+GF+ SIGNET 8850-1 Conductivity/Resistivity Transmitter

3-8850.090-1   C-3/01 English

Conductivity/Resistivity
62.50 uS/cm
25.0°C
+GF+ SIGNET

CAUTION!
- Remove power to unit before wiring input and output connections.
- Follow instructions carefully to avoid personal injury.

Contents
1. Installation
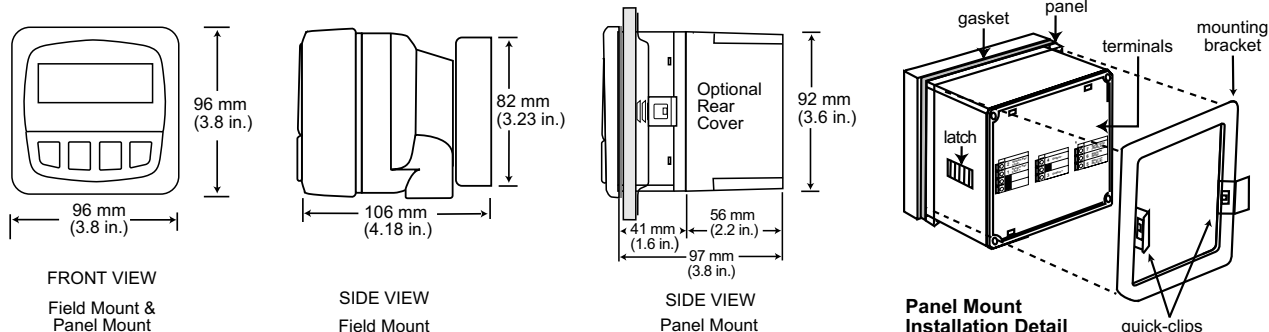2. Specifications
3. Electrical Connections
4. Menu Functions

1. Installation

ProcessPro transmitters are available in two styles: panel mount and field mount. The panel mount is supplied with the necessary hardware to install the transmitter. This manual includes complete panel mounting instructions.

Field mounting requires a separate mounting kit. The 3-8050 Universal kit enables the transmitter to be installed virtually anywhere. Detailed instructions for field installation options are included with the 3-8050 Universal kit.

1.1 Panel Installation

1. The panel mount transmitter is designed for installation using a 1/4 DIN Punch. For manual panel cutout, an adhesive template is provided as an installation guide. Recommended clearance on all sides between instruments is 1 inch.
2. Place gasket on instrument, and install in panel.
3. Slide mounting bracket over back of instrument until quick-clips snap into latches on side of instrument.
4. To remove, secure instrument temporarily with tape from front or grip from rear of instrument. DO NOT RELEASE. Press quick-clips outward and remove.

96 mm (3.8 in.) · 96 mm (3.8 in.)

FRONT VIEW
Field Mount & Panel Mount

82 mm (3.23 in.) · 106 mm (4.18 in.)

SIDE VIEW
Field Mount

Optional Rear Cover · 92 mm (3.6 in.) · 41 mm (1.6 in.) · 56 mm (2.2 in.) · 97 mm (3.8 in.)

SIDE VIEW
Panel Mount

gasket · panel · terminals · mounting bracket · latch · quick-clips

Panel Mount Installation Detail

2. Specifications

General

Compatible electrodes: +GF+ SIGNET 3-28XX-1 Standard and Certified Series Conductivity/Resistivity Electrodes

Accuracy: ±2% of reading

Enclosure:
- Rating: NEMA 4X/IP65 front
- Case: PBT
- Panel case gasket: Neoprene
- Window: Polyurethane coated polycarbonate
- Keypad: Sealed 4-key silicone rubber
- Weight: Approx. 325g (12 oz.)

Display:
- Alphanumeric 2 x 16 LCD
- Contrast: User selected, 5 levels
- Update rate: 1.8 s

U.S.A. Patent # 5,708,363

Electrical

- Power: 12 to 24 VDC ±10%, regulated, 80 mA max.

Sensor input range:
- Conductance: 0.055 to 400,000 µS
- Resistivity: 10 KΩ to 18.2 MΩ
- TDS: 0.023 to 200,000 ppm

(Measurements from 10 MΩ to 18 MΩ (0.055 µS to 0.1 µS) must be performed in solution temperatures from 20 °C to 100 °C.)

- Temperature: PT 1000, -25 to 120°C (-13 to 248°F)

Current output:
- 4 to 20 mA, isolated, fully adjustable and reversible
- Max loop impedance: 50 Ω max. @ 12 V
                         325 Ω max. @ 18 V
                         600 Ω max. @ 24 V
- Update rate: 200 ms
- Accuracy: ±0.03 mA @ 25°C, 24 V

Open-collector output, optically isolated:
- 50 mA max. sink, 30 VDC maximum pull-up voltage.
- Programmable for:
  - High, Low with adjustable hysteresis
  - Pulse operation (max. rate: 400 pulses/min).

