Catalog Number 6120318

Digital Contacting Conductivity Sensor

USER MANUAL

07/2014, Edition 4

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Section 1 Specifications

Specifications are subject to change without notice.

Table 1 3400sc-series Conductivity Probe Specifications

Components		Corrosion-resistant materials, fully-immersible probe with 10 m (30 ft) cable
Measuring Range (Conductivity)		See Table 3 on page 7
Measuring Range (Resistivity)		See Table 3 on page 7
Measuring Range (TDS)		See Table 3 on page 7
Measuring Range (Temperature)		–20.0 to 200.0 °C (–4.0 to 392.0 °F)
Operating Temperature/Humidity		–20 to 60 °C (–4 to 140 °F); 0–95% relative humidity, non-condensing
Storage Temperature/Humidity		–30 to 70 °C (–22 to 158 °F); 0–95% relative humidity, non-condensing
Response Time		90% of reading within 30 seconds of step change
Measurement Accuracy		±2% of reading
Temperature Accuracy		±0.1 °C
Repeatability		±0.5% of reading
Sensitivity		±0.5% of reading
Calibration/Verification		Comparison to standard
Sensor Interface		Modbus
Standard Probe Cable Length		Analog probe: 6 m (20 ft); Digital probe: 10 m (32.8 ft)
Probe Weight		0.3 to 0.4 kg (approximately one pound) dependent on probe type
Probe Dimensions		Dependent on probe type, see Figure 1 on page 10 through Figure 7 on page 12.
Calculated Sensor A and B Measurement:		
	% Rejection	0–100%
	% Passage	0–100%
	Ratio A/B or B/A	0–9.999, 0–99.99, 0–999.9, or 0–9999
	Difference A-B or B-A	Same as measuring ranges listed above for conductivity, resistivity, or TDS
Analog Outputs (1 and 2)		0.00–20.00 mA or 4.00–20.00 mA
Relay Operational Mode		Each relay (A, B, and C) can be driven by: selected sensor A or B measurement (conductivity, resistivity, TDS, or temperature); calculated sensor A and B measurement (% rejection, % passage, ratio A/B, ratio B/A, difference A - B or difference B - A); software alarm
Control Function Mode		Settings for high/low phasing, setpoint, deadband, overfeed timer, off delay, and on delay
Alarm Function Mode		Settings for low alarm point, low alarm point deadband, high alarm point, high alarm point deadband, off delay, and on delay
Timer Function Mode		Relay is activated by user-entered interval and time duration values
Status Function Mode		Not configurable; relay only activates when a sensor or analyzer fail diagnostic warning condition exists
Temperature Compensation		Automatic from –20.0 to 200.0 °C (–4.0 to 392.0 °F) with selection for Pt 1000 ohm RTD or Pt 100 ohm RTD temperature element, or manually fixed at a user-entered temperature

Table 2 Specific Conductivity Probe Specifications

	Model 3422-series Conductivity/resistivity Sensors	Model 3433-series Conductivity/resistivity Sensors	Model 3444-series Conductivity/resistivity Sensors	Model 3455-series Conductivity/resistivity Sensors
Wetted Materials				
	Titanium electrodes (316 stainless steel outer electrode for extended sensor body style used with ball valve assembly), PTFE Teflon insulator, and treated Viton® O-ring seals	Graphite electrodes, Ryton® body, and Viton® O-ring seals	316 stainless steel and titanium electrodes, PEEK insulator, and fluoroelastomer O-ring seals	316 stainless steel electrodes, PTFE Teflon insulator, and pufluoro-elastomer O-ring seals
Maximum Temperature/Pressure				
	Sensor with integral digital electronics: limited to 70 °C (160 °F). Analog sensor with Kynar (PVDF) compression fitting: 150 °C at 1.7 bar (302 °F at 25 psi) or 36 °C at 10.3 bar (97 °F at 150 psi) Analog sensor with manufacturer-supplied 316 stainless steel compression fitting: 150 °C at 13.7 bar (302 °F at 200 psi) Analog sensor with 316 stainless steel ball valve hardware assemblies: 125 °C at 10.3 bar (302 °F at 150 psi)	Analog sensor only: 150 °C at 6.8 bar (302 °F at 100 psi) or 20 °C at 13.7 bar (68 °F at 200 psi) Analog sensor with hardware: A lower rated mounting hardware or piping material may limit the temperature and pressure ratings listed above.	Analog sensor with integral cord grip: 100 °C at 20.7 bar (212 °F at 300 psi) Analog with integral analog polypropylene J-box Head: 92 °C at 20.7 bar (198 °F at 300 psi) Analog sensor with integral aluminum or 316 SS J-box head: 200 °C at 20.7 bar (392 °F at 300 psi)	Analog sensor with manufacturer-supplied sanitary mount hardware assemblies: 150 °C at 10.3 bar (302 °F at 150 psi) or 20 °C at 13.7 bar (68 °F at 200 psi)[1]
Flow Rate				
	0–3 m (0–10 ft) per second (fully immersed)	0–3 m (0–10 ft) per second (fully immersed)	0–3 m (0–10 ft) per second (fully immersed)	0–3 m (0–10 ft) per second (fully immersed)
Temperature Compensator				
	Pt 1000 RTD	Pt 1000 RTD	Pt 1000 RTD	Pt 1000 RTD
Sensor Cable:				
	Digital: PUR (polyethylene) 5-conductor, shielded, rated to 105 °C (221 °F); 10 m (33 ft) standard length Analog: 6-wire cable (four conductors and two isolated shield wires); rated at 150 °C (302 °F); 6 m (20 ft) long	Analog: 6-wire cable (four conductors and two isolated shield wires); rated at 150 °C (302 °F); 6 m (20 ft) long	Analog: 6-wire cable (four conductors and two isolated shield wires); rated at 150 °C (302 °F); 6 m (20 ft) long	Analog: 6-wire cable (four conductors and two isolated shield wires); rated at 150 °C (302 °F); 6 m (20 ft) long

[1] Other brands of mounting hardware assemblies and sanitary clamps may reduce the listed rating.

Table 3 Sensor Cell Constants and Measuring Ranges

Sensor Cell Constant	Inherent Measuring Range			
	Conductivity (µS/cm)	Resistivity (Mohm)	TDS	Salinity (PPT)
0.05	0–100	0.002–20	See Note[1]	not applicable
0.5	0–1000	0.001-20	See Note1	< 1
1	0–2000	not applicable	See Note1	< 2
5	0–10000	not applicable	See Note1	< 15
10	0–200000	not applicable	See Note1	< 500[2]

[1] To determine which cell constant to use, convert the full-scale TDS value to its equivalent conductivity value at 25 °C by multiplying the TDS value by 2. Find that value in the conductivity column and use the cell constant that corresponds to that value.

[2] Practical upper limit is 280.

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.

This product is acceptable for use in a Hazardous Location when used with an sc100 Controller and installed per Control Drawing 58600-78 as described in the sc100 Controller Manual, Cat. No. 5860018.

2.1.1 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.

Important Note: *Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 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).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.

2.2 General Sensor Information

The Contacting Conductivity Sensor allows aqueous samples to be easily and accurately analyzed for conductivity. Sensor models are available for applications with temperatures up to 200 °C (392 °F). Refer to Figure 1 and Figure 6 for sensor options.

The Conductivity sensor can be operated using the sc100 controller and the sc1000 controller. Refer to Operation on page 27 and sc1000 Operation on page 35 for more information.

Optional equipment, such as mounting hardware for the probe, is supplied with instructions for all user installation tasks. Several mounting options are available, allowing the probe to be adapted for use in many different applications.

Figure 1 Compression-style Sensor, 0.5-in. Diameter

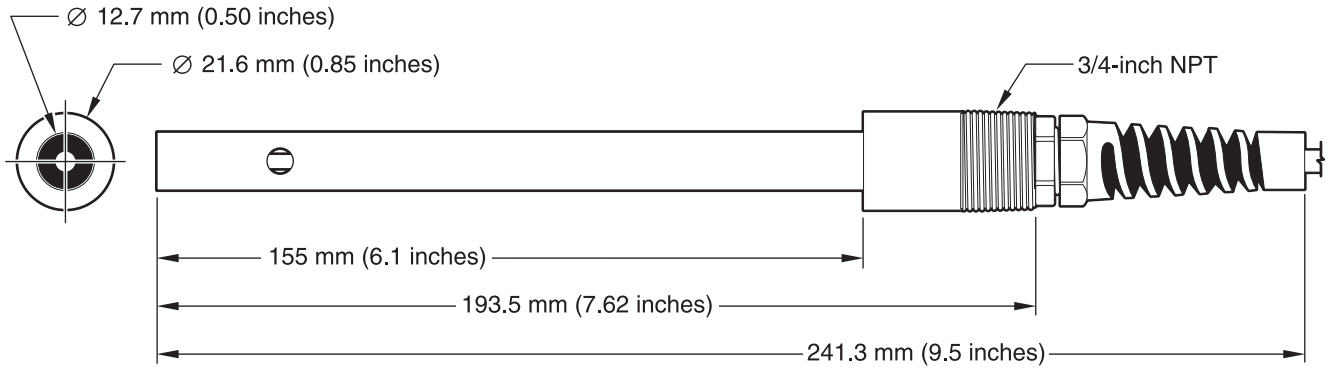


Figure 2 Compression-style Sensor, 0.75-in Diameter

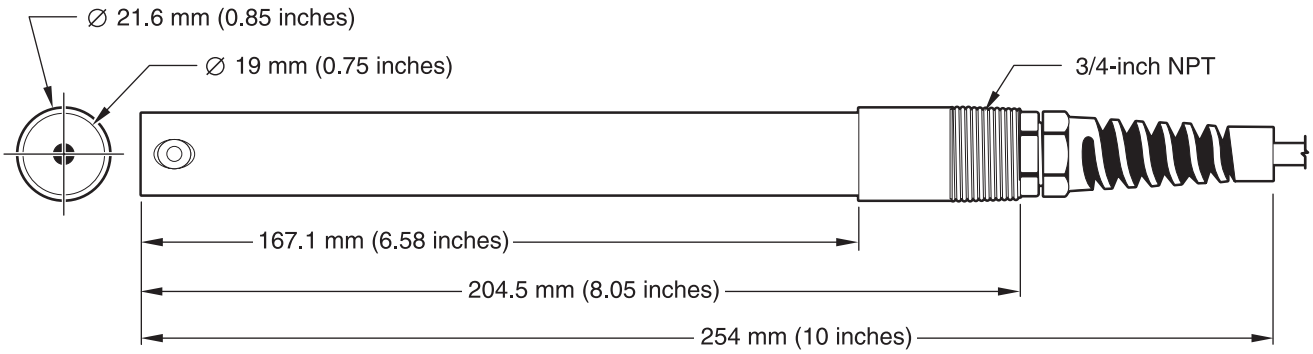


Figure 3 Compression-style Sensor with Teflon® Tip

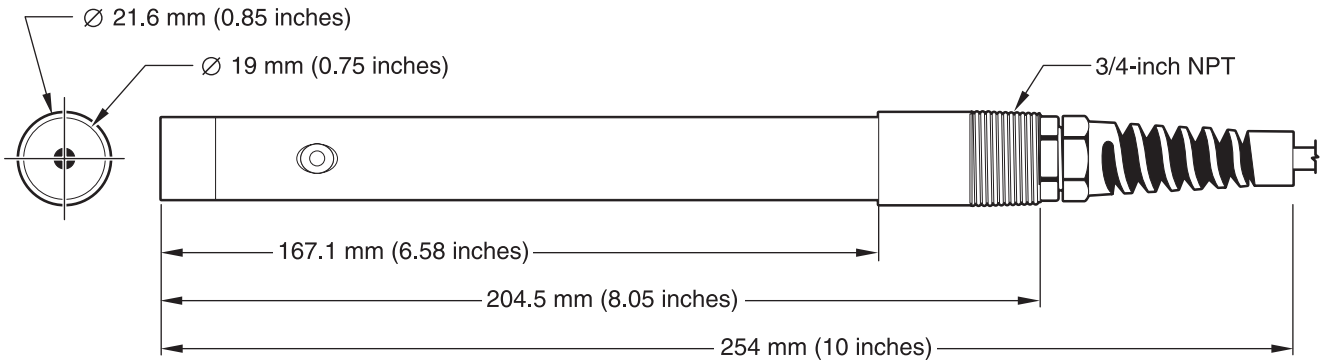


Figure 4 Compression-style Sensor (with integral junction box)

