens.

  Example: With this submenu screen displayed:

  ```
  ≣SET OUTPUT
  ▶SET PARAMETER ↓
  ```

  pressing the ⇩ **key** displays this related, same-level submenu screen:

  ```
  ≣SET OUTPUT
  ▶SET 4mA VALUE ↕
  ```

- **Edit/Selection Screens** always have a first line ending with a "?". Pressing the ⇩ **or** ⇧ **key** changes the value/ choice enclosed by parenthesis (second line on screen).

  Example: With this submenu screen displayed:

  ```
  SET °C OR °F?
  (°C              )
  ```

  pressing the ⇩ **key** displays this related choice:

  ```
  SET °C OR °F?
  (°F              )
  ```

2.4 Adjusting Edit/Selection Screen Values

Use **arrow keys** to edit/change the value/choice enclosed by parenthesis (examples shown above and below).

```
SET PARAMETER?
(SENSOR          )
```

```
SET 4mA VALUE?
(12.33 pH        )
```

A choice can be changed by simply using the ⇧ **and** ⇩ **keys**. Numerical values can be adjusted using the ⇦ **and** ⇨ **keys** to select a digit, and ⇧ **and** ⇩ **keys** to adjust its value.

2.5 Entering (Storing) Edit/Selection Screen Values/Choices

With the desired value/choice displayed, press the **ENTER key** to enter (store) it into the non-volatile transmitter memory. The previous screen will then re-appear.

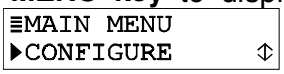
☞ ***NOTE:*** *You can always press the **ESC key** to abort saving a new setting. The original setting will be retained.*

SECTION 3
TRANSMITTER CONFIGURATION

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to enter a configuration setting.*

3.1 Selecting LANGUAGE to Operate Transmitter

The transmitter is normally equipped to display screens in English and Spanish (Español). However, another language such as French (Français), German (Deutsche), etc. may be substituted for Spanish. The transmitter is factory-set for English. To select the other language:

1. Press **MENU key** to display a "MAIN MENU screen. If the 

screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press ⇩ **key** until 

screen appears.

4. Press **ENTER key** to display 

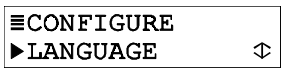
. Use ⇩ **or** ⇧ **key** to select a language, and press **ENTER key** to enter it.

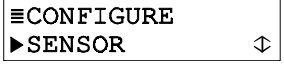
☞ ***NOTE:*** *After a language is selected and entered, all screens are displayed in that language.*

3.2 Configuring Sensor Characteristics

The transmitter must be configured to define the sensor used with it, and other related items such as the display format, desired buffer set for calibration, temperature element, input signal filtering, etc.

SELECT SENSOR Type

1. With the 

screen displayed, press ⇩ **key** <u>once</u> to display 

.

2. Press **ENTER key** to display
```
≣SENSOR
▶SELECT SENSOR ↓
```
.

3. Press **ENTER key** again to display a screen like
```
SELECT SENSOR?
(DIFF pH      )
```
. Use ⇩ **and** ⇧ **keys** to select the type of sensor to be used with the transmitter, and press **ENTER key** to enter it:

   - **DIFF pH:** Selects GLI Differential pH sensor.
   - **COMBINATION pH:** Selects conventional combination pH electrode.
   - **ORP:** Selects ORP sensor (either a GLI Differential ORP sensor or a conventional combination ORP electrode).

WARNING:

CHANGING THE SENSOR TYPE AUTOMATICALLY REPLACES ALL USER-ENTERED CONFIGURATION VALUES WITH FACTORY-DEFAULTS.

Select DISPLAY FORMAT

When using the transmitter to measure ORP, this function is not provided. (The ORP display format is fixed to show mV values as only whole numbers.) For pH measurement, select the desired display format (XX.XX or XX.X) for the MEASURE screen. This format setting has no effect on edit/selection screens, which always show pH values in a XX.XX format.

1. With the
```
≣SENSOR
▶SELECT SENSOR ↓
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶DISPLAY FORMAT↕
```
.

2. Press **ENTER key** to display a screen like
```
DISPLAY FORMAT?
(XX.XX pH     )
```
. Use ⇩ **and** ⇧ **keys** to select the desired format (XX.XX or XX.X), and press **ENTER key** to enter it.

SELECT BUFFER Set for pH Calibration

When using the transmitter to measure ORP, this function is not provided. For pH measurement, configure the transmitter to use one of these buffer sets for pH calibration:

- 4.00, 7.00, and 10.00
- DIN 19267 Standard (1.09, 4.65, 6.79, 9.23, and 12.75)

☞ ***NOTE:*** *When using buffers that are not included in either of the transmitter buffer sets, disregard selecting the buffer set. In this case, use only the "1 (or) 2 POINT SAMPLE" method for pH calibration.*

The transmitter automatically recognizes pH values from the selected buffer set and uses its associated built-in table of pH-versus-temperature values to improve measurement accuracy. To select a buffer set:

1. With the `≡SENSOR ▶DISPLAY FORMAT⇕` screen displayed, press ⇩ **key** <u>once</u> to display `≡SENSOR ▶SELECT BUFFER ⇕`.

2. Press **ENTER key** to display a screen like `SELECT BUFFER? (4,7,10 )`. Use ⇩ **and** ⇧ **keys** to select a buffer set (4, 7, 10 or DIN 19267) for use during calibration, and press **ENTER key** to enter it.

Select PURE H2O COMP (only for special applications)

When using the transmitter to measure ORP, this function is not provided. When measuring pH in solutions with the weakly dissociating electrolytes ammonia or morpholine, built-in tables provide a correction factor for pure water temperature compensation. This special compensation is specifically for use in power plant applications. It adds an associated temperature-dependent offset, from the selected table, to the measured pH. If custom compensation is required for pure water applications, a "user-defined" pH/°C linear slope factor can be applied to the measured pH.

☞ ***NOTE:*** *The selected pure water temperature compensation is limited to 50°C. If the process temperature is higher, the offset corresponding to 50°C is used.*

1. With the `≡SENSOR ▶SELECT BUFFER ⇕` screen displayed, press ⇩ **key** <u>once</u> to display `≡SENSOR ▶PURE H2O COMP ⇕`.

2. Press **ENTER key** to display
```
≣PURE H2O COMP
▶SELECT TYPE    ↓
```
.

3. Press **ENTER key** again to display a screen like
```
PURE H2O COMP?
(NONE           )
```
. Use ⇩ **and** ⇧ **keys** to select the desired pure water temperature compensation (NONE, AMMONIA, MORPHOLINE or USER DEFINED), and press **ENTER key** to enter it.

4. If "USER DEFINED" was selected, you must set the specific pH/°C linear slope:

   A. With the
```
≣PURE H2O COMP
▶SELECT TYPE    ↓
```
screen displayed, press ⇩ **key** once to display
```
≣PURE H2O COMP
▶SET SLOPE      ⇳
```
.

   B. Press **ENTER key** to display a screen like
```
SET SLOPE?
(0.0000 pH/°C  )
```
. Use **arrow keys** to adjust to a desired slope, and press **ENTER key** to enter it.

☞ ***NOTE:*** *The MEASURE screen will show an asterisk after the pH reading to indicate pure water temperature compensation was selected and is being applied.*

SET FILTER Time

A time constant (in seconds) can be set to filter or "smooth out" the sensor signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what sensor signal filter time to use is a compromise. The higher the filter time, the longer the sensor signal response time will be to a change in the actual process value.

1. With the
```
≣SENSOR
▶PURE H2O COMP ⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶SET FILTER     ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS      )
```
. Use **arrow keys** to adjust to a desired filter time, and press **ENTER key** to enter it.

ENTER NOTE (top line of MEASURE screen)

The top line of the MEASURE screen readouts that separately show the measurement, temperature, and analog output values are factory set to read "PH." This notation can be changed, for example, to "BASIN 1" to tailor the transmitter MEASURE screen to the application. The top line would then be "MEASURE BASIN 1." The notation is limited to eight characters which can be a combination of capital letters A through Z, numbers 0 through 9, spaces, # symbols, hyphens, and periods.

1. With the
```
≡SENSOR
▶SET FILTER      ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▶ENTER NOTE      ⇳
```
.

2. Press **ENTER key** to display
```
ENTER NOTE?
([P]H            )
```
. Create the desired notation on the second line:

   A. Starting with extreme left character position, use ⇧ **and** ⇩ **keys** to select the desired first character.

   B. Press ⇨ **key** once to select the next character, and use ⇧ **and** ⇩ **keys** to select its desired character.

   C. Repeat procedure until desired notation is displayed.

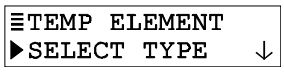
3. Press **ENTER key** to enter the displayed notation.

Select TEMP ELEMENT Type

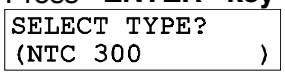
When using the transmitter to measure ORP, this function is not provided since ORP measurement does not require temperature compensation. When measuring pH, configure the transmitter for either automatic temperature compensation (by defining the sensor's built-in temperature element or an external element) or fixed MANUAL temperature compensation. When using MANUAL you must determine and enter a specific temperature.

☞ ***NOTE:*** *When a temperature element type has been selected but the element is not connected to the transmitter, a "WARNING: CHECK STATUS" message will appear. To prevent or clear the message, connect the element or select "MANUAL."*

1. With the
```
≡SENSOR
▶ENTER NOTE      ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▶TEMP ELEMENT    ⇳
```
.

2. Press **ENTER key** to display


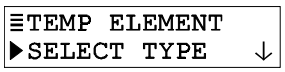
.

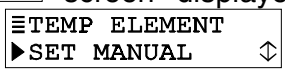
3. Press **ENTER key** again to display a screen like


. Use ⇩ **and** ⇧ **keys** to select the type of temperature element used with the pH sensor to compensate the measurement, and press **ENTER key** to enter it:

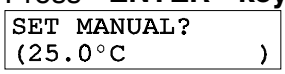
   - **NTC300:** Selects automatic temperature compensation using only a NTC 300 ohm thermistor temperature element (in all GLI Differential pH sensors -- except Model 6006P4-2000 pure water pH sensor systems which use a Pt 1000 RTD).
   - **PT1000:** Selects automatic temperature compensation using only a Pt 1000 RTD temperature element.
   - **PT100:** Selects automatic temperature compensation using only a Pt 100 RTD temperature element.
   - **MANUAL:** For pH measurement only -- selects fixed manual temperature compensation (disregards temperature element -- see step 4).

4. If "MANUAL" was selected, you must set the specific manual temperature compensation value:

   A. With the


screen displayed, press ⇩ **key** <u>once</u> to display


.

   B. Press **ENTER key** to display a screen like


. Use **arrow keys** to adjust to a desired temperature for fixed MANUAL compensation, and press **ENTER key** to enter it.

3.3 SET °C OR °F (temperature display format)

When using the transmitter to measure ORP, this function is not provided. When measuring pH, the temperature can also be displayed. The MEASURE screen can be set to display temperature values in °C or °F. In either case, display resolution for measured temperature is always "XX.X."

1. With the ≣TEMP ELEMENT / ▶SELECT TYPE ↓ or ≣TEMP ELEMENT / ▶SET MANUAL ⇳ screen displayed, press **ESC key** <u>twice</u> to display ≣CONFIGURE / ▶SENSOR ⇳.

2. Press ⇧ **key** -- not ⇩ **key** -- <u>twice</u> to display ≣CONFIGURE / ▶SET °C OR °F ⇳.

3. Press **ENTER key** to display a screen like SET °C OR °F? / (°C). Use ⇩ **and** ⇧ **keys** to select the displayed temperature units (°C or °F), and press **ENTER key** to enter it.

3.4 Configuring Analog Output

The transmitter provides an isolated 4-20 mA analog output. During normal measurement operation, the output is active but can be held at the last measured value for up to 30 minutes by using the "HOLD OUTPUT" function in the TEST/MAINT menu. (See PART THREE, Section 5.2 for details.) During calibration, the output is automatically held at the last measured value and, upon completion, returned to its active state.

SET PARAMETER (representation)

When using the transmitter to measure ORP, this function is not provided. (The output always represents the measured ORP.) When measuring pH, the output can be assigned to represent the SENSOR (measured pH) or measured TEMPERATURE.

1. With the ≣CONFIGURE / ▶SET °C OR °F ⇳ screen displayed, press ⇧ **key** -- not ⇩ **key** -- <u>twice</u> to display ≣CONFIGURE / ▶SET OUTPUT ↓.

2. Press **ENTER key** to display ≣SET OUTPUT / ▶SET PARAMETER ↓.

3. Press **ENTER key** again to display SET PARAMETER? / (SENSOR). Use ⇩ **and** ⇧ **keys** to select the parameter the output will represent, press **ENTER key** to enter it.

SET 4 mA and 20 mA VALUES (range expand)

Parameter values can be set to define the endpoints at which the 4 mA and 20 mA analog output values are desired.

1. With the ≣SET OUTPUT / ▶SET PARAMETER ↓ screen displayed, press ⇩ **key** <u>once</u> to display ≣SET OUTPUT / ▶SET 4mA VALUE ⇳ .

2. Press **ENTER key** to display a screen like SET 4mA VALUE? / (7.00 pH) . Use **arrow keys** to set the value at which 4 mA is desired, and press **ENTER key** to enter it.

3. After the ≣SET OUTPUT / ▶SET 4mA VALUE ⇳ screen re-appears, press ⇩ **key** <u>once</u> to display ≣SET OUTPUT / ▶SET 20mA VALUE⇳ .

4. Press **ENTER key** to display a screen like SET 20mA VALUE? / (12.33 pH) . Use **arrow keys** to set the value at which 20 mA is desired, and press **ENTER key** to enter it.

☞ ***NOTE:*** *If the same values are set for 4 mA and 20 mA, the output automatically goes to, and remains at, 20 mA.*

SET FILTER Time

A time constant (in seconds) can be set to filter or “smooth out” the analog output signal. A minimum value of “0 seconds” has no smoothing effect. A maximum value of “60 seconds” provides maximum smoothing. Deciding what output filter time to use is a compromise. The higher the filter time, the longer the analog output signal response time will be to a change in the measured value.

1. With the ≣SET OUTPUT / ▶SET 20mA VALUE⇳ screen displayed, press ⇩ **key** <u>once</u> to display ≣SET OUTPUT / ▶SET FILTER ⇳ .

2. Press **ENTER key** to display a screen like SET FILTER? / (0 SECONDS) . Use **arrow keys** to adjust to a desired filter time, and press **ENTER key** to enter it.

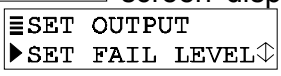
SET FAIL LEVEL Mode (off, 4 mA or 20 mA)

When a "WARNING CHECK STATUS" message appears, indicating that a system problem may exist, the analog output can be set to respond in one of three ways:

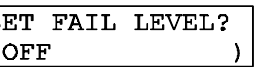
- **OFF:** Output remains active.
- **4mA:** Output automatically goes to and remains at 4 mA.
- **20mA:** Output automatically goes to and remains at 20 mA.

To SET FAIL LEVEL mode to suit your application:

1. With the 

screen displayed, press ⇩ **key** <u>once</u> to display 

.

2. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to select a response mode (OFF, 4mA or 20mA), and press **ENTER key** to enter it.

3.5 SET PASSCODE (feature enabled or disabled)

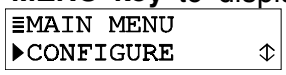
The transmitter has a passcode feature to restrict access to configuration settings and calibration to only authorized personnel.

- **DISABLED:** With the passcode feature disabled, all configuration settings can be displayed and changed, and the transmitter can be calibrated.

- **ENABLED:** With the passcode feature enabled, all configuration settings can be displayed -- but they cannot be changed -- and the CALIBRATE and TEST/MAINT menus cannot be accessed without the passcode. When you attempt to change a setting in the CONFIGURE menu by pressing the **ENTER key**, a displayed notification requests passcode entry. A valid passcode entry saves the changed setting and returns the display to the "MAIN MENU" branch selection screen. An incorrect passcode entry causes the display to momentarily show an error notification before returning to the "MAIN MENU" branch selection screen. There is no limit on attempts to enter a valid passcode.

The passcode is factory-set to "**3 4 5 6**." It cannot be changed.

To enable or disable the passcode feature:

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

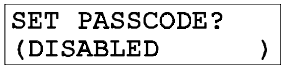
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press ⇩ **key** once to display 

.

4. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to select the desired passcode mode (DISABLED or ENABLED), and press **ENTER key** to enter it.

3.6 Configuration Setting Summary

TABLE A lists all configuration settings and their entry ranges/choices and factory defaults, categorized by basic functions.

TABLE A -- Transmitter Configuration Settings (Ranges/Choices and Defaults)

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
LANGUAGE Setting			
LANGUAGE?	ENGLISH and SPANISH (French, German, etc. may be substituted for Spanish)	ENGLISH	
SENSOR Settings			
SELECT SENSOR?	DIFF pH, COMB pH or ORP	DIFF pH	
DISPLAY FORMAT?	pH: XX.XX pH or XX.X pH ORP: Fixed at XXXX mV	pH: XX.XX pH ORP: XXXX mV	
SELECT BUFFER?	pH: 4, 7, 10 or DIN 19267 ORP: Screen not applicable/provided.	pH: 4, 7, 10 ORP: Not applicable	
PURE H2O COMP SELECT TYPE?	pH: NONE, AMMONIA MORPHOLINE or USER DEFINED ORP: Screen not applicable/provided.	pH: NONE ORP: Not applicable	
SET FILTER?	0-60 seconds	0 seconds	
ENTER NOTE?	pH: Replace PH with up to eight characters ORP: Replace ORP with up to eight characters	pH: PH ORP: ORP	
TEMP ELE: SELECT TYPE?	pH: NTC300, PT1000, PT100 or MANUAL ORP: Screen not applicable/provided.	pH: NTC300 ORP: Not applicable	
TEMP ELE: SET MANUAL?	pH: 0.0-100.0°C ORP: Screen not applicable/provided.	pH: 25.0°C ORP: Not applicable	
TEMPERATURE Display Setting			
SET °C OR °F?	pH: °C or °F ORP: Screen not applicable/provided.	pH: °C ORP: Not applicable	
OUTPUT Settings			
SET PARAMETER?	pH: SENSOR or TEMPERATURE ORP: Screen not applicable/provided.	pH: SENSOR ORP: Not applicable	
SET 4mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 0.00 pH ORP: 0 mV TEMP: 0.0°C or 32.0°F	
SET 20mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 14.00 pH ORP: +2100 mV TEMP: 200.0°C or 392.0°F	
SET FILTER?	0-60 seconds	0 seconds	
SET FAIL LEVEL?	OFF, 4 mA or 20 mA	OFF	
PASSCODE Setting			
SET PASSCODE?	DISABLED or ENABLED	DISABLED	
TEST/MAINT Simulation Function Settings			
SELECT SIM?	pH: SENSOR or TEMPERATURE ORP: Screen not applicable/provided.	pH: SENSOR ORP: Not applicable	
SIM SENSOR?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	Present measured value of sensor's selected parameter (pH, ORP or temperature)	

SECTION 4
TRANSMITTER CALIBRATION

4.1 Important Information

Four methods are available for pH calibration (Section 4.2). To calibrate ORP, use only the 1-POINT SAMPLE method described in Section 4.3. The analog output loop can also be calibrated (Section 4.4).

Calibrate Periodically

To maintain best measurement accuracy, periodically calibrate the transmitter. Performance of the pH or ORP sensor slowly degrades over time, eventually causing inaccurate readings. The time period between calibrations, and the rate of system drift, can vary considerably with each application and its specific conditions.

☞ **Calibration Tip!** Establish a maintenance program to keep the sensor relatively clean and the transmitter calibrated. The daily, weekly or monthly intervals between performing maintenance will be influenced by the characteristics of the process solution, and can only be determined by operating experience.

Temperature-corrected pH Measurement

The transmitter is factory-calibrated for accurate temperature measurement. It will provide pH readings that are automatically corrected for temperature changes when the transmitter:

- Receives a temperature signal from a pH sensor that has a built-in temperature element (all GLI Differential sensors) or from an external temperature element.
- Has been correctly set for the type of temperature element being used for automatic compensation.

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to calibrate the transmitter.*

An in-progress calibration can always be aborted by pressing the ESC key. *After the "ABORT: YES?" screen appears, do <u>one</u> of the following:*

- *Press **ENTER key** to abort. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).*
- *Press ⇧ **or** ⇩ **key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.*

Calibration Tip! If a "CONFIRM FAILURE?" screen appears during calibration, press **ENTER key** to confirm. Then, use ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do one of the following:

- With "(CAL: EXIT)" selected, press **ENTER key**. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).
- With "(CAL: REPEAT)" selected, press **ENTER key** to repeat calibration of the point.

4.2 pH Calibration

Based on convenience and your application requirements, use one of the four methods provided for pH calibration.

CAUTION:

WHEN USING A NEW SENSOR OR REPLACING THE STANDARD CELL SOLUTION AND SALT BRIDGE ON AN EXISTING GLI DIFFERENTIAL SENSOR, ALWAYS PERFORM A "RESET CALIBRATE" USING THE TEST/MAINT MENU (PART THREE, SECTION 5.8) BEFORE CALIBRATING.

NOTE: *When calibrating a sensor for the first time, always use a two-point method for best accuracy.*

2 POINT BUFFER Method

This recommended method requires two buffers, typically pH 7 and pH 4. (pH 10 buffer is also readily available but is not as stable, particularly at extreme temperatures.) This method automatically recognizes buffers from the selected buffer set. **Therefore, you must use buffers that match values in the buffer set** (see PART THREE, Section 3.2, subheading "SELECT BUFFER Set for pH Calibration" for details.)

NOTE: *When using buffers that are not included in either of the transmitter buffer sets, disregard this calibration method. Instead, use only the "2 POINT SAMPLE" calibration method.*

1. Immerse the sensor in the first pH buffer (preferably pH 7). **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the `≡MAIN MENU ▶CALIBRATE ↓` screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display `≡CALIBRATE ▶SENSOR ↓`.

4. Press **ENTER key** again to display `≡SENSOR ▶2 POINT BUFFER↓`.

5. Press **ENTER key** again to display `2 POINT BUFFER: IN 1ST SOLUTION?`. With the sensor in the first buffer, press **ENTER key** again to confirm this.

☞ ***NOTE:*** *During calibration, the analog output is automatically "held" at the last measured value.*

6. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like `2 POINT BUFFER: PT1 = 7.00 pH` appears for 5 seconds to confirm calibration of this point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration you can <u>manually</u> complete calibration of the point by pressing the **ENTER key**. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

7. After the `2 POINT BUFFER: IN 2ND SOLUTION?` screen appears, remove the sensor from the first buffer, rinse it with <u>clean</u> water, and immerse it in the second buffer (typically 4 pH). Then press **ENTER key** to confirm this.

8. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the

transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like

```
2 POINT BUFFER:
PT2 = 4.00 pH
```

appears for 5 seconds to confirm calibration of this point.

9. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

10. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

11. Re-install the sensor into the process.

12. Press **ENTER key** to display the active measurement reading on the "2 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "2 POINT BUFFER" calibration.

1 POINT BUFFER Method

This method is similar to the 2 POINT BUFFER method except that only one buffer is used to calibrate one point. This method also automatically recognizes buffers from the buffer set you selected. Therefore, you must use a buffer that matches a value in the buffer set. (See PART THREE, Section 3.2, subheading "SELECT BUFFER Set for pH Calibration" for selection details.)

☞ ***NOTE:*** *When using a buffer that is not included in either of the transmitter buffer sets, disregard this calibration method. Instead, use only the "1 POINT SAMPLE" calibration method.*

1. Immerse the sensor in the pH buffer. **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the `≣MAIN MENU ▶CALIBRATE ↓` screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display `≣CALIBRATE ▶SENSOR ↓`.

4. Press **ENTER key** again to display `≣SENSOR ▶2 POINT BUFFER↓`.

5. Press ⇩ **key** <u>once</u> to display `≣SENSOR ▶1 POINT BUFFER⇕`.

6. Press **ENTER key** to display `1 POINT BUFFER: SAMPLE READY?`. With the sensor in the buffer, press **ENTER key** to confirm this.

☞ ***NOTE:*** *During calibration, the analog output is automatically "held" at the last measured value.*

7. While the `1 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates the point. Thereafter, a screen like `1 POINT BUFFER: PT = 7.00 pH` appears for 5 seconds to confirm calibration of the point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration, you can <u>manually</u> complete calibration of the point by pressing the **ENTER key**. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

8. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the

slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

9. Press **ENTER key** to end calibration ("1 POINT BUFFER: CONFIRM CAL OK?" screen appears).

10. Re-install the sensor into the process.

11. Press **ENTER key** to display the active measurement reading on the "1 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "1 POINT BUFFER" calibration.

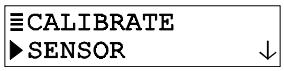
2 POINT SAMPLE Method

This method requires you to enter the known pH values of two process samples (or two pH buffers). Determine sample values using laboratory analysis or comparison readings.

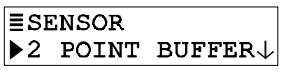
1. Immerse the sensor in the first solution (sample or buffer). **Important: Allow the sensor and sample temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

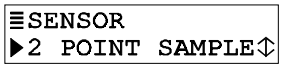
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display 

.

4. Press **ENTER key** again to display 

.

5. Press ⇩ **key** twice to display 

.

6. Press **ENTER key** to display `2 POINT SAMPLE: IN 1ST SOLUTION?` . With the sensor in the first sample, press **ENTER key** again to confirm this. This active `2 POINT SAMPLE: PT1 = X.XX pH` screen appears showing the measurement reading.

7. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `2 POINT SAMPLE? (X.XX pH )` screen appears showing the "last" measured value.

8. Determine the pH value of the first solution. For a sample, use laboratory analysis or a calibrated portable pH meter. (When using a pH buffer, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

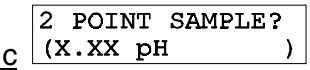
9. With the static `2 POINT SAMPLE? (X.XX pH )` screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the first solution (sample or buffer). Then press **ENTER key** to enter it, completing calibration of the first point.

10. After the `2 POINT SAMPLE: IN 2ND SOLUTION?` screen appears, remove the sensor from the first solution, and rinse it with clean water.

11. Immerse the sensor in the second solution, and press **ENTER key** to confirm. This active `2 POINT SAMPLE: PT2 = X.XX pH` screen appears showing the measurement reading.

12. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `2 POINT SAMPLE? (X.XX pH )` screen appears showing the "last" measured value.

13. Determine the pH value of the second solution.

14. With the static 

screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the second solution. Then press **ENTER key** to enter it, completing calibration of the second point.

15. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

16. Press **ENTER key** to end calibration ("2 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

17. Re-install the sensor into the process.

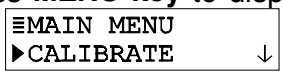
18. Press **ENTER key** to display the active measurement reading on the "2 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "2 POINT SAMPLE" calibration.

1 POINT SAMPLE Method

This method is similar to the 2 POINT SAMPLE method except that only one sample (or buffer) is used to calibrate one point. This method requires you to enter the known pH value of the sample (or pH buffer). Determine the sample value using laboratory analysis or a comparison reading.

1. Immerse the sensor in the sample (or buffer). **Important: Allow the sensor and sample temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

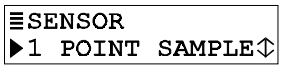
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display 

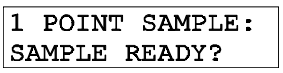
.

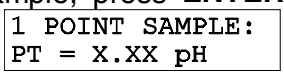
4. Press **ENTER key** again to display 

.

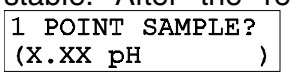
5. Press ⇩ **key** three times to display 

.

6. Press **ENTER key** to display 

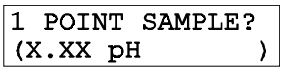
. With the sensor in the sample, press **ENTER key** to confirm this. This active 

screen appears showing the measurement reading.

7. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static 

screen appears showing the "last" measured value.

8. Determine the pH value of the sample using laboratory analysis or a calibrated portable pH meter. (When using a pH buffer, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

9. With the static 

screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the sample (or buffer). Then press **ENTER key** to enter it, completing calibration of the point.

10. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to

improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

11. Press **ENTER key** to end calibration ("1 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

12. Re-install the sensor into the process.

13. Press **ENTER key** to display the active measurement reading on the "1 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "1 POINT SAMPLE" calibration.

4.3 ORP Calibration

Calibrate for ORP measurement using only this "1 POINT SAMPLE" method.

CAUTION:

WHEN USING A NEW SENSOR OR REPLACING THE STANDARD CELL SOLUTION AND SALT BRIDGE ON AN EXISTING GLI DIFFERENTIAL SENSOR, ALWAYS PERFORM A "RESET CALIBRATE" USING THE TEST/MAINT MENU (PART THREE, SECTION 5.8) BEFORE CALIBRATING.

NOTE: *A two-point calibration method is purposely excluded since it could provide bad results. Immersing the sensor into one reference solution and then into the other could contaminate electrochemical components of the sensor.*

The "1 POINT SAMPLE" method requires you to enter the known mV value of a sample (or reference solution).

Determine the sample mV value using laboratory analysis or a comparison reading.

1. Immerse the sensor in the sample (or reference solution).

2. Press **MENU key** to display a "MAIN MENU" screen. If the `≡MAIN MENU ▶CALIBRATE ↓` screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display `≡CALIBRATE ▶SENSOR ↓`.

4. Press **ENTER key** again to display `≡SENSOR ▶1 POINT SAMPLE↓`.

5. Press **ENTER key** again to display `1 POINT SAMPLE: SAMPLE READY?`. With the sensor in the sample (or reference solution), press **ENTER key** to confirm this. This <u>active</u> `1 POINT SAMPLE: PT = XXXX mV` screen appears showing the measurement reading.

6. Wait for the reading to stabilize. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too <u>unstable</u>. After the reading has stabilized, this <u>static</u> `1 POINT SAMPLE? (XXXX mV )` screen appears showing the "last" measured value.

7. If not using an ORP reference solution, determine the mV value of the sample using laboratory analysis or a calibrated portable ORP meter.

8. With the <u>static</u> `1 POINT SAMPLE? (XXXX mV )` screen displayed, use **arrow keys** to adjust the displayed value to exactly match the <u>known</u> mV value of the sample (or reference solution). Then press **ENTER key** to enter it, completing calibration of the point.

