

# Rosemount™ FCL

## Free Chlorine System with Rosemount 56 Transmitter



## Essential instructions

Read this page before proceeding!

Your instrument purchase from Emerson is one of the finest available for your particular application. Emerson designs, manufactures, and tests its products to meet many national and international standards. Experience indicates that its performance is directly related to the quality of the installation and knowledge of the user in operating and maintaining the instrument. To ensure continued operation to the design specifications, read this Manual thoroughly before proceeding with installation, commissioning, operation, and maintenance of this instrument. If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired. Failure to follow the proper instructions may cause any one of the following situations to occur: loss of life, personal injury, property damage, damage to this instrument, and warranty invalidation.

- Ensure that you have received the correct model and options from your purchase order. Verify that this Manual covers your model and options. If not, call 1-800-999-9307 to request the correct Manual.
- For clarification of instructions, contact your Rosemount™ representative.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Use only qualified personnel to install, operate, program, and maintain the product.
- Install equipment as specified in the installation instructions of the appropriate Reference Manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- Use only factory documented components for repair. Tampering or unauthorized substitution of parts and procedures can affect the performance and cause unsafe operation of your process.

### **⚠ WARNING**

#### **Electrical shock**

Making cable connections to and servicing this instrument require access to shock hazard level voltages, which can cause death or serious injury.

Equipment protected throughout by double insulation.

Disconnect main power and relay contacts wired to separate power sources before servicing.

Do not operate or energize instrument with case open.

Non-metallic cable strain reliefs do not provide grounding between conduit connections. Use grounding type bushings and jumper wires.

Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other national or local codes.

Unused cable conduit entries must be securely sealed by non-flammable closures to provide exposure integrity in compliance with personal safety and environmental protection requirements. Unused conduit openings must be sealed with NEMA 4X or IP65 conduit plugs to maintain the ingress protection rating (IP65).

Operate only with front and rear panels fastened and in place over terminal area.

Safety and performance require that this instrument be connected and properly grounded through a three-wire power source.

### **⚠ WARNING**

This product is not intended for use in the light industrial, residential, or commercial environments per the instrument's certification to EN50081-2.

### **⚠ CAUTION**

#### **Radio interference**

This product generates, uses, and can radiate radio frequency energy and thus can cause radio communication interference. Improper installation or operation may increase such interference. As temporarily permitted by regulation, this unit has not been tested for compliance within the limits of Class A computing devices, pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference.

Operation of this equipment in a residential area may cause interference, in which case the operator, at his own expense, will be required to take whatever measures may be required to correct the interference.

## **⚠ WARNING**

### **Physical access**

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

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# 1 Description and specifications

## 1.1 Specifications

**Table 1-1: General Specifications**

Characteristic	Specifications
<b>Sample requirements</b>	
Pressure	3 to 65 psig (122 to 549 kPa abs) A check valve in the inlet prevents the sensor flow cells from going dry if sample flow is lost. The check valve opens at 3 psig (122 kPa abs). If the check valve is removed, minimum pressure is 1 psig (108 kPa abs).
Temperature	32 to 122 °F (0 to 50 °C)
Minimum flow	3 gal/hr (11 L/hr)
Maximum flow	80 gal/hr (303 L/hr); high flow causes the overflow tube to back up.
Sample conductivity	> 50 µS/cm at 77 °F (25 °C)
Process connection	¼-in. OD tubing compression fitting (can be removed and replaced with barbed fitting for soft tubing)
Drain connection	¾-in. barbed fitting. Sample must drain to open atmosphere.
Wetted parts	Overflow sampler and flow cell: acrylic, polycarbonate, Kynar™, nylon, silicone Chlorine sensor: Noryl™, Viton™, wood, silicone, polyethersulfone, polyester, and platinum pH sensor (3900 VP): stainless steel, glass, Teflon™, polyphenylene sulfide, EPDM, and silicone
Response time	< 80 sec to 95% of final reading for inlet sample flow of 3 gph (11 L/hr)
Weight/shipping weight <sup>(1)</sup>	Rosemount FCL-01: 10 lb./13 lb. (4.5 kg/6.0 kg) Rosemount FCL-02: 11 lb./14 lb. (5.0 kg/6.5 kg)

(1) Rounded to the nearest 1 lb. (0.5 kg)



**Table 1-2: Sensor Specifications**

Characteristics	Specifications
Free chlorine range	0 to 10 ppm as Cl <sub>2</sub> . For higher ranges, consult the factory.
pH correction range	6.0 to 9.5. For samples having pH between 9.5 and 10.0, consult the factory. If pH < 6.0, correction is not necessary. For manual pH correction, choose option -01. For continuous pH correction, choose option -02.
Accuracy	Accuracy depends on the accuracy of the chemical test used to calibrate the sensor.

**Table 1-2: Sensor Specifications (continued)**

Characteristics	Specifications
Interferences	Monochloramine, permanganate, peroxides
Electrolyte volume	25 mL (approx.)
Electrolyte life	3 months (approx.); for best results, replace electrolyte monthly.

**Table 1-3: Rosemount™ 56 Transmitter**

Characteristic	Specifications
Case	Polycarbonate
Display	Full color LCD, 3.7x x 2 in. (95 x 56 mm); you can customize the display.
Languages	English, French, German, Italian, Spanish, Portuguese, Chinese, Russian, and Polish
Ambient temperature and humidity	14 to 140 °F (-20 to 60 °C)
Power	85 to 265 Vac, 47.5 to 65.0 Hz, 20 W
RFI/EMI	EN 61326
LVD	EN-6101-01 
Outputs	Four 4-20 or 0-20 mA isolated current outputs; assignable to measurement or temperature; fully scalable; maximum load 550 Ω. HART® digital signal is superimposed on output 1.
Alarms and timers	Four relays, fully configurable as a setpoint alarm. Interval timer, TPC, bleed and feed timer, delay timer, date and time timer, and fault alarm.
Relays	Form C, SPDT, epoxy sealed
Relay contact ratings	 5 A at 28 Vdc or 300 Vac (resistive) ½ HP at 120/240 Vac
Data logger	Data automatically stored every 30 seconds for 30 days; older data removed to make room for new data. the following data are automatically stored: Chlorine: date and time, ppm, temperature, and raw sensor current pH: date and time, pH, temperature, mV, glass impedance, and reference impedance (if available)
Event logger	Stores up to 300 events with date and time stamps: faults, warnings, calibration data, calibration results (pass or fail), power on/off cycles, and hold on/off. Can also store alarm relay activation and deactivation. Older events are automatically removed to make room for new events.
Data event downloading	Through USB port on front panel.

**Table 1-3: Rosemount™ 56 Transmitter (continued)**

Characteristic	Specifications
Digital communications	HART digital communication is standard. Profibus® DP is optional.

## 1.2 Ordering information

The Rosemount™ FCL is a system used for measuring free chlorine in aqueous samples. This complete system consists of a free chlorine sensor (pH sensor optional), a transmitter, and a constant head overflow device to control sample flow. All components are mounted on a backplate. The factory ships three replacement membranes and a 4 oz. (118 mL) bottle of electrolyte solution with the system.

### Free Chlorine System

**Table 1-4: Free Chlorine System**

Code	Measurement option
01	Without pH sensor
02	With pH sensor
Code	Transmitter option
240	56-03-24-38-HT, 85 - 265 Vac, 47.5/65.0 Hz, chlorine only (option -01 only)
241	56-03-24-32-HT, 85 - 265 Vac, 47.5/65.0 Hz, chlorine and pH (option -02 only)
<b>Typical model number: FCL-02-241</b>	

### Component parts

**Table 1-5: Transmitter**

Transmitter model	Description
56-03-24-38-HT	Rosemount 56-03-24-38-HT, 85 - 265 Vac, 47.5/65.0 Hz, chlorine only
56-03-24-32-HT	Rosemount 56-03-25-32-HT, 85 - 265 Vac, 47.5/65.0 Hz, chlorine and pH

**Table 1-6: Sensor**

Sensor model	Description
499ACL-01-54-VP	Free chlorine sensor with Variopol connector
3900VP-02-10	pH sensor with Variopol connector

**Table 1-7: Cable**

Sensor cable	Description
23747-04	Interconnecting cable, Variopol for Rosemount 499ACL sensor, 4 ft. (1.2 m)
24281-05	Interconnecting cable, Variopol for Rosemount 3900VP sensor, 4 ft. (1.2 m)

### Accessories

**Table 1-8: Tag**

Part number	Description
9240048-00	Tag, stainless steel (specify marking)

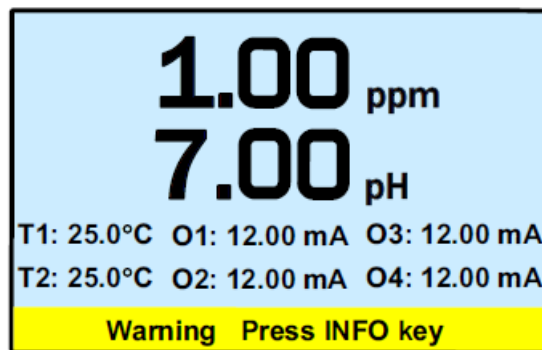
## 2 Display and operation

### 2.1 Main display

The transmitter has a four line display.

See [Figure 2-1](#). The display can be customized to meet your requirements. Fault or warning messages, if appropriate, appear at the bottom of the screen. See [Overview](#).

**Figure 2-1: Main display**



The following abbreviations are used in the lower two lines of the display. The number following the display refers to the sensor, alarm relay, or output.