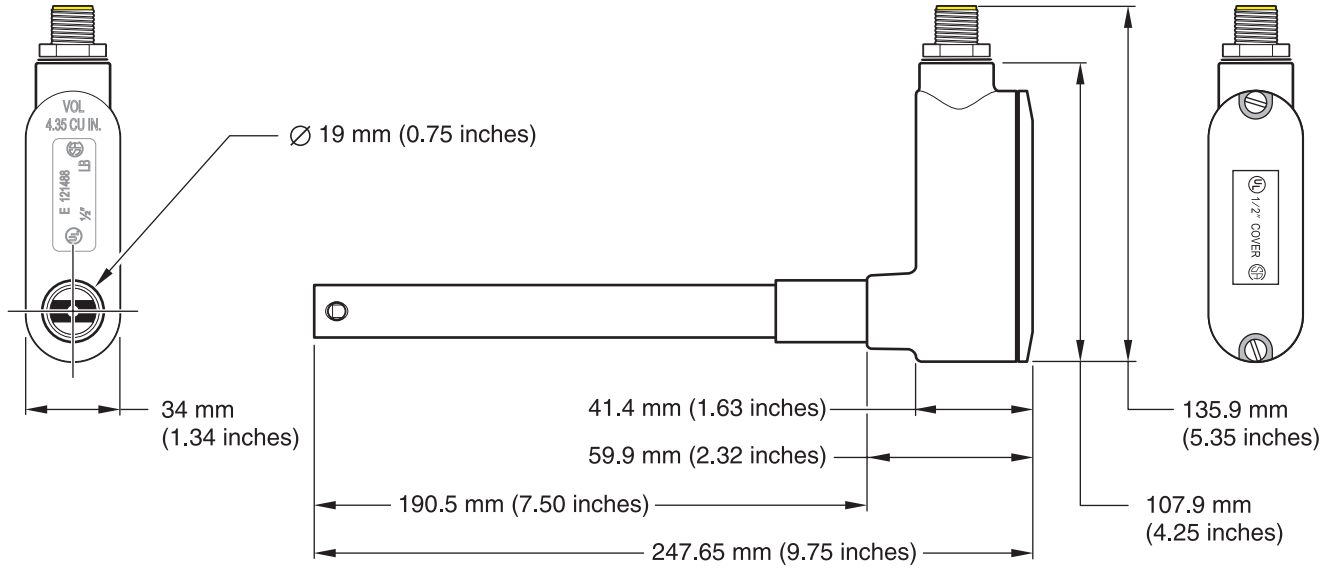


Figure 5 Sanitary (CIP)-style Sensor

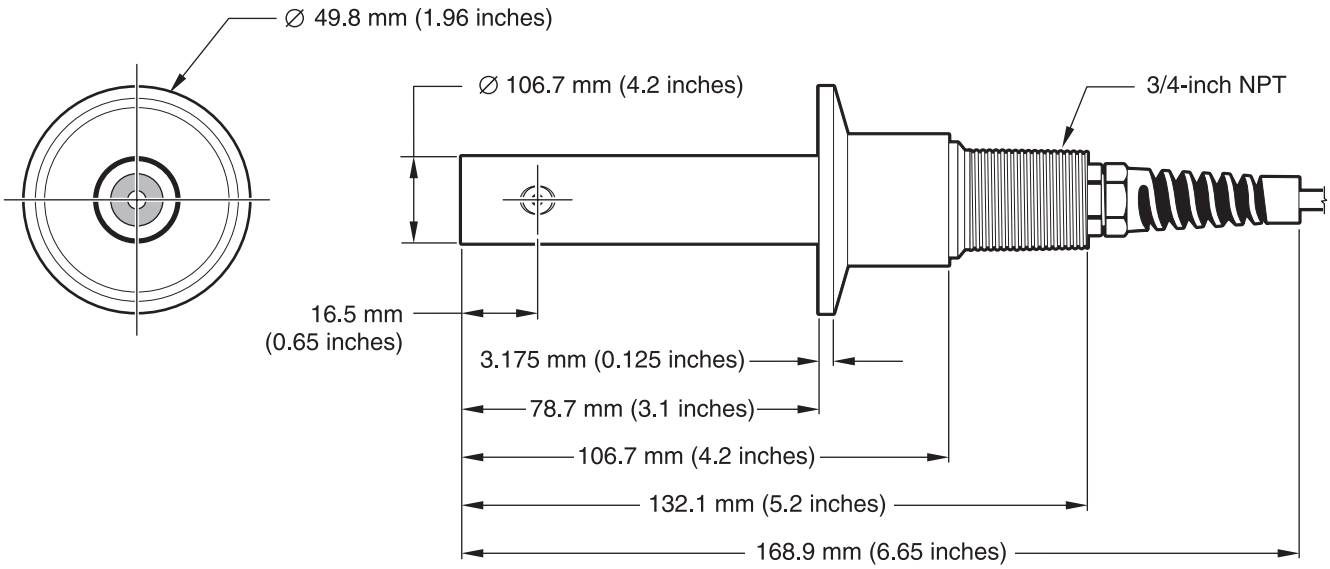


Figure 6 Non-metallic General Purpose Sensor

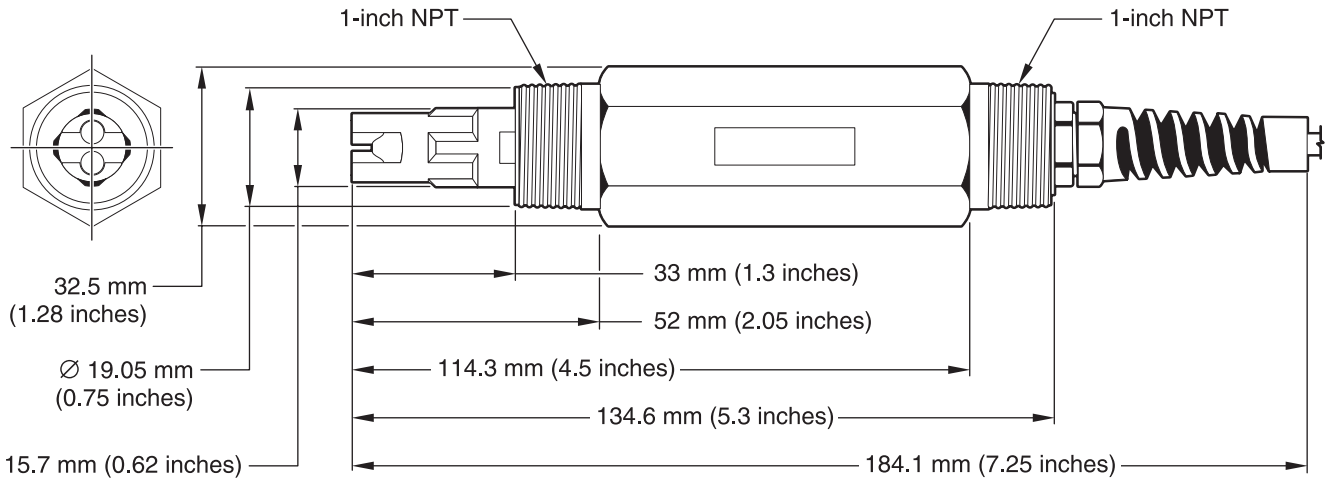
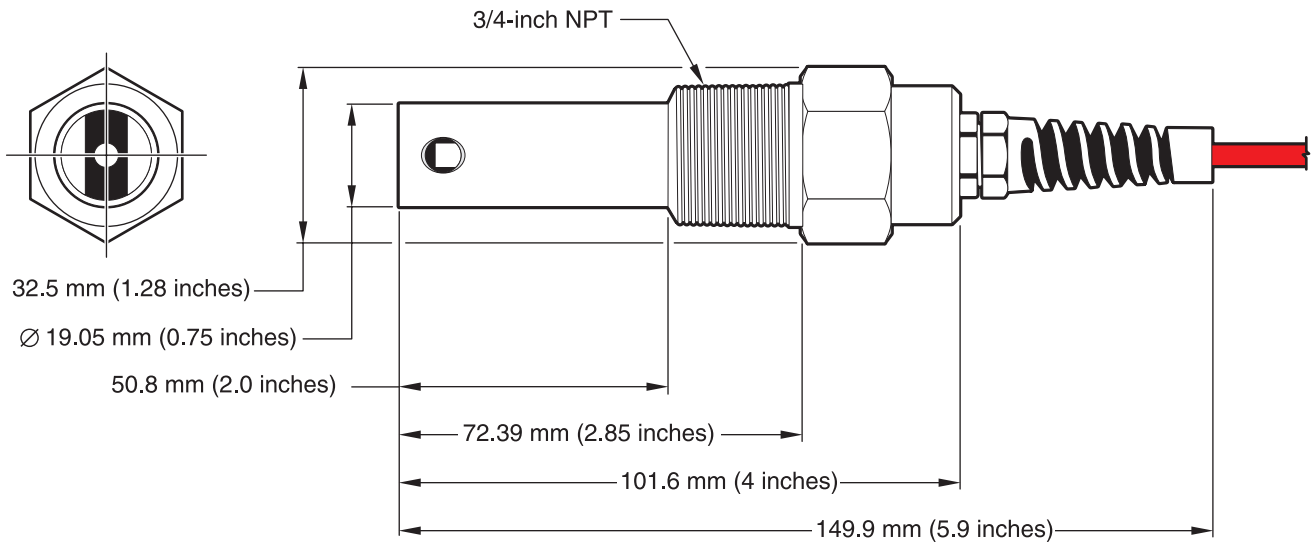


Figure 7 Boiler/Condensate Sensor



2.3 The Digital Gateway

The Digital Gateway was developed to provide a means to use existing analog sensors with the new digital controllers. The gateway contains all the necessary software and hardware to interface with the controller and output a digital signal.