9. Press **ENTER key** again to end calibration ("1 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

10. Re-install the sensor into the process.

11. Press **ENTER key** to display the <u>active</u> measurement

reading on the "1 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).

This completes ORP calibration.

4.4 Analog Output Calibration

The transmitter analog output is factory-calibrated. However, it can be re-calibrated if desired.

NOTE: *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to calibrate the analog output.*

Also, the transmitter adjustment range for output values during calibration is ± 2 mA.

1. Press **MENU key** to display a "MAIN MENU" screen. If the ≡MAIN MENU ▶CALIBRATE ↓ screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display ≡CALIBRATE ▶SENSOR ↓.

3. Press ⇩ **key** once to display ≡CALIBRATE ▶CAL OUTPUT ⇕.

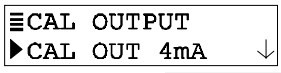
4. Press **ENTER key** to display ≡CAL OUTPUT ▶CAL OUT 4mA ↓.

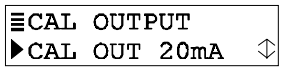
5. Press **ENTER key** again to display a screen like CAL OUT 4mA? (XXX). The displayed value is "counts" -- not mA -- that dynamically change as the output is adjusted.

6. Connect a calibrated digital multimeter in series with the loop load to measure the actual minimum mA output in the loop.

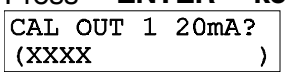
7. Use **arrow keys** to adjust the minimum output value to read exactly "4.00 mA" on the digital multimeter -- not

the transmitter display, and press **ENTER key** to complete calibration of the minimum endpoint value.

8. After the 

screen re-appears, press ⇩ **key** <u>once</u> to display 

.

9. Press **ENTER key** to display a screen like 

. Once again, the displayed value is “counts” -- not mA -- that dynamically change as the output is adjusted.

10. Now measure the actual <u>maximum</u> mA output in the loop with the digital multimeter.

11. Use **arrow keys** to adjust the maximum output value to read <u>exactly</u> “20.00 mA” on the <u>digital</u> <u>multimeter</u> -- not the transmitter display, and press **ENTER key** to complete calibration of the maximum endpoint value.

This completes analog output calibration.

SECTION 5
TEST/MAINTENANCE

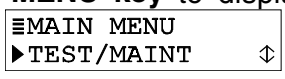
The transmitter has TEST/MAINT menu screens to:

- Check operating status of the transmitter and sensor.
- Hold analog output at its last measured value.
- Provide analog output test signal to confirm operation of connected device.
- Identify transmitter firmware EPROM version.
- Simulate a pH (or mV) or temperature signal to exercise the measurement loop.
- Reset configuration -- not calibration -- values to defaults.
- Reset calibration -- not configuration -- values to defaults.

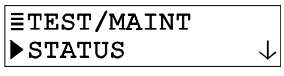
☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to use the TEST/MAINT menu screens.*

5.1 STATUS Check (transmitter and sensor)

The system diagnostic capabilities of the transmitter enable you to check the operating status of the transmitter and sensor. The MEASURE screen will flash the "WARNING: CHECK STATUS" message when a system diagnostic "fail" condition has been detected. To determine the condition causing the warning, display the "STATUS" screens.

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press **ENTER key** again to display "STATUS: ANALYZER OK" screen. This screen confirms that the transmitter is operating properly. If "FAIL" appears, it may mean:
   - Analog-to-digital converter not responding.
   - Internal serial communications failure.

4. Press **ENTER key** once to view "STATUS: SENSOR OK" screen. If "FAIL" appears, it indicates that the sensor is inoperative or its signal is out of range (more than + 480 mV or less than -480 mV for pH, or more than +2100 mV or less than -2100 mV for ORP).

5. Press **ENTER key** once to view "STATUS: SLOPE" screen, which indicates a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

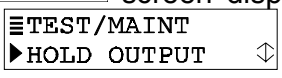
6. Press **ENTER key** once to view the "STATUS: TEMP OK" screen. If "FAIL" appears, it indicates that the temperature element in the sensor is inoperative, disconnected or incorrectly wired.

7. To end status checking, press **ESC key** or **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.2 HOLD OUTPUT

The HOLD OUTPUT function conveniently holds the analog output at its last measured value for up to 30 minutes to suspend operation of any connected device.

1. With the 

screen displayed, press ⇩ **key** once to display 

.

2. Press **ENTER key** to immediately hold the analog output ("HOLD OUTPUT: ENTER TO RELEASE" screen appears, acknowledging hold is applied).

NOTE: *If the keypad is not used within 30 minutes, the analog output will automatically change back to its active state and the display will return to the MEASURE screen.*

3. To release the hold at any time and return the analog output back to its "active" state, press **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.3 OUTPUT Test Signal

The OUTPUT function provides an analog output test signal of a desired mA value to confirm operation of a connected device.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶OUTPUT ⇳ screen appears.

2. Press **ENTER key** to display a screen like OUTPUT? (XX.XXmA) .

NOTE: *The mA output test signal is now active. Its value is shown on this screen.*

3. Use **arrow keys** to adjust the displayed value to obtain the desired mA test signal.

4. To remove the output test signal and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.4 Firmware (EPROM VERSION) Check

The EPROM VERSION function checks the version of firmware used in the transmitter.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶EPROM VERSION ⇳ screen appears.

2. Press **ENTER key** to view the EPROM version screen.

3. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.5 SELECT SIM Measurement

The SELECT SIM function selects a type of simulated measurement. It is used in conjunction with the SIM SENSOR function (Section 5.6) to simulate a measured value, making the analog output respond accordingly. **(When using the transmitter to measure ORP, the SELECT SIM function is not provided because the simulated measurement always represents mV.)**

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≡TEST/MAINT ▶SELECT SIM ⇳ screen appears.

2. Press **ENTER key** to display a screen like SELECT SIM? (SENSOR). Use ⇩ **and** ⇧ **keys** to select the type of simulated measurement, and press **ENTER key** to enter it:
   - **SENSOR:** Selects simulated measurement to be pH.
   - **TEMPERATURE:** Selects simulated measurement to be temperature.

5.6 SIM SENSOR Setting

After selecting the type of simulated measurement (Section 5.5), use the SIM SENSOR function to set the desired simulation value.

1. With the ≡TEST/MAINT ▶SELECT SIM ⇳ screen displayed, press ⇩ **key** once to display ≡TEST/MAINT ▶SIM SENSOR ⇳.

2. Press **ENTER key** to display a screen like SIM SENSOR? (X.XX pH).

☞ ***NOTE:*** *The analog output signal is now active. It has a mA value that corresponds to the measurement value shown on this screen.*

3. Use **arrow keys** to adjust the displayed simulation value to the desired value.

4. To remove the simulated output and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.7 RESET CONFIGURE Values to Factory Defaults

The RESET CONFIGURE function resets stored configuration settings (all at the same time) -- **but not calibration settings** -- to their factory-set defaults shown in TABLE A.

NOTE: *Resetting configuration values also excludes the SELECT SENSOR function (DIFF pH, COMB pH or ORP) which remains as is until you change it.*

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶RESET CONFIGURE screen appears.
2. Press **ENTER key** to display the "RESET CONFIGURE: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (To abort this procedure, press **ESC key** now.)
3. Press **ENTER key** to reset stored configuration settings -- **not calibration settings** -- to factory defaults. The "RESET CONFIGURE: DONE" screen appears, acknowledging that reset has occurred.
4. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.8 RESET CALIBRATE Values to Factory Defaults

The RESET CALIBRATE function resets stored calibration settings -- **but not configuration settings** -- to factory-set defaults.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶RESET CALIBRATE screen appears.
2. Press **ENTER key** to display the "RESET CALIBRATE: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (To abort this procedure, press **ESC key** now.)
3. Press **ENTER key** to reset all stored calibration settings -- **not configuration settings** -- to factory defaults. The "RESET CALIBRATE: DONE" screen appears, acknowledging that reset has occurred.
4. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

PART FOUR - SERVICE AND MAINTENANCE

SECTION 1
GENERAL INFORMATION

If a measurement problem exists and you suspect the sensor cable, inspect it for physical damage. If an interconnect cable is used, check the junction box, then disconnect the cable at both ends (sensor and transmitter) and, using an ohmmeter, check its wires for continuity and internal shorts.

SECTION 2
PRESERVING MEASUREMENT ACCURACY

2.1 Keeping Sensor Clean

To maintain measurement accuracy, periodically clean the sensor. Operating experience will help you determine when to clean the sensor (daily, weekly or monthly intervals). Use the recommended cleaning procedure described in the GLI sensor operating manual.

2.2 Keeping Transmitter Calibrated

Depending on application circumstances, periodically calibrate the transmitter to maintain measurement accuracy.

Maintenance Tip! Upon startup, frequently check the system until operating experience can determine the optimum time between calibrations that provides acceptable measurement results.

- pH: Calibrate using one of the methods described in PART THREE, Section 4.2.
- ORP: Calibrate using only the method described in PART THREE, Section 4.3.

Calibrating with old, contaminated or diluted pH buffers may cause measurement errors. **Do not reuse buffers.** Never pour the portion of buffer used for calibration back into the buffer bottle -- always discard it. Note that the pH value of a buffer changes as its temperature changes. (Always refer to the pH value-versus-temperature table on the buffer bottle.) Therefore, always allow the temperatures of the sensor and buffer to equalize while calibrating.

2.3 Avoiding Electrical Interference

Recommendation: Do not run the sensor cable (and interconnect cable, if used) in the same conduit with AC or DC power wiring. Also, connect cable shielding as recommended (PART TWO, Section 3.1).

Maintenance Tip! Excess cable should not be coiled near motors or other equipment that may generate electrical or magnetic fields. Cut cables to proper length during installation to avoid unnecessary inductive pickup ("electrical noise" may interfere with sensor signal).

SECTION 3
TROUBLESHOOTING

3.1 Ground Loops

The transmitter may be affected by a "ground loop" problem (two or more electrically grounded points at different potentials).

Symptoms Indicating a Possible Ground Loop

- Transmitter reading is offset from the actual value by a consistent amount, or ....
- Transmitter reading is frozen on one value, or ....
- Transmitter reading is "off scale" (upscale or downscale).

Although the source of a ground loop is difficult to determine, there are several common causes.

Common Causes of a Ground Loop

- Components, such as recorders or computers, are connected to non-isolated analog outputs.
- Not using shielded cabling or failure to properly connect all cable shields.
- Moisture or corrosion in a junction box.

Determining if Ground Loop Exists

The following simple test can help to determine if there is a ground loop:

1. With the pH (or ORP) MEASURE screen displayed, immerse the sensor in a non-conductive container (plastic or glass) filled with a pH buffer (or ORP refer-

ence solution) of known value. Note the transmitter reading for this solution.

2. Connect one end of a wire to a known earth ground such as a metal water pipe. Place the other end of this wire into the buffer next to the sensor.

3. Note the transmitter reading now and compare it with the reading taken in step 1. If the reading changed, a ground loop exists.

Finding Source of Ground Loop

Sometimes the source of a ground loop is easy to find, but it usually takes an organized approach to isolate the problem.

Troubleshooting Tip! Use a systematic troubleshooting method. If possible, start by grounding all shields and electrical grounds at one stable point. One at a time, turn off all pumps, motors, and switches that are in contact with the process. Each time you do this, check if the ground loop still exists. Since the process media being measured is electrically conductive, the source of the ground loop may not be readily apparent.

3.2 Isolating Measuring System Problem

When experiencing problems, try to determine the primary measurement system component causing the problem (sensor, transmitter or interconnect cable, if used):

Checking Electrical Connections

1. Verify that adequate DC voltage exists at the appropriate transmitter TB1 terminals.

2. Check all transmitter wiring to ensure proper connections.

Verifying Sensor Operation

To verify sensor operation, refer to the procedure in the troubleshooting section of the sensor operating manual. Or replace the suspect sensor with a known new or working sensor and perform calibration

Verifying Transmitter Operation

1. After disconnecting DC power from the transmitter, disconnect the sensor (and interconnect cable, if used).

2. Depending on the type of sensor, refer to the appropriate category below and follow the steps to simulate a pH (or ORP) input signal and a temperature signal:

For GLI Differential Technique Sensor

A. Connect a jumper between Terminal 3 (shield/black) and Terminal 5 (green) on TB2.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 5 (green) and Terminal 7 (red) on TB2, with the (+) lead on Terminal 7.

C. When using the transmitter to measure pH, connect a 1% tolerance, 301 ohm resistor between Terminals 4 (yellow) and 5 (green) on TB2. **When using transmitter to measure ORP, disregard this step.**

D. Make sure transmitter is configured for a 300 ohm NTC temperature element (PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type”).

For Conventional Combination Electrode

A. Connect a jumper between Terminal 3 and Terminal 5 (reference) on TB2.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 3 and Terminal 7 (active) on TB2, with the (+) lead on Terminal 7.

C. When using the transmitter to measure pH, connect a 1% tolerance, 1000 ohm resistor between Terminals 3 and 4 on TB2. **When using transmitter to measure ORP, disregard this step.**

D. Make sure the transmitter is configured for a Pt 1000 temperature element (PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type”).

3. Reconnect DC power to the transmitter.

4. Set millivolt generator to provide each of the following outputs, checking the transmitter MEASURE screen each time for these corresponding pH (or mV) readings:

Generator Output	Corresponding Transmitter Reading	
	For pH	For ORP
Zero mV	7 pH (approximately)	0 mV
(-)175 mV	10 pH (approximately)	(-)175 mV
(+)175 mV	4 pH (approximately)	(+)175 mV
When Using Jumper Only (not generator)		
- - - -	7 pH (approximately)	0 mV

5. When using the transmitter to measure pH, change the transmitter MEASURE screen to show temperature. **When using transmitter to measure ORP, disregard this step.**

   - For a GLI Differential Technique sensor, the temperature value should be approximately “25°C.”
   - For a conventional combination electrode, the temperature value should be approximately “0°C.”

If these readings are achieved, the transmitter is operating properly, but the interconnect cable (if used) may be faulty.

Verifying Interconnect Cable Integrity

1. Disconnect DC power, the millivolt generator, and temperature simulation resistor from the transmitter.

2. Reconnect the sensor directly to the transmitter (purposely bypassing the interconnect cable and junction box, if used).

3. Reconnect DC power to the transmitter.

4. Use a two-point method to calibrate the transmitter. (For ORP measurement, use only the “1 POINT SAMPLE” method described in PART THREE, Section 4.3.) If calibration was:

   - **Successful:** The transmitter and sensor are operating properly, but the interconnect cable is probably faulty.
   - **Unsuccessful:** The sensor is probably inoperative.

SECTION 4
TRANSMITTER REPAIR/RETURN

4.1 Customer Assistance

If you need assistance in troubleshooting or repair service, please contact your local GLI representative, or GLI Customer Service at:

GLI International, Inc.
9020 West Dean Road
Milwaukee, WI 53224

Phone: [800] 543-8907
Fax: [414] 355-8346
E-mail: info@gliint.com

— GLI CUSTOMER SERVICE HOURS —

	Eastern Std. Time	Central Std. Time	Mountain Std. Time	Pacific Std. Time
Monday through Thursday	8:30 a.m. to 5:30 p.m.	7:30 a.m. to 4:30 p.m.	6:30 a.m. to 3:30 p.m.	5:30 a.m. to 2:30 p.m.
Friday	8:30 a.m. to 4:00 p.m.	7:30 a.m. to 3:00 p.m.	6:30 a.m. to 2:00 p.m.	5:30 a.m. to 1:00 p.m.

4.2 Repair/Return Policy

Call GLI Customer Service before returning a transmitter for repair. Many problems can be diagnosed and resolved over the telephone. GLI will issue a Return Material Authorization (RMA) number for a transmitter being returned. **All returned transmitters must be freight prepaid and include:**

1. A clearly written description of the malfunction.
2. Name of person to contact and the phone number where they can be reached.
3. Proper return address to ship transmitter back. Include preferred shipping method (UPS, Federal Express, etc.) if applicable.
4. A purchase order if transmitter(s) is out of warranty to cover costs of repair.

☞ ***NOTE:*** *If the transmitter is damaged during return shipment because of inadequate packaging, the customer is responsible for any resulting repair costs. (**Recommendation:** Use the original GLI shipping carton or an equivalent.)*

Also, GLI will not accept transmitters returned for repair or replacement unless they are thoroughly cleaned and all process material is removed.

CLARIFIED WATER TURBIDIMETER

LEFT BLANK

THE NEW

1720E

experience + accuracy + simplicity

What can the unsurpassed

WORLD LEADER IN TURBIDITY

measurement do for you?

The 1720E TURBIDIMETER

is the newest in a long line of successful Hach turbidimeters from the unsurpassed world leader in turbidity measurement.

HACH®

Be Right™

THE NEW

1720E

experience + accuracy + simplicity

EXPERIENCE

The Model 1720E Low Range Turbidimeter reflects an astounding 45 years of Hach leadership in turbidity measurement science. Metropolitan water treatment systems, rural water utilities, wastewater treatment plants large and small, and industrial processes of every kind - all have relied on Hach turbidimeters for nearly five decades. In fact, Hach has the largest turbidimeter installation base in the world.

Operators and engineers alike know they can count on the performance of Hach turbidimeters and calibration standards as well as the experienced Hach personnel designing, manufacturing, selling, installing, and supporting these systems. Additionally, Hach offers a 2-year warranty on the 1720E, compared to the 1-year warranty offered with many other turbidimeters on the market. Hach is not only the world's turbidity leader, but also your partner in turbidity measurement, filtration management, and treatment process optimization solutions.

ACCURACY

Now, the 1720E Turbidimeter combines Hach's proven design, demonstrated accuracy and reliability, plus innovative elements that add more power and utility to your low-level turbidity monitoring program:

> Built-in bubble removal system - eliminates falsely high readings at low levels

> Sensitivity - fast response to fine changes in low-level turbidity

> Repeatability -not effected by sample flow and pressure

SIMPLICITY

> Simplified two-module design - sensor and controller interface with simple plug & play connection

> Reduced instrumentation - controller accepts two sensors; adding a second 1720E sensor unit gives you two complete turbidimeters

> Easy, calibration and verification - with no interruption in sample flow

THE BEST TOOL FOR EFFLUENT MONITORING REQUIREMEN

PRINCIPLE OF OPERATION

NEPHELOMETRIC MEASUREMENT

Incandescent light directed from the sensor head assembly down into the turbidimeter body is scattered by suspended particles in the sample. The sensor's submerged photocell detects light scattered at 90° from the incident beam.

SAMPLE FLOW PATH

Sample enters the center column of the turbidimeter, rises into the measuring chamber and spills over the weir into the drain port. This configuration results in an optically flat surface free of turbulence.

SIMPLIFIED CALIBRATION

One-point calibration with prepared StablCal™ Stabilized Formazin Solution eliminates the errors of formazin suspension dilution, takes less than two minutes per sensor, and is a USEPA-accepted method.

BUILT-IN BUBBLE REMOVAL

Continuously flowing sample flows through the patented* bubble removal system, which vents entrained air from the sample stream and eliminates the most significant interference in low-level turbidity measurement. The built-in bubble removal system is immune to changes in sample flow and pressure.

COMPLIANT DESIGN

The 1720E Low Range Turbidimeter applies the instrument design and meets performance criteria established by the U.S. Environmental Protection Agency (USEPA) in Method 180.1, making it suitable for regulatory reporting.

*U.S. patent 5,831,727

SIMPLE RELIABLE CALIBRATION TOOLS

ICE-PIC VERIFICATION MODULE

The ICE-PIC Module is a newer, faster way to calibrate and check the performance of Hach 1720 series turbidimeters. The benefits of using the ICE-PIC Module include:

- > Saves time - verify performance in less than one minute
- > Accurate - factory calibrated, with a certificate of accuracy provided
- > Cost effective - a one-time investment, with no consumables
- > Small and lightweight - great for spot verification around the facility
- > Available in 20 and 1.0 NTU

TS!

STABLCAL® STABILIZED FORMAZIN PRIMARY STANDARDS

- > Disposable and non-toxic
- > Avoid preparation and dilution of formazin standards with StablCal standards
- > Can be used to calibrate any turbidimeter
- > Guaranteed shelf life of two years
- > Low level certified standards available in 1 L or 3.78 L (1 Gallon)
- > Low level standards range from 0.06 to 1 NTU

POWERFUL DATA MANAGEMENT AND COMMUNICATIONS

DATA COLLECTION AND DISPLAY

The 1720E Turbidimeter sc100 Controller receives data from one or two sensors. Its built-in data logger collects turbidity measurements at user selectable intervals (1-15 minutes), along with calibration and verification points, alarm history, and instrument setup changes for 6 months. Local display, recall, graphing, and trending in CSV format make chart recorders redundant.

DIRECT DIGITAL COMMUNICATION

This revolutionary smart controller is a new standard for Hach instruments. Not only will it accept a rapidly increasing number of Hach anaylytical tools; but it will reduce your operator training load as a wide variety of instruments will share the same interface and control method.

The sc100 Controller also offers optional DigitalDirect solutions for direct measurement from sensor to control room - no analog/digital conversion. Choose from MODBUS® /RS485, MODBUS/RS232, LonWorks protocols, or the wireless IR port.

MORE OUTPUT FEATURES

Meet your specific application needs with even more data management and communication features:

- > Two analog outputs; three set-point alarms
- > Wireless IR port communication
- > Compatibility with existing AquaTrend® Networks
- > Data is downloadable in user-selected time intervals; stores up to 6 months of data

THE LARGEST SURFACE WATER TREATMENT PLANT

in the world has been using Hach process turbidimeters for years.

The city of Chicago has two plants that currently have more than 300 Hach 1720D turbidimeters installed to meet the high volume demand and NPDWR regulatory rules. Why Hach? According to John Spatz, the Bureau of Water Supply Deputy Commissioner, the instruments have proven to be "very accurate and dependable."

The facility has found that the 1720D turbidimeters need very little maintenance and are easy to operate. Spatz says they rarely refer back to the manual once the instrument is installed. "The instruments are very user-friendly" according to Spatz. He also likes the idea of having data back-up in the unit, in case the SCADA system is not operational.

During the purchasing research, the city looked at several turbidimeters, then chose Hach because the 1720D best fit the facilities' needs. The plants also use several Hach bench-top turbidimeters.

HACH®

Be Right™

1720E SPECIFICATIONS*

Range	0.001-100 Nephelometric Turbidity Units (NTU)
Accuracy**	± 2% of reading or ± 0.015 NTU (whichever is greater) from 0 to 10 NTU; ± 5% of reading from 10 to 40 NTU; ± 10% of reading from 40 to 100 NTU
Displayed Resolution	0.0001 NTU from 0 to 9.9999 NTU; 0.001 NTU from 10.000 to 99.999 NTU
Repeatability**	Better than ± 1.0% of reading or ± 0.002 NTU, whichever is greater
Response Time	For a full-scale step change, initial response in 1 minute, 15 seconds
Signal Average Time	User Selectable ranging from 6, 30, 60, 90 seconds; user default 30 seconds
Sample Flow Required	200 to 750 mL/minute (3.1 to 11.9 gal/hour)
Storage Temperature	-20 to +60° C (-4 to 140° F)
Operating Temperature	0 to 50° C (32 to 122° F) for single sensor system, 0 to 40° C (32 to 104° F) for two sensor system
Operating Humidity	5 to 95% non-condensing
Sample Temperature	0 to 50° C (32 to 122° F)
Recorder Outputs	Two selectable for 0-20 mA or 4-20 mA. Output span programmable over any portion of the 0-100 NTU range; built into the sc100 Controller
Alarms	Three set-point alarms, each equipped with an SPDT relay with unpowered contacts rated 5A resistive load at 230 VAC; built into the sc100 Controller
Power Requirements	100-230 VAC, 50/60 Hz, auto selecting; 40 VA
Sample Inlet Fitting	1/4" NPT female, 1/4" compression fitting (provided)
Drain Fitting	1/2" NPT female, 1/2" hose barb (provided)
Enclosures	NEMA-4X/IP66 Controller
Digital Communications	Network card compatible; MODBUS/RS485, MODBUS/RS232, LonWorks® protocol (optional)
Wireless Communication	IR Port on the sc100 Controller to download into a handheld Personal Digital Assistant (PDA) or laptop computer via MODBUS
Compliance	Standard Methods 2130B, USEPA 180.1, Hach Method 8195
Certification	
Safety:	Listed by ETL to UL 61010A-1: Certified by ETL to CSA C22.2 No. 1010.1: CE certified by Hach Company to EN 61010-1
Immunity:	CE certified by Hach Company to EN61326 (industrial levels)
Emissions	
Class A:	EN 61326, CISPR 11, FCC Part 15, Canadian Interference-Causing Equipment Regulation ICES-003
Dimensions	Turbidimeter Body and Cap: 10 x 12 x 16 inches (25.4 x 30.5 x 40.6 cm) sc100 Controller: 5.67 x 5.67 x 5.91 inches (14.4 X 14.4 X 15.0 cm)
Mounting	Turbidimeter Body and Head Assembly: wall and floor stand sc100 Controller: wall, pole, panel, and floor stand
Shipping Weight	1720E Turbidimeter and sc100 Controller: 13.5 lbs. (6.12 kg) 1720E Turbidimeter: 10 lbs. (4.54 kg)

* Subject to change without notice.

** Defined according to ISO 15839.

Typical Proposal Specifications: 1720E Low Range Turbidimeter

GENERAL

The turbidity monitoring system shall include at least one Turbidimeter and one interface unit. The system shall be capable of functioning as a single sensor system and also be easily expanded up to two turbidimeters per interface unit. The connections between the turbidimeter and interface unit will include plug & play connections.

TURBIDIMETER

The turbidimeter shall measure turbidity in the range of 0.001-100 NTU and be a microprocessor-based, continuous-reading, on-line nephelometric instrument meeting all design and performance criteria specified by USEPA method 180.1. Light shall be directed through the surface of the sample and the detector shall be immersed in the sample, eliminating glass windows and flow cells. Optical components shall be mounted in a sealed head assembly that can be removed easily for calibration/service, without disturbing sample flow. The turbidimeter body shall be constructed of corrosion-resistant polystyrene, and shall include an internal bubble removal system to vent entrained air from the sample stream. The turbidimeter shall offer the choice of formazin-based (20 or 1 NTU) or instrument comparison-based calibration methods. Accuracy shall be ± 2% of reading or ± 0.015 NTU (whichever is greater) from 0 to 10 NTU; ± 5% of reading from 10 to 40 NTU; ± 10% of reading from 40 to 100 NTU. Displayed resolution shall be 0.0001 NTU from 0 to 9.9999 NTU; 0.001 NTU from 10.000 to 99.999 NTU and repeatability shall be better than ± 1.0% of reading or ± 0.002 NTU (whichever is greater). User selectable signal averaging, bubble removal, alarm and recorder output hold, and self-test diagnostics shall be provided. All turbidimeters on the network shall have the option for MODBUS/RS232, MODBUS/RS485, LonWorks serial input/output capability for two-way communication to a computer or have wireless downloading capability through the IR Port located on the interface unit to download and print real-time turbidity data, calibration history, and current set points in a CSV format.

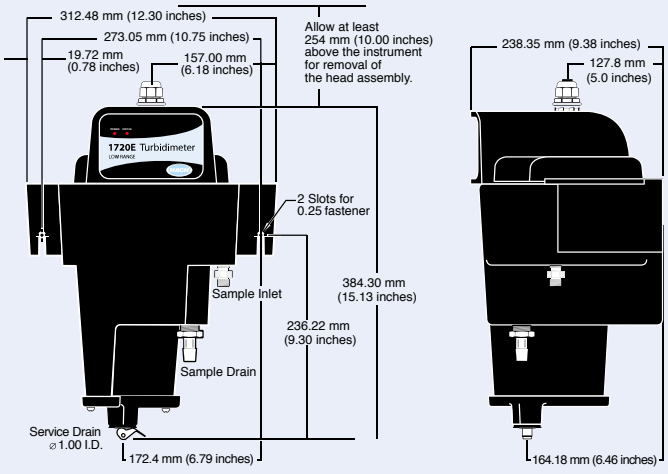
INTERFACE MODULE

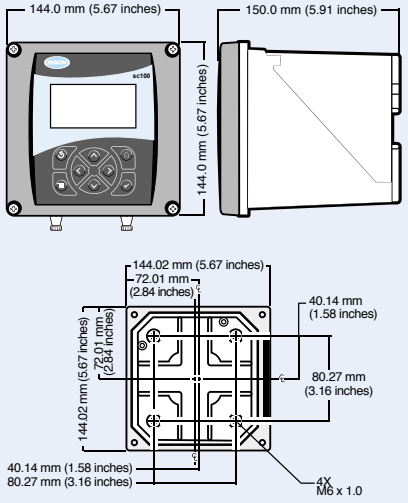
The Interface unit shall allow operators to control sensor and interface functions with user-friendly, menu-driven software, and shall provide data logging of measurement data from up to two turbidimeters for 15 minutes, 1 hour, 24 hours, 30 days, or 180 days and the capability to transfer data to a computer or printer via direct MODBUS communications or directly into a Personal Digital Assistant (PDA) via a wireless IR Port. The interface unit will also have a built-in data logger with the storage capacity to store data on 15-minute intervals for up to 6 months with two sensors per controller. Each interface will also include two analog outputs and 3 un-powered SPDT alarm contacts. The interface unit and the DC power supply shall be housed in a NEMA-4X (indoor) industrial metal/plastic enclosure, and the power supply shall automatically accept input in the range of 100 to 230 Vac, 50/60 Hz.

SAFETY AND ELECTRICAL DESIGN STANDARDS

All system components are ETL listed to UL 61010A-1, certified by ETL to CSA C22.2 No. 1010.1, and CE certified by manufacturer for safety to EN 61010-1. For EMC immunity and emissions, system components are CE certified by manufacturer to EN 61326 (industrial levels), for North America to FCC Part 15, and Canadian Interference-Causing Equipment Regulation ICES-003, and for rest of world to CISPR 11 Class A levels.