Environmental

- Operating temperature: -10 to 70°C (14 to 158°F)
- Storage temperature: -15 to 80°C (5 to 176°F)
- Relative humidity: 0 to 95%, non-condensing
- Maximum altitude: 2000 m (6562 ft)
- Insulation category: II
- Pollution degree: 2

Standards and Approvals

- CSA, CE, UL listed
- Immunity: EN50082-2
- Emissions: EN55011
- Safety: EN61010
- Manufactured under ISO 9001 and ISO 14001

3. Electrical Connections

⚠️ **Caution:** Failure to fully open terminal jaws before removing wire may permanently damage instrument.

Wiring Procedure
1. Remove 0.5 - 0.625 in. (13-16 mm) of insulation from wire end.
2. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
3. Insert exposed (non-insulated) wire end in terminal hole until it bottoms out.
4. Release orange terminal lever to secure wire in place. Gently pull on each wire to ensure a good connection.
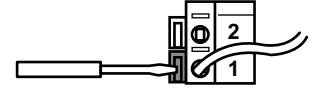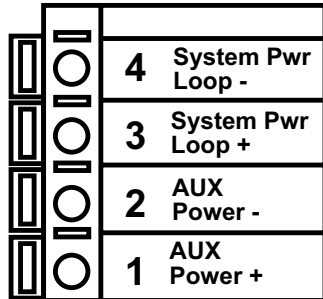
Wiring Removal Procedure
1. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
2. When fully open, remove wire from terminal.

Terminals 3 and 4: Loop Power
12-24 VDC ±10% system power
    and current loop output.
Max. loop impedance:
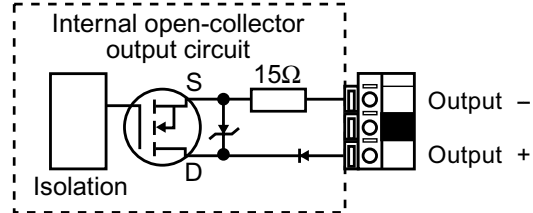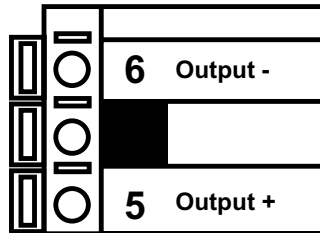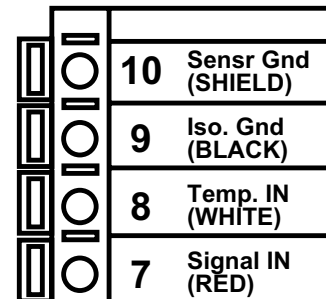   50 Ω max. @ 12 V
    325 Ω max. @ 18 V
    600 Ω max. @ 24 V

Terminals 7-10: Sensor input
7 is conductivity input
8 is temperature input
9 is the isolated signal ground
10 is the sensor earth ground

4	System Pwr Loop -
3	System Pwr Loop +
2	AUX Power -
1	AUX Power +

| 6 | Output - |
| 5 | Output + |

10	Sensr Gnd (SHIELD)
9	Iso. Gnd (BLACK)
8	Temp. IN (WHITE)
7	Signal IN (RED)

Terminals 1-2: Auxiliary power
Provides DC power to measurement circuit.

Internal open-collector output circuit
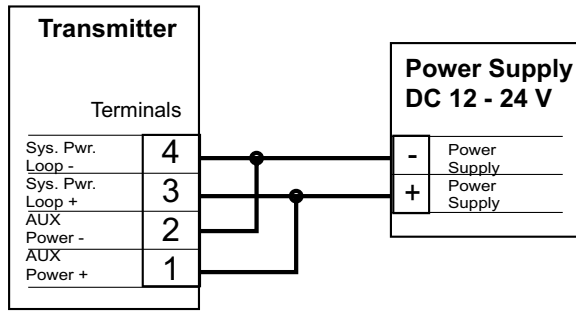
S 15Ω