2.4 Theory of Operation

The Contacting Conductivity Sensors are designed to accurately measure conductivity/resistivity/TDS/salinity from ultrapure water (0.056 µS/cm) to 200,000 µS/cm in clear fluids. Conductivity is a measure of the ability of a solution to conduct an electric current and resistivity is the measure of the ability of a solution to resist an electric current. Total Dissolved Solids (TDS) is a measure that reflects the amount of solids dissolved in a water sample and salinity is a measure of the dissolved salts in a solution.

Each sensor is available in a variety of precisely measured cell constants and different materials to meet many measurement needs and are ideal for deionization, reverse osmosis, electro-deionization, desalination, chemical purity, and other clear fluid applications.

Each sensor is individually tested to determine its absolute cell constant (shown on its label as K =X) and temperature element value (to the nearest 0.1 ohm). The cell constant (K) and temperature factor (T) are entered during instrument configuration or calibration to ensure the highest possible measurement accuracy.

Available cell constants include: 0.05, 0.5, 1.0, 5.0, and 10. The temperature element was designed to provide fast response to changes in temperature and ensure high measurement accuracy.

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER
Seul un technicien qualifié peut effectuer les tâches d'installation décrites dans cette section du manuel.

The Contacting Conductivity sensor can be used with either an sc100 or sc1000 controller. Refer to section 3.1 for sc100 installation instructions and section 3.2 on page 16 for sc1000 installation instructions.

The Contacting Conductivity sensor may be ordered with an internal or external digital gateway. If you received an external digital gateway, refer to section 3.3 on page 17 for digital gateway connecting/wiring and mounting instructions.

3.1 Connecting/Wiring the Sensor to the sc100 Controller

DANGER
The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations . See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER
Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

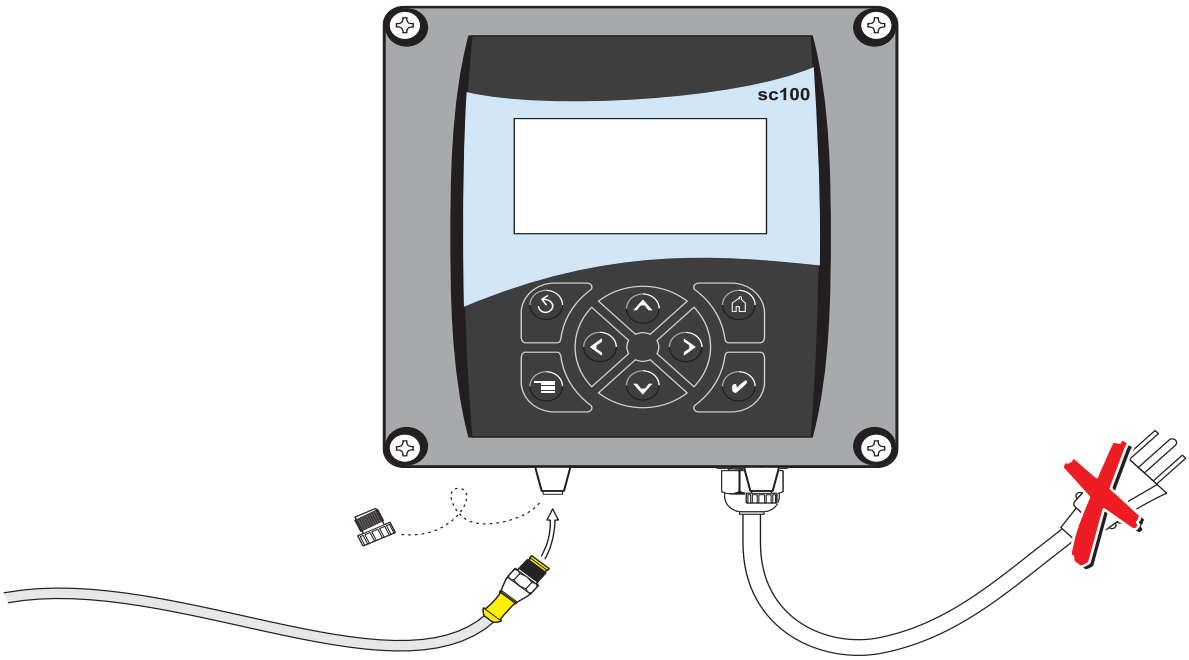
3.1.1 Connecting the sc Sensor in a Non-hazardous Location

3.1.1.1 Attaching a sc Sensor with a Quick-connect Fitting

Important Note: *The standard quick-connect fitting is NOT suitable for Class 1, Division 2 Hazardous Location installations without the connector lock installed, see section 3.1.2 on page 15 for more information.*

The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller (Figure 8). Retain the connector cap to seal the connector opening in case the sensor must be removed. Optional extension cables may be purchased to extend the sensor cable length. If the total cable length exceeds 100 m (300 ft), a termination box must be installed.

Figure 8 Attaching the Sensor using the Quick-connect Fitting



3.1.1.2 Hard-wiring a sc Sensor to the Controller

Important Note: *Hard-wiring the sensor to the sc100 is not an approved method for Class I, Division 2 Hazardous Locations.*

1. Disconnect power to the controller if powered.
2. Open the controller cover.
3. Disconnect and remove the existing wires between the quick-connect and terminal strip J5, see Figure 9 on page 15.
4. Remove the quick-connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.
5. Cut the connector from the sensor cable.
6. Strip the insulation on the cable back 1-inch. Strip ¼-inch of each individual wire end.
7. Pass the cable through conduit and a conduit hub or a strain relief fitting (Cat. No. 16664) and an available access hole in the controller enclosure. Tighten the fitting.

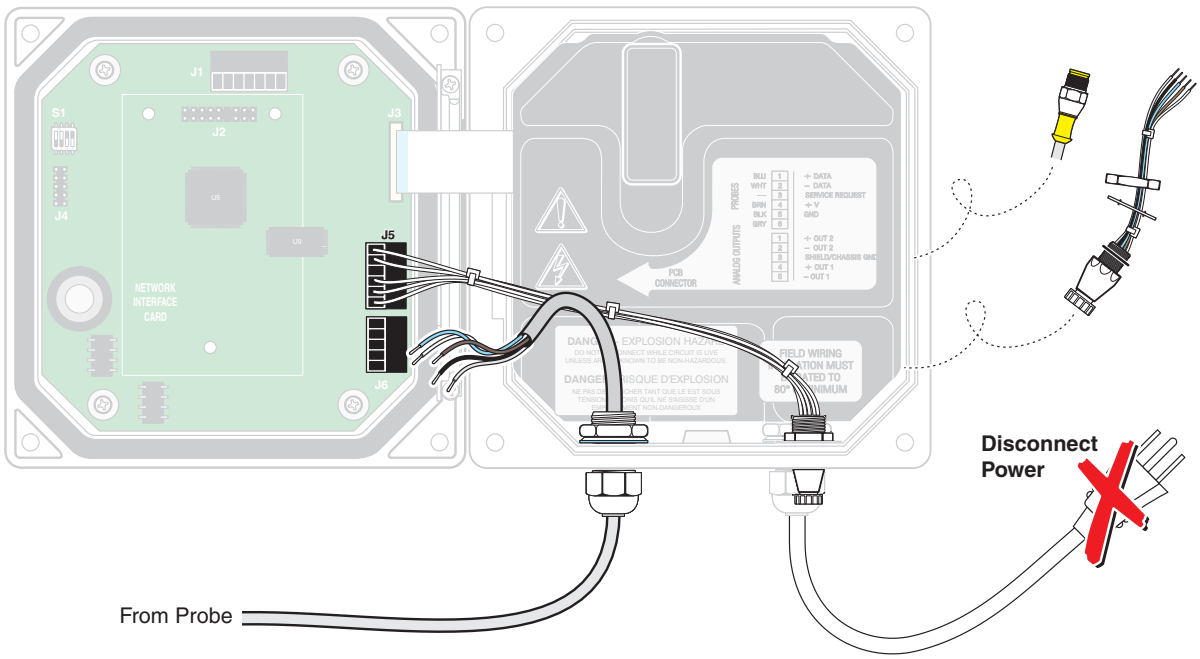
Note: *Use of strain relief fitting other than Cat. No. 16664 may result in a hazard. Use only the recommended strain relief fitting.*

8. Reinstall the plug on the sensor access opening to maintain the environmental rating.
9. Wire as shown in Table 4 and Figure 9.
10. Close and secure the cover.

Table 4 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 VDC	Brown
5	Circuit Common	Black
6	Shield	Shield (grey wire in existing quick-disconnect fitting)

Figure 9 Hard-wiring the sensor



3.1.2 Connecting the sc Sensor to a sc100 Controller in a Hazardous Location

DANGER
The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations . See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER
Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

DANGER
Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

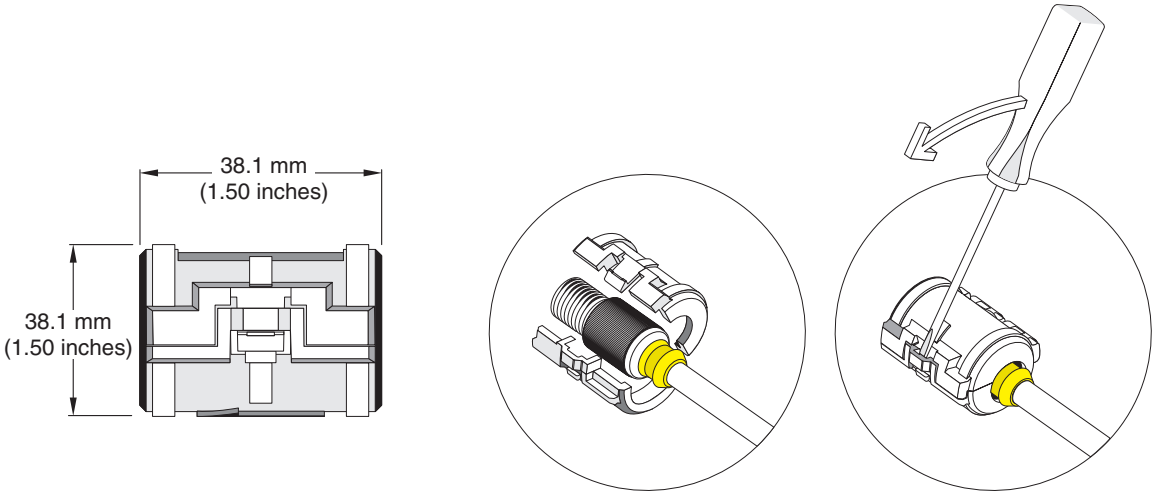
DANGER
Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est designe non dangereux avant de replacer le aucon composant.

