Reference Manual
00809-0200-3415, Rev AA
January 2023

Rosemount™ TCL

Total Chlorine System with Rosemount 56 Transmitter

ROSEMOUNT™

EMERSON™

Essential instructions

Read this page before proceeding!

Emerson designs, manufactures, and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use, and maintain them to ensure they continue to operate within their normal specifications. You must adhere to the following instructions and integrate them into your safety program when installing, using, and maintaining Emerson's Rosemount products. 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.

- Read all instructions prior to installing, operating, and servicing the product.
- If this reference manual is not the correct one, call 1-800-854-8257 or 949-757-8500 to request the correct reference manual. Save this reference manual for future reference.
- If you do not understand any of the instructions, contact your Emerson representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install equipment as specified in the installation instructions of the appropriate Quick Start Guide and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Emerson. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, and may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified people, to prevent electrical shock and personal injury.

⚠ WARNING

Hazardous area installation

Qualified on-site safety personnel must carefully evaluate installations near flammable liquids or in hazardous areas.

This device is not Intrinisically Safe or Explosion Proof.

To secure and maintain intrinsically safe installation, use an appropriate transmitter/safety barrier/sensor combination. The installation system must be in accordance with the governing approval agency (FM, CSA, or BASEEFA/CENELEC) hazardous area classification requirements. Consult your transmitter Reference Manual for details.

Proper installation, operation, and servicing of this sensor in a hazardous area installation are entirely the operator's responsibility.

⚠ 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.

- Be sure to disconnect all hazardous voltages before opening the enclosure.
- Disconnect relay contacts made to separate power sources before servicing.
- 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 enclosure integrity in compliance with personal safety and environmental protection requirements.
- The unused conduit openings need to be sealed with NEMA 4X or IP65 conduit plugs to maintain the ingress protection rating (IP65).
- For safety and proper performance, this instrument must be connected to a properly grounded three-wire power source.
- Proper relay use and configuration is the operator's responsibility.
- No external power to the instrument of more than 69 Vdc or 43 V peak is allowed, with the exception of power and relay terminals. Any violation will impair the safety protection provided.
- Do not operate this instrument without the front cover secured. Refer installation, operation, and servicing to qualified personnel.

⚠ WARNING

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

Hazardous voltage

- Can cause severe injury or death. Disconnect power before servicing.

⚠ CAUTION

Sensor/process application compatibility

The wetted sensor materials may not be compatible with process composition and operating conditions.

Application compatibility is entirely the operator's responsibility.

⚠ 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.

Contents

1 Description and specifications

1.1 Features

Rosemount TCL Sample Conditioning System

The sample conditioning system permits a single sensor to measure total chlorine in water. The sample conditioning system continuously injects a solution of acetic acid (vinegar) and potassium iodide into the sample. The acid lowers the pH to between 3.5 and 4.5 and allows total chlorine in the sample to quantitatively react with the potassium iodide to produce iodine. The sensor measures the iodine concentration, and the transmitter displays the total oxidant concentration in ppm as Cl_2.

Rosemount 56 Transmitter

The is housed in a corrosion resistant NEMA 4X enclosure. It is suitable for panel, pipe, or wall mounting. You can operate the transmitter with a membrane keypad.

and programming screens are simple and intuitive. Plain language prompts in languages guide you.

Four fully programmable relays are available.

Rosemount 499ACL-02 Total Chlorine Sensor

The Rosemount 499ACL-02 Total Chlorine Sensor is used in the TCL Sample Conditioning System. Although the sensor is called a chlorine sensor, it really measures iodine. The iodine comes from the reaction between oxidants in the sample and the acetic acid/ potassium iodide reagent added by the sample conditioning system.

The sensor consists of a gold cathode and a silver anode in an electrolyte solution. A silicone membrane, permeable to iodine, is stretched over the cathode. The transmitter applies a voltage to the cathode sufficiently negative to reduce all the iodine reaching it. Because the concentration of iodine in the sensor is always zero, a concentration gradient continuously forces iodine from the sample through the membrane into the sensor.

The reduction of iodine in the sensor generates a current directly proportional to the diffusion rate of iodine through the membrane, which is directly proportional to the concentration of iodine in the sample. Because the iodine concentration depends on the amount of total chlorine in the sample, the sensor current is ultimately proportional to the total chlorine concentration.

The permeability of the membrane to iodine is a function of temperature. A Pt100 RTD in the sensor measures the temperature, and the transmitter uses the temperature to compensate the total chlorine reading for changes in membrane permeability.

Sensor maintenance is fast and easy. Replacing the membrane requires no special tools or fixtures. Simply place the membrane assembly on the cathode and screw the retainer in place. Installing a new membrane and replenishing the electrolyte takes only a few minutes.

1.2 Specifications

1.3 Ordering information and accessories

Refer to the Rosemount TCL Total Chlorine System Product Data Sheet for more information.

2 Principles of operation

3 Installation

3.1 Unpacking and inspection

Procedure

1. Inspect the shipping container(s). If there is damage, contact the shipper immediately for instructions.
2. If there is no apparent damage, unpack the container(s).
3. Ensure that all items shown on the packing list are present.

   If items are missing, notify Emerson immediately.

3.2 Installation

3.2.1 General installation information

1. Although the system is suitable for outdoor use, do not install it in direct sunlight or in areas of extreme temperature.

   ⚠ CAUTION

   Hazardous areas

   The system is not suitable for use in hazardous areas.

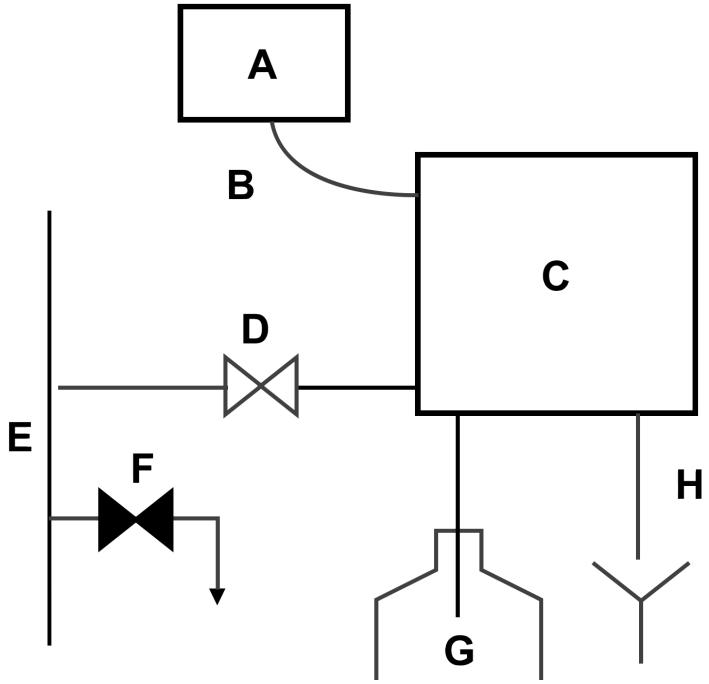
2. Install the system in an area where vibrations and electromagnetic and radio frequency interference are minimized or absent.
3. The transmitter is suitable for panel, pipe, or wall mounting. The sample conditioning enclosure must be mounted on a wall. Provide adequate room beneath the enclosure for the 5-gallon reagent carboy.
4. Be sure that the distance between the transmitter and sample conditioning cabinet does not exceed the length of the sensor cable.

3.2.2 Install the sample conditioning enclosure

Follow the steps below to install the sample conditioning enclosure.

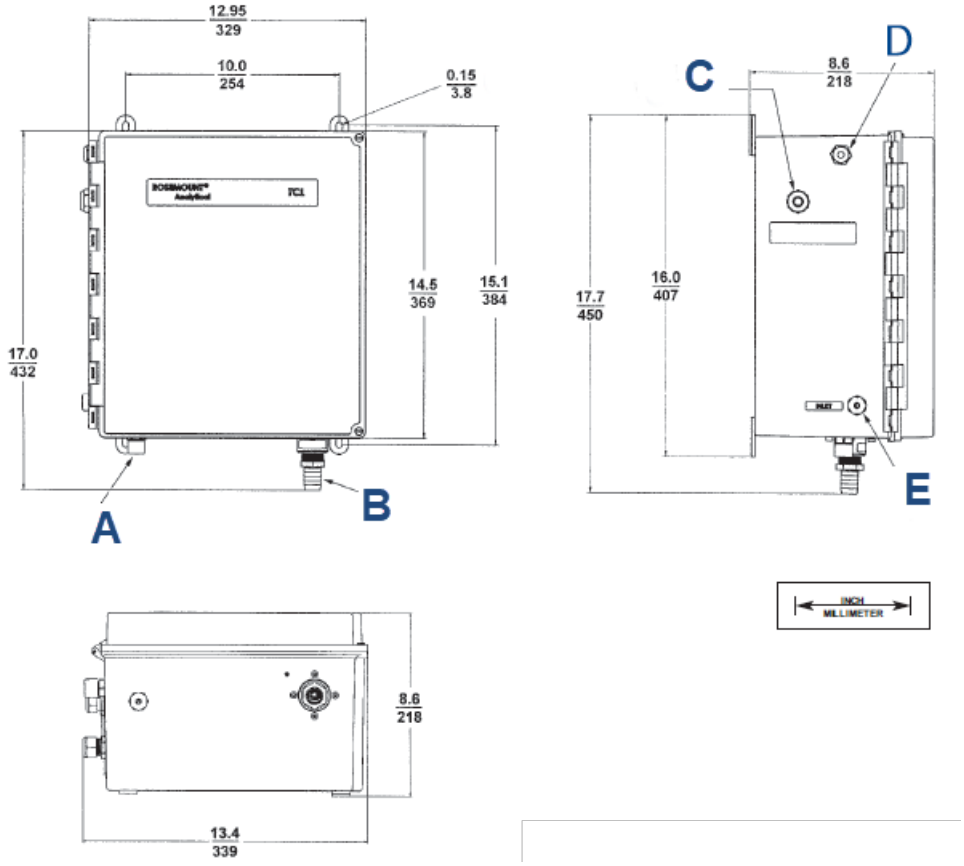
Refer to Figure 3-1, Figure 3-2, and Figure 3-3 for installation details.

Figure 3-1: Installing the Sample Conditioning Enclosure



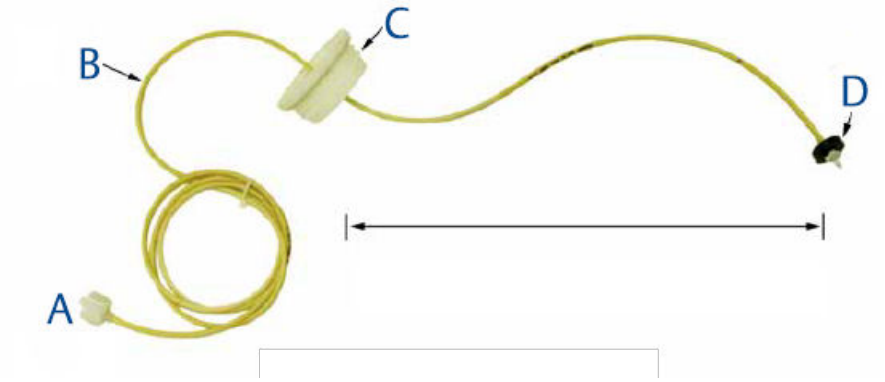
A. Transmitter
B. Sensor cable
C. Rosemount™ TCL enclosure
D. Sample inlet ¼-in. OD tubing
E. Process piping
F. Sample tap
G. Reagent bottle
H. Drain ¾-in. barbed fitting

Figure 3-2: TCL Case Dimensions



A. Reagent inlet
B. Drain
C. Power cable
D. Sensor cable
E. Sample inlet

Figure 3-3: Reagent Tubing Assembly



Tubing should extend about 14-in. (360 mm) below cap.