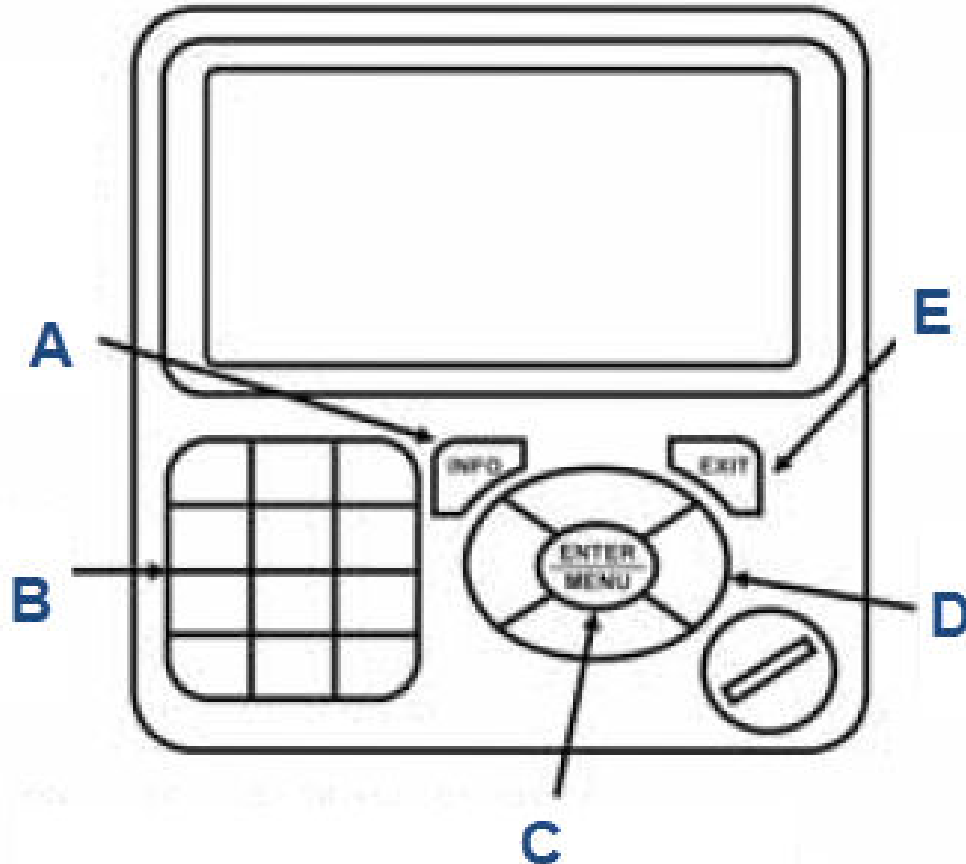
O	Output
T	Temperature (live)
Tm	Temperature (manual)
M	Measurement
AL	Alarm relay
I	Sensor current (chlorine)
mV	mV input (pH)
Slp	slope (pH)
R.Z.	reference impedance (pH)
Gl.Z.	glass impedance (pH)

## 2.2 Keypad

Local communication with the transmitter is through the membrane keypad.

See [Figure 2-2](#).

**Figure 2-2: Transmitter Keypad**



- A. Press **INFO** to get more information about the control setting or calibration step the cursor is on. To close the **INFO** box, press any key.
- B. Use the alphanumeric keypad to enter numbers or letters.
- C. When the main display is showing, press **ENTER/MENU** to view the main menu. In other cases, press **ENTER/MENU** to select an item for editing or to store a change.
- D. Four navigation keys move the cursor up, down, left, and right.
- E. Press **EXIT** to return the display to the first screen in a series of related screens. Changes that have not been stored will not be saved.

## 2.3 Operation

The operation of the Rosemount 56 Transmitter can best be understood from the following example.

### Procedure

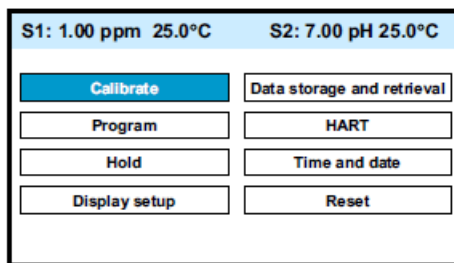
1. With the main display showing (Figure 2-1), press ENTER/MENU.  
The main **Menu**, shown below, appears.

#### Important

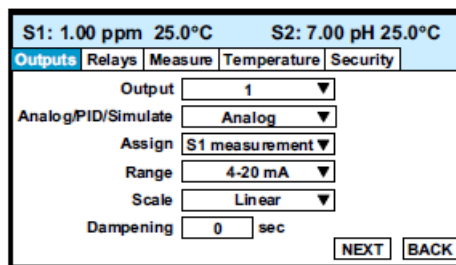
Pressing the ENTER/MENU key will bring up the main **Menu** only if the main display is showing.

Note that the current reading and temperature for sensor 1 (S1) and sensor 2 (S2), if applicable, always appear at the top of the screen.

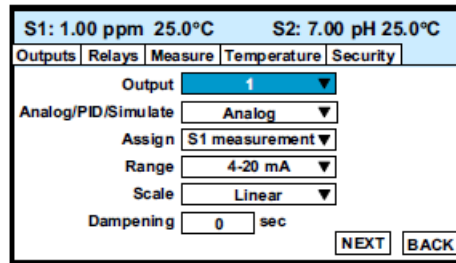
The cursor (dark blue backlit field) is on Calibrate.



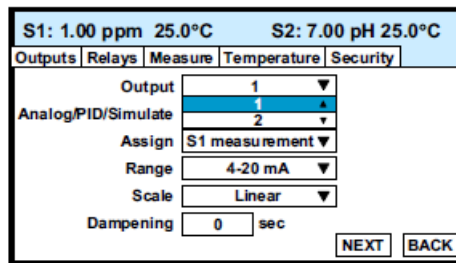
2. Press **Down** to move the cursor to Program.
3. Press ENTER/MENU.  
The cursor is on **Outputs**, and the first screen in the **Outputs** submenu is showing.



4. To select a different program submenu, use **Right** to move the cursor to the desired tab and press ENTER/MENU.
5. To enter the **Outputs** submenu, press **Down**.  
The cursor moves to the first control box, Output. The Rosemount 56 has four analog outputs, and this control lets you select which output to configure. The default is output 1.



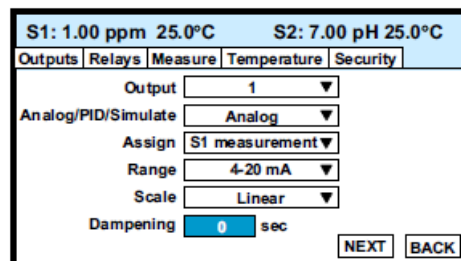
6. To select a different output, press ENTER/MENU. A list of the available outputs, shown two at a time, appears.



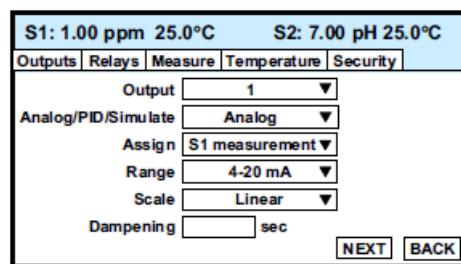
7. To view the list, press or press and hold Up or Down. To select and store the highlighted selection, press ENTER/MENU. To move from one control box to another, press Up or Down.

Some controls require you to select an item from a list. Others, like Dampening, require you to enter a number.

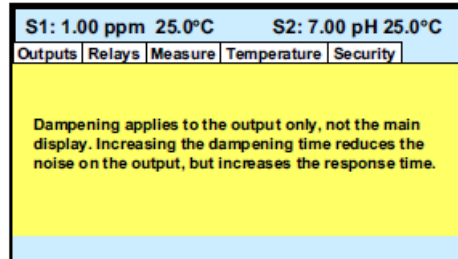
8. Move the cursor to Dampening at the bottom of the screen. The default Dampening value is 0 seconds.



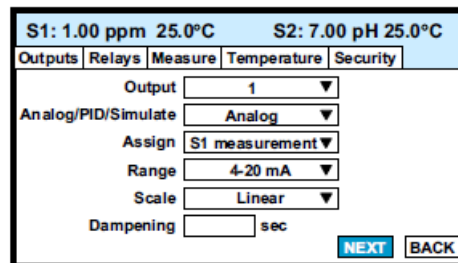
9. To change the value, press ENTER/MENU. The dark blue back-lighting disappears, indicating that a number can be entered.



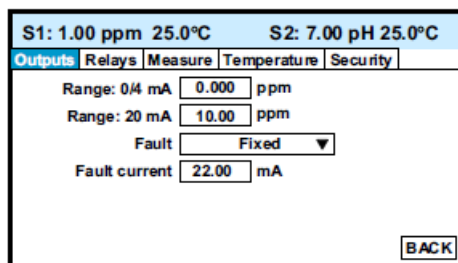
10. Use the numeric keypad to enter the desired number. If you make an error, press **Left** to erase the digit last entered. To store the number, press **ENTER/MENU**.  
Every control box has an information or help screen associated with it.
11. To view the information screen for the control box the cursor is on, press **INFO**.  
The information screen for Dampening is shown below.



12. To close the information screen, press any key.  
A **NEXT** and **BACK** button are at the bottom of the screen. **NEXT** means that additional control boxes are available on at least one or more screen.



13. To view the next screen, use the navigation keys (either **Down** or **Right**) to move the cursor to **NEXT** and press **ENTER/MENU**.  
The next screen in the **Outputs** submenu appears. The cursor is on the **Outputs** tab.



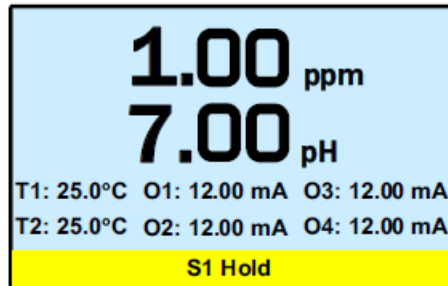
14. To enter the screen, press **Down**.
15. To return to the previous screen, move the cursor to **BACK** and press **ENTER/MENU**.
16. To return to the main menu, press **EXIT**.



**Important**

Be sure to press **APPLY** once the box has been unchecked.

A message stating which sensors are in hold appears in the fault/warning banner at the bottom of the display.



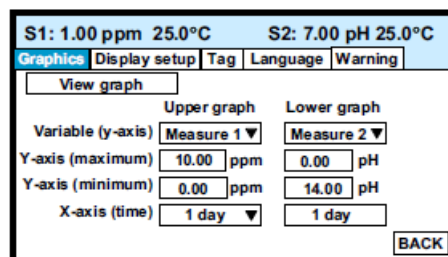
## 2.5 Main display

### 2.5.1 Configuring the main display

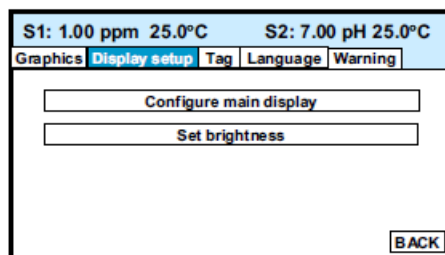
The main display can be configured to meet your specific requirements.

