Instruction Manual
PN 51-1055CLpH/rev.M
November 2005

Model SOLU COMP® II

Dual Input Chlorine/pH Analyzer

ROSEMOUNT® Analytical

EMERSON™ Process Management

ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Your purchase from Rosemount Analytical, Inc. has resulted in one of the finest instruments available for your particular application. These instruments have been designed, and tested to meet many national and international standards. Experience indicates that its performance is directly related to the quality of the installation and knowledge of the user in operating and maintaining the instrument. To ensure their continued operation to the design specifications, personnel should read this manual thoroughly before proceeding with installation, commissioning, operation, and maintenance of this instrument. If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired.

- Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.
- Ensure that you have received the correct model and options from your purchase order. Verify that this manual covers your model and options. If not, call 1-800-854-8257 or 949-757-8500 to request correct manual.
- For clarification of instructions, contact your Rosemount representative.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Use only qualified personnel to install, operate, update, program and maintain the product.
- Educate your personnel in the proper installation, operation, and maintenance of the product.
- Install equipment as specified in the Installation section of this manual. Follow appropriate local and national codes. Only connect the product to electrical and pressure sources specified in this manual.
- Use only factory documented components for repair. Tampering or unauthorized substitution of parts and procedures can affect the performance and cause unsafe operation of your process.
- All equipment doors must be closed and protective covers must be in place unless qualified personnel are performing maintenance.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired.

WARNINGS

RISK OF ELECTRICAL SHOCK

□ Equipment protected throughout by double insulation.

- Installation of cable connections and servicing of this product require access to shock hazard voltage levels.
- Main power and relay contacts wired to separate power source must be disconnected before servicing.
- Do not operate or energize instrument with case open!
- Signal wiring connected in this box must be rated at least 240 V.
- Non-metallic cable strain reliefs do not provide grounding between conduit connections! Use grounding type bushings and jumper wires.
- 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. Unused conduit openings must be sealed with NEMA 4X or IP65 conduit plugs to maintain the ingress protection rating (NEMA 4X).
- Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other applicable national or local codes.
- Operate only with front and rear panels fastened and in place over terminal area.
- Safety and performance require that this instrument be connected and properly grounded through a three-wire power source.
- Proper relay use and configuration is the responsibility of the user.

CAUTION

This product generates, uses, and can radiate radio frequency energy and thus can cause radio communication interference. Improper installation, or operation, may increase such interference. As temporarily permitted by regulation, this unit has not been tested for compliance within the limits of Class A computing devices, pursuant to Subpart J of Part 15, of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area may cause interference, in which case the user at his own expense, will be required to take whatever measures may be required to correct the interference.

WARNING

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

Emerson Process Management

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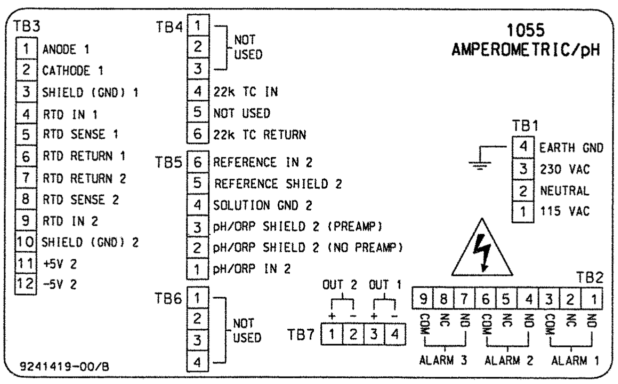
QUICK START GUIDE

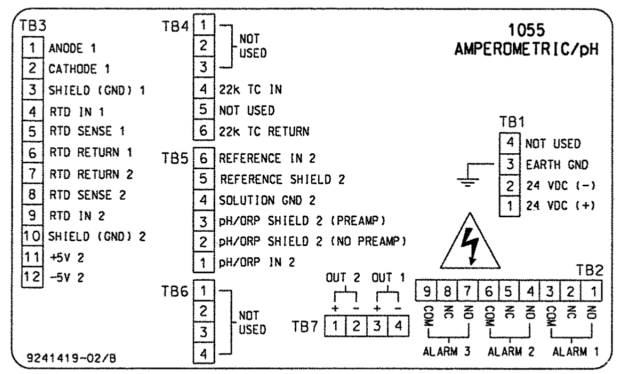
FOR MODEL SOLU COMP II CHLORINE/pH ANALYZER

(Model Options 1055-24-32 and 1055-24)

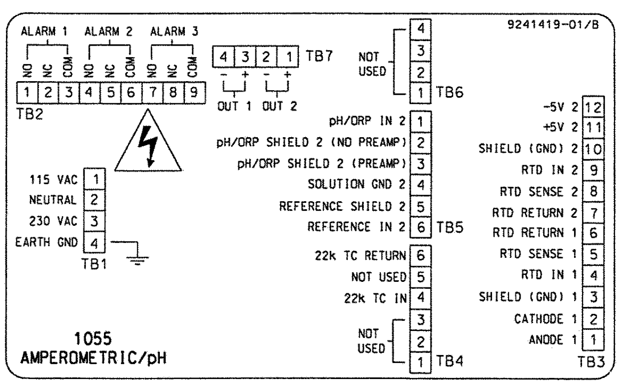
1. Refer to Section 2.0 for installation instructions.
2. Wire sensor(s) to the analyzer. See the drawings below. Refer to the sensor instruction sheet for details. Make alarm, output, and power connections as shown below.



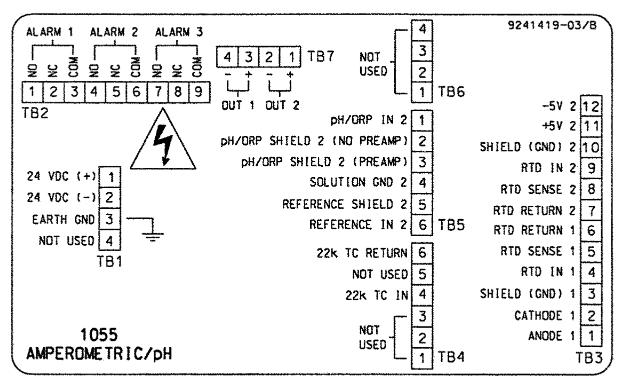
Wiring Connections for Solu Comp II Model 1055-01-10 (Panel Mount with 115/230 Vac Power)



Wiring Connections for Solu Comp II Model 1055-02-10 (Panel Mount with 24 Vdc Power)



Wiring Connections for Solu Comp II Model 1055-01-11 (Surface/Pipe Mounting with 115/230 Vac Power)



Wiring Connections for Solu Comp II Model 1055-02-11 (Surface/Pipe Mounting with 24 Vdc Power)

3. Once connections are secured and verified, apply power to the analyzer.

CONTINUED ON THE FOLLOWING PAGE

4. When the analyzer is powered up for the first time, **Quick Start** screens appear. Using **Quick Start** is easy.
   a. A blinking field shows the position of the cursor.
   b. Use the ◀ or ▶ key to move the cursor left or right. Use the ▲ or ▼ key to move the cursor up or down or to increase or decrease the value of a digit. Use the ▲ or ▼ key to move the decimal point.
   c. Press ENTER to store a setting. Press EXIT to leave without storing changes. Pressing EXIT also returns the display to the previous screen.

```
English        Fran ais
Espa ol              >>
```

5. Choose the desired language. Choose **>>** to show more choices.

```
# of sensors?
One                 Two
```

6. Choose the number of sensors wired to the analyzer.

```
S1 Chlorine Type
free      total      >>
```

7. Choose the measurement for sensor 1 (chlorine). Choose **>>** for more choices.

NOTE

If one sensor is selected, only **S1** (chlorine) will be available. **S2** (pH/ORP) cannot be chosen for single measurement.

```
S2 Measure?          pH
Redox               ORP
```

8. Choose the measurement for sensor 2 (pH). If the analyzer was configured to measure chlorine only, this screen does not appear.

```
Temperature in?
 C                    F
```

9. Choose temperature units.

10. The main display appears. The outputs and alarms are assigned to default values.

11. If free chlorine is to be measured (499ACL-01 sensor), the analyzer must be configured for automatic or manual pH correction. Go to the main menu and choose **Program** followed by **Measurement**. Choose **Sensor 1** then **Free Chlorine**. Choose **Auto** or **Manual** pH correction. For manual pH correction, enter the pH of the process liquid.

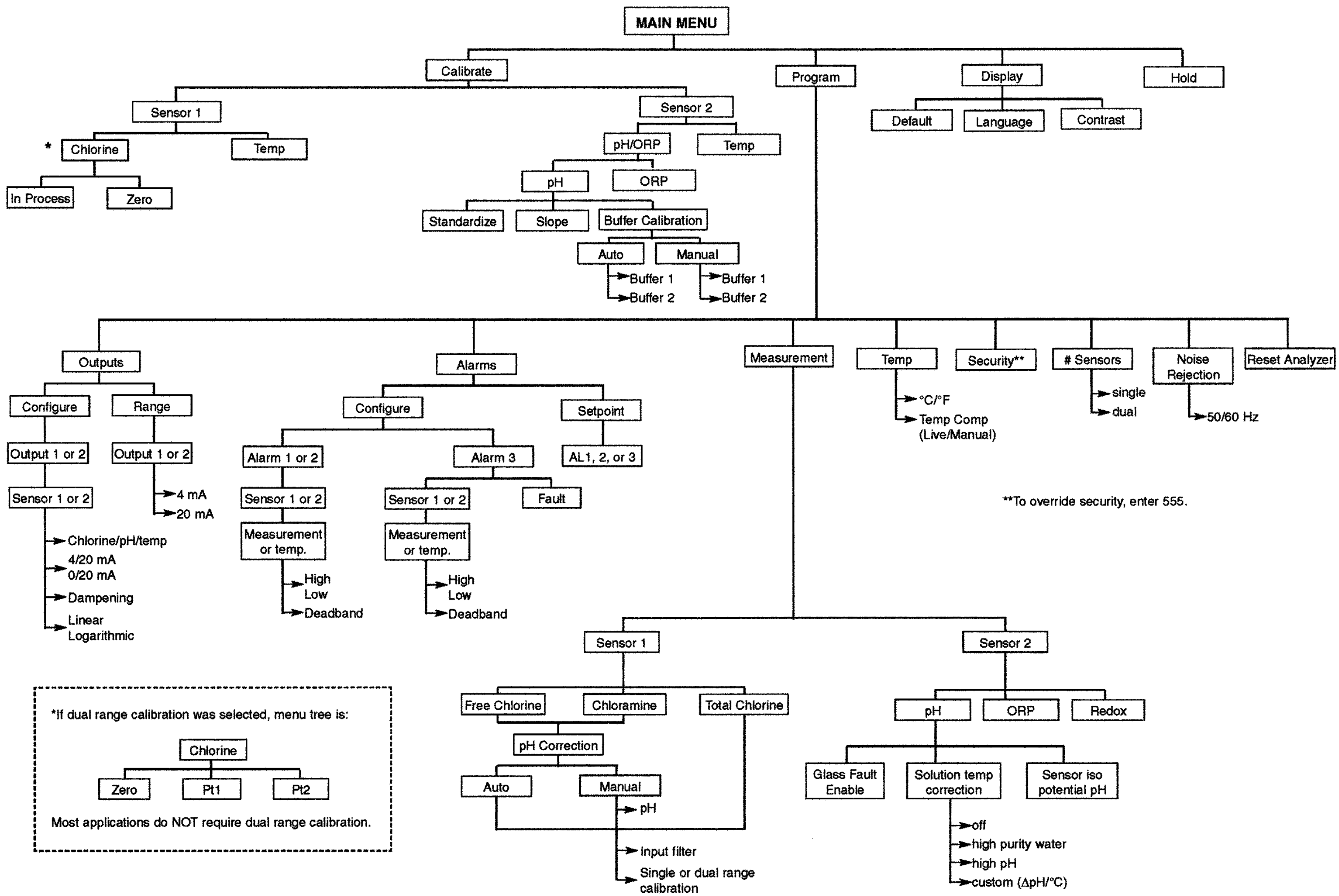
    If total chlorine (499ACL-02 sensor) or monochloramine (499ACL-03 sensor) is to be measured, pH correction is NOT required.

12. To change outputs, alarms, and temperature-related settings, go to the main menu and choose **Program**. Follow the prompts. For a guide to the Program menu, see the menu tree on the following page.

13. To return the analyzer to the default settings, choose **Reset Analyzer** in the Program menu.

QUICK REFERENCE GUIDE

MENU TREE FOR CHLORINE/pH MEASUREMENTS



About This Document

This manual contains instructions for installation and operation of the Solu Comp II Model 1055 Dual Input Chlorine/pH Analyzer.

The following list provides notes concerning all revisions of this document.

Rev. Level	Date	Notes
A	12/01	This is the initial release of the product manual. The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering.
B	2/02	Revise wiring diagrams.
C	7/02	Add UL specs.
D	10/02	Deleted option code -41 reference.
E	4/03	Added Monochloramine section and updated CE specs.
F	8/03	Minor textual revisions on pages 42, 55, 63, 71, 74-77.
G	12/03	Updated troubleshooting section 8.1.
H	3/04	Revised H2SO4 specs and recommended sensors on pages 4 & 6.
I	10/04	Updated mounting drawings on pages 13 & 14.
J	11/04	Updated mounting drawing on page 12.
K	12/04	Updated USP references.
L	4/05	Revised panel mount drawing.
M	11/05	???

MODEL SOLU COMP II
DUAL INPUT CHLORINE/pH ANALYZER

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SECTION 1.0.
DESCRIPTION AND SPECIFICATIONS

1.1 FEATURES AND APPLICATIONS

The Solu Comp II analyzers offer the choice of single or dual sensor input with measurement choices of pH/ORP, resistivity/conductivity/TDS, % concentration, ratio conductivity, total and free chlorine, chlorine, dissolved ozone, flow and temperature. Dual measurement analyzers offer a wide choice of measurement combinations thus reducing the cost per loop and needed panel space.

FIELD COMMISSION OPTION: The Solu Comp II can be ordered with the ability to commission measurements in the field. This added flexibility can greatly reduce the number of spare instruments required for field servicing.

QUICK START PROGRAMMING: Exclusive Quick Start screens appear the first time the Solu Comp II is powered up. Screen prompts direct the user to register the number of sensors, the measurement unit(s) and the language to display. Some measurement specific prompts are also displayed. The measurement loop is ready for use in a matter of minutes.

MENUS: Menu screens for calibrating and registering choices are simple and intuitive. Plain language prompts guide the user through the procedures. There are no service codes to enter before gaining access to menus.

DUAL SENSOR INPUT AND OUTPUT: The Solu Comp II accepts single or dual sensor input. The two 4-20 mA outputs can be independently programmed to correspond to any selected measurement or temperature. Output damping and linear or log output may also be field selected.

ALARMS: The Solu Comp II has three fully programmable alarm relays that can be assigned to any selected measurement or temperature. Alarms can be configured as high, low, or USP[1]. The third relay has the additional choice of fault alarm operation. When selected, a fault alarm will activate the relay when a sensor or analyzer fault occurs.

ENCLOSURE: The panel mount version fits standard ½ DIN panel cutouts, and its shallow depth is ideally suited for easy mounting in Hoffman-type enclosures. A panel mount gasket is included to maintain the weather rating of the panel. Surface/pipe mount enclosure includes self-tapping screws for surface mounting. A pipe mounting accessory kit is available for mounting to a 2-inch pipe.

DISPLAY: The two-line, 16-character, back-lit display can be customized to meet user requirements. All operations and descriptive messages can be field selected for English, French, German, Italian, Spanish, or Portuguese. Informative screens, which permit data not shown in the regular display, may be seen at the push of a button.

TEMPERATURE: Most measurements (except ORP and flow) require temperature compensation. The Solu Comp II will automatically recognize either a Pt100 or Pt1000 RTD, normally built into the sensor. When this RTD is present, the Solu Comp II can be set up to display the temperature in °C or °F as well as set any one or more of the alarms and/or outputs to respond to this sensor input. If two measurements with temperature are present either can be chosen for each alarm and output selected.

[1] *USP alarm applies to conductivity/resistivity only.*

1.2 SPECIFICATIONS - General

Case: ABS. Pipe, surface, and panel mount versions are NEMA 4X/CSA 4 (IP65).

Dimensions

Panel (code -10): 6.10 x 6.10 x 3.72 in. (155 x 155 x 94.5 mm)

Surface/Pipe (code -11): 6.23 x 6.23 x 3.23 in. (158 x 158 x 82 mm); see page 5 for dimensions of pipe mounting bracket.

Conduit openings: Accepts PG13.5 or 1/2 in. conduit fittings

Display: Two line, 16-character, back-lit display. Character height: 4.8 mm. Display can be customized to meet individual requirements. Depending on number of sensors, as many as 14 display screens are available.

Ambient temperature and humidity: 0 to 50°C, (32 to 122°F) RH 5 to 95% (non-condensing)

Note: The analyzer is operable from -20 to 60°C (-4 to 140°F) with some degradation in display performance.

Power:

Code -01: 115/230 Vac ±15%, 50/60 Hz ±6%, 8.0W
Code -02*: 24 Vdc ±15%, 6.0W
Installation Category II

* *For +24Vdc Power Supply use only devices meeting NEC Class II or UL recognized (UL 1950).*

Equipment protected throughout by double insulation.

Hazardous Location:

C US –LR 34186 Class I, Division 2, Groups A, B, C, & D

FM APPROVED

POLLUTION DEGREE 4: Extended Environment Outdoor use where conductive contamination such as rain, snow, or dust may be present. (Hazardous Location only)

Ordinary Location: (-68 only)

UL LISTED

12RN

POLLUTION DEGREE 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

RFI/EMI: EN-61326
LVD: EN-61010-1

Input: Choice of single or dual sensor input with measurement choices of pH/ORP, conductivity/resistivity, toroidal conductivity, flow, chlorine, dissolved oxygen, and dissolved ozone. Field-commissioned units allow user to change measurements on either or both inputs. See combination guide for valid combinations. For contacting conductivity measurements, temperature element must be a Pt 1000 RTD. For other measurements, use either a Pt100 RTD, Pt1000 RTD, or 22k NTC (D.O. only).

Outputs: Two 4-20 mA or 0-20 mA isolated outputs. Continuously adjustable. Linear or logarithmic. Maximum load 600 ohms. Output dampening with time constant of 5 sec is user-selectable.

Alarms: Three alarm relays for process measurement(s) or temperature. Alarm 3 can be configured as a fault alarm, instead of a process alarm. Each relay can be configured independently. Alarm logic (high or low activation or USP*) and deadband are user-programmable. The USP* alarm can be programmed to activate when the conductivity is within a user-selectable percentage of the limit.

**conductivity/resistivity measurement only*

Relays: Form C, single pole double throw, epoxy sealed

	Resistive	Inductive
28 Vdc	5.0 A	3.0 A
115 Vac	5.0 A	3.0 A
230 Vac	5.0 A	1.5 A

Terminal Connections Rating: 26-14 AWG wire size

Weight/Shipping weight (rounded up to nearest lb or nearest 0.5 kg)**:** 3 lb (1.5 kg)/4 lb (2.0 kg)

CONTACTING CONDUCTIVITY (Codes -20 and/or -30)

Measures conductivity in the range 0 to 20,000 µS/cm. Display choices are conductivity, resistivity, and TDS (total dissolved solids). Three temperature corrections are available: high purity water (dilute sodium chloride), cation conductivity (dilute hydrochloric acid), and adjustable linear temperature coefficient (0 to 5.00%/°C). Temperature correction can be disabled, allowing the analyzer to display raw conductivity.

PERFORMANCE SPECIFICATIONS -

Range	Cell constant (/cm)	Accuracy[1,2]
0.055 - 9.99 µS/cm	0.01	0.9% of reading or ±0.002 µS/cm
10 - 50 µS/cm	0.01	±2% of reading
0.055 - 500 µS/cm	0.1	±2% of reading or ±0.1 µS/cm
0.055 - 5000 µS/cm	1.0	±2% of reading or ±1 µS/cm
0 - 5 mS/cm	1.0	±2% of reading or ±0.001 mS/cm
0 - 20 mS/cm	10	±2% of reading or ±0.01 mS/cm

ANALYZER (CONDUCTIVITY INPUT)

Accuracy (Resistivity):** 0.9% of reading

Accuracy (Temperature):** ±0.1°C between 5°C and 100°C; ±1°C between 101°C and 200°C

Stability: 0.5% of reading/month

Ambient Temperature Effect: ±0.05% of reading/°C

Output Accuracy: ±0.1 mA

Temperature correction: High purity water (dilute sodium chloride), cation conductivity (dilute hydrochloric acid), linear temperature coefficient (0.0 to 5.00%/°C), or none. High purity water and cation conductivity temperature correction apply between 0 and 100°C. Linear temperature coefficient can be applied between -5 and 200°C.

Measurement Range: 0.0 to 20,000 µS/cm, 0.05 to 20 MΩ-cm, or 0 to 10,000 ppm TDS

Temperature Range: -5°C to 200°C (23°F to 392°F)

```
12.34 µS/cm  40.3 C
7.34pH       25.3 C
```

[1] *whichever is greater*
[2] *Accuracy values pertain to Endurance Model 400 Series conductivity sensors only*

RECOMMENDED SENSORS FOR CONDUCTIVITY:

The Solu Comp II is intended for use with the ENDURANCE Model 400 series conductivity sensor (Pt 1000 RTD).

Model 400 Screw-in/Insertion

Model 400VP Screw-in/Insertion with 6.0 VP connector

Model 401 Screw-in/Insertion (except 401-15)

Model 402 Retractable

Model 402VP Retractable with 6.0 VP connector

Model 403 Sanitary Flanged

Model 403VP Sanitary Flanged with 6.0 VP connector

Model 404 Flow-Through

The analyzer can also be used with Rosemount Analytical conductivity sensor Models 140, 141, 142, and 150 having a Pt 100 RTD.

Refer to the table to select the appropriate cell constant.

Range, µS/cm	Cell constant, /cm
0.0 to 50	0.01
5 to 500	0.1
50 to 5,000	1.0
500 to 20,000	10

Ratio Conductivity (Codes -20-30):

The dual conductivity Solu Comp II can function as a ratio analyzer or recovery device (% passage or % rejection). Product sensor 2's conductivity reading is always displayed.

Ratio

```
Ratio         .3325
S2     4.621 µS/cm
```

%Pass

```
%Passage       12.1
S2     4.621 µS/cm
```

%Reject

```
%Reject        87.9
S2     4.621 µS/cm
```

TOROIDAL CONDUCTIVITY (Codes -21 and/or -31)

When used with Model Series 200 Toroidal Conductivity Sensors, display choices are conductivity, resistivity, and percent concentration. The percent concentration selection includes the choice of four common solutions (0-12% NaOH, 0-15% HCl, and 0-25% or 96-99.7% H_2SO_4). The conductivity-concentration algorithms for these solutions are fully temperature compensated. For other solutions, a simple-to-use menu allows the customer to enter his own data. The analyzer accepts as many as five (5) data points and fits either a linear (two [2] points) or a quadratic function (three [3] or more points) to the data. Reference temperature and linear temperature slope may also be adjusted for optimum results.

RECOMMENDED SENSORS:

Model 222 Flow-through conductivity sensor

Model 225 Clean-in-place conductivity sensor

Model 226 Large bore conductivity sensor

Model 228 Toroidal conductivity sensor

Model 242 Flow-through conductivity sensor

Model 247 Economy conductivity sensor

PERFORMANCE SPECIFICATIONS -

Measurement Range: see table below

Accuracy: ± 1% of reading and ± 0.01 mS/cm

Repeatability: ± 0.5% of reading and ± 0.005 mS/cm

Stability: ± 0.25% of reading and ± 0.005 mS/cm/month, noncumulative

Ambient Temperature Effect: ± 0.05% of reading/°C

Temperature Compensation: -15 to 200°C (5 to 392°F) automatic or manual. Automatic requires a Pt100/1000 RTD

Temperature correction: Linear temperature coefficient (0.0 to 5.00%/°C) neutral salt (dilute sodium chloride) or none

```
S1  1027mS/cm     100 C
S2  847.1µS/cm    100 C
```

INDUCTIVE SENSORS					
Conductivity Sensor Model Number	226	228	225	222 (1in.)	222 (2 in.)
Cell Constant*	1.0	3.0	3.0	6.0	4.0
Minimum Range	50	250	250	500	500
Maximum Range	1,000,000	2,000,000	2,000,000	2,000,000	2,000,000
* Typical	FULL SCALE MICROSIEMENS/cm				

pH/ORP (Codes -22 and/or -32)

For use with any standard pH or ORP sensor and all Uniloc sensors and junction boxes with built-in diagnostic style preamplifiers, display choices are pH, ORP or Redox. The automatic buffer recognition feature uses stored buffer values and their temperature curves for the most common buffer standards available worldwide. The analyzer will recognize the value of the buffer being measured and perform a self stabilization check on the sensor before completing the calibration. Manual or automatic temperature compensation is keypad selectable. Change in pH due to process temperature can be compensated using a programmable temperature coefficient or isopotential point. Measurement and display of pH glass and reference impedance helps alert the user to sensor maintenance needs.

**reference impedance is suppressed with amperometric/pH combinations (-24, -25, -26)*

PERFORMANCE SPECIFICATIONS - ANALYZER (pH INPUT)

Measurement Range [pH]: 0 to 14 pH

Accuracy: ±0.01 pH

Repeatability: ±0.01 pH

Stability: ±0.01 pH/month, non-cumulative

Temperature Coefficient: ±0.003 pH/°C

Temperature Compensation: Pt100/Pt1000 RTD, Automatic or Manual -15 to 100°C (5 to 212°F)

Temperature Correction: Choose from standard measurement compensation, solution temperature correction for high purity or dilute base solutions, and custom temperature correction.