INSTALLATION





HOW TO ORDER

60101-00	1720E Turbidimeter with sc100 Controller
60101-01	1720E Turbidimeter, Sensor Only

1720E with DigitalDirect communications

60101-02	1720E/sc100 with MODBUS/RS485 output
60101-03	1720E/sc100 with MODBUS/RS232 output
60101-04	1720E/sc100 with LonWorks output

CABLES*

57960-00	25 ft. (7.7 M) Extension Cable
46306-00	Power Cord with Strain Relief (125 VAC)
46308-00	Power Cord with Strain Relief (230 VAC), European Style Plug

*Note: Power cables must be ordered separately.

OPTIONAL ACCESSORIES
ICE-PIC Verification Module/1720E:

52250-00	20 NTU
52215-00	1 NTU

STABLCAL COMPARATIVE CALIBRATION STANDARDS (for 1720E, 1720D, and 1720C Turbidimeters)***

26601-53	20.0 NTU, 1 L each

*** Note: Calibration Cylinder must be ordered separately.

STABLCAL VERIFICATION STANDARDS

26598-53	1.0 NTU, 1 L each
27463-53	40.0 NTU, 1 L each
26979-53	0.3 NTU, 1 L each
26980-53	0.5 NTU, 1 L each
27233-53	0.1 NTU, 1 L each

FORMAZIN CALIBRATION STANDARDS

44156-00	Formazin Calibration Kit for user-prepared calibration includes 4000 NTU Formazin, (500 mL), TenSette® Pipet, and Calibration Cylinder
2461-49	Formazin Primary Standard, 4000 NTU, 500 mL, replacement for kit #44156-00
44153-000	Calibration Cylinder, 1L
57432-00	Floor Stand

Lit. No. 2446
J35 Printed in U.S.A.

At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water – it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

For current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area.

In the United States, contact:

HACH Company
World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 800-227-4224
Fax: 970-669-2932
E-mail: orders@hach.com
Website: www.hach.com

U.S. exporters and customers in Canada, Latin America, sub-Saharan Africa, Asia, and Australia/New Zealand, contact:

HACH Company
World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 970-669-3050
Fax: 970-461-3939
E-mail: intl@hach.com
Website: www.hach.com

In Europe, the Middle East, and Mediterranean Africa, contact:

HACH + LANGE Europe
Dr. Bruno Lange GmbH & Co. KG
Willstätterstraße 11
D-40549 Düsseldorf
GERMANY
Telephone: +49 (0) 211-5288-0
Fax: +49 (0) 211-5288-143
E-mail: kundenservice@drlange.de
www.drlange.com

HACH®

Be Right™

sc100 Controller

The Model sc100 Controller receives data from one or two sensors. Its plug-and-play, mix-and-match operation lets it fit into any facility or workflow. Digital communication with any Hach digital sensor or probe is simple and reliable.

Features and Benefits

One Controller for One or Two Sensors

The Hach sc100 Controller receives data from up to two sensors. Use any of Hach's line of digital sensors for pH/ORP, conductivity, dissolved oxygen, or turbidity.

One Controller for One or Two Parameters

Not only can the sc100 controller be used for up to two sensors, but the sensors need not be the same. Mix and match any combination of parameters.

One Controller for Many Options

Communications using RS485/MODBUS® or RS232/MODBUS® protocols or the wireless infrared port are available. (Contact your Hach representative for other communication protocols.) Multiple control functions include built-in PID, control contacts, and alarm functions.

"Plug and Play" Operation

There's no complicated wiring or set up procedures with the sc100 controller. Just plug the sensor in and it's ready for use without special ordering or software configuration.

Simple, Reliable Data Collection

A built-in data logger collects measurement at user selectable intervals (1 to 15 minutes), together with calibration and verification points, alarm history, and instrument setup changes for up to 6 months. With a two-year warranty, the Hach sc100 Controller is built to last.

DW = drinking water WW = wastewater municipal PW = pure water / power
IW = industrial water E = environmental C = collections FB = food and beverage

HACH®

Be Right™

Specifications*

Ambient Conditions

Operation
With less than 7 W sensor load:
-20 to 60° C (-4 to 140° F); 0 to 95% relative humidity, non-condensing

With less than 25 W sensor load:
-20 to 40° C (-4 to 104° F); 0 to 95% relative humidity, non-condensing

Storage
-20 to 70° C (-4 to 158° F); 0 to 95% relative humidity, non-condensing

Power Requirements

100 to 230 Vac, 50/60 Hz; Power: 11W with 7W sensor load; 35W with 25W sensor load

Display

Graphic dot matrix LCD, 128 x 64 pixels with LED backlighting

Relays

Three SPDT, user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum

Outputs

Two analog 4-20 mA, maximum impedance 500 Ohms, optional digital network connection

Control

PID, High/low phasing, setpoint, deadband, overfeed timer, off delay, and on delay

Alarms

Low alarm point, low alarm point deadband, high alarm point, high alarm point deadband, off delay, and on delay

Communication (Optional)

RS-232 (MODBUS®): Configure and retrieve measured data for one analyzer using IBM-compatible PC

RS-485 (MODBUS®): Advanced communications/networking with PLC or SCADA system directly from analyzer.

Memory Backup

All user settings are retained indefinitely in memory (non-volatile) (EEPROM)

Mounting Configurations

Surface, panel, and pipe (horizontal and vertical)

Enclosure

NEMA 4X/IP66; metal enclosure with corrosion-resistant finish

Dimensions

1/2 DIN; 144 x 144 x 150 mm (5.7 x 5.7 x 5.9 in.)

Weight

1.6 kg (3.5 lbs.)

Certifications

ETL to UL 61010A-1 and CSA C22.2 No. 1010.1

**Specifications subject to change without notice.*

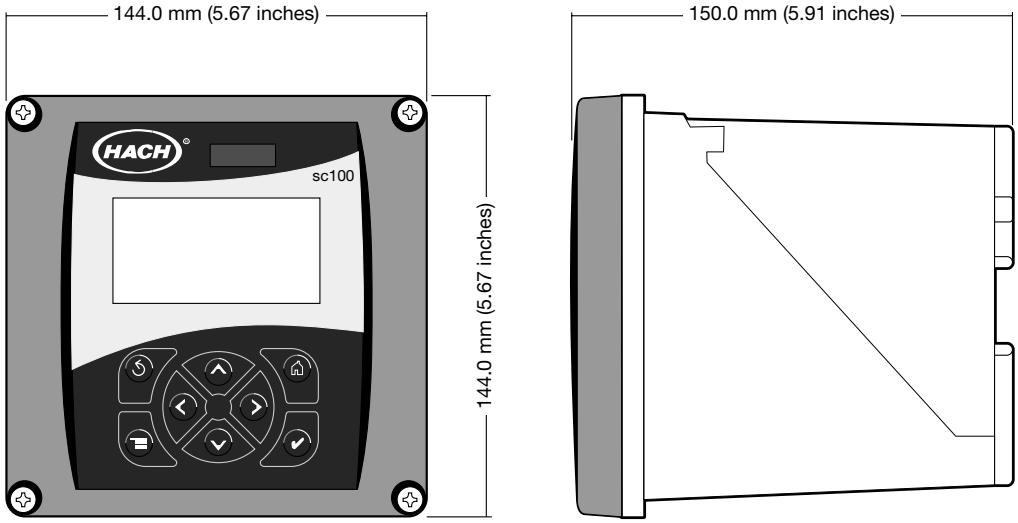
Engineering Specifications

1. The controller shall be a microprocessor-based instrument.
2. Connections between the sensors and the controller shall be “plug and play.”
3. The controller shall have the option for RS232/MODBUS® or RS485/MODBUS® serial input/output capability for two-way communication to a computer and have wireless downloading capability through an IR Port located on the interface unit to download and print realtime data, calibration history, and current set points in a CSV format.
4. The Interface unit shall allow operators to control sensor and interface functions with menu-driven software.
5. The interface unit shall have a built-in data logger with the capacity to store data on 15-minute intervals for up to 6 months with two sensors per controller.
5. The interface unit shall include two analog 4-20 mA outputs and 3 unpowered SPDT form ‘C’ alarm contacts.
7. The interface unit shall include two independent PID control functions.
8. The interface unit shall be housed in a NEMA-4X/IP66 metal enclosure with corrosion-resistant finish.
9. The controller shall be mounted horizontal or vertical on surface, panel, or pipe.
10. The AC power supply shall be housed in the interface unit and automatically accept input in the range of 100 to 230 Vac, 50/60 Hz.
11. All system components shall be certified by ETL to UL 61010A-1, CSA C22.2 No. 1010.1.
12. The controller shall be warranted for two full years against defects in material and workmanship.
13. The controller shall be Hach Company Model sc100 Controller.

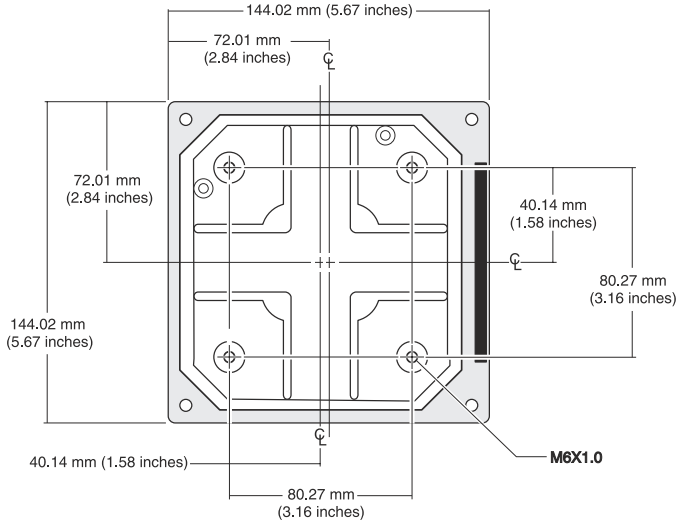
Dimensions

The sc100 controller unit can be installed on a surface, panel, or pipe (horizontally or vertically). No tools are needed to connect the controller unit to any Hach digital sensor.

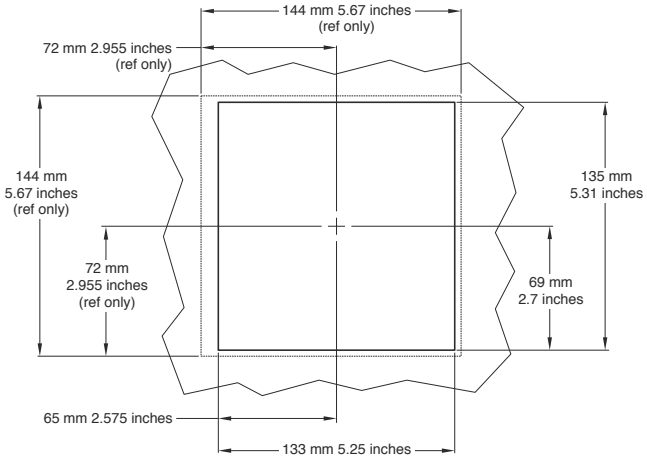
Front and Side Views



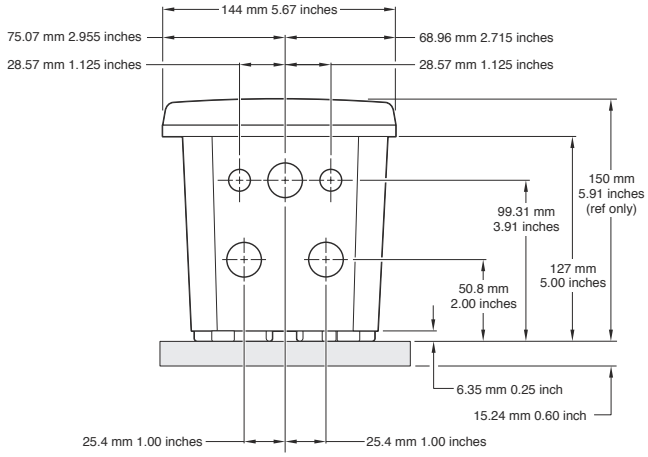
Back View



Panel Mount Cut-Out Dimensions



Conduit Hole Dimensions



Ordering Information

LXV401.52.00002 sc100 Controller Standard

LXV401.52.01002 sc100 Controller with RS-232 (MODBUS®)

LXV401.52.02002 sc100 Controller with RS-485 (MODBUS®)

Note: Power cords must be ordered separately.

Note: Other communication options are available. Please contact Hach Technical Support or your Hach representative.

Power Cords

54488-00	Power Cord with strain relief, 125 Vac
54489-00	Power Cord with strain relief, 230 Vac, European-style plug

Accessories

58690-00	Sun Shield, for controller

To complete your measurement system, choose from Hach's family of digital sensors...

Lit. No. 2463
XXXX Printed in U.S.A.

At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water—it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

For current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area.

In the United States, contact:

HACH COMPANY World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 800-227-4224
Fax: 970-669-2932
E-mail: orders@hach.com
www.hach.com

U.S. exporters and customers in Canada, Latin America, sub-Saharan Africa, Asia, and Australia/New Zealand, contact:

HACH COMPANY World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 970-669-3050
Fax: 970-461-3939
E-mail: intl@hach.com
www.hach.com

In Europe, the Middle East, and Mediterranean Africa, contact:

HACH + LANGE Europe
Dr. Bruno Lange GmbH & Co. KG
Willstätterstraße 11
D-40549 Düsseldorf
GERMANY
Tel: +49 (0) 211 5288-0
Fax: +49 (0) 211 5288-143
E-mail: kundenservice@drlange.de
www.drlange.com

HACH®

Be Right™

Catalog Number 60100-18

Hach sc100™ 1720E Analysis System

Instrument Manual

11/03 2ed

Table of Contents

Section 1 Specifications

Specifications are subject to change without notice.

Table 1 Turbidimeter Specifications

<table>
<tr><td>Method of Detection</td><td>Nephelometric light scatter at 90 degrees relative to the incident light beam. The incident light beam is composed of a tungsten filament light source with a color temperature between 2200 and 3000K.</td></tr>
<tr><td>Range</td><td>0.001–100 nephelometric turbidity units (NTU)</td></tr>
<tr><td>Accuracy</td><td>± 2% of reading or ± 0.015 NTU (whichever is greater) from 0 to 40 NTU;
± 5% of reading from 40 to 100 NTU</td></tr>
<tr><td>Linearity</td><td>Better than 1% 0–40 NTU on formazin. Allows for accurate calibration at high turbidity values. Temperature dependent ±2 °C.</td></tr>
<tr><td>Resolution (Displayed)</td><td>0.0001 NTU up to 9.9999 NTU; 0.001 NTU from 10.000 to 99.999 NTU</td></tr>
<tr><td>Repeatability</td><td>Better than ±1.0% of reading or ±0.002 NTU, whichever is greater for each range.</td></tr>
<tr><td>Response Time</td><td>For a full-scale step change, initial response in 1 minute, 15 seconds. Varies with flow rate, see the table below. The response time is also dependent on the signal averaging time, which is user selectable.
<table>
<tr><th rowspan="2">% Step Change</th><th colspan="3">Flow Rate</th></tr>
<tr><th>750</th><th>500</th><th>250</th></tr>
<tr><td>10</td><td>1¼ minutes</td><td>1½ minutes</td><td>2½ minutes</td></tr>
<tr><td>50</td><td>2 minutes</td><td>2½ minutes</td><td>6 minutes</td></tr>
<tr><td>90</td><td>3½ minutes</td><td>3½ minutes</td><td>9 minutes</td></tr>
<tr><td>99</td><td>4 minutes</td><td>5 minutes</td><td>12 minutes</td></tr>
</table></td></tr>
<tr><td>Sample Flow Required</td><td>200 to 750 mL/minute (3.2 to 11.9 gal/hour)</td></tr>
<tr><td>Sensor Storage Temperature</td><td>–20 to 60 °C (–4 to 140 °F); 95% relative humidity, non-condensing.</td></tr>
<tr><td>Operating Temperature</td><td>0 to 50 °C (32–122 °F) for single sensor system, 0 to 40 °C (32–104 °F) for two sensor system</td></tr>
<tr><td>Sample Temperature Range</td><td>0 to 50 °C (32–122 °F)</td></tr>
<tr><td>Operating Humidity</td><td>5 to 95% non-condensing</td></tr>
<tr><td>Power Requirements</td><td>12 V dc ±5%, 12.5 watts maximum</td></tr>
<tr><td>Sample Inlet Fitting</td><td>¼-inch NPT female. ¼-inch compression fitting (supplied)</td></tr>
<tr><td>Drain Fitting</td><td>½-inch NPT female, ½-inch hose barb (supplied)</td></tr>
<tr><td>Signal Average (Filter) Time</td><td>no averaging, 6, 30, 60, and 90 seconds, user selectable. Default is 30 seconds.</td></tr>
<tr><td>Sensor Dimensions</td><td>Turbidimeter body and cap: 25.4 x 30.5 x 40.6 cm (10 x 12 x 16 inches)</td></tr>
<tr><td>Sensor Cable Length</td><td>2 m (6.6 ft); Optional 7.62 m (25 ft) extension cable. Maximum cable length is 9.62 m (31.6 ft).</td></tr>
<tr><td>Sensor Cable Rating</td><td>Cable: 105 °C, 300 V, PVC jacket
Wires: 22 AWG, PVC jacket</td></tr>
<tr><td>Mounting Options</td><td>Wall; floor stand</td></tr>
<tr><td>Shipping Weight</td><td>1720E Turbidimeter and Controller: 6.31 kg (13.5 lb); 1720E Turbidimeter only: 4.71 kg (10 lb)</td></tr>
</table>

Table 1 Turbidimeter Specifications (continued)

Calibration Methods	**1.** StablCal® (stabilized formazin) – primary or wet calibration of the instrument **2.** Formazin – user-prepared primary or wet calibration of the instrument **3.** Multi-sensor calibration – Performed with a specialized calibration procedure for up to eight sensors on a single set of fresh StablCal® standards.
Verification (Wet) Method	**1.** StablCal® (stabilized formazin) – recommended for verification in the appropriate application range of measurement. For regulatory verification, standards of 0.1. 0.3. 0.5 and 1.0 NTU are available. **2.** Formazin – fresh user-prepared standard
Verification (Dry) Method	**1.** ICE-PIC™ Verification Module with factory-set values of 20.0 or 1.0 ±25%. Unique value is assigned when dry verification is done immediately after calibration and is used as pass/fail criteria for subsequent verifications.
Recommended Cleaning Intervals	**1.** Mandatory before calibration **2.** Optional before verification **3.** Mandatory upon verification failure
Languages	English (default), German, Spanish, Nederlands
Installation Environment	Indoor
Primary Compliance Method	USEPA 180.1; Hach Method 8195; ASTM D 6698; Standard Methods 2130B
Limit of Detection	0.0032 NTU (according to criteria specified by ISO 15839)

Table 2 Controller Specifications

Component Description	Microprocessor-controlled measuring unit with measured value display, temperature display (for some parameters), and menu-driven system
Controller Operating Temperature	–20 to 60 °C (–4 to 140 °F); 95% relative humidity, non-condensing with sensor load <7 W; –20 to 40 °C (–4 to 104 °F) with sensor load <25 W
Controller Storage Temperature	–20 to 70 °C (–4 to 158 °F); 95% relative humidity, non-condensing
Enclosure	NEMA 4X/IP66 metal enclosure with a corrosion-resistant finish
Power Requirements	100–230 V ac ±10%, 50/60 Hz; Power: 11 W with 7 W sensor load, 35 W with 25 W sensor load
Pollution Degree/Installation Category	II; II
Outputs	Two (Analog outputs, each selectable for 0–20mA or 4–20 mA), maximum impedance 500 ohm. Output span programmable over any portion of the 0–100 NTU range. Optional digital network connection[1]. Infrared Data Acquisition (IrDA).
Relays	Three SPDT, user-configurable contacts rated 100–230 V ac, 5 Amp resistive maximum.
Controller Dimensions	½ DIN—144 x 144 x 150 mm (5.7 x 5.7 x 5.9 inches)
Controller Weight	1.6 kg (3.5 lb)

1. See Replacement Parts and Accessories on page 55.

Section 2 General Information

2.1 Safety Information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

Use of Hazard Information
DANGER: Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation that may result in minor or moderate injury.

Note: Information that requires special emphasis.

Precautionary Labels
Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).

2.2 General Product Information

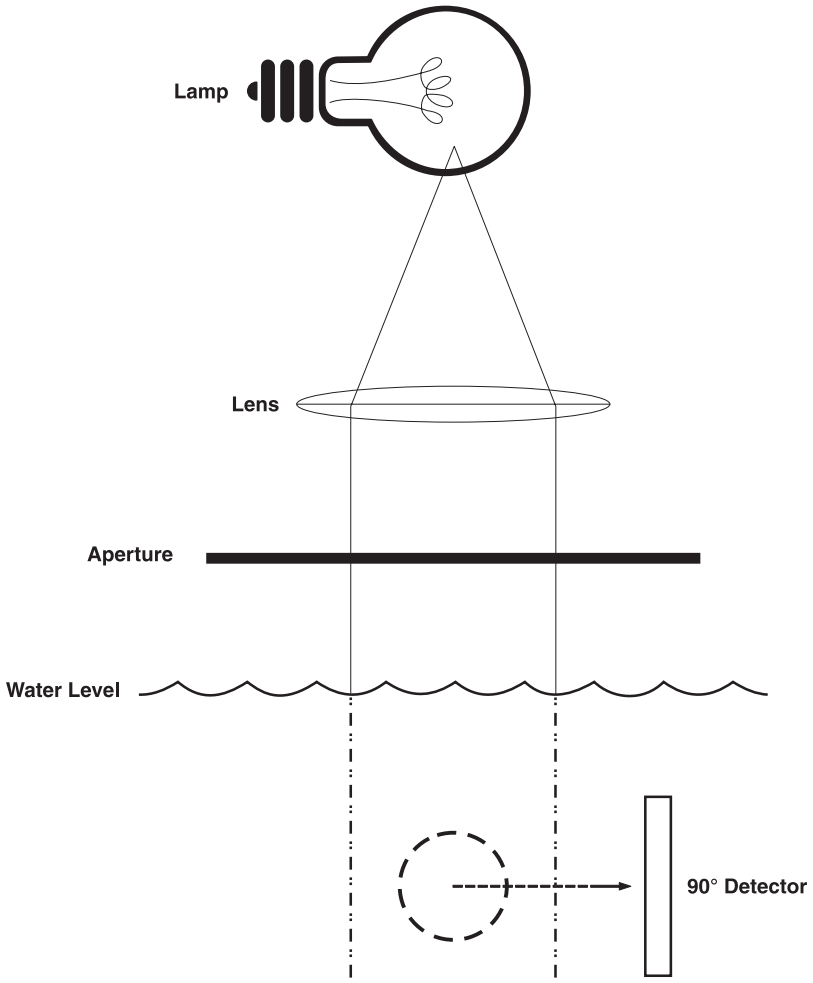
The controller enclosure is NEMA4X/IP66-rated and has a corrosion-resistant finish designed to withstand corrosive environmental constituents such as salt spray and hydrogen sulfide. The controller display shows the current turbidity reading if connected to a single sensor, or two readings when two sensors are connected.

The 1720E Turbidimeter is a continuous-reading nephelometric turbidimeter designed for low-range turbidity monitoring. This process turbidimeter is capable of measuring turbidity from 0.001 to 100.0 NTU. Calibration is based on formazin, the primary turbidity reference standard adopted by the APHA *Standard Methods for the Examination of Water and Wastewater* and the U.S. Environmental Protection Agency (EPA) and on StablCal® which is also recognized as a primary standard.

2.3 Theory of Operation

The 1720E Turbidimeter measures turbidity by directing a strong beam of collimated light from the sensor head assembly down into the sample in the turbidimeter body. Light scattered at 90° relative to the center line of incident light by suspended particles in the sample is detected by the submerged photocell (see Figure 1).

Figure 1 90 Degree Detector



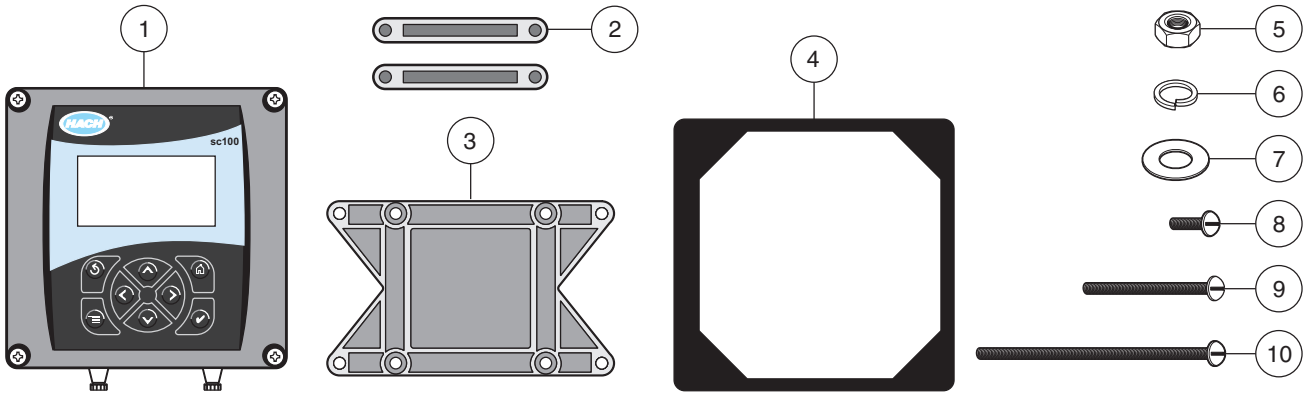
The amount of light scattered is proportional to the turbidity of the sample. If the turbidity of the sample is negligible, little light will be scattered and detected by the photocell and the turbidity reading will be low. High turbidity, on the other hand, will cause a high level of light scattering and result in a high reading.

Sample enters the turbidimeter body and flows through the baffle network of the bubble trap. The flow allows bubbles to either cling to surfaces of the baffle system or rise to the surface and vent to atmosphere. After traveling through the bubble trap, sample enters the center column of the turbidimeter body, rises into the measuring chamber and spills over the weir into the drain port. A reading is taken once per second.

Section 3 Installation

DANGER
Only qualified personnel should conduct the installation tasks described in this section of the manual. The 1720E/sc100 product configuration is not intended for installation in hazardous locations.

Figure 2 Controller Mounting Components



1. Controller	**6.** Lock washer, ¼-inch I.D. (4), Cat. No. 8H1336
2. Mounting foot for panel mounting (2), Cat. No. 1000B4F3222	**7.** Flat washer, ¼-inch I.D. (4), Cat. No. 8H1346
3. Bracket for panel and pipe mounting, Cat. No. 1000C4F3217-101	**8.** Pan head screws (4), M6 x 1.0 x 20 mm, Cat. No. 58674-00
4. Gasket for panel mounting, rubber, Cat. No. 1000A4F3249-101	**9.** Pan head screws (4), M6 x 1.0 x 100 mm, Cat. No. 5867500
5. Hex nut, M6 (4), Cat. No. 5867300	**10.** Pan head screws (4), M6 x 1.0 x 150 mm, Cat. No. 5867600

Table 3 Customer-supplied Items

Item
14-AWG wire for electrical power connections in conduit or if allowed by local electrical codes, 115 or 230 V ac power cord plus a NEMA 4X-rated strain relief
High-quality, shielded instrumentation cable for connecting the analog outputs plus a NEMA 4X-rated strain relief
Mounting hardware for the sensor
Sun shield for mounting configurations where the sun strikes the front of the display (available from the manufacturer, order separately). See Figure 8 on page 11.
Common hand tools

3.1 Mechanical Installation

Install in an environment that is protected from corrosive fluids. The sensor is adversely affected by ClO_2. Install the sensor in an area well ventilated from any corrosive liquids or gasses.