**Procedure**

1. With the main display showing, press **ENTER/MENU**.  
The main menu appears.
2. Choose **Display Setup**.  
The screen below appears.

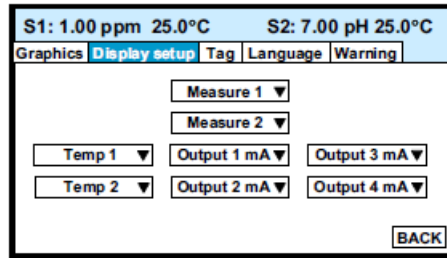


3. Move the cursor to **Display setup** and press **ENTER/MENU**.  
The screen below appears.



4. Choose **Configure main display**.

The screen below appears. The position of each control box corresponds to the position of the variable in the main display.



5. Move the cursor to the control box and press **ENTER/MENU**. Use **Up** and **Down** to scroll through the list of variables and press **ENTER/MENU** to select the desired variable for display.

## 2.5.2 Set brightness

Complete the following steps to set the brightness on the 56 Transmitter screen.

### Procedure

1. Move the cursor to the Set brightness button shown in step 3 in [Section](#) and press **ENTER/MENU**.
2. Then move the cursor to Display brightness and select the desired brightness. The information screen gives recommendations about setting the brightness level especially in areas where the ambient temperature exceeds 50 °C (121 °F).

## 2.6 Security

### 2.6.1 Enter security code

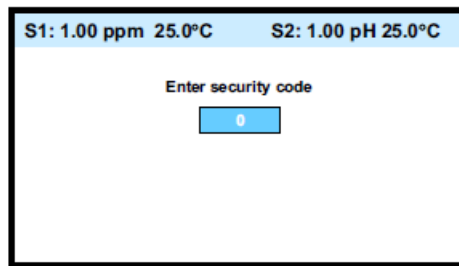
Security codes prevent accidental or unwanted changes to program settings or calibrations.

There are three levels of security:

1. A user can view the main display and diagnostic screens only.
2. A user has access to the **Calibration** and **Hold** menus only.
3. A user has access to all menus.

### Procedure

1. If a security code has been programmed, pressing a submenu button (see [Operation](#)) causes the security screen shown below to appear.



2. Enter the three digit security code.  
If the entry is correct, the requested submenu appears, and you have access to all the submenus the code entitles you to.  
If the entry is wrong, the **Invalid code** screen appears.

## 2.6.2 Assigning security codes

See [Section](#).

## 2.6.3 Bypassing security codes

Call the factory.



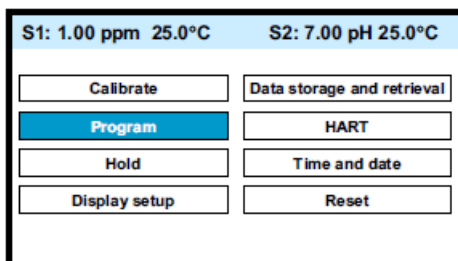
# 3 Programming the transmitter

## 3.1 Entering the Program menus

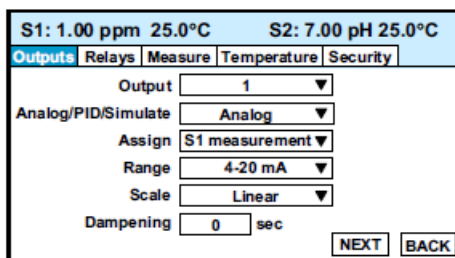
Complete the following steps to access the **Program** menus on your 56 Transmitter.

### Procedure

1. With the main display showing, press **ENTER/MENU** to display the main menu.



2. Move the cursor to Program and press **ENTER/MENU**.



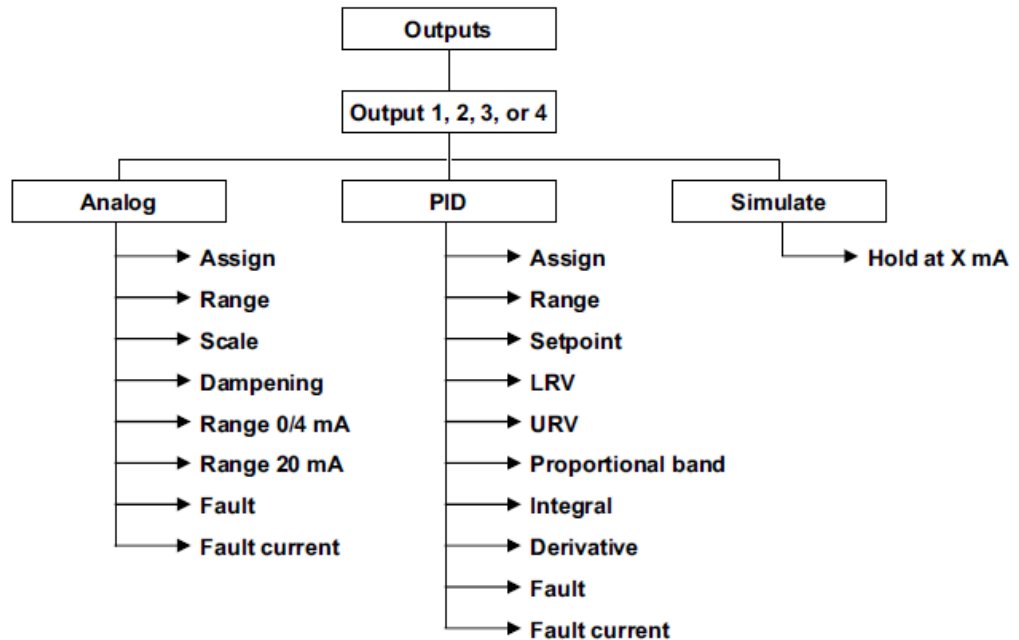
3. Move the cursor to the tab showing the desired submenu and press **ENTER/MENU**.  
A fifth tab, not shown, labeled pH diagnostics setup, will be present if one of the sensors is a pH sensor.

## 3.2 Outputs

### 3.2.1 Menu tree

Figure 3-1 is the **Outputs** menu tree.

**Figure 3-1: Menu tree for the Outputs submenu**



### 3.2.2 Output settings

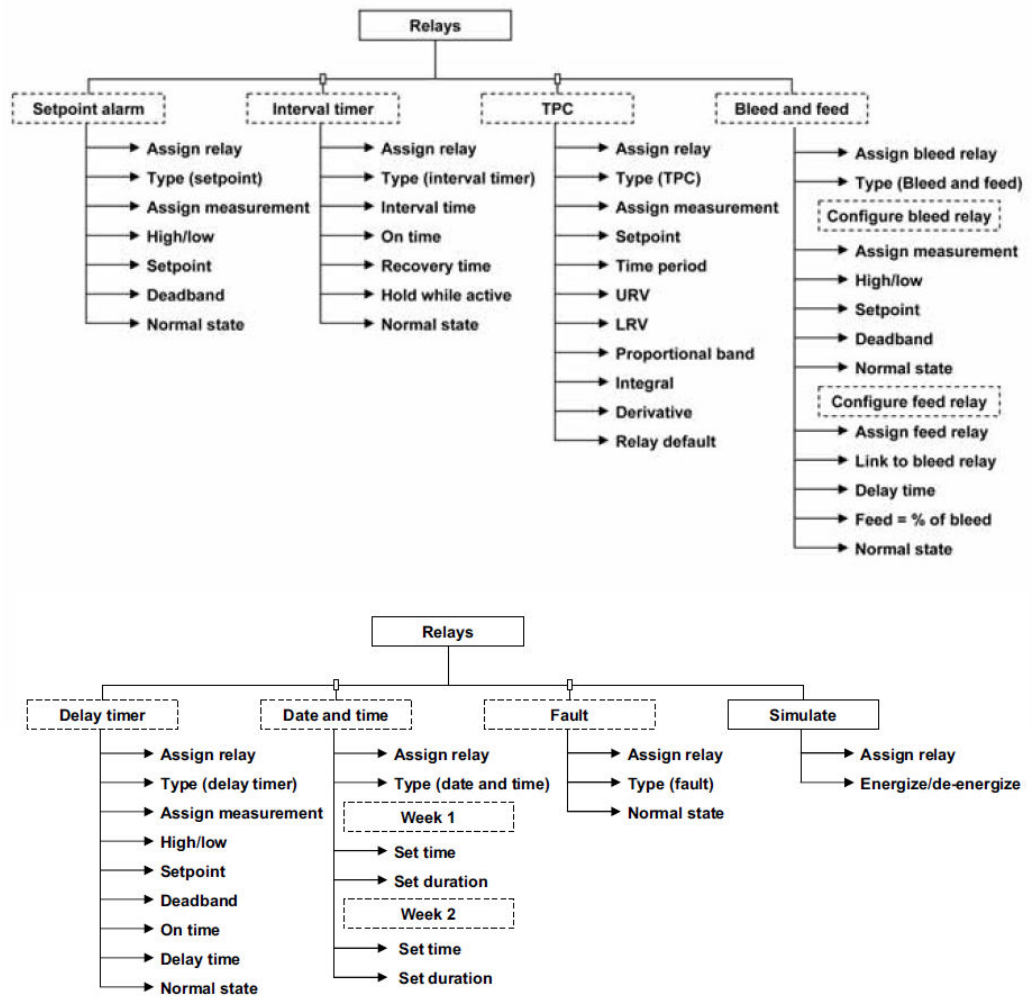
Move the cursor to the appropriate control box and press the desired setting. For more information about the control box the cursor is on, press **INFO**. To close the information screen, press any key.

## 3.3 Relays

### 3.3.1 Menu tree

Figure 3-2 is the **Relays** menu tree.