PERFORMANCE SPECIFICATIONS - ANALYZER (ORP INPUT)

Measurement Range [ORP]: -1400 to +1400 mV

Accuracy: ±2.0 mV

Repeatability: ±1.0 mV

Stability: ±1.0 mV/month, non-cumulative

Temperature Coefficient: ±0.2 mV/°C

Temperature Measurement: -15 to 100°C (5 to 212°F)

Temperature Correction: none required

```
S1  4.34pH      25 C
S2 12.34pH      27 C
```

RECOMMENDED SENSORS FOR pH:

Model 320B Flow Through pH
Model 320HP High Purity pH
Model 328A Steam Sterilizable pH
Model 370 and 371 EuroSenz pH
Model 381+ Insertion/Submersion/Flow Through pH
Model 385+ Insertion/Submersion/Retractable pH
Model 389 Insertion/Submersion pH
Model 396 Insertion/Submersion pH
Model 396VP Insertion/Submersion pH with VP 6.0 connector
Model 396P Insertion/Submersion pH
Model 396PVP Insertion/Submersion pH with VP 6.0 connector
Model 396R Retractable pH
Model 396RVP Retractable pH with VP 6.0 connector
Model 397 Quik Disconnect pH
Model 398 Insertion/Submersion pH
Model 398VP Insertion/Submersion with VP 6.0 connector
Model 398R Retractable pH
Model 398RVP Retractable pH with VP 6.0 connector
Model 399 Insertion/Submersion pH
Model Hx338 Steam Sterilizable pH
Model Hx348 Steam Sterilizable pH

RECOMMENDED SENSORS FOR ORP:

Model 330 Flow Through ORP
Model 371 EuroSenz ORP
Model 381+ Insertion/Submersion/Flow Through ORP
Model 385+ Insertion/Submersion/Retractable pH
Model 389 Insertion/Submersion ORP
Model 396P Insertion/Submersion ORP
Model 396PVP Insertion/Submersion ORP with VP 6.0 connector
Model 396R Retractable ORP
Model 398 Insertion/Submersion ORP
Model 398VP Insertion/Submersion with VP 6.0 connector
Model 398R Retractable ORP
Model 398RVP Retractable ORP with VP 6.0 connector

When used with conductivity (-20-32 or -22-30):

Model 320HP High Purity ORP
Model 381+ Insertion/Submersion/Flow Through ORP
Model 385+ Insertion/Submersion/Retractable ORP
Model 396P Insertion/Submersion ORP
Model 396PVP Insertion/Submersion ORP with VP 6.0 connector
Model 396R Retractable ORP
Model 396RVP Retractable ORP with VP 6.0 connector

FLOW
(Standard on all models or stand alone, Code -23 and/or -33)

For use with most pulse signal flow sensors, the Solu Comp II's user selectable units of measure include flow rates in GPM (Gallon per minute), LPM (liters per minute), or m3/hr (cubic meters per hour), and velocity in ft/sec or m/sec. When configured to measure flow, the unit also acts as a totalizer in the chosen unit (gallons, liters, or cubic meters).

Dual flow instruments can be configured as a % recovery device or a flow difference device.

PERFORMANCE SPECIFICATIONS

Frequency Range: 0.5 - 4000 Hz

Flow Rate: 0 - 9999 GPM, LPM, m3/hr

Totalized Flow: 0 - 9,999,999 Gallons; 37,850,000 Liters; 37,850 m3

Accuracy: ±1% (±1.5% from 3000 to 4000 Hz)

Repeatability: ±1%

RECOMMENDED SENSORS

+GF+ Signet 515 Rotor-X Flow sensor Model 515/8510-XX (PN P51530-PO)

Fluidyne Flow Sensor Model 2300A (PN Hydro-Flow-2300-A-10-5R-3-1-1)

Consult factory for other pulse type sensor compatibility.

```
S2 12.34 GPM
S2 47.25K Gal
```

FREE AND TOTAL CHLORINE (Code -24)

When used with a chlorine specific membrane-covered amperometric sensor, display choices are free chlorine or total chlorine. (Total chlorine measurement requires the use of the Model SCS921 or other sample conditioning system). Because the permeability of the membrane is a function of temperature, a correction is necessary when the sensor is used at a temperature different from the one at which it was calibrated. The Solu Comp II automatically applies the temperature correction factor. The process temperature is measured by an RTD in the sensor. An input filter allows the user to configure the analyzer for rapid response or low noise. The low noise option is recommended for samples containing less than 0.1 ppm chlorine.

pH is also a factor in the measurement of free chlorine. An aqueous solution of free chlorine is a mixture of hypochlorous acid and hypochlorite ion. The relative amount of each depends on the temperature and pH. Generally, increasing the pH and temperature reduces the amount of hypochlorous acid in the mixture. Because the response of the sensor to hypochlorous acid is greater than its response to hypochlorite, accurate determination of chlorine requires knowledge of the pH and temperature of the sample. If the pH is relatively constant, a fixed pH correction factor can be entered into the analyzer. If the pH is greater than 7 and fluctuates by more than 0.2, continuous measurement of the pH and automatic pH correction is necessary. For automatic pH correction, select code -32 and an appropriate pH sensor.

PERFORMANCE SPECIFICATIONS

Measurement Range: 0-20 ppm (mg/L) chlorine (as Cl_2)

Resolution: 0.001 ppm

Automatic pH Correction (requires Code -32): 5.0 to 9.5 pH

Temperature Correction: Automatic (with Pt100 RTD in sensor) or manual 0-50°C. Can be disabled if desired.

Input filter: time constant 1 - 999 sec

RECOMMENDED SENSORS

Chlorine: 499A CL-01 Free Chlorine or 499A CL-02 Total Residual Chlorine (requires sample conditioning)

pH: 399-09-62, 399VP-09, 399-14

```
      12.34 ppm
26.3 C       8.34pH
```

DISSOLVED OXYGEN (Code -25)

The Solu Comp II is compatible with the Model 499ADO, 499ATrDO, Hx438, and Gx438 dissolved oxygen sensors. The sensors are membrane-covered amperometric sensors. For more information concerning the use and operation of the amperometric oxygen sensors, refer to the product data sheets. The Solu Comp II displays dissolved oxygen in ppm, ppb, or percent saturation.

The Solu Comp II fully compensates oxygen readings for changes in membrane permeability caused by temperature changes. In the Model 499ADO and 499ATrDO sensors, temperature is measured by a Pt 100 RTD. The Hx438 and Gx438 sensors use a 22kNTC.

Calibration is easy. Simply expose the sensor to water saturated air. Wait until readings are stable and press a few keys. The analyzer measures the temperature and barometric pressure and automatically completes the calibration. If removing the sensor from the process liquid is impractical, the analyzer can be calibrated against a standard instrument. Calibration can be corrected for process salinity.

PERFORMANCE SPECIFICATIONS

Measurement Range: 0-20 ppm (mg/L) dissolved oxygen; 0- 250% saturation

Resolution: 0.01 ppm; 0.1 ppb for 499A TrDO sensor (when O_2 <1.00 ppm); 0.1%

Temperature Correction for Membrane Permeability: Automatic (with Pt100 RTD in sensor) or manual 0-50°C. Can be disabled if desired.

Input filter: time constant 1 - 999 sec

RECOMMENDED SENSORS

Model 499A DO Dissolved Oxygen Sensor

Model Hx438 Steam Sterilizable Dissolved Oxygen Sensor

Model Gx438 Steam Sterilizable Dissolved Oxygen Sensor

Model 499A TrDO Trace Dissolved Oxygen Sensor

```
      10.34 ppm
29.3 C      12.34mA
```

DISSOLVED OZONE (Code -26)

For use with an ozone permeable membrane-covered amperometric sensor. Because the permeability of the membrane is a function of temperature, a correction is necessary when the sensor is used at a temperature different from the one at which it was calibrated. The Solu Comp II automatically applies the temperature correction factor. The process temperature is measured by an RTD in the sensor. The Solu Comp II is calibrated taking a measurement of the ozone level in the process by an independent chemical method and setting the display equal to the measured value. An input filter allows the user to configure the analyzer for rapid response of low noise. The low noise option is recommended for samples containing less than 0.1 ppm dissolved ozone.

```
      10.34 ppm
29.3 C      12.34mA
```

PERFORMANCE SPECIFICATIONS

Measurement Range: 0-10 ppm (mg/L)

Resolution: 0.001 ppm dissolved ozone

Temperature Correction for Membrane Permeability: Automatic (with Pt100 RTD in sensor) or manual 0-35°C. Can be disabled if desired.

Input filter: time constant 1 - 999 sec

RECOMMENDED SENSOR

Model 499A OZ Dissolved Ozone Sensor

LOOP SPECIFICATIONS WITH A MODEL 499A OZ SENSOR

Loop Accuracy: ±5% of reading or ± 3 ppb at 25°C, whichever is greater

Repeatability: ±2% of reading at a constant temperature

1.3 ORDERING INFORMATION

The Solu Comp II analyzers offer the choice of single or dual sensor input with measurement choices of pH/ORP, conductivity/resistivity, toroidal conductivity, flow, chlorine, dissolved oxygen, and dissolved ozone. See combination guide (on the following page) for valid combinations. Standard features include two isolated outputs, three alarm relays, customizable two-line display, and temperature correction.

MODEL 1055 SOLU COMP II ANALYZER

CODE	POWER
01	115/230 Vac, 50/60 Hz
02	24 Vdc

CODE	MOUNTING
10	Panel mounting enclosure
11	Pipe/Surface mounting enclosure (Pipe mounting requires accessory kit PN 23820-00)

CODE	MEASUREMENT 1 (Required Selection)
20	Contacting Conductivity
21	Toroidal Conductivity
22	pH/ORP
23	Flow
24	Chlorine
25	Dissolved Oxygen
26	Ozone

CODE	MEASUREMENT 2 (Optional)
30	Contacting Conductivity
31	Toroidal Conductivity
32	pH/ORP
33	Flow

CODE	OPTIONAL
68	UL Approval

Field Commissioned Suites option offers the user the ability to commission the Solu Comp II to any valid measurement combination. This feature provides the benefit of a reduction in the number of spare instruments required to meet emergency inventory needs. Please refer to the Suites tables (on the following page) for valid measurement combinations. Suites include a complete set of instrument wiring labels.

MODEL 1055 SOLU COMP II ANALYZER

CODE	POWER
01	115/230 Vac, 50/60 Hz
02	24 Vdc

CODE	MOUNTING
10	Panel mounting enclosure
11	Pipe/Surface mounting enclosure (Pipe mounting requires accessory kit PN 23820-00)

CODE	FIELD-COMMISSIONED SUITES (Optional) see tables below
S1	Suite 1 - Field Commissioned Measurement (basic)
S1A	Suite 1 - Field Commissioned Measurement (includes amperometric)
S2	Suite 2 - Field Commissioned Measurement (basic)
S2A	Suite 2 - Field Commissioned Measurement (includes amperometric)

CODE	OPTIONAL
DM	Dual Measurement

CODE	OPTIONAL
68	UL Approval

COMBINATION GUIDE

Measurement Choices

Measure 1 \ Measure 2	None	pH/ORP	Flow	Conductivity Toroid	Conductivity Contact
pH/ORP					
Contacting conductivity					
Flow					
Toroidal Conductivity					
Dissolved Oxygen					
Chlorine					
Ozone					

Available

Not available

Field Commissioned Measurement Choices Suite 1

	Measure 1 \ Measure 2	None	Dual Measurement (DM) pH/ORP	Flow	Contacting Conductivity
Basic	pH/ORP				
	Contacting conductivity				
Amperometric	Dissolved Oxygen*				
	Chlorine				
	Ozone				
	Toroidal Conductivity				

Available

Not available

Field Commissioned Measurement Choices Suite 2

	Measure 1 \ Measure 2	None	Dual Measurement (DM) pH/ORP	Flow	Conductivity Toroid	Conductivity Contact
Basic	pH/ORP					
	Flow					
	Contacting conductivity					
	Toroidal Conductivity					
Amperometric	Dissolved Oxygen*					
	Chlorine					
	Ozone					

Available

Not available

* For D.O. sensors with 22k thermistor, use Suite 1 only.

ACCESSORIES (Weights are rounded up to nearest whole lb or 0.5 kg)

PART NUMBER	DESCRIPTION	WEIGHT	SHIPPING WT.
23820-00	Pipe mounting kit, includes U-bolts, mounting bracket, nuts, washers, and screws (complete)	2 lb (1.0 kg)	4 lb (2.0 kg)
23554-00	Gland fittings, PG 13.5, 5 per package	1 lb (0.5 kg)	2 lb (1.0 kg)
9240048-00	Tag, stainless steel (specify marking)	1 lb (0.5 kg)	1 lb (0.5 kg)
	pH INPUT		
9210012	Buffer Solution, 4.01 pH, 16 oz.	1 lb (0.5 kg)	2 lb (1.0 kg)
9210013	Buffer Solution, 6.86 pH, 16 oz.	1 lb (0.5 kg)	2 lb (1.0 kg)
9210014	Buffer Solution, 9.18 pH, 16 oz.	1 lb (0.5 kg)	2 lb (1.0 kg)
	CONDUCTIVITY INPUT		
SS-1	Conductivity Standard, 1409 µS/cm at 25°C, 1 quart (945 mL)	2 lb (1.0 kg)	4 lb (2.0 kg)
SS-1A	Conductivity Standard, 1409 µS/cm at 25°C, 1 gallon (3785 mL)	9 lb (4.0 kg)	11 lb (5.0 kg)
SS-5	Conductivity Standard, 1000 µS/cm at 25°C, 1 quart (945 mL)	2 lb (1.0 kg)	4 lb (2.0 kg)
SS-5A	Conductivity Standard, 1000 µS/cm at 25°C, 1 gallon (3785 mL)	9 lb (4.0 kg)	11 lb (5.0 kg)
SS-6	Conductivity Standard, 200 µS/cm at 25°C, 1 quart (945 mL)	2 lb (1.0 kg)	4 lb (2.0 kg)
SS-6A	Conductivity Standard, 200 µS/cm at 25°C, 1 gallon (3785 mL)	9 lb (4.0 kg)	11 lb (5.0 kg)
SS-7	Conductivity Standard, 5000 µS/cm at 25°C, 1 quart (945 mL)	2 lb (1.0 kg)	4 lb (2.0 kg)
SS-7A	Conductivity Standard, 5000 µS/cm at 25°C, 1 gallon (3785 mL)	9 lb (4.0 kg)	11 lb (5.0 kg)

SECTION 2.0.
INSTALLATION

2.1 UNPACKING AND INSPECTION

Inspect the shipping container. If it is damaged, contact the shipper immediately for instructions. Save the box. If there is no apparent damage, unpack the container. Be sure all items shown on the packing list are present. If items are missing, notify Rosemount Analytical immediately.

2.2 INSTALLATION

2.2.1 General Information

1. Although the analyzer is suitable for outdoor use, do not install it in direct sunlight or in areas of extreme temperatures.
2. Install the analyzer in an area where vibrations and electromagnetic and radio frequency interference are minimized or absent.
3. Keep the analyzer and sensor wiring at least one foot from high voltage conductors. Be sure there is easy access to the analyzer.
4. The analyzer is suitable for panel, pipe, or surface mounting. Refer to the table below.
5. See Section 3.1 for removal of conduit knockouts.

Type of Mounting	Section
Panel	2.2.2
Pipe	2.2.3
Surface	2.2.4

6. To reduce the likelihood of stress on wiring connections, the hinged front panel (-11 models) shall not be removed from the base during wiring installation, and there shall be sufficient wire leads to avoid stress on conductors.
7. For UL-approved models (-68), the clear wiring shield must be installed prior to operation.

2.2.2 Panel Mounting.

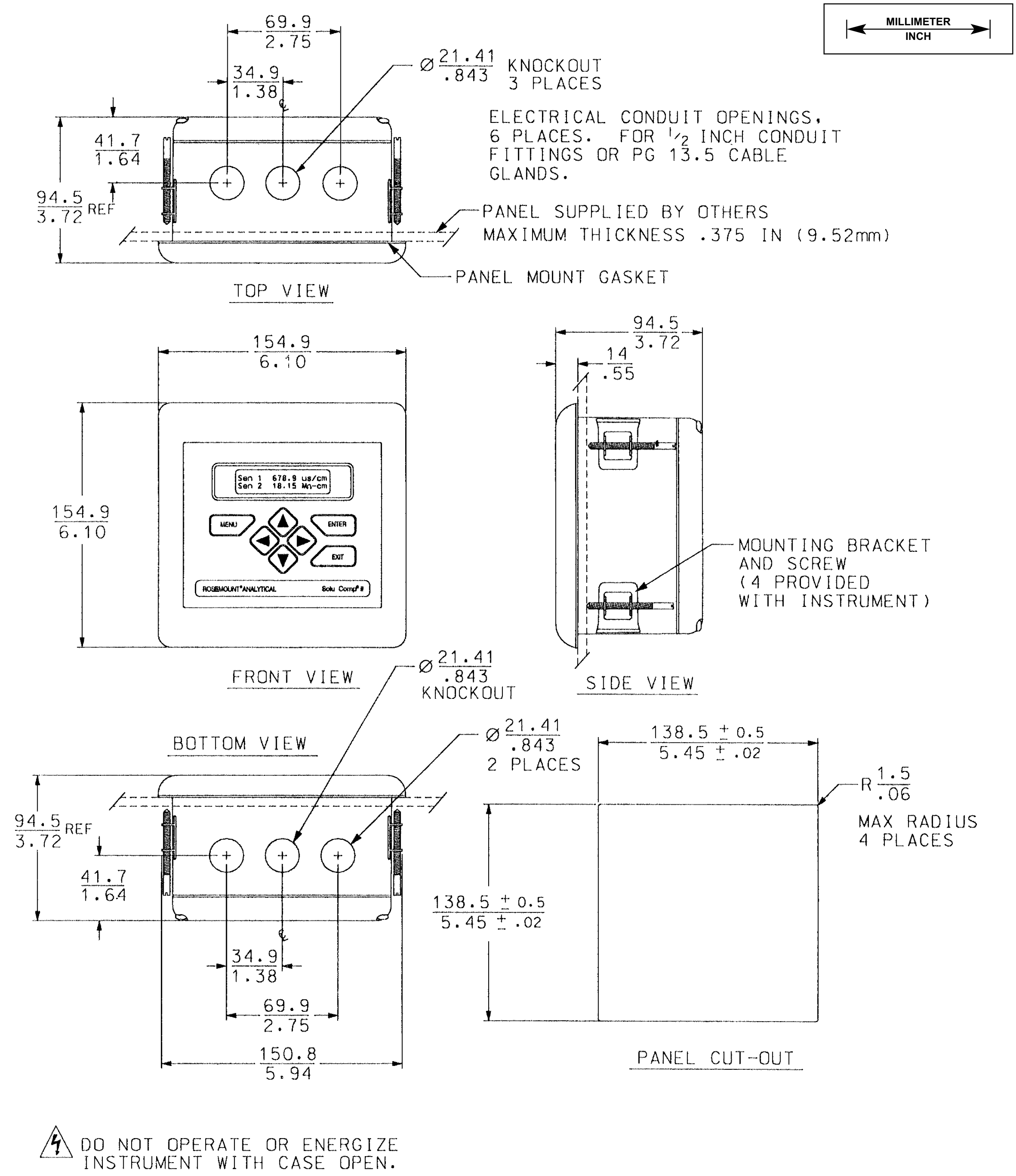


FIGURE 2-1. Panel Mount Installation

Access to the wiring terminals is through the rear cover. Four screws hold the cover in place.

2.2.3 Pipe Mounting

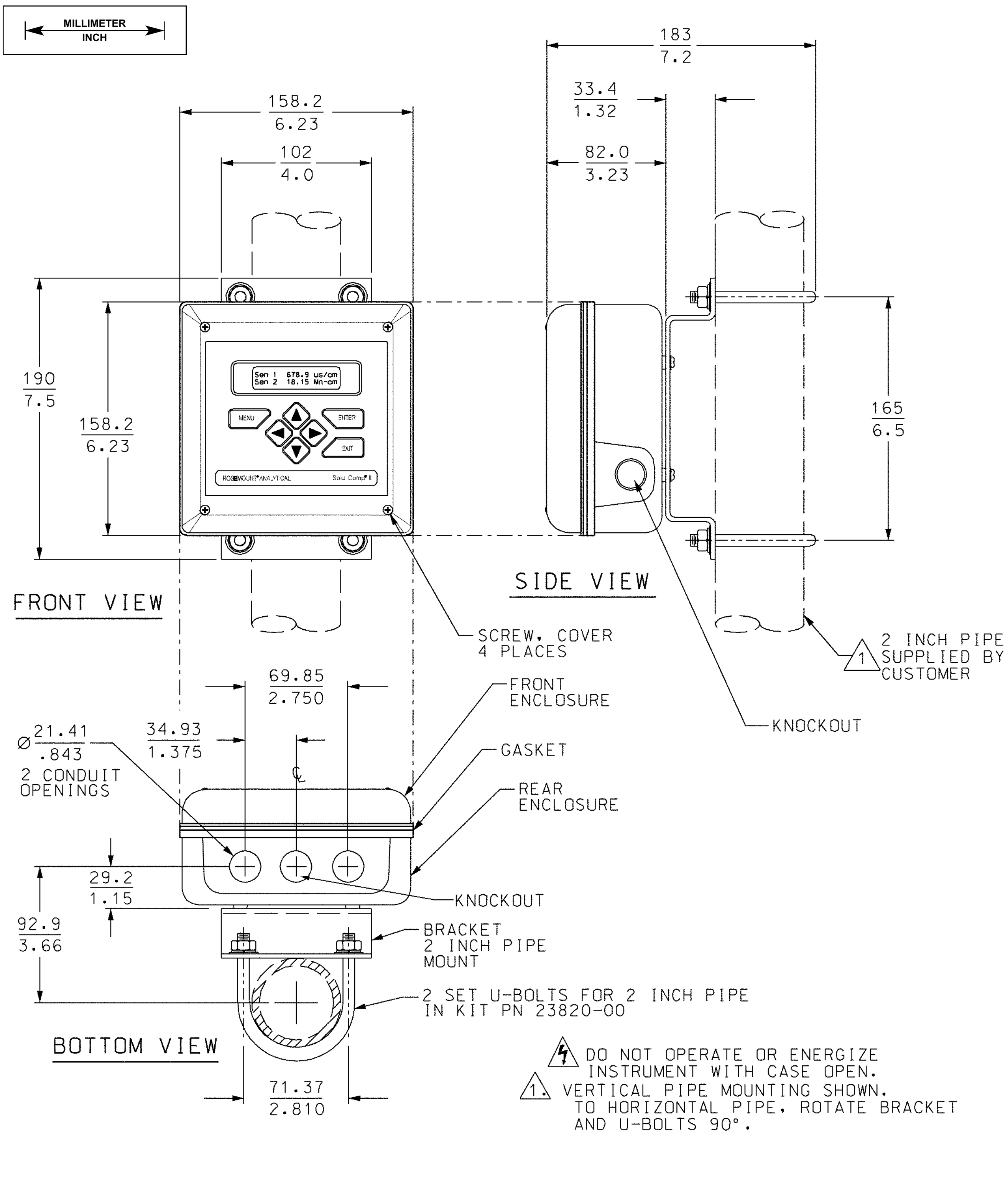


FIGURE 2-2. Pipe Mount Installation

The front panel is hinged at the bottom. The panel swings down for access to the wiring terminals.

2.2.4 Surface Mounting.

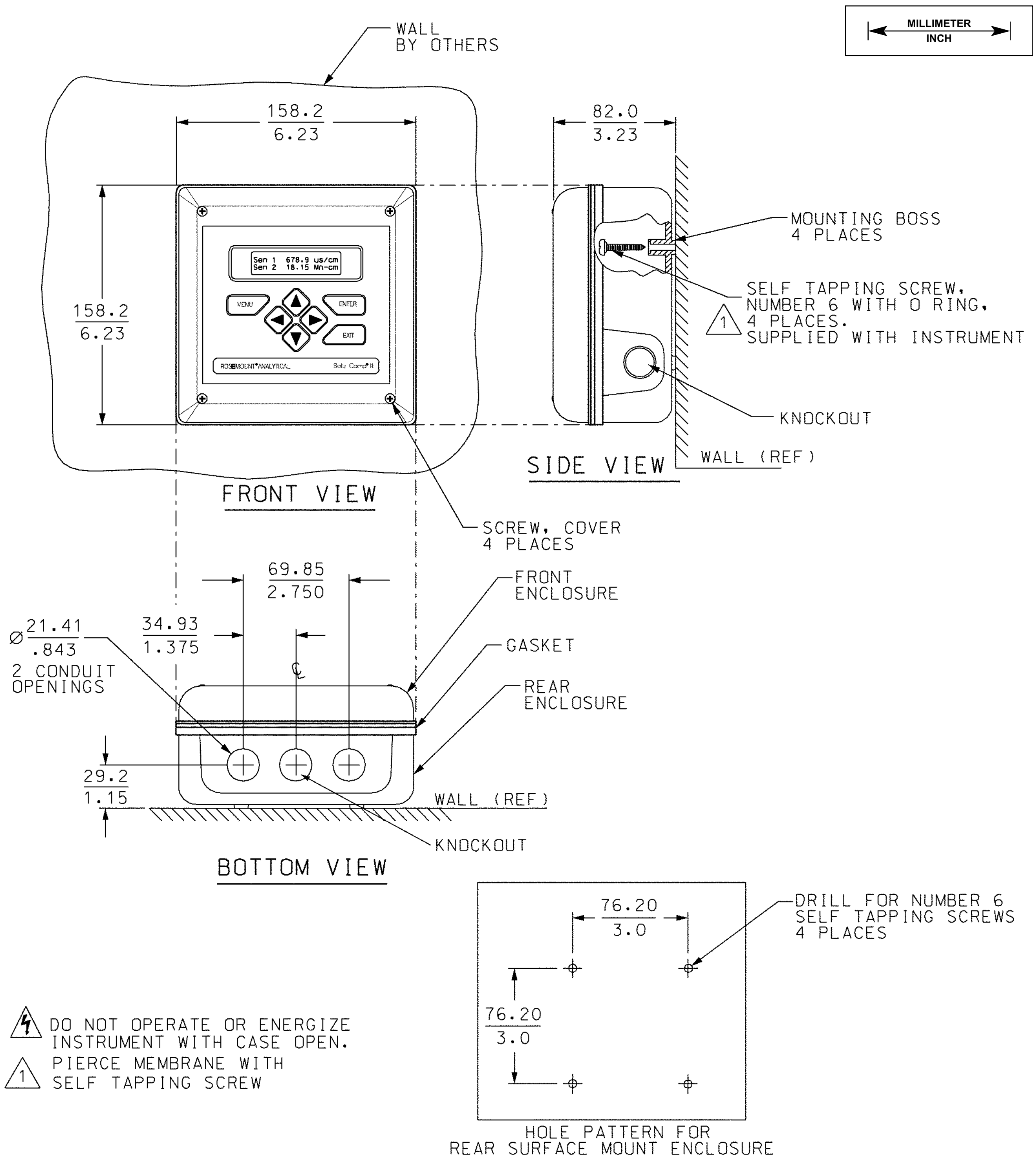


FIGURE 2-4. Surface Mount Installation

The front panel is hinged at the bottom. The panel swings down for access to the wiring terminals.