3.1.2.1 Attaching a sc Sensor with a Quick-connect Fitting in a Hazardous Location

The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller, see Figure 8. For hazardous locations, a connector safety lock (Cat. No. 6139900) **must** be installed. Retain the connector cap to seal the connector opening in case the sensor must be removed.

1. Remove the connector cap from sc100 controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.
2. Connect the sensor connector to the plug on the sc100.
3. Install a connector safety lock (Figure 10). Align the lock over the connector and squeeze the two halves together to lock. To remove the connector safety lock by inserting a small flat-bladed screwdriver into the locking groove. Pivot the screwdriver away from the groove and separate the two halves (Figure 10).

Figure 10 Installing the Connector Safety Lock



3.2 Connecting the Sensor to the sc1000

3.2.1 Connecting the Sensor using the Quick-connect Fittings

1. Unscrew the connector cap from the controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.
2. Push the connector into the socket.
3. Hand-tighten the union nut.

Note: *Do not use the middle connection for the sensors as this is reserved for the display module.*

3.3 Using the Digital Gateway

The digital gateway is designed to provide a digital interface to the controller. The non-sensor end is wired to the sc100 or sc1000 controller in a non-hazardous location as shown in section 3.1.1 on page 13. The non-sensor end is wired to the sc100 controller in a hazardous location as shown in section 3.1.2 on page 15.

3.3.1 Wiring the sc Sensor to the Digital Gateway

DANGER
The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations . See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER
Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

DANGER
Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

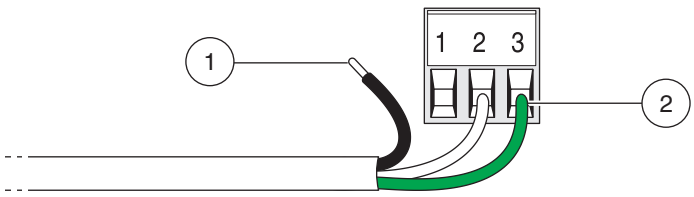
DANGER
Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est designe non dangereux avant de replacer le aucon composant.

1. Route the cable from the sensor through the strain relief in the digital gateway then properly terminate the wire ends (see Figure 11).

Note: *Do not tighten the strain relief until the digital gateway is wired and the two halves are threaded securely together.*

2. Insert the wires as shown in Table 5 and Figure 12.
3. Make sure the O-ring is properly installed between the two halves of the digital gateway and thread the two halves together. Hand tighten.
4. Tighten the strain relief to secure the sensor cable.
5. Connect the digital gateway to the controller.
   - sc100 Non-Hazardous Location Instructions—section 3.1.1 on page 13.
   - sc100 Hazardous Location Instructions—section 3.1.2 on page 15g
   - sc1000 Connection Instructions—Refer to section 3.2 on page 16.

Figure 11 Proper Wire Preparation and Insertion

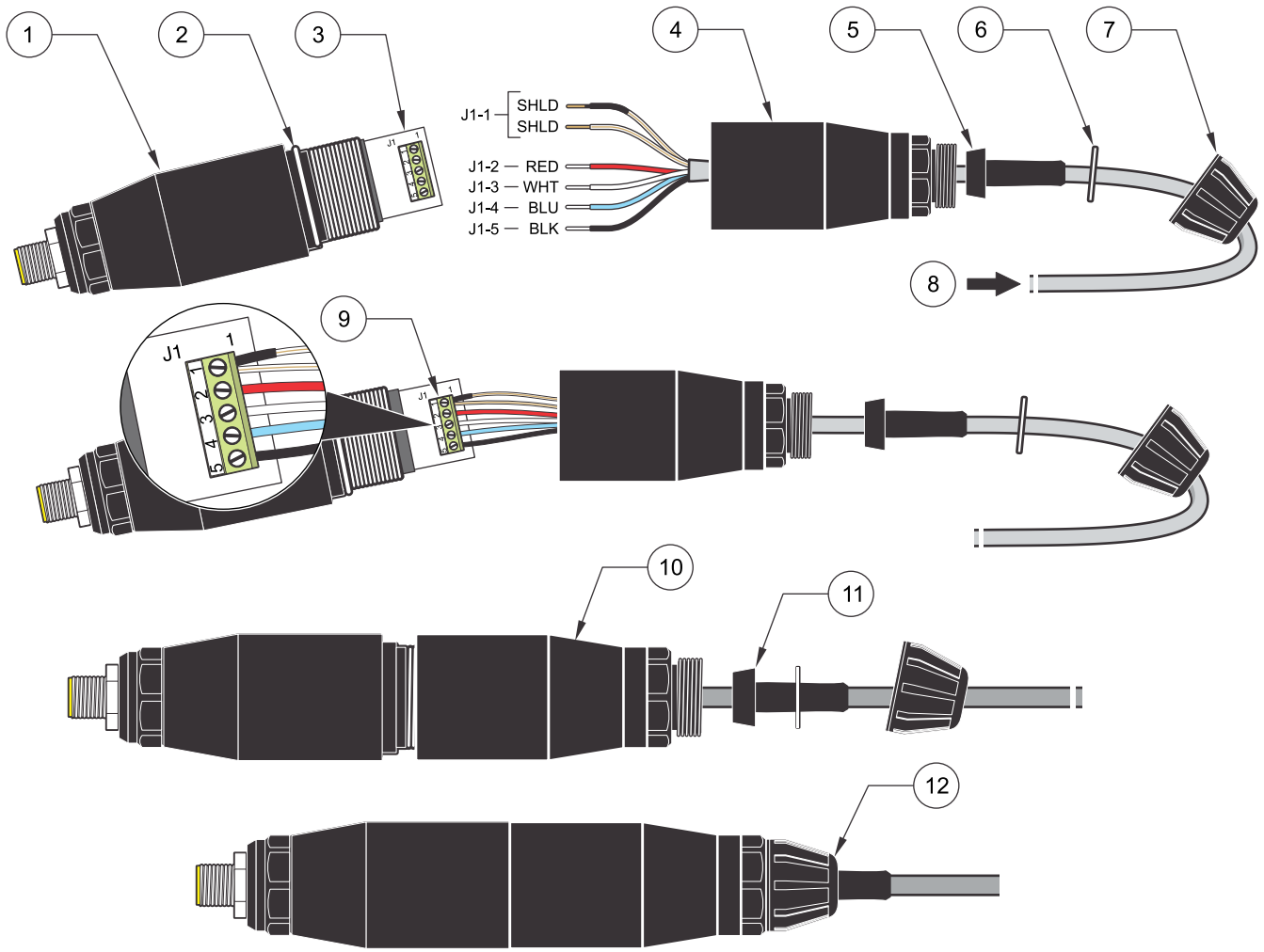


1. Strip ¼-inch of insulation.	**2.** Seat insulation against connector with no bare wire exposed.

Table 5 Wiring the Digital Gateway

Sensor (wire color)	Sensor Signal	Digital Gateway Sensor Wire connector
Clear	Shield	J1-1
Clear w/shrink wrap	Shield	J1-1
Red	Drive	J1-2
White	Temp –	J1-3
Blue	Temp +	J1-4
Black	Sense	J1-5

Figure 12 Wiring and Assembling the Digital Gateway



1. Digital gateway front	**7.** Nut, strain relief
2. O-ring	**8.** From sensor
3. Sensor wire connector	**9.** Insert wires into connector according to Table 5. Use the included 2 mm screwdriver (Cat. No. 6134300) to secure connections.
4. Digital gateway back	**10.** Screw back of digital gateway onto front
5. Cable bushing	**11.** Push cable bushing and anti-rotation washer into back.
6. Anti-rotation washer	**12.** Fasten cord grip securely. Assembly is complete.

3.3.2 Mounting the Digital Gateway

The digital gateway is supplied with a mounting clip for mounting to a wall or other flat surface. Use an appropriate fastener to secure it to the wall. After the sensor is wired to the digital gateway and the two halves are threaded together, place the mounting clip over the center of the digital gateway and squeeze the clip together to secure. See Figure 14.

Figure 13 Digital Gateway Dimensions

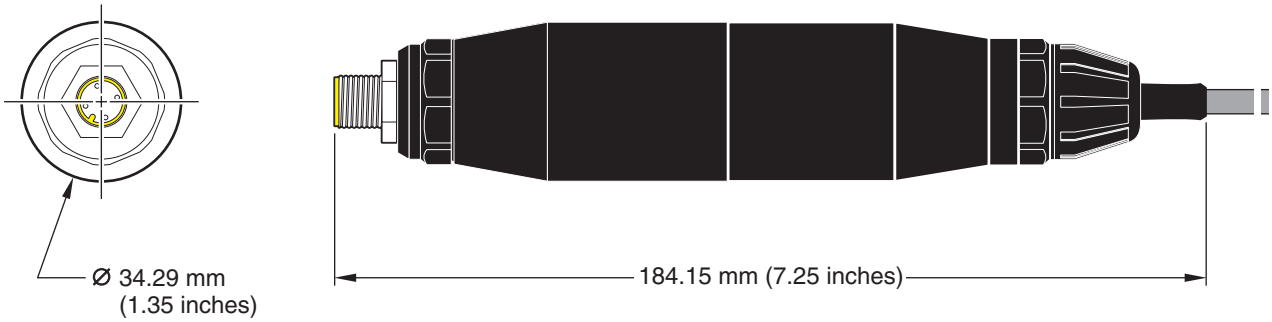
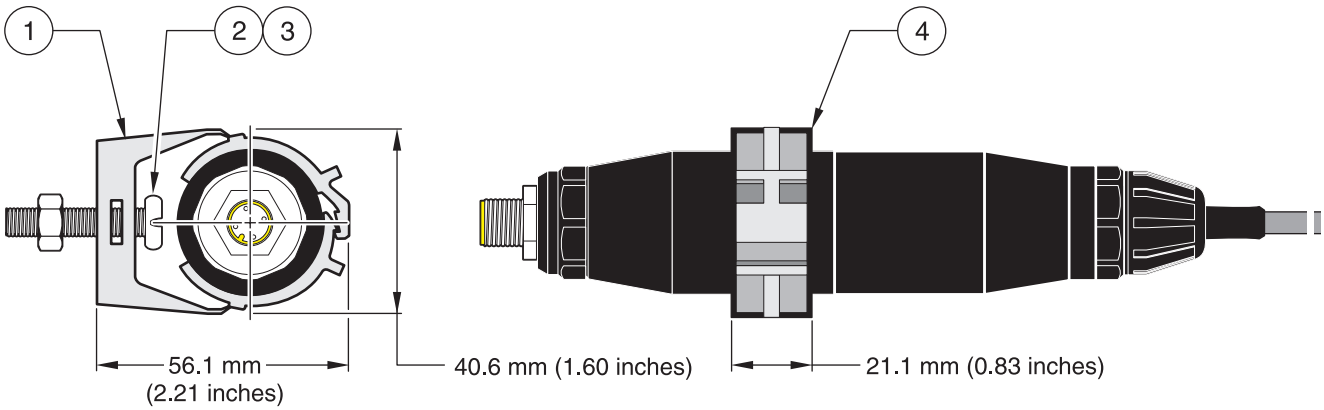


Figure 14 Mounting the Digital Gateway



1.	Mounting clip	**3.**	Hex nut, ¼-28
2.	Screw, pan head, ¼-28 x 1.25-in.es	**4.**	Mount clip, insert digital gateway, squeeze clip closed.