Isolation   D

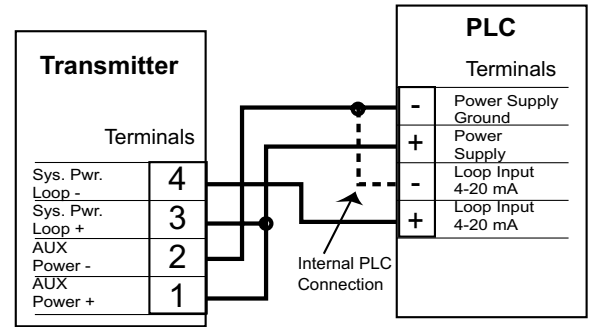Output −

Output +

Terminals 5-6: Open-collector Output
• A transistor output, programmable (see CALIBRATE menu) as High or Low setpoint with adjustable hysteresis and proportional Pulse (to 400 pulses per minute maximum).
• May be disabled (Off) if not used.
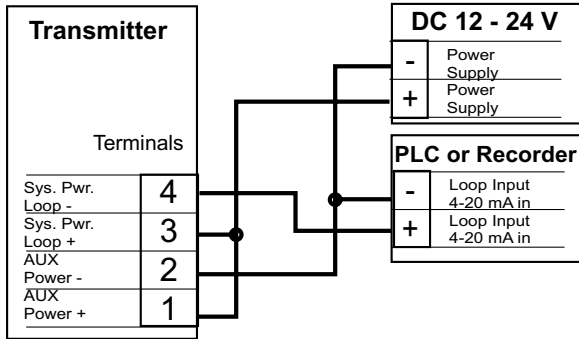
3.1 System Power/Loop Connections
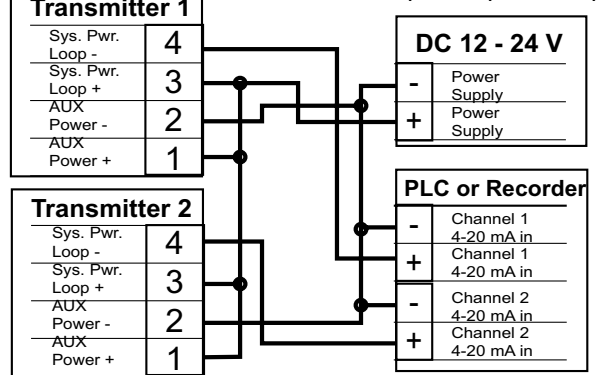
Stand-alone application, no current loop used

Transmitter		Power Supply DC 12 - 24 V	
Terminals			
Sys. Pwr. Loop -	4	-	Power Supply
Sys. Pwr. Loop +	3	+	Power Supply
AUX Power -	2		
AUX Power +	1		

Connection to a PLC with built-in power supply

Transmitter		PLC	
		Terminals	
Sys. Pwr. Loop -	4	-	Power Supply Ground
Sys. Pwr. Loop +	3	+	Power Supply
AUX Power -	2	-	Loop Input 4-20 mA
AUX Power +	1	+	Loop Input 4-20 mA

Internal PLC Connection

Connection to a PLC/Recorder, separate supply

Transmitter		DC 12 - 24 V	
		-	Power Supply
		+	Power Supply
Terminals		**PLC or Recorder**	
Sys. Pwr. Loop -	4	-	Loop Input 4-20 mA in
Sys. Pwr. Loop +	3	+	Loop Input 4-20 mA in
AUX Power -	2		
AUX Power +	1		

Example: Two transmitters connected to PLC/Recorder with separate power supply

Transmitter 1		DC 12 - 24 V	
Sys. Pwr. Loop -	4	-	Power Supply
Sys. Pwr. Loop +	3	+	Power Supply
AUX Power -	2		
AUX Power +	1		

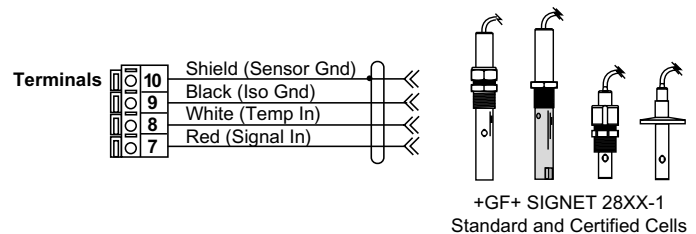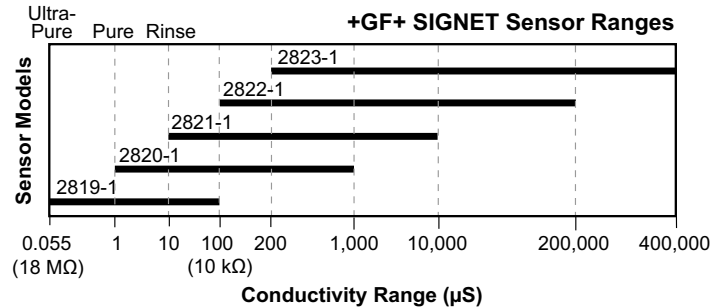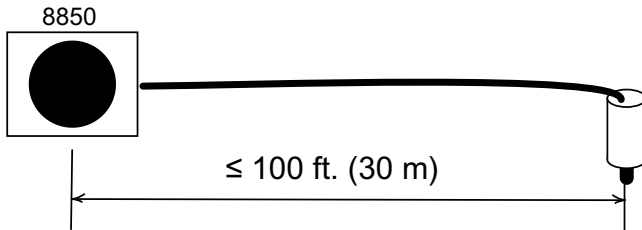| Transmitter 2		PLC or Recorder	
Sys. Pwr. Loop -	4	-	Channel 1 4-20 mA in
Sys. Pwr. Loop +	3	+	Channel 1 4-20 mA in
AUX Power -	2	-	Channel 2 4-20 mA in
AUX Power +	1	+	Channel 2 4-20 mA in