A. Reagent inlet fitting
B. Reagent tubing
C. Cap
D. Weight

Procedure

1. Connect the sample line to the sample conditioning system. Use ¼-in. OD hard plastic or stainless steel tubing. If dechlorinated water is being measured, provide a way for occasionally substituting a chlorinated water sample for the dechlorinated sample.

   Chlorinated water is needed to calibrate the sensor and to check its response.

2. If a grab sample is not already available, install one in the process piping. Choose a point as close as possible to the sample line supplying the TCL.

   Be sure that opening the sample valve does not appreciably alter the flow of sample to the instrument.

3. Connect the drain to a length of ¾-in. ID flexible plastic tubing.

   Important
   The sample must drain to open atmosphere.

4. Find the reagent tubing and fitting in the plastic bag taped to the inside of the enclosure door. Screw the reagent fitting onto the bulkhead fitting at the bottom left of the enclosure. Pass the reagent tubing through the hole in the carboy cap. Be sure the plastic weight will be inside the carboy when the cap is in place. Attach the reagent tubing to the barbed connector.

   See Figure 3-3.

5. Place the blue plastic carboy beneath the enclosure. Screw the cap and tubing assembly on the carboy.

   To prepare reagent, see Prepare the reagent.

3.2.3 Install the sensor

Complete the following steps to install the Rosemount 499ACL-02 Sensor in the TCL system.

Procedure

1. From inside the sample conditioning enclosure, thread the sensor cable or VP cable through the gland on the upper left side.

   Leave about one foot of cable inside the enclosure.
2. Wire the cable to the transmitter. Refer to Sensor wiring.
3. Remove the nut and adapter from the flow cell.
4. Slip the nut over the end of the sensor.
5. Thread the adapter onto the sensor. Hand-tighten only.
6. If you are using a VP cable, connect the cable to the sensor.

   The connector and receptacle are keyed to ensure proper mating.
7. Once the key has slid into place, tighten the connection by turning the knurled ring clockwise.
8. Remove the protective cap from the end of the sensor.
9. Insert the sensor in the flow cell. Hand tighten the nut.

4 Wiring

4.1 Prepare transmitter conduit openings

The transmitter enclosure has six conduit openings. Four conduit openings are fitted with conduit plugs.

Conduit openings accept ½-in. conduit fittings or PG 13.5 cable glands. To keep the case watertight, block unused openings with NEMA® 4X or IP65 conduit plugs.

4.2 Provide power to the sample conditioning system

Complete the following steps to power the sample conditioning system.

⚠ WARNING

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

Note
Provide a switch or breaker to disconnect the sample conditioning cabinet from the main power supply. Install the switch or breaker near the unit and identify it as the disconnecting device for the sample conditioning system.

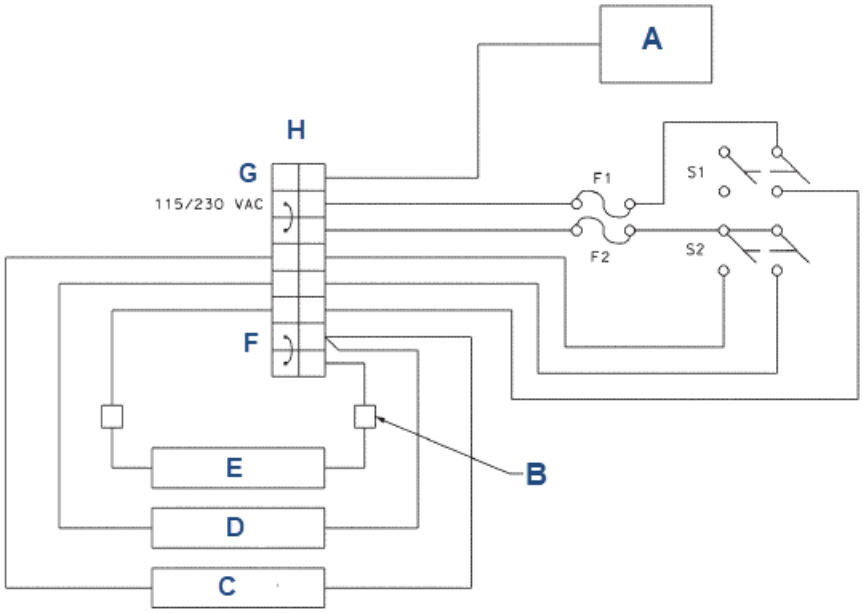
Procedure

1. Be sure the pump switches on the wiring access panel are in the **Off** position.
2. Remove the four screws securing the wiring access panel. Pull the panel out of the way to reveal the power terminal strip.
3. Insert the power cable through the strain relief connection labeled *Power*.
   See Figure 3-2.
4. Wire the power cable to the terminal strip as shown in Figure 4-1.

   ⚠ CAUTION

   EQUIPMENT DAMAGE
   Do not apply 230 Vac power to a 115 Vac TCL (Model option -11). Doing so will damage the instrument.

Figure 4-1: Power wiring



Model option -11: 115 Vac only

Model option -12: 230 Vac only

A. Front panel
B. Connector
C. Air pump
D. Sample pump
E. Reagent pump
F. Neutral
G. Ground
H. Terminal block

Important
Leave the pump power switches off until ready to start up the unit.

See Startup.

4.3 Power

Wire AC mains power supply to the power supply board, which is mounted vertically on the left hand side of the transmitter enclosure beneath the gray plastic cover.

Procedure

1. To remove the cover, grab it by the upper edges and pull straight out.
   The power connector is at the bottom of the board. See Alarm relay connection.
2. Bring the power cable through the conduit opening just below the connector.
3. Unplug the connector from the board and wire the power cable to it.
   Lead connections are marked on the connector. (**L** is live or hot; **N** is neutral; the ground connection has the standard symbol.)

4. Replace the cover.

   The two tabs at the back edge of the cover fit into slots at the rear of the enclosure, and the three small slots in the front of the cover snap into the three tabs next to the relay terminal strip. See Alarm relay connection.

5. Once the tabs are lined up, push the cover to snap it into place.
6. Run the power wiring through the conduit opening nearest the power terminal.

   AC power wiring should be 14 gauge or greater.

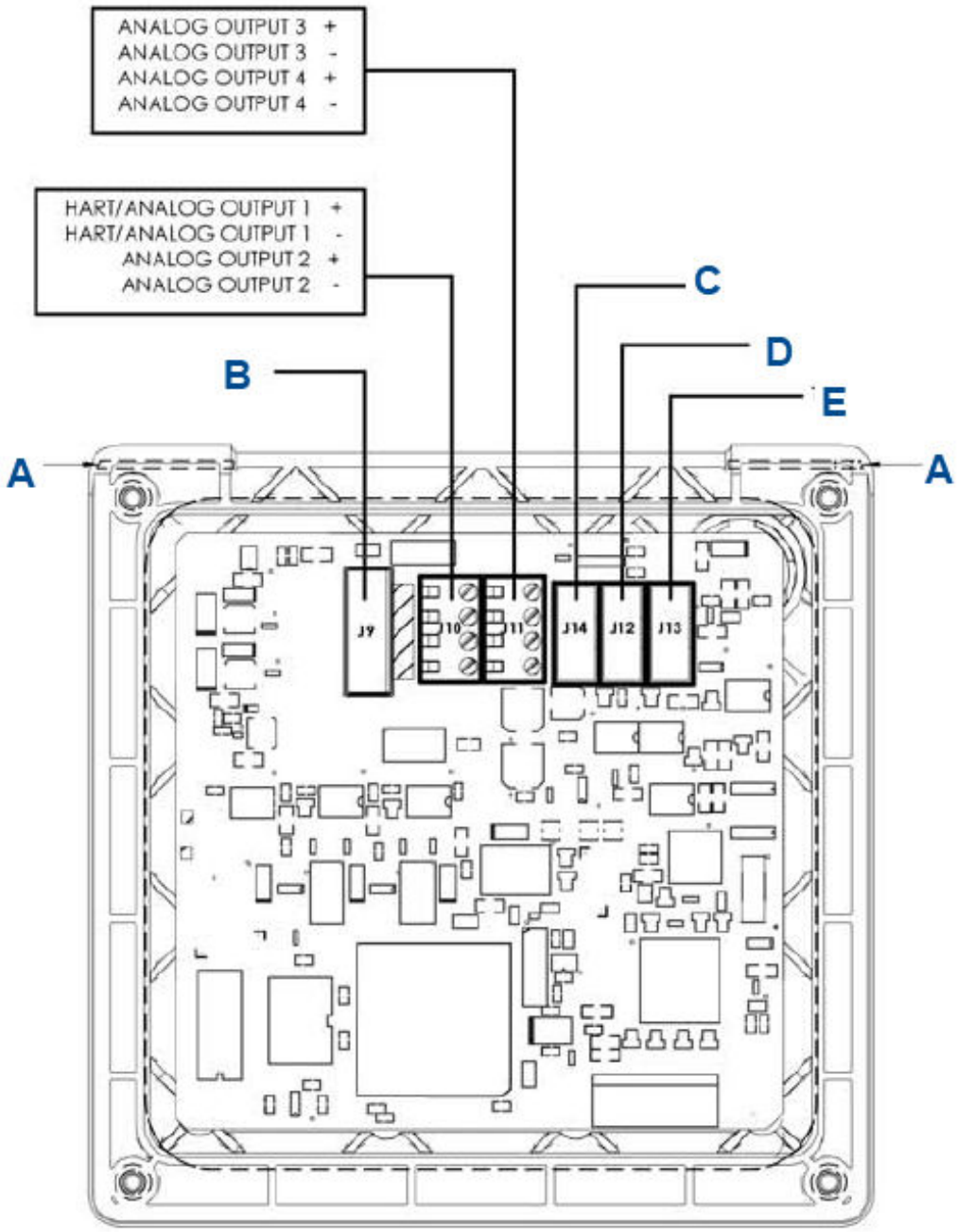
7. Provide a switch or breaker to disconnect the transmitter from the main power supply.
8. Install the switch or breaker near the transmitter and label it as the disconnecting device for the transmitter.

4.4 Wire analog outputs

Four analog current outputs are located on the main circuit board, which is attached to the inside of the enclosure door.

Figure 4-2 shows the locations of the terminals, the outputs they are assigned to, and the polarity.