3.1.1 Controller Dimension Illustrations

Figure 3 Controller Dimensions

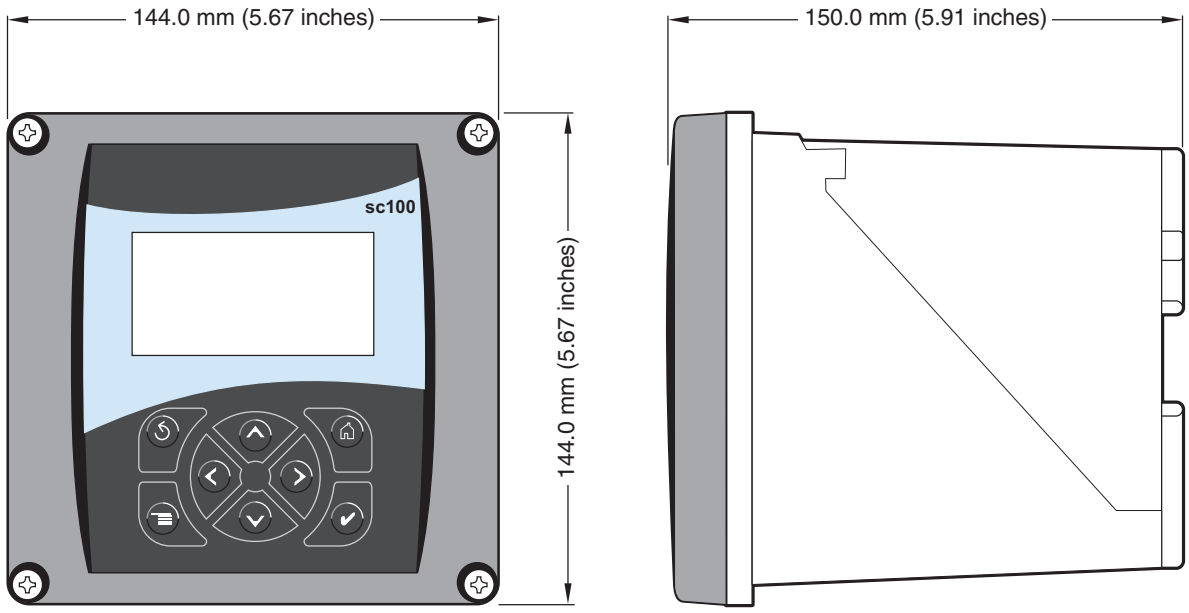


Figure 4 Controller Mounting Dimensions

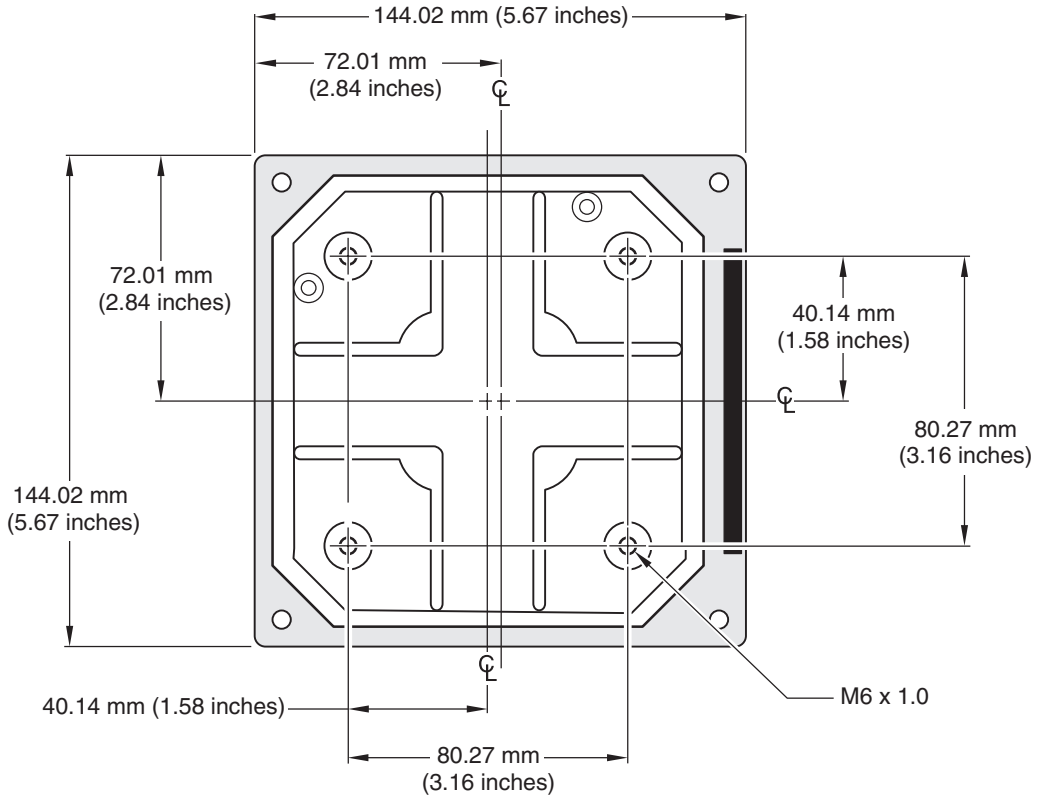


Figure 5 Panel Mount Cut-out Dimensions

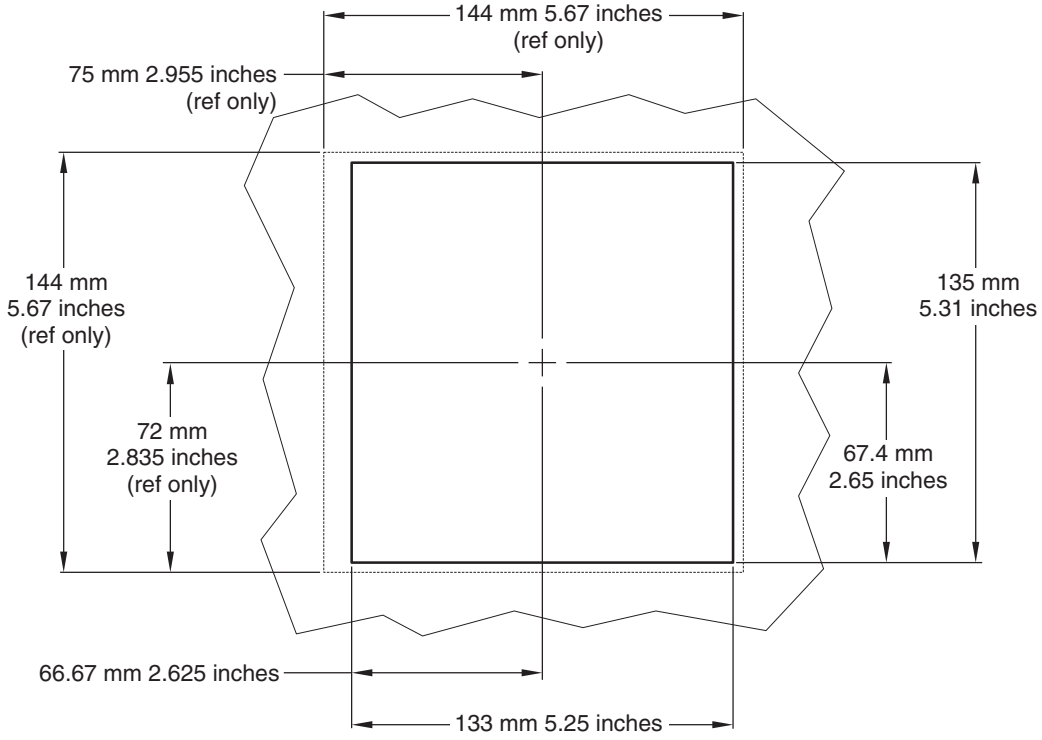
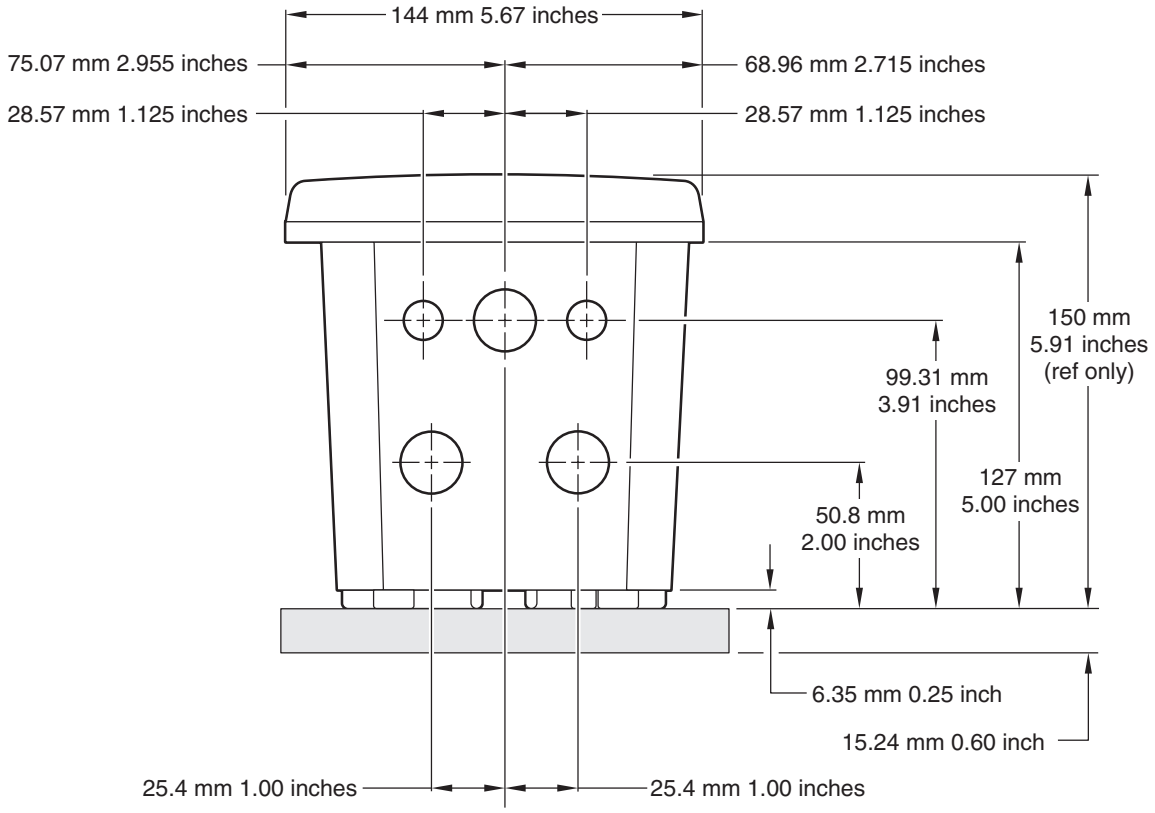


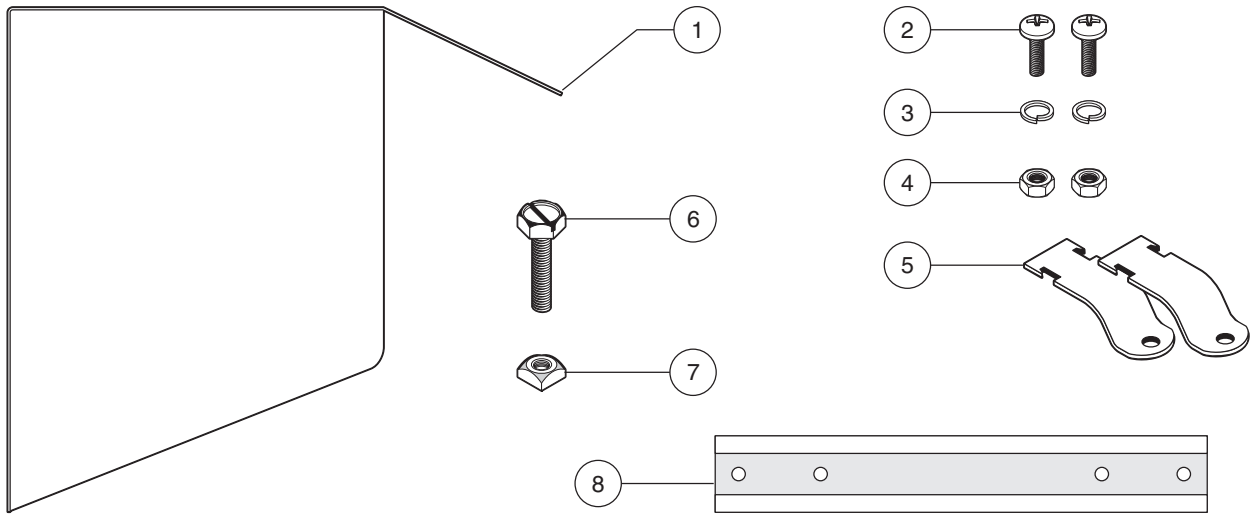
Figure 6 Conduit Hole Dimensions



3.1.2 Using the Optional Sun Shield

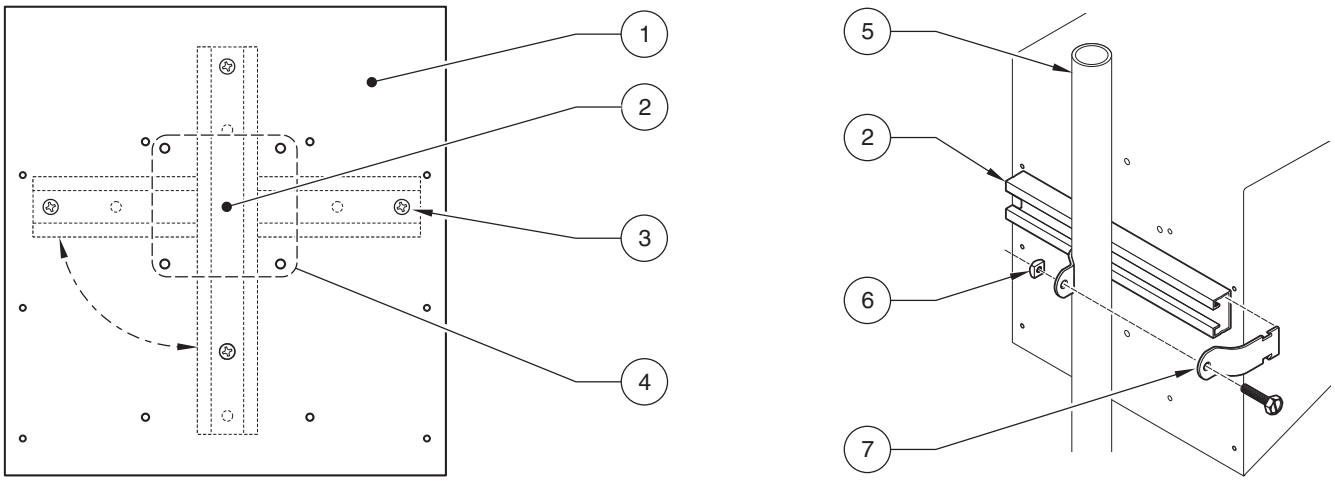
The optional sun shield was designed to increase the readability of the display by screening it from direct sunlight. See Replacement Parts and Accessories on page 55 for ordering information.

Figure 7 Sun Shield Kit Components



1.	Sun shield	**5.**	Pipe mounting brackets (2), includes items 6 and 7, Cat. No. 9H1079
2.	Pan head screws, M6 x 1.0 x 12 mm (6), Cat. No. 200-1025	**6.**	Hex/slotted head screw, 5/16-inch x 1.0-inch (supplied with item number 5)
3.	Lock washers, ¼-inch I.D. (2), Cat. No. 8H1336	**7.**	Square nut, 5/16-inch (supplied with item number 5)
4.	Hex nuts, M6 x 1.0 (2), Cat. No. 5867300	**8.**	Uni-strut, 27 cm (10.5 inch) length, Cat. No. 276F1227

Figure 8 Mounting the Controller in the Sun Shield

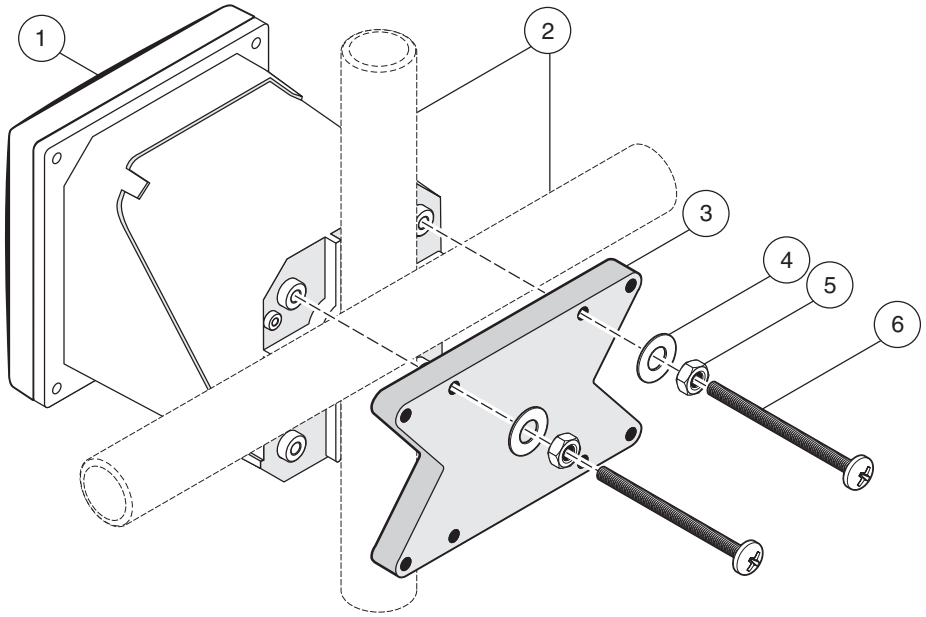


1.	Sun shield	**4.**	Hole pattern for mounting controller	**7.**	Slide mounting brackets into the uni-strut as shown. Place the mounting brackets around the pipe and fasten the hardware.
2.	Uni-strut (rotate 90° as required)	**5.**	Pipe (vertical or horizontal as required)		
3.	Pan head screw, lock washer (2 each)	**6.**	Hex/slotted head screw and square nut		

3.1.3 Mounting the Controller

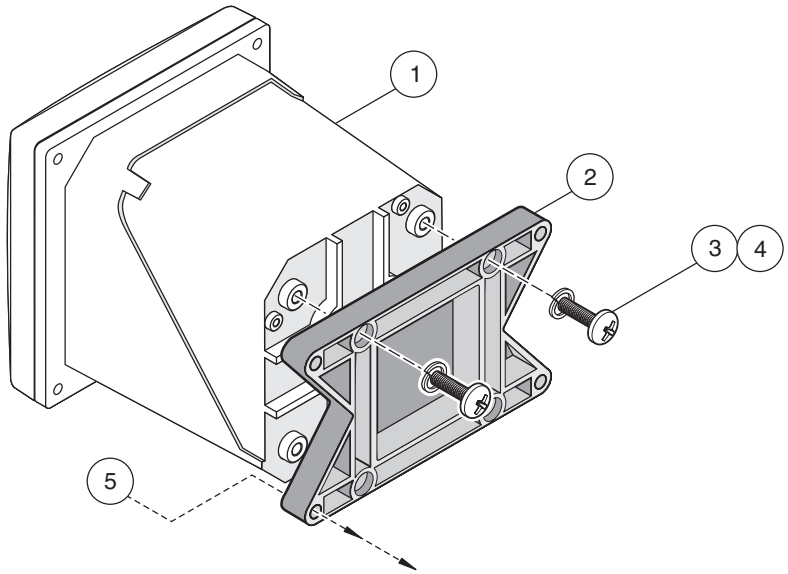
Attach the controller to a rail or wall or mount it in a panel. Supplied mounting hardware is shown in Figure 9, Figure 10, and Figure 11.

Figure 9 Vertical or Horizontal Pipe Mounting the Controller



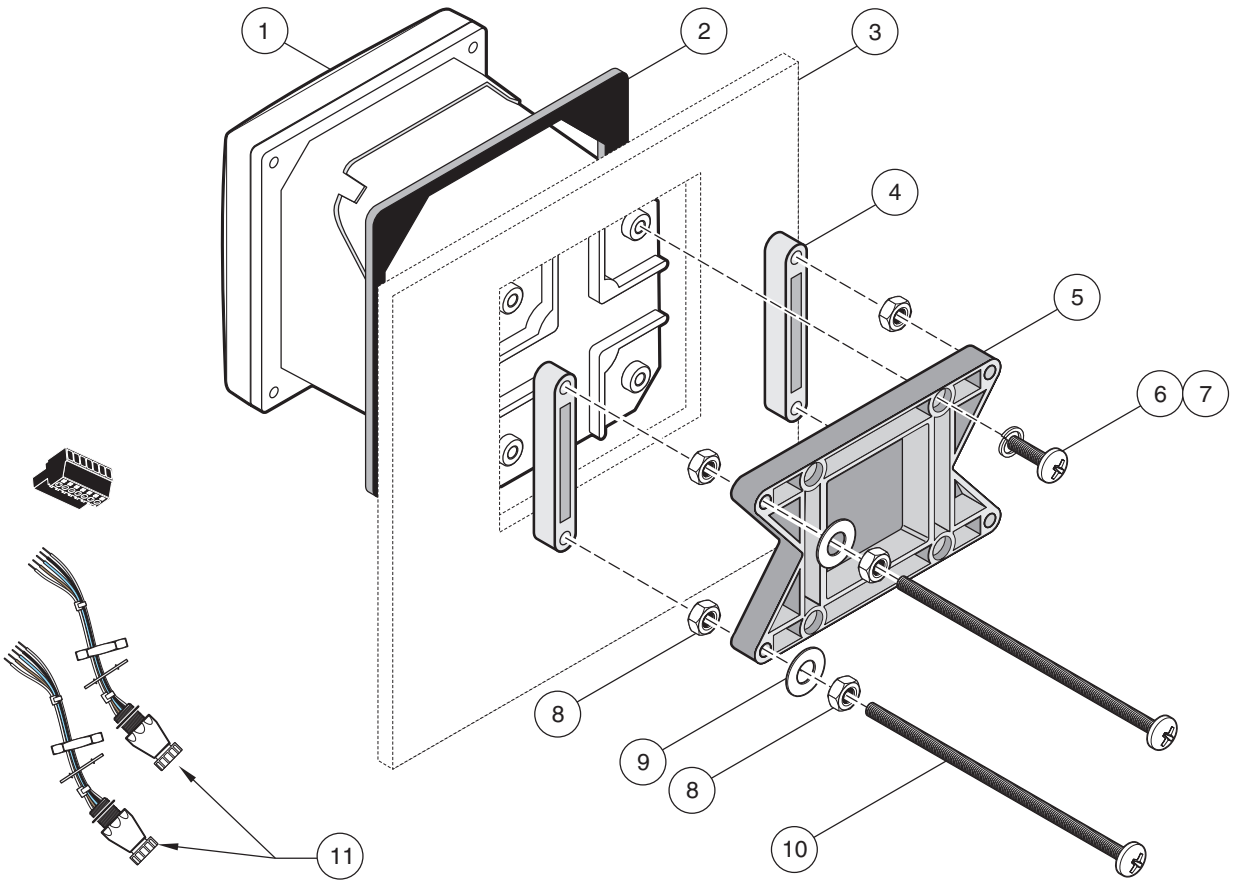
1.	Controller	**4.**	Flat washer, ¼-inch I.D. (4), Cat. No. 8H1346
2.	Pipe (vertical or horizontal)	**5.**	Hex nut, M6 (4), Cat. No. 5867300
3.	Bracket, pipe mounting, Cat. No. 1000C4F3217-101	**6.**	Pan head screw, M6 x 1.0 x 100 mm (4), Cat. No. 5867400

Figure 10 Wall Mounting the Controller



1.	Controller	**4.**	Pan head screw, M6 x 1.0 x 20 mm (4), Cat. No. 5867400
2.	Bracket, Cat. No. 1000C4F3217-101	**5.**	Customer-supplied hardware for wall mounting
3.	Lock washer, ¼-inch I.D., Cat. No. 8H1336		

Figure 11 Panel Mounting the Controller



1.	Controller	**7.**	Lock washer, ¼-inch I.D., (4) Cat. No. 8H1336
2.	Gasket, rubber, panel mount, Cat. No. 1000A4F3249-101	**8.**	Hex nut (4), Cat. No. 5867300
3.	Panel (maximum thickness is 9.5 mm (3/8 inch))	**9.**	Flat washer (4), Cat. No. 8H1346
4.	Mounting Foot (2), Cat. No. 1000B4F3222	**10.**	Pan head screw, M6 x 1.0 x 150 mm (4), Cat. No. 5867600
5.	Mounting bracket, controller, Cat. No. 1000C4F3217-101	**11.**	It may be necessary to remove the sensor connectors. See procedure below.
6.	Pan head screw (4), Cat. No. 5867400		

To remove the sensor connectors before inserting the controller enclosure into the panel cut-out:

1. Disconnect power to the controller.

1. Disconnect the wires at terminal block J5, see Figure 21 on page 21.

2. Loosen and remove the nut securing the sensor connector inside the enclosure. Remove the sensor connector and wires. Repeat step 1 and 2 for the other sensor connector.

3. After the controller is in place in the panel, reinstall the sensor connectors and reconnect the wiring to terminal J5 as shown in Figure 21 on page 21.

3.2 Electrical Installation

DANGER
The instrument must be installed by qualified technical personnel for adherence to all applicable electrical codes. The 1720E/sc100 product configuration is not intended for installation in hazardous locations.

High-voltage wiring for the controller is conducted behind the high voltage barrier in the controller enclosure. The barrier must remain in place unless a qualified installation technician is installing wiring for power, alarms, or relays. See Figure 12 for barrier removal information.

3.2.1 Installation in Conduit

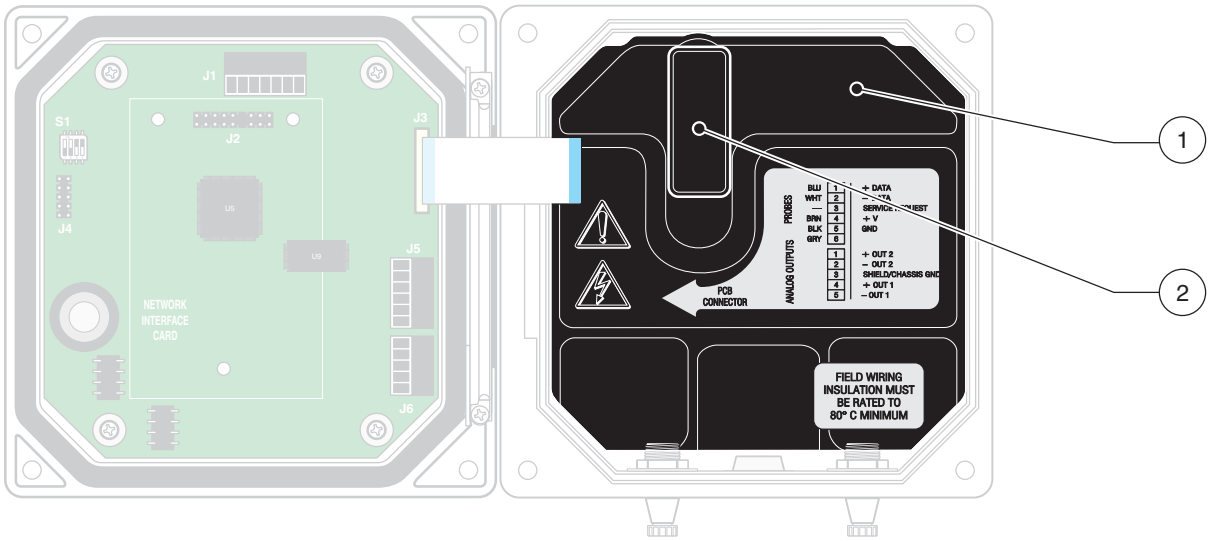
In hard-wired electrical applications, the power and safety ground service drops for the instrument must be 18 to 12 AWG. See Figure 13 on page 15 for strain relief and conduit opening sealing plug information. See section 3.2.3 on page 15 for wiring information.

3.2.2 Installation Using a Power Cord

DANGER
Use of power cords is not permitted in hazardous locations.

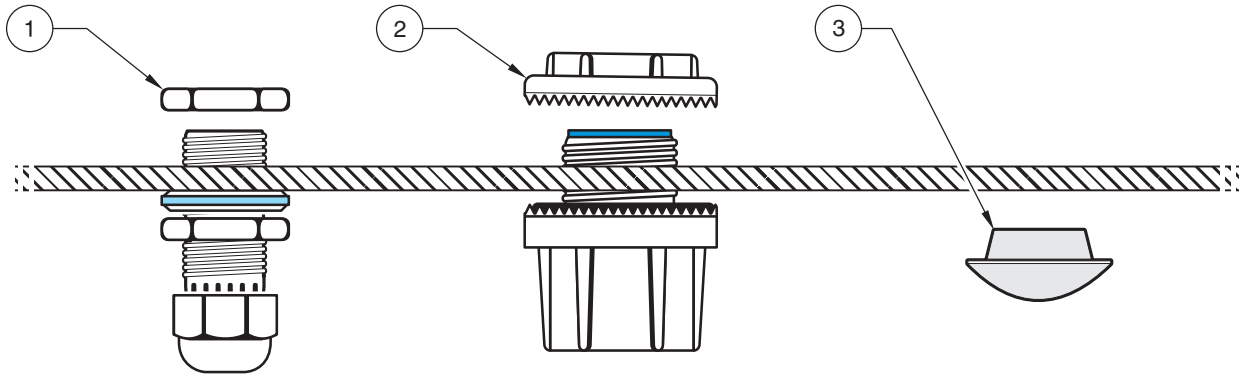
Where permitted by local electrical codes, a sealing-type strain relief to maintain the NEMA 4X/IP66 environmental rating and a power cord less than 3 meters (10 feet) in length with three 18-gauge conductors (including a safety ground wire) can be used, see Replacement Parts and Accessories on page 55. See Figure 13 on page 15 for strain relief and conduit opening sealing plug assembly. See section 3.2.3 on page 15 for wiring information.

Figure 12 Removing Voltage Barrier



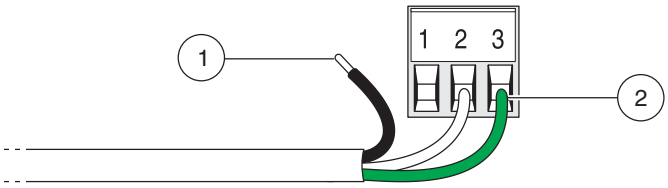
1. High voltage barrier	**2.** Unsnap the barrier latch then pull out to remove the barrier.

Figure 13 Using the Optional Strain Relief and Conduit Plug



1. Power cord strain relief	**2.** Conduit strain relief	**3.** Conduit opening sealing plug

Figure 14 Proper Wire Preparation and Insertion



1. Strip ¼-inch of insulation.	**2.** Seat insulation against connector with no bare wire exposed.

3.2.3 Wiring for Power at the Controller

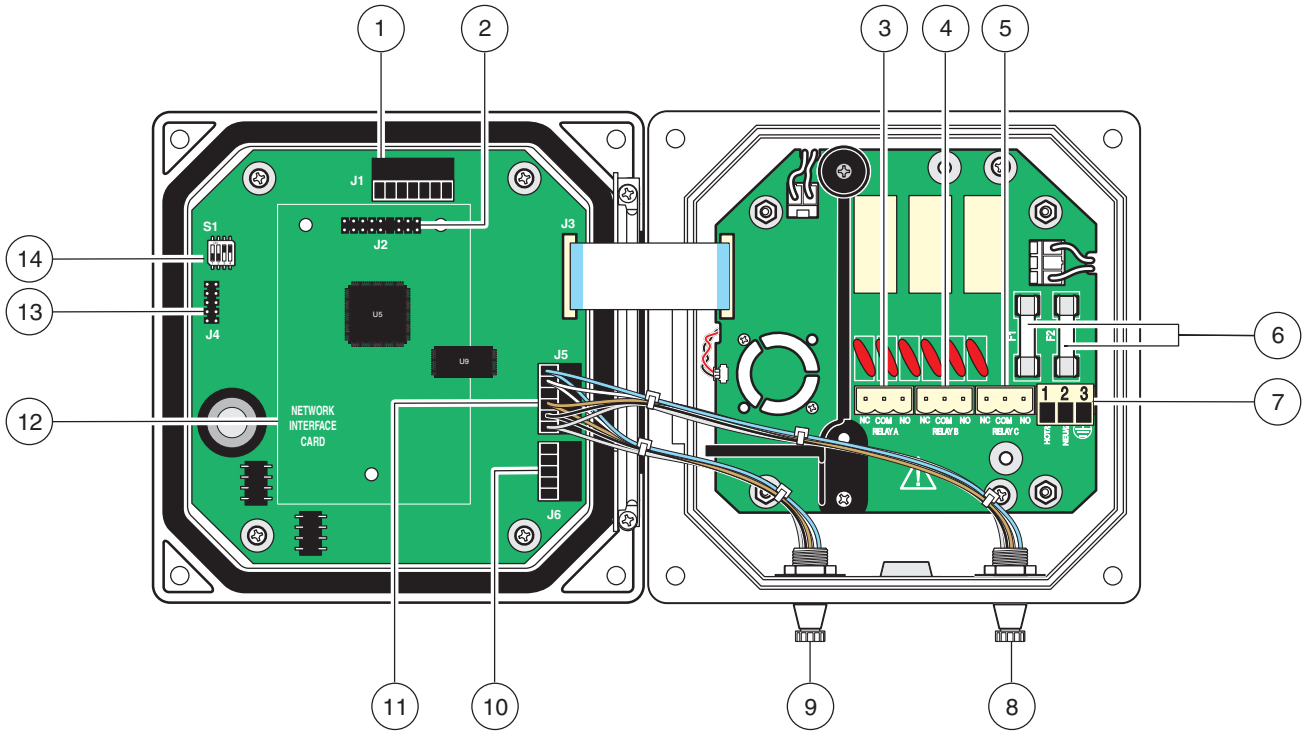
Wire the instrument for line power by hard-wiring in conduit or by wiring to a power cord if local code allows. Regardless of the type of wire used, the connections are made at the same terminal. A local disconnect designed to meet local electrical code is required and must be identified for all types of installation. See Figure 16 and Figure 17 on page 17 for suggested local disconnect configurations.