3.2 Sensor Input Connections

Wiring Tips:
- Do not route sensor cable in conduit containing AC power wiring. Electrical noise may interfere with sensor signal.
- Routing sensor cable in grounded metal conduit will help prevent electrical noise and mechanical damage.
- Seal cable entry points to prevent moisture damage.
- Only one wire should be inserted into a terminal. Splice double wires outside the terminal.

Select the sensor with a range closest to your process minimum and maximum values.
- 2819-1 (0.01 cell): 0.055 to 100 µS (10 kΩ to 18 MΩ)
  Use the 2819-1 for all resistivity requirements
- 2820-1 (0.1 cell): 1 to 1000 µS
- 2821-1 (1.0 cell): 10 to 10,000 µS
- 2822-1 (10.0 cell): 100 to 200,000 µS
- 2823-1 (20.0 cell): 200 to 400,000 µS

+GF+ SIGNET Sensor Ranges

Sensor Models: 2823-1, 2822-1, 2821-1, 2820-1, 2819-1

Ultra-Pure | Pure | Rinse

Conductivity Range (µS): 0.055 (18 MΩ), 1, 10, 100 (10 kΩ), 200, 1,000, 10,000, 200,000, 400,000

8850

≤ 100 ft. (30 m)

Terminals		
	10	Shield (Sensor Gnd)
	9	Black (Iso Gnd)
	8	White (Temp In)
	7	Red (Signal In)

+GF+ SIGNET 28XX-1 Standard and Certified Cells
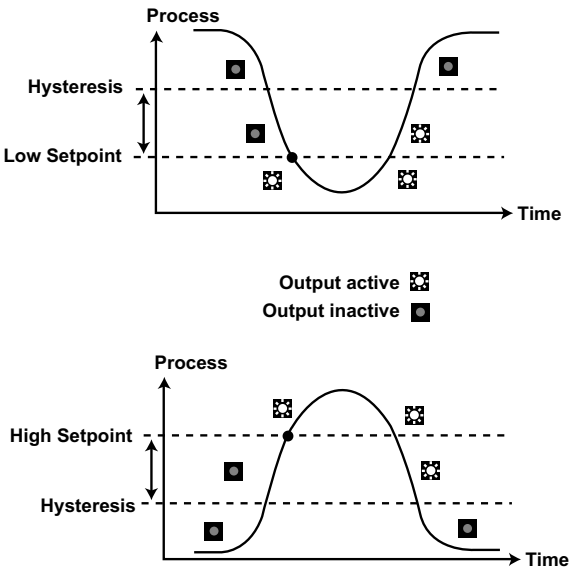
3.3 Open Collector Output

The Open Collector output can be used as a switch that responds when the process value moves above or below a setpoint, or it can be used to generate a pulse at a rate proportional to the process value.

• **Low:**

Output triggers when process variable is less than the setpoint. The output will relax when the process variable moves above the setpoint plus the hysteresis value.

• **High:**

Output triggers when process variable is greater than the setpoint. The output will relax when the process variable moves below the setpoint plus the hysteresis value.

• **Proportional Pulsing**

The Open Collector output will generate a 100 mS pulse at the rate defined by settings in the CALIBRATE menu.

In the example below:
• The output will be 0 pulses/min. when value is less than 5.
• The output will be 50 pulses/min. when value is 7.5.
• The output will be 100 when value is greater than 10.

The starting point, endpoint and maximum pulse rate are selectable in the CALIBRATE menu.
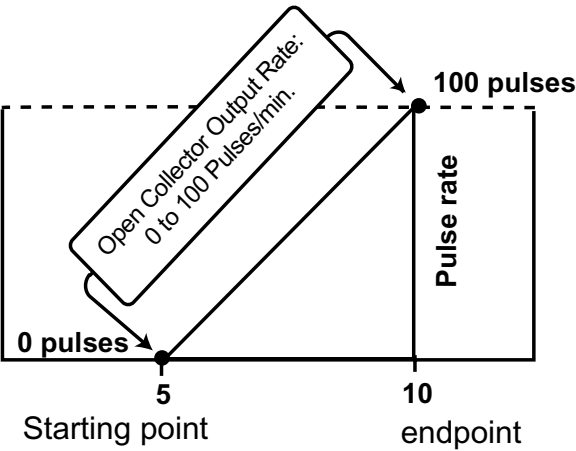
VIEW menu

• During normal operation, ProcessPro displays the VIEW menu.
• When editing the CALIBRATE or OPTIONS menus, ProcessPro will return to the VIEW menu if no activity occurs for 10 minutes.
• To select a VIEW display, press the UP or DOWN arrow keys. The selections will scroll in a continuous loop.
• Changing the VIEW display does not interrupt system operations.
• No key code is necessary to change display selection.
• Output settings cannot be edited from the VIEW menu.