Figure 4-2: Analog Output Connections



A. Hinge pin
B. To power supply PCB (ribbon cable)
C. To digital I/O communication board
D. To sensor 1 signal board
E. To sensor 2 signal board

The analog outputs are on the main board near the hinged end of the enclosure door.

For best EMI/RFI protection, use shielded output signal cable enclosed in earth-grounded metal conduit.

Keep output signal wiring separate from power wiring. Do not run signal and power or relay wiring in the same conduit or close together in a cable tray.

4.5 Alarm wiring

See Alarm relay connections.

Keep alarm relay wiring separate from signal wiring. Do not run signal and power or relay wiring in the same conduit or close together in a cable tray.

4.6 Sensor wiring

If it is necessary to replace the sensor cable, refer to the instructions below.

Procedure

1. Shut off power to the transmitter.
2. Locate the chlorine signal board.

Slot 1 (left)	Slot 2 (center)	Slot 3 (right)
Power	input 1 (chlorine)	input 2 (optional)

3. Insert the sensor cable through the conduit opening nearest the chlorine board.
4. Slide the board forward to gain access to the wires and terminal screws.
5. Connect the sensor to the chlorine board. Refer to Figure 4-3 or Figure 4-4

Figure 4-3: Wiring Sensor with Optimum EMI/RFI or Variopol Cable to Rosemount 1056 Transmitter

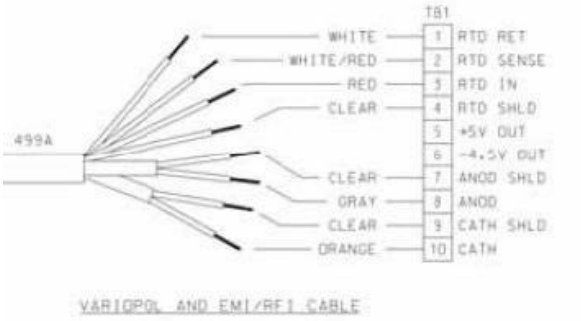
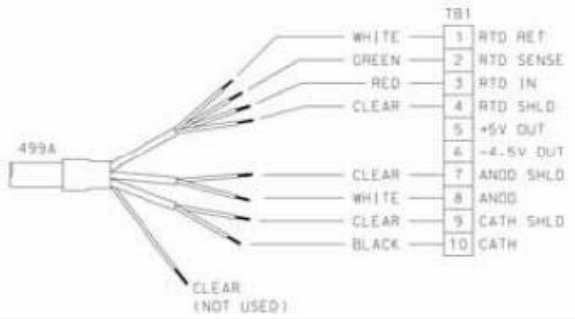


Figure 4-4: Wiring Power with Standard Cable to Rosemount 1056 Transmitter



6. Once the cable has been connected to the board, slide the board fully into the enclosure while taking up the excess cable through the conduit opening.
7. If you are using a cable gland, tighten the gland nut to secure the cable and ensure a sealed enclosure.

4.7 Apply power to the transmitter and complete Quick Start

For Rosemount Total Chlorine System with Rosemount 56 transmitter:

Procedure

1. Once connections are secured and verified, apply power to the transmitter.
   When the transmitter is powered up for the first time, ***Quick Start*** screens appear. The first ***Quick Start*** screen has two control boxes, one for language and the other for temperature units.
   a. The cursor, shown by dark blue backlighting, is on the language control box. To change the language, press the **ENTER/MENU** key. A list of available languages, shown two at a time, appears. Using the **Up** and **Down** keys, scroll (see) to display the choices. Press **ENTER/MENU** to select the desired language. Press **Down** to move the cursor to the temperature control box. To change units, press **ENTER/MENU** and scroll to either °F or °C. Press **ENTER/MENU** to store the selection.
   b. To move to the next screen, use the navigation keys to move the cursor to **NEXT** and press **ENTER/MENU**.
2. The next screen lists navigation rules. Press **ENTER/MENU** for the next screen.
3. Configure sensor 1.
   Sensor 1 is the total chlorine sensor. The screen has two control boxes.
   a) For measurement, choose **Total chlorine**
   b) Choose the desired units, mg/L or ppm.
4. Move the cursor to NEXT and press **ENTER/MENU**.
   The display changes to show some basic keypad operation guidelines.
5. Press **ENTER/MENU** to show the main display.
   The outputs, alarms, display configuration, and data logging are all assigned to default values. The default value for data logging is disabled.

6. To change the settings, refer to Main display, Programming the transmitter, Data and event logging and retrieval.

5 Startup

Complete Wiring before starting this section.

5.1 Prepare the reagent

Complete the following steps to prepare the potassium iodide reagent.

⚠ WARNING

HAZARDOUS SUBSTANCE
The reagent contains potassium iodide dissolved in distilled vinegar or 5% acetic acid. Avoid contact with skin and eyes. Wash thoroughly after using.

Important
Do not prepare the solution until ready to use.

Procedure

1. Position the blue plastic carboy under the sample conditioning cabinet. Unscrew the cap and reagent tube assembly.
2. Add the potassium iodide reagent to the carboy.

   See the table.

Expected range, ppm as Cl_2	Amount of KI needed per 5 gal (19 L) of vinegar	Part number
0-5 ppm	25 grams	24164-00
0-10 ppm	50 grams	24164-01
0-20 ppm	2 x 50 grams	24164-01

3. Add 5 gallons (19 L) of distilled white vinegar one gallon (4 L) at a time. Swirl the carboy after each addition.
4. Screw the cap on the carboy. Be sure the reagent uptake tube extends to the bottom of the carboy.
5. If it hasn't already been connected, connect the reagent tube to the small fitting on the bottom left hand side of the enclosure.

   Note
   The shelf life of the potassium iodide vinegar solution is at least two months if stored in the blue carboy. Do not store the reagent in a container other than the blue carboy. The reagent is sensitive to sunlight, which the blue carboy effectively blocks.

5.2 Zero the sensor

Complete the following steps to zero the 499ACL-02 Total Chlorine Sensor.

Procedure

1. Place the sensor in a beaker of deionized water or simply place the sensor in air.
2. Let the sensor operate until the current is stable.

3. Zero the sensor.

5.3 Start sample flow

Adjust the sample flow until a slow stream of liquid is running down the inside tube of the sampling cup.

5.4 Begin operation and calibrate the sensor

Complete the following steps to start operating the Rosemount TCL and calibrate the 499ACL-02 Sensor.

Procedure

1. Turn on the reagent and sample pump switches.

   Observe that liquid begins to fill the flow cell. The sample flow is about 11 mL/min, so the flow cell fills rather slowly. Also observe that the air pump is operating.

   The pump produces very vigorous bubbling in the flow cell. Once the flow of reagent starts, it takes about two minutes for the reagent to reach the flow cell. If the concentration of total chlorine in the sample is greater than about 0.5 ppm, the treated sample in the flow cell will be pale yellow. Sample containing more chlorine will be dark yellow.

2. Monitor the sensor current. Once the reading is stable, calibrate the unit.

   It may take thirty minutes or longer for the reading to stabilize when the sensor is first put in service.

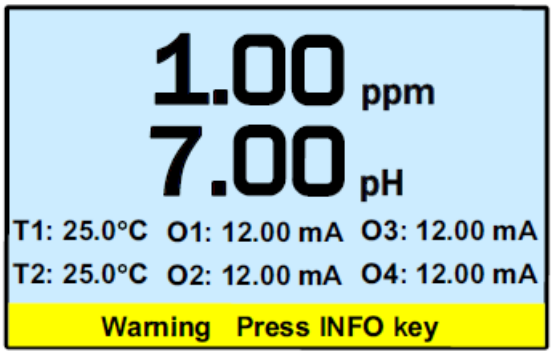
6 Display and operation

6.1 Main display

The transmitter has a four line display.

See Figure 6-1. 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 6-1: 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.

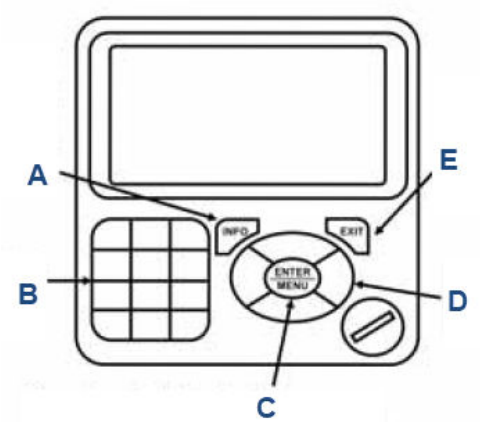
O	Output
T	Temperature (live)
Tm	Temperature (manual)
M	Measurement
AL	Alarm relay
I	Sensor current (chlorine)

6.2 Keypad

Local communication with the transmitter is through the membrane keypad.

See Figure 6-2.

Figure 6-2: 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.*

6.3 Operation

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

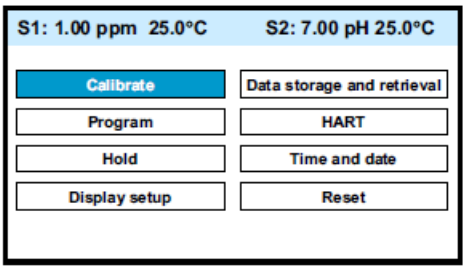
Procedure

1. With the main display showing (Figure 6-1), press **ENTER/MENU**.
   The main ***Menu***, shown below, appears.

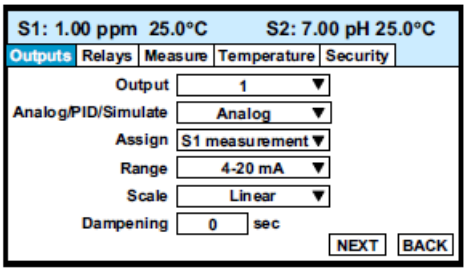
   Important
   Pressing the **ENTER/MENU** key will bring up the main ***Menu*** only if the main display is showing.

   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.

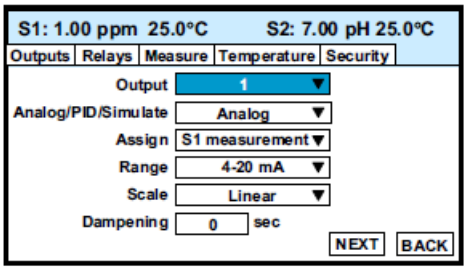
   The cursor (dark blue backlit field) is on Calibrate.



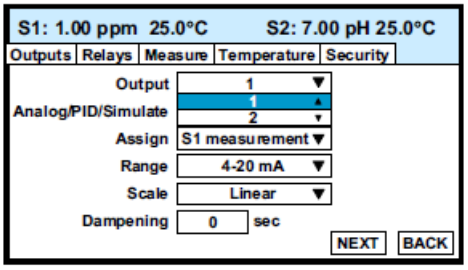
2. Press **Down** to move the cursor to Program.
3. Press **ENTER/MENU**.
   The cursor is on **Outputs**, and the first screen in the **Outputs** submenu is showing.



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.



