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Instruction Manual



QUICK GUIDE

- Wiring Diagram Page 10
- Programming the Display Page 13
- Calibration Chapter 6
- Troubleshooting Chapter 8

Model 30
pH/Dissolved Oxygen Dual Input 4-Wire Transmitter

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BROADLEY TECHNOLOGIES

Doc. No. L2647 6/2001

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ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Your purchase from Broadley Technologies 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 1-877-246-7900 or 949-452-1112 to request correct manual.
- For clarification of instructions, contact your Broadley Technologies 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.

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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.

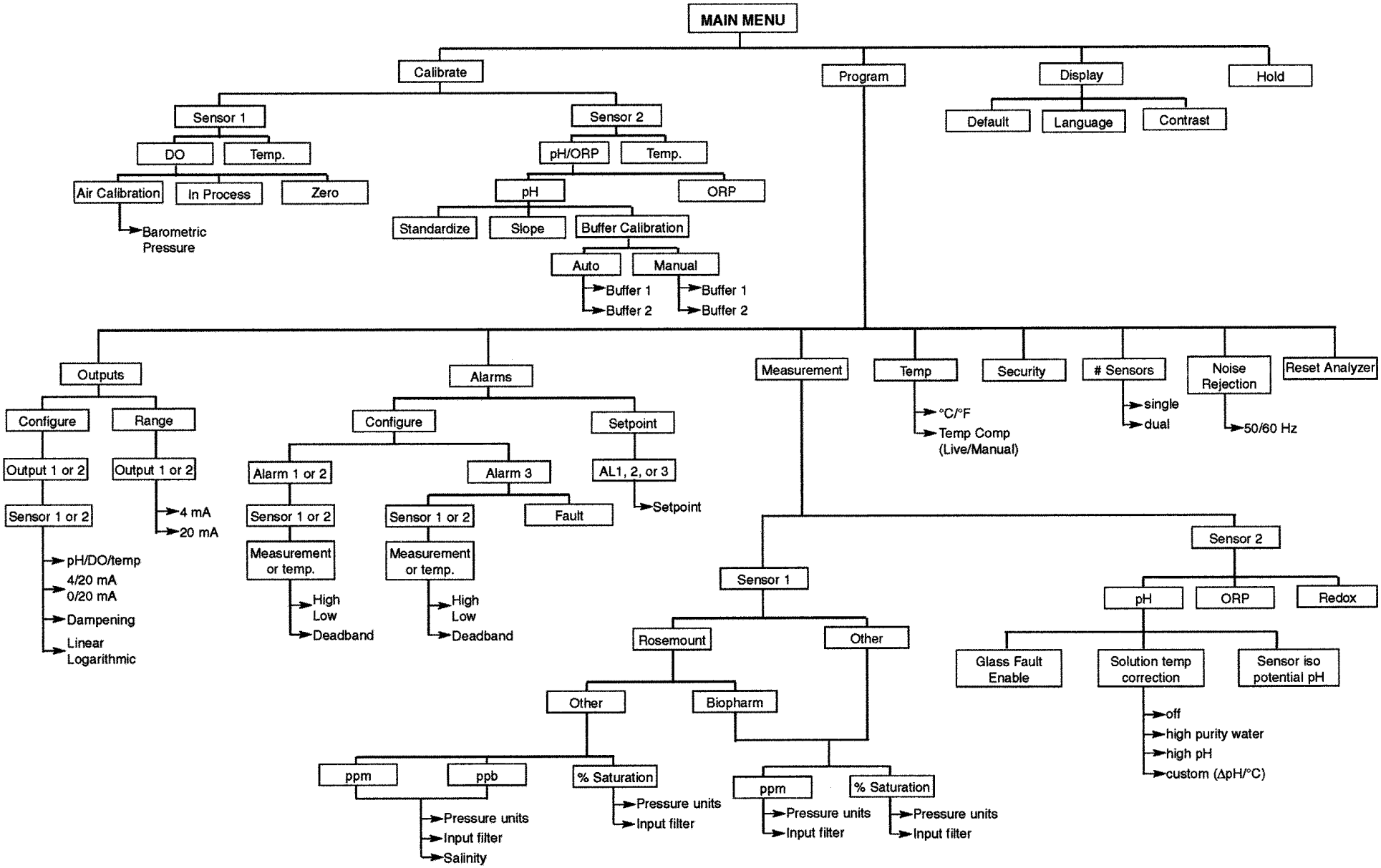
WARNING

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

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QUICK REFERENCE GUIDE

MENU TREE FOR pH/DISSOLVED OXYGEN MEASUREMENTS



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MODEL 30 DUAL INPUT pH/DISSOLVED OXYGEN TRANSMITTER

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SECTION 1.0. DESCRIPTION AND SPECIFICATIONS

1.1 FEATURES AND APPLICATIONS
1.2 SPECIFICATIONS

1.1 FEATURES AND APPLICATIONS

The Model 30 transmitters offer the choice of single or dual sensor input with measurement choices of pH/ORP and dissolved oxygen.

Dual measurement analyzers offer a wide choice of measurement combinations thus reducing the cost per loop and needed panel space.

FIELD COMMISSION OPTION: The Model 30 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 Model 30 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 Model 30 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 Model 30 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 23[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) require temperature compensation. The Model 30 will automatically recognize either a Pt100 or Pt1000 RTD, normally built into the sensor. When this RTD is present, the Model 30 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 23 alarm applies to conductivity/resistivity only.

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1.2 SPECIFICATIONS - General

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

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

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 7 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: 98 to 132 Vac, 50/60 Hz, 8 watts max.
196 to 264 Vac, 50/60 Hz, 8 watts max.
Code -02: 20 to 30 Vdc, 8 watts maximum

⧈ Equipment protected throughout by double insulation.

RFI/EMI: EN-50081-2
EN-50082-2 CE

LVD: EN-61010-1

Input: Choice of single or dual sensor input with measurement choices of pH/ORP and

dissolved oxygen. 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) and deadband are user-programmable.

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

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

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pH/ORP

For use with any standard pH or ORP sensor. 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.

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

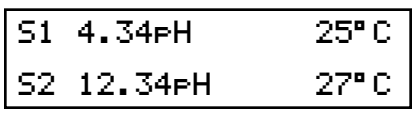
Repeatability: ±1.0 mV

Stability: ±1.0 mV/month, non-cumulative

Temperature Coefficient: ±0.2 mV/°C

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

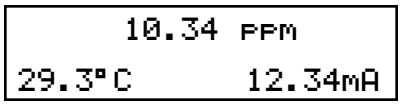
Temperature Correction: none required



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DISSOLVED OXYGEN

When used with an oxygen permeable membrane-covered amperometric sensor, display choices are ppb or ppm dissolved oxygen or % saturation. 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 Model 30 automatically applies the temperature correction factor. The process temperature is measured by an element in the sensor. Calibrating the analyzer is as simple as exposing the sensor to air and keying in the barometric pressure. If removing the sensor from the process is impractical, the analyzer can also be calibrated against a standard instrument. Solubility correction factors for liquids containing high concentrations of electrolytes can be registered into the analyzer. The Model 30 automatically calculates ppb/ppm dissolved oxygen taking into account the high salt concentration.



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: 1- 255 samples

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SECTION 2.0. INSTALLATION

2.1 UNPACKING AND INSPECTION
2.2 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 Broadley Technologies 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

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2.2.2 Panel Mounting.