View Menu

Display	Description
`123.45 μS/cm` `+67.89 °C`	Monitor the Conductivity and Temperature values from the sensor. This is the permanent display.

The VIEW displays below are temporary. The permanent display will return after 10 minutes

`Loop Output:` `13.75 mA`	Monitor the Loop Current output.
`Last CAL:` `06-30-01`	Check the Last Calibration date.
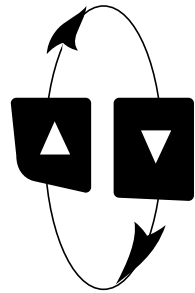
ProcessPro Editing Procedure:

Step 1. Press and hold ENTER key:
- 2 seconds to select the CALIBRATE menu.
- 5 seconds to select the OPTIONS menu.

Step 2. The Key Code is UP-UP-UP-DOWN keys in sequence.
- After entering the Key Code, the display will show the first item in the selected menu.

Step 3. Scroll menu with UP or DOWN arrow keys.

Step 4. Press RIGHT ARROW key to select menu item to be edited.
- The first display element will begin flashing.

Step 5. Press UP or DOWN keys to edit the flashing element.
- RIGHT ARROW key advances the flashing element.

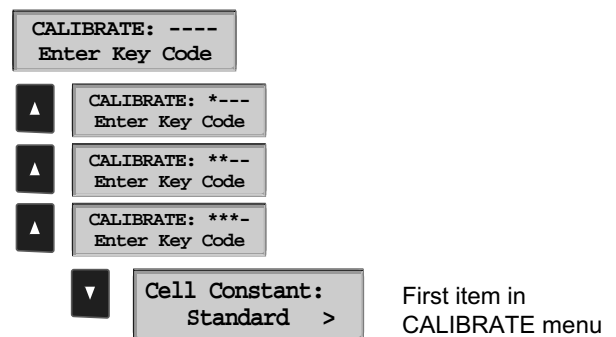**Step 6. Press ENTER key to save the new setting and return to Step 3.**

Notes on Step 1:
- The View Menu is normally displayed.
- The CALIBRATE and OPTIONS menus require a KEY CODE.

Press & hold for access: **ENTER**

VIEW

CALIBRATE

OPTIONS

2s   **5s**
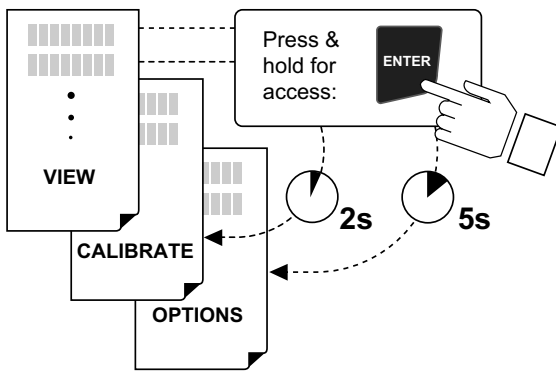
Notes on Step 2:
If no key is pressed for 5 minutes while display is showing "Enter Key Code", the display will return to the VIEW menu.

```
CALIBRATE: ----
  Enter Key Code
```
▲
```
CALIBRATE: *---
  Enter Key Code
```
▲
```
CALIBRATE: **--
  Enter Key Code
```
▲
```
CALIBRATE: ***-
  Enter Key Code
```
▼
```
Cell Constant:
  Standard   >
```
First item in
CALIBRATE menu

Notes on Steps 3 and 4:
- Refer to pages 6 and 7 for complete listing of menu items and their use.
- From the Step 3 display, pressing the UP and DOWN keys simultaneously will return the display to the VIEW menu.
- If no key is pressed for 10 minutes, display will also return to the VIEW menu.