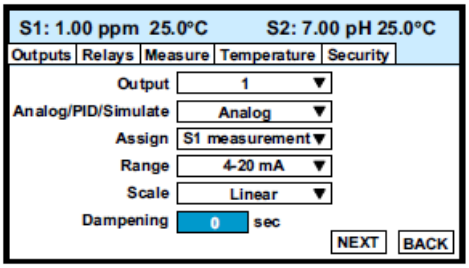
6. To select a different output, press **ENTER/MENU**.
   A list of the available outputs, shown two at a time, appears.



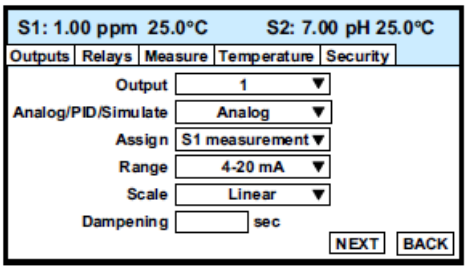
7. To view the list, press and hold **Up** or **Down**. To select and store the highlighted selection, press **ENTER/MENU**. To move from one control box to another, press **Up** or **Down**.

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

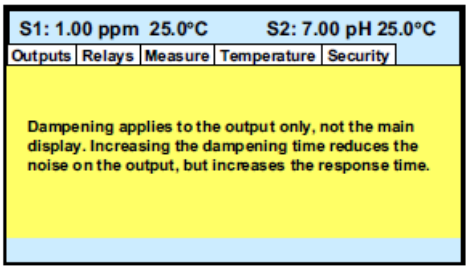
8. Move the cursor to Dampening at the bottom of the screen.
   The default Dampening value is 0 seconds.



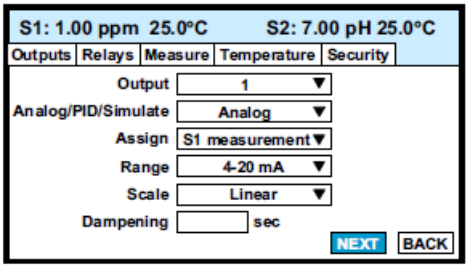
9. To change the value, press **ENTER/MENU**.
   The dark blue back-lighting disappears, indicating that a number can be entered.



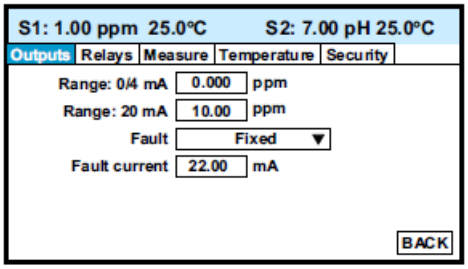
10. Use the numeric keypad to enter the desired number. If you make an error, press **Left** to erase the digit last entered. To store the number, press **ENTER/MENU**.
    Every control box has an information or help screen associated with it.
11. To view the information screen for the control box the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

6.4 Hold

6.4.1 Putting sensor in hold

To prevent unwanted alarms and improper operation of control systems or dosing pumps, place the alarm relays and outputs assigned to the sensor in hold before removing the sensor for maintenance.

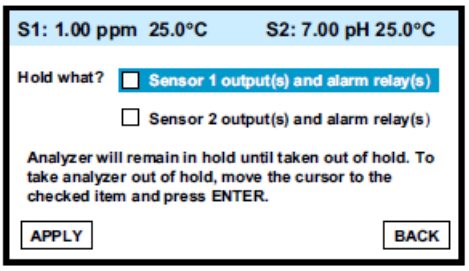
Hold is also useful if calibration, for example, buffering a pH sensor, will cause an out of limits condition. During hold, outputs assigned to the sensor remain at the last value, and alarms assigned to the sensor remain in their present state.

6.4.2 Use the Hold function

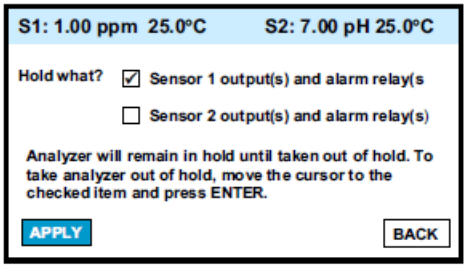
The Hold function uses certain programming features not discussed in Operation.

Procedure

1. With the main display showing, press **ENTER/MENU**.
   The main menu appears.
2. Choose Hold.
   The screen below appears. The cursor is on the first checkbox.



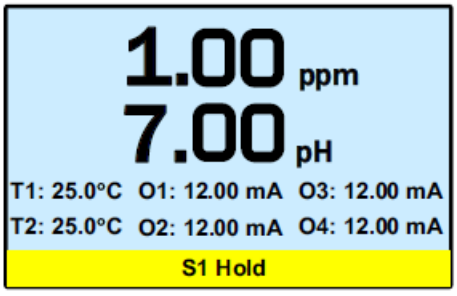
3. To hold outputs and relays associated with sensor 1, press **ENTER/MENU**. A check appears in the checkbox. To put sensor 2 on hold also, move the cursor to the sensor 2 line and press **ENTER/MENU** to select the sensor 2 checkbox.
4. To activate Hold, move the cursor to the APPLY at the bottom left of the screen and press **ENTER/MENU**.
   The selected sensor outputs and alarm relays remain on hold until taken out of hold. However, if power is lost and then restored, hold will automatically be turned off.



The screen describes how to take the transmitter out of hold.

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.



6.5 Main display

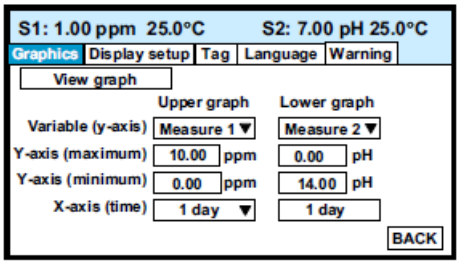
6.5.1 Configuring the main display

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

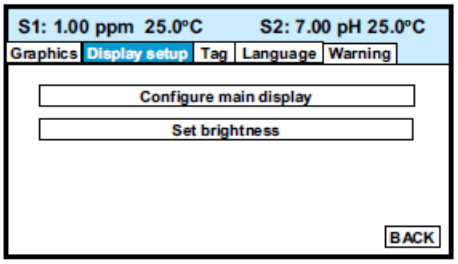
Procedure

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

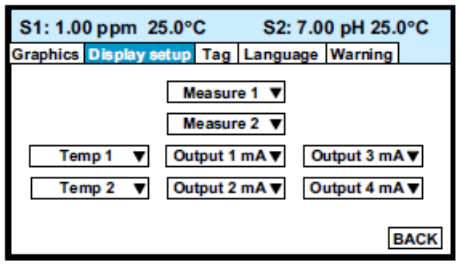
2. Choose **Display Setup**.
   The screen below appears.



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.

6.5.2 Set brightness

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

Procedure

1. Move the cursor to the Set brightness button shown in step 3 in Configuring the main display 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).

6.6 Security

6.6.1 How the security code works

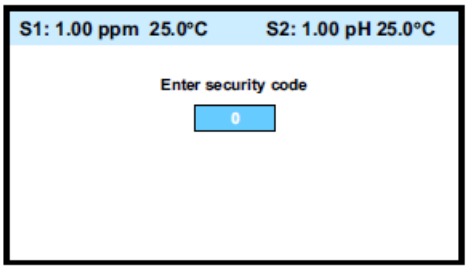
Security codes prevent accidental or unwanted changes to program settings or calibrations.

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.

6.6.2 Assigning security codes

See Security.

6.6.3 Bypassing security codes

Call the factory.

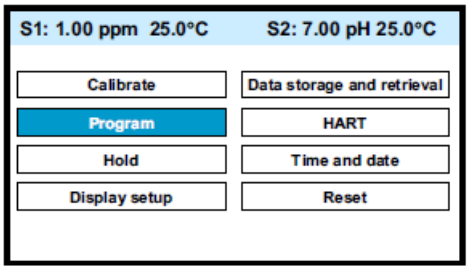
7 Programming the transmitter

7.1 Entering the Program menus

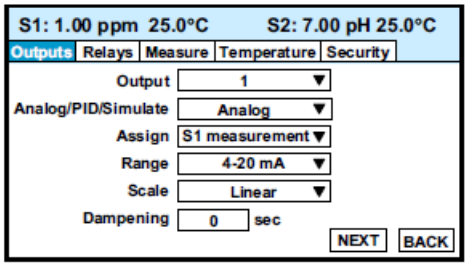
Complete the following steps to access the **Program** menus on your 56 Transmitter.

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**.



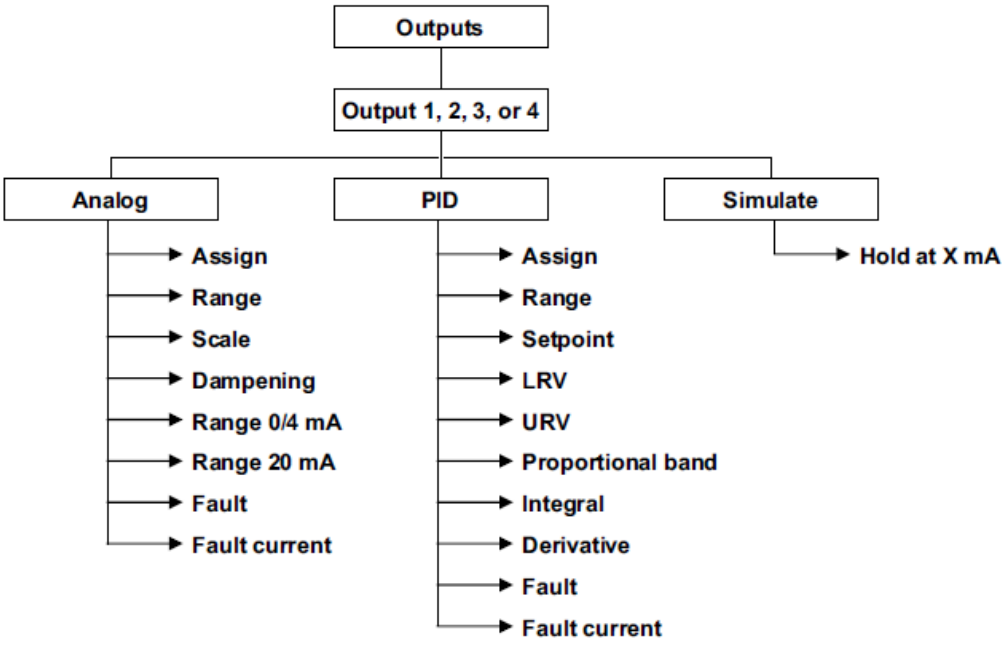
3. Move the cursor to the tab showing the desired submenu and press **ENTER/MENU**.
   A fifth tab, not shown, labeled pH diagnostics setup, will be present if one of the sensors is a pH sensor.

7.2 Outputs

7.2.1 Menu tree

Figure 7-1 is the **Outputs** menu tree.