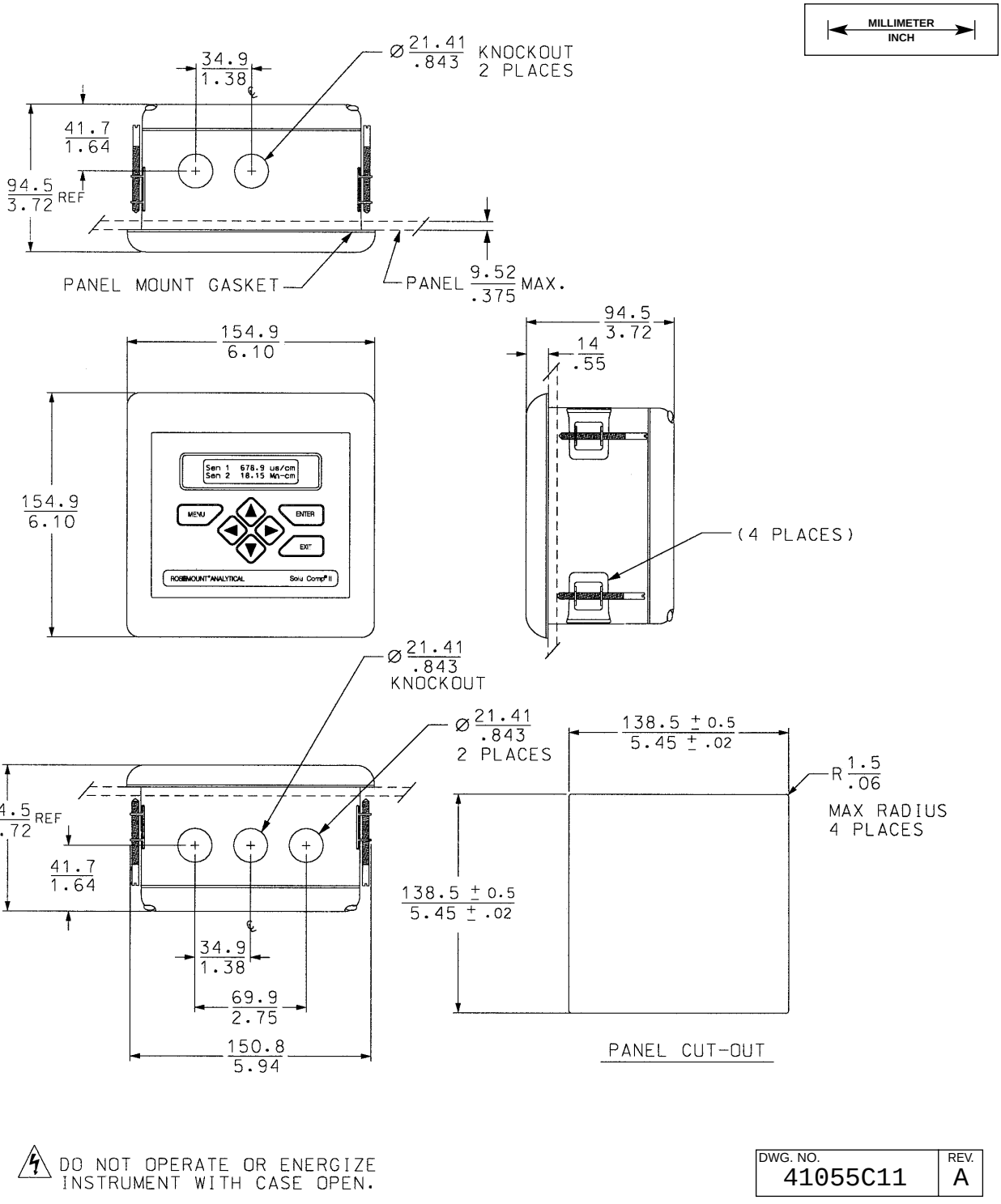


FIGURE 2-1. Panel Mount Installation

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

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2.2.3 Pipe Mounting.

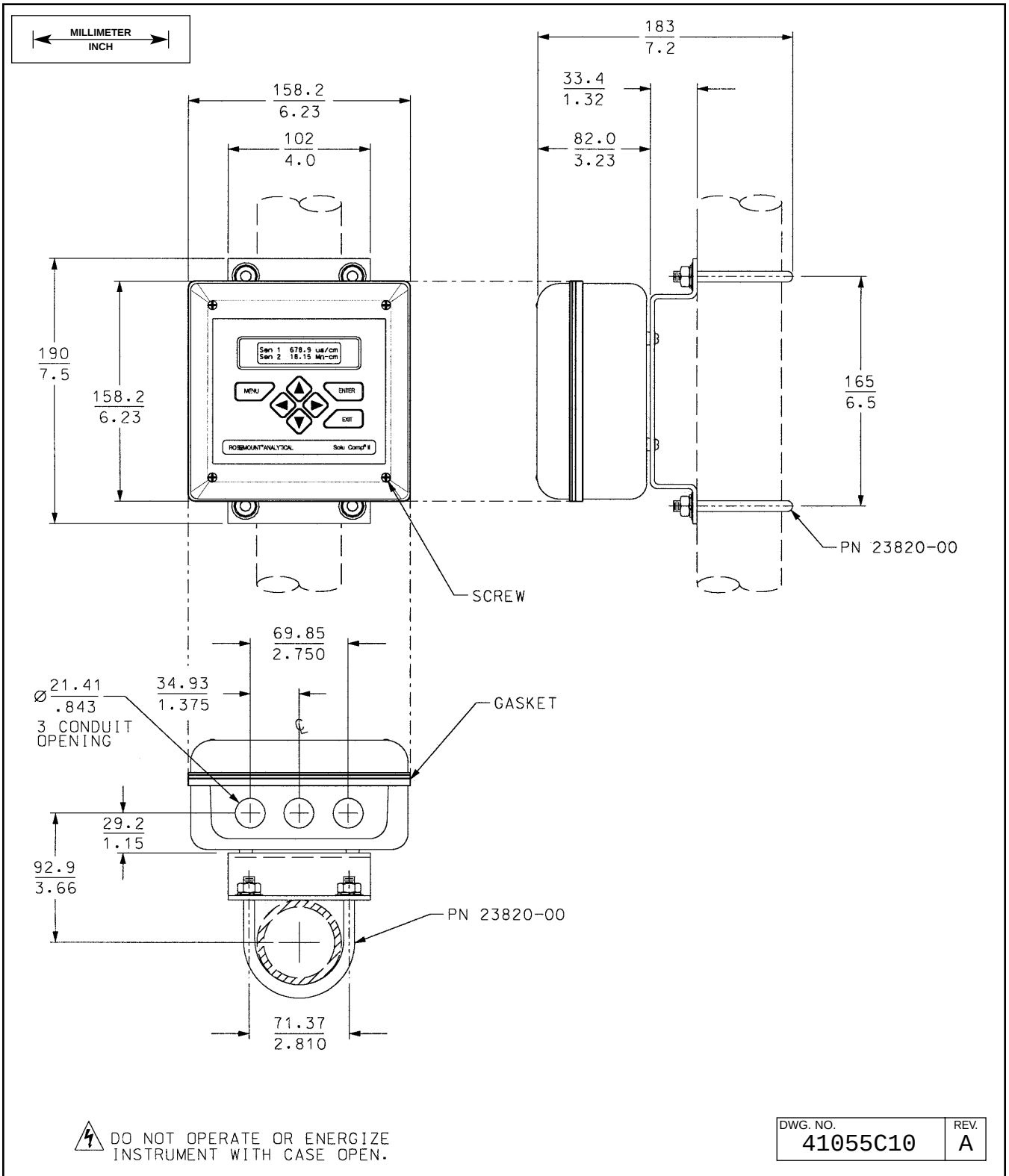


FIGURE 2-2. Pipe Mount Installation

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

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2.2.4 Surface Mounting.

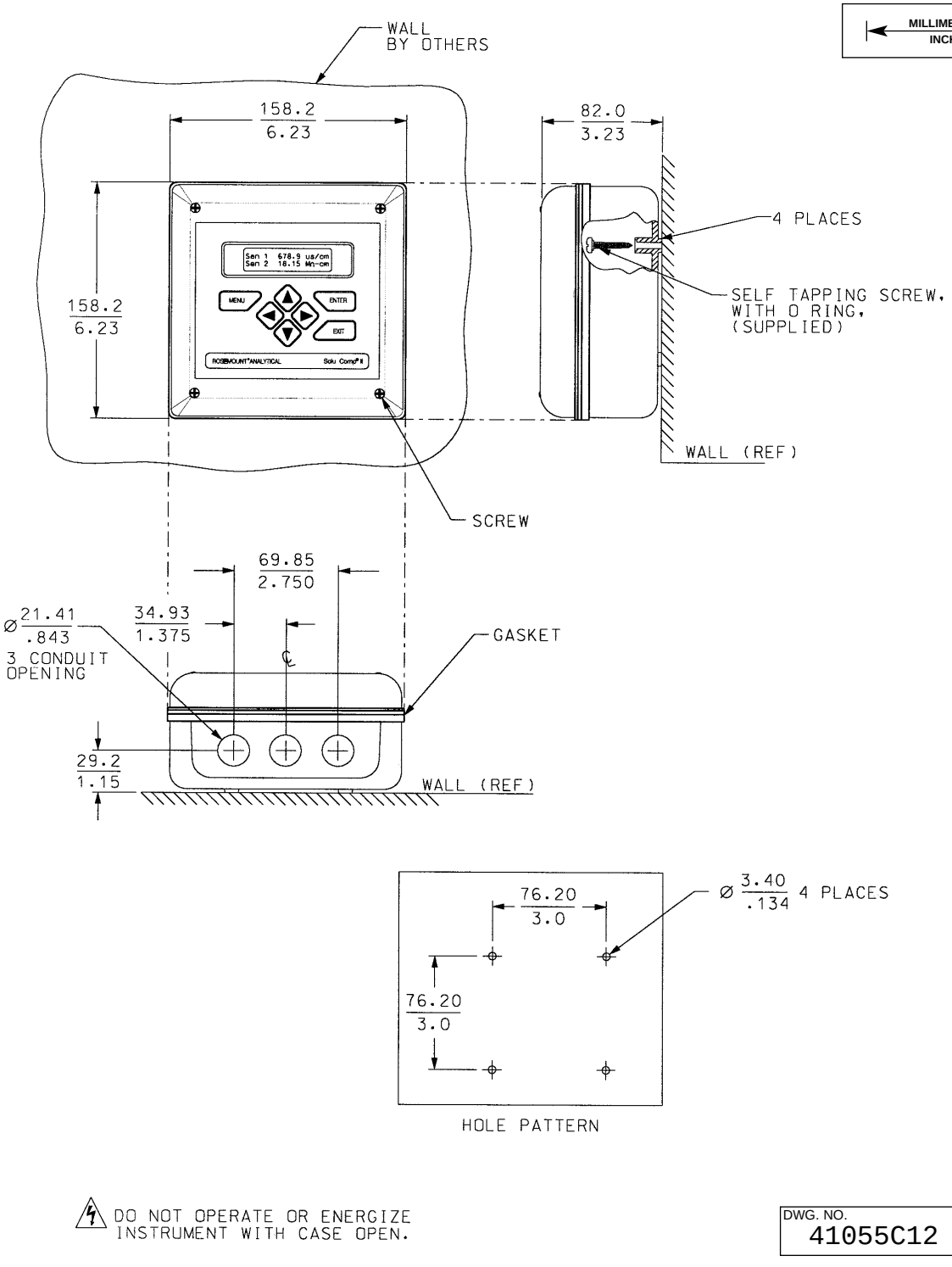


FIGURE 2-3. Surface Mount Installation

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

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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
30-A-PH/DO	panel mount	two open, three knockouts
30-B-PH/DO	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).