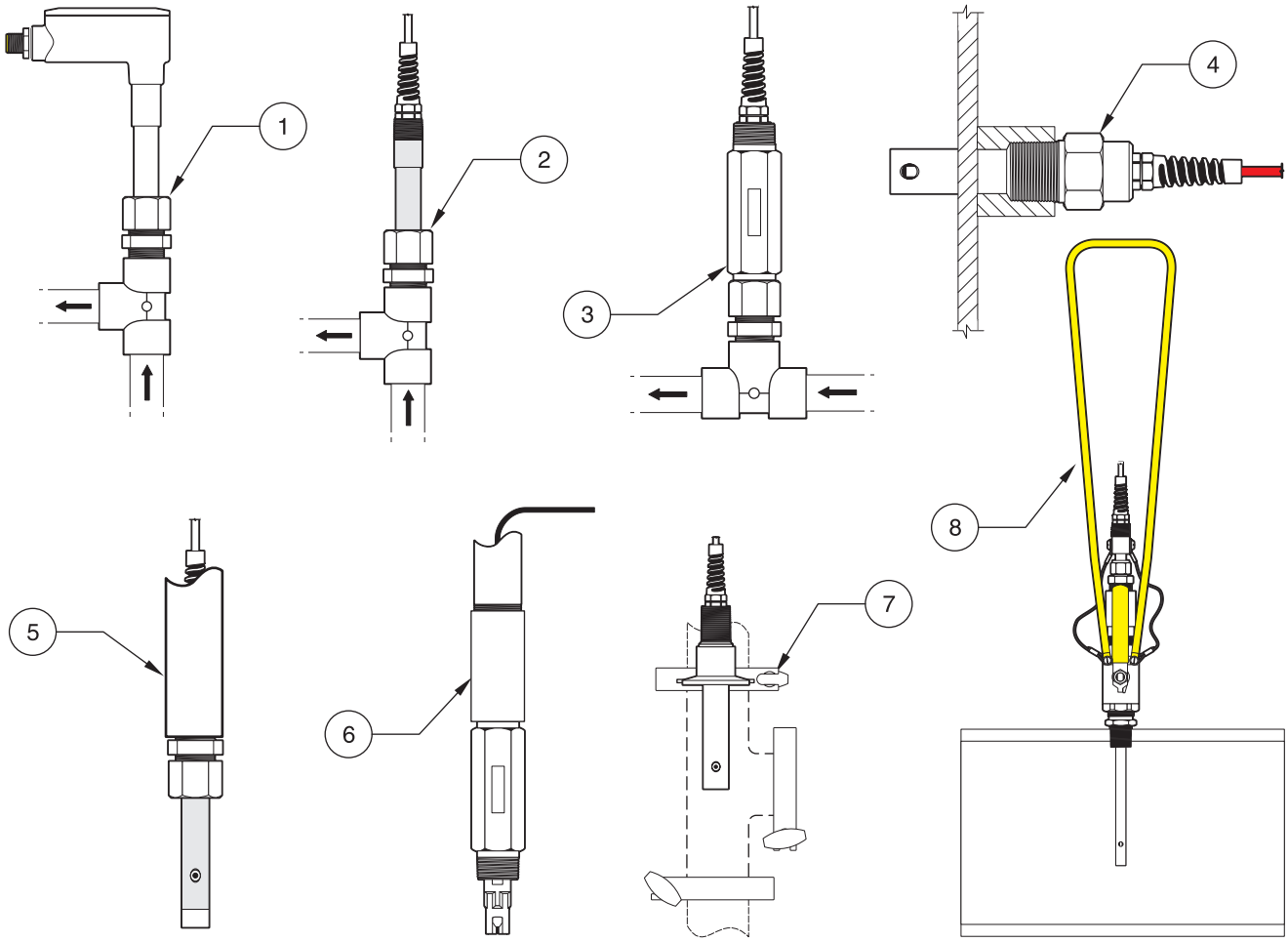
3.4 Installing the Sensor in the Sample Stream

Two compression-style installation schemes are available. For sensors with a 0.05 cell constant, use ½-in or ¾-in male NPT compression fittings made of Kynar (PVDF) or 316 stainless steel. For sensors with any other cell constant, use a ¾-in. male NPT compression fitting made of Kynar or 316 stainless steel. In all cases, the fitting enables the sensor to be insertion mounted, up to 102 mm (4 in.) deep, into a pipe tee or vessel. Reversing the fitting enables the sensor to be fastened onto the end of a pipe for immersion mounting.

A longer version of the sensor can be installed into a 316 stainless steel ball valve assembly to insert/retract the sensor without stopping the process flow. Maximum insertion depth is 178 mm (7 in.).

Examples of common sensor installations are shown in Figure 15 and dimension drawings are shown in Figure 1 on page 10 through Figure 7 on page 12. Refer to the instructions supplied with the mounting hardware for installation specifics.

Figure 15 Sensor Installation Examples

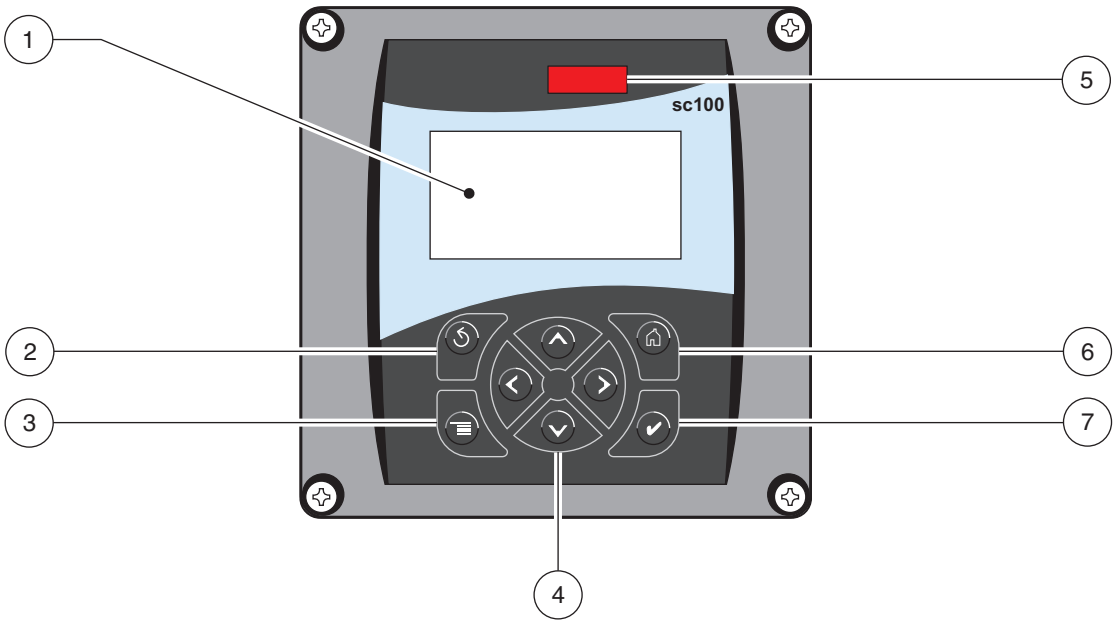


1.	Insertion mounting	**5.**	End of pipe immersion
2.	Insertion mounting	**6.**	Non-metallic sensor, end of pipe immersion
3.	Non-metallic sensor, insertion mounting	**7.**	Sanitary (CIP) flange mounting
4.	Boiler wall insertion mounting	**8.**	Ball valve insertion for compression-style sensor with extended sensor body

4.1 Using the sc100 Controller

The front of the controller is shown in Figure 16. The keypad consists of the eight keys described in Table 6.

Figure 16 Front of the Controller



1. Instrument display	**5.** IrDA window
2. **BACK** key	**6.** **HOME** key
3. **MENU** key	**7.** **ENTER** key
4. **RIGHT**, **LEFT**, **UP**, and **DOWN** keys	

Table 6 Controller Key Functions/Features

Number	Key	Function
2	back	Moves back one level in the menu structure.
3	menu	Moves to the main menu from other menus. This key is not active in menus where a selection or other input must be made.
4		Navigates through the menus, changes settings, and increments and decrements digits.
5	home	Moves 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	Accepts an input value, updates, or accepts displayed menu options.

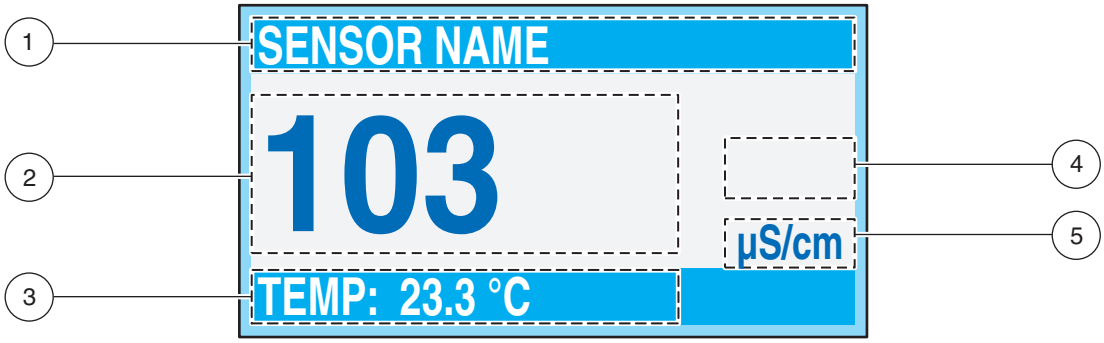
4.1.1 sc100 Display Features

When a sensor is connected and the controller is in measurement mode, the controller display will show the current conductivity reading plus the sample temperature.

The display will flash on startup, when a sensor error has occurred, when the hold outputs function has been activated, and when a sensor is being calibrated.

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.

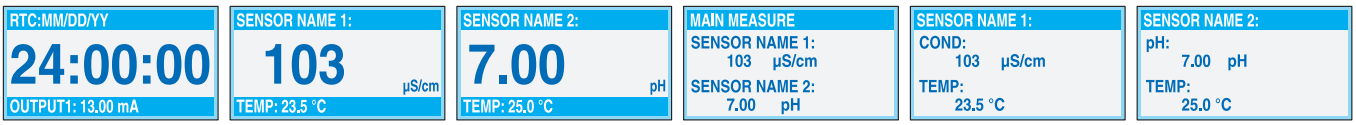
Figure 17 Display



1.	Status bar. Indicates the sensor name and status of relays. The relay letter is displayed when the relay is energized.	**3.**	Secondary measurement
		4.	Warning icon area
2.	Main measurement	**5.**	Measurement units (µS, mS, kohm, mohm, TDS, Salinity)

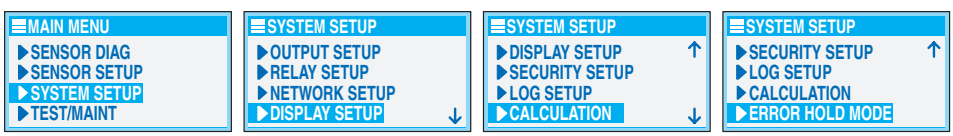
4.1.2 Important Key Presses

- Press **HOME** 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 secondary measurement (temperature) and output information.