1. Obtain appropriate fittings with NEMA 4X/IP66 environmental rating.
2. Loosen the screws using a phillips-head screwdriver and open the hinged controller cover.
3. Remove the high-voltage barrier (see Figure 12 on page 14).
4. Insert the wires through the strain relief fitting or conduit hub located in the right-rear access hole in the bottom of the enclosure. Tighten the strain relief if used, to secure the cord.
5. Properly prepare each wire (Figure 14) and insert each wire into the terminal according to Table 4. Tug gently after each insertion to ensure the connection is secure.
6. Seal any unused openings in the controller box with conduit opening sealing plugs, see Replacement Parts and Accessories on page 55.
7. Reinstall the high-voltage barrier and latch to secure.

Table 4 Power Wiring Information

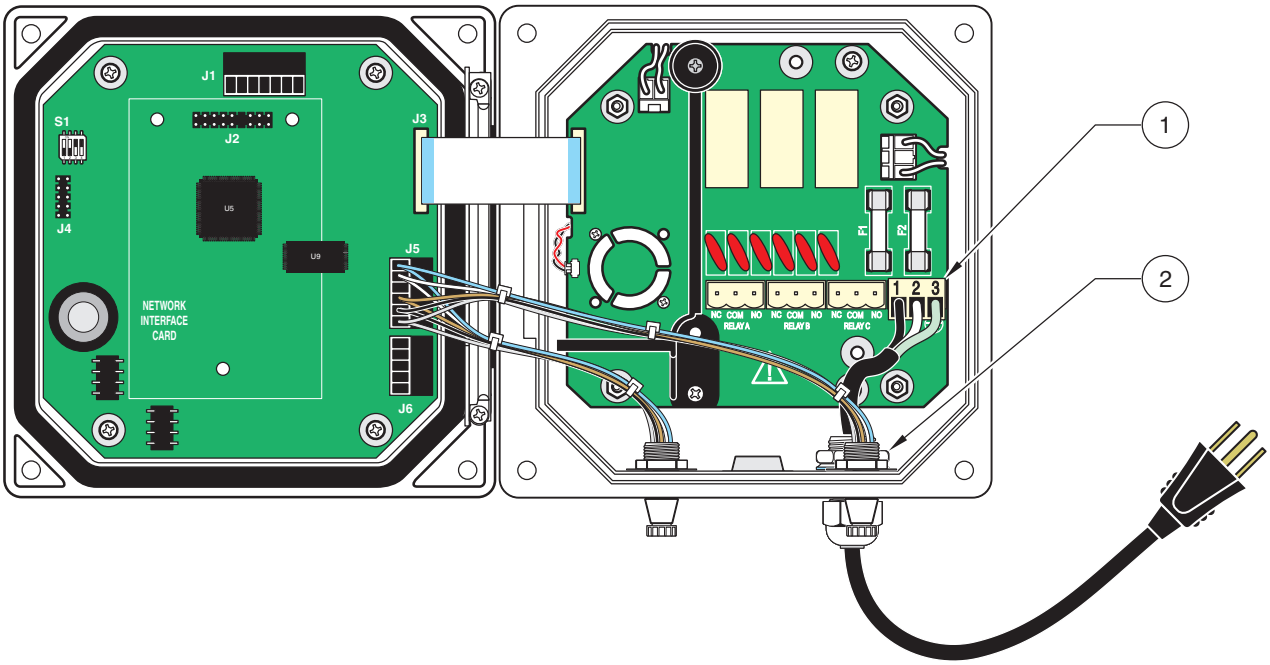
Terminal Number	Terminal Description	Wire Color Code for North America	Wire Color Code for Europe
1	Hot (L1)	Black	Brown
2	Neutral (N)	White	Blue
3	Protective Earth (PE)	Green	Green w/yellow tracer

Figure 15 Wiring Connections



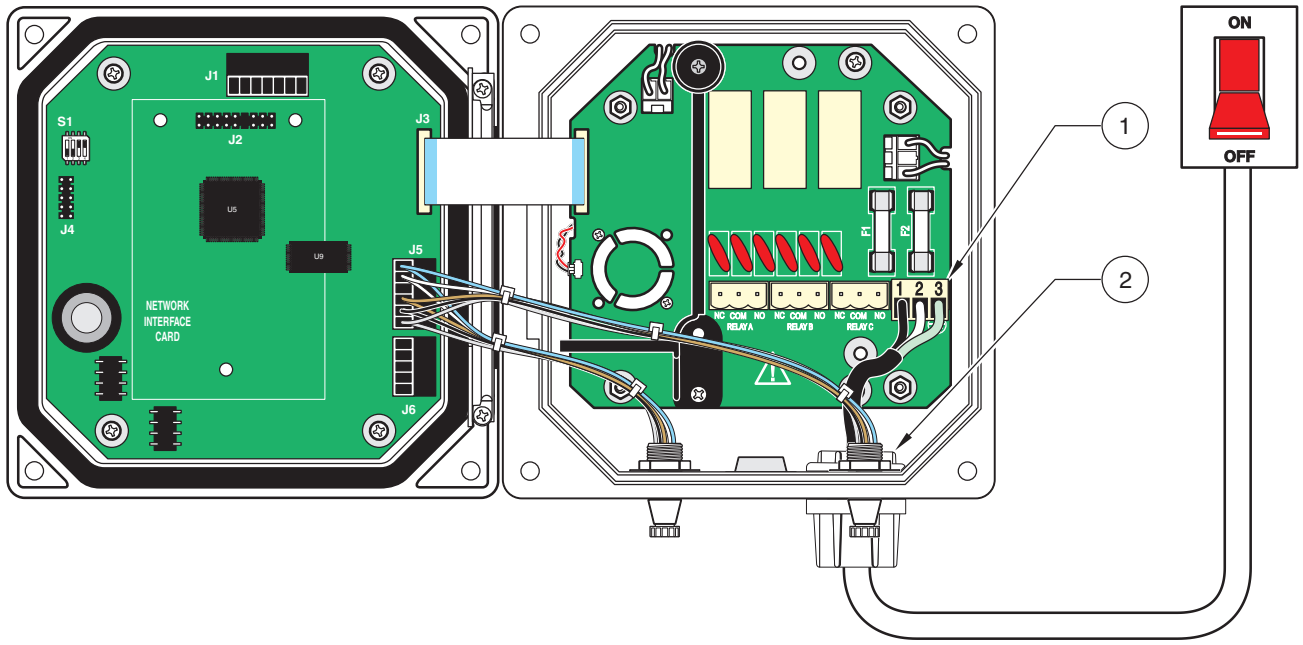
1. J1—Network connector	**8.** Sensor connector
2. J2—Header for optional network interface card	**9.** Sensor connector
3. J5—Relay A connector	**10.** J6—Analog output (4–20 mA) connector
4. J6—Relay B connector	**11.** J5—Sensor connector for hard-wiring
5. J7—Relay C connector	**12.** Position for network interface card
6. Fuses (F1, F2)	**13.** Service port
7. J8—ac Power connections	**14.** Sensor terminator selector/service port configuration

Figure 16 Local Disconnect for Power Cord



1. Power terminal	**2.** Power cord strain relief

Figure 17 Local Disconnect for Hard-wired Line Power



1. Power terminal	**2.** Conduit strain relief

3.3 Alarms and Relays

The controller is equipped with three unpowered relays rated 100–230 V ac, 50/60 Hz, 5 amp resistive maximum.

3.3.1 Connecting the Relays

The relay connector accepts 18–12 AWG wire (as determined by load application). Wire gauge less than 18 AWG is not recommended.

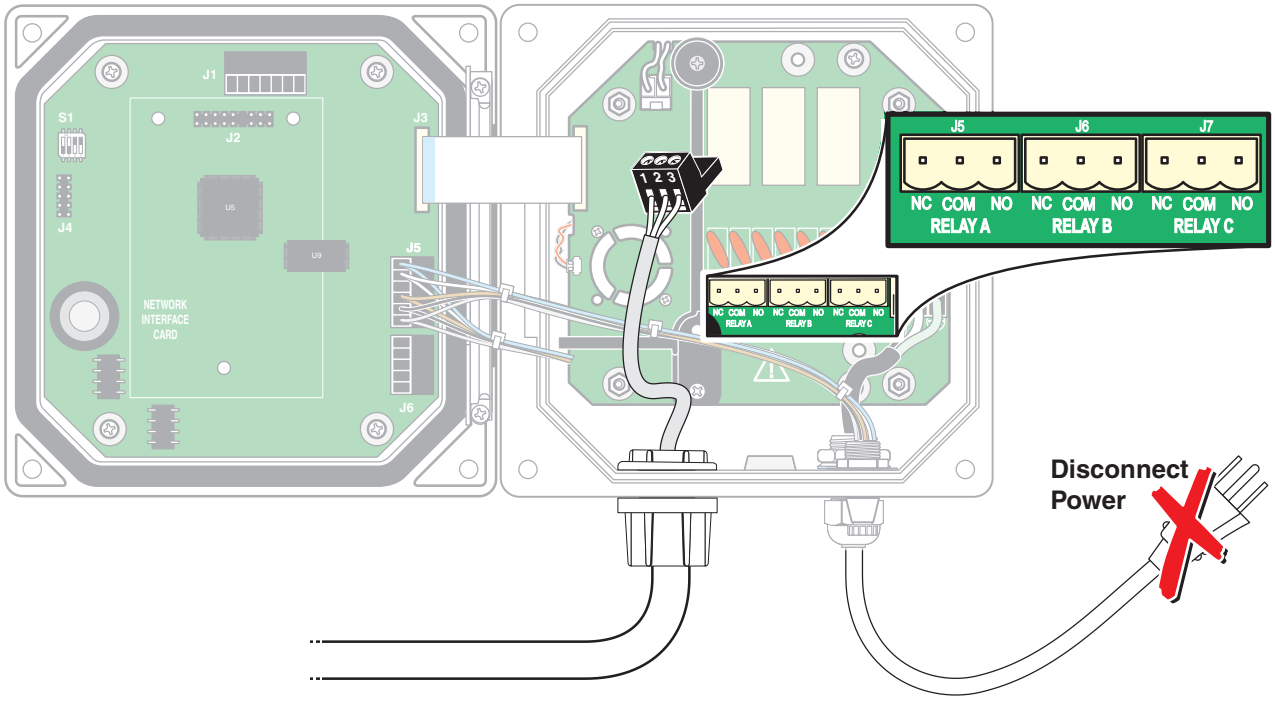
Danger: Relay loads must be resistive. User must externally limit current to the relays to 5 Amps by use of a fuse or breaker.

The controller contains three relays designed for use with high voltage (greater than 30V-RMS and 42.2V-PEAK or 60 V dc). Refer to Figure 18 for connection information. The wiring is not designed for low voltage connections. Relay must not be powered from the same wiring used to power the controller. See section 4.6 on page 34 for relay setup details.

Danger: ac power terminals are designed for single wires. Do not use more than one wire in each terminal.

The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive or when power is removed from the controller.

Figure 18 Alarm and Relay Connections



3.3.2 Connecting the Analog Outputs

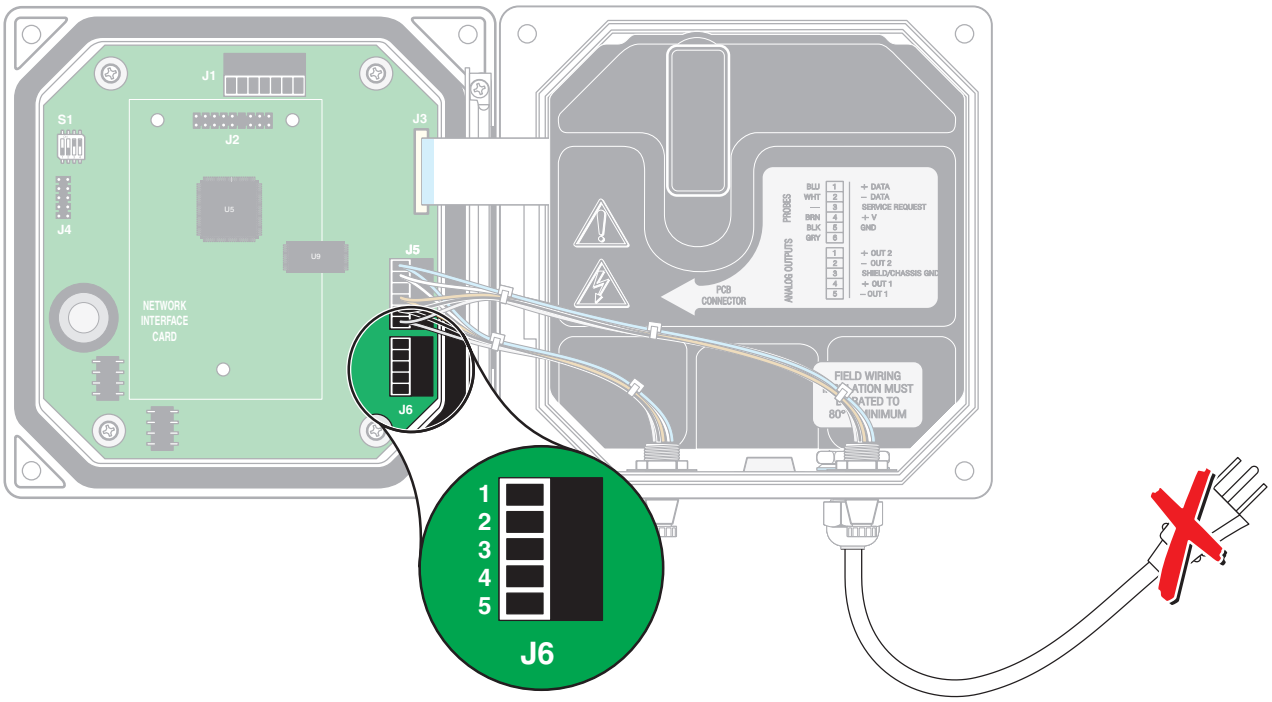
Two isolated analog outputs (1 and 2) are provided, see Figure 19. Each output can be set to 0–20 or 4–20 mA, and can be assigned to represent the measured parameter or secondary measurement such as temperature. Make connections with twisted-pair shielded wire and connect the shield at the controlled component end or at the control loop end. Do not connect the shield at both ends of the cable. Use of non-shielded cable may result in radio frequency emission or susceptibility levels higher than allowed. Maximum loop resistance is 500 ohm. Refer to section 4.5 on page 32 for output software setup.

Make wiring connections at the analyzer end as shown in Figure 19.

Table 5 Output Connections at Terminal Block J6

Recorder Wires	Circuit Board Position
Output 2 +	1
Output 2 –	2
Shield	3
Output 1 +	4
Output 1 –	5

Figure 19 Analog Output Connections



3.4 Connecting/Wiring the Sensor Cable

The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller, see Figure 20. Retain the connector cap to seal the connector opening in case the sensor must be removed.

The 1720E sensor cable may be extended by a maximum of 7.62 m (25 ft), see Replacement Parts and Accessories on page 55.

Modify the controller for sensor hard-wiring as follows:

1. Remove all power to the controller.
2. Open the controller cover.

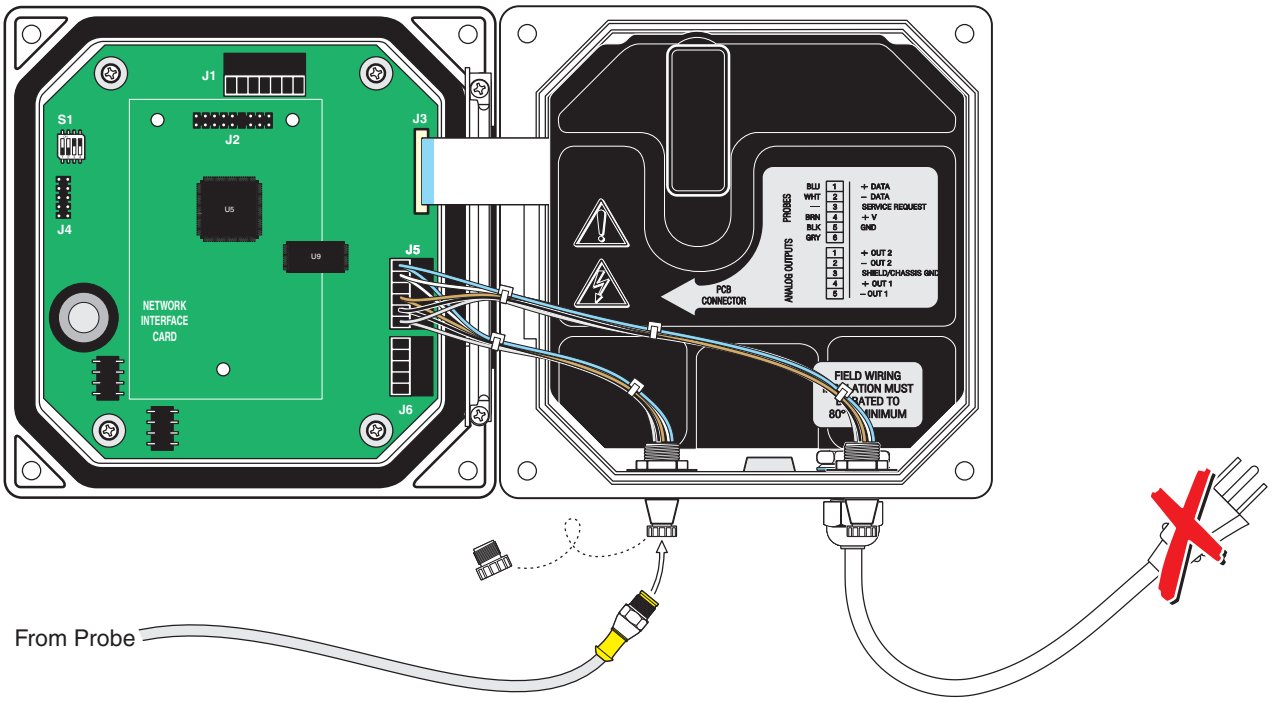
3. Disconnect and remove the existing wires between the quick connect and terminal block J5, see Figure 21 on page 21.

4. Remove the quick connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.

Table 6 Wiring the Sensor at Terminal Block J5

Terminal Number	Terminal Designation	Wire Color
1	Data (+)	Blue
2	Data (–)	White
3	Service Request	No Connection
4	+12 V dc	Brown
5	Circuit Common	Black
6	Shield	Shield (grey wire in existing quick disconnect fitting)

Figure 20 Attaching the Sensor using the Quick-connect Fitting



5. Cut the connector from the sensor cable.

6. Reinstall the plug on the sensor access opening to maintain the environmental rating.

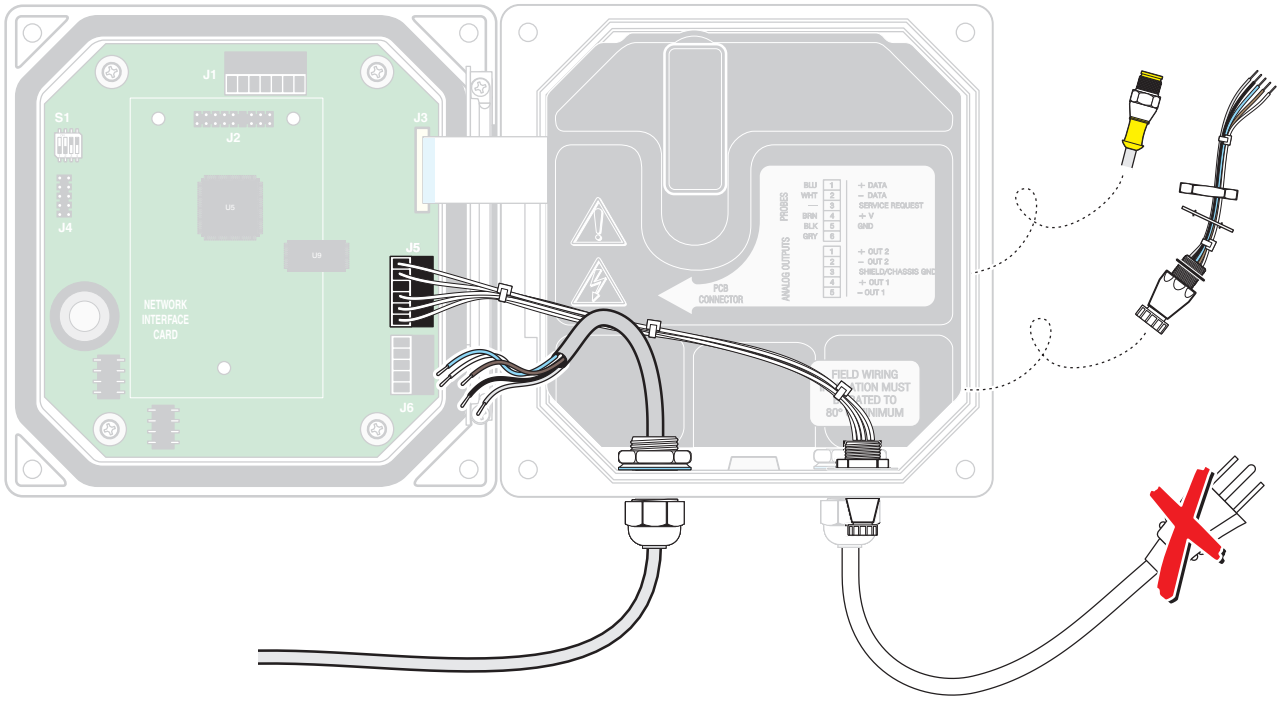
7. Strip the insulation on the cable back 1-inch. Strip ¼-inch of each individual wire end.

8. Wire as shown in Table 6.

9. Pass the cable through conduit and a conduit hub or a strain relief fitting and an available access hole in the controller enclosure. Tighten the fitting.

10. Close and secure the cover.

Figure 21 Hard-wiring the Sensor



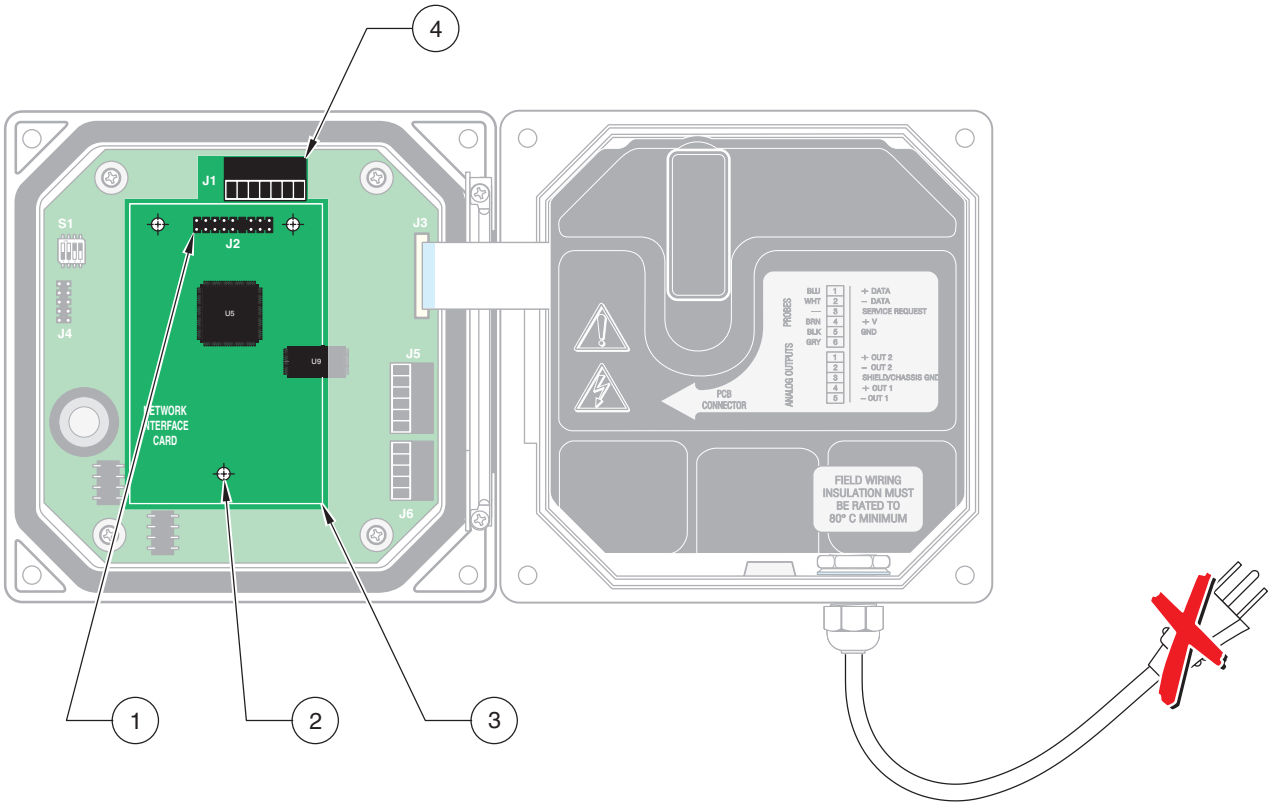
3.5 Connecting the Optional Digital Output

At this time, the manufacturer supports ModBUS RS485 and ModBUS RS232 communication protocols. The optional digital output card is installed in the location indicated in Figure 22 on page 22. Terminal block J1 provides user connection to the optional network card. The terminal connection is based on the selected network card. Refer to the instructions supplied with the network card for more details.

Table 7 Network Connections at Terminal Block J1

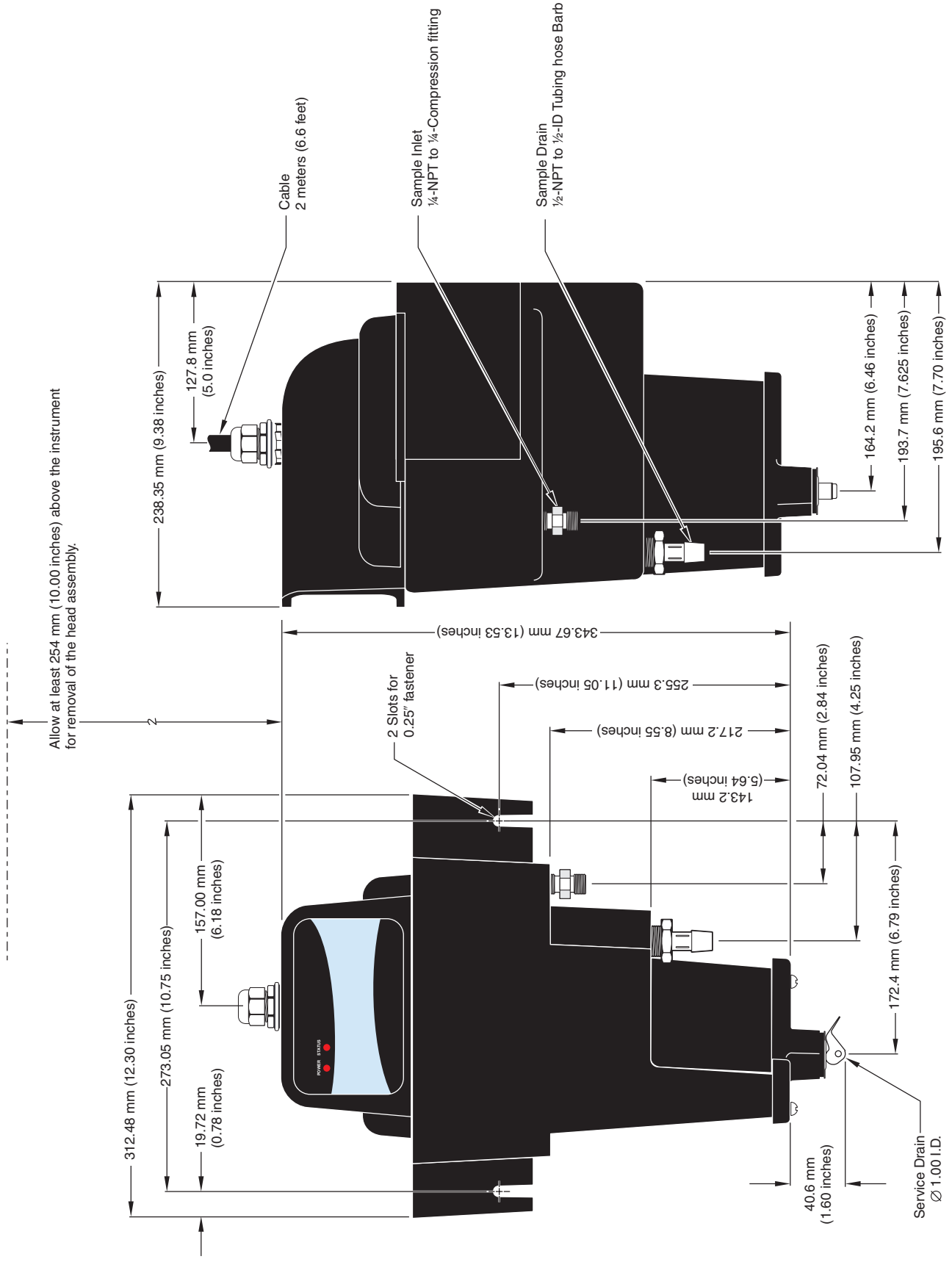
Terminal Number	ModBUS RS485	ModBUS RS232
1	In +	—
2	In –	—
3	Out +	—
4	Out –	—
5	Common	Common
6	No connection	No connection
7	Shield	Shield

Figure 22 Network Card Position in the Controller



1. J2—Network card header	**2.** Mounting hole (3)	**3.** Network card placement	**4.** J1 Terminal

Figure 23 1720E Dimensions



3.6 Turbidimeter Installation Information

The turbidimeter body is designed for wall-mounting (although it may be mounted on the optional floor stand). The turbidimeter sensor must be mounted within six feet of the controller unless an extension cable is used. Maximum cable length is 9.6 m (31 feet).