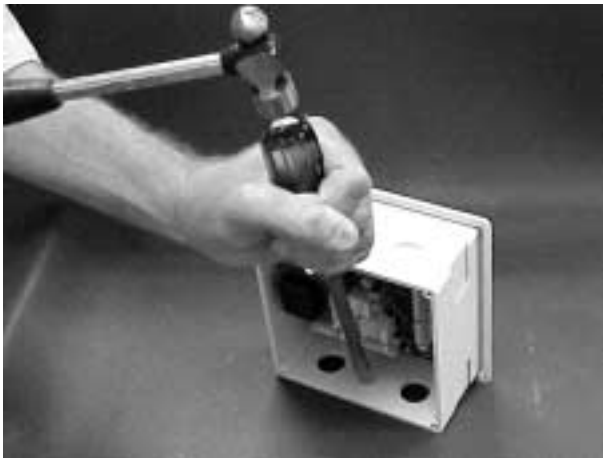


FIGURE 3-1. Removing the Knockouts

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.

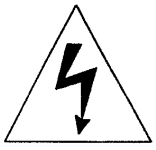
3.2 POWER, ALARM, OUTPUT, AND SENSOR CONNECTIONS

The Model 30 is available in two mounting configurations.The positions of the power, alarm, output, and sensor terminal blocks are different in each. Refer to the table to find the correct drawing.

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.

MODEL	MOUNTING	POWER	FIGURE
30-A-PH/DO	Panel	115/230 Vac	3-2
		24 Vdc	3-3
30-B-PH/DO	Surface/Pipe	115/230 Vac	3-4
		24 Vdc	3-5

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.

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

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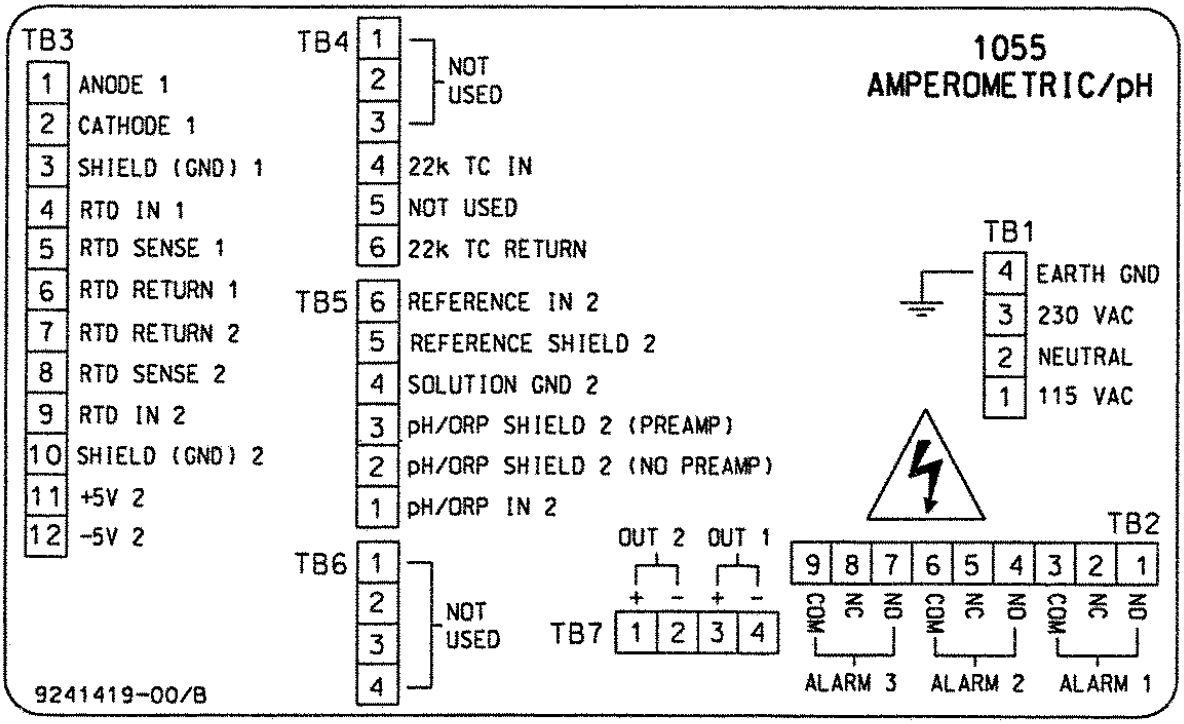


FIGURE 3-2. Wiring Connections for Model 30-A-PH/DO (Panel Mount with 115/230 Vac Power)

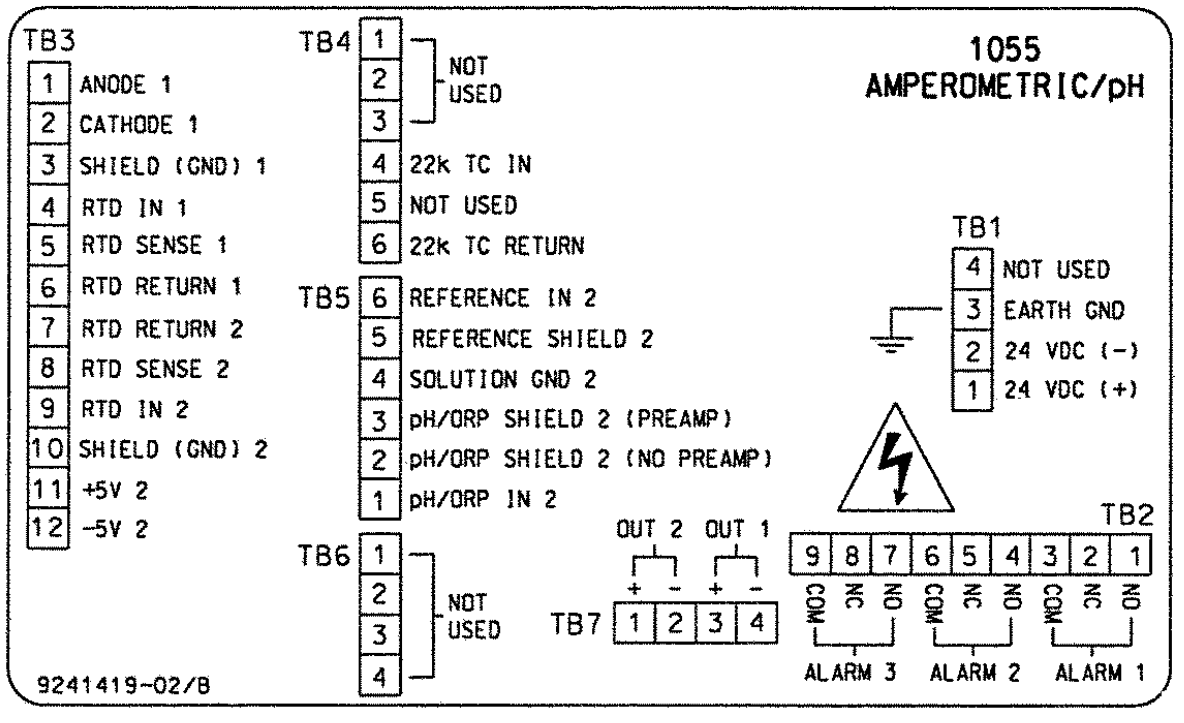


FIGURE 3-3. Wiring Connections (Panel Mount with 24 Vdc Power)

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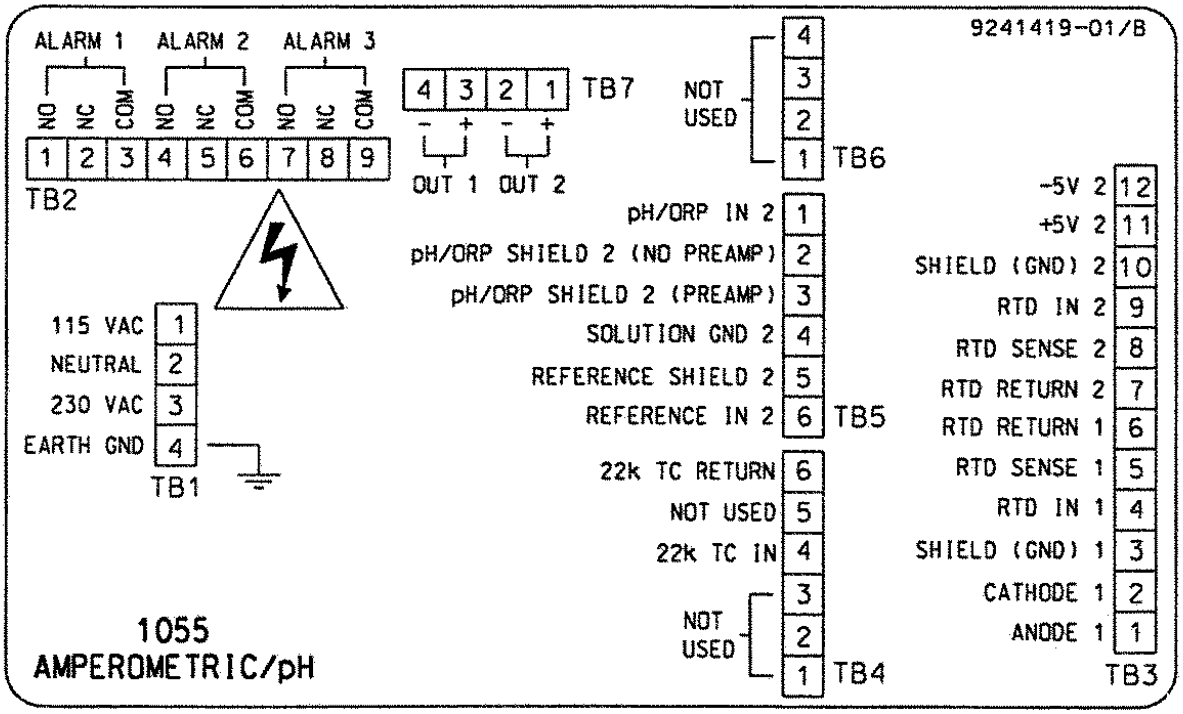