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



4.2 Using the sc1000 Controller

The sc1000 is a touch screen application. Use your finger to touch keys and menu commands. In normal operation the touch screen displays the measured values for the sensors selected.

4.2.1 Display Features

4.2.1.1 Using the Pop-up Toolbar

The pop-up toolbar provides access to the controller and sensor settings. The toolbar is normally hidden from view. To view the toolbar, touch the bottom-left of the screen.

Figure 18 Pop-up Toolbar Functions

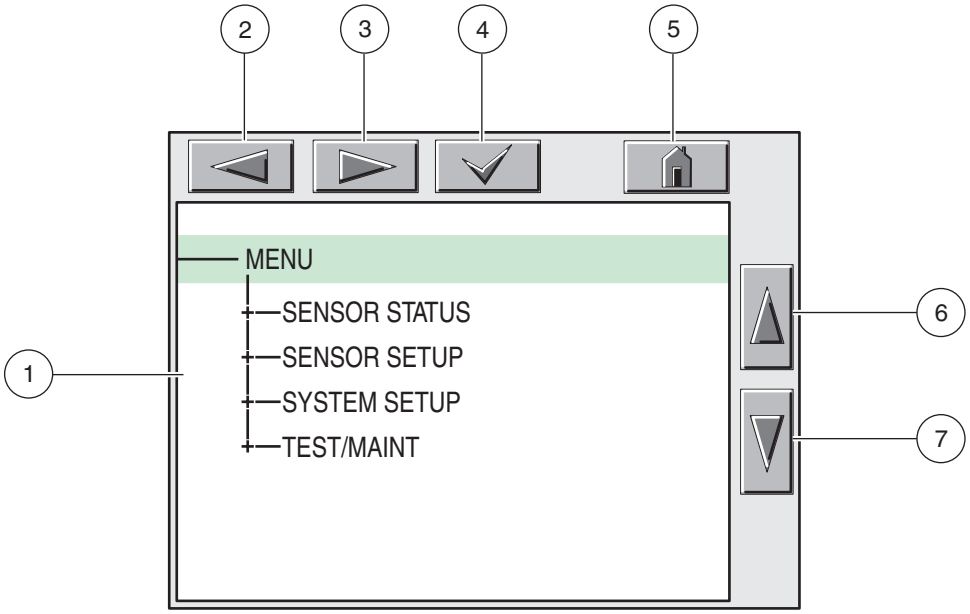
	**MAIN MENU**–displays the Main Menu Structure
	**UP** Arrow–scrolls up to the previous displayed value.
	Displays one value.
	Displays two values at the same time.
	Displays four values at the same time.
	**LIST**–displays the list of connected devices and sensors.
	**DOWN** Arrow–scrolls down to the next displayed value.

4.2.1.2 Using the Menu Windows

If the Menu button (from the pop-up toolbar) is selected, the Main Menu screen is opened. The Main Menu screen allows the user to view the sensor status, configure the sensor setup, system setup, and perform diagnostics.

The menu structure may vary depending on the configuration of the system.

Figure 19 Main Menu



1.	Display Area
2.	**BACK**
3.	**FORWARD**
4.	**ENTER**–confirms the entry or selection.
5.	**HOME**–changes to the display of measured values. The pop-up toolbar cannot open from the menu window. To view the Main Menu from this display, touch the Home button and then the bottom of the screen.
6.	**UP**–scrolls up
7.	**DOWN**–scrolls down

4.2.1.3 Navigating the Menu Windows

To view a menu item, touch the menu item or use the **UP** and **DOWN** keys to highlight the item. The menu item remains highlighted for approximately 4 seconds after it is selected. To view the highlighted command, select the area to the left of the menu item or select the **ENTER** button.

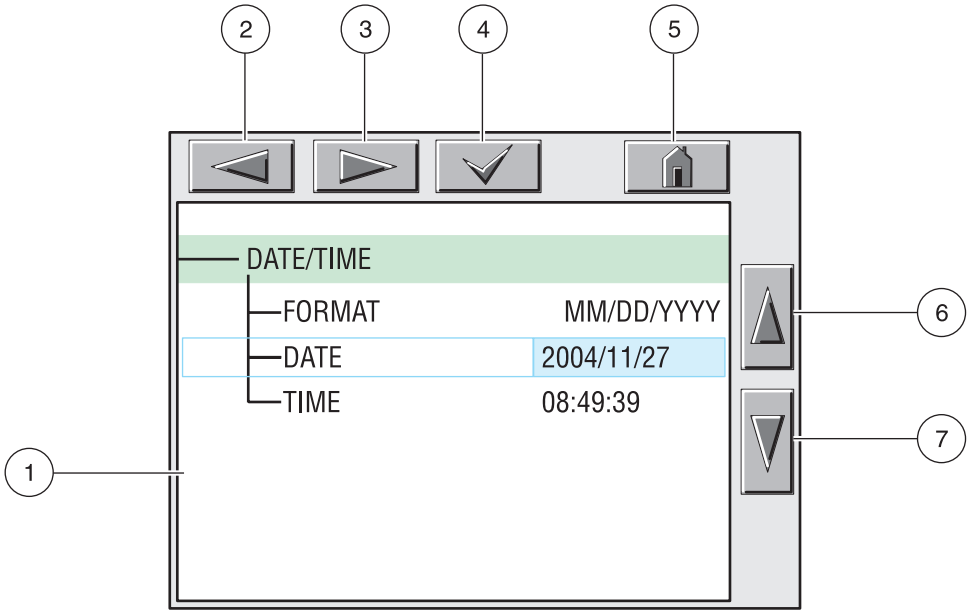
A "**+**" next to a menu command indicates there is a submenu. Touch the "+" to view the submenu. An "**i**" next to a menu command indicates it is information only.

If a menu item is editable, highlight the item and touch the far-left part of the menu item until it is highlighted and press **ENTER** or double-tap the highlighted item. A keypad will be displayed to change an entry (Figure 21 on page 25) or a list box will be displayed (Figure 22 on page 26).

Messages are displayed in the message window (Figure 23 on page 26).

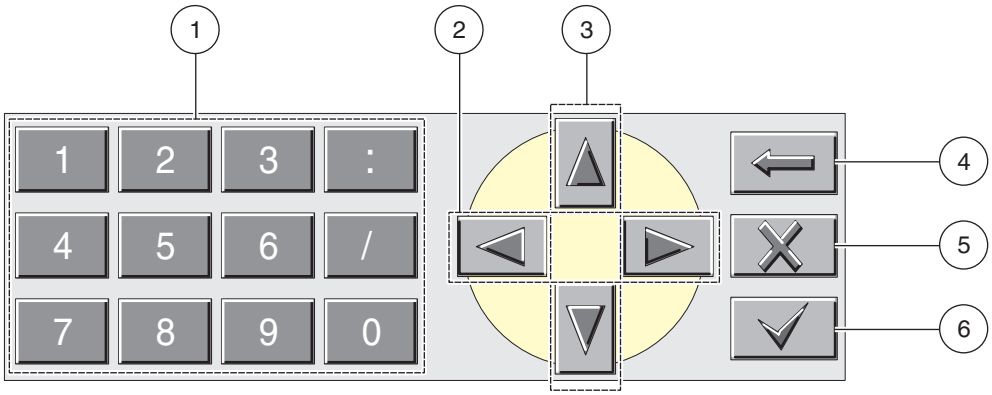
If an entry is incorrect, repeat the entry with the correct values. If the entry is outside the working range, a correction to the entry is made automatically.

Figure 20 Changing a Menu Item



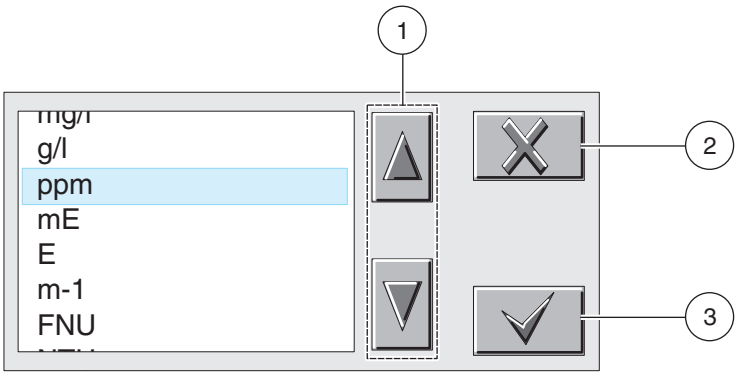
1.	Display Area	**5.**	**HOME**–changes to the display of measured values.
2.	**BACK**	**6.**	**UP**–scrolls up
3.	**FORWARD**	**7.**	**DOWN**–scrolls down
4.	**ENTER**–confirms the entry or selection.		

Figure 21 Keypad



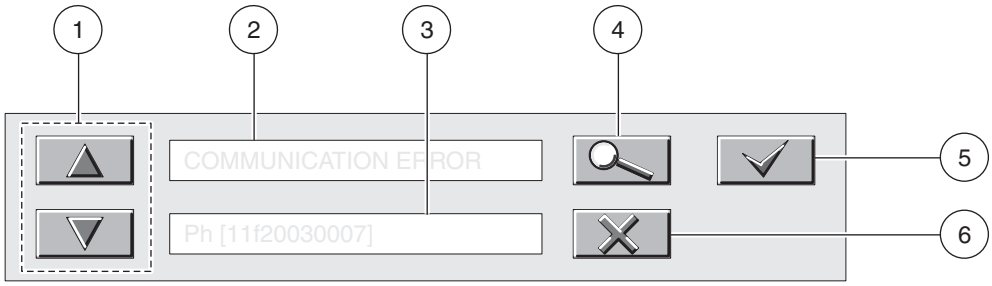
1.	Enters numbers or the character as shown on the button.
2.	Moves the cursor one position to the left or to the right.
3.	Increase/Decrease a number or letter at the cursor position. Keep the button pressed to change the numbers/characters continuously.
4.	Deletes the character to the left of the cursor.
5.	**CANCEL**–cancels the entry.
6.	**ENTER**–confirms the entry or selection.

Figure 22 List Box



1.	Scrolls up or down
2.	**CANCEL**–cancels and entry.
3.	**ENTER**–confirms a selection.

Figure 23 Message window



1.	Scrolls up or down.
2.	Displays the messages or warnings.
3.	Displays details on the selected entry.
4.	This button changes back to the previous display.
5.	**ENTER**–confirms an entry.
6.	**CANCEL**–cancels an entry.