Step 3: Finished Editing?
Press the UP and DOWN keys simultaneously after saving the last setting to return to normal operation.

```
Cell Constant:
  Standard   >
```
▼ **Step 3** ▲
```
Output Setpnt:
  20.0 uS >
```
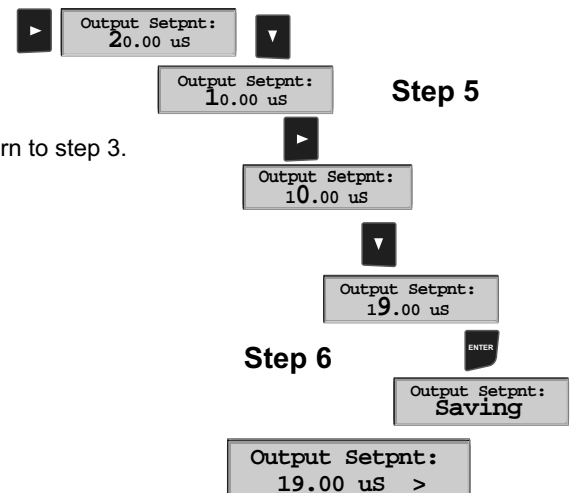► **Step 4**
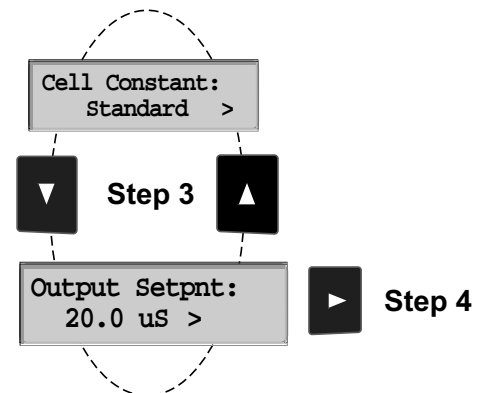
Notes on Steps 5 and 6:
- All output functions remain active during editing.
- Only the flashing element can be edited.
- RIGHT ARROW key advances the flashing element in a continuous loop.
- Edited value is effective immediately after pressing ENTER key.
- If no key is pressed for 10 minutes unit will restore the last saved value and return to step 3.
- Step 6 (pressing ENTER key) always returns you to Step 3.
- Repeat steps 3-6 until all editing is completed.

Step 5: Made an Error?
Press the UP and DOWN keys simultaneously while any element is flashing. This will recall the last saved value of the item being edited and return you to Step 3.

► ▼
```
Output Setpnt:
  20.00 uS
```
```
Output Setpnt:
  10.00 uS
```
Step 5
►
```
Output Setpnt:
  10.00 uS
```
▼
```
Output Setpnt:
  19.00 uS
```
Step 6   ENTER
```
Output Setpnt:
  Saving
```
```
Output Setpnt:
  19.00 uS  >
```

Calibrate Menu

Display (Factory settings shown)	Description
Cell Constant: Standard >	Select CUSTOM only if you are connecting a certified conductivity sensor. Select STANDARD for all other systems.
Cell: Standard 1 >	For STANDARD sensors: Select from these options: 0.01, 0.1, 1.0, 10.0 or 20.0.
Cell: Custom 1.0000 >	For CUSTOM sensors: Enter the precise cell constant from the certificate provided with your sensor, or from the information label on the sensor.
Cond Units: uS >	Select from the following options: μS, mS, kΩ, MΩ, PPM
PPM Factor: 2.00 >	If the Units selection is PPM, you can set the ratio of Total Dissolved Solids to μS. See section 3 of this manual for additional information. The TDS factor can only be set in PPM.
Set: Temperature >	Adjust the temperature of the system based on an accurate external reference.
Set: Conductivity >	For use with STANDARD sensors: Perform this single-point wet calibration for most accurate results. Not required for CUSTOM sensors except for periodic system accuracy confirmation. Enter all zeroes to restore factory calibration to TEMP and COND settings.
Loop Source: Cond >	Select the input source to be associated with the current loop output: Conductivity or Temperature.
Loop Range: uS 0.0000 $\rightarrow$ 100.000 >	Select the minimum and maximum values for the current loop output. Be sure to modify this setting if you change the Cond. Units.
Output Source: Cond >	Select the source for the Open Collector output: Conductivity or Temperature
Output Mode: Low >	Select the mode of operation for the Open Collector output. Options available are High, Low or proportional Pulse. The signal may be disabled (Off) if not in use.
Output Setpnt: 10.0000 uS >	In Low or High Mode, this Open Collector output will be activated when the process reaches this value. Be sure to modify this setting if you change the Cond. Units.
Output Hys: 0.5000 uS >	The Open Collector output will be deactivated at Setpoint ± Hysteresis, depending on High or Low Setpoint selection. (See details on page 4.)
Output Rng: uS 10.0000 $\rightarrow$ 40.0000 >	In Pulse mode, set the process values where the proportional pulse will start and where it will reach the maximum rate. Be sure to modify this setting if you change the Cond. Units.
Output PlsRate: 120 Pulses/Min >	In Pulse mode, set the maximum rate for the proportional Pulse output. The 8850 will accept any value from 0 to 400.
Last CAL: 06-30-01 >	Use this "note pad" to record important dates, such as annual recertification or scheduled maintenance.