Figure 3-2: Menu tree for the Relays submenu

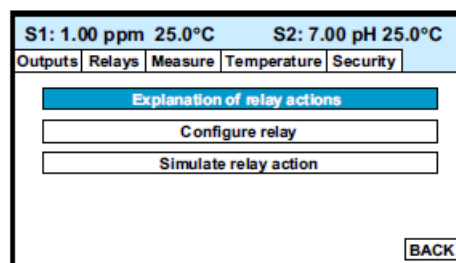


### 3.3.2 Configure relay settings

A large number of relay actions are available in the Rosemount 56.

#### Procedure

1. For more information about a relay action, move the cursor to Explanation of relay actions and press ENTER/MENU.



The screen below appears.

2. Select the desired relay action and press **INFO** to display the information screen.
3. To close the information screen, press any key.  
The totalizer-based relay timer is not available in the FCL. It is available only if one of the measurements is flow.
4. To configure a relay, press **EXIT** to return to the first screen.
5. Move the cursor to the Configure relay button and press **ENTER/MENU**.  
A screen similar to the one below appears.

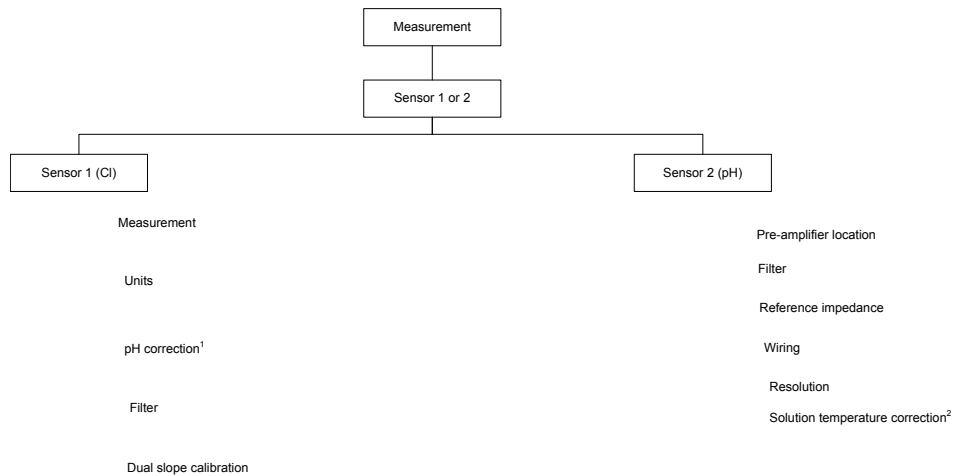
6. Move the cursor to the appropriate control box and make the desired setting.
7. For more information about the control the cursor is on, press **INFO**.
8. To close the information screen, press any key.

## 3.4 Measurement

### 3.4.1 Menu tree

Figure 3-3 is the **Measurement** menu tree.

**Figure 3-3: Menu tree for the Measurement submenu**



- A. For FCL-02, choose Live/automatic. For FCL-01, choose manual and set manual pH to the expected pH of the process liquid.
- B. If the pH measurement is being made to correct the chlorine sensor reading, leave solution temperature correction off.

## 3.4.2 Configure measurement settings

Complete the following steps to change the measurement settings on your 56 Transmitter.

### Procedure

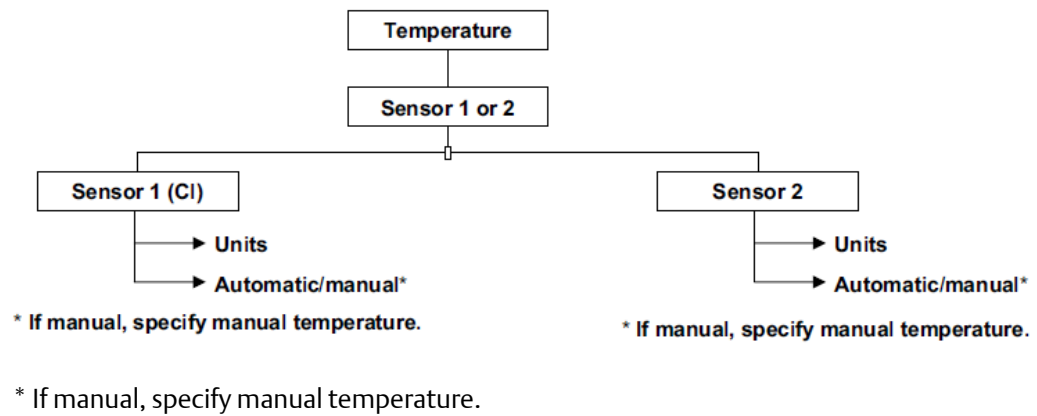
1. Move the cursor to the appropriate control box and make the desired setting.
2. For more information about the control the cursor is on, press **INFO**.
3. To close the information screen, press any key.

## 3.5 Temperature

### 3.5.1 Menu tree

Figure 3-4 is the **Temperature** menu tree.

Figure 3-4: Menu tree for the Temperature submenu



## 3.5.2 Configure temperature settings

Complete the following steps to change the temperature settings on your 56 Transmitter.

### Procedure

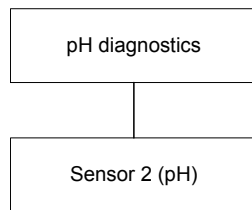
1. Move the cursor to the appropriate control box and make the desired setting.
2. For more information about the control the cursor is on, press **INFO**.
3. To close the information screen, press any key.

## 3.6 pH diagnostic setup

### 3.6.1 Menu tree

Figure 3-5 is the pH diagnostic setup menu tree.

Figure 3-5: Menu tree for the pH diagnostic setup submenu



Maximum allowed offset

Minimum allowed slope

Maximum allowed slope

Sensor diagnostics on/off

Ref fault high

Glass fault high

Glass impedance temp correction on/off

Glass impedance measurement method

Sensor diagnostics on

## 3.6.2 Configure pH settings

Complete the following steps to set up the pH diagnostics on the Rosemount 56 Transmitter.

### Procedure

1. Move the cursor to the appropriate control box and make the desired setting.
2. For more information about the control the cursor is on, press **INFO**.
3. To close the information screen, press any key.

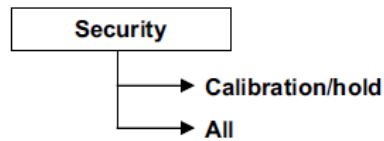
## 3.7 Security

### 3.7.1 Menu tree

Figure 3-6 is the Security menu tree.

---

**Figure 3-6: Menu Tree for the Security Sub-Menu**



### 3.7.2 Configure security settings

Complete the following steps to change the security settings on your 56 transmitter.

**Procedure**

1. Move the cursor to the appropriate control box and make the desired setting.
2. For more information about the control the cursor is on, press **INFO**.
3. To close the information screen, press any key.

### 3.7.3 Restoring default settings

See [Reset](#).

# 4 Calibrate

## 4.1 Introduction

The **Calibrate** menu allows you to do the following:

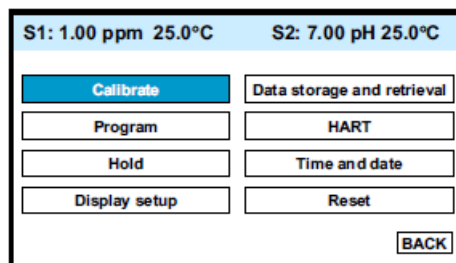
1. Calibrate the RTD (temperature sensing element) in the chlorine and pH sensors.
2. Calibrate the pH sensor. Four methods are available:
  - a. Two-point automatic buffer calibration
  - b. Manual two-point buffer calibration.
  - c. Standardization (one-point calibration) against either a grab sample or an in-process measurement.
  - d. Manual entry of pH sensor slope and offset if they are already known.
3. Calibrate the chlorine sensor.
4. Calibrate the analog outputs.

## 4.2 Entering the Calibration menus

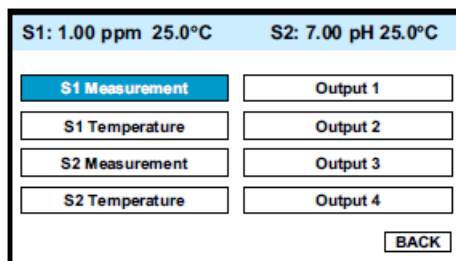
Complete the following steps to enter the **Calibration** submenus on your 56 Transmitter.

### Procedure

1. With the main display showing, press **ENTER/MENU** to display the main **Menu**. The cursor is on Calibrate.



2. Press **ENTER/MENU**.



3. Choose the sensor (measurement or temperature) or output to be calibrated.

Sensor 1 (S1) is the free chlorine sensor; sensor 2 (S2) is the pH sensor (if present).

## 4.3 Calibrating temperature

Complete the following steps to calibrate the temperature on your 56 Transmitter.

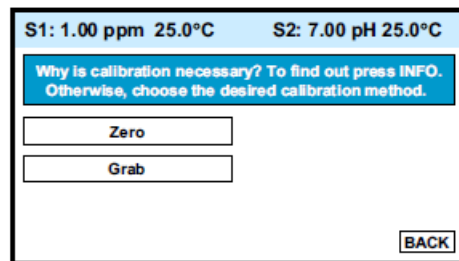
### Procedure

1. To calibrate the temperature device in the sensor, choose S1 temperature or S2 temperature and follow the prompts.  
If you want more information about a calibration step, press **INFO**.  
Once the calibration is complete, the screen shows the results of the calibration. The screen also shows some acceptance criteria to help you determine whether to accept the calibration.
2. Press **INFO** for an information screen to aid with troubleshooting if the calibration results are not acceptable.

## 4.4 Calibrate the free chlorine sensor

### Procedure

1. Choose sensor 1 (free chlorine) in [Entering the Calibration menus](#).  
The screen below appears.



There are two steps to calibrating a free chlorine sensor, measuring the zero current (Zero) and determining the slope of the calibration curve (Grab). Because stable free chlorine standards in the ppm range do not exist, the sensor must be calibrated against the results of a laboratory test run on a grab sample.

2. To zero the sensor, select Zero and follow the prompts.  
For more information about preparing the zero solution and measuring the zero current, press **INFO** when prompted.  
If the zero step is successful, the transmitter displays the **Zero complete** screen and the measured zero current. The screen also shows the typical zero current for the sensor and the recommended acceptance criterion. You are asked to accept the zero current. Press **INFO** for an information screen to aid with troubleshooting if the results are not acceptable.  
If the zero current is badly in error, the transmitter displays the **Zero failed** screen. Press **INFO** for troubleshooting.