Section 5 Operation

5.1 Using the sc Controller

Before using the sensor in combination with an sc controller make yourself familiar with the operating mode of the controller. Refer to the controller user manual and learn how to use and navigate the menu functions.

5.2 Sensor Setup

When a sensor is initially installed, the serial number of the sensor will be displayed as the sensor name. To change the sensor name refer to the following instructions:

1. Select the Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Select the appropriate sensor if more than one sensor is attached and confirm.
4. Select CONFIGURE and confirm.
5. Select EDIT NAME and edit the name. Confirm or cancel to return to the Sensor Setup menu.

5.3 Sensor Data Logging

The sc controller provides one data log and one event log for each sensor. The data log stores the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, warning conditions, etc. The data log and the event log can be read out in a CSV format. For downloading the logs please refer to the controller user manual.

5.4 Sensor Status Menu

SELECT SENSOR (if more than one sensor is attached)

STATUS	
ERROR LIST	See section 7.1 on page 35.
WARNING LIST	See section 7.2 on page 35.

5.5 Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)

CALIBRATE	
ZERO	Perform a zero cal to remove sensor offset.
1 POINT SAMPLE	Perform a single point calibration.
TEMP ADJUST	Displays the measured temperature and allows adjustment by ± 5 °C.
DEFAULT SETUP	Return the instrument to the default calibration settings.
CONFIGURE	
EDIT NAME	Enter a 10-digit name in any combination of symbols and alpha or numeric characters.
SELECT MEASURE	Choose from Conductivity, Resistivity, TDS, or Salinity.
MEAS UNITS	Choose measurement units (dependent on the parameter selected in the Select Measure menu)
TEMP UNITS	Select Celsius or Fahrenheit.
FILTER	Average the measurement over time by entering a number between 0–60. Default is 0 seconds.
LOG SETUP	Choose from Sensor Interval or Temp Interval. If the interval is enabled, choose from the displayed options for frequency of the sensor or temperature reading. Default is Disabled.
CONFIG TDS	Set TDS factor. Default is 0.49 ppm/µS. (This option appears only when the selected parameter is TDS.
CELL CONSTANT	Choose Select Cell K to choose a nominal cell constant value from the displayed options that is close to the “K” value provided with the sensor. Then choose Set Cell K to enter the specific “K” value supplied with the sensor. Entering the “K” value eliminates the need for calibration until the sensor is replaced and sets the analyzer measurement range to correspond to the specified cell constant.
T–COMPENSATION	The factory default for temperature compensation is linear with a 2.00% per °C slope and a 25 °C reference temperature. The default settings are appropriate for most aqueous solutions. To enter different slope and reference temperature values for an uncommon solution, access the menu options described below. LINEAR: Recommended for most applications. Press **ENTER** to change the slope or reference temperature. AMMONIA: Not available for TDS. Contact Technical Consulting Services for application specific information and assistance. NATURAL WATER: Not available for TDS. Contact Technical Consulting Services for application specific information and assistance. USER TABLE: Use to configure a temperature compensation table by entering up to 10 x-axis parameters and 10 y-axis parameters. Contact Technical Consulting Services for additional information and assistance.
TEMP ELEMENT	Select the temperature element type (100PT, 1000PT (default), or manual) then choose Select Factor to enter the specific “T” Factor supplied with the sensor.
AC FREQUENCY	Choose 50 or 60 Hz depending on the power line frequency for optimal noise rejection. Default is 60 Hz.
DEFAULT SETUP	Reset the configure settings to the factory defaults.
DIAG/TEST	
PROBE INFO	Display the probe device driver version number, software version number, or probe 12-digit serial number using this menu.
SIGNALS	Display the conductivity A/D counts or the temperature output in Ohms
CAL DATA	Display the CELL K: 1.00000 (current cell constant), TEMP ADJ: current temperature offset correction, ZERO 1: Zero counts for gain 1, ZERO 2: Zero counts for gain 2, ZERO 3: Zero counts for gain 3

5.6 Calibration

Each contacting conductivity sensor has a unique zero point and offset. Always zero the sensor when calibrating it for the first time. Zeroing provides the best possible measurement accuracy and eliminates discrepancies between sensor measurements on two different channels. Zeroing should always be followed by a calibration.

5.6.1 Zero Cal

Zero the sensor if it is being calibrated for the first time. Make sure the sensor is dry before zeroing.

1. Select the Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Select the appropriate sensor if more than one sensor is attached and confirm.
4. Select CALIBRATE and confirm.
5. Select ZERO and confirm.
6. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
7. Move the sensor to air and confirm to continue.
8. The zero calibration procedure will begin and “WAIT TO STABILIZE” will be displayed.
9. Confirm, when the current value and temperature will be displayed.
10. Return the sensor to the process.

5.6.2 One Point Sample Calibration

The wet calibration requires that the sensor be immersed into a properly prepared conductivity reference solution (Table 7 on page 30) or if installed in the process sample, the process value must be determined by laboratory analysis or comparison reading.

Remove the probe from the process and clean it. Obtain a sample solution with a known value and proceed as follows:

1. Select the Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Select the appropriate sensor if more than one sensor is attached and confirm.
4. Select CALIBRATE and confirm.
5. Select ZERO and confirm.
6. Select 1 POINT SAMPLE and confirm.
7. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
8. Move the sensor to the sample and confirm to continue.

9. Confirm when stable.

10. Edit the value and temperature using the keypad and confirm.

11. Return the sensor to the process.

5.6.3 Concurrent Calibration of Two Sensors

1. Begin a calibration on the first sensor and continue until “WAIT TO STABILIZE” is displayed.

2. Select Leave and confirm. The display will return to the Main Measurement screen and the reading for both sensors will be flashing.

3. Begin the calibration for the second sensor and continue until “WAIT TO STABILIZE” is displayed.

4. Select LEAVE. The display will return to the Main Measurement screen and the reading for both sensors will be flashing. The calibration for both sensors is now running in the background.

5. To return to the calibration of either sensor, select the Main Menu

6. Select SENSOR SETUP and confirm.

7. Select the appropriate sensor and confirm.

8. The calibration in progress will be displayed. Continue with the calibration.

5.6.3.1 Preparing Conductivity Reference Solutions

Use Table 7 to prepare a conductivity reference solution with a value between 200 and 100,000 µS/cm. The value prepared should be near the typical measured process value for best accuracy. Add the listed grams of pure, dried NaCl to one liter of high-purity, deionized, CO_2-free water at 25 °C to obtain the stated conductivity.

Table 7 Conductivity Reference Solutions

Desired Solution Value			Grams NaCl to be added
µS/cm	mS/cm	ppm (NaCl)[1]	
100	0.10	50	0.05
200	0.20	100	0.10
500	0.50	250	0.25
1000	1.00	500	0.50
2000	2.00	1010	1.01
3000	3.00	1530	1.53
4000	4.00	2060	2.06
5000	5.00	2610	2.61
8000	8.00	4340	4.34
10000	10.00	5560	5.56
20000	20.00	11590	11.59

[1] When using the ppm measuring scale for compounds other than NaCl, refer to the appropriate chemistry handbook for reference solution for formulation.

5.7 Adjusting the Temperature

View or change the temperature using the steps below.

1. Select the Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Select the appropriate sensor if more than one sensor is attached and confirm.
4. Select DIAG/TEST and confirm.
5. Select TEMP ADJUST and confirm. The temperature will be displayed.
6. Edit the temperature and confirm.

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER
Seul un technicien qualifié peut effectuer les tâches d'installation décrites dans cette section du manuel.

DANGER
Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER
Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est designe non dangereux avant de replacer le aucon composant.

DANGER
Explosion hazard. Substitution of components may impair suitability for Class 1, Division 2.

DANGER
Risque d'explosion. La substitution de composants peut rendre ce materiel inacceptable pour les emplacements de Classe 1, Division 2.

6.1 Maintenance Schedule

Maintenance Task	90 days	Annually
Clean the sensor[1]	**x**	
Calibrate Sensor (if required by regulatory agency)	**Per the schedule mandated by your regulatory agency.**	

[1] Cleaning frequency is application dependent. More or less frequent cleaning will be appropriate in some applications.

6.2 Cleaning the Sensor

CAUTION
Before cleaning with acid, determine if any hazardous reaction products could form. (For example, a sensor used in a cyanide bath should not be put directly into a strong acid for cleaning because poisonous cyanide gas could be produced.) Acids are hazardous. Wear appropriate eye protection and clothing in accordance with Material Safety Data Sheet recommendations.

Keep the sensor clean to maintain measurement accuracy. The time between cleaning (days, weeks, etc.) is affected by the characteristics of the process solution and can only be determined by operating experience.

1. Clean the exterior of the sensor with a stream of water. If debris remains, wipe with a soft, wet cloth.

2. Remove most contaminate buildup by carefully wiping the inner electrode rod, and the concentric outer electrode tube (inner and outer surfaces) with a soft clean cloth. Then rinse the sensor with clean, warm water.

3. Prepare a mild soap solution using warm water and dishwashing detergent or similar.

4. Soak the sensor for 2 to 3 minutes in the soap solution.

5. Use a soft brush, cotton swab, or pipe cleaner to scrub the entire measuring end of the sensor, thoroughly cleaning the electrode surfaces.

6. If detergent solution cleaning cannot remove surface deposits, use muriatic acid (or another dilute acid) to dissolve the deposits. Soak the sensor in dilute acid **no more than 5 minutes**.

Note: *The acid should be as dilute as possible, but yet strong enough to clean. Experience will help determine which acid to use and how dilute it can be. Some stubborn coatings may require a different cleaning agent. For assistance in these difficult cases, contact Technical Consulting Services.*

7. Rinse the sensor with clean, warm water and then place the sensor back into the mild soap solution for 2 to 3 minutes to neutralize any remaining acid.

8. Rinse the sensor in clean, warm water.

9. Calibrate the analyzer using the procedure in the analyzer instruction manual. If calibration cannot be attained, check the sensor using the procedure in the troubleshooting section.

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 this sensor will be held. The following conditions will cause the sensor reading to flash:

- Sensor calibration
- Relay timer washing cycle
- Loss of communication

Highlight the Sensor Diag menu and press **ENTER**. Highlight Errors and press **ENTER** to determine the cause of the error. Errors are defined in Table 8.

Table 8 Error Codes

Displayed Error	Definition	Resolution
ADC FAIL	ADC reading bad	Contact Customer Service
SENSOR FAIL	Sensor ADC reading bad	Contact Customer Service
FLASH FAIL	Failed operation on Flash Memory	Contact Customer Service

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 Sensor Diag menu and press **ENTER** to determine the cause of the warning.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning. Warnings are defined in Table 9.

Table 9 Warning Codes

Displayed Warning	Definition	Resolution
TEMP < –20 °C	The sensed temperature is below –20 °C (–4 °F).	Temperature out of Range: Increase process temperature or discontinue use until the process temperature is above –20 °C (–4 °F). Bad Temperature Sensor: Check temperature of the sample stream with an independent temperature measuring device. If the temperature is within range, contact the Technical Consulting Services Department.
TEMP > 200 °C	The sensed temperature is above 200 °C (392 °F).	Temperature out of Range: Decrease process temperature or discontinue use until the process temperature is below 200 °C (392 °F). Bad Temperature Sensor: Check temperature of the sample stream with an independent temperature measuring device. If the temperature is within range, contact the Technical Consulting Services Department.