Figure 7-1: Menu tree for the Outputs submenu



7.2.2 Output settings

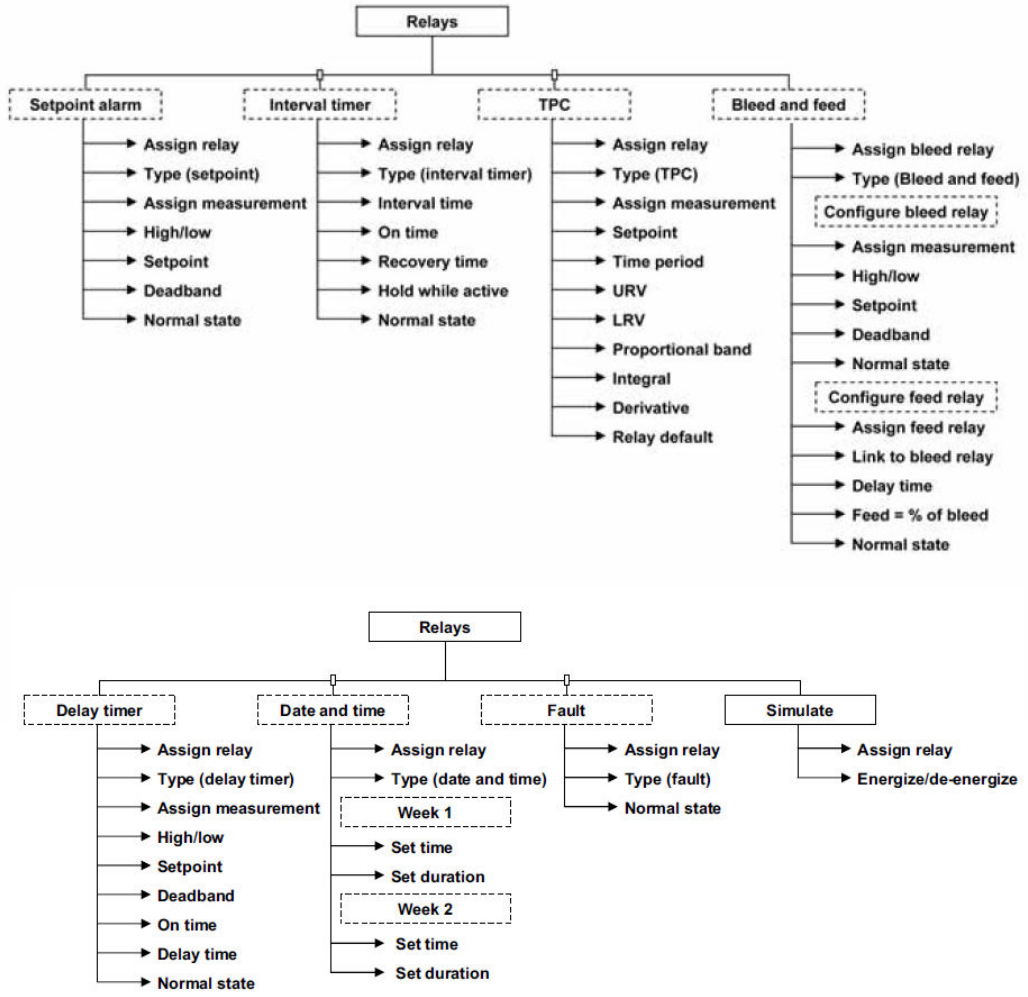
Move the cursor to the appropriate control box and press the desired setting. For more information about the control box the cursor is on, press **INFO**. To close the information screen, press any key.

7.3 Relays

7.3.1 Menu tree

Figure 7-2 is the **Relays** menu tree.

Figure 7-2: Menu tree for the Relays submenu

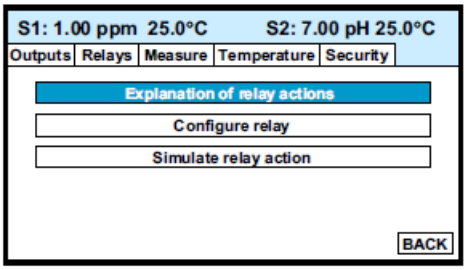


7.3.2 Configure relay settings

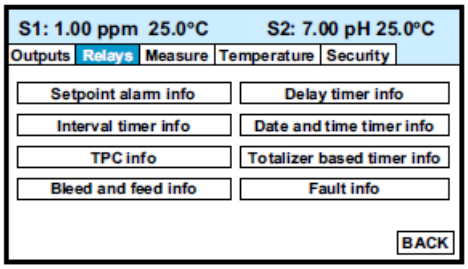
A large number of relay actions are available in the Rosemount 56.

Procedure

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

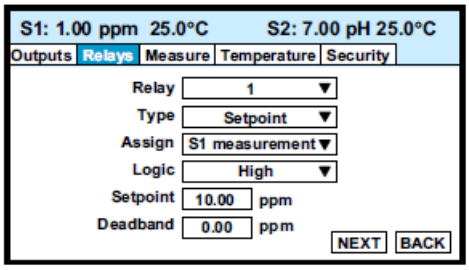


The screen below appears.



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 . 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.

7.4 Measurement

7.4.1 Menu tree

Figure 7-3 is the **Measurement** menu tree.

Figure 7-3: Menu tree for the Measurement submenu

7.4.2 Configure measurement settings

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

Procedure

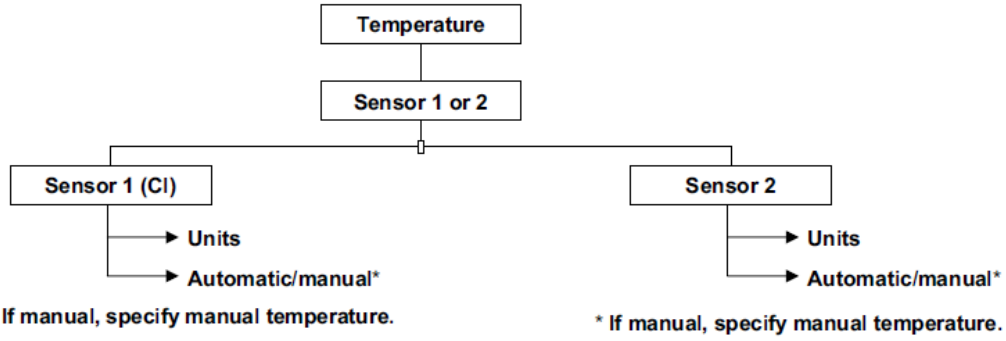
1. Move the cursor to the appropriate control box and make the desired setting.
2. For more information about the control the cursor is on, press **INFO**.
3. To close the information screen, press any key.

7.5 Temperature

7.5.1 Menu tree

Figure 7-4 is the **Temperature** menu tree.

Figure 7-4: Menu tree for the Temperature submenu



7.5.2 Configure temperature settings

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

Procedure

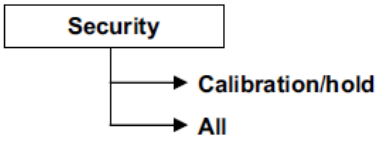
1. Move the cursor to the appropriate control box and make the desired setting.
2. For more information about the control the cursor is on, press **INFO**.
3. To close the information screen, press any key.

7.6 Security

7.6.1 Menu tree

Figure 7-5 is the ***Security*** menu tree.

Figure 7-5: Menu Tree for the Security Sub-Menu



7.6.2 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.

7.6.3 Restoring default settings

See Reset.

8 Calibrate

8.1 Introduction

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

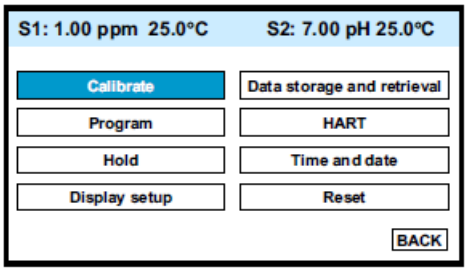
1. Calibrate the temperature sensing element in the .
2. Calibrate the sensor.
3. Calibrate the analog outputs.

8.2 Entering the Calibration menus

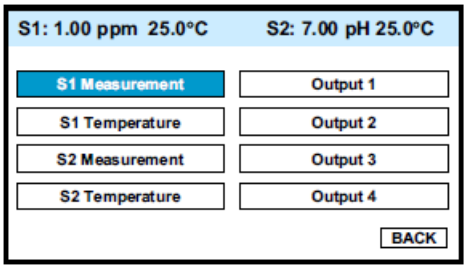
Complete the following steps to enter the **Calibration** submenus on your 56 Transmitter.

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).

8.3 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**.

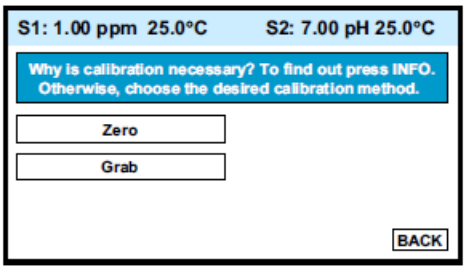
Once the calibration is complete, the screen shows the results of the calibration. The screen also shows some acceptance criteria to help you determine whether to accept the calibration.

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

8.4

Procedure

1. Choose sensor 1 (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 chlorine standards 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 criterian. 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 and the sample is flowing down the inside tube of the overflow sampler.

   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.

8.5 Calibrate the analog outputs

Complete the following steps to calibrate the analog outputs in the Rosemount 56 transmitter.

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**.

   If the calibration is successful, the ***Trim complete*** screen appears. If the entered value is more than 1.0 mA different from the simulated current output, the transmitter displays the ***Possible error*** screen, and you are asked to accept the calibration.
2. Press **INFO** for an information screen to aid with troubleshooting if the calibration not acceptable.

8.6 Reset

8.6.1 Purpose

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 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.

8.6.2 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 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**.

9 Data and event logging and retrieval

9.1 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.

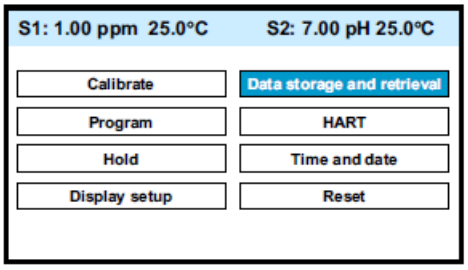
The transmitter can store up to 30 days of data. When the capacity of the logger is reached, the transmitter removes the oldest data to make room for new data. Data storage frequency is every 30 seconds.

9.2 Configure data and event logging and retrieval

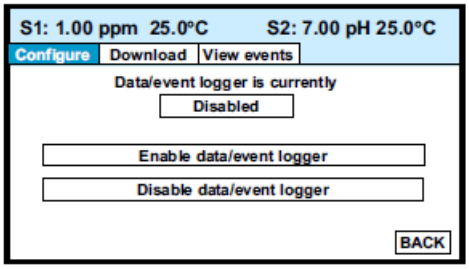
Complete the following steps to configure data and event logging and retrieval on the Rosemount 56 transmitter.

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 form the data/event logger. Download data before resetting time or date. See Downloading data and events.

9.3 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 finename for downoloaded 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*.

9.4 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.