SECTION 3.0.
WIRING

3.1 PREPARING CONDUIT OPENINGS
3.2 POWER, ALARM, OUTPUT, AND SENSOR CONNECTIONS

3.1 PREPARING CONDUIT OPENINGS

The number of conduit openings and the location depend on the model.

Model	Description	Conduit openings
1055-10	panel mount	two open, three knockouts
1055-11	surface or pipe mount	three open, no knockouts

Conduit openings accept 1/2-inch conduit fittings or PG 13.5 cable glands. To keep the case watertight, block unused openings with NEMA 4X or IP65 conduit plugs.

NOTE

Use watertight fittings and hubs that comply with the requirements of UL514B. Connect the conduit hub to the conduit before attaching the fitting to the analyzer (UL508-26.16).

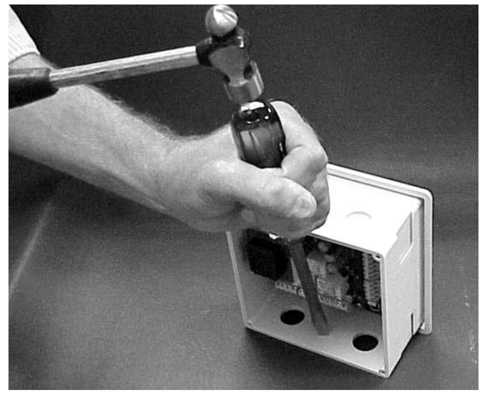


FIGURE 3-1. Removing the Knockouts

Figure 3-1 shows how to remove the knockouts. The knockout grooves are on the outside of the case. Place the screwdriver blade on the inside of the case and align it approximately along the groove. Rap the screwdriver sharply with a hammer until the groove cracks. Move the screwdriver to an uncracked portion of the groove and continue the process until the knockout falls out. Use a small knife blade to remove the flash from the inside of the hole.

3.2 POWER, ALARM, OUTPUT, AND SENSOR CONNECTIONS

3.2.1 General

The Solu Comp II is available in two mounting configurations. The positions of the power, alarm, output, and sensor terminals are different in each. Refer to the table below to find the correct drawing.

MODEL	MOUNTING	POWER	FIGURE
1055-01-10	Panel	115/230 Vac	3-2
1055-02-10		24 Vdc	3-3
1055-01-11	Surface/Pipe	115/230 Vac	3-4
1055-02-11		24 Vdc	3-5

For best EMI/RFI protection use shielded output signal cable enclosed in an earth-grounded metal conduit. Connect the shield to earth ground at terminal 4 on TB1.

AC wiring should be 14 gauge or greater. Provide a switch or breaker to disconnect the analyzer from the main power supply. Install the switch or breaker near the analyzer and label it as the disconnecting device for the analyzer.

WARNING:
RISK OF ELECTRICAL SHOCK

AC connections and grounding must be in compliance with UL 508 or local electrical code. DO NOT apply power to the analyzer until all electrical connections are verified and secure.

Do not bring AC power and relay wiring in through the top conduit opening (panel mount analyzer only).

Keep AC power and relay wiring separated from other wiring in the analyzer.

Do not allow wiring to press on the transformer and power supply board.

To reduce the likelihood of stress on wiring connections, do not remove the hinged front cover of the wall/pipe mount enclosure while making connections. Be sure there is sufficient cable slack in the enclosure to avoid stress on conductors and connections.

Do not run sensor and power wiring in the same conduit or close together in a cable tray.

For UL-approved models (-68), the clear wiring shield must be installed prior to operation.

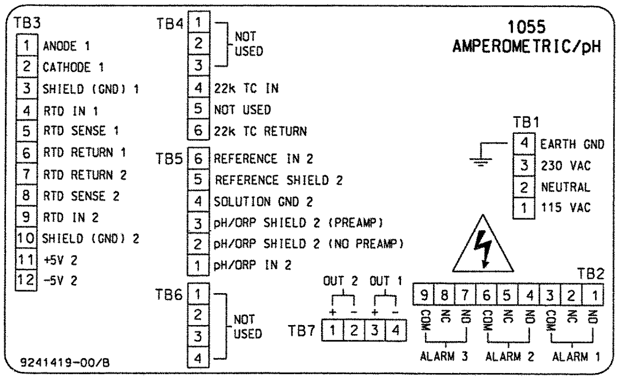


Figure 3-2. Wiring Connections for Solu Comp II Model 1055-01-10 (Panel Mount with 115/230 Vac Power)

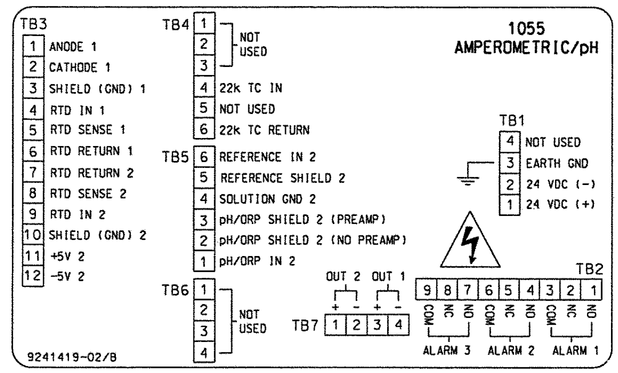


Figure 3-3. Wiring Connections for Solu Comp II Model 1055-02-10 (Panel Mount with 24 Vdc Power)

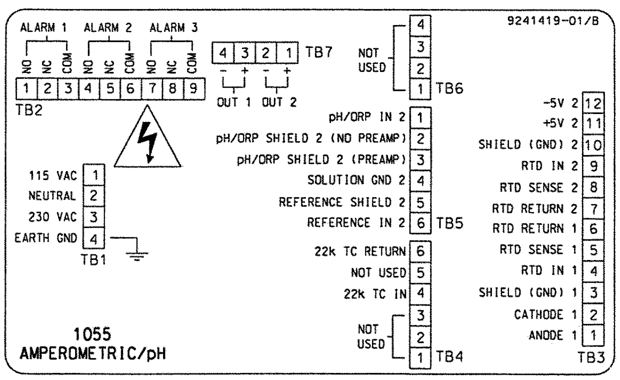


Figure 3-4. Wiring Connections for Solu Comp II Model 1055-01-11 (Surface/Pipe Mounting with 115/230 Vac Power)

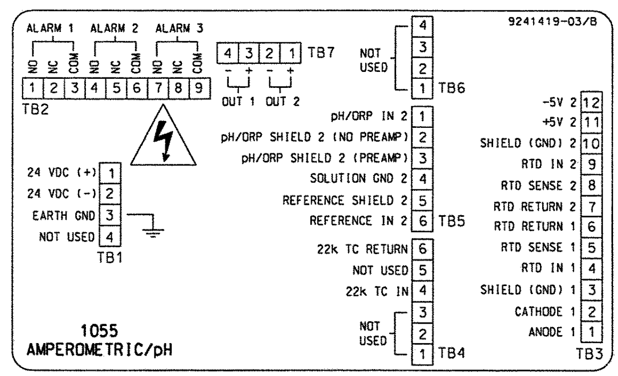


Figure 3-5. Wiring Connections for Solu Comp II Model 1055-02-11 (Surface/Pipe Mounting with 24 Vdc Power)

3.2.2 Sensor Wiring (free chlorine, total chlorine, or monochloramine sensor only).

The free chlorine (499ACL-01), total chlorine (499ACL-02), and monochloramine (499ACL-03) sensors have identical wiring.

Use the pigtail wire and wire nuts provided with the sensor when more than one wire must be attached to a single terminal.

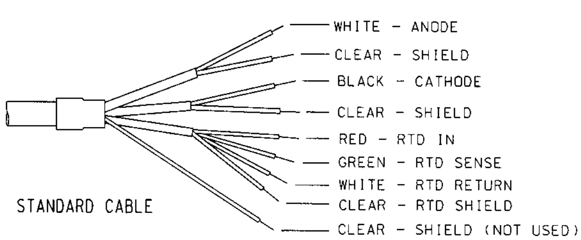


Figure 3-6. Chlorine sensor with standard cable.

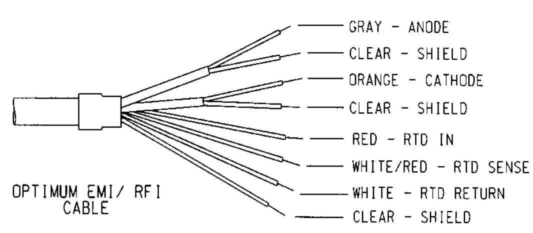


Figure 3-7. Chlorine sensor with optimum EMI/RFI or Variopol cable.

3.2.3 Sensor Wiring (pH-independent free chlorine sensor 498CL-01)

Figure 38. pH-independent free chlorine sensor.

3.2.4 Sensor Wiring (free chlorine with pH sensor for automatic pH correction)

If free chlorine is being measured using the 499ACL-01 sensor and the pH of the liquid varies more than 0.2 pH unit, a continuous correction for pH must be applied to the chlorine reading. Therefore, a pH sensor must also be wired to the analyzer. This section gives wiring diagrams for the pH sensors typically used.

NOTE

When wiring a pH and free chlorine sensor to the analyzer, connect the anode and pH reference terminals (TB3-1 and TB5-6) with the jumper provided with the analyzer. The jumper is a 10 MΩ resistor in parallel with a 0.1 μf capacitor (PN 23980-00).

Refer to the table to select the appropriate wiring diagram.

Use the pigtail wires and wire nuts provided when two or more wires must be connected to the same terminal.

Insulate and tape back unused wires.

1055 configuration	Chlorine sensor cable	pH sensor	Figure
Panel mounting	Standard	399-09-62	3-9
	Standard	399VP-09	3-10
	Standard	399-14	3-11
	EMI/RFI; Variopol	399-09-62	3-12
	EMI/RFI; Variopol	399VP-09	3-13
	EMI/RFI; Variopol	399-14	3-14
Wall/pipe mounting	Standard	399-09-62	3-15
	Standard	399VP-09	3-16
	Standard	399-14	3-17
	EMI/RFI; Variopol	399-09-62	3-18
	EMI/RFI; Variopol	399VP-09	3-19
	EMI/RFI; Variopol	399-14	3-20

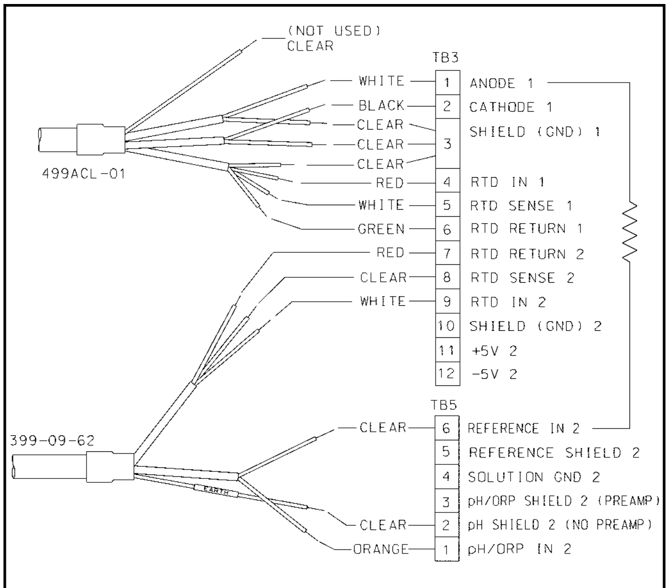


Figure 3-9. Wiring diagram: 1055 panel mount; 499ACL with standard cable; 399-09-62

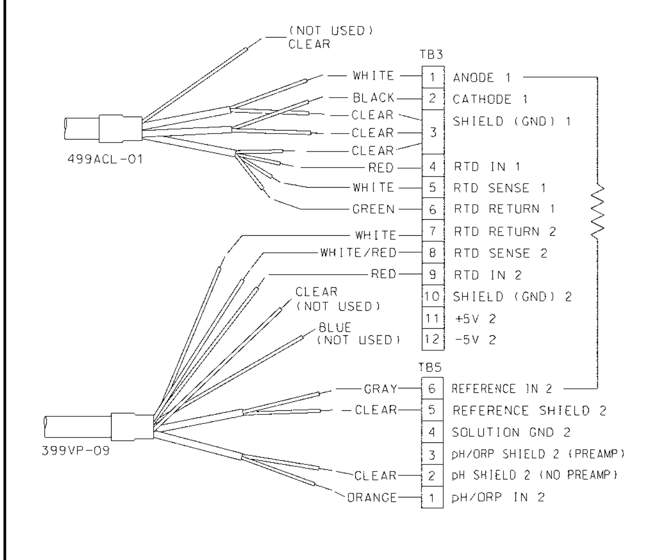
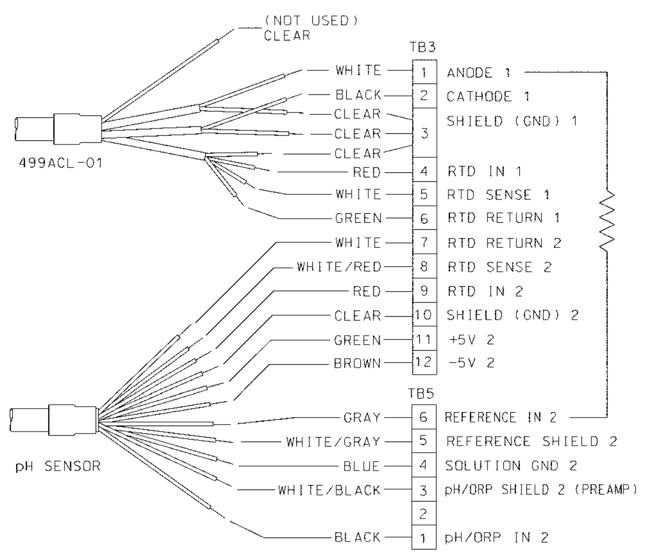


Figure 3-10. Wiring diagram: 1055 panel mount; 499ACL with standard cable; 399VP-09



Although the blue wire is connected to a terminal labeled *solution ground*, the blue wire does not connect to a solution ground in the sensor. The 399-14 sensor has no solution ground. The blue wire, instead, ties the preamplifier in the sensor to instrument common

Figure 3-11. Wiring diagram: 1055 panel mount; 499ACL with standard cable; 399-14

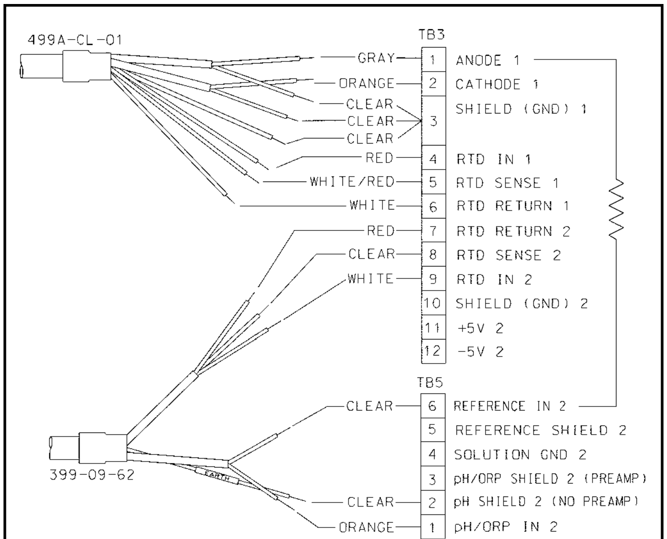


Figure 3-12. Wiring diagram: 1055 panel mount; 499ACL with EMI/RFI or Variopol cable; 399-09-62

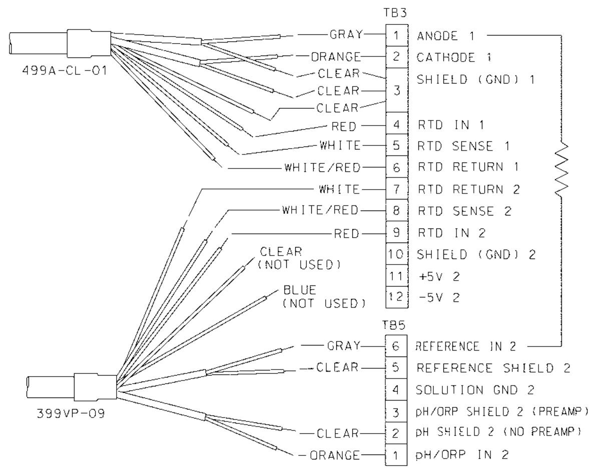
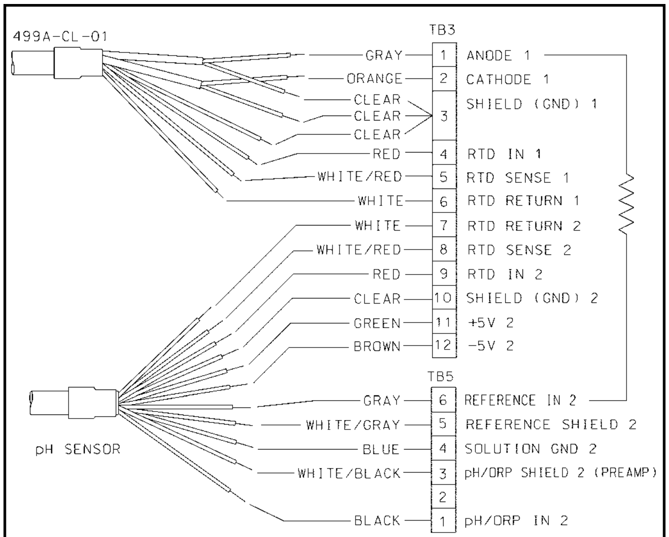


Figure 3-13. Wiring diagram: 1055 panel mount; 499ACL with EMI/RFI or Variopol cable; 399VP-09



Although the blue wire is connected to a terminal labeled *solution ground*, the blue wire does not connect to a solution ground in the sensor. The 399-14 sensor has no solution ground. The blue wire, instead, ties the preamplifier in the sensor to instrument common

Figure 3-14. Wiring diagram: 1055 pipe/wall mount; 499ACL with EMI/RFI or Variopol cable; 399-14

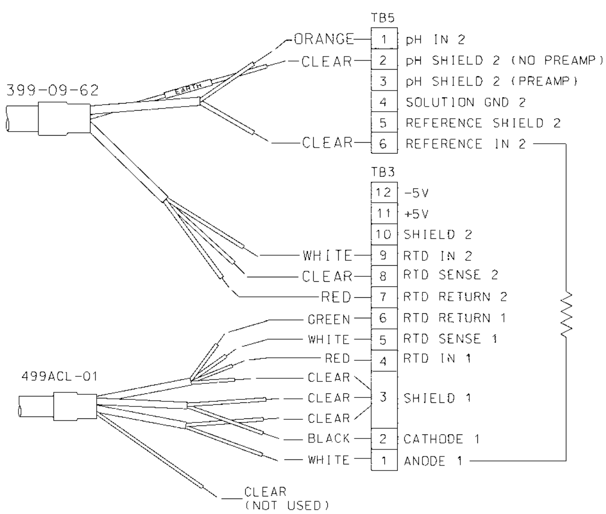


Figure 3-15. Wiring diagram: 1055 pipe/wall mount; 499ACL with standard cable; 399-09-62

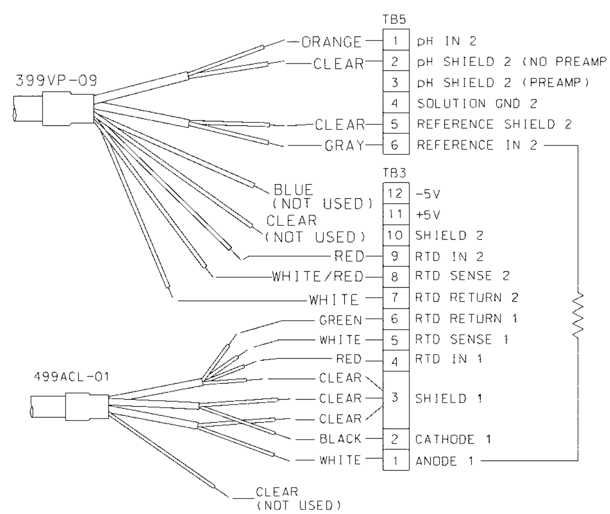
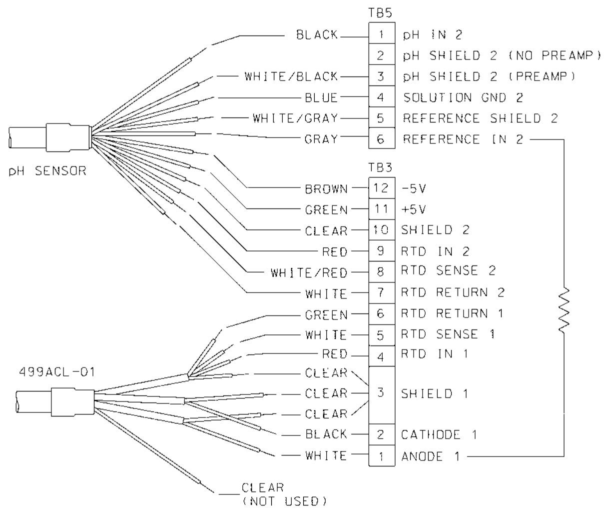


Figure 3-16. Wiring diagram: 1055 pipe/wall mount; 499ACL with standard cable; 399VP-09



Although the blue wire is connected to a terminal labeled *solution ground*, the blue wire does not connect to a solution ground in the sensor. The 399-14 sensor has no solution ground. The blue wire, instead, ties the preamplifier in the sensor to instrument common

Figure 3-17. Wiring diagram: 1055 pipe/wall mount; 499ACL with standard cable; 399-14

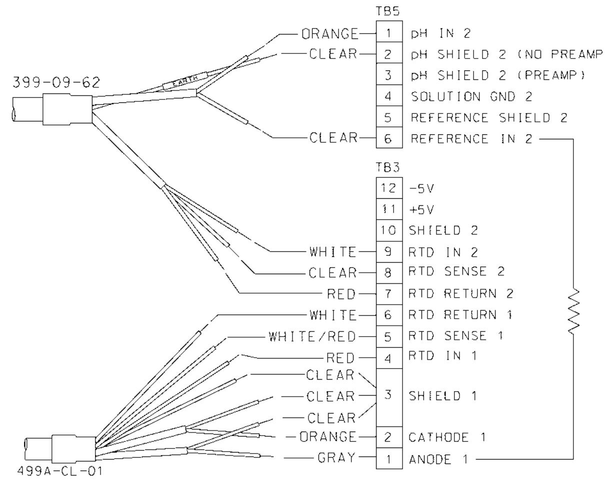


Figure 3-18. Wiring diagram: 1055 pipe/wall mount; 499ACL with EMI/RFI or Variopol cable; 399-09-62

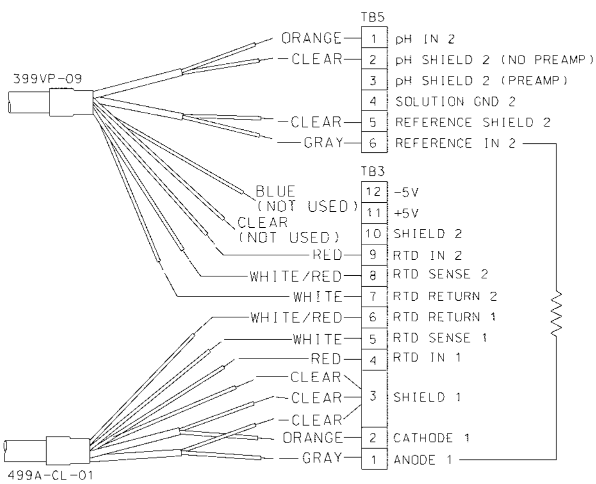
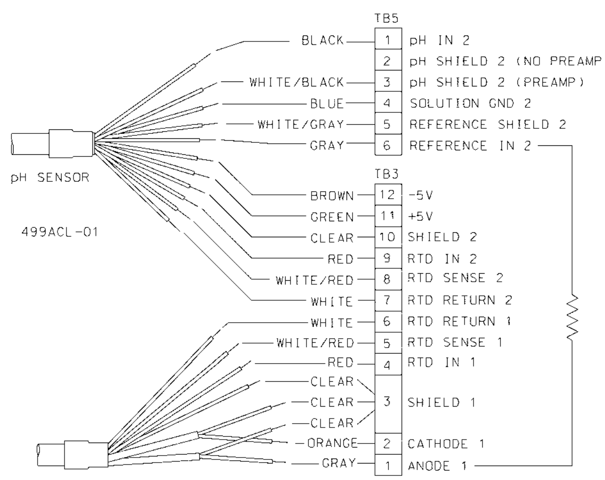


Figure 3-19. Wiring diagram: 1055 pipe/wall mount; 499ACL with EMI/RFI or Variopol cable; 399VP-09



Although the blue wire is connected to a terminal labeled *solution ground*, the blue wire does not connect to a solution ground in the sensor. The 399-14 sensor has no solution ground. The blue wire, instead, ties the preamplifier in the sensor to instrument common

Figure 3-20. Wiring diagram: 1055 pipe/wall mount; 499ACL with EMI/RFI or Variopol cable; 399-14

3.2.5 Sensor Wiring (pH-independent free chlorine sensor 498CL-01 with pH sensor)

Although the pH-independent free chlorine sensor (Model 498CL-01) does not require continuous pH correction, it can still be used with a pH sensor. This section gives wiring diagrams for the three pH sensors recommended for use with the free chlorine sensor.