FIGURE 3-4. Wiring Connections for Model 30-B-PH/DO
(Surface/Pipe Mounting with 115/230 Vac Power)

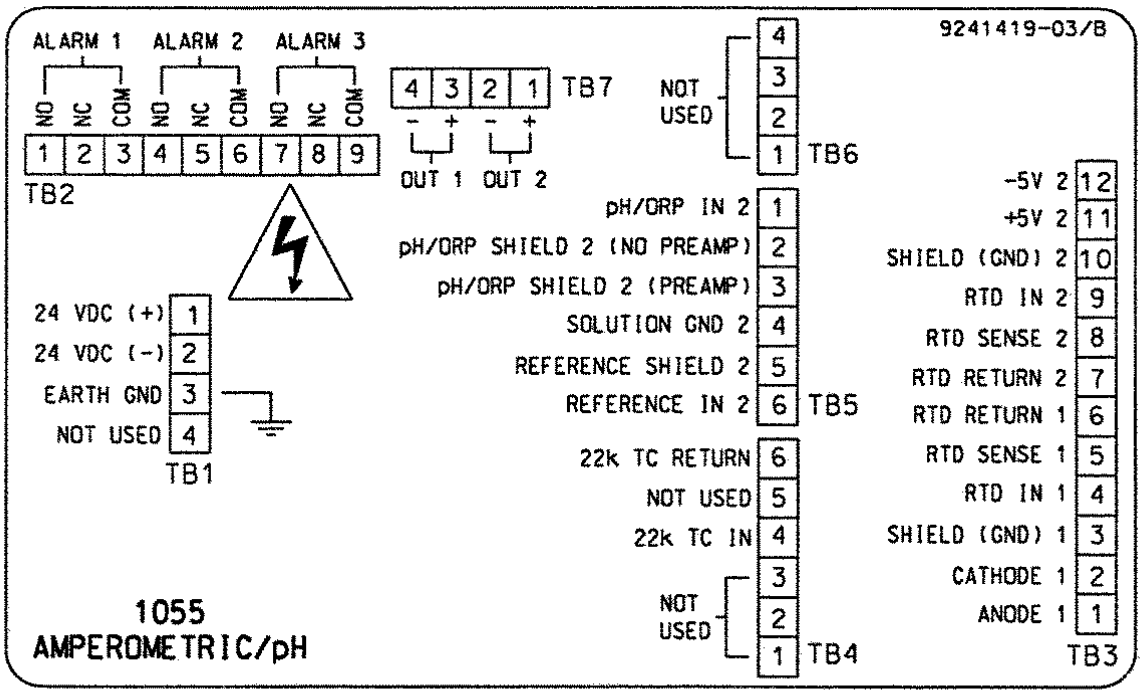


FIGURE 3-5. Wiring Connections
(Surface/Pipe Mounting with 24 Vdc Power)

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SECTION 4.0
DISPLAY AND OPERATION

4.1 DISPLAY
4.2 KEYPAD
4.3 PROGRAMMING AND CALIBRATING THE MODEL 30 - TUTORIAL
4.4 SECURITY
4.5 USING HOLD

4.1. DISPLAY

The Model 30 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 Model 30 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.

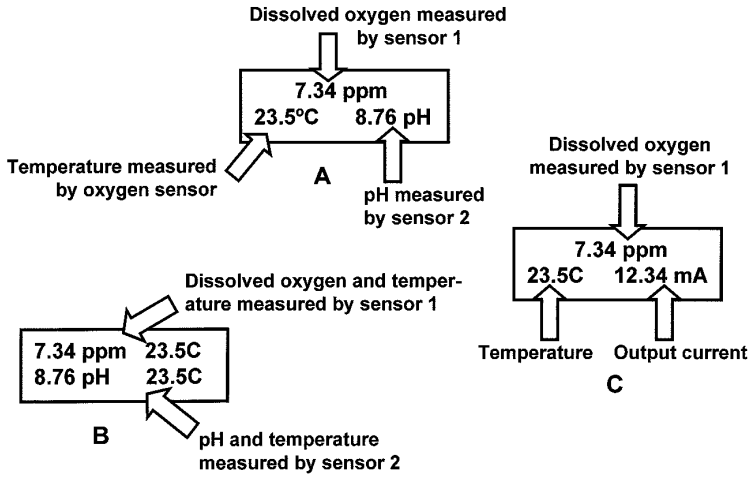


FIGURE 4-1. Displays During Normal Operation

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

4.2 KEYPAD

Figure 4-2 shows the Model 30 keypad.

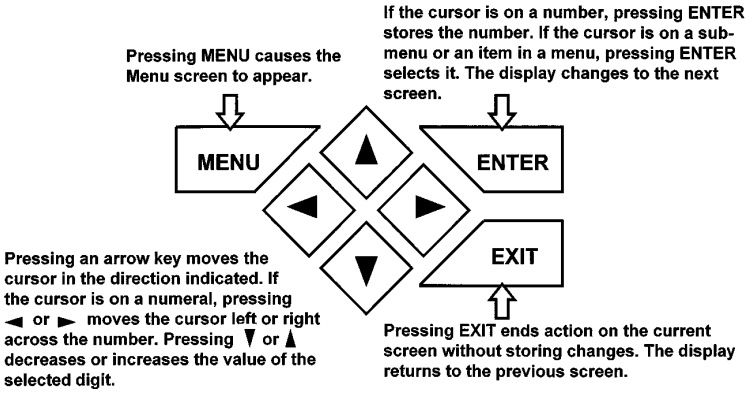


FIGURE 4-2. 30 Keypad

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.

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4.3 PROGRAMMING AND CALIBRATING THE MODEL 30 - TUTORIAL

Setting up and calibrating the Model 30 is easy. The following tutorial describes how to move around in the programming menus. For practice, the tutorial also describes how to assign conductivity values to the 4 and 20 mA outputs for sensor 1.



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**.



2. To assign dissolved oxygen 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.

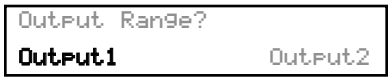


3. The **Program** sub-menu permits the user to set outputs, alarms, automatic or manual temperature compensation, and a security code. When the sub-menu opens, **Outputs** is blinking, which means the cursor is on Outputs. Press ▼ or ► (or any arrow key) to move the cursor around the display. Move the 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**).

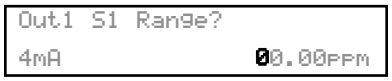
4. For practice, assign values to the 4 and 20 mA outputs for sensor 1. Move the cursor to **Outputs** and press ENTER.



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.



6. The screen shown at left appears. The Model 30 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**.

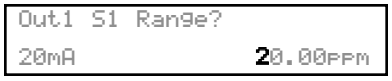


7. The screen shown at left appears. **Out1 S1** in the top line means output 1 (**Out1**) is assigned to sensor 1 (**S1**). Either output can be assigned to either sensor (sensor and output assignments are made under the **Output Configure** menu shown in step 5). Use the **Out1 S1 Range?** screen to assign a dissolved oxygen concentration to the **4 mA** output.

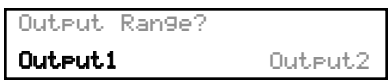
   a. Use the arrow keys to change the concentration to the desired value. Press ◄ or ► to move the cursor from digit to digit. Press ▲ or ▼ to increase or decrease the value of the digit. Holding ▲ or ▼ down causes the numeral to continuously scroll up or down.

   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.



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



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.

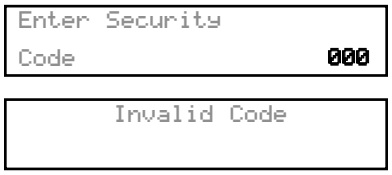
NOTE
To store values or settings, press ENTER before pressing EXIT.

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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.



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.

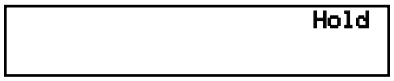
4.4.3 Setting a Security Code

See Section 5.7.

4.5 USING HOLD

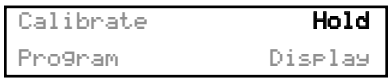
4.5.1 Purpose

The analyzer output is always proportional to measured pH or dissolved oxygen. 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.

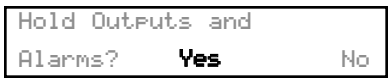


4.5.2 Using the Hold Function

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



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.