10 Graphical display

10.1 Graphical display overview

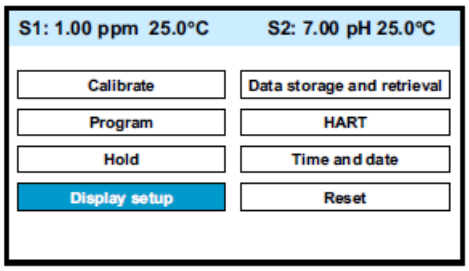
The Rosemount™ 56 Transmitter has a dual graphical display. You can configure each graph to meet your requirements, although the time axis on both graphs must be the same. You can set the time scale to one hour, one day, seven days, or thirty days.

10.2 Configuration

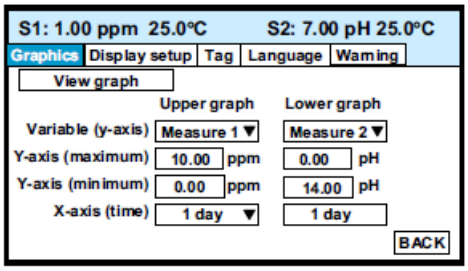
Complete the following steps to configure the graphical display on your 56 Transmitter.

Procedure

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

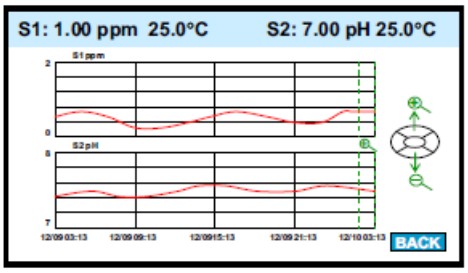


The screen shown below appears.



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**.

11 Digital communications

The Rosemount 56 Transmitter has HART communications as a standard feature and Profibus DP as an option. For more information, refer to the Rosemount 56 HART or Profibus DP Addendum manuals.

12 Maintenance

12.1 Replace sensor circuit board

The Rosemount™ 56 transmitter used with the Rosemount TCL 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.

The sensor circuit board (PN 24203-01) is replaceable. If you have a dual input transmitter, consult the Rosemount 56 Reference Manual for the part number of the other board.

⚠ WARNING

Electrical shock

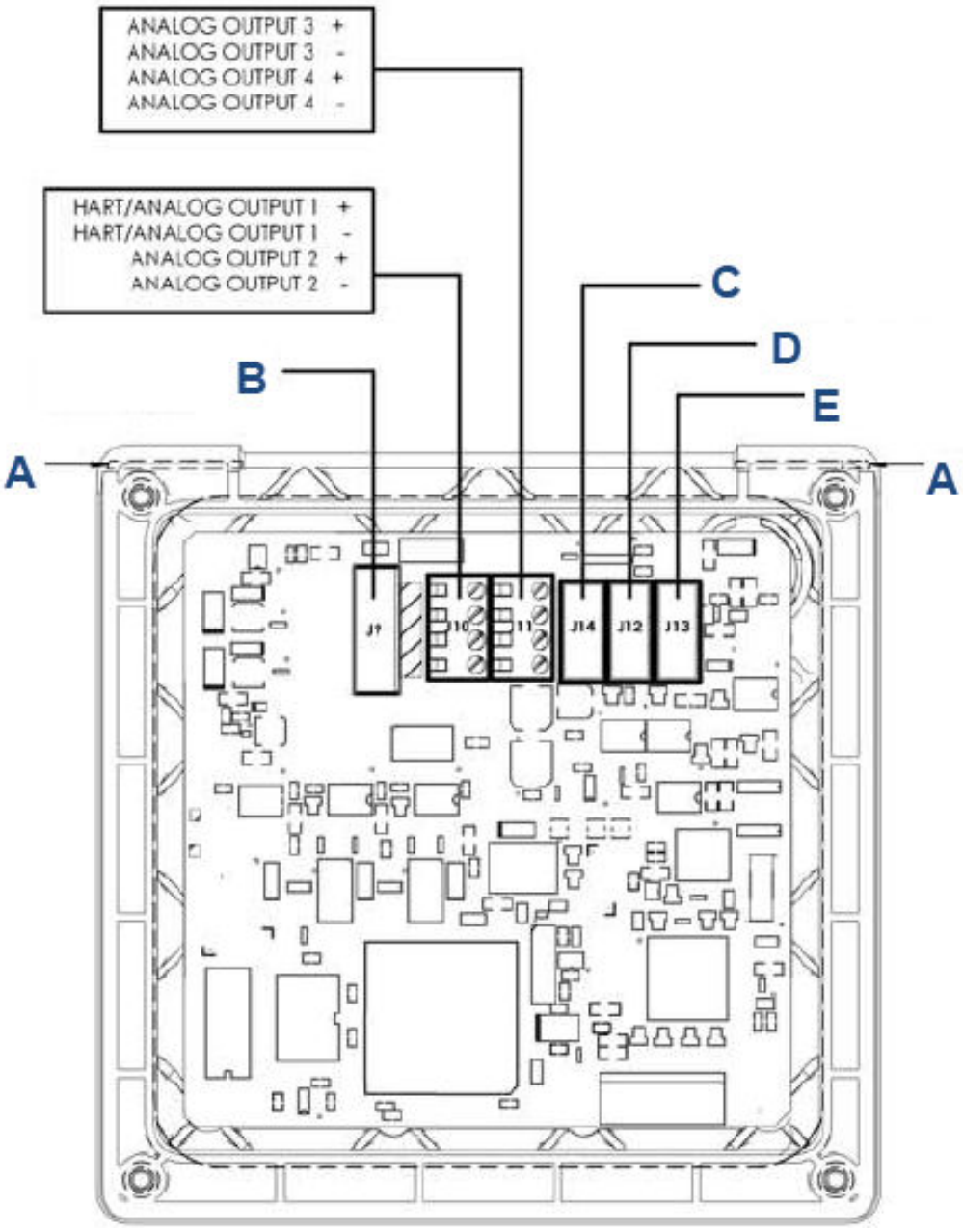
Disconnect main power and relay contacts to separate power source before servicing.

To replace the 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. See Figure 12-1.
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. Close the front panel.
9. Turn on power.

Figure 12-1: Main Board Showing Connections to Sensor Board(s)



A. Hinge pin
B. To power supply PCB (ribbon cable)
C. To digital in/out communication board
D. To sensor 1 signal board
E. To sensor 2 signal board

12.2 Total chlorine sensor

12.2.1 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.

12.2.2 Cleaning the membrane

Keep the membrane clean.

Clean the membrane with water sprayed from a wash bottle. Use a soft tissue to gently wipe the membrane.

12.2.3 Replacing the membrane

Complete the following steps to replace the membrane on the total chlorine sensor.

Procedure

1. Hold the sensor with the membrane facing up.
2. Unscrew the membrane retainer. Remove the membrane assembly and O-ring.
   See Figure.
3. Inspect the cathode. If it is tarnished, clean it by gently rubbing in the direction of the existing scratches (do not use a circular motion) with 400-600 grit silicon carbon finishing paper. Rinse the cathode thoroughly with water.
4. Prepare a new membrane. Hold the membrane assembly with the cup formed by the membrane and membrane holder pointing up. Fill the cup with electrolyte solution. Set aside.
5. Put a new O-ring in the groove.
6. Place a drop of electolyte solution on the cathode. Invert the membrane assembly and place it over the cathode stem.
7. Screw the membrane retainer back in place.
8. Hold the sensor with the membrane pointing down. Shake the sensor a few times, as though shaking down a clinical thermometer.

12.2.4 Replacing the electrolyte solution and membrane

Procedure

1. Unscrew the membrane retainer.
2. Remove the membrane assembly and O-ring.
   See .
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. Wrap the plug with

7. 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 allowing the wood ring to soak up the electrolyte solution.
8. Hold the sensor at about a 45 degree angle with the cathode end pointing up.
9. Add electrolyte solution through the fill hole until the liquid overflows.
10. Tap the sensor near the threads to release trapped air bubbles.
11. Add more electrolyte solution if necessary.
12. Place the fill plug in the electrolyte port and begin screwing it in.
13. After several threads have engaged, rotate the sensor so that the cathode is pointing up and continue tightening the fill plug.

    Do not overtighten.
14. Place a new O-ring in the groove around the cathode post.
15. Insert a small blunt probe, like a toothpick with the end cut off, through the pressure equalizing port. See .

⚠ CAUTION

Equipment damage

A sharp probe may puncture the bladder and destroy the sensor.

Do not use a sharp probe.

16. ; then place the membrane assembly over the cathode.
17. Screw the membrane retainer in place.

12.3 Sample conditioning system

12.3.1 Reagent

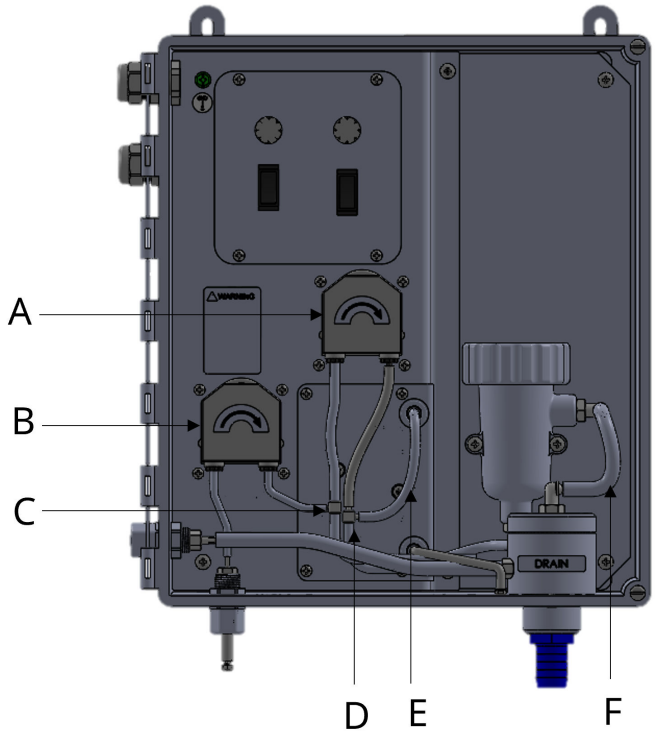
The sample conditioning reagent lasts about two months.

Before putting fresh reagent in the carboy, discard any small amount of remaining reagent. To prepare the reagent refer to the procedure in Prepare the reagent.

12.3.2 Sample and reagent tubing

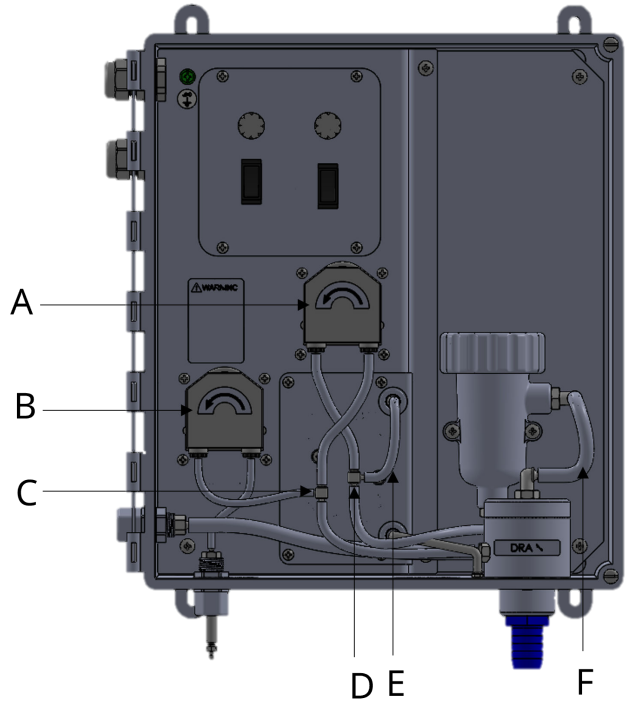
Periodically inspect sample and reagent tubing for cracks, leaks, and plugs. Replace tubing if it is damaged or plugged.