3.6.1 Mounting the Turbidimeter Body

Locate the turbidimeter as close to the sampling point as possible. A shorter distance for the sample to travel results in a faster response time.

Clean the turbidimeter body and bubble trap before installation using the instructions supplied in section 6.4.3, Cleaning the Turbidimeter Body and Bubble Trap on page 48. Slotted mounting brackets are integral parts of the turbidimeter body. Install customer-supplied hardware appropriate for the installation environment using the criteria detailed below:

- Install in a location that is isolated from vibration.
- Allow at least 22 cm (approximately 10 inches) clearance for removal of the head assembly and bubble trap cover from the top of the turbidimeter body.
- Leave enough room below the turbidimeter body to remove the bottom plug and to place a container under the drain when calibrating or cleaning.

Note: *Make sure the top of the turbidimeter body is level.*

- Install two ¼-20 bolts 10-3/4 inches apart (on center). Leave at least ¼-inch of the bolt head exposed.
- Make sure the bolts are installed level.

Slide the slotted mounting brackets of the turbidimeter body onto the bolts.

3.6.2 Installing the Head Assembly

After the turbidimeter body has been mounted, install the bubble trap cover, then place the head assembly on the turbidimeter body with the label facing the front. Move the head assembly back and forth slightly to ensure it is properly seated on the body of the instrument. Failure to properly seat the head will result in light leakage and erroneous readings.

The rear portion of the head assembly has a molded “lip” which may be used to hang the head assembly on the turbidimeter body edge for routine maintenance.

3.7 Installing a Sample Line

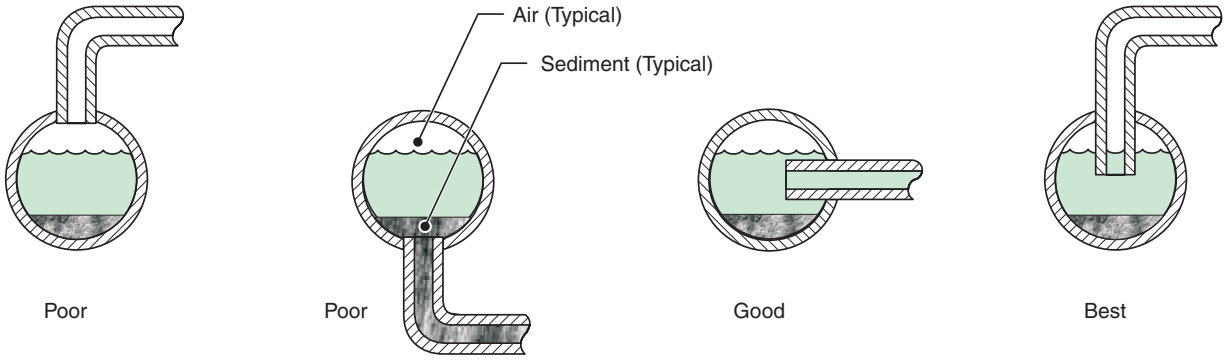
DANGER
This turbidimeter is not designed for use in hazardous locations or with samples that are flammable or explosive in nature. If any sample solution other than water is used in this product, test the sample/product compatibility to ensure user safety and proper product performance.

One-fourth inch O.D. rigid or semi-rigid tubing is recommended for sample lines. Run them as directly as possible between the turbidimeter body and the sampling point to minimize sample flow lag time.

Install sample line taps into larger process pipes to minimize interference from air bubbles or pipeline bottom sediment. A tap projecting into the center of the pipe is ideal. Figure 24 shows examples of sample tap installations.

Note: *When setting the flow rate, take care to avoid sweeping air “micro-bubbles” through the internal bubble trap. Observe the sample flow inside the turbidimeter body. If small air bubbles can be seen flowing up through the center, reduce the flow rate.*

Figure 24 Sampling Techniques



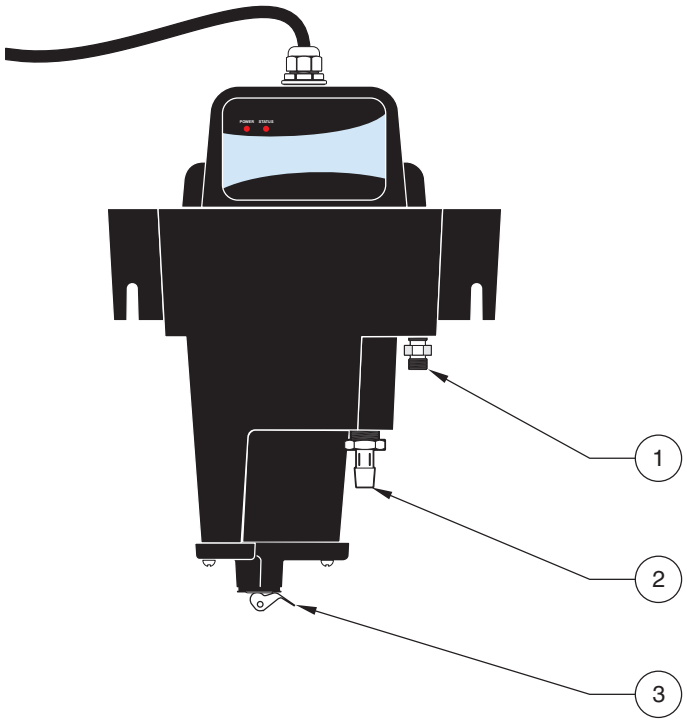
3.8 Sample Connections

Sample inlet and drain connections are made on the turbidimeter body. The sample inlet fitting installed in the body is a ¼-inch NPT x ¼-inch compression fitting. One additional fitting supplied with the instrument is a ½-inch NPT-to-hose fitting for use with ½-inch ID flexible plastic tubing on the drain.

Note: *For samples with high solids content (high turbidity), operate at the highest flow rate possible. For samples with low solids content (low expected turbidity), operate at a low flow rate (200–300 mL/min).*

The required flow rate is 200 to 750 mL/minute (4.0 to 11.9 gal/hour). Flow rate into the turbidimeter may be controlled with a flow restriction device on the inlet line. Flow rates below 200 mL/min will reduce response time and cause inaccurate readings. Flow rates above 750 mL/min will cause the turbidimeter to overflow, indicating the flow rate is too high.

Figure 25 Sample Connections

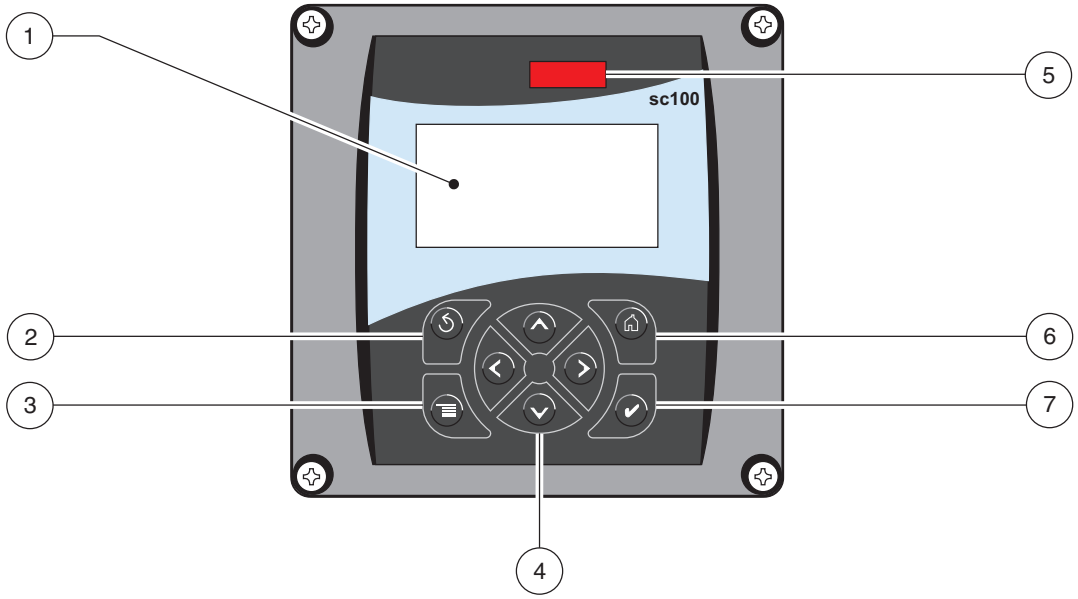


1. Sample Inlet, ¼-28 NPT x ¼-inch Compression fitting	**2.** Drain, ½-inch NPT fitting	**3.** Service Drain

4.1 Using the Keypad

The front of the controller is shown in Figure 26. The keypad consists of the eight keys described in Table 8.

Figure 26 Front of the Controller



1. Instrument Display	**4.** Right, Left, Up, and Down keys	**7.** Enter key
2. Back key	**5.** IrDA (Infrared Data Acquisition) window	
3. Menu key	**6.** Home key	

Table 8 Controller Key Functions/Features

Number	Key	Function
2	back	Move back one level in the menu structure.
3	menu	Move to the main menu from other menus. This key is not active in menus where a selection or other input must be made.
4		Navigate through the menus, change settings, and increment and decrement digits.
5	home	Move to the Main Measurement screen from any other screen. This key is not active in menus where a selection or other input must be made.
6	enter	Accept an input value, updates, or accepts displayed menu options.

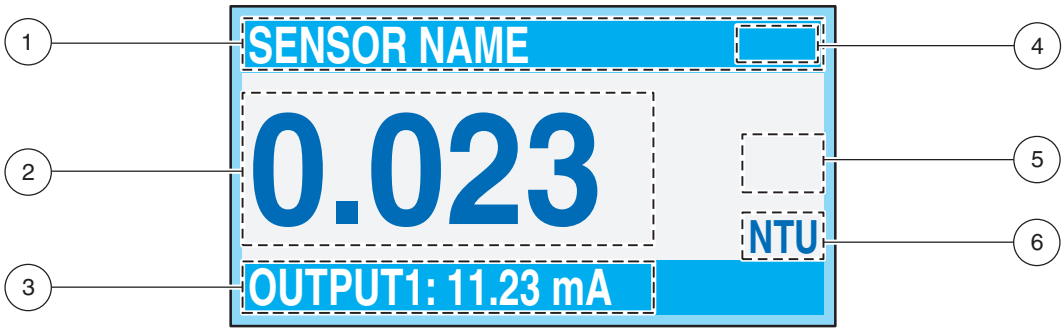
4.2 Controller Display Features

When the controller is in measurement mode, measurements for each connected sensor are displayed.

The display will flash on startup, when the hold outputs function has been activated, and when the filter function (signal average) is changed to a different value.

An active system warning will cause the warning icon (a triangle with an exclamation point inside) to be displayed on the right side of the display.

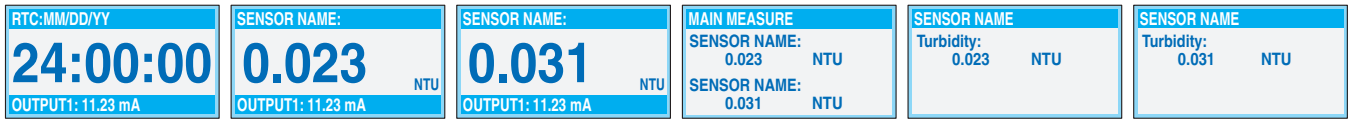
Figure 27 Display



1.	Status bar. Indicates the sensor name and status of relays. The relay letter is displayed when the relay is energized.	**4.**	Energized relay indicator
2.	Main measurement	**5.**	Warning icon area
3.	Secondary measurement/output information	**6.**	Measurement units

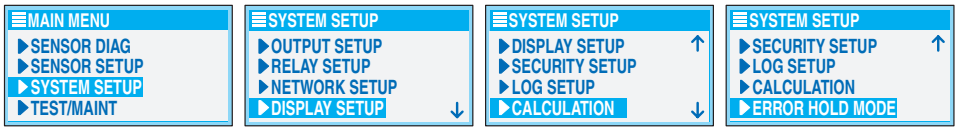
4.2.1 Important Key Presses

- Press the **HOME** key then the **RIGHT** or **LEFT** key to display two readings when two sensors are connected. Continue to press the **RIGHT** or **LEFT** key to toggle through the available display options as shown below.



- Press the **UP** and **DOWN** keys to toggle the status bar at the bottom of the measurement display to display the output information.

- In Menu mode, an arrow may appear on the right side of the display to indicate that more items are available. Press the **UP** or **DOWN** key (corresponding to the arrow direction) to display additional menus.



4.3 Instrument Setup

4.3.1 Software Text Abbreviation Conventions

Abbreviation	Meaning	Abbreviation	Meaning
Adj	Adjust	P/F	Pass/Fail
Cal	Calibration	Pass	Password
Cont.	Continue	Preped	Prepared
Cyl	Cylinder	SN	Serial Number
Dflt	Default	Std	Standard
Diag	Diagnostic	Temp	Temperature
Int	Internal	Ver	Verification
Meas.	Measurement	Xfer	Transfer

4.3.2 Adjusting Display Contrast

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SYSTEM SETUP	
3		DISPLAY SETUP	
4	—	ADJ CONTRAST	
5		(+0–50)	
6		MAIN MENU or Main Measurement Screen	—

4.3.3 Specifying the Displayed Language

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SYSTEM SETUP	
3		DISPLAY SETUP	
4		LANGUAGE	
5		select language	
6		Main Menu or Main Measurement Screen	—

4.3.4 Setting the Time and Date

4.3.4.1 Setting the Time

Note: *The time is available only in 24-hour (military) format.*

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SYSTEM SETUP	
3		DISPLAY SETUP	
4		SET DATE/TIME	
5		highlight TIME	
6		select character to edit	
		choose appropriate number	
7		Main Menu or Main Measurement Screen	—

4.3.4.2 Setting the Date Format and Date

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SYSTEM SETUP	
3		DISPLAY SETUP	
4		SET DATE/TIME	
5	—	highlight DATE FORMAT	
6		choose appropriate date format	
7		Highlight DATE	
8		select character to edit	—
		choose appropriate number	
9		Main Menu or Main Measurement Screen	—

4.4 Changing the Sensor Name

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SENSOR SETUP	
3		highlight sensor of interest if more than one sensor is attached	
4		CONFIGURE	
5		EDIT NAME	
6		select character to edit	—
		choose appropriate alpha/numeric digit	
7		Main Menu or Main Measurement Screen	—

4.4.1 Setting Up System Security

The sc100 has a passcode feature to restrict unauthorized access to Network Setup, Security Setup, Log Setup, and Test/Maint menus. In addition, the passcode also regulates function selection for relay options. The passcode is factory set to **sc100** (the five digits must be followed by a space to remove the trailing asterisk). The passcode may be changed, see section 4.4.1.1.

The following two options are available:

Disabled: All configuration settings and calibrations can be changed. This is the default setting.

Enabled: All configuration settings can be displayed but not changed. Network Setup, Security Setup, Log Setup, and Test/Maint menus cannot be accessed without the passcode.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SYSTEM SETUP	enter
3	⌄	SECURITY SETUP	enter
4	—	SET PASSCODE	enter
5	⌄	highlight ENABLED	enter
6	menu home	Main Menu or Main Measurement Screen	—

4.4.1.1 Editing the Passcode

If the passcode is enabled, it may be edited. The passcode can consist of up to six digits (alpha and/or numeric and available characters). If a passcode is forgotten, obtain the Master passcode from the Technical Consulting Services Department, see Technical and Customer Service (U.S.A. only) on page 57.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SYSTEM SETUP	enter
3	⌄	highlight SECURITY SETUP	enter
4	‹ ›	ENTER (current or default) PASSCODE	—
	⌄	EDIT PASSCODE	enter

Step	Select	Menu Level/Instructions	Confirm
5		Change the existing passcode	
6		Main Menu or Main Measurement Screen	—

4.5 Output Options

The controller provides two isolated analog outputs (Output 1 and Output 2). Customize the outputs using the table in section 4.5.1 on page 32.

4.5.1 Output Setup Menu (from System Setup)

1.	Select OUTPUT 1 or 2
SELECT SOURCE	
	Press **ENTER** to access a list of all connected sensors. Choose the sensor to associate with the output.
SET PARAMETER	
	Highlight the appropriate displayed parameter and press **ENTER.**
SET FUNCTION	
	Select LINEAR CONTROL for current output to track the measurement value. Select PID CONTROL for the sc100 to operate as a PID controller.
SET TRANSFER	
	Each analog output is normally active, responding to the measured value of its assigned parameter. However, during calibration, each output can be transferred to this preset transfer value. Default: 4mA; Range: 0–20
SET FILTER	
	Allows the user to average the analog outputs over time Default: 0; Range: 0–120 seconds
SCALE 0 mA/4 mA	
	Select 0 mA or 4 mA for minimum current (outputs will be set to 0–20 mA or 4–20 mA).
ACTIVATION	
	FUNCTION set to LINEAR CONTROL
	If LINEAR CONTROL was selected in SET FUNCTION, set the low and the high values for the current output here. Defaults: Low = 0; High = 100; Low Value Range: 0–100, High Value Range: 0–100.
	FUNCTION set to PID CONTROL
	If PID CONTROL was selected in SET FUNCTION, configure the PID Control as follows: **1.** Set MODE: AUTO or MANUAL. Manual output default: 100% **2.** Set PHASE: DIRECT or REVERSE controller operation. **3.** SET SETPOINT: enter the set point the PID control will control the process to. Default: 100; Range: 0–100 **4.** PROP BAND: control the proportional band for the PID control. Default: 5.00; Range: 0–1000 **5.** INTEGRAL: control the integral action time period in minutes. Range: 0–999 **6.** DERIVATIVE: control the settings for the rate control. Range: 0–999

4.5.2 Hold/Transfer Outputs

When cleaning or servicing the instrument, the analog outputs can be held at the last measured values. To hold the output until released:

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		TEST/MAINT	
		Enter Passcode if enabled	
3		HOLD OUTPUTS	
4	—	SET OUTMODE	
5		Select HOLD OUTPUTS or XFER OUTPUTS	
6		SET CHANNELS	
7		Select ALL or 1720E	
8		ACTIVATION	
9	—	LAUNCH	
10		Main Menu or Main Measurement Screen	reading will flash

During calibration, the analog outputs can remain active, be held, or be transferred to a preset mA value. When output hold or transfer is enabled during a calibration, the hold or transfer is automatically released when calibration is completed. See section 5.3, Sensor Calibration and Verification on page 40.

4.5.3 Release Outputs

Step	Select	Menu Level	Confirm
1		MAIN MENU	—
2		TEST/MAINT	
3		HOLD OUTPUTS	
4		ACTIVATION	

Step	Select	Menu Level	Confirm
5	—	RELEASE	enter
6	menu home	Main Menu or Main Measurement Screen	—

4.6 Relay Options

Step	Select	Menu Level	Confirm
1	menu	MAIN MENU	—
2		SYSTEM SETUP	enter
3		RELAY SETUP	enter
4	—	Customize the options using the information in section 4.6.1	—

4.6.1 Relay Setup Menu (from System Setup)

1. Select Relay A, B, or C	
SELECT SOURCE	
	Choose from the available options (none, installed sensors, real time clock (RTC)).
SET PARAMETER	
	Choose from the available options.
SET FUNCTION	
	Source set to sensor
	Alarm: Operates relays in response to the measured parameter. Contains separate High and Low Alarm points, deadbands, and ON/OFF delay. Defaults: Low = 0.000 NTU, high = 100.00 NTU, low deadband = 5.000 NTU, high deadband = 5.000 NTU, on/off delays default to zero seconds; Range: 0–999 sec. **Feeder Control**: Operates in response to the measured parameter. Can be set for phasing, set point, deadband, overfeed timer, and ON/OFF delay. **Event Control**: Controls a cleaning system (or equivalent) on a timed basis. **Warning**: Activated when the analyzer detects a sensor warning.
	Source set to RTC
	Timer: Sets the timer for a cleaning system (or equivalent). Controls the output hold, interval, duration and off delay.
SET TRANSFER	
	Normally, each control or alarm relay is active, responding to the measured value of its assigned parameter. During calibration, however, the relay can be transferred to a preset on/off state to suit the application requirements. Select Energize or De-energize and press **ENTER**.

4.6.1 Relay Setup Menu (from System Setup) (continued)

ACTIVATION		
Function set to ALARM		
	LOW ALARM	Sets the value where the relay will turn on in response to decreasing measured value. For example: if the low alarm is set for 1.0 and the measured value drops to 0.9, the relay will be activated. Range: 0.00–100 NTU
	HIGH ALARM	Sets the value where the relay will turn on in response to increasing measured value. For example: if the high alarm is set for 4.0 and the measured value increases to 4.2, the relay will be activated. Range: 0.00–100 NTU
	LOW DEADBAND	Sets the range where the relay remains on after the measured value increases above the low alarm value. Default is 20% of the range. For example: if the low alarm is set for 1.0 and the low deadband is set for 0.5, then the relay remains on between 1.5 and 1.0. Range: 0.00–100 NTU
	HIGH DEADBAND	Sets the range where the relay remains on after the measured value decreases below the high alarm value. For example: if the high alarm is set for 4.0 and the high deadband is set for 0.5, then the relay remains on between 3.5 and 4.0. Range: 0.00–100 NTU
	OFF DELAY	Sets a time to delay the relay from normally turning off. Off Delay Range: 0–999 seconds
	ON DELAY	Sets a time to delay the relay from normally turning on. On Delay Range: 0–999 seconds
Function set to FEEDER CONTROL		
	PHASE	“High” phase assigns the relay setpoint to respond to an increasing measured value; conversely, a “Low” phase assigns the relay setpoint to respond to a decreasing measured value.
	SET SETPOINT	Sets the value where the relay will turn on. Default: 100 NTU; Range: 0–100
	DEADBAND	Sets the range where the relay remains on after the measured value decreases below the setpoint value (high phase relay) or increases above the setpoint value (low phase relay). Default: 5 NTU; Range: 0–100 NTU
	OVERFEED TIMER	Sets the time to limit how long the relay can remain “on.” Default: 5 minutes; Range: 0–999 minutes
	OFF DELAY	Sets a time to delay the relay from normally turning off. Default: 0 seconds; Range: 0–999 seconds
	ON DELAY	Sets a time to delay the relay from normally turning on. Default: 0 seconds; Range: 0–999 seconds
Function set to EVENT CONTROL		
	PHASE	“High” phase assigns the relay setpoint to respond to increasing measured value; conversely, a “Low” phase assigns the relay setpoint to respond to decreasing measured value.
	SET SETPOINT	Sets the value where the relay will turn on. Default: 100; Range: 0–100
	DEADBAND	Sets the range where the relay remains on after the measured value decreases below the setpoint value (high phase relay) or increases above the setpoint value (low phase relay). Default: 5 NTU; Range: 0–100 NTU,
	OnMax TIMER	Sets the time to limit the time the relay can remain “on.” Default: 0 seconds; Range: 0–999 seconds
	OffMax TIMER	Sets a time to delay the relay from normally turning off. Default: 0 seconds; Range: 0–999 seconds
	OnMin TIMER	Sets the time to limit the time the relay can remain “on.” Default: 0 seconds; Range: 0–999 seconds
	OffMin TIMER	Sets the time to limit the time the relay can remain “off.” Default: 0 seconds; Range: 0–999 seconds
Function set to TIMER CONTROL (RTC selected in SELECT SOURCE)		
	HOLD OUTPUTS	Set OUTMODE to select output hold operation and select the channels that cause the outputs to be held.
	INTERVAL	Set the off time for the relay. Default: 5 minutes; Range: 0–999 minutes
	DURATION	Set the on time for the relay. Default: 30 seconds; Range: 0–999 seconds
	OFF DELAY	Set the time for additional hold/output time after the relay has been turned off. Default: 1 second; Range: 0–999 seconds
Function set to WARNING CONTROL		
	WARNING LEVEL	Set the warning level that will trigger a relay. Range: 0–32 (warnings assigned to 1-9 for 1720E). For example: Set the warning level to 0 to allow all warnings to trigger the relay; set the warning level to 5 to allow warnings 6 and above to trigger the relay. Set the warning level to 9 or greater to not trigger the relay on any warning. See Table 10 on page 52 for a full list of warnings.

4.7 Data and Event Logging Options

The sc100 provides two data logs (one for each sensor) and two event logs (one for each sensor). The data logs store the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, and warning conditions. The data logs are stored in a packed binary format and the event logs are stored in a CSV format. The logs can be downloaded through either the digital network port or the IrDA port using the file transfer program available from the manufacturer.

The default datalogging frequency is 15 minutes. If the datalogging frequency is set to 15 minute intervals, the instrument can continue to store data for approximately six months.

4.7.1 Data Logging Options

Sensor Data Log:

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2		SENSOR SETUP	enter
3		Highlight sensor of interest if more that one sensor is attached.	enter
4		CONFIGURE	enter
5		DATALOG INTERVAL (select from 30 sec., 1 min., 5 min., 10 min., 15 min.)	enter
6	menu home	Main Menu or Main Measurement Screen	—

4.8 Digital Network Options

The sc100 provides two digital communication methods with the controller (the digital network port and the IrDA port). Either of the digital ports can be used to access setup data, measurement data, or data/event logs. For the features available for each individual digital network port, refer to the instruction sheet supplied with the selected network card.

4.9 Menu Structure

4.9.1 Sensor Diagnostics Menu

SELECT SENSOR		
	ERROR LIST	Displays a list of errors that are present. See section 7.1 on page 52.
	WARNING LIST	Displays a list of warnings that are present. See section 7.2 on page 52.

4.9.2 Sensor Setup Menu

CALIBRATE		
SELECT SENSOR (if more than one sensor is attached)		
	USER PREPD CAL	Calibration using 4000 NTU stock solution diluted to 20.00 NTU formazin.
	STABLCAL CAL	Calibration using 20 NTU StablCal Stabilized Formazin Standard
	VERIFICATION	Perform a verification, set the pass/fail criteria, and view the verification history.
	0 ELECTRONICS	Zero electronics
	SET DFLT GAIN	Return instrument to default calibration.
	CAL HISTORY	View the last 12 entered calibrations. Press the ENTER key to move to the next history entry. See section 5.5 on page 46 for more information.
CONFIGURE		
	BUBBLE REJECT	Choose Yes or No to enable/disable bubble reject. Default: Yes
	SIGNAL AVG	Choose no averaging or specify the amount of time for signal averaging. Available options are: no averaging, 6 sec., 30 sec., 60 sec., or 90 sec. Default is 30 seconds.
	MEAS UNITS	Select the appropriate measurement units to display. Choose from mg/L, NTU, TE/F, and FTU. Default: NTU
	EDIT NAME	Enter up to a 12-digit name in any combination of symbols and alpha or numeric characters. Press **ENTER** when the entry is complete. The name will be displayed on the status line above the measurement value on the main display.
	SET RESOLUTION	Set the number of significant digits to display. Default is three significant digits.
	DATALOG INTRVL	Choose the amount of time between saving data points to the data log. Default: 15 min.; Options: 30 sec., 1 minute, 5 minutes, 10 minutes, or 15 minutes.
DIAG/TEST		
	SOFTWARE VERS.	Displays the software version number.
	DRIVER VERS	Displays the software driver version number.
	SERIAL NUMBER	Displays the serial number of the sensor.
	INT TEMP	Displays the internal temperature of the sensor electronics in °C.
	DEFAULT SETUP	Restores the sensor's factory default settings and invalidates the current calibration.
	POWER CHECK	Displays the electrical statistics for the sensor.
	CAL VALUE	Displays the gain and zero electronics values for the current calibration.

4.9.3 System Setup Menu

OUTPUT SETUP (see section 4.5 on page 32 for expanded menu information)		
SELECT OUTPUT 1 or 2		
	SELECT SOURCE	Press **ENTER** to access a list of all connected sensors and select the sensor that will drive the output.
	SET PARAMETER	Press **ENTER** to select from the displayed parameters.
	SET FUNCTION	Select LINEAR CONTROL for current output to track the measurement valve. Select PID CONTROL for the sc100 to operate as a PID controller.
	SET TRANSFER	Each analog output is normally active, responding to the measured value of its assigned parameter. However, during calibration, each output can be transferred to this preset transfer value.
	SET FILTER	Average measurements over time (0–120 seconds). Default: 0 seconds.
	SCALE 0 mA/4 mA	Select 0 mA or 4 mA for minimum current (outputs will be set to 0–20 mA or 4–20 mA).
	ACTIVATION	Dependent on Function selected previously. See section 4.5 on page 32 for additional information.

4.9.3 System Setup Menu (continued)

RELAY SETUP (See section 4.6 on page 34 for expanded menu information.)		
SELECT RELAY A, B, or C		
	SELECT SOURCE	Select from none, any connected sensor, or the real time clock (RTC).
	SET PARAMETER	Press **ENTER** to select from the displayed parameters.
	SET FUNCTION	Select from the available options to customize the relay functions. See section 4.6.1 on page 34 for additional details.
	SET TRANSFER	Sets the relay to Energize or De-energize (user-selectable).
	ACTIVATION	Activate the relays from this menu (dependent on Function selected).
NETWORK SETUP (this menu appears only if a network card is installed in the controller)		
	MODBUS ADDRESS	Highlight sc100 Analyzer, or either connected sensor then press **ENTER** to select. Choose a number between 1 and 247 as the address (each source must have a different address) then press **ENTER**.
	BAUD RATE	Select a baud rate of 9600, 19200, 38.4K, 57.6K, or 115.2K. Default: 19200
	STOP BITS	Select 1 or 2 stop bits. Default: 1
	MODBUS MODE	Select RTU or ASCII. Default: RTU
	DATA ORDER	Select NORMAL or SWAPPED.
DISPLAY SETUP		
	ADJ CONTRAST	Use the **UP** and **DOWN** keys to increase or decrease the contrast, see section 4.3.2 on page 28. Range = 0–50
	LANGUAGE	The default is English. Choose from the available options to allow all menus to appear in the selected language.
	SET DATE/TIME	Use this menu to select the date format and to set the date and time (24-hour (military) format), see section 4.3.4 on page 29.
SECURITY SETUP (Enter a 6-digit passcode)		
SET PASSCODE		
	ENABLE	Enables system security. See section 4.4.1 on page 31.
	DISABLE	Disables system security. See section 4.4.1 on page 31.
LOG SETUP (Not used for 1720E system. Enable datalogging from the sensor setup menu for 1720E)		
	DATALOG SETUP	Set up datalogging of data and events. See section 4.7.1 on page 36.
ERROR HOLD MODE		
	HOLD OUTPUTS	Holds outputs when unable to communicate with the sensor.
	XFER OUTPUTS	Goes to transfer state when unable to communicate with the sensor.