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SECTION 5.0
PROGRAMMING THE ANALYZER

5.1 GENERAL
5.2 CHANGING STARTUP SETTINGS
5.3 CONFIGURING AND RANGING THE OUTPUTS
5.4 CONFIGURING ALARMS AND ASSIGNING SETPOINTS
5.5 SELECTING THE TYPE OF MEASUREMENT
5.6 CHOOSING TEMPERATURE UNITS AND MANUAL OR AUTOMATIC TEMPERATURE COMPENSATION
5.7 SETTING A SECURITY CODE
5.8 NOISE REJECTION
5.9 SINGLE SENSOR OR DUAL SENSOR INPUT
5.10 RESETTING FACTORY CALIBRATION AND FACTORY DEFAULT SETTINGS
5.11 SELECTING A DEFAULT SCREEN, LANGUAGE, AND SCREEN CONTRAST

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 DO sensor being used
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 Model 30 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 DO sensor. 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 DO SENSOR, AND WHETHER pH, ORP, OR REDOX IS DESIRED FOR SENSOR 2 (SECTION 5.5) BEFORE MAKING OTHER PROGRAM SETTINGS.

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TABLE 5-1. DEFAULT SETTINGS

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

Sensor(s)	Output 1	Output 2	Section
Single sensor	Dissolved oxygen	Temperature	5.3 and 5.9
Dual sensor	Dissolved oxygen (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 dissolved oxygen measurement, pH, ORP, or redox is selected during Quick Start)

Measurement	Range	Section
Dissolved oxygen - ppm	0 to 20 ppm	5.3
Dissolved oxygen - ppb	0 to 900 ppb	5.3
Dissolved oxygen - % sat.	0 to 200%	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			
	1	2	3	Section
Assigned to	Sensor 1 (dissolved oxygen)	Sensor 2 (pH/ORP) (note)	Fault	5.4
High or low	High	High (note)	NA	5.4
Deadband	0	0	NA	5.4
Setpoint (Dissolved oxygen - ppm)	0 ppm (high); 20 ppm (low)	0 ppm (high); 20 ppm (low)	NA	5.4
Setpoint (Dissolved oxygen - ppb)	0 ppb (high); 990 ppb (low)	0 ppb (high); 990 ppb (low)	NA	5.4
Setpoint (Dissolved oxygen - % sat.)	0 ppm (high); 200% (low)	0 ppm (high); 200% (low)	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.

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TABLE 5-1. DEFAULT SETTINGS (continued)

5. TEMPERATURE RELATED SETTINGS

		Section
Units	°C	5.6
Automatic temperature compensation (DO)	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

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5.3 CONFIGURING AND RANGING THE OUTPUTS.

5.3.1 Purpose

The Model 30 accepts input from a dissolved oxygen, 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 (dissolved oxygen, 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 dissolved oxygen, 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).

M

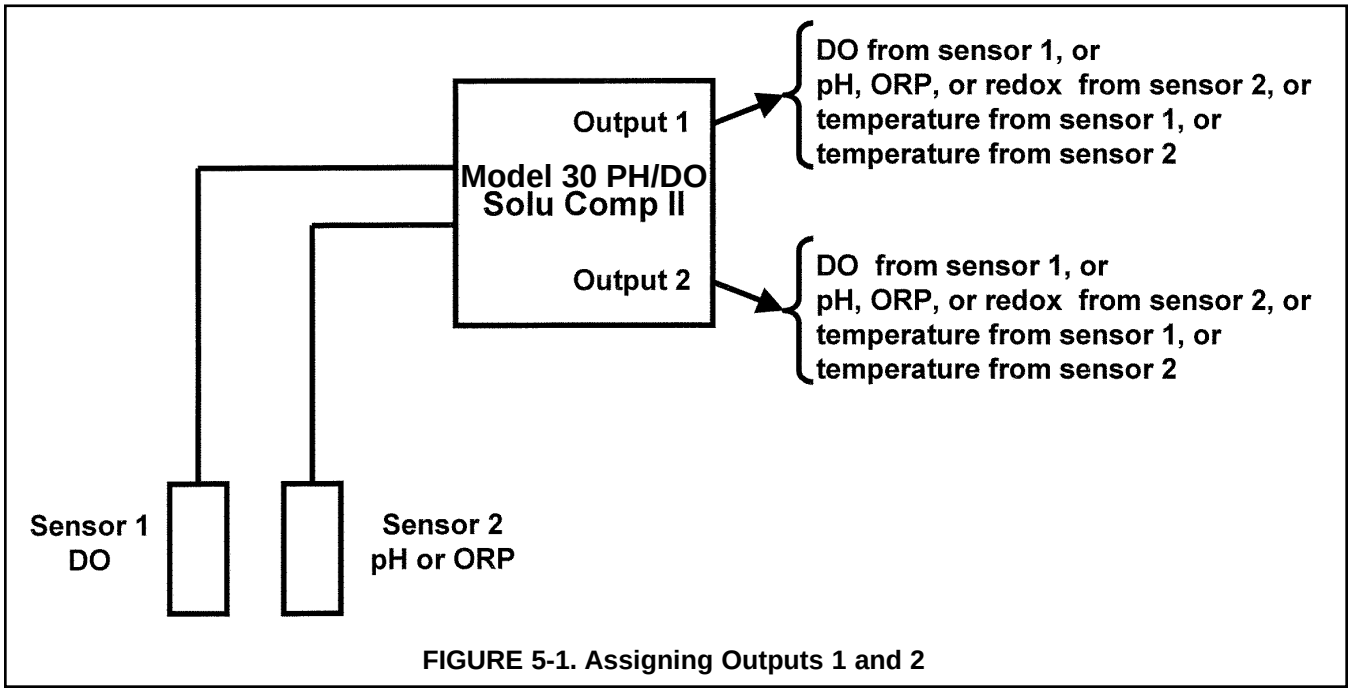


FIGURE 5-1. Assigning Outputs 1 and 2

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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.



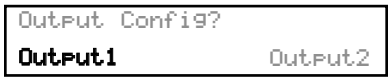
1. Press MENU. The main menu screen appears. Choose **Program**.



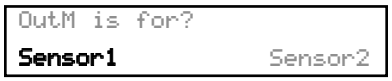
2. Choose **Outputs**.



3. Choose **Output Configure**.



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



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



6. Choose **Measurement** or **Temp**. If the output selected was assigned to Sensor 1, **Measurement** means DO. 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.



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



2. Choose **Outputs**.



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.

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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**). Alarms 1 and 2 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 be assigned to either sensor or 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 Model 30 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.

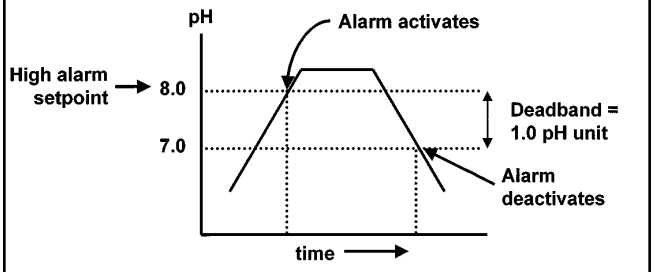


FIGURE 5-2. High Alarm Logic

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.

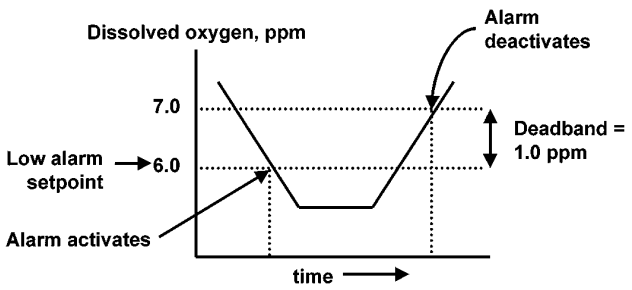


FIGURE 5-3. Low Alarm Logic

The alarm activates when the DO 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.

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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.



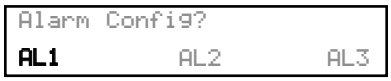
1. Press MENU. The main menu screen appears. Choose **Program**.



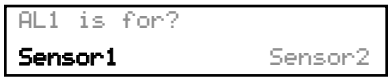
2. Choose **Alarms**.



3. Choose **Alarm Configure**.



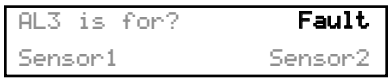
4. Choose Alarm 1 (**AL1**), Alarm 2 (**AL2**), or Alarm 3 (**AL3**).





5. For **AL1** or **AL2**
   a. Choose **Sensor 1** (DO) 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.



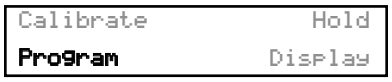
7. For **AL3**
   a. Choose **Sensor1** (DO), **Sensor2** (pH), or **Fault**.
   b. For sensor 1 or 2, choose **Measurement** or **Temp**.
   c. Choose **High** or **Low**. Set the deadband.
   d. Choosing **Fault** means **AL3** will activate when a sensor or analyzer fault exists. There is no user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

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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.



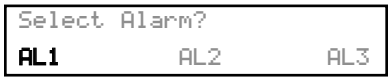
1. Press MENU. The main menu screen appears. Choose **Program**.



2. Choose **Alarms**.



3. Choose **Alarm Setpoints**.



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



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.