Figure 12-2: Tubing Layout for Units with Clockwise Flow Reagent and Sample Pumps



A. Sample pump
B. Reagent pump
C. Reagent injection tee (small barb)
D. Air injection tee (large barb)
E. Air
F. Drain

Figure 12-3: Tubing Layout for Units with Counter-clockwise Flow Reagent and Sample Pumps



A. Sample pump
B. Reagent pump
C. Reagent injection tee (small barb)
D. Air injection tee (large barb)
E. Air
F. Drain

12.3.3 Replacing reagent tubing

Depending on the TCL configuration and manufacturing date, the reagent pump may have either clockwise or counter-clockwise flow direction. It is important to use the right reagent tubing kit for your reagent pump flow direction. Refer to the product datasheet for reagent tubing kit ordering information.

Procedure

1. Turn off sample and reagent pumps.
2. Luer fittings connect the reagent tubing to the pump. Disconnect the tubing by turning the fitting in the direction of the arrows shown in Figure 12-4.
3. Disconnect the other end of the suction tubing from the barb on the reagent inlet fitting in the bottom of the enclosure. Disconnect the other end of the discharge tubing from the reagent injection tee.
4. Install the replacement tubing.

   Note that the discharge tubing is longer than the suction tubing.

12.3.4 Replacing sample tubing

Depending on the TCL configuration and manufacturing date, the sample pump may have either clockwise or counter-clockwise flow direction. The same sample tubing kit can be used for either sample pump flow direction. Refer to the product datasheet for sample tubing kit ordering information.

Procedure

1. Turn off the sample and reagent pumps.
2. Luer fittings connect the sample tubing to the pump. Disconnect the tubing by turning the fitting in the direction of the arrows shown in Figure 12-4.
3. Disconnect the other end of the sample pump suction tubing from the overflow sampler. Pull the reagent injection tubing off the reagent injection tee.
4. Disconnect the other end of the sample pump discharge tubing from the flow cell. Pull the air injection tubing off the air injection tee.
5. Disconnect the sample inlet and drain tubing.
6. Install the replacement sample pump suction and discharge tubing assemblies.

   The assemblies look similar. To tell the difference, note the air injection tee in the discharge tubing assembly has a larger diameter barb than the reagent injection tee in the suction tubing assembly.
7. Install replacement sample inlet and drain tubing.

   The sample inlet tubing is longer than the drain tubing.

12.3.5 Replacing peristaltic pump tubing

The expected life of the peristaltic pump tubing is one year.

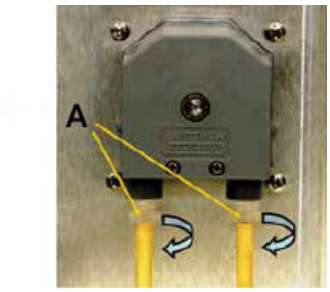
To replace pump tubing:

Procedure

1. Turn off the sample and reagent pumps.
2. The reagent and sample tubing is connected to the pump tubing with luer fittings. Disconnect the fittings from the pump by turning the fitting in the direction of the arrow.

   See Figure 12-4.

Figure 12-4: Luer Fittings

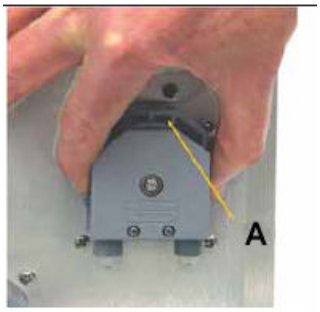


A. Luer fittings

3. Using your thumb and forefinger, gently pinch the sides of the pump cover. Slide the cover upwards to remove it.

See Figure 12-5.

Figure 12-5: Pump Cover



A. Pump cover

4. Using your thumb as shown in Figure 12-6, push the tubing fitting straight outward until the fitting slides out of the socket.

Figure 12-6: Pushing the Tubing Fitting Out

5. Remove and discard the pump tubing.
6. Insert the new tubing one end at a time. Tongues on the sides of the gray fittings at the end of the tube fit into receiving grooves in the pump casing. Push the fitting in place until it clicks. Gently stretch the tubing over the rollers and insert the other fitting into the receiving socket on the other side of the pump.

   See Figure 12-7.

Figure 12-7: Inserting New Tubing

7. Replace the pump cover.
   a) Place the cover on the pump casing.

      See Figure 12-8.

Figure 12-8: Replacing the Pump Cover

b) Be sure the pins at the bottom of the cover (Figure 12-9) ride on the tracks in the pump casing.

Figure 12-9: Pins

c) The position of the track is outlined in Figure 12-10. The pins on the pump cover must ride in these tracks as the cover is pushed into place. Gently squeeze the ends of the cover to guide the pins.

Figure 12-10: Track

d) Push down until the cover snaps into place.

8. Reconnect the tubing.

12.3.6 Replacing the air pump

Complete the following steps to replace the air pump on your total chlorine system.

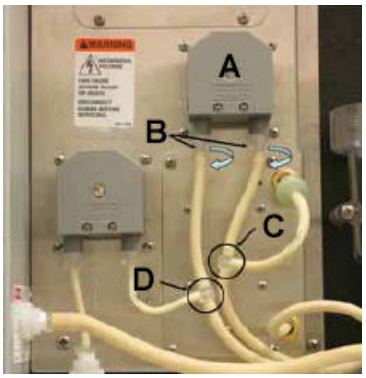
⚠ WARNING

HAZARDOUS VOLTAGE
Can cause severe injury or death. Disconnect power before servicing.

Procedure

1. Disconnect power to the transmitter.
2. Refer to Figure 12-11. Disconnect the reagent and air injection tubes. Disconnect the suction and discharge tubing by turning the Luer fitting in the direction shown in the figure. Disconnect the air pump inlet tubing from the barbed tubing in the bottom of the enclosure.

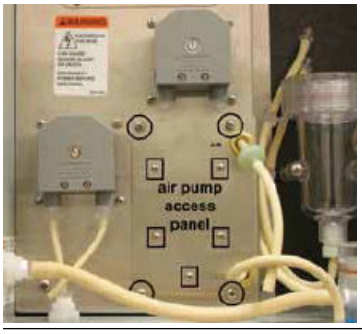
Figure 12-11: Replacing the Air Pump



A. Sample pump
B. Luer fittings
C. Air injection
D. Reagent injection

3. Remove the four screws (circled in Figure 12-11 and Figure 12-12) holding the air pump access panel. Pull out the pump and panel.

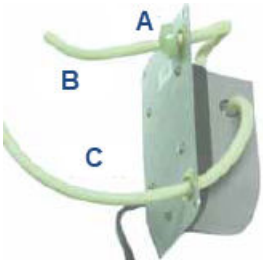
Figure 12-12: Air Pump Access Panel



4. Disconnect the air inlet and outlet tubing from the air pump.

See Figure 12-13.

Figure 12-13: Air Inlet and Outlet Tubing

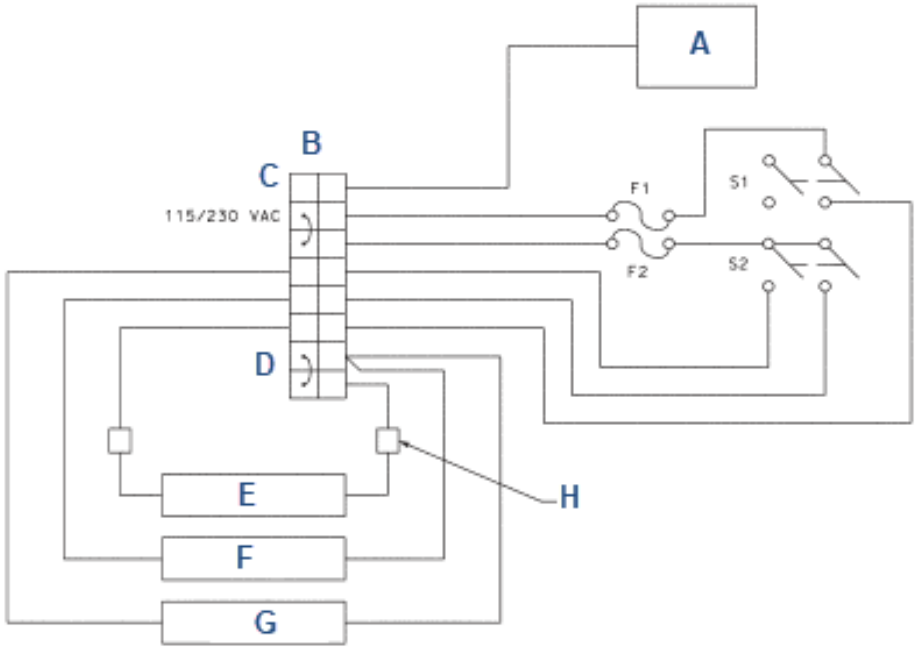


A. Check valve
B. Air outlet
C. Air inlet

5. Remove the five screws (surrounded by squares in Figure 12-12) holding the air pump to the access panel.
6. Remove the four screws holding the wiring access panel.
7. Disconnect the air pump power wires from the terminal strip. Discard the old air pump.

   See Figure 12-14.

Figure 12-14: Terminal Strip



Model option -11: 115 VAC only

Model option -12: 230 VAC only

A. Front panel
B. Terminal block
C. Ground
D. Neutral
E. Reagent pump
F. Sample pump
G. Air pump
H. Connector

8. Remove the five screws holding the rubber base of the replacement air pump to the body.
9. Using the five screws removed in step 6, attach the replacement air pump to the access panel.
10. Connect the air pump power wires to the terminal strip.
11. Replace the wiring access panel.
12. Connect the air inlet and outlet tubing to the air pump.

    See Figure 12-13. The conical end of the check valve points in the direction of the air flow.
13. Replace the air pump access panel.
14. Connect the sample pump tubing to the pump. Connect the reagent and air injection tubing. Connect the air inlet tubing to the barbed fitting at the bottom of the enclosure.

12.3.7 Replacing the air pump diaphragm and check valves

Complete the following steps to replace the air pump diaphragm and check valves on your total chlorine system.

⚠ WARNING

Hazardous voltage

Can cause severe injury or death.

Disconnect power before servicing.