4.9.4 Test/Maint Menu

STATUS		
	Indicates the status of each relay and indicates which sensors are connected to the controller.	
OUTPUT CAL		
	SELECT OUTPUT 1 or 2	
		Calibrate Analog Output by specifying values to correspond to 4 mA and 20 mA.
HOLD OUTPUTS		
	SET OUTMODE	Choose Hold Outputs or Xfer Outputs.
	SET CHANNELS	Choose any individual attached sensor or all attached sensors to be held or transferred.
	ACTIVATION	Select Launch or Release.

4.9.4 Test/Maint Menu (continued)

OVERFEED RESET		
	Reset the overfeed time out.	
TEST OUTPUT		
	SELECT OUTPUT 1 or 2	
		User selectable mA value. 0–20 mA
TEST RELAY		
	SELECT RELAY A, B, or C	
		Energize or de-energize the selected relay.
RESET CONFIG		
		Reset to default configuration of the controller
SIMULATION		
	SELECT SOURCE, SET PARAMETER, SET SIM VALUE	
		Simulate sensor measurement values for testing the outputs and relays.
SCAN SENSORS		
	Manually scans for sensors to determine if sensors have been added or removed.	
MODBUS STATS		
	Indicates the communication statistics for use with an external network.	
CODE VERSION		
	Indicates the controller software version.	

Section 5 System Startup

5.1 General Operation

Plug the sensor into the unpowered controller by aligning the orientation tab on the cable connector with the channel in the controller connector. Push in and turn to secure the connection. Tug gently to check the connection.

After all plumbing and electrical connections have been completed and checked, place the head on the body and supply power to the system. Ensure the head is seated on the body when power is applied, since dark readings are measured at this time. If power is applied while the sensor head is off the turbidimeter body, cycle the power with the sensor head on the body.

The first time a controller is powered up, a language selection menu will appear. The user must select the correct language from the displayed options.
Use the **UP** and **DOWN** keys to highlight the appropriate language and press **ENTER** to select.

Following language selection and upon power-up, the controller will search for connected sensors. The display will show the main measurement screen. Press the **MENU** key to access the menus.

5.2 Starting Sample Flow

Start sample flow through the instrument by opening the sample supply valve. Allow the turbidimeter to run long enough for the tubing and body to become completely wetted and the reading on the display to stabilize. One to two hours or longer may be required initially for complete stabilization. Allow measurements to become stable through adequate conditioning before completing instrument settings or performing calibrations.

5.3 Sensor Calibration and Verification

The manufacturer offers two EPA-approved calibration methods one using user-prepared formazin and the other using StablCal® stabilized formazin. Two verification methods (wet and dry) are also offered.

The 1720E Turbidimeter is factory-calibrated using StablCal® Stabilized Formazin before shipment. The instrument must be recalibrated before use to meet published accuracy specifications. In addition, recalibration is recommended after any significant maintenance or repair and at least once every three months during normal operation. **The turbidimeter body and bubble trap must be thoroughly cleaned and rinsed before initial use and prior to each calibration.**

Tips to achieve the most accurate calibrations:

- Optimum performance is achieved when calibration is performed in the turbidimeter body. Accurately prepare the standard then add it to the turbidimeter body at the appropriate step in the procedure. Do not prepare the standard in the body.
- Stop sample flow, drain, and clean the turbidimeter body before beginning the calibration procedure.
- Always clean the photocell window per the instructions in section 6.4.2 on page 48. Rinse the photocell with deionized water and dry with a soft, lint-free cloth before calibrating.

- Always clean the turbidimeter body or calibration cylinder per the instructions in section 6.4.3 on page 48. Rinse with deionized water before calibrating.
- Store the calibration cylinder upside-down to minimize contamination between calibrations.
- Pour the calibration standard into the turbidimeter body at the inflow end (left side when facing the instrument).
- Gently invert StablCal standards for 1 minute before opening. Do not shake. This ensures a consistent turbidity of the standard.
- If the 20.0 NTU StablCal standard is allowed to sit in the calibration cylinder or turbidimeter body for more than 15 minutes, it must be remixed (gently swirled in the calibration cylinder) before use to ensure a consistent turbidity.
- Discard all standards after use per the instructions on the container. Never transfer the standard back into its original container. Contamination will result.
- Always recalibrate after restoring default settings.

5.3.1 User-prepared Calibration

Before starting the calibration, read and apply the tips in section 5.3.

Follow the procedure as written (using 1 L of deionized water and 5.0 mL of 4000 NTU formazin) **if using a calibration cylinder** for calibration.

If using the turbidimeter body for the user-prepared calibration follow the procedure below using 20 NTU formazin in step 6c. Prepare the standard as follows**:**

1. Stop the sample flow, then drain and clean the body.
2. Prepare a 20 NTU standard by adding 5.0 mL of 4000 NTU formazin to a 1-L flask. Dilute to the mark with deionized water and invert gently to mix.
3. Drain the deionized water and pour the prepared 20 NTU standard into the turbidimeter body at step 6c. Do not add additional 4000 NTU formazin.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SENSOR SETUP	enter
3	⌄	SELECT SENSOR (if more than one sensor is connected)	enter
4	⌄	CALIBRATE	enter
5	—	USER PREPD CAL	enter

Step	Select	Menu Level/Instructions	Confirm
6		OUTPUT MODE Select ACTIVE, HOLD, or TRANSFER	
	a	Stop sample flow. Drain body and clean the body and bubble trap. FILL CYL WITH 1 L DI WATER. REPLACE HEAD.	
	b	Measured reading (based on a gain of 1.0) displayed	
	c	(Remove head) ADD 5 ML OF 4000 NTU FORMAZIN INTO CAL CYLINDER.	
	d	Measured reading (based on a gain of 1.0) displayed	
	e	GOOD CAL! GAIN: X.XX ENTER TO CONT	 (to store)
	f	Verify CAL? (see Note below)	 to verify  exit no verify
7		Select VERIFICATION type (begin at step 7 in section 5.4.1 on page 44 or section 5.4.2 on page 45) or enter initials to complete calibration.	
8	—	RETURN SENSOR TO MEASURE MODE	
9		Main Menu or Main Measurement Screen	—

Note: *If a dry verification is performed directly after a calibration, the measured value is assigned as the expected value for future verifications (when using the dry verification device with the same serial number). As long as the verification exists within the verification history, the expected value will be retained. Otherwise, the expected value will be the nominal labeled value associated with the dry verification device.*

5.3.2 Calibration with StablCal®

Before starting the calibration, read and apply the tips in section 5.3 on page 40.

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SENSOR SETUP	

Step	Select	Menu Level/Instructions	Confirm
3	—	CALIBRATE	enter
4		STABLCAL CAL	enter
5		OUTPUT MODE Select ACTIVE, HOLD, or TRANSFER	enter
6	a	Drain/clean/rinse the turbidimeter body or cal cylinder. POUR 20 NTU STD INTO CYL/BODY. REPLACE HEAD	enter
	b	Measured reading and reading based on 1.0 gain displayed	enter
	c	GOOD CAL! GAIN: X.XX ENTER TO CONT	enter (to store)
	d	Verify CAL? (see Note below)	enter to verify/ back exit no verify
	e	Select VERIFICATION type (begin at step 7 in section 5.4.1 on page 44 or section 5.4.2 on page 45) or enter initials to complete calibration.}	enter
7	—	RETURN SENSOR TO MEASURE MODE	enter
8	menu home	Main Menu or Main Measurement Screen	—

Note: *If a dry verification is performed directly after a calibration, the measured value is assigned as the expected value for future verifications (when using the dry verification device with the same serial number). As long as the verification exists within the verification history, the expected value will be retained. Otherwise, the expected value will be the nominal value associated with the dry verification device.*

5.4 Instrument Verification

Instrument verification is intended as a simple check to ensure turbidimeter functionality between calibrations. A verification is initially performed directly after a calibration and subsequent independent verifications are referenced to the initial verification. The pass/fail criteria is set and subsequent verifications are deemed good or bad, when compared to the initial verification. All verifications are based on the current calibration and must be repeated when the instrument is recalibrated or when the pass/fail criteria is not met.

Two types of verifications are offered. The dry verification is performed using a “dry” calibration device such as the ICEPIC™. A wet verification is performed using a standard with a predetermined value such as StablCal® Stabilized Formazin or a user-prepared standard with a value that has been verified on an independent device such as a laboratory turbidimeter.

5.4.1 Dry Verification

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SENSOR SETUP	enter
3	⌄	CALIBRATE	enter
4	⌄	VERIFICATION	enter
5	—	PERFORM VER	enter
6	⌃ ⌄	OUTPUT MODE Choose ACTIVE, HOLD, or TRANSFER	enter
7	—	VER TYPE Select DRY	enter
8	⌃ ⌄	DRY VERIFY select 1 NTU STD or 20 NTU STD or verify SN of previously used calibration device	enter
		Set Head on Standard	enter
		Reading Displayed	enter (to accept)
		GOOD VER!	enter (to store)
9	⌃ ⌄	ENTER INITIALS (user input)	enter
10	—	RETURN SENSOR TO MEASURE MODE	enter
11	menu home	MAIN MENU or Main Measurement Screen	—

5.4.2 Wet Verification

Before starting the verification, read and apply the appropriate tips in section 5.3 on page 40.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SENSOR SETUP	enter
3	—	CALIBRATE	enter
4	⌄	VERIFICATION	enter
5	—	PERFORM VER	enter
6	⌃ ⌄	OUTPUT MODE Choose ACTIVE, HOLD, TRANSFER	enter
7	⌄	Select VER TYPE Select WET	enter
8	⌃ ⌄	Enter Std Turbidity	enter
	a.	DRAIN AND CLEAN SENSOR BODY. ENTER TO CONT	enter
	b.	POUR STANDARD INTO CYL/BODY. PLACE HEAD ON. ENTER TO CONT	enter
	c.	Reading Displayed	enter (to accept)
	d.	GOOD VER!	enter
9	⌃ ⌄	ENTER INITIALS	enter
10	⌃ ⌄	RETURN SENSOR TO MEASURE MODE	enter
11	menu home	Main Menu or Main Measurement Screen	—

5.5 Calibration and Verification History

The calibration and verification history logs contain information on the last 12 calibrations and the last 12 verifications. The calibration history log shows the gain value, the time and date of the calibration, and the initials of the operator performing verification.

Note: *Restoring default settings from the DIAG/TEST menu will return the turbidimeter to its non calibration state (gain = 1.0) but it will not remove the previous calibration history from memory.*

The calibration history log is accessed from the Calibrate menu. The verification history log is accessed from the Verification menu (a submenu of the Calibrate menu).

Each verification history entry shows the serial number of the verification device (dry verification) or the value of the verification standard (wet verification), the time and date of the verification, and the initials of the operator performing the verification.

Scroll through the entries by pressing the **ENTER** key. After scrolling through all 12 histories, the display will return to the calibration menu level.

When the instrument is received from the factory, default values or blank spaces will be shown for the calibration and verification history information. Those values will be replaced with real data as the history log is filled.

The data is retained as first in, first out. When the log is full, the newest entry is stored and the oldest entry in the log is deleted.

Section 6 Maintenance

DANGER
Only qualified personnel should conduct the maintenance tasks described in this section of the manual.

6.1 Maintenance Schedule

Maintenance Task	Frequency
Clean the sensor	Before each calibration and as needed. Depends on sample characteristics.
Calibrate Sensor (as required by regulatory agency)	Per agency-dictated schedule.

Scheduled periodic maintenance requirements of the 1720E are minimal and include calibration and cleaning of the photocell window, bubble trap, and body. Check and clean the bubble trap and turbidimeter body (as described in section 6.4.3) if visual inspection shows that it is necessary. Perform other maintenance on a regular basis; experience will dictate scheduling and may depend on the installation, sample type, and season.

It is very important to maintain the cleanliness of the interior and exterior of the turbidimeter body, head assembly, the integral bubble trap, and the surrounding area. Doing so will ensure accurate, low-level turbidity measurements.

Clean the body before calibration and verification (especially when measurements are being made at 1.0 NTU or lower).

Check and/or perform a calibration periodically (as experience dictates) using one of the methods described in section 5.3 on page 40. A calibration history menu option is available under Sensor Setup/Calibrate.

6.2 Removing a Sensor from the System

Prior to physically removing a sensor from the system, record all user defined settings such as relays, signal averaging, etc. Disconnect the sensor connector at the controller.

6.3 Reinstalling a Sensor on the System

To return the system to normal operation following a software upgrade or sensor repair perform the following procedure:

1. Detach all sensors from the sc100 controller.
2. From the main menu, press the down arrow key to highlight TEST/MAINT. Press **ENTER**.
3. Use the down arrow key to scroll to SCAN SENSORS and press **ENTER**.
4. Remove attached sensors by selecting the corresponding serial number or select “All”.
5. **Power down the sc100 then attach the 1720E.**
6. Supply power to the sc100. The system will initialize automatically.

Note: *Clean sensors before reinstallation on the system.*

6.4 Cleaning

6.4.1 Cleaning the Controller

With the enclosure securely closed, wipe the exterior with a damp cloth.

6.4.2 Cleaning the Photocell Window

Occasional cleaning of the photocell window is required. The frequency will depend on the nature and concentration of dissolved and suspended solids in the sample. Biological activity is a primary factor in mineral scale deposit on the window and the amount differs with sample temperature. In general, more growth will occur in warm temperatures and less in cold.

Note: *Take care to not scratch the photocell window.*

Inspect the photocell window often to determine cleaning needs. Remove any organic growth or film on the photocell window before standardization or calibration. Use a cotton swab and isopropyl alcohol or a mild detergent (such as Liqui-nox®) to remove most sediment and dirt. Mineral scale buildup may require cleaning with a mild acid applied with a cotton swab followed by a detergent wash. **Do not use abrasive cleaners.**

6.4.3 Cleaning the Turbidimeter Body and Bubble Trap

Sediment may collect in the turbidimeter body after extended use. Noise (fluctuation) in the reading could indicate the need to clean the body and/or bubble trap. The 1720E bubble trap and bottom plate may be removed to make cleaning easier. Drain and clean the turbidimeter body before each calibration. Establish a regular schedule or perform cleaning as determined by visual inspection.

Cleaning the Turbidimeter Body

Note: *The turbidimeter body, bubble trap, and detector must be cleaned before each calibration.*

1. Turn off sample flow to the turbidimeter body.
2. Remove the head assembly and bubble trap cover from the body. Remove the bubble trap by lifting it vertically. Set it aside to be cleaned separately.
3. Drain the body by removing the plug from the bottom of the body.
4. Replace the drain plug and fill the body to the weir with cleaning solution. This cleaning solution can consist of dilute chlorine solution (25 mL of household bleach in 3.78 liters of water) or a laboratory detergent such as Liqui-nox (1 mL detergent in 1 liter of water).
5. Use a soft brush to clean the inside surfaces of the body.
6. Remove the drain plug again and thoroughly flush the turbidimeter body with ultra-filtered deionized water. Clean and replace the plug.

Cleaning the Bubble Trap

1. Prepare a cleaning solution (as in step 4 above) in a container large enough to submerge the entire bubble trap.
2. Using a test tube brush such as Cat. No. 690-00, clean each surface.
3. Rinse the bubble trap thoroughly with ultra-filtered deionized water and reinstall it in the turbidimeter body.
4. Replace the bubble trap cover and head assembly on the top of the body.

5. Restore sample flow to the instrument.

6. Calibrate the instrument using one of the methods in section 5.3 on page 40.

If the above cleaning procedures have been performed and the turbidimeter readings are still noisy, the bottom plate and gasket may need to be removed and cleaned. Carefully perform the following procedure to ensure the turbidimeter body integrity is maintained.

1. Turn off sample flow to the turbidimeter body.

2. Remove the head assembly, bubble trap cover, and bubble trap (by lifting it vertically) from the body.

3. Drain the body by removing the plug from the bottom of the body.

4. Lift the body off of its mounting screws.

5. With the body turned upside-down, remove the two Phillips-head screws holding the bottom plate.

6. Lift the bottom plate off the body; set the gasket aside for use in reassembly.

7. Use a soft brush and a dilute cleaning solution (as prepared above) to clean the bottom plate and inside surfaces of the turbidimeter body. Rinse the entire body and bottom plate with ultra-filtered deionized water.

8. Reassemble by inserting the gasket into the molded channel in the bottom plate.

9. Fit the bottom plate onto the turbidimeter body.

10. Reinstall both screws and carefully tighten to 15 inch-lb maximum.

11. Reinstall the turbidimeter onto the wall mounting screws.

12. Replace the bubble trap, bubble trap cover, and head assembly on the top of the body.

13. Restore sample flow to the instrument.

6.4.4 Replacing the Lamp Assembly

The Lamp Assembly is located on the head assembly. Under normal use, Hach recommends replacing the lamp once a year to maintain peak performance. Replacement bulbs have been “burned-in” at the factory and are ready for installation and use.

To change the lamp, refer to Figure 28 on page 50 and perform the following steps:

1. Disconnect power to the controller to remove all power to the turbidimeter.

2. Disconnect the lamp leads by unplugging the connector.

3. After the bulb has cooled, remove as follows:

a. Wear cotton gloves to protect your hands and to avoid fingerprints on the bulb.

b. Grasp the bulb.

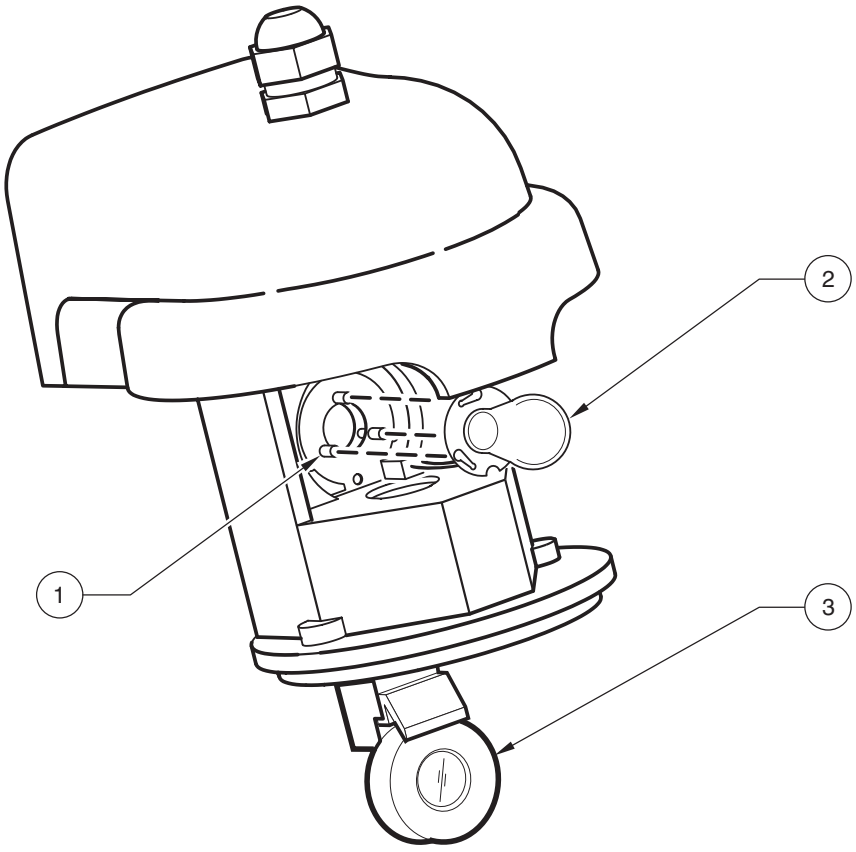
c. Twist the bulb in a counterclockwise direction, pulling out slightly, until it is released from the housing.

d. Pull the lamp leads and connector through the hole in the lamp housing.

Do not touch the new bulb with bare hands. Etched glass and reduced lamp life will result. Wear cotton gloves or grasp the lamp assembly with a tissue to avoid contamination. If contamination occurs, clean the glass bulb portion with isopropyl alcohol.

Replace the bulb by reversing the above instructions. The bulb base only fits one way; align the notch in the metal bulb flange with the hole in the lamp holder.

Figure 28 Lamp Replacement



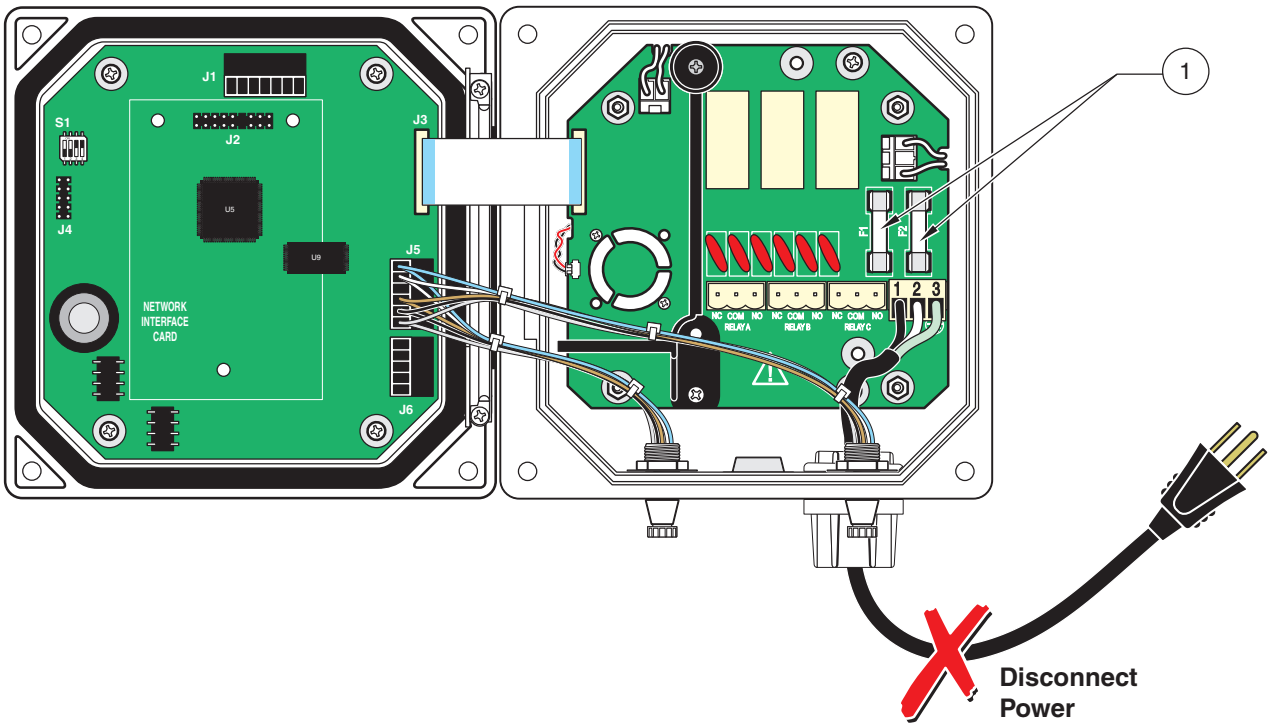
1. Lamp Housing	**2.** Lamp Assembly	**3.** Photo Detector

6.5 Fuse Replacement

The controller contains two mains fuses. Failed fuses are an indication that an equipment problem could exist. Problem resolution and fuse replacement should only be performed by qualified service personnel. Refer to Figure 29 and perform the following steps to replace the fuses:

1. Disconnect power to the controller (including power to relays if powered).
2. Open the hinged controller cover by completely loosening all four captive screws in the cover.
3. Remove the high voltage barrier; pull out on the lever of the captive fastener then pull straight out on the barrier. Set the barrier aside for reinstallation.
4. Remove the fuses and install new fuses of the same type and rating (T, 1.6A, 250 V, slow blow).
5. Reinstall the high voltage barrier.
6. Close the controller cover and hand-tighten the four screws.
7. Reconnect all power to the instrument.

Figure 29 Fuse Replacement



1.	Fuses F1 and F2, 1.6 A

Section 7 Troubleshooting

7.1 Error Codes

When a sensor is experiencing an error condition, the sensor reading on the measurement screen will flash and all relays and analog outputs associated with the sensor will be held.

Highlight the Probe Diag menu and press **ENTER**. Highlight Errors and press **ENTER** to determine the case of the error. Errors are defined in Table 9.

Table 9 Error Codes

Displayed Error	Definition
A/D Fail	Failed A/D converter. Call the Service Department.
Lamp Fail	The light source has failed. See section 6.4.4 on page 49 for instructions for replacing it.
Flash Fail	Datalog and event log will not work.

7.2 Warnings

A sensor warning will leave all menus, relays, and outputs functioning normally, but will cause a warning icon to flash on the right side of the display. Highlight the Probe Diag menu and press **ENTER** to determine the cause of the error. Warnings are defined in Table 10.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning. Errors are defined in Table 10.

Table 10 Warning Codes

Warning Number	Displayed Warning	Definition/Resolution
1	Dark Reading Warning	Dark reading detects too much light.
2	Temperature Warning	Sensor head internal temperature is higher than specified. Contact the Service Department.
3	Data Log Full Warning	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
4	Event Log Full Warning	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
5	5 Volt Warning	Monitored voltage is outside the range of 4.5 – 5.5 V @ microprocessor input -> 698 to 854 counts from the microprocessor ADC.
6	Voltage in Warning	Monitored voltage is outside the range of 9.08 – 14.3 V @ microprocessor pin -> 279 to 435 counts from the microprocessor ADC.
7	Lamp V Warning	Monitored voltage is outside the range of 3.96 – 4.48 V @ microprocessor pin -> 614 to 385 counts from the microprocessor ADC.
8	Lamp I Warning	Monitored voltage is outside the range of 1.67 – 2.75 V @ microprocessor pin -> 39 to 64 counts from the microprocessor ADC.
9	Output Mode Not Normal	Activated when the sensor is not in normal measurement mode (such as when in calibration or verification mode).

Table 11 presents sensor warnings displayed in the Event Log, possible causes, and corrective actions.

Table 11 Troubleshooting

Sensor Warning	Possible Cause	Corrective Action
Bad Lamp	Lamp burned out	Replace the lamp. See section 6.4.4 on page 49.
	Lamp unplugged	Restore connection
	+12 V connection loose at controller	Restore connection
	Dislodged lamp	Reinstall lamp
	Bad circuit board in turbidimeter head	Contact the Customer Service Department.
Low Signal	Photocell coated/dirty	See Cleaning the Photocell Window on page 48. Contact the Customer Service Department.
	Photocell wires disconnected	Reconnect wires
	Photocell broken/cracked	Replace photocell Contact the Customer Service Department.
	Lens coated/dirty	Clean the lens using isopropyl alcohol and a cotton swab.
	Obstructed light path	Remove obstruction
	Sample turbidity >100 NTU	Switch to a high range turbidimeter
	See Bad Lamp causes above	See Bad Lamp corrective actions above
Bad System Voltage	Improper wiring at controller	See the controller wiring instructions in section 3.2, Electrical Installation on page 14.
	Turbidimeter head cable shortened to improper length	Contact the Customer Service Department.
	Fluctuation in voltage	Turn instrument power off and back on.
	Bad circuit board in turbidimeter head	Contact the Service Department
A/D Converter Timeout	Fluctuation in voltage	Turn instrument power off and back on.
	Bad circuit board in turbidimeter head	Contact the Customer Service Department.
High Dark Counts	Light Leak—Turbidimeter head not on turbidimeter body or calibration cylinder during Power Up or Zero Electronics	Make sure the turbidimeter head is on the turbidimeter body and properly aligned and repower instrument or perform ZERO ELECTRONICS in the CALIBRATION MENU.
	Light Leak—Turbidimeter head not properly aligned on the turbidimeter body or calibration cylinder during Power Up or Zero Electronics	Make sure the turbidimeter head is properly aligned and repower instrument or perform ZERO ELECTRONICS in the CALIBRATION MENU.
	Photocell broken/cracked	Contact the Customer Service Department.

The following table presents additional malfunctions which may not be recorded in the Event Log.

Table 12 Additional Malfunctions Not Recorded in the Event Log

Symptom	Possible Cause	Corrective Action
Continuous Underrange (negative reading)	Calibration standards not in the correct order or incorrect dilution	Verify the accuracy of calibration standards and recalibrate the instrument. See Low Signal in Table 11.
Continuous Overrange (100 NTU)	Calibration standards not in the correct order or incorrect dilution	Verify the accuracy of calibration standards and recalibrate the instrument.

Table 12 Additional Malfunctions Not Recorded in the Event Log (continued)

Symptom	Possible Cause	Corrective Action
Erratic Readings	Calibration standards have the same value Inadequate bubble removal from sample	Verify the accuracy of calibration standards and recalibrate the instrument. Increase the signal averaging time to a longer interval. Make sure the Bubble Reject feature is turned on. Slow the flow of sample into the instrument.
High Readings	Deionized water turbidity is greater than 0.5 NTU	Clean the instrument. Access Calibration History for turbidity value of ultra-filtered water. Verify the flow is between 200–750 mL/min. Recalibrate the instrument.

7.3 Event Codes

Event codes are not displayed on the screen of the sc100 and must be downloaded from the event log to be viewed. See section 4.7 on page 36 for additional information. Troubleshooting actions are given in section Table 11 on page 53.