Options Menu

Display (Factory settings shown)	Description
Contrast: **3** >	Adjust the LCD contrast for best viewing. A setting of 1 is lower contrast, 5 is higher. In general, select lower contrast if the display is in warmer ambient surroundings.
Cond Decimal: ******.*** >	Set the decimal to the best resolution for your application. The display will automatically scale down to this restriction. Select *****., ****.*, ***.** **.*** or *.****
Averaging **Off** >	OFF provides the most instantaneous response to process changes. Select LOW (4 sec) or HIGH (8 sec) averaging if your process experiences frequent or extreme fluctuations.
Loop Adjust: **4.00 mA** > **Loop Adjust:** **20.00 mA** >	Adjust the minimum and maximum current output. The display value represents the precise current output. Adjustment limits: • 3.80 mA < 4.00 mA > 5.00 mA • 19.00 mA < 20.00 mA > 21.00 mA Use this setting to match the system output to any external device.
Temp Display: **ºC** >	Select ºC or ºF
Temperature **Comp %: 2.00** >	Set the percent change in Conductivity caused by a 1ºC change in temperature. May be from 0.00 to 10.00.
Output Active: **Low** >	Active HIGH: This setting is used to turn a device (pump, valve) ON at the setpoint. Active LOW: This setting is used to turn a device OFF at the setpoint.
Test Loop: >	Press UP and DOWN keys to manually order any output current value from 3.6 mA to 21.00 mA to test the output loop.
Test Output: >	Press UP and DOWN keys to manually toggle the Open Collector output state.

Calibration Procedure

This instrument has been electronically calibrated at the factory.
- Procedure A verifies the accuracy and linearity of the instrument by simulating temperature and conductivity values with precision (±0.1%) fixed resistors.
- Procedure B is a wet calibration. This procedure uses the sensor input and NIST traceable test solutions. When done correctly, this procedure offers the most accurate system calibration.

A) Accuracy Verification with Precision Resistors (Electronic Calibration):
1. Simulate the Temperature
The temperature input to the 8850 is a PT-1000 thermistor, where 1000 Ohms (Ω) is equal to 0 ºC and a change of 3.84 Ω equals a 1ºC change. (1000 Ω = 0 ºC, 1003.84 Ω = 1.0 ºC, 1007.68 Ω = 2.0 ºC...................1096 Ω = 25 ºC)

- Connect a resistor (1000 Ω to 1096 Ω) between "Temp IN" and "Iso. Gnd" terminals.
- Set Temp;   Adjust the temperature to exact value based on the measured resistance. (see Editing Procedure, Calibrate menu).
- To verify the temperature linearity, connect a second resistor value to the terminals.
- If the instrument does not display the correct value, service is required. ($\pm$ 0.5 ºC)

2. Simulate the Conductivity
You may calculate the exact Resistance needed to simulate a specific conductivity value , or you may calculate the exact Conductivity based on a resistor value:

$$\text{Resistance} \quad = \quad \frac{\text{Cell constant}}{\text{conductivity (Siemens*)}} \qquad \textbf{e.g.} \quad \frac{0.1 \text{ Cell}}{0.000020 \text{ (Siemens*)}} \quad = 5{,}000 \ \Omega \text{ or } 5 \ K\Omega$$

$$\text{Conductivity} \quad = \quad \frac{\text{Sensor cell}}{\text{Simulation resistance } (\Omega)} \qquad \textbf{e.g.} \quad \frac{0.1 \text{ Cell}}{100{,}000 \ (\Omega)} \quad \begin{array}{l} = 0.000001 \text{ Siemens*} \\ \text{or } 1\mu S/cm \end{array}$$

(*1 μS = 1 X 10^{-6} Siemens or 0.000001 Siemens)

- Connect the conductivity resistor between the "Signal IN " and "Iso Gnd" terminals.
- Set Cond: Adjust the conductivity value based on the resistor value. (see Editing Procedure and Calibrate menu).
- Verify the linearity of the instrument by connecting a second resistor of a different value.
- If the instrument does not display the correct value ($\pm$ 2% of reading), service is required.

9	Iso. Gnd (BLACK)	
8	Temp. IN (WHITE)	TC resistor
7	Signal IN (RED)	Simulation resistor
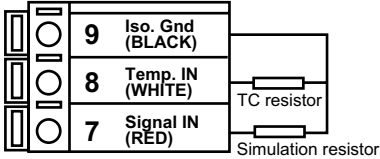
B) Wet Calibration with NIST Traceable Solutions:
When using NIST traceable standards, review the temperature information provided with the test solution. Prevent contamination of the test solution. The sensor must be at the temperature specified on the test solution label.