NOTE

When wiring the pH-independent free chlorine sensor and a pH sensor to the analyzer, connect the pH reference terminal to the pH solution ground terminal using the RC jumper provided (PN 23988-00).

Refer to the table to select the appropriate wiring diagram.

Use pigtail wires and wire nuts provided when two or more wires must be connected to the same terminal.

Insulate and tape back unused wires.

1055 configuration	pH sensor	Figure
Panel mounting	399-09-62	3-21
	399VP-09	3-22
	399-14	3-23
Pipe/wall mounting	399-09-62	3-24
	399VP-09	3-25
	399-14	3-26

Figure 3-21. Wiring diagram: 1055 panel mount; 498CL-01; 399-09-62

Figure 3-22. Wiring diagram: 1055 panel mount; 498CL-01; 399VP-09

Figure 3-23. Wiring diagram: 1055 panel mount; 498CL-01; 399-1

Figure 3-24. Wiring diagram: 1055 panel mount; 498CL-01; 399-09-62

Figure 3-25. Wiring diagram: 1055 panel mount; 498CL-01; 399VP-09

Figure 3-26. Wiring diagram: 1055 panel mount; 498CL-01; 399-14

SECTION 4.0
DISPLAY AND OPERATION

4.1. DISPLAY

The Solu Comp II has a two-line display. The display can be customized to meet user requirements (see Section 5.11). Figure 4-1 shows some of the displays available during normal operation. View A is the default screen for dual sensors. View C is the default screen for a single sensor.

The Solu Comp II has information screens that supplement the data in the main display. Press or to view the information screens. **The last information screen is the software version.**

During calibration and programming, key presses cause different displays to appear. The displays are self-explanatory and guide the user step-by-step through the procedure.

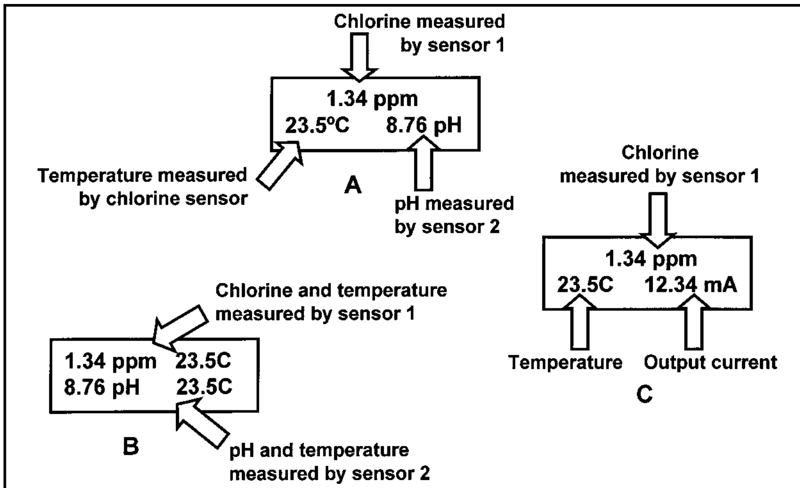


FIGURE 4-1. Displays During Normal Operation

Screen A shows chlorine and pH. The temperature shown is the temperature measured by the chlorine sensor. Screen B shows chlorine and pH and the temperature measured by each sensor. Screen C shows the data for the chlorine sensor only.

4.2 KEYPAD

Figure 4-2 shows the Solu Comp II keypad.

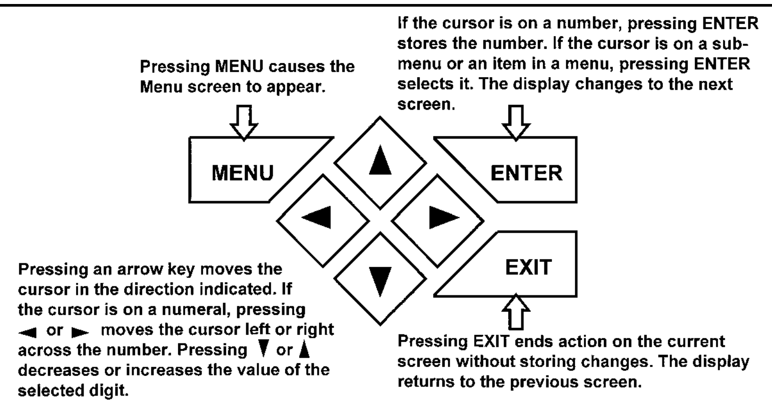


FIGURE 4-2. Solu Comp II Keypad

Four arrow keys move the cursor around the screen. A blinking word or numeral show the position of the cursor. The arrow keys are also used to change the value of a numeral. Pressing ENTER stores numbers and settings and moves the display to the next screen. Pressing EXIT returns to the previous screen without storing changes. Pressing MENU always causes the main menu screen to appear. Pressing MENU followed by EXIT causes the main display to appear.

4.3 PROGRAMMING AND CALIBRATING THE SOLU COMP II - TUTORIAL

Setting up and calibrating the Solu Comp II is easy. The following tutorial describes how to move around in the programming menus. For practice, the tutorial also describes how to assign chlorine values to the 4 and 20 mA outputs for sensor 1.

```
Calibrate          Hold
Program         Display
```

1. If the MENU screen (shown at the left) is not already showing, press MENU. **Calibrate** is blinking, which means the cursor is on **Calibrate**.

```
Calibrate          Hold
Program         Display
```

2. To assign chlorine or pH values to current outputs, the **Program** sub-menu must be open. Press ▼. The cursor moves to **Program** (**Program** blinking). Press ENTER. Pressing ENTER opens the **Program** sub-menu.

```
Outputs          Alarms
Measurement          >>
```

3. The **Program** sub-menu permits the user to set outputs, alarms, automatic or manual temperature compensation, and a security code. When the sub-menu opens, **Outputs** is blinking, which means the cursor is on Outputs. Press ▼ or ▶ (or any arrow key) to move the cursor around the display. Move the cursor to **>>** and press ENTER to cause a second screen with more program items to appear. There are three screens in the **Program** menu. Pressing **>>** and ENTER in the third screen causes the display to return to the first screen (**Outputs**, **Alarms**, **Measurement**).
4. For practice, assign values to the 4 and 20 mA outputs for sensor 1. Move the cursor to **Outputs** and press ENTER.

```
Output Range
Output Configure
```

5. The screen shown at left appears. The cursor is on **Output Range** (blinking). Output range is used to assign values to the low and high current outputs. Press ENTER.

```
Output Range?
Output1         Output2
```

6. The screen shown at left appears. The Solu Comp II has two outputs, output 1 and output 2. Move the cursor to the desired output and press ENTER. For purposes of the example, choose **Output 1**.

```
Out1 S1 Range?
4mA            00.00ppm
```

7. The screen shown at left appears. **Out1 S1** in the top line means output 1 (**Out1**) is assigned to sensor 1 (**S1**). Either output can be assigned to either sensor (sensor and output assignments are made under the **Output Configure** menu shown in step 5). Use the **Out1 S1 Range?** screen to assign a chlorine concentration to the **4 mA** output.
   a. Use the arrow keys to change the concentration to the desired value. Press ◀ or ▶ to move the cursor from digit to digit. Press ▲ or ▼ to increase or decrease the value of the digit. Holding ▲ or ▼ down causes the numeral to continuously scroll up or down.
   b. To move the decimal point, press ◀ or ▶ until the cursor is on the decimal point. Press ▲ to move the decimal point to the right. Press ▼ to move the decimal point to the left.
   c. Press ENTER to store the setting.

```
Out1 S1 Range?
20mA           20.00ppm
```

8. The screen shown at left appears. Use this screen to assign a full scale chlorine concentration to the **20 mA** output. Use the arrow keys to change the chlorine to the desired value. Press ENTER to store the setting.

```
Output Range?
Output1         Output2
```

9. The screen shown at left appears. To assign values to the low and high currents for output 2, select **Output 2** and follow the prompts.
10. To return to the main menu, press MENU. To return to the main display press MENU then EXIT, or press EXIT repeatedly until the main display appears. To return to the previous display press EXIT.

NOTE
To store values or settings, press ENTER before pressing EXIT.

4.4 SECURITY

4.4.1 How the Security Code Works

Use the security code to prevent accidental or unwanted changes to program settings, displays, and calibration.

```
Enter Security
Code         000
```

```
  Invalid Code
```

1. If a security code has been programmed, pressing MENU causes the security screen to appear.
2. Enter the three-digit security code.
3. If the entry is correct, the main menu screen appears. If the entry is incorrect, the **Invalid Code** screen appears. The **Enter Security Code** screen reappears after 2 seconds.

4.4.2 Bypassing the Security Code

Enter 555. The main menu will open.

4.4.3 Setting a Security Code

See Section 5.6.

4.5 USING HOLD

4.5.1 Purpose

The analyzer output is always proportional to measured pH or chlorine. To prevent unwanted alarms and improper operation of control systems or dosing pumps, place the analyzer in hold before removing the sensor for calibration and maintenance. Be sure to remove the analyzer from hold once calibration is complete. During hold, both outputs remain at the last value. **Once in hold, the analyzer remains there indefinitely.** While in hold, the screen shown to the left appears periodically.

```
            Hold
```

4.5.2 Using the Hold Function

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate     Hold
Program    Display
```

```
Hold Outputs and
Alarms?   Yes   No
```

1. Press MENU. The main menu screen appears. Choose **Hold**.
2. The **Hold Outputs and Alarms ?** screen appears. Choose **Yes** to place the analyzer in hold. Choose **No** to take the analyzer out of hold.
3. The main display screen will appear.

SECTION 5.0
PROGRAMMING THE ANALYZER

5.1 GENERAL

This section describes how to do the following:

1. configure and assign values to the current outputs
2. configure and assign setpoints to the alarm relays
3. choose the type of chlorine measurement being made
4. choose temperature units and manual or automatic temperature mode
5. set a security code
6. tell the analyzer the frequency of the ac power (needed for optimum noise rejection)
7. tell the analyzer the number of sensors being used
8. reset the analyzer to factory calibration and default settings
9. select a default display screen

Default settings are shown in Table 5-1 on the following page. To change a default setting, refer to the section listed in the table. To reset default settings, see Section 5.10.

5.2 CHANGING STARTUP SETTINGS

When the Solu Comp II is powered up for the first time, startup screens appear. The screens prompt the user to identify the number of sensors being used and the type of chlorine measurement: free or total chlorine or monochloramine. For dual sensor input, the user can choose pH, ORP, or redox for the second sensor. If incorrect settings were entered at startup, enter the correct settings now. To change the number of sensors refer to Section 5.9. To change the measurement, refer to Section 5.5.

FOR BEST RESULTS, ENTER THE NUMBER OF SENSORS BEING USED (SECTION 5.9), THE TYPE OF CHLORINE MEASUREMENT, AND WHETHER pH, ORP, OR REDOX IS DESIRED FOR SENSOR 2 (SECTION 5.5) BEFORE MAKING OTHER PROGRAM SETTINGS.

TABLE 5-1. DEFAULT SETTINGS

1. SENSOR-OUTPUT ASSIGNMENTS (type of chlorine measurement, pH, ORP, or redox is selected during Quick Start)

Sensor(s)	Output 1	Output 2	Section
Single sensor	chlorine	Temperature	5.3 and 5.9
Dual sensor	chlorine (sensor 1)	pH/ORP/Redox (sensor 2)	5.3 and 5.9

2. OTHER OUTPUT SETTINGS

Output	Dampening	0 or 4 mA	Mode	Section
1	off	4	Linear	5.3
2	off	4	Linear	5.3

3. OUTPUT RANGES (type of chlorine measurement, pH, ORP, or redox is selected during Quick Start)

Measurement	Range	Section
chlorine - ppm	0 to 20 ppm	5.3
pH	0 to 14	5.3
ORP/Redox	-1400 to 1400 mV	5.3
Temperature	0 to 100°C	5.3

4. ALARM CONFIGURATION AND SETPOINTS

	Alarm			Section
	1	2	3	
Assigned to	Sensor 1 (chlorine)	Sensor 2 (pH/ORP) (note)	Fault	5.4
High or low	High	High (note)	NA	5.4
Deadband	0	0	NA	5.4
Setpoint (ppm)	0 ppm (low); 20 ppm (high)	0 ppm (low); 20 ppm (high)	NA	5.4
Setpoint (pH)	14 (high); 0 (low)	14 (high); 0 (low)	NA	5.4
Setpoint (ORP/Redox)	1400 mV (high); -1400 (low)	1400 mV (high); -1400 (low)	NA	5.4

Note: For single sensor input, alarm 2 is assigned to sensor 1, and is configured as a low alarm.

TABLE 5-1. DEFAULT SETTINGS (continued)

5. TEMPERATURE RELATED SETTINGS

		Section
Units	°C	5.6
Automatic temperature compensation (chlorine)	On	5.6
Automatic temperature compensation (pH)	On	5.6
Solution temperature correction (pH)	Off	5.5
Isopotential pH	7.00	5.5

6. MISCELLANEOUS SETTINGS

		Section
Language	English	5.11
Hold	off	4.5
Security code	000 (no security code)	5.7
ac power frequency	60 Hz	5.8

5.3 CONFIGURING AND RANGING THE OUTPUTS.

5.3.1 Purpose

The Solu Comp II accepts input from a free chlorine, total chlorine, pH, or ORP sensor and has two current outputs. This section describes how to configure and range the outputs. **CONFIGURE THE OUTPUTS FIRST.**

1. Configuring an output means
   a. Selecting either a 4-20 mA or 0-20 mA output,
   b. Assigning a sensor and a measurement (free chlorine, total chlorine, pH, ORP, or redox potential) to output 1 and output 2,
   c. Turning on or turning off output current dampening,
   d. Choosing a linear or logarithmic output.
2. Ranging the outputs means assigning values to the low (0 or 4 mA) and high (20 mA) outputs.

5.3.2 Definitions

1. CURRENT OUTPUTS. The analyzer provides either a continuous 4-20 mA or 0-20 mA output current directly proportional to chlorine concentration, pH, ORP, or redox potential.
2. ASSIGNING OUTPUTS. Figure 5-1 shows the ways in which the outputs can be assigned.
3. DAMPEN. Output dampening smooths out noisy readings. It also increases the response time of the output. With output dampening the time to reach 63% of final reading following a step change is 5 sec. Output dampening does not affect the response time of the display.
4. MODE. The current output can be made directly proportional to the displayed value (linear mode) or directly proportional to the common logarithm of the displayed value (log mode).

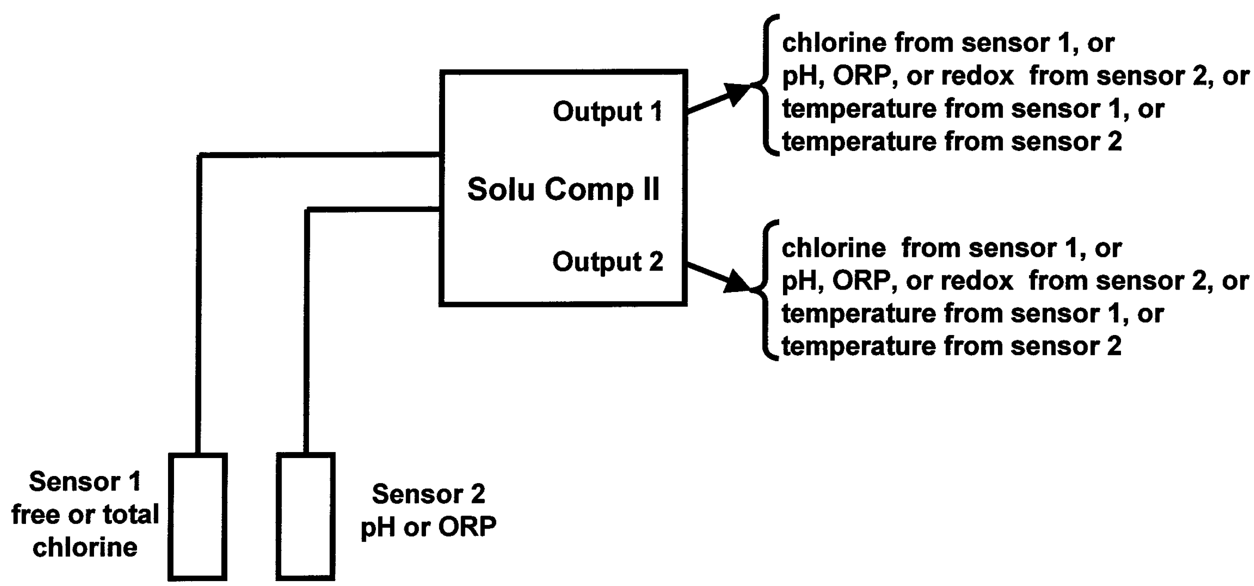


FIGURE 5-1. Assigning Outputs 1 and 2

5.3.3. Procedure: Configure Outputs.

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate        Hold
Program       Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs        Alarms
Measurement        >>
```

2. Choose **Outputs**.

```
Output Range
Output Configure
```

3. Choose **Output Configure**.

```
Output Config?
Output1       Output2
```

4. Choose **Output1** or **Output2**.

```
OutM is for?
Sensor1       Sensor2
```

5. Choose **Sensor1** (chlorine) or **Sensor2** (pH). Either sensor can be assigned to either output.

```
OutM is for?
Measurement      Temp
```

6. Choose **Measurement** or **Temp**. If the output selected was assigned to Sensor 1, **Measurement** means chlorine. If the output selected was assigned to Sensor 2, **Measurement** means pH, ORP, or redox potential.
7. Make the appropriate settings:
   a. Choose **4-20 mA** or **0-20 mA**.
   b. Choose **Yes** or **No** for output dampening.
   c. Choose **Linear** or **Log** output.
8. The display returns to the **Output Config?** screen. Select the other output or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

5.3.4. Procedure: Assigning Values to the Low and High Current Outputs (Output Ranging)

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate        Hold
Program       Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs        Alarms
Measurement        >>
```

2. Choose **Outputs**.

```
Output Range
Output Configure
```

3. Choose **Output Range**. Choose **Output1** or **Output2**.
4. Make the appropriate settings.
   a. Assign a value to the low current (**0 mA** or **4 mA**) output.
   b. Assign a value to the high current (**20 mA**) output.
5. The display returns to the **Output Range** screen. Select the other output or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

5.4 CONFIGURING ALARMS AND ASSIGNING SETPOINTS

5.4.1 Purpose

This section describes how to do the following:

1. assign an alarm relay to a sensor,
2. set the alarm logic to high or low,
3. assign values to the alarm setpoints,
4. set the alarm deadbands.

ALARM RELAYS MUST BE CONFIGURED BEFORE ASSIGNING SETPOINTS.

5.4.2 Definitions

1. ASSIGNING ALARMS. There are three alarms (**AL1**, **AL2**, and **AL3**). The alarms can be assigned to any sensor. For example, **AL1** and **AL2** can be assigned to sensor 1 with, perhaps, one alarm configured as a high alarm and the other as a low alarm, and **AL3** can be assigned to sensor 2. Alarm 3 can also be used as a fault alarm. The fault alarm activates when a fault exists in a sensor or the analyzer.
2. FAULT ALARM. A fault condition exists when the Solu Comp II detects a problem with a sensor or with the analyzer that is likely to cause seriously erroneous readings. If Alarm 3 was programmed as a fault alarm, the alarm 3 relay will activate. The word **Fault** will appear alternately in the display with the reading.
3. ALARM LOGIC, SETPOINTS, AND DEADBANDS. See Figures 5-2 and 5-3.

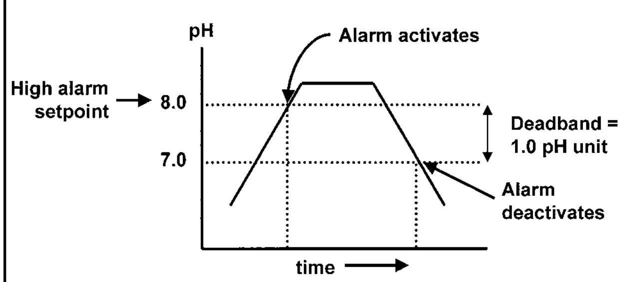


FIGURE 5-2. High Alarm Logic

The alarm activates when the pH exceeds the high setpoint. The alarm remains activated until the reading drops below the value determined by the deadband.

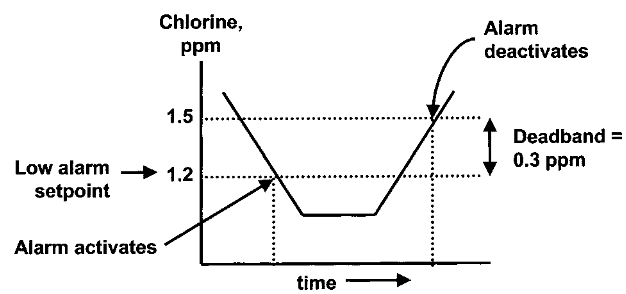


FIGURE 5-3. Low Alarm Logic

The alarm activates when the chlorine concentration drops below the low setpoint. The alarm remains activated until the reading increases above the value determined by the deadband.

Alarm relays are single pole-double throw (SPDT). When an alarm is activated, the coil is energized.

When an alarm activates, **AL1**, **AL2**, or **AL3** (as appropriate) appears periodically in the display.

5.4.3 Procedure: Configuring Alarms

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate          Hold
Program         Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs          Alarms
Measurement          >>
```

2. Choose **Alarms**.

```
Alarm Setpoints
Alarm Configure
```

3. Choose **Alarm Configure**.

```
Alarm Config?
AL1         AL2     AL3
```

4. Choose Alarm 1 (**AL1**), Alarm 2 (**AL2**), or Alarm 3 (**AL3**).

```
AL1 is for?
Sensor1         Sensor2
```

```
AL1 S1 is for?
Measurement        Temp
```

5. For **AL1** or **AL2**
   a. Choose **Sensor 1** (chlorine) or **Sensor 2** (pH).
   b. Choose **Measurement** or **Temp**.
   c. Choose **High** or **Low**.
   d. Set the alarm **Deadband**.

6. The display returns to the **Alarm Configure?** screen. Select another alarm or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

```
AL3 is for?       Fault
Sensor1         Sensor2
```

7. For **AL3**
   a. Choose **Sensor1** (chlorine), **Sensor2** (pH), or **Fault**.
   b. For sensor 1 or 2, choose **Measurement** or **Temp**.
   c. Choose **High** or **Low**. Set the deadband.
   d. Choosing **Fault** means **AL3** will activate when a sensor or analyzer fault exists. There is no user setting to make.

8. The display returns to the **Alarm Configure?** screen. Select another alarm or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

5.4.4 Procedure: Programming Alarm Setpoints

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate          Hold
Program         Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs          Alarms
Measurement          >>
```

2. Choose **Alarms**.

```
Alarm Setpoints
Alarm Configure
```

3. Choose **Alarm Setpoints**.

```
Select Alarm?
AL1         AL2     AL3
```

4. Choose Alarm 1 **(AL1**), Alarm 2 (**AL2**), or Alarm 3 (**AL3**).