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5.5 SELECTING THE TYPE OF MEASUREMENT

5.5.1 Purpose

This section describes how to do the following:

1. Program the Model 30 to measure dissolved oxygen, pH, ORP, or redox potential.
2. Identify the type of dissolved oxygen sensor being used.
3. Make the following settings for dissolved oxygen
   a. barometric pressure units for air calibration
   b. electronic filtering of sensor current
   c. salinity correction.
4. 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 — Dissolved Oxygen

1. TYPE OF DO SENSOR. The Model 30 is compatible with three types of dissolved oxygen sensors available from Rosemount Analytical: conventional DO sensors used primarily in aeration basins, dissolved oxygen sensors for the determination of trace (ppb) oxygen in boiler feedwater, and steam-sterilizable sensors for bio-pharmaceutical manufacturing. The sensors have different temperature elements and membrane permeability corrections and, in some cases, require different polarizing voltages. By answering a series of questions, the user tells the analyzer which sensor is being used. The Model 30 is also compatible with steam-sterilizable sensors available from Broadley-James Corporation. Consult the factory for additional information.
2. INPUT FILTER. Before converting the sensor current to a dissolved oxygen reading, the Model 30 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.
3. PRESSURE UNITS. During air calibration, the analyzer uses the barometric pressure to calculate the partial pressure of oxygen, from which it calculates the equilibrium solubility of atmospheric oxygen in water. The user can select the units in which barometric pressure is displayed.
4. SALINITY. The solubility of oxygen in water depends on the concentration of dissolved salts in the water. Increasing the concentration of electrolytes reduces the solubility of oxygen—the so called salting-out effect. If the concentration of salts is less than about 1000 ppm, the effect is negligible. When the oxygen sensor is calibrated, the analyzer assumes that measurements will be made in water containing a relatively low concentration of dissolved salts. If the salt concentration is greater than about 1000 ppm, accuracy can be improved by applying a salinity correction. Enter the salinity as parts per thousand (‰) of sodium chloride. If the water contains a mixture of electrolytes, enter the ionic strength (as parts per thousand as NaCl). One percent is ten parts per thousand.
5. PERCENT SATURATION. Percent saturation is the concentration of oxygen in the sample divided by the saturation concentration. The saturation concentration is the maximum amount of oxygen the sample can hold at a given temperature.

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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 Model 30 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 Model 30 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 Model 30 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 Model 30 has built-in temperature corrections for high purity water and for dilute solutions of a strong base. The analyzer also accepts a custom correction.
6. CUSTOM TEMPERATURE CORRECTION. The custom temperature correction has units of ΔpH/°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 Model 30 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.

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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.



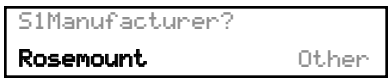
1. Press MENU. The main menu screen appears. Choose **Program**.



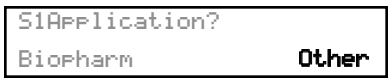
2. Choose **Measurement**.



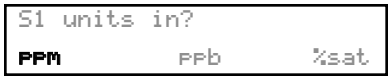
3. Choose **Sensor 1** (DO) or **Sensor 2** (pH). For a single input configuration, the **Sensor 1 Sensor 2** screen does not appear.
   If you chose Sensor 1, go to step 4.
   If you chose Sensor 2, go to step 11.



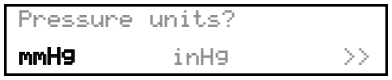
4. For Sensor 1 (DO), identify the manufacturer of the sensor, Rosemount Analytical or other. Choose other for Broadley-James sensors.



5. Identify the application. **Biopharm** is biopharmaceutical manufacturing. **Other** is aeration basins, boiler feedwater, etc.



6. Select the desired units. The screen at left appears only if **Rosemount** and **Other** were selected in steps 4 and 5. Otherwise, the choice ppb does not appear.



7. Choose the desired pressure units: **mmHg**, **inHg**, **atm**, **kPa**, or **bar**.

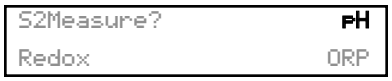


8. Choose the amount of filtering desired.

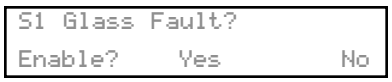


9. Enter the salinity (in part per thousand of sodium chloride) in the sample.

10. 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.



11. If **Sensor 2** (pH) was selected, the screen at left appears. Select **pH**, **Redox**, or **ORP**. If pH was selected, go to step 12; otherwise, go to step 17.



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



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



14. For **Soln Temp Corr**, choose **Off**, **UltraPure**, **HighpH**, or **Custom**. For **Custom**, enter the desired temperature coefficient.



15. 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.

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

17. 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.

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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 and for air calibration.
3. Choose automatic or manual temperature compensation for pH.
4. Enter a temperature for manual temperature compensation.

5.6.3 Definitions — dissolved oxygen

1. AUTOMATIC TEMPERATURE COMPENSATION - DISSOLVED OXYGEN. Temperature is important in the amperometric determination of dissolved oxygen for two reasons.

   The oxygen sensor is a membrane-covered amperometric sensor. 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 dissolved oxygen level remained constant. A correction equation in the analyzer software automatically compensates for changes in membrane permeability caused by temperature. In automatic temperature compensation, the analyzer uses the temperature measured by the sensor for the correction.

   The analyzer also uses temperature during air calibration. From the temperature the analyzer calculates the saturation pressure of water and using the barometric pressure calculates the partial pressure of atmospheric oxygen. Once the analyzer knows the partial pressure of oxygen, it calculates the equilibrium solubility of oxygen in water using a temperature-dependent factor called the Bunsen coefficient. In automatic temperature compensation, the analyzer performs the calibration using the temperature measured by the sensor.

2. MANUAL TEMPERATURE COMPENSATION - DISSOLVED OXYGEN. In manual temperature compensation, the analyzer uses the temperature entered by the user for membrane permeability correction and for air calibration. 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.

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.

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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.



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



2. Choose **>>**.



3. Choose **Temp.**



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 (DO) 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.



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



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.

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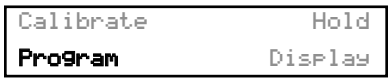
5.8 NOISE REJECTION

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.



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



2. Choose **>>**.



3. Choose **>>**.



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.

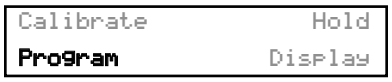
5.9 SINGLE SENSOR OR DUAL SENSOR INPUT

5.9.1 Purpose

The Model 30 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.

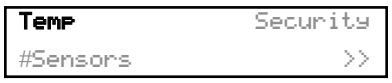
To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.



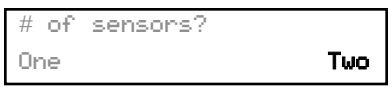
1. Press MENU. The main menu screen appears. Choose **Program**.



2. Choose **>>**.



3. Choose **#Sensors**.



4. Choose **One** or **Two**. Choosing **One** configures the analyzer as a dissolved oxygen analyzer.
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.

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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.

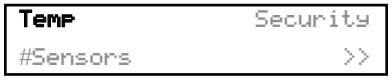
To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.



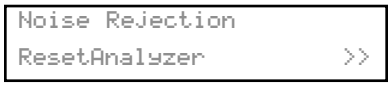
1. Press MENU. The main menu screen appears. Choose **Program**.



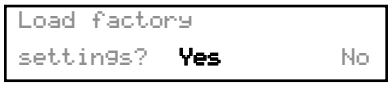
2. Choose **>>**.



3. Choose **>>**.



4. Choose **ResetAnalyzer**.



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 Model 30 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, dissolved oxygen or pH. The units for dissolved oxygen are ppm (mg/L) or ppb (ug/L) as O_2.

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

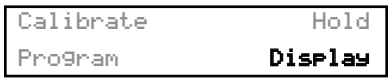
   iii. **G** is the impedance of the glass pH electrode.

2. select a language
3. change the screen contrast

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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



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.

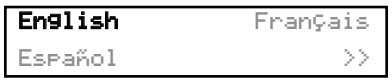
5.11.3 Procedure: Choosing a Language



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

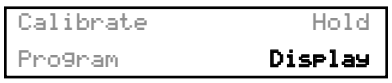


2. Choose **Language**.



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



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



2. Choose **Contrst**.



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.

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SECTION 6.0
CALIBRATION

6.1 INTRODUCTION
6.2 CALIBRATING TEMPERATURE
6.3 CALIBRATION - DISSOLVED OXYGEN
6.4 AUTO CALIBRATION - pH
6.5 MANUAL CALIBRATION - pH
6.6 STANDARDIZATION - pH
6.7 ENTERING A KNOWN SLOPE - pH
6.8 ORP CALIBRATION

6.1 INTRODUCTION

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

Oxygen sensors require periodic full-scale calibration. Automatic air calibration is standard. The user simply suspends the sensor over a container filled with water. When readings are stable, the analyzer automatically calculates the equilibrium solubility of atmospheric oxygen in water and calculates the sensitivity (sensor current divided by oxygen concentration). The sensor can also be calibrated against a referee instrument.

New oxygen 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 an oxygen-free environment 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.

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6.2 CALIBRATING TEMPERATURE

6.2.1 Purpose

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

Temperature affects the determination of oxygen in two ways.

1. The analyzer uses temperature during automatic air calibration. From the temperature, the analyzer calculates the vapor pressure of water and, using the barometric pressure, calculates the partial pressure of atmospheric oxygen. Once the analyzer knows the partial pressure of oxygen, it calculates the equilibrium solubility of oxygen in water using a temperature-dependent factor called the Bunsen coefficient. Overall, a 1°C error in the temperature measurement produces about a 2% error in the solubility calculated during calibration and about the same error in the final measurement.
2. The oxygen sensor is a membrane-covered amperometric sensor. Oxygen from the sample diffuses through the membrane and is consumed at an electrode immediately behind the membrane. The reaction produces a current directly proportional to the concentration of oxygen. The permeability of the membrane depends on temperature. Therefore, both temperature and dissolved oxygen least affect the sensor current. To account for changes in the sensor current caused by temperature alone, the analyzer automatically applies a membrane permeablility correction. Because the membrane permeability changes about 4%/°C at 25°C, a 1°C error in temperature can produce about a 4% error in oxygen reading.