- Remove the sensor from the system. Rinse the sensor in a small amount of test solution.
- Place the sensor into the test solution.
- Place a reference thermometer into the same solution.
- Allow sufficient time for the temperature to stabilize.
- Set Temp: Adjust the temperature value based on the reference thermometer. (see Editing Procedure.)
- Set Cond: Adjust the conductivity value based on the test solution value. (see Editing Procedure.)
- Verify the linearity by placing the sensor into a second test solution of a different value.
- If the instrument does not display the correct value (Temperature $\pm$ 0.5 ºC, Conductivity $\pm$ 2% of reading), service is required.

Temperature Coefficient

Conductivity measurement is highly dependent on temperature. Temperature dependence is expressed as the relative change per °C, commonly known as percent/°C change from 25°C, or slope of the solution.

Slopes can vary significantly depending on process solution type. The factory default temperature compensation factor is 2.00%/°C. Process solutions may require adjustment for maximum accuracy. To determine the optimum temperature compensation factor for a process:

1. Disable the 8850 temperature compensation % factor by entering 0.00.

2. Heat the sample solution close to the maximum process temperature. Place sensor in the sample solution allowing several minutes for stabilization. Access the VIEW menu and record the displayed temperature and conductivity values in the spaces provided:

   Displayed temperature: T1 = _____ °C
   Displayed conductivity: C1 = _____ °C

(Do not use this procedure for solutions from 0.055 µS to 0.1 µS (10 MΩ to 18 MΩ). An internal pure water curve is used for these ranges. The factory default setting of 2.00%/°C should be used.)

3. Cool the sample solution close to the minimum process temperature. Place sensor in the sample solution allowing several minutes for stabilization. Record displayed temperature and conductivity values in the spaces provided:

   Displayed temperature: T2 = _____ °C
   Displayed conductivity: C2 = _____ °C

   (A 10% change in conductivity between steps 2 and 3 is recommended.)

4. Substitute recorded readings (steps 2 and 3) into the following formula:

$$\text{TC Slope} = \frac{100 \times (C1 - C2)}{(C2 \times (T1 - 25)) - (C1 \times (T2 - 25))}$$

   Example: A sample solution has a conductivity of 205 µS @ 48°C. After cooling the solution, the conductivity was measured at 150 µS @ 23 °C. (C1 = 205, T1 = 48, C2 = 150, T2 = 23)
   The TC is calculated as follows:

$$\text{TC Slope} = \frac{100 \times (205 - 150)}{(150 \times (48 - 25)) - (205 \times (23 - 25))} = \frac{5500}{3860} = 1.42\%/°C$$

Parts Per Million (PPM) Factor

This feature is only applicable when PPM display units are selected. The programmable PPM Factor is adjustable from 0.01 to 3.00 (factory default = 2.00).

Determine the best PPM Factor for a process solution by calculating the solution's conductivity (µS) and the percent of total dissolved solids (PPM).

$$\text{PPM Factor} = \frac{\text{Solution conductivity (µS/cm)}}{\text{Total dissolved solids (PPM)}}$$

$$\text{TDS (PPM)} = \frac{\text{Solution conductivity (µS/cm)}}{\text{PPM Factor}}$$

Example: • Solution conductivity = 400 µS/cm

              • TDS = 200 PPM (mg/L)

$$\text{PPM Factor} = \frac{400 \text{ µS/cm}}{200 \text{ PPM}} = \textbf{2.00}$$

Troubleshooting

Display Condition	Possible Causes	Suggested Solutions
"- - - -"	• Display is over range. This may be a normal condition if your process operates at/near the limits of the sensor range.	• Check sensor for correct range. • Check Decimal setting in OPTIONS menu. • Check Calibrate menu settings for incompatible SOURCE and RANGE values.
Value Must be less than 3	The PPM factor must be a value from 0.00 to 3.00	Set a PPM value less than 3.
Value must be greater than 0	Custom cell constant cannot be set to 0	Set cell constant to a value greater than 0
"Value must be 400 or less"	Pulse Rate cannot be greater than 400	Set a pulse rate value less than 400
Display erratic, shows "0" or "------" intermittently	Aux Power not connected	Wire 8850 according to diagram (Section 3.1)
"Too much Error Check Sensor"	• Defective or dirty/coated sensor • Wiring error • Fluid conductivity too low • Defective temp element	• Clean or replace sensor • Check and correct wiring • Replace sensor

Technical notes

If a Current Loop is locked at 3.6 mA, the problem is related to the temperature circuit:

This occurs only if the 8850 detects a resistance from the temperature sensor that is less than 250Ω or greater than 2800Ω.

- Check the sensor wiring for open/short or poor connections on white (TEMP IN) and black (ISO GND)wires.
- The PT1000 temperature device in the sensor is defective.
- The transmitter is defective.

Notes

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Signet Scientific Company, 3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: gfsignet.com • Or call (in the U.S.): (800) 854-4090

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