```
AL1 S1 Setpoint?
High          20.00ppm
```

5. The display shows the alarm selected (**AL1**) and the configuration. The alarm is for Sensor 1 (**S1**), and the logic is high. Use the arrow keys to change the alarm setpoint.

6. The display returns to the **Select Alarm?** screen. Select another alarm or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

5.5 SELECTING THE TYPE OF MEASUREMENT

5.5.1 Purpose

This section describes how to do the following:

1. Program the Solu Comp II to measure free chlorine, total chlorine, monochloramine, pH, ORP, or redox potential.
2. Set automatic or manual pH correction for the free chlorine measurement
3. Determine the level of electronic filtering of the sensor current
4. Enable or disable dual slope calibration
5. Make the following settings for pH
   a. solution temperature correction
   b. analyzer isopotential point.
   c. enable or disable glass impedance fault.

5.5.2 Definitions — Chlorine

1. FREE CHLORINE. Free chlorine is the result of adding sodium hypochlorite (bleach), calcium hypochlorite (bleaching powder), or chlorine gas to fresh water. Free chlorine is the sum of hypochlorous acid (HOCl) and hypochlorite ion (OCl^-).
2. TOTAL CHLORINE. Total chlorine is the sum of free and combined chlorine. Combined chlorine generally refers to chlorine oxidants in which chlorine is combined with ammonia or organic amines. Monochloramine, used to disinfect potable water, is an example of combined chlorine. The term total chlorine also refers to other chlorine oxidants such as chlorine dioxide. To measure total chlorine the sample must first be treated with a mixture of acetic acid and potassium iodide. Total chlorine reacts with iodide to produce an equivalent amount of iodine, which the sensor measures.
3. MONOCHLORAMINE. Monochloramine (NH_2Cl) is a type of combined chlorine. It is produced by the reaction between ammonia and chlorine (or sodium hypochlorite). Monochloramine forms almost exclusively when an excess of ammonia is present and the pH is greater than about 8.3. If the pH is less than 8.3, mixtures of monochloramine and dichloramine form. Excess chlorine also promotes the formation of dichloramine. Monochloramine is used extensively for drinking water disinfection in the United States. Although it is less effective than free chlorine and, therefore, requires higher dosages and longer contact times, it has the advantage of not forming potentially harmful disinfection by-products.
4. pH CORRECTION. Free chlorine is the sum of hypochlorous acid (HOCl) and hypochlorite ion (OCl^-). The relative amount of each depends on the pH of the sample. As pH increases, the concentration of HOCl decreases and the concentration of OCl^- increases. Because the raw signal generated by a free chlorine sensor depends primarily on the concentration of HOCl reaching the cathode, a change in the pH of the sample after calibration can cause an error.

   The raw signal from the 499ACL-01 sensor is strongly dependent on pH. The 498CL-01 sensor is relatively immune. The key difference between the sensors is the high acidity of the fill solution in the 498CL-01 sensor. The acidity converts OCl^- into HOCl, making the sensor response practically independent of pH.

   Measurements made with the 499ACL-01 sensor usually require a pH correction. The Solu Comp II offers both automatic and manual pH correction. In automatic pH correction, a pH sensor continuously monitors the pH of the sample and the analyzer uses the pH signal to correct the free chlorine reading for changes in pH. In manual correction, the user must enter the pH of the solution. Generally, if the pH changes more than about 0.2 units over short periods of time, automatic pH correction is best. If the pH is relatively steady or subject only to seasonal changes, manual pH correction is adequate.

   The 498CL-01 sensor response is practically independent of pH, and the sensor requires no pH correction. However, if the user wishes to measure the pH of the process liquid for other purposes, the Solu Comp II permits an independent pH measurement to be made.

.

5. INPUT FILTER. Before converting the sensor current to a chlorine reading, the Solu Comp II applies an input filter. The filter reduces noisy readings, but increases the response time. The level of filtering is selected by choosing the amount of time required for the display to reach 63% of a step change.

6. DUAL SLOPE CALIBRATION. The Model 499ACL-01 (free chlorine) and 499ACL-02 (total chlorine) sensor lose sensitivity at high concentrations of chlorine. The Solu Comp II has a dual slope feature that allows the user to compensate for the non-linearity of the sensor. For the vast majority of applications, dual slope calibration is unnecessary.

5.5.3 Definitions — pH/ORP

1. ORP. ORP is oxidation-reduction potential. It is the voltage difference between a noble metal (usually platinum) indicator electrode and a silver/silver chloride reference electrode.

2. REDOX. Redox is redox potential. Redox potential is measured the same way as ORP. The sign of the redox potential is the negative of ORP.

3. SIGN CONVENTION. The ORP of a solution of 0.1 M iron (II) ammonium sulfate and 0.1 M iron (III) ammonium sulfate in 1 M sulfuric acid is positive. The redox potential is negative.

4. GLASS IMPEDANCE FAULT. The Solu Comp II can be used with pH sensors having advanced diagnostic features that permit the continuous determination of glass and reference electrode impedance. When the analyzer detects low glass impedance, indicating a broken or cracked glass membrane, it automatically displays a fault message. If the Solu Comp II is to be used with non-glass pH electrodes, the glass impedance fault should be disabled.

5. SOLUTION TEMPERATURE CORRECTION. The pH of a solution, particularly an alkaline one, is a function of temperature. If the temperature changes, so does the pH, even though the concentration of the acid or base causing the pH remains constant. Solution temperature compensation converts the pH at the measurement temperature to the pH at a reference temperature. The Solu Comp II corrects the pH to a reference temperature of 25°C.

   For an accurate solution temperature correction, the exact composition of the solution must be known. The Solu Comp II has built-in temperature corrections for high purity water and for dilute solutions of a strong base. The analyzer also accepts a custom correction.

   APPLICATION NOTE

   If pH is being measured for the purpose of correcting a free chlorine measurement using the 499ACL-01 sensor, **DO NOT** use solution temperature correction. Free chlorine readings must be corrected using the pH at the actual sample temperature.

6. CUSTOM TEMPERATURE CORRECTION. The custom temperature correction has units of ∆pH/°C. The example shows how the analyzer uses the custom correction. Suppose the pH of the solution being measured decreases 0.022 units for every Celsius degree rise in temperature. The temperature correction is -0.022pH/°C. If the pH at 20°C is 8.95, the corrected pH (at 25°C) is 8.95 + (-0.022)(25 - 20) or 8.84.

7. ISOPOTENTIAL pH. The isopotential pH is the pH at which the cell voltage (the cell is the pH electrode, reference electrode, and solution being measured) is independent of temperature. Most pH cells have isopotential pH reasonably close to 7.00, so the Solu Comp II assumes the cell isopotential pH is 7.00. However, certain specialized electrodes have isopotential pH different from 7.00.

   NOTE

   Do NOT change the isopotential pH of the transmitter unless you are thoroughly familiar with the role of sensor and analyzer isopotential point in pH measurement, OR the sensor operating instructions specifically state the isopotential pH is a value other than pH 7.00.

5.5.4 Procedure.

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate           Hold
Program          Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs           Alarms
Measurement           >>
```

2. Choose **Measurement**.

```
Configure?
Sensor1          Sensor2
```

3. Choose **Sensor 1** (chlorine) or **Sensor 2** (pH). For a single input configuration, the **Sensor 1 Sensor 2** screen does not appear.

   If you chose Sensor 1, go to step 4.

   If you chose Sensor 2, go to step 10.

```
S1 Chlorine Type
free      total       >>
```

4. For **Sensor 1** (chlorine), identify the type of chlorine measurement: **free**, **total**, or **chloramine** (monochloramine).

```
S1 pH Comp?
Auto              Manual
```

5. If you chose free, select **Auto** or **Manual** temperature correction. If you are using a pH-independent free chlorine sensor (Model 498ACL-01), choose **Manual**.

```
      Manual pH
      07.00 pH
```

6. If you chose **Manual**, enter the desired pH. The analyzer will use this pH in all subsequent calculations, no matter what the true pH is. If you are using a pH-independent free chlorine sensor (Model 498ACL-01), enter 7.00.

```
Input filter?
63% in 005sec
```

7. Choose the amount of filtering desired.

```
Dual Range Cal?
Disable           Enable
```

8. Enable or disable dual slope calibration. In the vast majority of applications, dual slope calibration is unnecessary.

9. The display returns to the screen shown in step 3. To configure the pH (ORP) sensor, choose **Sensor 2**. To return to the previous screen, press EXIT. To return to the main display, press MENU followed by EXIT.

```
S2Measure?            pH
Redox                ORP
```

10. If **Sensor 2** (pH) was selected, the screen at left appears. Select **pH**, **Redox**, or **ORP**. If pH was selected, go to step 11; otherwise, go to step 16.

```
S1 Glass Fault?
Enable?    Yes        No
```

11. Choose **No** if the pH sensing electrode is **NOT** a glass electrode.

```
Soln Temp Corr
Sensor Isoptntl
```

12. Choose **Soln Temp Corr** or **Sensor Isoptntl**.

```
S1 SolnTempCorr?
Off      Ultrapure    >>
```

13. For **Soln Temp Corr**, choose **Off**, **UltraPure**, **HighpH**, or **Custom**. For **Custom**, enter the desired temperature coefficient. IF pH IS BEING MEASURED FOR THE PURPOSE OF CORRECTING A FREE CHLORINE READING, CHOOSE **OFF**.

```
Sensor Isoptntl
S1:       07.00pH
```

14. For **Sensor Isoptntl**, enter the desired sensor isopotential pH. Do not change the sensor isopotential pH unless the sensor is known to have an isopotential pH different from 7.00.

15. The display returns to the screen shown in step 3.

16. If **Redox** or **ORP** was selected, there are no further settings to make. The display returns to the screen shown in step 3. Press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

5.6 CHOOSING TEMPERATURE UNITS AND MANUAL OR AUTOMATIC TEMPERATURE COMPENSATION

5.6.1 Purpose

This section describes how to do the following:

1. Choose temperature display units (°C or °F).
2. Choose automatic or manual temperature compensation for membrane permeability.
3. Choose automatic or manual temperature compensation for pH.
4. Enter a temperature for manual temperature compensation.

5.6.3 Definitions — chlorine

1. AUTOMATIC TEMPERATURE COMPENSATION - CHLORINE.

   The chlorine sensors are membrane-covered amperometric sensors. The permeability of the membrane is a function of temperature. As temperature increases, membrane permeability increases. Thus, an increase in temperature will cause the sensor current and the analyzer reading to increase even though the chlorine level remained constant. A correction equation in the analyzer software automatically corrects for changes in membrane permeability. Each chlorine sensor has a unique membrane permeability correction. In automatic temperature compensation, the analyzer uses the temperature measured by the sensor for the correction. Temperature is also used in the pH correction applied to free chlorine measurements.

2. MANUAL TEMPERATURE COMPENSATION - CHLORINE. In manual temperature compensation, the analyzer uses the temperature entered by the user for membrane permeability and pH correction. It does not use the actual process temperature. Do NOT use manual temperature compensation unless the measurement and calibration temperatures differ by no more than about 2°C. Manual temperature compensation is useful if the sensor temperature element has failed an a replacement sensor is not available.

5.6.3 Definitions — pH

1. AUTOMATIC TEMPERATURE COMPENSATION — pH. The analyzer uses a temperature-dependent factor to convert measured cell voltage to pH. In automatic temperature compensation, the analyzer measures the temperature and automatically calculates the correct conversion factor. For maximum accuracy, use automatic temperature compensation.

2. MANUAL TEMPERATURE COMPENSATION — pH. In manual temperature compensation, the analyzer converts measured voltage to pH using the temperature entered by the user. It does not use the actual process temperature. Do **NOT** use manual temperature compensation unless the process temperature varies no more than about ±2°C or the pH is between 6 and 8. Manual temperature compensation is useful if the sensor temperature element has failed and a replacement sensor is not available.

5.6.3 Procedure.

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate        Hold
Program       Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs        Alarms
Measurement        >>
```

2. Choose **>>**.

```
Temp         Security
#Sensors           >>
```

3. Choose **Temp.**

```
Config Temp?
°C/F      Live/Manual
```

4. Choose **°C/F** to change temperature units. Choose **Live/Manual** to turn on (Live) or turn off (Manual) automatic temperature compensation.
   a. If **°C/F** is chosen, select **°C** or **°F** in the next screen.
   b. If **Live/Manual** is chosen, select **Live** or **Manual** for sensor 1 (chlorine) in the next screen.
   c. If **Manual** is chosen, enter the temperature in the next screen. The temperature entered in this step will be used in all subsequent measurements, no matter what the process temperature is.
   d. The display will return to the **Live/Manual** screen for sensor 2 (pH). Make the desired selections for sensor 2.

5.7 SETTING A SECURITY CODE

5.7.1 Purpose.

This section describes how to set a security code. The security code prevents program and calibration settings from accidentally being changed. Refer to Section 4.4 for additional information.

5.7.2 Procedure.

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate        Hold
Program       Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs        Alarms
Measurement        >>
```

```
Temp         Security
#Sensors           >>
```

2. Choose **>>**, then **Security**.

3. Enter a three digit security code. The security code takes effect two minutes after the last key stroke.

4. The display returns to the security menu screen. Press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

5.8 NOISE REJECTION

5.8.1 Purpose.

For maximum noise rejection, the frequency of the ac power must be entered in the analyzer.

5.8.2. Procedure.

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

Calibrate	Hold
Program	Display

1. Press MENU. The main menu screen appears. Choose **Program**.

Outputs	Alarms
Measurement	>>

2. Choose **>>**.

Temp	Security
#Sensors	>>

3. Choose **>>**.

Noise Rejection	
ResetAnalyzer	>>

4. Choose **Noise Rejection**.
5. Enter the mains frequency, 50 Hz or 60 Hz.
6. The display returns to the **Noise Rejection** screen. To return to the main menu, press EXIT. To return to the main display, press MENU followed by EXIT.

5.9 SINGLE SENSOR OR DUAL SENSOR INPUT

5.9.1 Purpose

The Solu Comp II accepts input from a single sensor or from two sensors. This section describes how to program the analyzer for single or dual sensors. **COMPLETE THIS SECTION BEFORE DOING OTHER PROGRAMMING.**

5.9.2 Procedure.

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

Calibrate	Hold
Program	Display

1. Press MENU. The main menu screen appears. Choose **Program**.

Outputs	Alarms
Measurement	>>

2. Choose **>>**.

Temp	Security
#Sensors	>>

3. Choose **#Sensors**.

# of sensors?	
One	**Two**

4. Choose **One** or **Two**. Choosing **One** configures the analyzer as a chlorine analyzer. S2 (pH/ORP) cannot be chosen for single measurement.
5. The display returns to the **# Sensors** screen. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

5.10 RESETTING FACTORY CALIBRATION AND FACTORY DEFAULT SETTINGS

5.10.1 Purpose.

This section describes how to re-install factory calibration and default values. The process also clears all fault messages and returns the display to the first quick start screen.

5.10.2. Procedure.

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

```
Calibrate        Hold
Program       Display
```

1. Press MENU. The main menu screen appears. Choose **Program**.

```
Outputs        Alarms
Measurement        >>
```

2. Choose **>>**.

```
Temp         Security
#Sensors           >>
```

3. Choose **>>**.

```
Noise Rejection
ResetAnalyzer      >>
```

4. Choose **ResetAnalyzer**.

```
Load factory
settings?  Yes     No
```

5. Choose **Yes** or No. If **Yes** is selected, previous settings are cleared and the **Quick Start Menu** appears.

5.11 SELECTING A DEFAULT SCREEN, LANGUAGE, AND SCREEN CONTRAST

5.11.1 Purpose

This section describes how to do the following:

1. set a default display screen

   The default display screen is the screen shown during normal operation. The Solu Comp II allows the user to choose from a large number of screens. Which screens are available depends on how the analyzer was configured. The following is an explanation of the abbreviations used in the screens.

   In the display:

   i. The units attached to the reading make clear what is being displayed, chlorine or pH. The units for chlorine are ppm (mg/L) as Cl_2.

   ii. **S2** means sensor 2. **S2** appears if the user has chosen to display data only from sensor 2 (pH).

   iii. **G** is the impedance of the glass pH electrode.

2. select a language
3. change the screen contrast

To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.

5.11.2 Procedure: Selecting a Display Screen

```
Calibrate          Hold
Program         Display
```

```
Default Display
Language       Contrast
```

1. Press MENU. The main menu screen appears. Choose **Display**.
2. Choose **Default Display**.
3. Press ▲ or ▼ until the desired display appears. Press ENTER. For an explanation of abbreviations, see Section 5.11.1.
4. The display returns to the screen in step 2. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

5.11.3 Procedure: Choosing a Language

```
Calibrate          Hold
Program         Display
```

```
Default Display
Language       Contrast
```

```
English        Fran ais
Espa ol              >>
```

1. Press MENU. The main menu screen appears. Choose **Display**.
2. Choose **Language**.
3. Choose English, Français, Español, Deutsch, Italiano, or Portugues.
4. The display returns to the screen in step 2. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

5.11.2 Procedure: Changing Screen Contrast

```
Calibrate          Hold
Program         Display
```

```
Default Display
Units          Contrast
```

```
Screen Contrast:
           50
```

1. Press MENU. The main menu screen appears. Choose **Display**.
2. Choose **Contrast**.
3. Press ▲ or ▼ to increase or decrease the screen contrast. As contrast increases, the number increases.
4. The display returns to the screen shown in step 2. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

SECTION 6.0
CALIBRATION

6.1 INTRODUCTION

The Calibrate Menu allows the user to calibrate sensor 1 (chlorine) and sensor 2 (pH or ORP). The temperature response of each sensor can also be calibrated.

Chlorine sensors require periodic full-scale calibration. The purpose of the full-scale standard is to establish the slope of the calibration curve. Because stable chlorine standards do not exist, **the sensor must be calibrated against a test run a grab sample of the process liquid.** Several manufacturers offer portable test kits for this purpose.

New chlorine sensors must be zeroed before being placed in service. Sensors should also be zeroed every time the electrolyte solution is replaced. Zeroing involves placing the sensor in a chlorine-free sample until the sensor current drops to its lowest stable value.

For pH sensors, two-point buffer calibration is standard. In auto calibration the analyzer calculates the pH of the buffer from the nominal value entered by the user and does not accept calibration data until readings are stable. In manual calibration the user enters buffer values and judges when readings are stable. The pH reading can also be standardized, that is, forced to match the reading from a referee instrument. Finally, if the user knows the electrode slope (at 25°C), he can enter it directly.

The ORP calibration is a single-point calibration against an ORP standard.

6.2 CALIBRATING TEMPERATURE

6.2.1 Purpose

Temperature is important in the measurement of chlorine, pH, and ORP for different reasons.

Both the free and total chlorine sensors are membrane-covered amperometric sensors. As the sensor operates, free chlorine, monochloramine, or iodine, in the case of the total chlorine sensor, diffuses through the membrane and is consumed at an electrode immediately behind the membrane. The reaction produces a current that depends on the rate at which the analyte diffuses through the membrane. The analyte is the substance being measured: free chlorine or iodine. The diffusion rate, in turn, depends on the concentration of the analyte and how easily it passes through the membrane (the membrane permeability). Because membrane permeability is a function of temperature, the sensor current will change if either the concentration or temperature changes. To account for changes in sensor current caused by temperature alone, the analyzer automatically applies a membrane permeability correction. The membrane permeability changes about 3%/°C at 25°C, so a 1°C error in temperature produces about a 3% error in the reading. Temperature also plays a role in the pH correction applied to free chlorine readings.

Temperature is also important in pH measurements.

1. The analyzer uses a temperature dependent factor to convert measured cell voltage to pH. Normally, a slight inaccuracy in the temperature reading is unimportant unless the pH reading is significantly different from 7.00. Even then, the error is small. For example, at pH 12 and 25°C, a 1°C error produces a pH error less than ±0.02.
2. During auto calibration, the Solu Comp II recognizes the buffer being used and calculates the actual pH of the buffer at the measured temperature. Because the pH of most buffers changes only slightly with temperature, reasonable errors in temperature do not produce large errors in the buffer pH. For example, a 1°C error causes **at most** an error of ±0.03 in the calculated buffer pH.
3. The Solu Comp II can be programmed to calculate and display pH at a reference temperature (25°C). The maximum change in solution pH with temperature is about ±0.04 pH/°C, so a 1°C temperature error does introduce a small error. However, the major source of error in solution temperature compensation is using an incorrect temperature coefficient.

Temperature affects the measurement of ORP in a complicated fashion that is best determined empirically.

Without calibration the accuracy of the temperature measurement is about ±0.4°C. Calibrate the sensor/analyzer unit if

1. ±0.4°C accuracy is not acceptable
2. the temperature measurement is suspected of being in error. Calibrate temperature by making the analyzer reading match the temperature measured with a **standard thermometer**.

6.2.2 Procedure

1. Remove the sensor from the process. Place it in an insulated container of water along with a **calibrated thermometer**. Submerge at least the bottom two inches of the sensor. Stir continuously.
2. Allow the sensor to reach thermal equilibrium. For some sensors, the time constant for a change in temperature is 5 min., so it may take as long as 30 min. for temperature equilibration.
3. If the sensor cannot be removed from the process, measure the temperature of a flowing sample taken from a point as close to the sensor as possible. Let the sample continuously overflow an insulated container holding a **calibrated thermometer**.
4. Change the Solu Comp II display to match the **calibrated thermometer** using the procedure below.

```
Calibrate          Hold
Program         Display
```

a. Press MENU. The main menu screen appears. Choose **Calibrate**.

```
Calibrate?
Sensor1         Sensor2
```

b. Choose **Sensor1** (chlorine) or **Sensor2** (pH).

```
CalSensor1?
Measurement        Temp
```

c. Choose **Temp**.

```
Live             25.0°C
CalS1           +25.0°C
```

d. If the analyzer was programmed in Section 5.6 to use the actual process temperature, the screen at left will appear. To calibrate the temperature, change the number in the second line to match the temperature measured with the **standard thermometer**. Press ENTER. Go to step f.

If the calibration temperature is more than 2 or 3°C different from the live reading, see Section 8.7.1.

If the analyzer was programmed to use a temperature entered by the user, go to step e.

```
ManualTemp?
S1: +25.0°C
```

e. The screen at left will appear. Change the temperature to the desired value, then press ENTER. The analyzer will use the temperature entered in this step in all measurements and calculations, no matter what the true temperature is.

```
CalSensor1?
Measurement        Temp
```

f. The screen at left will appear. Press EXIT.

```
Calibrate?
Sensor1         Sensor2
```

g. Choose the other sensor and calibrate its temperature response.

h. To return to the main display, press MENU followed by EXIT.

6.3 CALIBRATION — FREE CHLORINE

6.3.1 Purpose

This section covers the calibration of both the 499ACL-01 free chlorine sensor and the 498CL-01 pH-independent free chlorine sensor.

As Figure 6-1 shows, a free chlorine sensor generates a current directly proportional to the concentration of free chlorine in the sample. Calibrating the sensor requires exposing it to a solution containing no chlorine (zero standard) and to a solution containing a known amount of chlorine (full-scale standard).

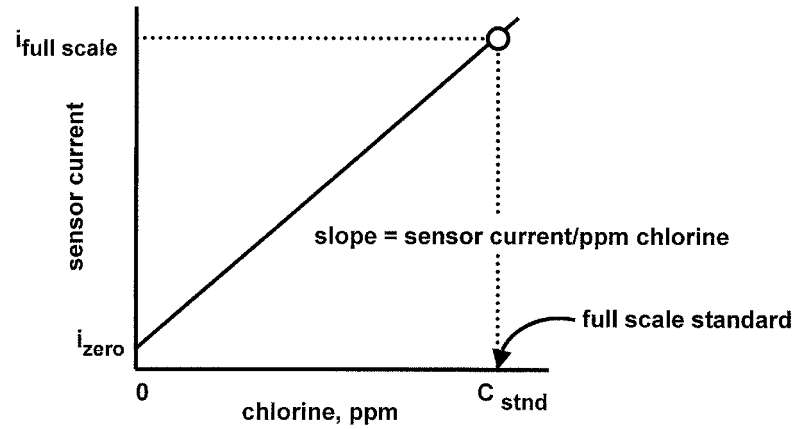


FIGURE 6-1. Sensor Current as a Function of Free Chlorine Concentration

The zero standard is necessary because chlorine sensors, even when no chlorine is in the sample, generate a small current called the residual current. The analyzer compensates for the residual current by subtracting it from the measured current before converting the result to a chlorine value. New sensors require zeroing before being placed in service, and sensors should be zeroed whenever the electrolyte solution is replaced. The following are suitable zero standards:

- To zero the 499ACL-01 sensor use deionized water containing about 0.5 gram (1/8 teaspoonful) of table salt in 1 liter. DO NOT USE DEIONIZED WATER ALONE FOR ZEROING THE 499ACL-01 SENSOR. The zero solution must have conductivity greater than 50 µS/cm.
- To zero the 498CL-01 pH-independent free chlorine sensor use deionized water. The salt is not necessary.
- Both sensors can zeroed using tap water known to contain no chlorine. Expose tap water to bright sunlight for 24 hours.

The purpose of the full-scale standard is to establish the slope of the calibration curve. Because stable chlorine standards do not exist, **the sensor must be calibrated against a test run on a grab sample of the process liquid.** Several manufacturers offer portable test kits for this purpose. Observe the following precautions when taking and testing the grab sample.

- Take the grab sample from a point as close to the sensor as possible. Be sure that taking the sample does not alter the flow of the sample to the sensor. It is best to install the sample tap just downstream from the sensor.
- Chlorine solutions are unstable. Run the test immediately after taking the sample. Try to calibrate the sensor when the chlorine concentration is at the upper end of the normal operating range.

Free chlorine measurements made with the 499ACL-01 sensor also require a pH correction. Free chlorine is the sum of hypochlorous acid (HOCl) and hypochlorite ion (OCl^-). The relative amount of each depends on the pH of the sample. As pH increases, the concentration of HOCl decreases and the concentration of OCl^- increases. Because the raw signal generated by a free chlorine sensor depends primarily on the concentration of HOCl reaching the cathode, a change in the pH of the sample after calibration can cause an error.

The Solu Comp II offers both automatic and manual pH correction. In automatic pH correction, a pH sensor continuously monitors the pH of the sample and the analyzer uses the pH signal to correct the free chlorine reading for changes in pH. In manual correction, the user must enter the pH of the solution. Generally, if the pH changes more than about 0.2 units over short periods of time, automatic pH correction is best. If the pH is relatively steady or subject only to seasonal changes, manual pH correction is adequate.

During calibration of the 499ACL-01 sensor, the analyzer must know the pH of the solution. If the analyzer is using automatic pH correction, the pH sensor (properly calibrated) **must be in the process liquid before starting the calibration.** If the analyzer is using manual pH correction, be sure to enter the pH value before starting the calibration.