3. To calibrate the sensor response in chlorinated water, select Grab and follow the prompts.

Be sure the sensor is installed in the flow cell in the FCL and the sample is flowing down the inside tube of the overflow sampler.

---

**Important**

If you are calibrating the FCL-02, calibrate the pH sensor first and install it in its flow cell before calibrating the free chlorine sensor.

---

If the calibration is successful, the transmitter displays the **Calibration complete** screen and the sensitivity (nA/ppm). The screen also shows the typical sensitivity range for the sensor and the recommended acceptance criterion. You are asked to accept the calibration. Press **INFO** for an information screen to aid with troubleshooting if the calibration is not acceptable.

If the sensitivity is badly in error, the transmitter displays the **Calibration failed** screen. Press **INFO** for troubleshooting.

## 4.5 Calibrate the pH sensor

Complete the following steps to calibrate the pH sensor if you have the Rosemount™ FCL-02.

### Procedure

1. Choose Sensor 2 (pH) in [Entering the Calibration menus](#).  
The screen below appears. There are five possible ways to calibrate the pH sensor.
2. Select the desired calibration method (Auto buffer is recommended) and follow the prompts.

For more information about calibration methods, press **INFO**.

If you choose Auto buffer calibration, the screen below appears to allow you to set up auto buffer calibration parameters. The default values are recommended.

If the calibration is successful, the transmitter displays the calibration results (slope and offset for automatic and manual buffer calibration and offset for standardize calibration).

If there is a possible calibration error, the transmitter displays the calibration results and the nature of the error. You will be asked to accept the calibration. Press **INFO** for an information screen to aid with troubleshooting if the calibration is not acceptable.

If there is a serious calibration error, the transmitter displays the calibration results and the error. Press **INFO** for an information screen to aid with troubleshooting and repeat the calibration.

## 4.6 Calibrate the analog outputs

### Procedure

1. Choose the appropriate output in [Entering the Calibration menus](#) and follow the prompts to trim the selected output.

If you want more information about a calibration step, press **INFO**.

2. Press **INFO** for an information screen to aid with troubleshooting if the calibration is not acceptable.

## 4.7 Reset

There are three resets.

1. Reset all user settings, including calibration and program settings, to the factory default values. The transmitter will return to Quick Start.

---

### **Important**

The event logger and data logger (see [Data and event logging and retrieval](#)) will be unaffected.

---

2. Reset sensor calibration to the default value. The transmitter will clear all user-entered calibration data for the selected sensor. It will leave all other user-entered data unaffected.
3. Reset the analog output calibration for the selected output to the default value. The transmitter will leave all other user-entered settings unchanged.

### **Procedure**

1. With the main display showing, press **ENTER/MENU** to display the main menu.
2. Move the cursor to Reset and press **ENTER/MENU**.
3. Check the desired boxes and press **APPLY**.

## 5 Digital communications

The Rosemount 56 Transmitter supplied with the FCL has HART communications as a standard feature. For more information, refer to the Rosemount 56 HART Addendum Manual.



## 6 Data and event logging and retrieval

### 6.1 Data and event logging overview

Data and event logging is a standard feature in the Rosemount™ 56 Transmitter. However, the operator must enable the feature.

When data and event logging is enabled, the Rosemount 56 Transmitter will automatically store the following events with date and time stamp: faults warnings, calibration data, calibration results (pass or fail), power on/off cycles, hold on/off, and new sensor board detected. At your discretion, the transmitter will also store alarm activation and deactivation as events. The event logger holds 300 events. When the capacity of the logger is reached, the transmitter removes the oldest events to make room for new events.

When data/event logging is enabled, the transmitter will automatically store the following measurement data for total chlorine: date and time, ppm chlorine, temperature, and sensor current.

When data/event logging is enabled, the transmitter will automatically store the following measurement data:

Free chlorine: date and time, ppm chlorine, temperature, and sensor current.

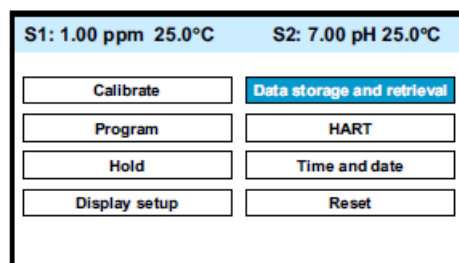
pH: date and time, pH, temperature, mV, glass impedance, reference impedance, and raw pH (if displayed pH has a solution temperature correction applied).

The transmitter can store up to 30 days of data. When the capacity of the logger is reached, the transmitter removes the oldest data to make room for new data. Data storage frequency is every 30 seconds.

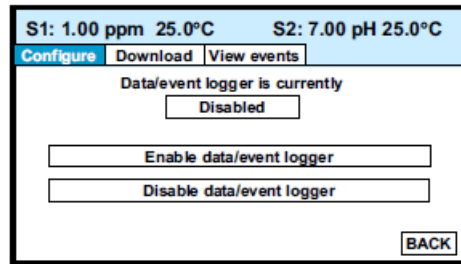
### 6.2 Configure data and event logging and retrieval

#### Procedure

1. With the main display showing, press **ENTER/MENU**. Choose Data storage and retrieval.



The screen below appears. The data logger is currently disabled (default).



2. To enable the data logger, move the cursor to Enable data/event logger and press ENTER/MENU.
3. Make the appropriate date and time settings and choose which alarm relay activations and deactivations to record as events.

---

#### Note

Setting the date or time to an earlier value than the one currently showing will cause data to be lost from the data/event logger. Download data before resetting time or date. See [Downloading data and events](#).

---

## 6.3 Downloading data and events

Complete the following steps to download data and events from your 56 Transmitter to a USB flash drive.

#### Procedure

1. To download data or events, move the cursor to the **Download** tab and press ENTER/MENU.
2. Unscrew the USB port cover in the lower right hand corner of the front panel and insert a USB flash drive in the port.
3. Press the appropriate button to download data or events.  
Downloading may take as long as 20 minutes. During download, the display and keypad are frozen, but all other transmitter functions continue.

Downloaded data and events are stored in a spreadsheet. There is a separate spreadsheet for every day of data. The filename for downloaded data is *dl mmddyy* or *dl ddmmyy* depending on the date and time format you select. The filename for downloaded events is *el mmddyy* or *el ddmmyy*.

## 6.4 Viewing events

The event log can be viewed on the Rosemount 56 Transmitter display.

#### Procedure

1. Move the cursor to the **View events** tab and press ENTER/MENU.
2. Move the cursor to the View Events button and press ENTER/MENU.
3. To scroll through the list of events, move the cursor to the **DOWN** or **UP** key at the bottom of the screen and press and hold ENTER/MENU.

## 6.5 Date and time

To reset the date and time from the main **Menu**, press the **Time and Date** button.

---

### **Note**

Setting the date and time to an earlier value than the one showing will cause data to be lost from the data/event logger. See [Downloading data and events](#).

---



# 7 Graphical display

## 7.1 Graphical display overview

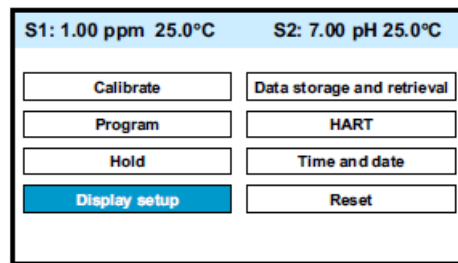
The Rosemount™ 56 Transmitter has a dual graphical display. You can configure each graph to meet your requirements, although the time axis on both graphs must be the same. You can set the time scale to one hour, one day, seven days, or thirty days.

## 7.2 Configuration

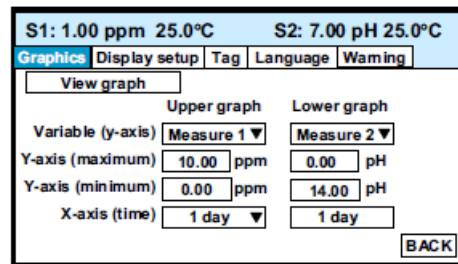
Complete the following steps to configure the graphical display on your 56 Transmitter.

### Procedure

1. With the main display showing, press **ENTER/MENU**. Choose Display setup.

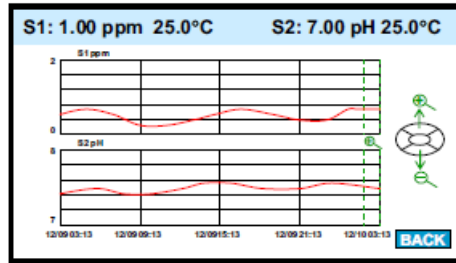


The screen shown below appears.



2. Configure the displayed variable, the maximum and minimum values for the Y-axis, and the time scale.

3. To view the graphs, move the cursor to the **View graph** button and press **ENTER/MENU**.



The time axis can be expanded or shrunk.

4. To expand the time scale, use **Left** or **Right** to move the pair of dotted green lines to the area of interest. Press **Up** to expand the graph. To shrink the time axis, press **Down**.

# 8 Maintenance

## 8.1 Replace sensor circuit board

The transmitter used with the Rosemount™ FCI requires little routine maintenance.

Clean the transmitter case and front panel by wiping with a clean soft cloth dampened with water only. Do not use solvents, like alcohol, that might cause a buildup of static charge.

Sensor circuit boards are replaceable.

PN	Description
21207-00	pH/ORP/ISE sensor board
24203-01	Chlorine sensor board

### **⚠ WARNING**

#### **Electrical shock**

Disconnect main power and relay contacts to separate power source before servicing.

To replace a board:

#### **Procedure**

1. Turn off power to the transmitter.
2. Loosen the four screws holding the front panel in place and let the front panel drop down.
3. Loosen the gland fitting and carefully push the sensor cable up through the fitting as you pull out the circuit board.
4. Once you have access to the terminal strip, disconnect the sensor.
5. Unplug the sensor board from the main board.
6. Slide the replacement board partially into the board slot. Plug the sensor board into the main board and reattach the sensor wires.
7. Carefully pull the sensor cable through the gland fitting as you push the sensor board back into the enclosure.
8. Tighten the cable glands.
9. Close the front panel.
10. Turn on power.