7.3 General Troubleshooting

Problem	Resolution
User cannot remember the passcode.	
	Call the Technical Consulting Services Department and ask for the Master Passcode. See Repair Service on page 59 for contact information.
Performed a Reset Config and current passcode no longer works.	
	Passcode has been reset to the factory default of **SC100**_(passcode must be followed by a space to remove the trailing asterisk). Reenter factory default passcode.
Reading is unstable	
	Clean and calibrate sensor

7.4 Checking Sensor Operation

7.4.1 Sensors without the Integral Junction Box

Use the following troubleshooting steps for sensors without the integrated integral junction box (Model: D3422, D3433, D3444, and D3455).

1. Disconnect the sensor from the analyzer or junction box.
2. Clean the sensor using the procedure in section 6.2 on page 33.
3. Using an ohmmeter, check all of the measurement point resistance readings shown in Table 10, Table 11, and Table 12. Make sure that the ohmmeter is set to its highest range for all infinite (open circuit) resistance readings.
4. If you cannot get the required readings for one or more of the resistance check or if the sensor still does not operate when the resistance checks are okay, contact Technical Support for more troubleshooting options.

Table 10 Sensor Operations (Resistance) Checks for Models 3422 and 3455

Measurement Points	Correct Resistance Readings
Between blue and white wires	1089–1106 ohms at 23–27 °C
Between red wire and sensor body	Less than 5 ohms
Between black wire and inner electrode	Less than 5 ohms
Between black and red wires	Infinite (open circuit)
Between black and white wires	Infinite (open circuit)
Between red and white wires	Infinite (open circuit)
Between red and inner shield wires	Infinite (open circuit)
Between black and inner shield wires	Infinite (open circuit)
Between white and inner shield wires	Infinite (open circuit)
Between outer and inner shield wires	Infinite (open circuit)

Table 11 Sensor Operations (Resistance) Checks for Models 3433

Measurement Points	Correct Resistance Readings
Between blue and white wires	1089–1106 ohms at 23–27 °C
Between black and red wires	Infinite (open circuit)
Between black and white wires	Infinite (open circuit)
Between red and white wires	Infinite (open circuit)
Between red and inner shield wires	Infinite (open circuit)
Between black and inner shield wires	Infinite (open circuit)
Between white and inner shield wires	Infinite (open circuit)
Between outer and inner shield wires	Infinite (open circuit)

Table 12 Sensor Operations (Resistance) Checks for Models 3422 and 3455

Measurement Points	Correct Resistance Readings
Between blue and white wires	1089–1106 ohms at 23–27 °C
Between red wire and sensor body	Less than 5 ohms
Between black wire and inner electrode	Less than 5 ohms
Between black and red wires	Infinite (open circuit)
Between black and white wires	Infinite (open circuit)
Between red and white wires	Infinite (open circuit)
Between red and outer shield wires	Infinite (open circuit)
Between black and outer shield wires	Infinite (open circuit)
Between white and outer shield wires	Infinite (open circuit)
Between outer and outer shield wires	Infinite (open circuit)

7.4.2 Analog or External Digital Gateway Sensors

1. Disconnect the sensor from the analyzer or junction box.
2. Clean the sensor using the procedure in section 6.2 on page 33.
3. Obtain a known standard (NIST-traceable is preferred for many applications) and take a measurement.
4. Reconnect the sensor to the controller or junction box.
5. If the resulting measurement is out of specification (different from the value stated on the label ± the stated standard error), contact Technical Consulting Services. See Repair Service on page 42 for contact information.

7.4.3 Sensor Linearity Check

1. Obtain two standards, one close to the maximum for the range of interest (high standard) and another with a value half way between the high standard and 0 (mid-range standard).

2. Prepare 50 mL high and mid-range standards in 100 mL beakers and add 50 mL of deionized water to another 100 mL beaker.

3. Insert the sensor into the beaker containing deionized water. Record the stable reading.

4. Remove the sensor from the deionized water and shake it gently to remove excess water.

5. Place the sensor into the high standard and record the stable reading.

6. Remove the sensor from the high standard, rinse with deionized water and shake gently to remove excess water.

7. Place the sensor in the mid-range standard and record the stable reading.

The mid-range standard reading should fall half way between the reading obtained for the deionized water and the high standard. If it does not, the sensor may be defective. Call Customer Service for assistance; see Repair Service on page 42 for contact information.

Section 8 Replacement Parts

8.1 Replacement Items and Accessories

Item	QTY	Catalog Number
Cable, sensor extension, 1 m (3.3 ft)	each	6122400
Cable, sensor extension, 7.7 m (25 ft)	each	5796000
Cable, sensor extension, 15 m (50 ft)	each	5796100
Cable, sensor extension, 31 m (100 ft)	each	5796200
Conductivity Reference Solution, 100–1000 µs/cm	1L	25M3A2000-119
Conductivity Reference Solution, 100–1000 µs/cm	1L	25M3A2050-119
Conductivity Reference Solution, 2000–100000 µs/cm	1L	25M3A2100-119
Conductivity Reference Solution, 200000–300000 µs/cm	1L	25M3A2200-119
Connector Safety Lock	each	6139900
Digital termination box	each	5867000
Instruction manual, sc100 Controller, English	each	5860018
Instruction manual, Conductivity System, English	each	6120318
Mount Hardware, Insertion (Ball Valve), 3422 series, SS, 0.05 cell constant	each	MH113M2C
Mount Hardware, Insertion (Ball Valve), 3422 series, SS for all other cell constants	each	MH114M2C
Mounting hardware kit, pipe	each	5794400
Mounting hardware kit, ball float	each	5794300
Plug, sealing, conduit opening	each	5868700
Strain relief, Heyco	each	16664

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

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

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send an 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

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
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 product manual.

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, 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 12 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 Controller/sc1000 Controller with Contacting Conductivity Probe** 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) Electrostatic Discharge Immunity (Criteria B)
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electromagnetic 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 Electromagnetic 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 Controller from its power source to verify that it is or is not the source of the interference.

2. If the Controller is connected into the same outlet as the device with which it is interfering, try another outlet.

3. Move the Controller away from the device receiving the interference.

4. Reposition the receiving antenna for the device receiving the interference.

5. Try combinations of the above.

Appendix A Modbus Register Information

Table 13 Sensor Modbus Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Tags	Conductivity	40001	Unsigned Integer	1	R/W	Sensor meas tag index
Tags	Temperature	40002	Unsigned Integer	1	R/W	Temperature tag index
Measurements	Conductivity	40003	Float	2	R	Sensor measurement
Measurements	Temperature	40005	Float	2	R	Temperature measurement
Settings	MeasMin	40007	Float	2	R	Minimum meas. value
Settings	MeasMax	40009	Float	2	R	Maximum meas. value
Settings	MeasFormat	40011	Unsigned Integer	2	R	Display format
Settings	MeasUnitsCond	40013	Unsigned Integer	1	R/W	Siemens units
Settings	MeasUnitsResist	40014	Unsigned Integer	1	R/W	Ohm units
Settings	MeasUnitsTDS	40015	Unsigned Integer	1	R/W	TDS units
Settings	MeasUnitsSalinity	40016	Unsigned Integer	1	R/W	Salinity units
Settings	TempUnits	40017	Unsigned Integer	1	R/W	Temperature units
Settings	Parameter	40018	Unsigned Integer	1	R/W	Selected primary parameter
Settings	DisplayFormat	40019	Unsigned Integer	1	R/W	User selected display format
Settings	Filter	40020	Unsigned Integer	1	R/W	Number of samples to average
Settings	TDSConfig	40021	Unsigned Integer	1	R/W	TDS configuration
Settings	TDS Factor	40022	Float	2	R/W	TDS multiplier
Settings	Cell Constant	40024	Float	2	R/W	Cell constant value
Settings	Cell Constant Min	40026	Float	2	R/W	Minimum cell constant value
Settings	Cell Constant Max	40028	Float	2	R/W	Maximum cell constant value
Settings	CellConstSel	40030	Unsigned Integer	1	R/W	Cell constant selection: 0.01, 0.05, 0.1, 0.5, 1.0, 5.0, 10.0
Settings	TCompSlope	40033	Float	2	R/W	Temp. comp. slope
Settings	TCompRefTemp	40035	Float	2	R/W	Temp. comp. ref. temp
Settings	TElementType	40041	Unsigned Integer	1	R/W	Temp. element: Manual, Pt100, Pt1000 = 0/1/2
Settings	TElementFactor	40042	Float	2	R/W	Temp. element offset
Settings	TElementManual	40048	Float	2	R/W	Temp. manual temperature
Settings	OutPutMode	40050	Unsigned Integer	1	R/W	Output mode during calibration: Active/Hold/Transfer = 0/1/2
Calibration	Cal Value	40052	Float	2	R	Calib. value
Settings	Sensor Name	40054	String	6	R/W	Name of sensor
Diagnostics	Driver Version	40060	String	8	R/W	Version of driver
Diagnostics	Serial Number	40068	String	6	R/W	Sensor serial number

Table 13 Sensor Modbus Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Tags	Function Code	40074	Unsigned Integer	1	R/W	Function code tag
Tags	Next State	40075	Unsigned Integer	1	R/W	Next state tag
Diagnostics	FactoryCalValue	40076	Float	2	R/W	Factory diagnostic
Diagnostics	FactoryCalCmd	40078	Unsigned Integer	1	R/W	Factory diagnostic
Diagnostics	Sensor Log Interval	40079	Unsigned Integer	1	R/W	Enable/disable sensor log interval
Diagnostics	Tempr Log Interval	40080	Unsigned Integer	1	R/W	Enable/disable temperature log interval
Diagnostics	Temp Counts	40081	Float	2	R	A/D counts for temperature
Diagnostics	Cond Counts	40083	Float	2	R	A/D counts for sensor
Diagnostics	Tohms	40085	Float	2	R	Calculated ohms of temp. sensor
Diagnostics	AutoRange	40087	Unsigned Integer	1	R/W	Autorange if set to 0
Diagnostics	Range	40088	Unsigned Integer	1	R/W	Current gain setting of sensor — 0/1/2
Diagnostics	Zero Counts 0	40089	Float	2	R	A/D counts for gain level 0
Diagnostics	Zero Counts 1	40091	Float	2	R	A/D counts for gain level 1
Diagnostics	Zero Counts 2	40093	Float	2	R	A/D counts for gain level 2
Settings	Freq Reject	40146	Unsigned Integer	1	R/W	Set 50/60 Hz rejection on A/D
Diagnostics	Driver Version	40147	Unsigned Integer	6	R	Device driver version
Diagnostics	Edit Temp	40153	Float	2	R/W	Edit temperature +/- 5 degrees celsius

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