Unlike the 499ACL-01 sensor, the 498CL-01 sensor has almost no pH dependence. The difference between the sensors is the high acidity of the fill solution in the 498CL-01. The acidity converts OCl^- into HOCl, making the sensor response practically independent of changes in sample pH. However, if the user wishes to measure pH for other purposes, the Solu Comp II permits an independent pH measurement to be made.

The Model 499ACL-01 free chlorine sensor loses sensitivity at high concentrations of chlorine. The Solu Comp II analyzer has a dual slope feature that allows the user to compensate for the non-linearity of the sensor. However, for the vast majority of applications, dual slope calibration is unnecessary.

6.3.2 Procedure — Zeroing the sensor.

1. Place the sensor in the zero standard. Be sure no air bubbles are trapped against the membrane. The sensor current will drop rapidly at first and then gradually reach a stable zero value. To monitor the sensor current, go to the main display and press ▼ until the sensor input current is showing. Typical zero currents for free chlorine sensors are shown in the table:

Sensor	pH correction	zero current
499ACL-01	may require pH correction	-10 to +10 nA
498CL-01	pH-independent	-10 to +50 nA

A new sensor or a sensor in which the electrolyte solution has been replaced may require several hours (occasionally as long as overnight) to reach a minimum zero current. DO NOT START THE ZERO ROUTINE UNTIL THE SENSOR HAS BEEN IN ZERO SOLUTION FOR AT LEAST TWO HOURS.

```
Calibrate          Hold
Program         Display
```

2. Press MENU. The main menu screen appears. Choose **Calibrate**.

```
Calibrate?
Sensor1         Sensor2
```

3. Choose **Sensor 1** (free chlorine). For a single sensor configuration, this screen will not appear.

```
CalSensor1?
Measurement        Temp
```

4. Choose **Measurement**.

```
Cal S1?
InProcess          Zero
```

5. Choose **Zero**.

```
S1 Live        1.000ppm
Zeroing            Wait
```

6. The screen at left appears. The top line is the current chlorine reading based on the previous calibration or, for a first time calibration, the default sensitivity.

```
Possible ZeroErr
Proceed?   Yes       No
```

7. Once the reading is stable, the screen at left appears. Sensor zero is complete and the analyzer has stored the zero current. The screen remains until the operator presses MENU then EXIT to return to the main display.

NOTE

Pressing ENTER during the zero step will cause the analyzer to use the present sensor current as the zero current. If the sensor is zeroed before the current has reached a minimum stable value, subsequent readings will be in error.

After zeroing, leave the sensor in the zero solution and verify that the sensor current is between the values shown in the table in step 1. To display the sensor current, go the the main display and press ▼ until the input current is showing.

S1 Live	0.000ppm
Sensor Zero Done	

Sensor Zero Fail
Current Too High

8. This screen appears if the zero current is extremely high. See Section 8.3 for troubleshooting. To repeat the zero step, press EXIT and choose **Zero**.
9. This screen appears if the zero current is moderately high. To continue, choose **Yes**. To repeat the zero step, choose **No**.

6.3.3 Procedure — Calibrating the sensor (single slope)

NOTE

Single slope calibration is the commonly used calibration method for both free chlorine sensors. Dual slope calibration, described is section 6.3.4, is rarely needed.

1. Place the sensor in the process liquid. If a 499ACL-01 sensor with automatic pH correction is being used, calibrate the pH sensor (section 6.4) and place it in the process liquid, too. If a 499ACL-01 sensor with manual pH correction is being used, measure the pH of the sample and enter the value. See Section 5.5. If a 498CL-01 sensor is being used, the pH measurement is not necessary. However, be sure that the Solu Comp II has been programmed for manual pH correction and the pH is 7.00. Adjust the sample flow until it is in the range recommended for the sensor. Refer to the sensor instruction sheet.
2. Adjust the chlorine concentration until it is near the upper end of the control range. Wait until the analyzer reading is stable before starting the calibration.

Calibrate	Hold
Program	Display

3. Press MENU. The main menu screen appears. Choose **Calibrate**.

Calibrate?	
Sensor1	Sensor2

4. Choose **Sensor 1** (free chlorine). For a single sensor configuration, this screen will not appear.

CalSensor1?	
Measurement	Temp

5. Choose **Measurement**.

Cal S1?	
InProcess	Zero

6. Choose **InProcess**.

Live	10.000ppm
Cal S1	10.000ppm

7. The screen shown at left appears. The top line is the current chlorine reading based on the previous calibration.

   Sample the process liquid. Make a note of the reading before taking the sample. Immediately determine free chlorine. Note the analyzer reading again. If the present reading (X) differs from the reading when the sample was taken (Y), calculate the value to enter (C) from the following formula:

   $$C = (X/Y)\ (A)$$

   where A is the concentration of chlorine in the grab sample.

   Change the reading in the second line to match the results of the grab sample test.

8. During calibration, the analyzer stores the measured current and calculates the sensitivity. Sensitivity is sensor current in nA divided by the concentration of chlorine.

Typical sensitivity for free chlorine sensors are shown in the table:

Sensor	pH correction	sensitivity
499ACL-01	may require pH correction	250-500 nA/ppm
498CL-01	pH-independent	400-1000 nA/ppm

Possible Cal Err
Proceed? Yes **No**

9. This screen appears if the sensitivity is moderately higher or lower than expected. To continue, choose **Yes**. To repeat the calibration, choose **No**. For troubleshooting assistance, see Section 8.3.

Calibration
Error

10. This screen appears if the sensitivity is much higher or lower than expected. See Section 8.3. for troubleshooting. To repeat the calibration step, press EXIT and choose **InProcess**.

6.3.4 Procedure — Calibrating the sensor (dual slope)

Figure 6-2 shows the principle of dual slope calibration. Between zero and concentration C1, the sensor response is linear. When the concentration of chlorine becomes greater than C1, the response is non-linear. In spite of the non-linearity, the response can be approximated by a straight line between point 1 and point 2.

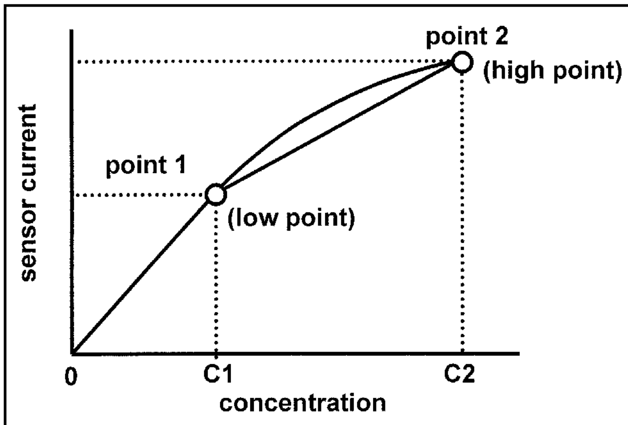


FIGURE 6-2. Dual Slope Calibration

Dual slope calibration is rarely needed. It is probably useful in fewer than 5% of applications.

1. Place the sensor in the zero standard. Be sure no air bubbles are trapped against the membrane. The sensor current will drop rapidly at first and then gradually reach a stable zero value. To monitor the sensor current, go to the main display and press ▼ until the sensor input current is showing.

   Typical zero currents for free chlorine sensors are shown in the table.

Sensor	pH correction	zero current
499ACL-01	may require pH correction	-10 to +10 nA
498CL-01	pH-independent	-10 to +50 nA

   A new sensor or a sensor in which the electrolyte solution has been replaced may require several hours (occasionally as long as overnight) to reach a minimum zero current. DO NOT START THE ZERO ROUTINE UNTIL THE SENSOR HAS BEEN IN ZERO SOLUTION FOR AT LEAST TWO HOURS.

2. Be sure the analyzer has been configured for dual slope calibration. See Section 5.5.4.

Calibrate Hold
Program Display

3. Press MENU. The main menu screen appears. Choose **Calibrate**.

Calibrate?
Sensor1 Sensor2

4. Choose **Sensor 1** (free chlorine) for a single sensor configuration, this screen will not appear.

CalSensor1?
Measurement Temp

5. Choose **Measurement**.

```
Cal S1?
Zero        pt1        pt2
```

6. Choose **Zero**.

```
S1 Live          1.000ppm
Zeroing              Wait
```

7. The screen at left appears. The top line is the current chlorine reading based on the previous calibration or, for a first time calibration, the default sensitivity.

```
S1 Live          0.000ppm
Sensor      Zero      Done
```

8. Once the reading is stable, the screen at left appears. Sensor zero is complete, and the analyzer has stored the zero current. The screen remains until the operator presses EXIT to return to the screen in step 9. If a "Sensor zero fail" or "Possible zero error" screen appears, refer to Section 8.3 -Troubleshooting.

```
Cal S1?
Zero        pt1        pt2
```

9. Place the sensor in the process liquid. If a 499ACL-01 sensor with automatic pH correction is being used, calibrate the pH sensor (section 6.4) and place it in the process liquid, too. If a 499ACL-01 sensor with manual pH correction is being used, measure the pH of the sample and enter the value. See Section 5.5. If a 498CL-01 sensor is being used, the pH measurement is not necessary. However, be sure that the Solu Comp II has been programmed for manual pH correction and the pH is 7.00. Adjust the sample flow until it is in the range recommended for the sensor. Refer to the sensor instruction sheet.

   Adjust the concentration of chlorine until it is near the upper end of the linear response range of the sensor (pt1 in Figure 6-2).

```
S1 Live          10.00ppm
pt1              10.00ppm
```

10. Choose **pt1**. The screen at left appears. The top line is the current chlorine reading based on the previous calibration or, for a first time calibration, the default sensitivity

11. Wait until the reading is stable.

    Sample the process liquid. Make a note of the reading before taking the sample. Immediately determine free chlorine. Note the analyzer reading again. If the present reading (X) differs from the reading when the sample was taken (Y), calculate the value to enter (C) from the following formula:

$$C = (X/Y)\ (A)$$

    where A is the concentration of chlorine in the grab sample.

    Change the reading in the second line to match the results of the grab sample test.

```
Cal S1?
Zero        pt1        pt2
```

12. The screen returns to the display in step 9.

13. Adjust the concentration of chlorine until it is near the top end of the range (pt2 in Figure 6-2).

```
S1 Live          10.00ppm
pt2              10.00ppm
```

14. Choose **pt2**. The screen at left appears. The top line is the current chlorine reading based on the previous calibration or, for a first time calibration, the default sensitivity.

15. Following the procedure in step 11, determine chlorine in a sample of the process liquid. Change the reading in the second line to match the results of the grab sample test.

16. The display returns to the screen in step 9. Press MENU followed by EXIT to return to the main display.

6.4 CALIBRATION — TOTAL CHLORINE

See Total Chlorine Analyzer instruction manual (PN 51-TCL1055) for calibration procedure.

6.5 CALIBRATION — MONOCHLORAMINE

6.5.1 Purpose

As Figure 6-6 shows, a monochloramine sensor generates a current directly proportional to the concentration of monochloramine in the sample. Calibrating the sensor requires exposing it to a solution containing no monochloramine (zero standard) and to a solution containing a known amount of monochloramine (full-scale standard).

The zero standard is necessary because monochloramine sensors, even when no monochloramine is in the sample, generate a small current called the residual or zero current. The analyzer compensates for the residual current by subtracting it from the measured current before converting the result to an monochloramine value. New sensors require zeroing before being placed in service, and sensors should be zeroed whenever the electrolyte solution is replaced. The best zero standard is deionized water containing about 500 ppm sodium chloride. Dissolve 0.5 grams (1/8 teaspoonful) of table salt in 1 liter of water. DO NOT USE DEIONIZED WATER ALONE FOR ZEROING THE SENSOR. THE CONDUCTIVITY OF THE ZERO WATER MUST BE GREATER THAN 50 µS/cm.

The purpose of the full-scale standard is to establish the slope of the calibration curve. Because stable monochloramine standards do not exist, **the sensor must be calibrated against a test run on a grab sample of the process liquid.** Several manufacturers offer portable test kits for this purpose. Observe the following precautions when taking and testing the grab sample.

- Take the grab sample from a point as close to the sensor as possible. Be sure that taking the sample does not alter the flow of the sample to the sensor. It is best to install the sample tap just downstream from the sensor.
- Monochloramine solutions are unstable. Run the test immediately after taking the sample. Try to calibrate the sensor when the monochloramine concentration is at the upper end of the normal operating range.

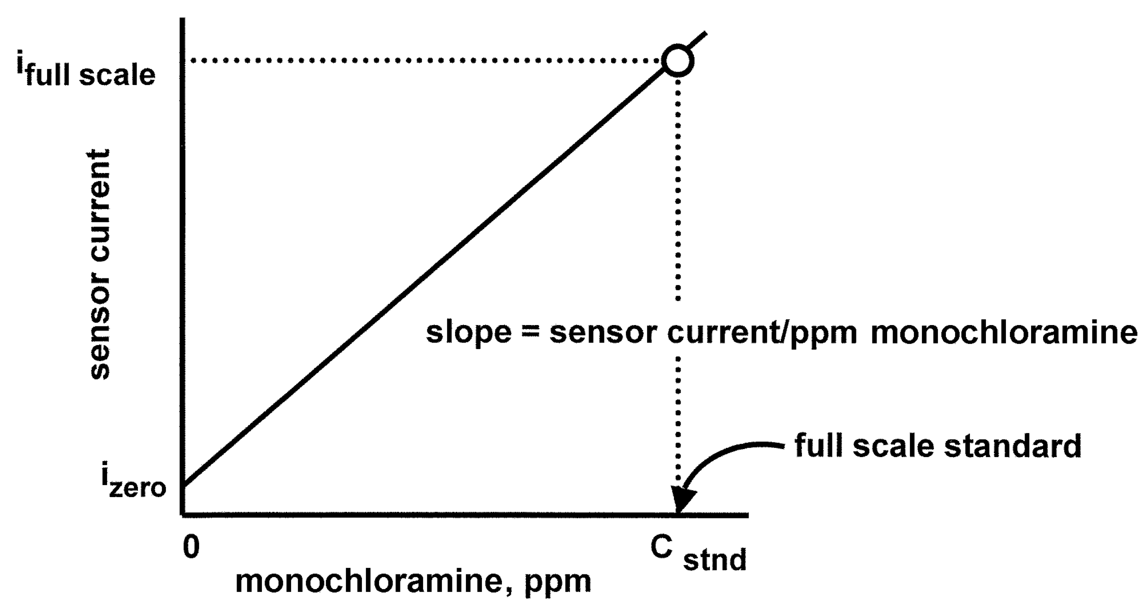


FIGURE 6-6. Sensor Current as a Function of Monochloramine Concentration

6.5.2 Procedure — Zeroing the sensor.

1. Place the sensor in the zero standard. Be sure no air bubbles are trapped against the membrane. The sensor current will drop rapidly at first and then gradually reach a stable zero value. To monitor the sensor current, go to the main display and press ▼ until the sensor input current is showing. Typical zero current for an monochloramine sensor is between 0 and 20 nA.

   A new sensor or a sensor in which the electrolyte solution has been replaced may require several hours (occasionally as long as overnight) to reach a minimum zero current. DO NOT START THE ZERO ROUTINE UNTIL THE SENSOR HAS BEEN IN ZERO SOLUTION FOR AT LEAST TWO HOURS.

```
Calibrate          Hold
Program         Display
```

2. Press MENU. The main menu screen appears. Choose **Calibrate**.

```
CalSensor1?
Measurement        Temp
```

3. Choose **Measurement**.

```
Cal S1?
InProcess          Zero
```

4. Choose **Zero**.

```
S1 Live        1.000ppm
Zeroing            Wait
```

5. The screen at left appears. The top line is the current monochloramine reading based on the previous calibration or, for a first time calibration, the default sensitivity.

```
S1 Live        0.000ppm
Sensor Zero Done
```

6. Once the reading is stable, the screen at left appears. Sensor zero is complete and the analyzer has stored the zero current. The screen remains until the operator presses MENU then EXIT to return to the main display.

   NOTE

   Pressing ENTER during the zero step will cause the analyzer to use the present sensor current as the zero current. If the sensor is zeroed before the current has reached a minimum stable value, subsequent readings will be in error.

   After zeroing, leave the sensor in the zero solution and verify that the sensor current is between 0 and 20 nA. To display the sensor current, go the the main display and press ▼ until the input current is showing.

```
Sensor Zero Fail
Current Too High
```

7. This screen appears if the zero current is extremely high. See Section 8.5 for troubleshooting. To repeat the zero step, press EXIT and choose **Zero**.

```
Possible ZeroErr
Proceed?   Yes       No
```

8. This screen appears if the zero current is moderately high. To continue, choose **Yes**. To repeat the zero step, choose **No**. See Section 8.5 for troubleshooting.

6.5.3 Procedure — Calibrating the sensor

1. Place the sensor in the process liquid. Adjust the sample flow until it is in the range recommended for the sensor. Refer to the sensor instruction sheet.
2. Adjust the monochloramine concentration until it is near the upper end of the operating range. Wait until the analyzer reading is stable before starting the calibration.

```
Calibrate        Hold
Program       Display
```

3. Press MENU. The main menu screen appears. Choose **Calibrate**.

```
CalSensor1?
Measurement      Temp
```

4. Choose **Measurement**.

```
Cal S1?
InProcess        Zero
```

5. Choose **InProcess**.

```
Live        10.000ppm
Cal S1      10.000ppm
```

6. The screen shown at left appears. The top line is the current monochloramine reading based on the previous calibration.

   Sample the process liquid. Make a note of the reading before taking the sample. Immediately determine monochloramine. Note the analyzer reading again. If the present reading (X) differs from the reading when the sample was taken (Y), calculate the value to enter (C) from the following formula:

   $$C = (X/Y)\ (A)$$

   where A is the concentration of monochloramine in the grab sample.

   Change the reading in the second line to match the results of the grab sample test.

7. During calibration, the analyzer stores the measured current and calculates the sensitivity. Sensitivity is sensor current in nA divided by the concentration of monochloramine. The sensitivity of a 499ACL-03 (monochloramine) sensor is 250-450 nA/ppm at 25°C.

```
Possible Cal Err
Proceed?   Yes     No
```

8. This screen appears if the sensitivity is moderately higher or lower than expected. To continue, choose **Yes**. To repeat the calibration, choose **No**. For troubleshooting assistance, see Section 8.5.

```
Calibration
Error
```

9. This screen appears if the sensitivity is much higher or lower than expected. See Section 8.5. for troubleshooting. To repeat the calibration step, press EXIT and choose **InProcess**.

6.6 AUTO CALIBRATION — pH

6.6.1 Purpose

1. New sensors must be calibrated before use. Regular recalibration is also necessary.
2. Use auto calibration instead of manual calibration. Auto calibration avoids common pitfalls and reduces errors.

6.6.2 Definitions

1. AUTO CALIBRATION. The analyzer recognizes the buffers and uses temperature-corrected pH values in the calibration. The table lists the buffers the Solu Comp II recognizes.

pH at 25°C (nominal pH)	Standard(s)
1.68	NIST, DIN 19266, JSI 8802, BSI (see note 1)
3.56	NIST, BSI
3.78	NIST
4.01	NIST, DIN 19266, JSI 8802, BSI
6.86	NIST, DIN 19266, JSI 8802, BSI
7.00	(see note 2)
7.41	NIST
9.18	NIST, DIN 19266, JSI 8802, BSI
10.01	NIST, JSI 8802, BSI
12.45	NIST, DIN 19266

Note 1: NIST is National Institute of Standards, DIN is Deutsche Institute für Normung, JSI is Japan Standards Institute, and BSI is British Standards Institute.

Note 2: pH 7 buffer is not a standard buffer. It is a popular commercial buffer in the United States.

The Solu Comp II also measures noise and drift and does not accept calibration data until readings are stable. Calibration data will be accepted as soon as the pH reading is constant to within 0.02 units for 10 seconds. The stability settings cannot be changed.

2. SLOPE AND OFFSET. Once the Solu Comp II successfully completes the calibration, it calculates and displays the calibration slope and offset. The slope is reported as the slope at 25°C. Figure 6-7 defines the terms.

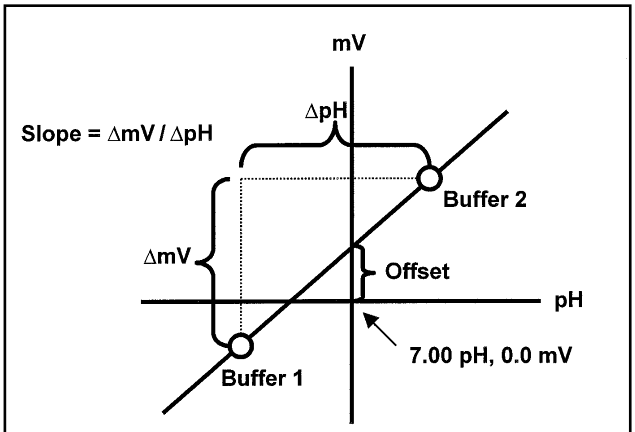


FIGURE 6-7. Calibration Slope and Offset

6.6.3 Procedure

1. Obtain two buffer solutions. Ideally the buffer pH values should bracket the range of pH values to be measured.
2. Remove the sensor from the process liquid. If the process and buffer temperatures are appreciably different, place the sensor in a container of tap water at the buffer temperature. Do not start the calibration until the sensor has reached the buffer temperature. Thirty minutes is usually adequate.
3. Calibrate the sensor by using the procedure on the following page.

Display	Step
Calibrate Hold Program Display	a. Press MENU. The main menu screen appears. Choose **Calibrate**.
Calibrate? **Sensor1** Sensor2	b. Choose **Sensor2** (pH sensor).
CalSensor2? **Measurement** Temp	c. Choose **Measurement**.
S2 Standardize Slope **BufferCal**	d. Choose **BufferCal**.
S2BufferCal? **Auto** Manual	e. Choose **Auto**.
S2AutoCal? **Buffer1** Buffer2	f. Choose **Buffer1**.
	g. Rinse the sensor with water and place it in buffer 1. Be sure the glass bulb and reference junction are completely submerged. Swirl the sensor.
S2Live 7.00pH AutoBuf1 **Wait**	h. The screen at left is displayed until the reading is stable (<0.02 pH change in 10 sec). When the reading is stable, the screen in step i appears. To bypass automatic stabilization, press ENTER at any time.
S2Live 7.00pH AutoBuf1 **7.01pH**	i. The top line shows the actual reading (**S2Live**). The analyzer also identifies the buffer and displays the nominal buffer value (buffer pH at 25°C). If the displayed value is not correct, press ▲ or ▼ to select the correct value. The nominal value will change, for example, from 7.01 pH to 6.86 pH. Press ENTER.
S2AutoCal? **Buffer1** Buffer2	j. The screen shown at left appears.
S2AutoCal? Buffer1 **Buffer2**	k. Remove the sensor from buffer 1, rinse it with water, and place it in buffer 2. Swirl the sensor. Choose **Buffer2**.
S2Live 7.00pH Buf2 **Wait**	l. The screen at left is displayed until the reading is stable (<0.02 pH change in 10 sec). When the reading is stable, the screen in step m appears. To bypass automatic stabilization, press ENTER at any time.
S2Live 7.00pH AutoBuf2 **7.01pH**	m. The top line shows the actual reading (**S2Live**). The analyzer also identifies the buffer and displays the nominal buffer value (buffer pH at 25°C). If the displayed value is not correct, press ▲ or ▼ to select the correct value. The nominal value will change, for example, from 7.01 pH to 6.86 pH. Press ENTER to accept the nominal value.
S2Offset 6mV Slope 59.16 25°C	n. If the calibration was successful, the analyzer will display the offset and slope (at 25°C). The display will return to the screen in step b. Choosing **Sensor1** (chlorine sensor) will permit the chlorine measurement to be calibrated.
Calibration Error	o. If the slope is out of range (less than 45 mV/pH or greater than 60 mV/pH), an error screen appears. The display then returns to step f. Repeat the calibration.
	p. To return to the main display, press MENU followed by EXIT.

6.7 MANUAL CALIBRATION — pH

6.7.1 Purpose

1. New sensors must be calibrated before use. Regular recalibration is also necessary.
2. Use manual calibration if non-standard buffers are being used; otherwise, use auto calibration. Auto calibration avoids common pitfalls and reduces errors.

6.7.2 Definitions

1. MANUAL CALIBRATION. In auto calibration the analyzer recognizes the buffer and uses the temperature-corrected pH value in the calibration. The analyzer also measures noise and drift and does not accept calibration data until readings are stable. During manual calibration, the user must judge when readings are stable and look up and enter the buffer values.
2. SLOPE AND OFFSET. Once the Solu Comp II successfully completes the calibration, it calculates and displays the calibration slope and offset. The slope is reported as the slope at 25ºC. Figure 6-7 defines the terms.