Temperature affects the measurement of pH in three ways.

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 Model 30 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 Model 30 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**.

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6.2.2 Procedure

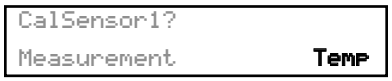
1. Remove the sensor from the process. Place it in an insulated container of water along with a **calibrated thermometer**. Submerge at least the bottom two inches of the sensor. Stir continuously.
2. Allow the sensor to reach thermal equilibrium. For some sensors, the time constant for a change in temperature 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 Model 30 display to match the **calibrated thermometer** using the procedure below.



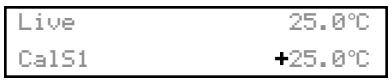
a. Press MENU. The main menu screen appears. Choose **Calibrate**.



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



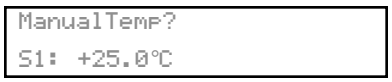
c. Choose **Temp**.



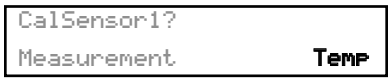
d. If the analyzer was programmed in Section 5.6 to use the actual process temperature, the screen at left will appear. To calibrate the temperature, change the number in the second line to match the temperature measured with the **standard thermometer**. Press ENTER. Go to step f.

If the calibration temperature is more than 2 or 3°C different from the live reading, see Section 8.3.1 or Section 8.4.2.

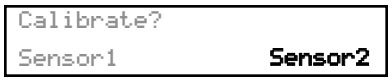
If the analyzer was programmed to use a temperature entered by the user, go to step e.



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.



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



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

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

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6.3 CALIBRATION — DISSOLVED OXYGEN

6.3.1 Purpose

As Figure 6-1 shows, oxygen sensors generate a current directly proportional to the partial pressure of oxygen in the sample. Calibrating the sensor requires exposing it to a solution containing no oxygen (zero standard) and to a solution containing a known amount of oxygen (full-scale standard).

The zero standard is necessary because oxygen sensors, even when no oxygen is present in the sample, generate a small current called the residual current. The analyzer subtracts the residual current from the measured current and converts the result to a dissolved oxygen reading. New sensors require zeroing before being placed in service, and sensors should be zeroed whenever the electrolyte solution is replaced. The recommended zero standard is 5% sodium sulfite in water, although oxygen-free nitrogen can also be used.

The purpose of the full-scale standard is to determine the slope of the calibration curve. Because the solubility of atmospheric oxygen in water as a function of temperature and barometric pressure is well known, the natural choice for a full-scale standard is air-saturated water. However, air-saturated water is difficult to prepare and use, so the universal practice is to use water-saturated air. From the point of view of the sensor, air-saturated water and water-saturated air are identical. The equivalence comes about because the sensor really measures the chemical potential of oxygen. Chemical potential is the force that drives oxygen molecules from the sample through the membrane into the sensor. Sensor current is proportional to the rate at which oxygen passes through the membrane, so current is really determined by the chemical potential of oxygen in the sample. Because oxygen in air-saturated water is in equilibrium with oxygen in water-saturated air, the chemical potential of oxygen in both phases is the same. Whether the sensor is in air-saturated water or water-saturated air, the driving force pushing oxygen into the sensor is the same, so the sensor current is the same.

Automatic air calibration is standard. The user simply exposes the sensor to water-saturated air. The analyzer monitors the sensor current. When the current is stable, the analyzer stores the current and measures the barometric pressure and temperature. The temperature element is part of the dissolved oxygen sensor. The pressure sensor is inside the analyzer. From the temperature, the analyzer calculates the saturation vapor pressure of water. Next, it calculates the pressure of dry air by subtracting the vapor pressure from the barometric pressure. Using the fact that dry air always contains 20.95% oxygen, the analyzer calculates the partial pressure of oxygen. Once the analyzer knows the partial pressure of oxygen, it uses the Bunsen coefficient to calculate the equilibrium solubility of atmospheric oxygen in water at the prevailing temperature. At 25°C and 760 mm Hg, the equilibrium solubility is 8.24 ppm.

Often it is too difficult or messy to remove the sensor from the process liquid for calibration. In this case, the sensor can also be calibrated against a measurement made with a portable laboratory instrument. The laboratory instrument typically uses a membrane-covered amperometric sensor that has been calibrated against water-saturated air.

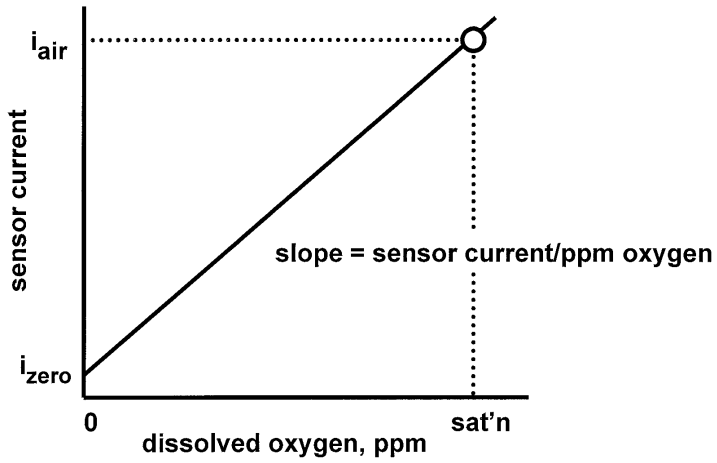


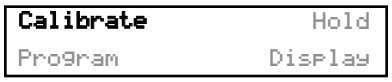
FIGURE 6-1. Sensor Current as a Function of Dissolved Oxygen Concentration

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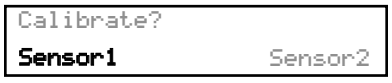
6.3.2 Procedure — Zeroing the sensor.

1. Place the sensor in a **fresh** solution of 5% sodium sulfite (Na_2SO_3) in water. Be sure air bubbles are not trapped against the membrane. The 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.

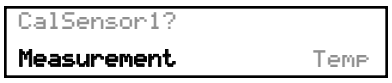
   A new sensor or a sensor in which the electrolyte solution has been replaced may require several hours (occasionally as long as overnight) to reach a minimum current.



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



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



4. Choose **Measurement**.



5. Choose **Zero**.



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

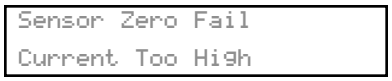


7. Once the reading is stable, the screen at left appears. Sensor zero is complete and the analyzer has stored the zero current. The screen remains until the operator presses MENU then EXIT to return to the main display.

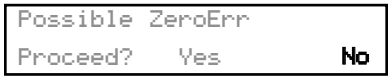
   NOTE

   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 agrees with the value shown in the table. To display the sensor current, go the the main display and press ▼until the input current is showing.



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**.

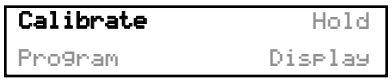


9. This screen appears if the zero current is moderately high. To continue, choose **Yes**. To repeat the zero step, choose **No**.

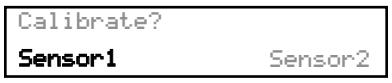
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6.3.3 Procedure — Calibrating the sensor in air

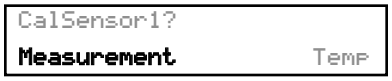
1. Remove the sensor from the process stream. Use a soft tissue and a stream of water from a wash bottle to clean the membrane. Blot dry. **The membrane must be dry during air calibration.**
2. Pour some water in a beaker and suspend the sensor with the membrane about 0.5 inch (1 cm) above the water surface. To avoid drift caused by temperature changes, keep the sensor out of the direct sun.
3. Monitor the dissolved oxygen reading and the temperature. Once readings have stopped drifting, begin the calibration. It may take 5 - 10 minutes for sensor reading in air to stabilize. Stabilization time may be even longer if the process temperature is appreciably different from the air temperature. For an accurate calibration, temperature measured by the sensor must be stable.



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



5. Choose **Sensor 1** (dissolved oxygen). For a single sensor configuration, this screen will not appear.



6. Choose **Measurement**.



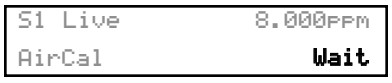
7. Choose **AirCal**.



8. The screen shows the barometric pressure. If the pressure sensor inside the analyzer is being used, the display is the current pressure. If the pressure sensor is **not** being used, the display is the barometric pressure last entered by the user. If the reading is wrong, enter the correct value.

NOTE

If pressure is being measured by the analyzer, entering a value will standardize the pressure sensor.

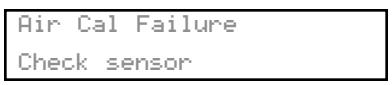


9. The screen at left appears. The top line is the current dissolved oxygen reading based on the previous calibration or, for a first time calibration, the default sensitivity.



10. Once the reading is stable (drift or noise less than 0.05 ppm in 10 seconds), the screen at left appears. Air calibration is complete. Press MENU then EXIT to return to the main display.
11. During calibration, the analyzer stores the measured current and calculates the sensitivity. Sensitivity is the sensor current in nA divided by the saturation concentration of oxygen in ppm.