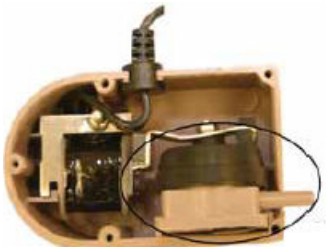
Procedure

1. Disconnect power to the transmitter.
2. Refer to Figure 12-11. Disconnect the reagent and air injection tubes. Disconnect the suction and discharge fitting by turning the Luer fitting in the direction shown in the figure. Disconnect the air pump inlet tubing from the barbed fitting at the bottom of the enclosure.
3. Remove the four screws (circled in Figure 12-12) holding the air pump access panel. Pull out the pump and panel.
4. Disconnect the air inlet and outlet tubing from the air pump.
   See Figure 12-13.
5. Remove the five screws (surrounded by squares in Figure 12-12) holding the air pump to the access panel.
6. Pull the rubber base off the pump.
7. Using needle nose pliers, remove the air inlet fitting from the side of the air pump.
   See Figure 12-15.

Figure 12-15: Inlet Fitting

8. Slide the pump assembly out of the air pump body.
   See Figure 12-16.

Figure 12-16: Pump Assembly



9. Following instructions on the package (PN 9160518), replace the diaphragm and check valves.
10. Slide the pump assembly back into the pump body and replace the barbed inlet fitting.
11. Replace the rubber base and screw the pump access panel back onto the air pump.
12. Connect the air inlet and outlet tubing to the air pump.

    See Figure 12-13. The conical end of the check valve points in the direction of the air flow.
13. Replace the air pump access panel.
14. Connect the sample pump tubing to the pump. Connect the reagent and injection tubing. Connect the air inlet tubing to the barbed fitting at the bottom of the enclosure.

13 Troubleshoot

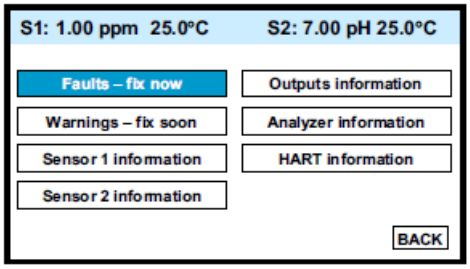
13.1 Overview

13.2 Reading and troubleshooting Fault and Warning messages

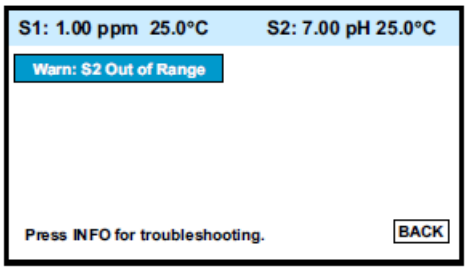
Complete the following steps to access Fault and Warning messages and determine what they mean.

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.



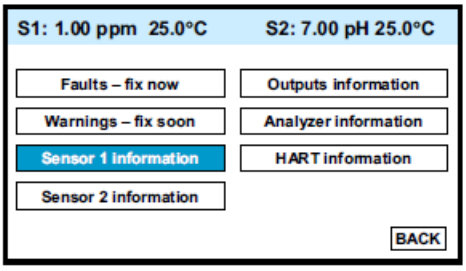
3. For troubleshooting information, press **INFO**.

13.3 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**.

13.4 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**.

13.5 Other troubleshooting

Problem	See Section
Process readings are erratic.	Process readings are erratic or wander
Readings drift.	Readings drift

13.5.1 Readings are low

1. Does the reagent carboy contain reagent? Is the reagent uptake tubing below the level of the reagent? Has potassium iodide been added to the acetic acid (vinegar) reagent?
2. Is there adequate flow to the overflow sampler? Excess sample should be flowing down the inside tube of the overflow sampler.
3. Does the reagent contain the correct amount of potassium iodide? See the table.

Expected range, ppm as Cl_2	Amount of KI needed per 5 gallons of vinegar	Part number
0 - 5 ppm	25 grams	24164-00
0 - 10 ppm	50 grams	24164-01
0 - 20 ppm	2 x 50 grams	24164-01

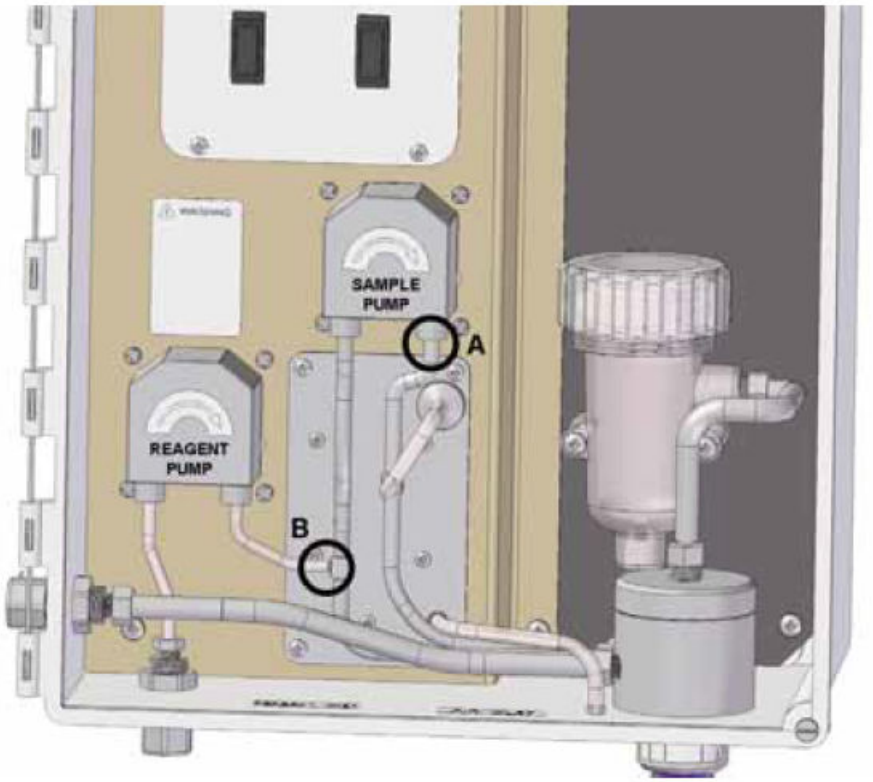
4. Was the comparison or calibration sample tested as soon as it was taken? Chlorine solutions can be unstable. Test the sample immediately after collecting it. Avoid exposing the sample to sunlight.
5. Is the membrane fouled or coated? A dirty membrane inhibits diffusion of iodine through the membrane, reducing sensor current. Clean the membrane by rinsing it with a stream of water from a wash bottle. Wipe gently with a soft tissue.
6. Are the reagent and sample pumps running? If a pump is not running, check the fuse and replace it if necessary. If the fuse is okay, replace the pump.
7. Are all the tube fittings tight? Pay particular attention to the Luer fittings that connect the tubing to the pumps.
8. Does the pump tubing element need replacing? Remove the tubing from the pump and inspect it. If the tubing appears permanently pinched or deformed, replace the tubing. Refer to Replacing peristaltic pump tubing for instructions on how to remove and replace the tubing elements. The expected life of a tubing element is about one year.
9. Is the sample flow to the sensor 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 reagent tubing at the injection tee. See B in Figure 13-1.
    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.
10. Is the reagent flow 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 13-1.

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.

Figure 13-1: Disconnecting Sample (A) and Reagent (B) Tubing Prior to Checking Flow



13.5.2 Process readings are erratic or wander

1. Is the sensor properly wired to the transmitter? See Wiring. Verify that all connections are tight.
2. Readings can be erratic when a new sensor is first placed in service. Readings usually stabilize after about an hour.
3. Is the air pump 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. Is the membrane damaged or loose? Replace the membrane if necessary.
5. Is the space between the membrane and cathode filled with electrolyte solution, and is the flow path between the electrolyte reservoir and membrane clear? Often the flow of electrolyte can be started by simply holding the sensor with the membrane end pointing down and sharply shaking the sensor a few times as though shaking down a clinical thermometer. If shaking does not work, try clearing the holes around

the cathode stem. Hold the sensor with the membrane end pointing up. Unscrew the membrane retainer and remove the membrane assembly. Use the end of a straightened paper clip to clear the holes at the base of the cathode stem.

13.5.3 Readings drift

1. Is the sample temperature 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 is about five minutes. Therefore, the reading may drift for a while after a sudden temperature change.
2. Is the membrane clean? For the sensor to work properly, must diffuse freely through the membrane. A coating on the membrane will interfere with the passage of , resulting in a .

13.5.4 Readings are too high

1. Is the sample conditioning reagent clear and colorless? If the reagent is pale yellow, results will be high. The pale yellow color is caused by iodine, which comes from the reaction between atmospheric oxygen and potassium iodide. The reaction is catalyzed by sunlight. The purpose of the blue carboy is to protect the reagent from sunlight.
2. Is the sensor fill solution fresh? An old, discolored fill solution may produce a high reading.

13.6 Other troubleshooting - general

Problem	See Section
Current output is too low.	Current output too low
Alarm relays do not operate properly.	Alarm relays don't work

13.6.1 Current output too low

Load resistance is too high. Maximum load is .

13.6.2 Alarm relays don't work

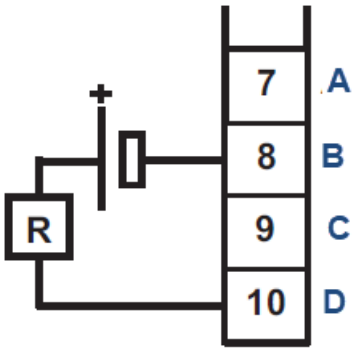
13.7 Simulating inputs

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 and connect a decade box and 1.5 V battery as shown in Figure 13-2.

Figure 13-2: 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 MΩ.
3. Note the sensor current.

   It should be about nA. The actual value depends on the voltage of the battery. To view the sensor current, go to the main display and press . Choose sensor 1. 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:

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

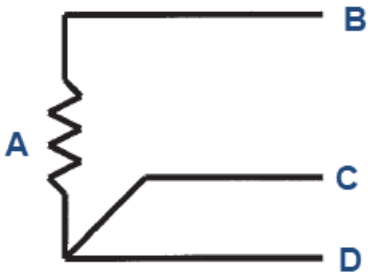
13.8 Simulating temperature

13.8.1 General

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

See Figure 13-3.

Figure 13-3: 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.

13.8.2 Simulating temperature

To simulate the temperature input, wire a decade box to the transmitter as shown in Figure 13-4.

Figure 13-4: 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 ±0.1 °C.

For example, start with a simulated resistance of 103.9 Ω, which corresponds to 10.0 °C. Assume the offset from the sensor calibration was -0.3 Ω. Because of the offset, the transmitter calculates temperature using 103.6 Ω. The result is 9.2 °C. Now change the resistance to 107.8 Ω, which corresponds to 20.0 °C. The transmitter uses 107.5 Ω 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.

Temperature (°C)	Pt 100 (Ω)
0	100.0
10	103.9
20	107.8

Temperature (°C)	Pt 100 (Ω)
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

14 Return of material

For any repair, warranty, and return of instrument requests, please contact the factory.

00809-0200-3415
Rev. AA
2023

For more information: **Emerson.com**

ROSEMOUNT™

EMERSON™