6.7.3 Procedure

1. Obtain two buffer solutions. Ideally, the buffer pHs should bracket the range of pH values to be measured. Also obtain a thermometer. The pH of most buffer solutions is a function of temperature. To calibrate the sensor properly, the pH of the buffer at the measurement temperature must be entered in the analyzer.
2. Remove the sensor from the process liquid. If the process and buffer temperature are appreciably different, place the sensor in a container of tap water at the buffer temperature. Do not start the calibration until the sensor has reached the buffer temperature. Thirty minutes is usually adequate.
3. Calibrate the sensor using the procedure on the following page.

```
Calibrate          Hold
Program         Display
```

a. Press MENU. The main menu screen appears. Choose **Calibrate**.

```
Calibrate?
Sensor1         Sensor2
```

b. Choose **Sensor2** (pH sensor).

```
CalSensor2?
Measurement        Temp
```

c. Choose **Measurement**.

```
S2          Standardize
Slope         BufferCal
```

d. Choose **BufferCal**.

```
S2BufferCal?
Auto             Manual
```

e. Choose **Manual**.

```
S2ManualCal?
Buffer1         Buffer2
```

f. Choose **Buffer1**.

g. Rinse the sensor with water and place it in buffer 1. Be sure the glass bulb and junction are completely submerged. Swirl the sensor. Also place a thermometer in the buffer. Press ENTER

```
S2Live           7.00pH
Buf1            07.00pH
```

h. The top line shows the actual buffer reading (**S2 Live**). Wait until the reading is stable, then note the temperature. Change the pH in the second line to the pH of the buffer at the measured temperature. Press ENTER.

```
S2ManualCal?
Buffer1         Buffer2
```

i. The screen at left appears. Choose **Buffer2**. Rinse the sensor and thermometer with water and place them in buffer 2. Be sure the bulb and junction are submerged. Swirl the sensor.

```
S2Live          10.00pH
Buf2            10.00pH
```

j. The top line shows the actual buffer reading (**S2 Live**). Wait until the reading is stable, then note the temperature. Change the pH in the second line to the pH of the buffer at the measured temperature. Press ENTER.

```
S2Offset            6mV
Slope        59.16 25°C
```

k. If the calibration was successful, the analyzer will display the offset and slope (at 25°C). The display will return to the screen in step b. Choosing **Sensor1** (chlorine sensor) will permit the chlorine measurement to be calibrated.

```
Calibration Error!
```

l. If the slope is out of range (less than 45 mV/pH or greater than 60 mV/pH), an error screen appears. The display then returns to step f. Repeat the calibration.

m. To return to the main display, press MENU followed by EXIT.

6.8 STANDARDIZATION — pH

6.8.1 Purpose

1. The pH measured by the Solu Comp II analyzer can be changed to match the reading from a second or referee instrument. The process of making the two readings agree is called standardization.
2. During standardization, the difference between the two pH values is converted to the equivalent voltage. The voltage, called the reference offset, is added to all subsequent measured cell voltages before they are converted to pH. If a standardized sensor is placed in a buffer solution, the measured pH will differ from the buffer pH by an amount equivalent to the standardization offset.

6.8.2 Procedure

1. Install the sensor in the process liquid.
2. Once readings are stable, measure the pH of the liquid using a referee instrument.
3. Because the pH of the process liquid may change if the temperature changes, measure the pH of the grab sample immediately after taking it.
4. For poorly buffered samples, it is best to determine the pH of a continuously flowing sample from a point as close as possible to the sensor.
5. Standardize the Solu Comp II analyzer by following the steps below.

Display	Step
Calibrate Hold Program Display	a. Press MENU. The main menu screen appears. Choose **Calibrate**.
Calibrate? Sensor1 **Sensor2**	b. Choose **Sensor2** (pH sensor).
CalSensor2? **Measurement** Temp	c. Choose **Measurement**.
S2 **Standardize** Slope BufferCal	d. Choose **Standardize**.
Live 7.00pH CalS2 **0**7.00pH	e. The top line shows the present pH reading. Change the pH reading in the second line to match the referee instrument. Press ENTER.
Invalid Input! Max: 14.00pH	f. The screen at left appears if the entered pH was greater than 14.00. The display then returns to step e. Repeat the standardization.
S2 **Standardize** Slope BufferCal	g. If the entry was accepted, the screen at left appears. To verify that the new pH was accepted, return to the main display by pressing MENU followed by EXIT.

6.9 ENTERING A KNOWN SLOPE VALUE — pH

6.9.1 Purpose

If the electrode slope is known from other measurements, it can be entered directly in the Solu Comp II analyzer. The slope must be entered as the slope at 25°C. To calculate the slope at 25°C from the slope at temperature t°C, use the equation:

$$\text{slope at 25°C} = (\text{slope at t°C}) \frac{298}{\text{t°C} + 273}$$

Changing the slope overrides the slope determined from the previous buffer calibration.

6.9.2 Procedure

```
Calibrate          Hold
Program         Display
```

1. Press MENU. The main menu screen appears. Choose **Calibrate**.

```
Calibrate?
Sensor1         Sensor2
```

2. Choose **Sensor2** (pH sensor).

```
CalSensor2?
Measurement        Temp
```

3. Choose **Measurement**.

```
S2          Standardize
Slope         BufferCal
```

4. Choose **Slope**.

```
Changing slope
overrides bufcal.
```

5. The screen at left appears briefly.

```
pH Slope   25°C?
S2:   59.16mV/pH
```

6. Change the slope to the desired value. Press ENTER.

```
Invalid Input!
```

7. The slope must be between 45 and 60 mV/pH. If the value entered is outside this range, the screen at left appears.

```
S2          Standardize
Slope         BufferCal
```

8. If the entry was accepted, the screen at left appears.

9. To return to the main display, press MENU followed by EXIT.

6.10 ORP CALIBRATION

6.10.1 Purpose

1. For process control, it is often important to make the measured ORP agree with the ORP of a standard solution.
2. During calibration, the measured ORP is made equal to the ORP of a standard solution at a single point.

6.10.2 Preparation of ORP standard solutions

ASTM D1498-93 gives procedures for the preparation of iron (II) - iron (III) and quinhydrone ORP standards. The iron (II) - iron (III) standard is recommended. It is fairly easy to make, is not particularly hazardous, and has a shelf life of about one year. In contrast, quinhydrone standards contain toxic quinhydrone and have only an eight-hour shelf life.

Iron (II) - iron (III) standard is available from Rosemount Analytical as PN R508-16OZ. The ORP of the standard solution measured against a silver-silver chloride reference electrode is 476±20mA at 25°C. The redox potential is -476±20mA at 25°C.

6.10.3 Procedure

Calibrate	Hold
Program	Display

1. Press MENU. The main menu screen appears. Choose **Calibrate**.

Calibrate?	
Sensor1	**Sensor2**

2. Choose **Sensor2** (ORP sensor).

CalSensor2?	
Measurement	Temp

3. Choose **Measurement**.

Live	600mV
CalS2	**+**0000mV

4. The top line shows the actual ORP or redox potential (**S2Live**). Once the reading is stable, change the number in the second line to the desired value. Press ENTER.
5. The display returns to the screen in step 2. Choosing **Sensor1** will permit the chlorine measurement to be calibrated.
6. To return to the main display, press MENU followed by EXIT.

SECTION 7.0
MAINTENANCE

7.1 OVERVIEW

The Solu Comp II analyzer needs little routine maintenance. The calibration of the analyzer and sensor should be checked periodically. To recalibrate the analyzer and sensor, see Section 6.0.

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

7.2 REPLACEMENT PARTS

Only a few components of the analyzer are replaceable. Refer to the table below to find the correct parts diagram.

Model	Description	See Figure
1055-10	Panel mounting enclosure	7-1
1055-11	Pipe/surface mounting enclosure	7-2

Circuit boards are not replaceable.

TABLE 7-1. Replacement Parts for 1055 Analyzer (Panel Mount Version)

Location in Figure 9-1	PN	Description	Shipping Weight
1	23823-00	Panel mounting kit, includes four brackets and four set screws	2 lb/1.0 kg
2	33654-00	Gasket, front, for panel mount version	2 lb/1.0 kg
3	33658-00	Gasket, rear cover, for panel mount version	2 lb/1.0 kg
4	note	Self-tapping screws, #6 x 1.25 in.	

Note: Information about the size of screws and O-rings is for information only. Screws and washers cannot be purchased from Rosemount Analytical.
Shipping weights are rounded up to the nearest whole lb or 0.5 kg.

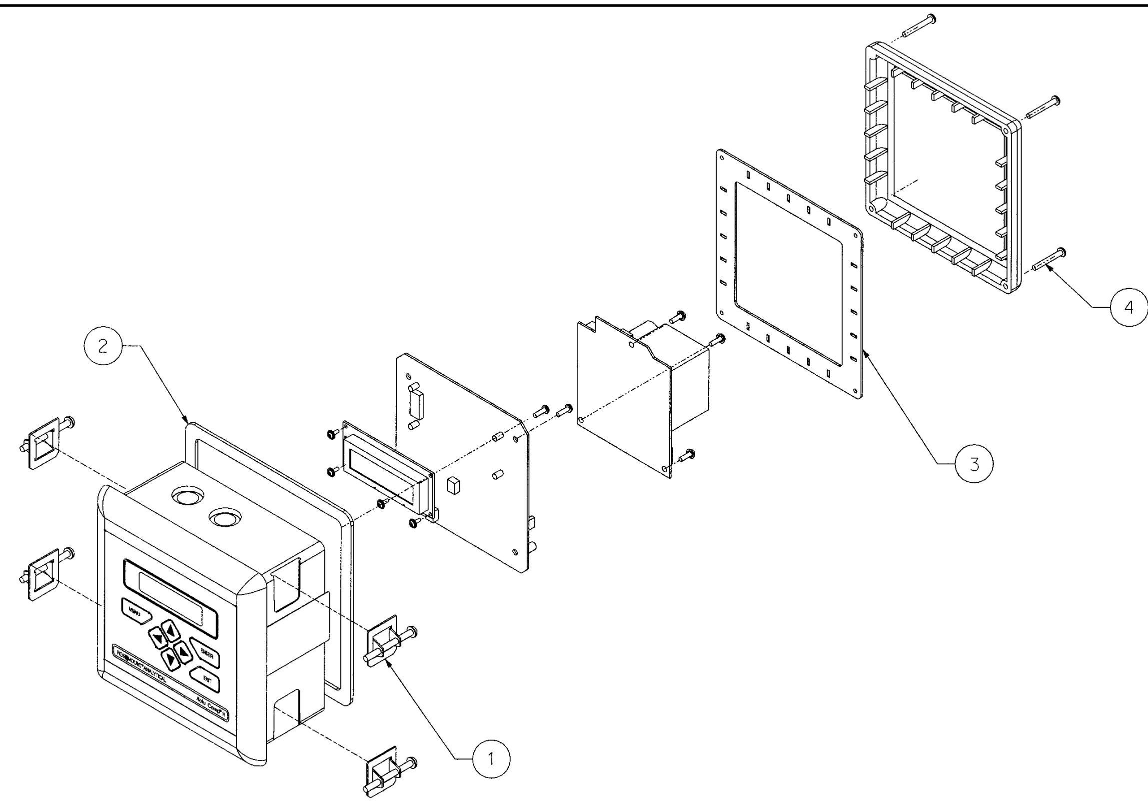


FIGURE 7-1. Exploded View of 1055 Analyzer (Panel Mount Version)

TABLE 9-2. Replacement Parts for 1055 Analyzer (Wall Mount Version)

Location in Figure 9-2	PN	Description	Shipping Weight
1	note	Screw, 6-32 x 1.38 in.	
2	note	O-ring 2-007	
3	33655-00	Gasket for pipe/surface mount version	2 lb/1.0 kg
not shown	23833-00	Surface mount kit; consists of four self-tapping screws #6 x 1.75 in. and four O-rings	1 lb/0.5 kg

Note: Information about the size of screws and O-rings is for information only. Screws and washers cannot be purchased from Rosemount Analytical.
Shipping weights are rounded up to the nearest whole lb or 0.5 kg.

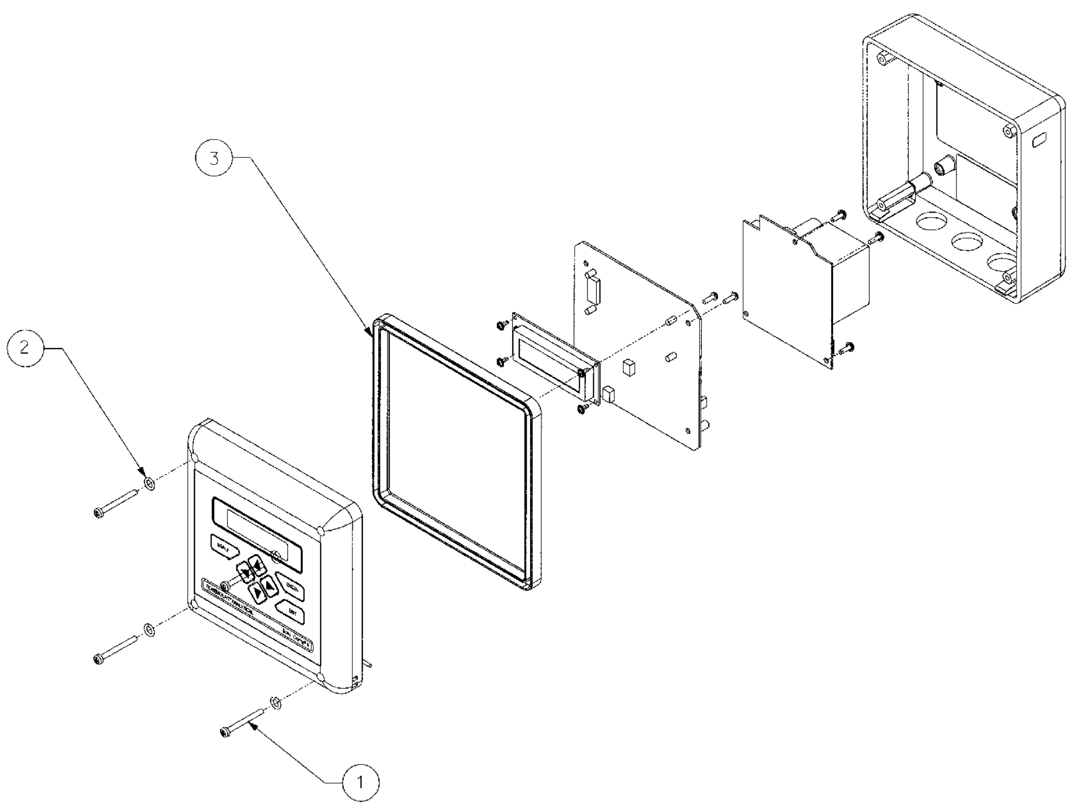


FIGURE 9-2. Exploded View of Model 1055 Analyzer (Wall Mount Version)

SECTION 8.0
TROUBLESHOOTING

8.1 OVERVIEW

The Solu Comp II continuously monitors itself and the sensor for faults. When the analyzer detects a fault, the word *fault* appears in the display alternately with the measurement. If alarm 3 was configured as a fault alarm, the alarm relay will energize. The outputs do not change during a fault condition. They continue to reflect the measured chlorine, pH, ORP, or temperature. **Press ▲ to display the fault codes.**

A large number of information screens are available to aid troubleshooting. The most useful of these are raw sensor current and sensitivity and zero current at last calibration. If pH is also being measured, sensor slope and offset and glass impedance are also available. To view the information screens, go to the main display and press the ▼ key.

8.2 TROUBLESHOOTING USING FAULT CODES

Fault Code	Explanation	See Section
S1 Out of Range	Sensor current exceeds 210 µA (chlorine only)	8.2.1
S2 Out of Range	Absolute value of measured voltage exceeds 2500 mV (pH/ORP only)	8.2.2
S2 Broken Glass	pH sensitive glass membrane is broken	8.2.3
TC1 Open or TC2 Open	RTD for sensor 1 or sensor 2 is open	8.2.4
TC1 Shorted or TC2 Shorted	RTD for sensor 1 or sensor 2 is shorted	8.2.4
S1 or S2 Sense Line Open	RTD sense line for sensor 1 or sensor 2 is open	8.2.5
EEPROM Failure	EEPROM failure	8.2.6

8.2.1 Sensor Current Exceeds 210 µA

Excessive sensor current implies that the sensor is miswired or the sensor has failed.

8.2.2 Absolute Value of Measured Voltage Exceeds 2500 mV

The voltage of a pH cell is usually between 600 mV and -600 mV, and the voltage of an ORP cell is between 2000 and -2000 mV. Readings outside the range -2500 mV to 2500 mV usually indicate a problem with sensor wiring or analyzer electronics.

A. If the sensor is being installed for the first time, check the wiring connections. See Section 3.3. If a junction box is being used, check connections at the junction box, too.

B. If the preamplifier is in a junction box, verify that the wires supplying the power (±5 Vdc) to the preamplifier are connected at the analyzer and junction box.

C. Verify that the sensor is completely submerged in the process liquid.

8.2.3 pH Sensitive Glass Membrane is Broken

The Solu Comp II continuously measures the impedance between the sensor solution ground and the inside of the pH-sensing electrode. If the glass membrane is intact, the impedance is normally between 10 MΩ and 1000 MΩ. If the membrane is cracked or broken, the impedance drops below 10 MΩ. If the membrane is cracked or broken, the sensor must be replaced.

8.2.4 RTD for Sensor 1 or Sensor 2 Open or Shorted.

There is an open or short in the sensor RTD or wiring.

A. If sensor is being installed for the first time, check the wiring connections. See Section 3.2.

B. Disconnect the sensor from the analyzer and measure the resistance between the RTD lead wires. See the sensor manual to identify the RTD leads. If there is an open or short circuit, replace the sensor.

C. If there is no open or short, check the analyzer. See Section 8.8.

8.2.5 RTD Sense Line for Sensor 1 or Sensor 2 is Open.

The Solu Comp II measures temperature using a three-wire RTD. See Figure 8-4. The in and return leads connect the RTD to the measuring circuit in the analyzer. A third wire, called the sense line, is connected to the return line. The sense line allows the analyzer to correct for the resistance of the in and return leads and to correct for changes in lead wire resistance with temperature.

A. Verify that all wiring connections are secure.

B. The analyzer can be operated with the sense line open. The measurement will be less accurate because the analyzer can no longer correct for lead wire resistance and for changes in lead wire resistance with ambient temperature. However, if the sensor is to be used at approximately constant temperature, the lead wire resistance error can be eliminated by calibrating the sensor at the measurement temperature. Errors caused by changes in lead wire resistance with changes in ambient temperature cannot be eliminated.To make the error message disappear, connect the RTD sense and return terminals with a jumper.

8.2.6 EEPROM Failure.

EEPROM failure means the analyzer is unable to store data in the non-volatile memory. Thus, if power is lost then restored, all configurations and calibrations will be lost. Call the factory for assistance. The analyzer will probably need to be replaced.

8.3 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — FREE CHLORINE

Problem	See Section
Zero current was accepted, but the current is out of range	8.3.1
Error or warning message appears while zeroing the sensor (zero current is too high)	8.3.1
Zero current is unstable	8.3.2
Sensor can be calibrated, but sensitivity is out of range	8.3.3
Process readings are erratic	8.3.4
Readings drift	8.3.5
Sensor does not respond to changes in chlorine level	8.3.6
Chlorine reading spikes following rapid change in pH	8.3.7
Chlorine readings are too low	8.3.8

8.3.1 Zero current is too high

A. Is the sensor properly wired to the analyzer? See Section 3.3.

B. Is the zero solution chlorine-free? Take a sample of the solution and test it for free chlorine level. The concentration should be less than 0.02 ppm.

C. Has adequate time been allowed for the sensor to reach a minimum stable residual current? It may take several hours, sometimes as long as overnight, for a new sensor to stabilize.

D. Check the membrane for damage and replace it if necessary.

8.3.2 Zero current is unstable

A. Is the sensor properly wired to the analyzer? See Section 3.3. Verify that all wiring connections are tight.

B. Readings are often erratic when a new or rebuilt sensor is first placed in service. Readings usually stabilize after about an hour.

C. Is the conductivity of the zero solution correct for the sensor being used? For a 499ACL-01 free chlorine sensor the zero solution should be deionized water containing about 0.5 grams of sodium chloride. At a minimum the conductivity of the zero solution should be greater than 50 uS/cm. DO NOT USE DEIONIZED WATER WITH THE 499ACL-01 sensor. For a 498CL-01 pH-independent free chlorine sensor, deionized water is appropriate for zeroing.

D. 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 and 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 you are using a 499ACL-01 sensor, and shaking the sensor does not improve the reading, 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. Be sure the wood ring remains with the membrane assembly. Use the end of a straightened paper clip to clear the holes at the base of the cathode. Replace the membrane.

   The 498CL-01 pH-independent free chlorine sensor has a mesh cathode that allows the fill solution to completely bathe the cathode. There are no small holes to become plugged. Do not attempt to clean the mesh cathode.

   Verify that the sensor is filled with electrolyte solution (499ACL-01) or electrolyte slurry (498CL-01). Refer to the sensor instruction manual for details.

8.3.3 Sensor can be calibrated, but the current is too low

A. Is the temperature low? For both the 499ACL-01 and 498CL-01 sensors, sensor current is a strong function of temperature. The current decreases about 3% for every ºC drop in temperature.

B. Is the pH high? The 499ACL-01 sensor current is a strong function of pH. Sensor current decreases as pH increases. Above pH 7, a 0.1 unit increase in pH lowers the current by about 5%. The 498CL-01 sensor current is practically independent of pH.

C. Sensor current depends on the rate of sample flow past the sensor tip. If the flow is too low, chlorine readings will be low. Refer to the sensor instruction sheet for recommended sample flows.

D. Low current can be caused by lack of electrolyte flow to the cathode and membrane. See step D in Section 8.3.2.

E. Is the membrane fouled or coated? A dirty membrane inhibits diffusion of free chlorine through the membrane, reducing the sensor current and increasing the response time. Clean the membrane by rinsing it with a stream of water from a wash bottle. DO NOT use a membrane or tissue to wipe the membrane.

F. If cleaning the membrane does not improve the sensor response, replace the membrane and electrolyte solution. See the sensor instruction sheet for details.

8.3.4 Process readings are erratic

A. Readings are often erratic when a new sensor or a rebuilt sensor is first placed in service. The current usually stabilizes after a few hours.

B. Is the sample flow within the recommended range? High sample flow may cause erratic readings. Refer to the sensor instruction sheet for recommended flow rates.

C. Is the fill solution making good contact with the cathode? Refer to Section 8.3.2.

D. Verify that wiring is correct. Pay particular attention to shield and ground connections.

E. If automatic pH correction is being used, check the pH reading. If the pH reading is noisy, the chlorine reading will also be noisy. If the pH sensor is the cause of the noise, use manual pH correction until the problem with the pH sensor can be corrected.

F. Is the membrane in good condition and is the sensor filled with electrolyte solution? Replace the fill solution (499ACL-01) or electrolyte slurry (498CL-01). Refer to the sensor instruction manual for details.

8.3.5 Readings drift

A. Is the sample temperature changing? Membrane permeability is a function of temperature. The time constant for the 499ACL-01 and 498CL-01 sensors are about five minutes. Therefore, the reading may drift for a while after a sudden temperature change.

B. Is the membrane clean? For the sensor to work properly, chlorine must diffuse freely through the membrane. A coating on the membrane will interfere with the passage of chlorine, resulting in slow response. Clean the membrane by rinsing it with a stream of water from a wash bottle. **DO NOT** use a membrane or tissue to wipe the membrane.

C. Is the sample flow within the recommended range? Gradual loss of sample flow will cause a downward drift.

D. Is the sensor new or has it been recently serviced? New or rebuilt sensors may require several hours to stabilize.

E. Is the pH of the process changing? (Applies only to to the 499ACL-01 sensor.) If manual pH correction is being used, a gradual change in pH will cause a gradual change in the chlorine reading. As pH increases, chlorine readings will decrease, even though the free chlorine level (as determined by a grab sample test) remained constant. If the pH change is no more than about 0.2, the change in the chlorine reading will be no more than about 10% of reading. If the pH changes are more than 0.2, use automatic pH correction.

8.3.6 Sensor does not respond to changes in chlorine level.

A. Is the grab sample test accurate? Is the grab sample representative of the sample flowing to the sensor?

B. Is the pH compensation correct? (Applies only to to the 499ACL-01 sensor.) If the controller is using manual pH correction, verify that the pH value in the controller equals the actual pH to within ±0.1 pH. If the controller is using automatic pH correction, check the calibration of the pH sensor.

C. Is the membrane clean? Clean the membrane and replace it if necessary. See Section 8.3.3. Is the fill solution making good contact with the cathode? See Section 8.3.2. Replace the electrolyte solution.

D. Replace the sensor.

8.3.7 Chlorine readings spike following sudden changes in pH (automatic pH correction 499ACL-01 only).

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

8.3.8 Chlorine readings are too low.

A. Was the sample tested as soon as it was taken? Chlorine solutions are unstable. Test the sample immediately after collecting it. Avoid exposing the sample to sunlight.

B. Low readings can be caused by zeroing the sensor before the residual current has reached a stable minimum value. Residual current is the current the sensor generates even when no chlorine is in the sample. Because the residual current is subtracted from subsequent measured currents, zeroing before the current is a minimum can lead to low results.

Example: The true residual current for a free chlorine sensor is 4 nA, and the sensitivity is 350 nA/ppm. Assume the measured current is 200 nA. The true concentration is (200-4)/350 or 0.56 ppm. If the sensor was zeroed prematurely when the current was 10 nA, the measured concentration will be (200-10)/350 or 0.54 ppm. The error is 3.6%. Suppose the measured current is 400 nA. The true concentration is 1.13 ppm, and the measured concentration is 1.11 ppm. The error is now 1.8%. The absolute difference between the reading remains the same, 0.02 ppm.

C. Sensor response depends on flow. If the flow is too low, readings will be low and flow sensitive. Verify that the flow past the sensor equals or exceeds the minimum value. See the sensor instruction manual for recommended flows.

8.4 TROUBLESHOOTING WHEN NO FAULT MESSAGE IS SHOWING - TOTAL CHLORINE

Refer to the instruction manual for the TCL for a complete troubleshooting guide.