Table 13 Event Log List

Event	Event #	Data1	Data2	Data3
Bubble Reject Change	0	0 = OFF 1= ON	—	—
Filter Size Change	1	0 = No avg 1 = 6 sec 2 = 30 sec 3 = 60 sec 4 = 90 sec	—	—
Data Log Interval Change	2	0 = 30 sec 1 = 1min 2 = 5 min 3 = 10 min 4 = 15 min	—	—
Power On	3	1	—	—
Calibration	4	Cal Gain	Initials	—
Verification	5	Expected Value	Meas Value	Initials
Dark Reading Warning	6	Measured Value	—	—
Temperature Warning	7	Temperature Value	—	—
Voltage Warning	8	16 = +5V high 32 = +5V low 64 = V in high 128 = V in low	—	—
Lamp Warning	9	1 = lamp V high 2 = lamp V low 4 = lamp I high 8 = lamp I low	—	—
A/D Fail	10	1	—	—
Lamp Fail	11	2	—	—
Flash Fail	12	3	—	—
Output Mode Change	13	1 = Hold 2 = Transfer	—	—

Section 8 Replacement Parts and Accessories

Replacement Items

Item	Cat. No.
Fuse, T, 1.6 A, 250 V	52083-00
Instruction Manual, sc100 Controller, English	58600-18
Instruction Manual, 1720E Turbidimeter System, English	60100-18
Installation kit, sc100 Controller	58672-00
Lamp Assembly	18950-00
sc100 Controller	58600-00

Optional Accessories

Cable, sensor extension, 7.7 m (25 ft)		57960-00
Cap, Connector Receptacle	each	52100-00
Deionized (demineralized) water	1 L	272-56
Digital Output Card for ModBUS RS232 communication		59200-00
Digital Output Card for ModBUS RS485 communication		59200-01
Drain plug for the 1720E body	each	44116-00
Filter, 0.45 µm, to produce ultra-filtered water for cleaning and calibration	each	26705-00
Filter, 0.2 µm, to produce ultra-filtered water for calibration standard preparation	each	23238-10
Formazin Calibration Kit includes:		
Calibration Cylinder, TenSette® Pipet, 4000 NTU Formazin Primary Standard (500 mL)	each	44156-00
Floor Stand	each	57432-00
Flow meter, 500–700 mL/min	each	40282-00
ICE-PIC Module for Calibration and Calibration Verification		
20 NTU	each	52250-00
1 NTU	each	52215-00
0.5 NTU	each	52225-00
Lid, Bubble Trap, 1720E	each	52012-00
Photocell Replacement Kit for the 1720E	each	52180-00
Pipet tips for 19700-01 TenSette Pipet	50/pkg	21856-96
Pipet tips for 19700-10 TenSette Pipet	50/pkg	21997-96
Plug, conduit opening		58687-00
Power Cord with strain relief, 115 V		54488-00
Power Cord with strain relief, 230 V		54489-00
Power Cord Kit, 10A-125V, 1.8 m (6 ft), UL/CSA listed	each	46306-00
Power Cord Kit, 10A-230V, 1.8 m (6 ft), European-style plug, VDE approved	each	46308-00
StablCal Calibration Set for the 1720 Series Turbidimeter		
Includes: StablCal Standards, < 0.1 NTU, 20.0 NTU	1 L/each	26596-00
StablCal Standard, 0.1 NTU	1 L	27233-53
StablCal Standard, 0.3 NTU	1 L	26979-53
StablCal Standard, 0.5 NTU	1 L	26980-53
StablCal Standard, 1.0 NTU	1 L	26598-53
Strain relief, Heyco		16664
Sun shield		58690-00
Swabs, Cotton, presterilized for cleaning the photodetector	100/pkg	25543-00
TenSette Pipet, 0.1 to 1.0 mL	each	19700-01
TenSette Pipet, 1.0 to 10.0 mL	each	19700-10
Tubing, Inlet, ¼ inch O.D., Polyethylene	per foot	51322-00
Tubing, Outlet, ½ inch I.D., ¾ inch O.D., Tygon R3603	per foot	51263-00

Calibration and Verification Standards and Accessories

Item	Qty	Cat. No.
Calibration Cylinder	each	44153-00
Formazin Calibration Standards		
Formazin, 4000 NTU Stock Solution	500 mL	2461-49
Calibration/Verification Modules		
ICE-PIC™ Module, 1 NTU	1 each	52215-00
ICE-PIC™ Module, 20 NTU	1 each	52250-00
StablCal® Calibration Standards		
StablCal® Stabilized Formazin Standard, 1 NTU	1 L	26598-53
StablCal® Stabilized Formazin Standard, 20 NTU	1 L	26601-53
StablCal® Stabilized Formazin Standard, <0.1 NTU	1 L	26597-53
StablCal® Stabilized Formazin Set, four 1-L bottles 20-NTU and four 1-L bottles <0.1 NTU	1 L each	26596-00
StablCal® Stabilized Formazin Standard, 40 NTU	1 gallon (3.78 L)	27463-56
StablCal® Stabilized Formazin Standard, 0.1 NTU	1 gallon (3.78 L)	27233-56

Section 9 How to Order

U.S.A. Customers

By Telephone:
6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By Fax:
(970) 669-2932

By Mail:
Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.

Ordering information by e-mail: orders@hach.com

9.1 Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- billing address
- Shipping address
- Catalog number
- Quantity

9.2 International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send e-mail to intl@hach.com or contact:

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; Fax: (970) 669-2932

9.3 Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call 1-800-227-4224 or e-mail techhelp@hach.com

Section 10 Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:
Hach Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
FAX: (515) 232-3835

In Canada:
Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

In Latin America, the Caribbean, the Far East, the
Indian Subcontinent, Africa, Europe, or the Middle East:
Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Section 11 Limited Warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price, subject to the pro-rated schedule above, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- **Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction**
- **Damage caused by misuse, neglect, accident or improper application or installation**
- **Damage caused by any repair or attempted repair not authorized by Hach Company**
- **Any product not used in accordance with the instructions furnished by Hach Company**
- **Freight charges to return merchandise to Hach Company**
- **Freight charges on expedited or express shipment of warranted parts or product**
- **Travel fees associated with on-site warranty repair**

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

Section 10 Compliance Information

Hach Co. certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The **Model sc100 with 1720E Sensor** has been tested and is certified as indicated to the following instrumentation standards:

Product Safety

UL 61010A-1 (ETL Listing # 65454)
CSA C22.2 No. 1010.1 (ETLc Certification # 65454)
Certified by Hach Co. to EN 61010-1 Amds. 1 & 2 (IEC1010-1) per 73/23/EEC, supporting test records by Intertek Testing Services.

Immunity

This equipment was tested for Industrial level EMC per:

EN 61326 (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) **per 89/336/EEC EMC:** Supporting test records by Hach Company, certified compliance by Hach Company.

Standards include:

IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electro-Static Discharge Immunity (Criteria B)
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electro-Magnetic Field Immunity (Criteria A)
IEC 1000-4-4:1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)
IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)
IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)
IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

Additional immunity Standard/s include:

ENV 50204:1996 Radiated Electro-Magnetic Field from Digital Telephones (Criteria A)

Emissions

This equipment was tested for Radio Frequency Emissions as follows:

Per **89/336/EEC** EMC: **EN 61326:1998** (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Class “A” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment
EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

Additional Emissions Standard/s include:

EN 55011 (CISPR 11) Class “A” emission limits

Canadian Interference-causing Equipment Regulation, IECS-003, Class A

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference- Causing Equipment Regulations.

Cet appareil numÈrique de la classe A respecte toutes les exigences du RËglement sur le matÈriel brouilleur du Canada.

FCC PART 15, Class “A” Limits

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the Model sc100 Controller from its power source to verify that it is or is not the source of the interference.

2. If the Model sc100 Controller is connected into the same outlet as the device with which it is interfering, try another outlet.

3. Move the Model sc100 Controller and 1720E sensor away from the device receiving the interference.

4. Reposition the device receiving the interference.

5. Try combinations of the above.

Appendix A ModBUS Register Information

Table 14 Controller ModBUS Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Measurements	Calculated Value	40001	Float	2	R	Value calculated from two sensor measurements
Setup	Language	40003	Unsigned Integer	1	R/W	Current System Language
Setup	Date Format	40004	Unsigned Integer	1	R/W	Current Data Display Format (0 = DD/MM/YY; 1 = MM/DD/YY; 2 = DD-MM-YY; 3 = MM-DD-YY)
Setup	Error Hold Mode	40005	Unsigned Integer	1	R/W	Error Mode Hold State (0 = Hold outputs; 1 = Transfer outputs to predefined value)
Setup/Analog Output 1	Source	40006	Unsigned Integer	1	R/W	Selects data source for this output (0 = None; 2 = sensor; 4 = Calculation)
Setup/Analog Output 1	Sensor Select	40007	Unsigned Integer	1	R/W	Selects sensor source when Source = Sensor (0 = sensor1; 1 = sensor2)
Setup/Analog Output 1	Measurement Select	40008	Unsigned Integer	1	R/W	Selects measurement on the sensor (0 = Meas1.. 3 = Meas4)
Setup/Analog Output 1	Type	40009	Unsigned Integer	1	R/W	Selects output type (0 = Linear output; 1 = PID control)
Setup/Analog Output 1	Transfer Value	40010	Float	2	R/W	Sets the transfer value
Setup/Analog Output 1	Filter	40012	Unsigned Integer	1	R/W	Sets the output filter value in seconds (0 to 120 sec.)
Setup/Analog Output 1	0mA - 4mA Select	40013	Unsigned Integer	1	R/W	Selects 0mA/4mA for min output (0 = 0mA; 1 = 4mA)
Setup/Analog Output 1/Linear	Min Setting	40014	Float	2	R/W	Sets the min output value
Setup/Analog Output 1/Linear	Max Setting	40016	Float	2	R/W	Sets the max output value
Setup/Analog Output 1/PID	PID Mode	40018	Unsigned Integer	1	R/W	Sets the PID mode (0 = auto; 1 = manual)
Setup/Analog Output 1/PID	PID Manual Set	40019	Float	2	R/W	Sets the PID manual output value (0.0 to 100.0%)
Setup/Analog Output 1/PID	PID Setpoint	40021	Float	2	R/W	Sets the PID setpoint
Setup/Analog Output 1/PID	PID Phase	40023	Unsigned Integer	1	R/W	Sets the PID phase (0 = Direct; 1 = Reverse)
Setup/Analog Output 1/PID	PID Proportional Band	40024	Float	2	R/W	Sets the PID proportional band
Setup/Analog Output 1/PID	PID Integral Time	40026	Unsigned Integer	1	R/W	Sets the PID integral time (min)
Setup/Analog Output 1/PID	PID Derivative Time	40027	Unsigned Integer	1	R/W	Sets the PID derivative time (min)
Setup/Analog Output 2	Source	40028	Unsigned Integer	1	R/W	Selects data source for this output (0 = None; 2 = Sensor; 4 = Calculation)
Setup/Analog Output 2	Sensor Select	40029	Unsigned Integer	1	R/W	Selects sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Analog Output 2	Measurement Select	40030	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Analog Output 2	Type	40031	Unsigned Integer	1	R/W	Selects output type (0 = Linear output; 1 = PID control)
Setup/Analog Output 2	Transfer Value	40032	Float	2	R/W	Sets the transfer value
Setup/Analog Output 2	Filter	40034	Unsigned Integer	1	R/W	Sets the output filter value in seconds (0 to 120 sec)
Setup/Analog Output 2	0mA - 4mA Select	40035	Unsigned Integer	1	R/W	Selects 0mA/4mA for min output (0 = 0mA; 1 = 4mA)
Setup/Analog Output 2/Linear	Min Setting	40036	Float	2	R/W	Sets the min output value
Setup/Analog Output 2/Linear	Max Setting	40038	Float	2	R/W	Sets the max output value
Setup/Analog Output 2/PID	Mode	40040	Unsigned Integer	1	R/W	Sets the PID mode (0 = auto; 1 = manual)
Setup/Analog Output 2/PID	Manual Set	40041	Float	2	R/W	Sets the PID manual output value (0.0 to 100.0%)
Setup/Analog Output 2/PID	Setpoint	40043	Float	2	R/W	Sets the PID setpoint
Setup/Analog Output 2/PID	Phase	40045	Unsigned Integer	1	R/W	Sets the PID phase (0 = Direct; 1 = Reverse)
Setup/Analog Output 2/PID	Proportional Band	40046	Float	2	R/W	Sets the PID proportional band
Setup/Analog Output 2/PID	Integral Time	40048	Unsigned Integer	1	R/W	Sets the PID integral time (min)
Setup/Analog Output 2/PID	Derivative Time	40049	Unsigned Integer	1	R/W	Sets the PID derivative time (min)
Setup/Relay 1	Source	40050	Unsigned Integer	1	R/W	Selects data source for this relay (0 = None; 1 = Real Time Clock; 2 = Sensor; 4 = Calculation)
Setup/Relay 1	Sensor Select	40051	Unsigned Integer	1	R/W	Selects Sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Relay 1	Measurement Select	40052	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)
Setup/Relay 1	Type	40053	Unsigned Integer	1	R/W	Selects the relay type (0 = Alarm; 1 = Control; 2 = Status; 3 = Timer; 4 = Event)
Setup/Relay 1	Transfer Setting	40054	Unsigned Integer	1	R/W	Selects the transfer value for the relays (0 = De-energized; 1 = Energized)
Setup/Relay 1/Alarm	High Alarm	40055	Float	2	R/W	Sets the high alarm setpoint
Setup/Relay 1/Alarm	Low Alarm	40057	Float	2	R/W	Sets the low alarm setpoint
Setup/Relay 1/Alarm	High Deadband	40059	Float	2	R/W	Sets the high alarm deadband
Setup/Relay 1/Alarm	Low Deadband	40061	Float	2	R/W	Sets the low alarm deadband
Setup/Relay 1/Alarm	On Delay	40063	Unsigned Integer	1	R/W	Sets the on delay time
Setup/Relay 1/Alarm	Off Delay	40064	Unsigned Integer	1	R/W	Sets the off delay time
Setup/Relay 1/Control	Setpoint	40065	Float	2	R/W	Sets the controller setpoint

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 1/Control	Phase	40067	Unsigned Integer	1	R/W	Sets the controller phase (0 = Low; 1 = High)
Setup/Relay 1/Control	Deadband	40068	Float	2	R/W	Sets the controller deadband
Setup/Relay 1/Control	Overfeed Timer	40070	Unsigned Integer	1	R/W	Sets the overfeed timer value (mins)
Setup/Relay 1/Control	On Delay	40071	Unsigned Integer	1	R/W	Sets the on delay time (sec)
Setup/Relay 1/Control	Off Delay	40072	Unsigned Integer	1	R/W	Sets the off delay time (sec)
Setup/Relay 1/Control	Reset Overfeed Timer	40073	Unsigned Integer	1	R/W	Resets the overfeed timer
Setup/Relay 1/Event	Setpoint	40074	Float	2	R/W	Sets the event setpoint
Setup/Relay 1/Event	Phase	40076	Unsigned Integer	1	R/W	Sets the event phase (0 = Low; 1 = High)
Setup/Relay 1/Event	Deadband	40077	Float	2	R/W	Sets the event deadband
Setup/Relay 1/Event	On Max Time	40079	Unsigned Integer	1	R/W	Sets the max on time (mins)
Setup/Relay 1/Event	On Min Time	40080	Unsigned Integer	1	R/W	Sets the min on time (mins)
Setup/Relay 1/Event	Off Max Time	40081	Unsigned Integer	1	R/W	Sets the max off time (mins)
Setup/Relay 1/Event	Off Min Time	40082	Unsigned Integer	1	R/W	Sets the min off time (mins)
Setup/Relay 1/Timer	Hold Type	40083	Unsigned Integer	1	R/W	Sets which Sensor outputs are affected during timer on time (0 = None; 2 = Selected Sensor; 13 = All Sensors)
Setup/Relay 1/Timer	Sensor Select	40084	Unsigned Integer	1	R/W	Selects which Sensor outputs are being held/transferred during the timers on time (this is used when Hold type is set for single Sensor)
Setup/Relay 1/Timer	Hold Mode	40085	Unsigned Integer	1	R/W	Selects hold outputs vs. set transfer value during timers on time
Setup/Relay 1/Timer	Duration Time	40086	Unsigned Integer	1	R/W	Sets the timer on duration time (sec)
Setup/Relay 1/Timer	Period Time	40087	Unsigned Integer	1	R/W	Sets the period between timer on events (mins)
Setup/Relay 1/Timer	Off Delay	40088	Unsigned Integer	1	R/W	Sets the time the affected Sensor outputs are held/transferred after the timer turns off (sec)
Setup/Relay 1/Status	Level	40089	Unsigned Integer	1	R/W	Sets the status level which will trigger the relay
Setup/Relay 2	Source	40090	Unsigned Integer	1	R/W	Selects data source for this relay (0 = None; 1 = Real Time Clock; 2 = Sensor; 4 = Calculation)
Setup/Relay 2	Sensor Select	40091	Unsigned Integer	1	R/W	Selects Sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Relay 2	Measurement Select	40092	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 2	Type	40093	Unsigned Integer	1	R/W	Selects the relay type (0 = Alarm; 1 = Control; 2 = Status; 3 = Timer; 4 = Event)
Setup/Relay 2	Transfer Setting	40094	Unsigned Integer	1	R/W	Selects the transfer value for the relays (0 = De-energized; 1 = Energized)
Setup/Relay 2/Alarm	High Alarm	40095	Float	2	R/W	Sets the high alarm setpoint
Setup/Relay 2/Alarm	Low Alarm	40097	Float	2	R/W	Sets the low alarm setpoint
Setup/Relay 2/Alarm	High Deadband	40099	Float	2	R/W	Sets the high alarm deadband
Setup/Relay 2/Alarm	Low Deadband	40101	Float	2	R/W	Sets the low alarm deadband
Setup/Relay 2/Alarm	On Delay	40103	Unsigned Integer	1	R/W	Sets the on delay time
Setup/Relay 2/Alarm	Off Delay	40104	Unsigned Integer	1	R/W	Sets the off delay time
Setup/Relay 2/Control	Setpoint	40105	Float	2	R/W	Sets the controller setpoint
Setup/Relay 2/Control	Phase	40107	Unsigned Integer	1	R/W	Sets the controller phase (0 = Low; 1 = High)
Setup/Relay 2/Control	Deadband	40108	Float	2	R/W	Sets the controller deadband
Setup/Relay 2/Control	Overfeed Timer	40110	Unsigned Integer	1	R/W	Sets the overfeed timer value (mins)
Setup/Relay 2/Control	On Delay	40111	Unsigned Integer	1	R/W	Sets the on delay time (sec)
Setup/Relay 2/Control	Off Delay	40112	Unsigned Integer	1	R/W	Sets the off delay time (sec)
Setup/Relay 2/Control	Reset Overfeed Timer	40113	Unsigned Integer	1	R/W	Resets the overfeed timer
Setup/Relay 2/Event	Setpoint	40114	Float	2	R/W	Sets the event setpoint
Setup/Relay 2/Event	Phase	40116	Unsigned Integer	1	R/W	Sets the event phase (0 = Low; 1 = High)
Setup/Relay 2/Event	Deadband	40117	Float	2	R/W	Sets the event deadband
Setup/Relay 2/Event	On Max Time	40119	Unsigned Integer	1	R/W	Sets the max on time (mins)
Setup/Relay 2/Event	On Min Time	40120	Unsigned Integer	1	R/W	Sets the min on time (mins)
Setup/Relay 2/Event	Off Max Time	40121	Unsigned Integer	1	R/W	Sets the max off time (mins)
Setup/Relay 2/Event	Off Min Time	40122	Unsigned Integer	1	R/W	Sets the min off time (mins)
Setup/Relay 2/Timer	Hold Type	40123	Unsigned Integer	1	R/W	Sets which Sensor outputs are affected during timer on time (0 = None; 2 = Selected Sensor; 13 = All Sensors)
Setup/Relay 2/Timer	Sensor Select	40124	Unsigned Integer	1	R/W	Selects which Sensor outputs are being held/transferred during the timers on time (this is used when Hold type is set for single Sensor)
Setup/Relay 2/Timer	Hold Mode	40125	Unsigned Integer	1	R/W	Selects hold outputs vs. set transfer value during timers on time

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 2/Timer	Duration Time	40126	Unsigned Integer	1	R/W	Sets the timer on duration time (sec)
Setup/Relay 2/Timer	Period Time	40127	Unsigned Integer	1	R/W	Sets the period between timer on events (mins)
Setup/Relay 2/Timer	Off Delay	40128	Unsigned Integer	1	R/W	Sets the time the affected Sensor outputs are held/transferred after the timer turns off (sec)
Setup/Relay 2/Status	Level	40129	Unsigned Integer	1	R/W	Sets the status level which will trigger the relay
Setup/Relay 3	Source	40130	Unsigned Integer	1	R/W	Selects data source for this relay (0 = None; 1 = Real Time Clock; 2 = Sensor; 4 = Calculation)
Setup/Relay 3	Sensor Select	40131	Unsigned Integer	1	R/W	Selects Sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Relay 3	Measurement Select	40132	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)
Setup/Relay 3	Type	40133	Unsigned Integer	1	R/W	Selects the relay type (0 = Alarm; 1 = Control; 2 = Status; 3 = Timer; 4 = Event)
Setup/Relay 3	Transfer Setting	40134	Unsigned Integer	1	R/W	Selects the transfer value for the relays (0 = De-energized; 1 = Energized)
Setup/Relay 3/Alarm	High Alarm	40135	Float	2	R/W	Sets the high alarm setpoint
Setup/Relay 3/Alarm	Low Alarm	40137	Float	2	R/W	Sets the low alarm setpoint
Setup/Relay 3/Alarm	High Deadband	40139	Float	2	R/W	Sets the high alarm deadband
Setup/Relay 3/Alarm	Low Deadband	40141	Float	2	R/W	Sets the low alarm deadband
Setup/Relay 3/Alarm	On Delay	40143	Unsigned Integer	1	R/W	Sets the on delay time
Setup/Relay 3/Alarm	Off Delay	40144	Unsigned Integer	1	R/W	Sets the off delay time
Setup/Relay 3/Control	Setpoint	40145	Float	2	R/W	Sets the controller setpoint
Setup/Relay 3/Control	Phase	40147	Unsigned Integer	1	R/W	Sets the controller phase (0 = Low; 1 = High)
Setup/Relay 3/Control	Deadband	40148	Float	2	R/W	Sets the controller deadband
Setup/Relay 3/Control	Overfeed Timer	40150	Unsigned Integer	1	R/W	Sets the overfeed timer value (mins)
Setup/Relay 3/Control	On Delay	40151	Unsigned Integer	1	R/W	Sets the on delay time (sec)
Setup/Relay 3/Control	Off Delay	40152	Unsigned Integer	1	R/W	Sets the off delay time (sec)
Setup/Relay 3/Control	Reset Overfeed Timer	40153	Unsigned Integer	1	R/W	Resets the overfeed timer
Setup/Relay 3/Event	Setpoint	40154	Float	2	R/W	Sets the event setpoint
Setup/Relay 3/Event	Phase	40156	Unsigned Integer	1	R/W	Sets the event phase (0 = Low; 1 = High)
Setup/Relay 3/Event	Deadband	40157	Float	2	R/W	Sets the event deadband
Setup/Relay 3/Event	On Max Time	40159	Unsigned Integer	1	R/W	Sets the max on time (mins)

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 3/Event	On Min Time	40160	Unsigned Integer	1	R/W	Sets the min on time (mins)
Setup/Relay 3/Event	Off Max Time	40161	Unsigned Integer	1	R/W	Sets the max off time (mins)
Setup/Relay 3/Event	Off Min Time	40162	Unsigned Integer	1	R/W	Sets the min off time (mins)
Setup/Relay 3/Timer	Hold Type	40163	Unsigned Integer	1	R/W	Sets which Sensor outputs are affected during timer on time (0 = None; 2 = Selected Sensor; 13 = All Sensors)
Setup/Relay 3/Timer	Sensor Select	40164	Unsigned Integer	1	R/W	Selects which Sensor outputs are being held/transferred during the timers on time (this is used when Hold type is set for single Sensor)
Setup/Relay 3/Timer	Hold Mode	40165	Unsigned Integer	1	R/W	Selects hold outputs vs. set transfer value during timers on time
Setup/Relay 3/Timer	Duration Time	40166	Unsigned Integer	1	R/W	Sets the timer on duration time (sec)
Setup/Relay 3/Timer	Period Time	40167	Unsigned Integer	1	R/W	Sets the period between timer on events (mins)
Setup/Relay 3/Timer	Off Delay	40168	Unsigned Integer	1	R/W	Sets the time the affected Sensor outputs are held/transferred after the timer turns off (sec)
Setup/Relay 3/Status	Level	40169	Unsigned Integer	1	R/W	Sets the status level which will trigger the relay
Comm/Net Card	Mode	40170	Unsigned Integer	1	R/W	Sets the Modbus mode (0 = RTU; 1 = ASCII)
Comm/Net Card	Baud	40171	Unsigned Integer	1	R/W	Sets the Modbus baud rate (0 = 9600; 1 = 19200; 2 = 38400; 3 = 57600; 4 = 115200)
Comm/Net Card	Stop Bits	40172	Unsigned Integer	1	R/W	Sets the number of stop bits (1,2)
Comm/Net Card	Data Order	40173	Unsigned Integer	1	R/W	Sets the register data order for floats (0 = Normal; 1 = Reversed)
Comm/Net Card	Min Response Time	40174	Unsigned Integer	1	R/W	Sets the minimum response time (0 to 30 sec)
Comm/Net Card	Max Response Time	40175	Unsigned Integer	1	R/W	Sets the maximum response time (100 to 1000 sec)
Comm/Net Card/Addresses	sc100	40176	Unsigned Integer	1	R/W	Sets the sc100 Modbus Address
Comm/Net Card/Addresses	Sensor 1	40177	Unsigned Integer	1	R/W	Sets the Sensor 1 Modbus Address
Comm/Net Card/Addresses	Sensor 2	40178	Unsigned Integer	1	R/W	Sets the Sensor 2 Modbus Address
Comm/Net Card/Stats	Good Messages	40179	Unsigned Integer	2	R/W	Number of good messages
Comm/Net Card/Stats	Bad Messages	40181	Unsigned Integer	2	R/W	Number of failed messages
Comm/Net Card/Stats	% Good Mesg	40183	Float	2	R/W	% of good messages

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Comm/Service Port	Mode	40185	Unsigned Integer	1	R/W	Sets the Modbus mode (0 = RTU; 1 = ASCII)
Comm/Service Port	Baud	40186	Unsigned Integer	1	R/W	Sets the Modbus baud rate (0 = 9600; 1 = 19200; 2 = 38400; 3 = 57600; 4 = 115200)
Comm/Service Port	Stop Bits	40187	Unsigned Integer	1	R/W	Sets the number of stop bits (1,2)
Comm/Service Port	Data Order	40188	Unsigned Integer	1	R/W	Sets the register data order for floats (0 = Normal; 1 = Reversed)
Comm/Service Port	Min Response Time	40189	Unsigned Integer	1	R/W	Sets the minimum response time (0 to 30 sec)
Comm/Service Port	Max Response Time	40190	Unsigned Integer	1	R/W	Sets the maximum response time (100 to 1000 sec)
Comm/Service Port/Addresses	sc100	40191	Unsigned Integer	1	R/W	Sets the sc100 Modbus Address
Comm/Service Port/Addresses	Sensor 1	40192	Unsigned Integer	1	R/W	Sets the Sensor 1 Modbus Address
Comm/Service Port/Addresses	Sensor 2	40193	Unsigned Integer	1	R/W	Sets the Sensor 2 Modbus Address
Comm/Service Port/Stats	Good Messages	40194	Unsigned Integer	2	R/W	Number of good messages
Comm/Service Port/Stats	Bad Messages	40196	Unsigned Integer	2	R/W	Number of failed messages
Comm/Service Port/Stats	% Good Mesg	40198	Float	2	R/W	% of good messages
Comm/Sensor/ Sensor1 Stats	Good Messages	40200	Unsigned Integer	2	R/W	Number of good messages
Comm/Sensor/ Sensor1 Stats	Bad Messages	40202	Unsigned Integer	2	R/W	Number of failed messages
Comm/Sensor/ Sensor1 Stats	% Good Mesg	40204	Float	2	R/W	% of good messages
Comm/Sensor/ Sensor2 Stats	Good Messages	40206	Unsigned Integer	2	R/W	Number of good messages
Comm/Sensor/ Sensor2 Stats	Bad Messages	40208	Unsigned Integer	2	R/W	Number of failed messages
Comm/Sensor/ Sensor2 Stats	% Good Mesg	40210	Float	2	R/W	% of good messages
Calibration	Output1 4mA count	40212	Unsigned Integer	1	R/W	Calibration counts for the 4mA output 1
Calibration	Output1 20mA count	40213	Unsigned Integer	1	R/W	Calibration counts for the 20mA output 1
Calibration	Output2 4mA count	40214	Unsigned Integer	1	R/W	Calibration counts for the 4mA output 2
Calibration	Output2 20mA count	40215	Unsigned Integer	1	R/W	Calibration counts for the 20mA output 2

Table 15 Sensor ModBUS Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Units (U)	Range
Measurements	Cal Gain	40013	float	2	R	none	0.5 to 2.0
Verification	PF Criteria	40062	Integer	1	R/W	—	—
Measurements	Turbidity	40001	Float	2	R	NTU	0/100
Diagnostics	Temperature	40005	Float	2	R	Deg C	—
Diagnostics	Dark Reading	40009	Float	2	R	NTU	0/100
Diagnostics	Raw Turbidity	40011	Float	2	R	NTU	—
Diagnostics	Lamp Voltage	40018	Float	2	R	Volts	—
Diagnostics	Lamp Current	40020	Float	2	R	Amps	—
Diagnostics	Plus 5V	40022	Float	2	R	Volts	—
Diagnostics	Voltage In	40024	Float	2	R	Volts	—
Setup	Software Version	40015	Float	2	R	—	—
Setup	Bubble Rej	40017	Integer	1	R/W	—	On/Off
Setup	DataLog Interval	40026	Integer	1	R/W	Sec or Min	30 sec, 1 min, 5 min, 10 min, 15 min
Setup	Sensor Name	40027	String	6	R/W	—	—
Setup	Filter Size	40033	Integer	1	R/W	sec	no averaging, 6, 30, 60, 90
Setup	Sensor Ser Num	40036	String	6	R/W	—	12 digits
Setup	Output Mode	40042	Integer	1	R/W	—	—
Setup	Set Resolution	40061	Integer	1	R/W	decimal places	4, 3, or 2

Index

T

V

W