## 8.2 Chlorine sensor

### 8.2.1 General

When used in clean water, the sensor requires little maintenance. Generally, the sensor needs maintenance when the response becomes sluggish or noisy or when readings drift following calibration.

Maintenance frequency is best determined by experience. For a sensor used in potable water, expect to clean the membrane every month and replace the membrane and electrolyte solution every three months. In water containing large amounts of suspended solids, for example, open recirculating cooling water, membrane cleaning or replacement will be more frequent.

### 8.2.2 Cleaning the membrane

Clean the membrane with water sprayed from a wash bottle.

---

**Important**

Do not use tissues to clean the membrane.

---

### 8.2.3 Replace the electrolyte solution and membrane

**Note****Harmful substance**

Fill solution may cause irritation. May be harmful if swallowed.

Avoid contact with skin and eyes.

**Table 8-1: Spare Parts**

Part number	Description
9550094	O-ring, Viton 2-014
33521-00	Membrane retainer
23501-08	Free chlorine membrane assembly: includes one membrane assembly and one O-ring
23502-08	Free chlorine membrane kit: includes three membrane assemblies and three O-rings
9109536	#4 free chlorine sensor fill solution, 4 oz. (120 mL)

**Procedure**

1. Unscrew the membrane retainer.
2. Remove the membrane assembly and O-ring.
3. Hold the sensor over a container with the cathode pointing down.

4. Remove the fill plug.
5. Allow the electrolyte solution to drain out.
6. Inspect the cathode.
  - a) If it is tarnished, clean it using a cotton-tipped swab dipped in baking soda or alumina.  
Use type A dry powder alumina intended for metallographic polishing of medium and soft metals.
  - b) Rinse thoroughly with water.
7. Wrap the plug with two turns of pipe tape and set aside.
8. Prepare a new membrane.
  - a) Hold the membrane assembly with the cup formed by the membrane and membrane holder pointing up.
  - b) Fill the cup with electrolyte solution.
  - c) Wait for the wooden ring to soak up the solution.  
This usually takes several minutes.
9. Hold the sensor at about a 45° angle with the cathode end pointing up.
10. Add electrolyte solution through the fill hole until the liquid overflows.
11. Tap the sensor near the threads to release trapped air bubbles.
12. Add more electrolyte solution if necessary.
13. Place the fill plug in the electrolyte port and begin screwing it in.
14. After several threads have engaged, rotate the sensor so that the cathode is pointing up and continue tightening the fill plug.  
Do not overtighten.
15. Place a new O-ring in the groove around the cathode post.
16. Cover the holes at the base of the cathode stem with several drops of electrolyte solution.
17. Insert a small blunt probe, like a toothpick with the end cut off, through the pressure equalizing port.

**▲ CAUTION**

**Equipment damage**

A sharp probe may puncture the bladder and destroy the sensor.  
Do not use a sharp probe.

18. Gently press the probe against the bladder several times to force liquid through the holes at the base of the cathode stem. Keep pressing the bladder until no air bubbles can be seen leaving the holes.  
Be sure the holes remain covered with electrolyte solution.
19. Place a drop of electrolyte solution on the cathode; then place the membrane assembly over the cathode.

20. Screw the membrane retainer in place.

## 8.3 pH sensor

### 8.3.1 pH sensor maintenance

When used in clean water, the pH sensor requires little maintenance.

Generally, the sensor needs maintenance when the response becomes sluggish or noisy. In clean water, the typical cleaning frequency is once a month. In water containing large amounts of suspended solids, for example, open recirculating cooling water, cleaning frequency will be substantially greater.

### 8.3.2 Cleaning the sensor

Complete the following steps to clean the pH sensor.

#### Procedure

1. Remove soft deposits by rinsing with a stream of water from a wash bottle.
2. If the sensor becomes coated with rust, dissolve the rust by soaking the sensor in dilute citric acid (dissolve 5 grams of citric acid crystals in 100 mL of water) for no longer than thirty minutes at room temperature.
3. Rinse the sensor thoroughly with water and soak in pH 4 buffer for several hours.
4. Recalibrate the sensor in buffers before returning it to service.

### 8.3.3 Other maintenance

The 3900VP-02-10 sensor supplied with the Rosemount FCL-02 is disposable. It has no replaceable parts.

## 8.4 Constant head flow controller

### 8.4.1 General head flow controller information

After a period of time, deposits may accumulate in the constant head overflow chamber and in the tubing leading to the flow cell(s). Deposits increase the resistance to flow and cause the flow to gradually decrease. Loss of flow may ultimately have an impact on the sensor performance.

The flow controller is designed to provide about 2 gal/hr (120 mL/min) flow. Loss of flow to about 1 gal/hr (60 mL/min) causes about a 5% decrease in chlorine sensor output.

Loss of flow has almost no effect on pH sensor performance other than to increase the overall response time.

## 8.4.2 Cleaning the flow controller

The flow controller can be taken apart completely for cleaning.

### Procedure

1. Use a strong flow of water to flush out the tubing.  
Use a pipe cleaner or small bottlebrush to remove more adherent deposits.
2. To prevent leaks, apply a thin layer of silicone grease (or equivalent) to the two O-rings as the base of the overflow chamber and to the O-ring sealing the central overflow tube to the base.

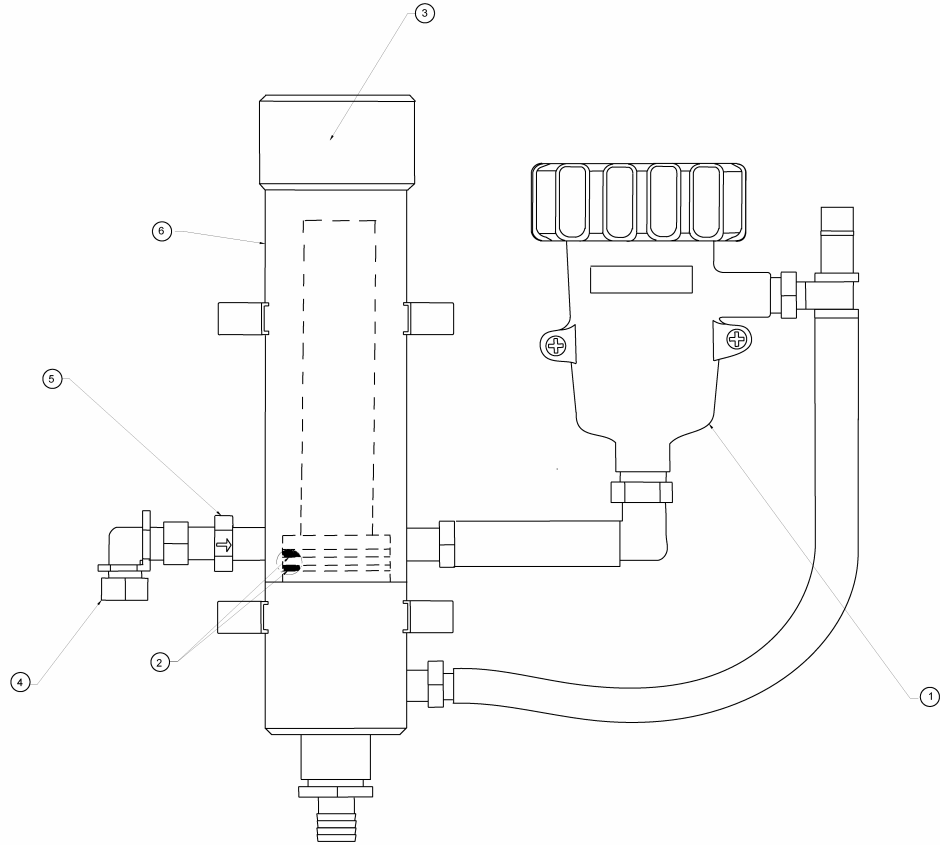
## 8.4.3 Other maintenance

Table 8-2 and Figure 8-1 show the replacement parts for the flow controller assembly used in the Rosemount FCL-01. Table 8-3 and Figure 8-2 show replacement parts for the flow controller assembly used in the Rosemount FCL-02.

**Table 8-2: Rosemount FCL-01 Constant Head Flow Controller Assembly Replacement Parts**

Location in Figure 8-1	PN	Description
1	24039-00	Flow cell for chlorine sensor with bubble shedding nozzle
2	24040-00	O-ring kit, two 2-222 and one 2-024 silicone O-rings with lubricant
3	33812-00	Dust cap for constant head flow controller
4	9322032	Elbow, 1/4 in. FNPT x 1/4 in. OD tubing
5	9350029	Check valve, 1/4 in. FNPT
6	33823-00	Outside tube for constant head device

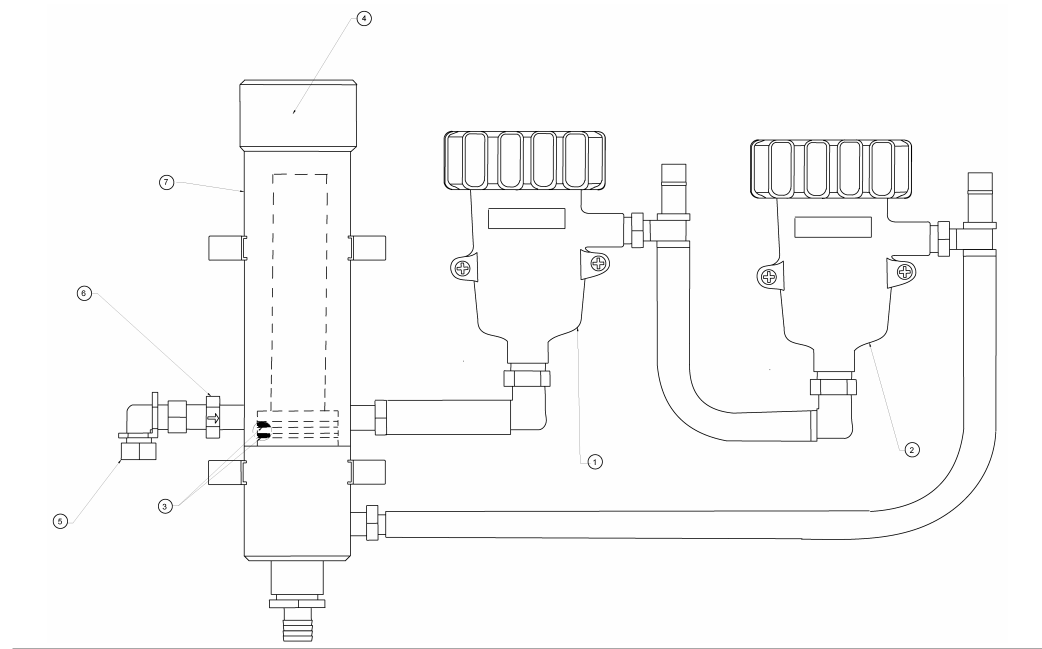
**Figure 8-1: Rosemount FCL-01 Constant Head Flow Controller Assembly Replacement Parts**