8.5 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — MONOCHLORAMINE

Problem	See Section
Zero current was accepted, but the current is outside the range -10 to 50 nA	8.5.1
Error or warning message appears while zeroing the sensor (zero current is too high)	8.5.1
Zero current is unstable	8.5.2
Sensor can be calibrated, but the current is less than about 250 nA/ppm at 25°C	8.5.3
Process readings are erratic	8.5.4
Readings drift	8.5.5
Sensor does not respond to changes in monochloramine level	8.5.6
Readings are too low	8.5.7

8.5.1 Zero current is too high

A. Is the sensor properly wired to the analyzer? See Section 3.3.

B. Is the zero solution monochloramine-free? Take a sample of the solution and test it for monochloramine level. The concentration should be less than 0.02 ppm.

C. Has adequate time been allowed for the sensor to reach a minimum stable residual current? It may take several hours, sometimes as long as overnight, for a new sensor to stabilize.

D. Check the membrane for damage and replace it if necessary. Be careful not to touch the membrane or cathode. Touching the cathode mesh may damage it.

8.5.2 Zero current is unstable

A. Is the sensor properly wired to the analyzer? See Section 3.3. Verify that all wiring connections are tight.

B. Readings are often erratic when a new or rebuilt sensor is first placed in service. Readings usually stabilize after about an hour.

C. Is the conductivity of the zero solution greater than 50 uS/cm? DO NOT USE DEIONIZED OR DISTILLED WATER TO ZERO THE SENSOR. The zero solution should contain at least 0.5 grams of sodium chloride per liter.

D. Is the space between the membrane and cathode mesh filled with electrolyte solution? Often the flow of electrolyte and 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.

   Verify that the sensor is filled with electrolyte solution. Refer to the sensor instruction manual for details.

8.5.3 Sensor can be calibrated, but the current is too low

A. Is the temperature low? The sensor current decreases about 5% for every °C drop in temperature.

B. Sensor current depends on the rate of sample flow past the sensor tip. If the flow is too low, monochloramine readings will be low. Refer to the sensor instruction sheet for recommended sample flows.

C. Low current can be caused by lack of electrolyte flow to the cathode and membrane. See step D in Section 8.5.2.

D. When was the sensor fill solution last replaced? The monochloramine sensor loses sensitivity, that is, it generates less current per ppm of monochloramine, as it operates. Gradual loss of sensitivity can usually be compensated for by calibrating the sensor weekly. After about two months, the sensitivity will have dropped to about 70% of its original value. At this point, the electrolyte solution and membrane should be replaced. Refer to the sensor instruction manual.

E. Is the membrane fouled or coated? A dirty membrane inhibits diffusion of monochloramine through the membrane, reducing the sensor current and increasing the response time. Clean the membrane by rinsing it with a stream of water from a wash bottle. DO NOT use a membrane or tissue to wipe the membrane.

F. If cleaning the membrane does not improve the sensor response, replace the membrane and electrolyte solution. See the sensor instruction sheet for details.

8.5.4 Process readings are erratic

A. Readings are often erratic when a new sensor or rebuilt sensor is first placed in service. The current usually stabilizes after a few hours.

B. Is the sample flow within the recommended range? High sample flow may cause erratic readings. Refer to the sensor instruction sheet for recommended flow rates.

C. Verify that wiring is correct. Pay particular attention to shield and ground connections.

D. Is the membrane in good condition and is the sensor filled with electrolyte solution? Replace the fill solution and electrolyte. Refer to the sensor instruction manual for details.

8.5.5 Readings drift

A. Is the sample temperature changing? Membrane permeability is a function of temperature. The time constant for the sensor is about five minutes. Therefore, the reading may drift for a while after a sudden temperature change.

B. Is the membrane clean? For the sensor to work properly, monochloramine must diffuse freely through the membrane. A coating on the membrane will interfere with the passage of monochloramine, resulting in slow response. Clean the membrane by rinsing it with a stream of water from a wash bottle. **DO NOT** use a membrane or tissue to wipe the membrane.

C. Is the sample flow within the recommended range? Gradual loss of sample flow will cause a downward drift.

D. Is the sensor new or has it been recently serviced? New or rebuilt sensors may require several hours to stabilize.

E. Gradual downward drift is caused by depletion of the fill solution. Normally, calibrating the sensor every week adequately compensates for the drift. After the sensor has been in service for several months, it will probably be necessary to replace the fill solution and membrane. Refer to the sensor instruction manual for details.

8.5.6 Sensor does not respond to changes in monochloramine level.

A. Is the grab sample test accurate? Is the grab sample representative of the sample flowing to the sensor?

B. When was the sensor fill solution last replaced? The monochloramine sensor loses sensitivity, that is, it generates less current per ppm of monochloramine, as it operates. After about two months, the sensitivity will have dropped to about 70% of its original value. If the fill solution is extremely old, the sensor may be completely non-responsive to monochloramine. Replace the fill solution and membrane. See the sensor instruction manual for details.

C. Is the membrane clean? Clean the membrane with a stream of water and replace it if necessary.

D. Replace the sensor.

8.5.7 Readings are too low.

A. Was the sample tested as soon as it was taken? Monochloramine solutions are moderately unstable. Test the sample immediately after collecting it. Avoid exposing the sample to sunlight.

B. When was the sensor fill solution last replaced? The monochloramine sensor loses sensitivity, that is, it generates less current per ppm of monochloramine, as it operates. Generally, calibrating the sensor every week compensates for the gradual loss in sensitivity. After about two months, the sensitivity will have dropped to about 70% of its original value. At this point, the electrolyte solution and membrane should be replaced. Refer to the sensor instruction manual.

C. Low readings can be caused by zeroing the sensor before the residual current has reached a stable minimum value. Residual current is the current the sensor generates even when no monochloramine is in the sample. Because the residual current is subtracted from subsequent measured currents, zeroing before the current is a minimum can lead to low results.

   Example: The true residual current for a monochloramine sensor is 20 nA, and the sensitivity is 400 nA/ppm. Assume the measured current is 600 nA. The true concentration is (600-20)/400 or 1.45 ppm. If the sensor was zeroed prematurely when the current was 40 nA, the measured concentration will be (600-40)/400 or 1.40 ppm. The error is 3.5%. Suppose the measured current is 800 nA. The true concentration is 1.95 ppm, and the measured concentration is 1.90 ppm. The error is now 2.6%. The absolute difference between the reading remains the same, 0.05 ppm.

D. Sensor response depends on flow. If the flow is too low, readings will be low and flow sensitive. Verify that the flow past the sensor equals or exceeds the minimum value. See the sensor instruction manual for recommended flows.

8.6 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — pH.

Problem	See Section
Calibration Error warning during two-point calibration	8.6.1
Calibration Error warning during standardization	8.6.2
Invalid Input while manually entering slope	8.6.3
Sensor does not respond to known pH changes	8.6.4
Calibration was successful, but process pH is slightly different from expected value	8.6.5
Calibration was successful, but process pH is grossly wrong and/or noisy	8.6.6

8.6.1 Calibration Error During Two-Point Calibration

Once the two-point (manual or automatic) calibration is complete, the Solu Comp II automatically calculates the sensor slope (at 25°). If the slope is greater than 60 mV/pH or less than 45 mV/pH, the analyzer displays the Calibration Error screen and does not update the calibration. Check the following:

A. Are the buffers accurate? Inspect the buffers for obvious signs of deterioration, such as turbidity or mold growth. Neutral and slightly acidic buffers are highly susceptible to molds. Alkaline buffers (pH 9 and greater), if they have been exposed to air for long periods, may also be inaccurate. Alkaline buffers absorb carbon dioxide from the atmosphere, which lowers the pH. If a high pH buffer was used in the failed calibration, repeat the calibration using a fresh buffer. If fresh buffer is not available, use a lower pH buffer. For example, use pH 4 and 7 buffer instead of pH 7 and 10 buffer.

B. Was adequate time allowed for temperature equilibration? If the sensor was in a process substantially hotter or colder than the buffer, place it in a container of water at ambient temperature for at least 20 minutes before starting the calibration. Using auto calibration avoids calibration errors caused by temperature drift. The analyzer will not update readings until the drift is less than 0.02 pH over 10 seconds.

C. Were correct pH values entered during manual calibration? Using auto calibration eliminates errors caused by improperly entering data.

D. Is the sensor properly wired to the analyzer? Check the sensor wiring including any connections in a junction box. See Section 3.2.

E. Is the sensor dirty or coated? See the sensor instruction manual for cleaning instructions.

```
      Glass Imp
123MΩ
```

F. Is the sensor faulty? With the main display showing, use ▲ or ▼ to scroll through the information screens until the electrode impedance screen (at left) is displayed. Refer to the table below for an interpretation of the impedance readings.

Another way of checking for a faulty sensor is to replace it with a new one. If the new sensor can be calibrated, the old sensor has failed.

G. Is the analyzer faulty? The best way to check for a faulty analyzer is to simulate pH inputs. See Section 8.7.

GLASS IMPEDANCE (**Glass Imp**)	
less than 10 MΩ	Glass bulb is cracked or broken. Sensor has failed.
between 10 and 1000 MΩ	Normal reading.
greater than 1000 MΩ	pH sensor may be nearing the end of its service life.

8.6.2 Calibration Error during Standardization.

During standardization, the millivolt signal from the pH cell is increased or decreased until it agrees with the pH reading from a referee instrument. A unit change in pH requires an offset of about 59 mV. The Solu Comp II limits the offset to ±1400 mV. If the standardization causes an offset greater than ±1400 mV, the analyzer will display the Calibration Error screen. The standardization will not be updated. Check the following:

A. Is the referee pH meter working and properly calibrated? Check the response of the referee sensor in buffers.

B. Is the process sensor working properly? Check the process sensor in buffers.

C. Is the sensor fully immersed in the process liquid? If the sensor is not completely submerged, it may be measuring the pH of the liquid film covering the glass bulb and reference element. The pH of this film may be different from the pH of the bulk liquid.

D. Is the sensor fouled? The sensor measures the pH of the liquid adjacent to the glass bulb. If the sensor is heavily fouled, the pH of liquid trapped against the bulb may be different from the bulk liquid.

E. Has the sensor been exposed to poisoning agents (sulfides or cyanides) or has it been exposed to extreme temperature? Poisoning agents and high temperature can shift the reference voltage many hundred millivolts. To check the reference voltage, see Section 8.11.

8.6.3 Invalid Input While Manually Entering Slope.

If the sensor slope is known from other sources, it can be entered directly into the analyzer. The Solu Comp II will not accept a slope (at 25°C) outside the range 45 to 60 mV/pH. See section 8.6.2 for troubleshooting sensor slope problems.

8.6.4 Sensor Does Not Respond to Known pH Changes.

A. Did the expected pH change really occur? If the process pH reading was not what was expected, check the performance of the sensor in buffers. Also, use a second pH meter to verify the change.

B. Is the sensor properly wired to the analyzer?

C. Is the glass bulb cracked or broken? Check the glass electrode impedance. See Section 8.6.2.

D. Is the analyzer working properly. Check the analyzer by simulating the pH input.

8.6.5 Buffer Calibration Is Acceptable, Process pH Is Slightly Different from Expected Value.

Differences between pH readings made with an on-line instrument and a laboratory or portable instrument are normal. The on-line instrument is subject to process variables, for example ground potentials, stray voltages, and orientation effects that may not affect the laboratory or portable instrument. To make the process reading agree with a referee instrument, see Section 6.6.

8.6.6 Calibration Was Successful, but Process pH Is Grossly Wrong and/or Noisy.

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

A. Is a ground loop present?

   1. Verify that the system works properly in buffers. Be sure there is no direct electrical connection between the buffer containers and the process liquid or piping.
   2. Strip back the ends of a heavy gauge wire. Connect one end of the wire to the process piping or place it in the process liquid. Place the other end of the wire in the container of buffer with the sensor. The wire makes an electrical connection between the process and sensor.
   3. If offsets and noise appear after making the connection, a ground loop exists.

B. Is the process grounded?

   1. The measurement system needs one path to ground: through the process liquid and piping. Plastic piping, fiberglass tanks, and ungrounded or poorly grounded vessels do not provide a path. A floating system can pick up stray voltages from other electrical equipment.
   2. Ground the piping or tank to a local earth ground.
   3. If noise still persists, simple grounding is not the problem. Noise is probably being carried into the instrument through the sensor wiring.

C. Simplify the sensor wiring.

   1. Disconnect all sensor wires at the analyzer except pH/mV IN, REFERENCE IN, RTD IN and RTD RETURN. See the wiring diagrams in Section 3.2. If the sensor is wired to the analyzer through a remote junction box containing a preamplifier, disconnect the wires at the sensor side of the junction box.
   2. Tape back the ends of the disconnected wires to keep them from making accidental connections with other wires or terminals.
   3. Connect a jumper wire between the RTD RETURN and RTD SENSE terminals (see wiring diagrams in Section 3.2).
   4. If noise and/or offsets disappear, the interference was coming into the analyzer through one of the sensor wires. The system can be operated permanently with the simplified wiring.

D. Check for extra ground connections or induced noise.

   1. If the sensor cable is run inside conduit, there may be a short between the cable and the conduit. Re-run the cable outside the conduit. If symptoms disappear, there is a short between the cable and the conduit. Likely a shield is exposed and touching the conduit. Repair the cable and reinstall it in the conduit.
   2. To avoid induced noise in the sensor cable, run it as far away as possible from power cables, relays, and electric motors. Keep sensor wiring out of crowded panels and cable trays.
   3. If ground loops persist, consult the factory. A visit from an experienced technician may be required to solve the problem.

8.7 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — GENERAL

Problem	See Section
New temperature reading during calibration is 2-3°C different from live reading	8.7.1
Current output is too low	8.7.1
Alarm relays do not operate when setpoint is exceeded	8.7.2
Display is unreadable — too faint or all pixels dark	8.7.3

8.7.1 Difference Between Solu Comp II and Standard Thermometer is Greater Than 3°C.

A. Is the standard thermometer, RTD, or thermistor accurate? General purpose liquid-in-glass thermometers, particularly ones that have been mistreated, can have surprisingly large errors.

B. Review Section 6.2.

8.7.2 Current Output Too Low.

Load resistance is too high. Maximum load is 600 Ω.

8.7.3 Alarm Relays Do Not Work

Verify the relays are properly wired.

8.7.4 Display is Unreadable.

While holding down the MENU key, press ▲ or ▼ until the display has the correct contrast.

8.8 SIMULATING INPUTS — CHLORINE

To check the performance of the analyzer, use a decade box and 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.

A. Disconnect the anode and cathode leads from terminals 1 and 2 on TB3 and connect a decade box and battery as shown in Figure 8-1. It is not necessary to disconnect the RTD leads.

B. Set the decade box to the resistance shown in the table.

Sensor	Polarizing Voltage	Resistance	Expected Current
499ACL-01 (free chlorine)	200 mV	2.8 MΩ	500 nA
499ACL-02 (total chlorine)	250 mV	675 kΩ	2000 nA
499ACL-03 (monochloramine)	400 mV	3 MΩ	400 nA

The input current of the Model 498CL-01 (pH independent free chlorine sensor) <u>cannot</u> be simulated.

C. Note the sensor current. It should be close to the value in the table. The actual value depends on the voltage of the battery. To view the sensor current, go to the main display and press ▼ until the sensor current is displayed.

D. Change the decade box resistance and verify that the correct current is shown. Calculate current from the equation:

$$\text{current } (\mu A) = \frac{V_{battery} - V_{polarizing} \text{ (mV)}}{\text{resistance (k}\Omega)}$$

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

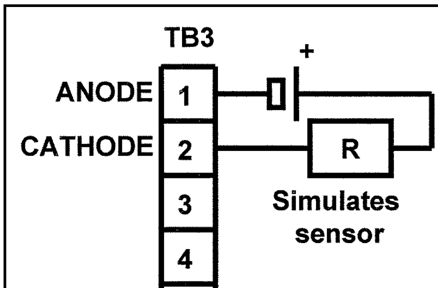


FIGURE 8-1. Simulating Chlorine

8.9 SIMULATING INPUTS — pH

8.9.1 General

This section describes how to simulate a pH input into the Solu Comp analyzer. To simulate a pH measurement, connect a standard millivolt source to the transmitter. If the transmitter is working properly, it will accurately measure the input voltage and convert it to pH. Although the general procedure is the same, the wiring details depend on the location of the preamplifier.

8.9.2 Simulating pH input when the preamplifier is in the analyzer.

1. Turn off automatic temperature correction and solution temperature correction. From the Program menu, choose **Temp**. Then choose **Live/Manual** and enter 25°C. See Section 5.6 for details.
2. Disconnect the sensor and connect a jumper wire between the pH IN and REFERENCE IN terminals.
3. From the display menu choose the pH/temperature/mV screen. The measured voltage should be 0 mV and the pH should be 7.00. Because calibration data stored in the analyzer may be offsetting the input voltage, the displayed pH may not be exactly 7.00.
4. If a standard millivolt source is available, disconnect the jumper wire between pH IN and REFERENCE IN and connect the voltage source as shown in Figure 8-2. Be sure to jumper the reference and solution ground terminals.
5. Calibrate the analyzer using the procedure in Section 6.3. Use 0.0 mV for Buffer 1 (pH 7.00) and -177.4 mV for Buffer 2 (pH 10.00). If the analyzer is working properly it should accept the calibration. The slope should be 59.16 mV/pH and the offset should be zero.
6. To check linearity, return to the main display and the pH/temperature/mV screen. Set the voltage source to the values shown in the table and verify that the pH and millivolt readings match the values in the table.

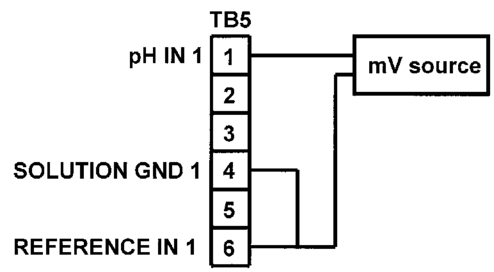


FIGURE 8-2. Simulating Inputs When the Preamplifier is in the Analyzer

Voltage (mV)	pH (at 25°)
295.8	2.00
177.5	4.00
59.2	6.00
-59.2	8.00
-177.5	10.00
-295.8	12.00

8.9.3 Simulating pH input when the preamplifier is in a junction box.

The procedure is the same as described in Section 8.4.1. Keep the connections between the analyzer and the junction box in place. Disconnect the sensor at the sensor side of the junction box and connect the voltage source as shown in Figure 8-3.

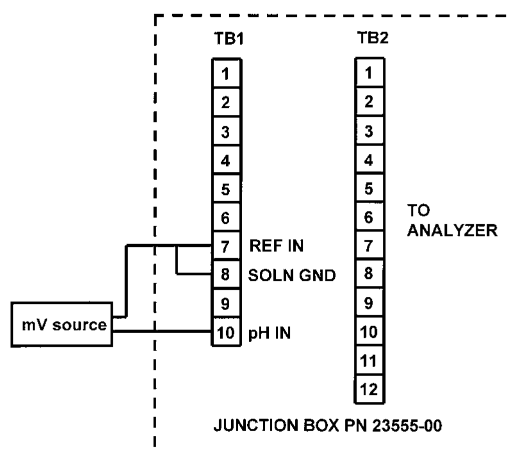


FIGURE 8-3. Simulating pH Input When the Preamplifier is in the Sensor.

8.9.4 Simulating pH input when the preamplifier is in the sensor.

The preamplifier in the sensor simply converts the high impedance signal into a low impedance signal without amplifying it. To simulate pH values, follow the procedure in Section 8.9.2.

8.10 SIMULATING TEMPERATURE

8.10.1 General.

The Solu Comp II accepts either a Pt100 RTD (for pH and chlorine sensors). The Pt100 RTD is in a three-wire configuration. See Figure 8-4.

8.10.2 Simulating temperature

To simulate the temperature input, wire a decade box to the analyzer or junction box as shown in Figure 8-5.

To check the accuracy of the temperature measurement, set the resistor simulating the RTD 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 Solu Comp II 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 analyzer 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 analyzer 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 analyzer is working correctly.

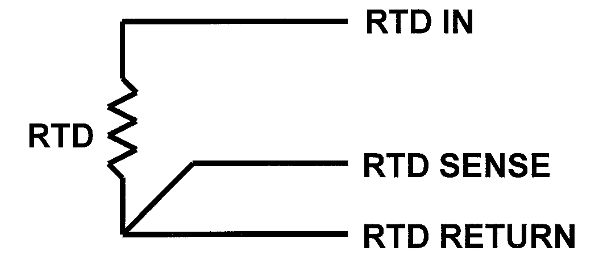


FIGURE 8-4. Three-Wire RTD Configuration.

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

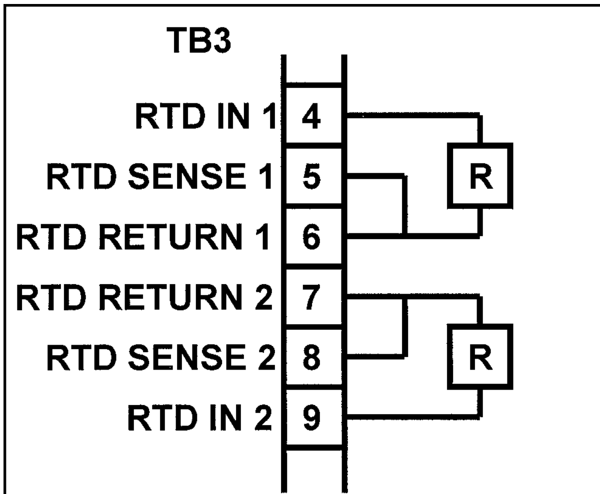


FIGURE 8-5. Simulating RTD Inputs.

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

8.11 MEASURING REFERENCE VOLTAGE

Some processes contain substances that poison or shift the potential of the reference electrode. Sulfide is a good example. Prolonged exposure to sulfide converts the reference electrode from a silver/silver chloride electrode to a silver/silver sulfide electrode. The change in reference voltage is several hundred millivolts. A good way to check for poisoning is to compare the voltage of the reference electrode with a silver/silver chloride electrode known to be good. The reference electrode from a new sensor is best. See Figure 8-6. If the reference electrode is good, the voltage difference should be no more than about 20 mV. A poisoned reference electrode usually requires replacement.

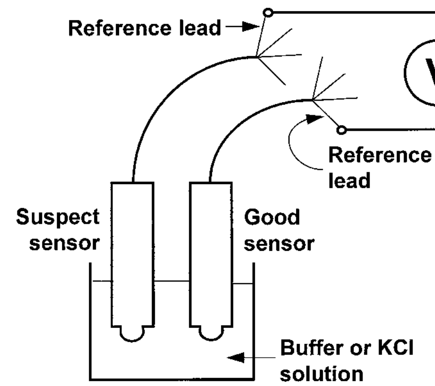


FIGURE 8-6. Checking for a Poisoned Reference Electrode.

Refer to the sensor wiring diagram to identify the reference leads. A laboratory silver/silver chloride electrode can be used in place of the second sensor.

SECTION 9.0
RETURN OF MATERIAL

9.1 GENERAL.

To expedite the repair and return of instruments, proper communication between the customer and the factory is important. Before returning a product for repair, call 1-949-757-8500 for a Return Materials Authorization (RMA) number.

9.2 WARRANTY REPAIR.

The following is the procedure for returning instruments still under warranty:

1. Call Rosemount Analytical for authorization.
2. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the unit must be supplied.
3. Carefully package the materials and enclose your “Letter of Transmittal” (see Warranty). If possible, pack the materials in the same manner as they were received.
4. Send the package prepaid to:

   Emerson Process Management, Liquid Division
   Liquid Division
   2400 Barranca Parkway
   Irvine, CA 92606

   Attn: Factory Repair

   RMA No. ____________

   Mark the package: Returned for Repair

   Model No. ____

9.3 NON-WARRANTY REPAIR.

The following is the procedure for returning for repair instruments that are no longer under warranty:

1. Call Rosemount Analytical for authorization.
2. Supply the purchase order number, and make sure to provide the name and telephone number of the individual to be contacted should additional information be needed.
3. Do Steps 3 and 4 of Section 9.2.

NOTE

Consult the factory for additional information regarding service or repair.

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Process Management

WARRANTY

Seller warrants that the firmware will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. **Consumables, such as glass electrodes, membranes, liquid junctions, electrolyte, o-rings, catalytic beads, etc., and Services are warranted for a period of 90 days from the date of shipment or provision.**

Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, promptly correct any errors that are found by Seller in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services.

All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller.

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

RETURN OF MATERIAL

Material returned for repair, whether in or out of warranty, should be shipped prepaid to:

Emerson Process Management
Liquid Division
2400 Barranca Parkway
Irvine, CA 92606

The shipping container should be marked:

Return for Repair
Model _________________________________

The returned material should be accompanied by a letter of transmittal which should include the following information (make a copy of the "Return of Materials Request" found on the last page of the Manual and provide the following thereon):

1. Location type of service, and length of time of service of the device.
2. Description of the faulty operation of the device and the circumstances of the failure.
3. Name and telephone number of the person to contact if there are questions about the returned material.
4. Statement as to whether warranty or non-warranty service is requested.
5. Complete shipping instructions for return of the material.

Adherence to these procedures will expedite handling of the returned material and will prevent unnecessary additional charges for inspection and testing to determine the problem with the device.

If the material is returned for out-of-warranty repairs, a purchase order for repairs should be enclosed.

The right people,
the right answers,
right now.

ROSEMOUNT ANALYTICAL
CUSTOMER SUPPORT CENTER
1-800-854-8257

ON-LINE ORDERING NOW AVAILABLE ON OUR WEB SITE
http://www.raihome.com

Specifications subject to change without notice.

Credit Cards for U.S. Purchases Only.

Emerson Process Management

Liquid Division
2400 Barranca Parkway
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Tel: (949) 757-8500
Fax: (949) 474-7250

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