**Table 8-3: Rosemount FCL-02 Constant Head Flow Controller Assembly Replacement Parts**

Location in Figure 8-2	PN	Description
1	24039-00	Flow cell for chlorine sensor with bubble shedding nozzle
2	24039-01	Flow cell for pH sensor
3	24040-00	O-ring kit, two 2-222 and one 2-024 silicone O-rings with lubricant
4	33812-00	Dust cap for constant head flow controller
5	9322032	Elbow, 1/4 in. FNPT x 1/4 in. OD tubing
6	9350029	Check valve, 1/4 in. FNPT
7	33823-00	Outside tube for constant head device

**Figure 8-2: Rosemount FCL-02 Constant Head Flow Controller Assembly Replacement Parts**





# 9 Troubleshoot

## 9.1 Overview

When the transmitter identifies a problem the word `warning` or `fault` appears intermittently at the bottom of the display. To read a fault or warning message and troubleshooting information, press **INFO**.

See [Use the diagnostic feature](#).

**Warning** The instrument or sensor is usable, but you should take steps as soon as possible to correct the condition causing the warning. Warning messages can be turned off. To turn off warning messages, go to the main menu and choose Display setup. Scroll to the **Warning** tab and turn off warning messages.

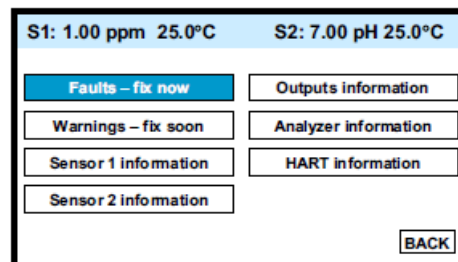
**Fault** The measurement is seriously in error and is not to be trusted. A fault condition might also mean that the transmitter has failed. Correct fault conditions immediately. When a fault occurs, the analog output goes to 22.00 mA or the value programmed in [Outputs](#). Fault messages cannot be turned off.

## 9.2 Reading and troubleshooting Fault and Warning messages

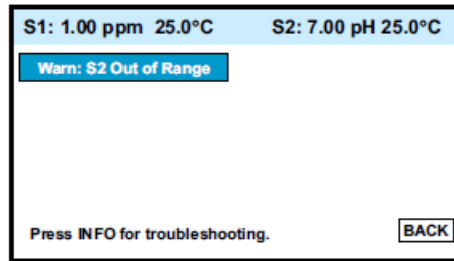
Complete the following steps to access Fault and Warning messages and determine what they mean.

### Procedure

1. With the main display showing, press **INFO**.  
The screen below appears.



2. Move the cursor to the appropriate button and press **ENTER/MENU**.  
A screen like the one below appears showing all fault or warning messages.



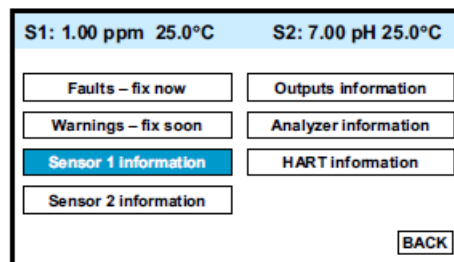
3. For troubleshooting information, press **INFO**.

## 9.3 Sensor diagnostics

Sensor diagnostic readings are often useful in troubleshooting measurement problems.

### Procedure

1. With the main display showing, press **INFO**.



2. Move the cursor to the Sensor 1 information or Sensor 2 information button and press **ENTER/MENU**.  
A list of sensor diagnostics appears.
3. For more information about a specific diagnostic measurement, move the cursor to the diagnostic of interest and press **INFO**.

## 9.4 Troubleshooting calibration problems

If a calibration attempt results in an error or a likely error, the transmitter displays the appropriate warning screen. For troubleshooting suggestions, press **INFO**.

## 9.5 Other troubleshooting - chlorine

Although calibration troubleshooting information is available in the transmitter by pressing **INFO**, troubleshooting information for process measurement problems is not.

Problem	See Section
Process readings are erratic.	<a href="#">Process readings are erratic or wander.</a>
Readings drift.	<a href="#">Readings drift</a>
Sensor does not respond to changes in chlorine level.	<a href="#">Sensor does not respond to changes in chlorine level.</a>

### 9.5.1 Process readings are erratic or wander.

#### Recommended actions

1. Make sure the sensor is properly wired to the transmitter. Verify that all connections are tight.
2. If the sensor is new, wait about an hour for readings to stabilize.  
Readings can be erratic when a new sensor is first placed in service.
3. Make sure the air pump is working.  
There should be a vigorous stream of bubbles in the flow cell. The bubbles help mix the sample and keep carbon dioxide bubbles off the membrane. Carbon dioxide forms when bicarbonate alkalinity in the sample reacts with acetic acid. The bubbles accumulate in the membrane and eventually break away, causing the total chlorine reading to wander.
4. Check to see if the membrane is damaged or loose. Replace the membrane if necessary.
5. Make sure the space between the membrane and cathode is filled with electrolyte solution and the flow path between the electrolyte reservoir and membrane is clear. Try starting the electrolyte flow by holding the sensor with the membrane end pointing down and sharply shaking the sensor a few times as though shaking down a clinical thermometer.
- 6.

### 9.5.2 Readings drift.

#### Recommended actions

1. Check to see if the sample temperature is changing.  
Membrane permeability is a function of temperature. The transmitter automatically corrects for changes in sensor current caused by temperature changes. The time constant for the Rosemount™ 499ACL-02 sensor is about five minutes. Therefore, the reading may drift for a while after a sudden temperature change.

2. Make sure the membrane is clean.  
For the sensor to work properly, iodine must diffuse freely through the membrane. A coating on the membrane will interfere with the passage of iodine, resulting in a gradual downward drift in readings.
  - a) Clean the membrane by rinsing with a stream of water from a wash bottle.
  - b) Wipe the membrane with a soft tissue.
3. If the sensor is new or has been recently service, wait for it to stabilize.  
New or rebuilt sensors may require several hours to stabilize.
4. Check to see if the flow of sample past the sensor is about 11 mL/min.  
If the sample flow is too low, the total chlorine reading will be low. If the flow is too high, the ratio between the sample flow and reagent flow will be too high, and there might be insufficient reagent to properly react with the total chlorine in the sample. To check sample flow:
  - a) Turn off the reagent and sample pumps.
  - b) Disconnect the luer fitting on the discharge of the sample pump.  
See A in [Figure 1](#).
  - c) Hold a small beaker under the discharge port.
  - d) Start the sample pump and collect sample for two minutes.
  - e) Measure the volume of sample collected in the beaker.  
After two minutes, the volume should be about 22 mL.
5. Make sure the reagent flow is about 0.2 mL/min.  
If the reagent flow is too low, there might be insufficient acetic acid to lower the sample pH and insufficient potassium iodide to react with total chlorine in the sample. To check reagent flow:
  - a) Turn off the reagent and sample pumps.
  - b) Disconnect the reagent tubing at the injection tee.  
See B in [Figure 1](#).
  - c) Place the end of the tubing in a 5 mL graduated cylinder.
  - d) Start the reagent pump and collect reagent for ten minutes.
  - e) Note the volume of reagent collected in the graduated cylinder.  
After ten minutes, the volume should be about 2 mL.

### 9.5.3 Sensor does not respond to changes in chlorine level.

1. Is the grab sample test accurate? Is the grab sample representative of the sample flowing to the sensor?
2. Is sample flowing past the sensor? Be sure the liquid level in the constant head sampler is level with the central overflow tube and that excess sample is flowing

down the tube. If necessary, disassemble and clean the overflow sampler. See [Constant head flow controller](#).

3. Is the pH compensation correct? If the transmitter is using manual pH correction, verify that the pH value in the transmitter equals the actual pH to within  $\pm 0.1$  pH. If the transmitter is using automatic pH correction, check the calibration of the pH sensor.
4. Is the membrane clean? Clean the membrane and replace it if necessary. Check that the holes at the base of the cathode stem are open. Use a straightened paper clip to clear the holes. Replace the electrolyte solution.
5. Replace the sensor.

## 9.5.4 Chlorine readings spike following sudden changes in pH (automatic pH correction).

Changes in pH alter the relative amounts of hypochlorous acid (HOCl) and hypochlorite ion ( $\text{OCl}^-$ ) in the sample. Because the sensor responds only to HOCl, an increase in pH causes the sensor current (and the apparent chlorine level) to drop even though the actual free chlorine concentration remains constant. To correct for the pH effect, the transmitter automatically applies a correction. Generally, the pH sensor responds faster than the chlorine sensor. After a sudden pH change, the transmitter will temporarily over-compensate and gradually return to the correct value. The time constant for return to normal is about 5 minutes.

## 9.6 Other troubleshooting - pH

Problem	See Section
Sensor does not respond to known pH changes.	<a href="#">Sensor does not respond to known pH changes.</a>
Calibration was successful, but process pH is slightly different from expected value.	<a href="#">Buffer calibration is acceptable; process pH is slightly different from expected value.</a>
Calibration was successful, but process pH is grossly wrong or noisy.	<a href="#">Calibration was successful, but process pH is grossly wrong and/or noisy.</a>
pH readings are moderately noisy and tend to wander.	<a href="#">pH readings are moderately noisy and tend to wander.</a>

### 9.6.1 Sensor does not respond to known pH changes.

#### Recommended actions

1. Check to see if the pH sensor is responsive to buffers. Check sensor response in two buffers at least two pH units apart.
2. Make sure the expected pH change really occurred. Use a second pH meter to verify the change.
3. Make sure sample is flowing past the sensor. Be sure the liquid level in the constant head sampler is level with the central overflow tube and that excess sample is flowing down the tube. If necessary, disassemble and clean the overflow sampler. See [Cleaning the sensor](#).

4. Make sure the sensor is properly wired to the transmitter.  
See [Wire sensor](#).
5. Check to see if the glass bulb is cracked or broken. Go to sensor diagnostics and check the glass electrode impedance.  
See [Simulate pH input](#).
6. Make sure the transmitter is working properly. Check the transmitter by simulating the pH input.

## 9.6.2 Buffer calibration is acceptable; process pH is slightly different from expected value.

Differences between pH readings made with an on-line instrument and a laboratory or portable instrument are normal. The on-line instrument is subject to process variables (for example, ground potentials, stray voltages, and orientation effects) that do not affect the laboratory or portable instrument.

To make the process readings agree with a referee instrument, standardize the sensor. See [Standardize pH value](#).

## 9.6.3 Calibration was successful, but process pH is grossly wrong and/or noisy.

Grossly wrong or noisy readings suggest a ground loop (measurement system connected to earth ground at more than one point), a floating system (no earth ground), or noise brought into the transmitter by the sensor cable. The problem arises from the process or installation. It is not a fault of the transmitter. The problem should disappear once the sensor is taken out of the system. Check the following:

### Recommended actions

1. Confirm a ground loop.
  - a) Verify that the system works properly in buffers. Be sure there is no direct electrical connection between the buffer containers and the process liquid or piping.
  - b) Strip back the ends of a heavy gauge wire. Connect one end of the wire to the process piping or place it in the process liquid. Place the other end of the wire in the container of buffer with the sensor. The wire makes an electrical connection between the process and sensor.
2. Make sure the process is grounded.

The measurement system needs one path to ground: through the process liquid and piping. Plastic piping, fiber glass tanks, and ungrounded or poorly grounded vessels do not provide a path. A floating system can pick up stray voltages from other electrical equipment.

  - a) Ground the piping or tank to a local earth ground.

If noise still persists, simple grounding is not the problem. Noise is probably being carried into the instrument through the sensor wiring.

3. Simplify the sensor wiring.
  - a) Disconnect all sensor wires at the transmitter except: IN REFERENCE, IN pH, RTD IN, and RTD RETURN.
  - b) Tape back the ends of the disconnected wires to keep them from making accidental connections with other wires or terminals.
  - c) Connect a jumper wire between the RTD RETURN and RTD SENSE terminals. See the wiring diagrams in [Wire sensor](#).

If noise and/or offsets disappear, the interference was coming into the transmitter through one of the sensor wires. You can operate the system permanently with the simplified wiring.

4. Check for extra ground connections or reduced noise.
  - a) To avoid induced noise in the sensor cable, run it as far away as possible from power cables, relays, and electric motors.
  - b) If ground loop problems persist, consult the factory. You may need a visit from an experienced service technician to solve the problem.

## 9.6.4 pH readings are moderately noisy and tend to wander.

pH readings that are moderately noisy ( $\pm 0.1$  pH) and tend to wander are probably caused by bubbles getting trapped against the pH sensor.

Although the overflow sampler is designed to allow bubbles to escape before they reach the pH sensor, and the sensor itself is designed so trapped air bubbles don't interfere with the measurement, bubbles may occasionally be a problem. Shaking the sensor will dislodge the bubbles. If bubbles remain a problem, contact the factory.

## 9.7 Other troubleshooting - general

Problem	See Section
Current output is too low.	<a href="#">Current output is too low.</a>
Alarm relays do not operate properly.	<a href="#">Alarm relays don't work.</a>

### 9.7.1 Current output is too low.

Load resistance is too high. Maximum load is 550  $\Omega$ .

### 9.7.2 Alarm relays don't work.

1. Verify the relays are properly wired.
2. Verify the relays are properly configured.

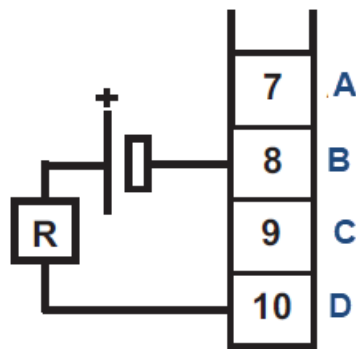
## 9.8 Simulate inputs - chlorine

To check the performance of the transmitter, use a decade box and 1.5 V battery to simulate the current from the sensor. The battery, which opposes the polarizing voltage, is necessary to ensure that the sensor current has the correct sign.

### Procedure

1. Disconnect the anode and cathode leads from terminals 8 and 10 on TB1 and connect a decade box and 1.5 V battery as shown in [Figure 9-1](#).

**Figure 9-1: Simulating Chlorine**



- A. Anode shield
- B. Anode
- C. Cathode shield
- D. Cathode

It is not necessary to disconnect the RTD leads.

2. Set the decade box to 2.8 M $\Omega$ .
3. Note the sensor current.  
It should be about 500 nA. The actual value depends on the voltage of the battery. To view the sensor current, go to the main display and press **INFO**. Choose sensor 1 information. The input current is the second line in the display.
4. Change the decade box resistance and verify that the correct current is shown. Calculate current from the equation:

$$\text{current(nA)} = \frac{V_{\text{battery}} - 200 \text{ (voltage in mV)}}{\text{resistance(M}\Omega\text{)}}$$

The voltage of a fresh 1.5 volt battery is about 1.6 volt (1600 mV).

## 9.9 Simulating inputs - pH

### 9.9.1 General

This section describes how to simulate a pH input into the transmitter. To simulate a pH measurement, connect a standard millivolt source to the transmitter. If the transmitter is working properly, it will accurately measure the input voltage and convert it to pH.

### 9.9.2 Simulate pH input

This section describes how to simulate a pH input into the transmitter. To simulate a pH measurement, connect a standard millivolt source to the transmitter. If the transmitter is working properly, it will accurately measure the input voltage and convert it to pH.

#### Procedure

1. Set automatic temperature correction to Manual and set manual temperature to 25 °C.  
See [Temperature](#).
2. Disconnect the sensor and jumper wire between the IN REFERENCE and IN pH terminals.
3. Press **INFO** and choose sensor 2 (pH).  
The input voltage should be 0 mV, and the pH should be 7.00. Because calibration data stored in the transmitter may be offsetting the input voltage, the displayed pH may not be exactly 7.00.
4. If a standard millivolt source is available, disconnect the jumper wire between IN REFERENCE and IN pH and connect the voltage source as shown in [Figure 9-2](#).

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#### Figure 9-2: Simulating pH input

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Be sure to jumper the IN REFERENCE and GND SOL terminals.

5. Calibrate the transmitter using the manual buffer procedure.  
Use 0.0 mV for Buffer 1 (pH 7.00) and -177.4 mV for Buffer 2 (pH 10.00).  
If the transmitter is working properly, it should accept the calibration. The slope should be 59.16 mV/pH, and the offset should be zero.
6. To check linearity, set the voltage source to the value shown in the table and verify that the pH and millivolt readings match the values in the table.

Voltage (mV)	pH (at 25 °C)
295.8	2.00
177.5	4.00
59.2	6.00
-59.2	8.00
-177.5	10.00

Voltage (mV)	pH (at 25 °C)
-295.8	12.00

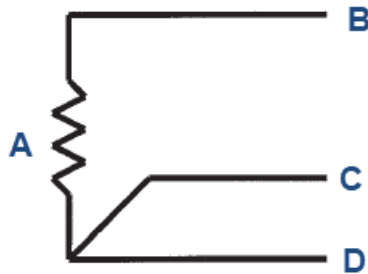
## 9.10 Simulating inputs - temperature

### 9.10.1 General information about simulating temperature

The transmitter accepts a Pt100 resistance temperature device. The Pt100 resistance temperature device is a three-wire configuration.

See [Figure 9-3](#).

**Figure 9-3: Three-Wire RTD Configuration**



- A. Resistance temperature device
- B. Resistance temperature device in
- C. Resistance temperature device sense
- D. Resistance temperature device return

Although only two wires are required to connect the resistance temperature device to the transmitter, using a third (and sometimes fourth) wire allows the transmitter to correct for the resistance of the lead wires and for changes in the lead wire resistance with temperature.

### 9.10.2 Simulate temperature

To simulate the temperature input, wire a decade box to the transmitter as shown in [Figure 9-4](#).

**Figure 9-4: Simulating Resistance Temperature Device Inputs**

- A. Resistance temperature device return
- B. Resistance temperature device sense
- C. Resistance temperature device in
- D. Resistance temperature device shield

To check the accuracy of the temperature measurement, set the resistor simulating the resistance temperature device to the values indicated in the table and note the

temperature readings. The measured temperature might not agree with the value in the table. During sensor calibration, an offset might have been applied to make the measured temperature agree with a standard thermometer. The offset is also applied to the simulated resistance. The transmitter is measuring temperature correctly if the difference between measured temperatures equals the difference between the values in the table to within  $\pm 0.1$  °C.

For example, start with a simulated resistance of  $103.9 \Omega$ , which corresponds to  $10.0$  °C. Assume the offset from the sensor calibration was  $-0.3 \Omega$ . Because of the offset, the transmitter calculates temperature using  $103.6 \Omega$ . The result is  $9.2$  °C. Now change the resistance to  $107.8 \Omega$ , which corresponds to  $20.0$  °C. The transmitter uses  $107.5 \Omega$  to calculate the temperature, so the display reads  $19.2$  °C. Because the difference between the displayed temperatures ( $10.0$  °C) is the same as the difference between the simulated temperatures, the transmitter is working correctly.

Temp. (°C)	Pt 100 ( $\Omega$ )
0	100.0
10	103.9
20	107.8
25	109.7
30	111.7
40	115.5
50	119.4
60	123.2
70	127.1
80	130.9
85	132.8
90	134.7
100	138.5

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