To view the sensitivity, press MENU then EXIT to return to the main display. Press ▼ until the sensitivity information screen is showing.



12. This screen appears if the sensitivity is extremely high or low. See Section 8.3 for troubleshooting. Repeat the calibration.

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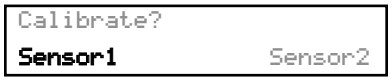
6.3.4 Procedure — Calibrating the sensor against a standard instrument

The analyzer and sensor can be calibrated against a standard instrument. For oxygen sensors installed in aeration basins in waste treatment plants, calibration against a second instrument is often preferred. For an accurate calibration be sure that…

1. The standard instrument has been zeroed and calibrated against water-saturated air following the manufacturer's instructions.
2. The standard sensor is immersed in the liquid as close to the process sensor as possible.
3. Adequate time is allowed for the standard sensor to stabilize before calibrating the process instrument.



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



2. Choose **Sensor 1** (dissolved oxygen). For a single sensor configuration, this screen will not appear.



3. Choose **Measurement**.



4. Choose **InProcess**.



5. The screen at left appears. The top line is the current dissolved oxygen reading based on the previous calibration. Change the reading in the second line to match the standard instrument. Press ENTER.

6. The display returns to the screen shown in step 4. Press MENU followed by EXIT to return to the main display.

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6.4 AUTO CALIBRATION — pH

6.4.1 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.

6.4.2 Definitions

1. AUTO CALIBRATION. The analyzer recognizes the buffers and uses temperature-corrected pH values in the calibration. The table lists the buffers the Model 30 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 Model 30 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 Model 30 successfully completes the calibration, it calculates and displays the calibration slope and offset. The slope is reported as the slope at 25°C. Figure 6-2 defines the terms.

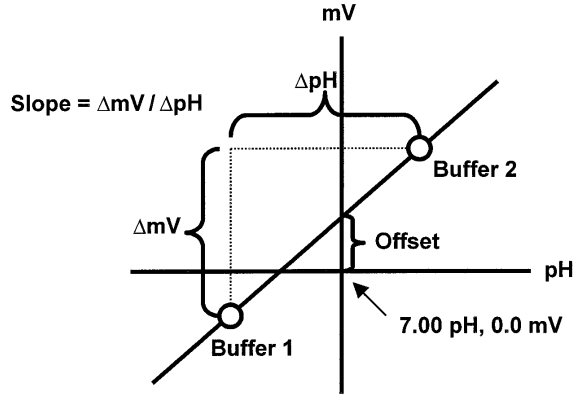


FIGURE 6-2. Calibration Slope and Offset

6.4.3 Procedure

1. Obtain two buffer solutions. Ideally the buffer pH values should bracket the range of pH values to be measured.

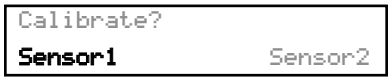
2. Remove the sensor from the process liquid. If the process and buffer temperatures are appreciably different, place the sensor in a container of tap water at the buffer temperature. Do not start the calibration until the sensor has reached the buffer temperature. Thirty minutes is usually adequate.

3. Calibrate the sensor by using the procedure on the following page.

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



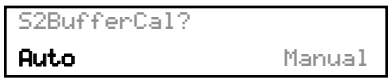
b. Choose **Sensor2** (pH sensor).



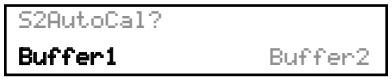
c. Choose **Measurement**.



d. Choose **BufferCal**.



e. Choose **Auto**.



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.



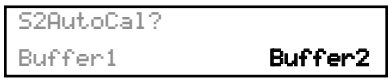
h. The screen at left is displayed until the reading is stable (<0.02 pH change in 10 sec). When the reading is stable, the screen in step i appears. To bypass automatic stabilization, press ENTER at any time.



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.



j. The screen shown at left appears.



k. Remove the sensor from buffer 1, rinse it with water, and place it in buffer 2. Swirl the sensor. Choose **Buffer2**.



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.



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.



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** (dissolved oxygen sensor) will permit the dissolved oxygen measurement to be calibrated.



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.

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6.5 MANUAL CALIBRATION — pH

6.5.1 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.

6.5.2 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 Model 30 successfully completes the calibration, it calculates and displays the calibration slope and offset. The slope is reported as the slope at 25ºC. Figure 6-2 defines the terms.

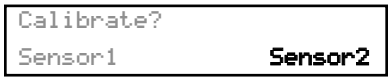
6.5.3 Procedure

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.

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



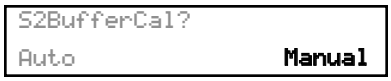
b. Choose **Sensor2** (pH sensor).



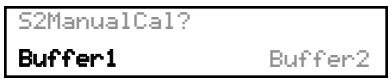
c. Choose **Measurement**.



d. Choose **BufferCal**.



e. Choose **Manual**.

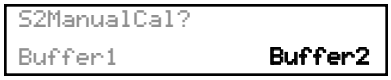


f. Choose **Buffer1**.

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



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.



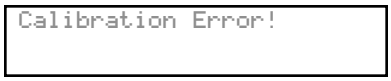
i. The screen at left appears. Choose **Buffer2**. Rinse the sensor and thermometer with water and place them in buffer 2. Be sure the bulb and junction are submerged. Swirl the sensor.



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.



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** (dissolved oxygen sensor) will permit the dissolved oxygen measurement to be calibrated.



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.

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6.6 STANDARDIZATION — pH

6.6.1 Purpose

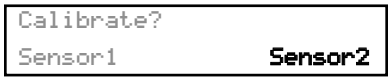
1. The pH measured by the Model 30 analyzer can be changed to match the reading from a second or referee instrument. The process of making the two readings agree is called standardization.
2. During standardization, the difference between the two pH values is converted to the equivalent voltage. The 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.

6.6.2 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 Model 30 transmitter by following the steps below.



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



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



c. Choose **Measurement**.



d. Choose **Standardize**.



e. The top line shows the present pH reading. Change the pH reading in the second line to match the referee instrument. Press ENTER.



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.



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.

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6.7 ENTERING A KNOWN SLOPE VALUE — pH

6.7.1 Purpose

If the electrode slope is known from other measurements, it can be entered directly in the Model 30 transmitter. 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:

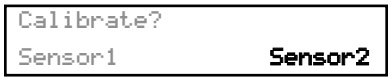
$$\text{slope at } 25°C = (\text{slope at } t°C)\ \frac{298}{t°C + 273}$$

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

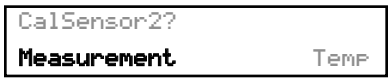
6.7.2 Procedure



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



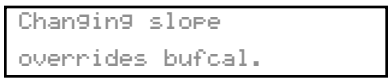
2. Choose **Sensor2** (pH sensor).



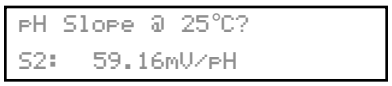
3. Choose **Measurement**.



4. Choose **Slope**.



5. The screen at left appears briefly.



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



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



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

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

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6.8 ORP CALIBRATION

6.8.1 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.

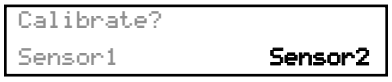
6.8.2 Preparation of ORP standard solutions

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.

6.8.3 Procedure



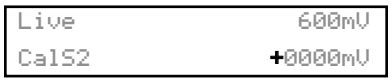
1. Press MENU. The main menu screen appears. Choose **Calibrate**.



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



3. Choose **Measurement**.



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 dissolved oxygen measurement to be calibrated.
6. To return to the main display, press MENU followed by EXIT.

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SECTION 7.0
MAINTENANCE

7.1 OVERVIEW
7.2 REPLACEMENT PARTS

7.1 OVERVIEW

The Model 30 transmitter needs little routine maintenance. The calibration of the transmitter and sensor should be checked periodically. To recalibrate the transmitter and sensor, see Section 6.0.

Clean the transmitter 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

Many components of the transmitter are replaceable. Refer to the table below to find the correct parts diagram.

Model	Description	See Figure
30-A-PH/DO	Panel mounting enclosure	7-1
30-B-PH/DO	Pipe/surface mounting enclosure	7-2

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TABLE 7-1. Replacement Parts for Model 30 (Panel Mount Version)

Location in Figure 7-1		Description	Shipping Weight
1		Panel mounting kit, includes four brackets and four set screws	2 lb/1.0 kg
2		Enclosure, front, for panel mount version, includes keypad	3 lb/1.0 kg
3		Gasket, front, for panel mount version	2 lb/1.0 kg
4	note	Screw, 2-56 x 0.187 in., with integral washer	
5		Display board, LCD	2 lb/1.0 kg
6	note	PCB, microprocessor	
7	note	Screw, self-tapping, #4 x 0.375 in.	
8	note	PCB, power supply, 115/230 Vac or 24 Vdc	
9	note	Screw, 4-40 x 0.31 in., with integral washer	
10		Gasket, rear cover, for panel mount version	2 lb/1.0 kg
11		Enclosure cover, rear, for panel mount version, 115/230 Vac	2 lb/1.0 kg
11		Enclosure cover, rear, for panel mount version, 24 Vdc	2 lb/1.0 kg
12	note	Self-tapping screws, #6 x 1.25 in.	

Note: Information about circuit boards and size of screws and washers is for information only. Circuit boards (other than the display board) and screws and washers cannot be purchased from Broadley Technologies.
Shipping weights are rounded up to the nearest whole lb or 0.5 kg.

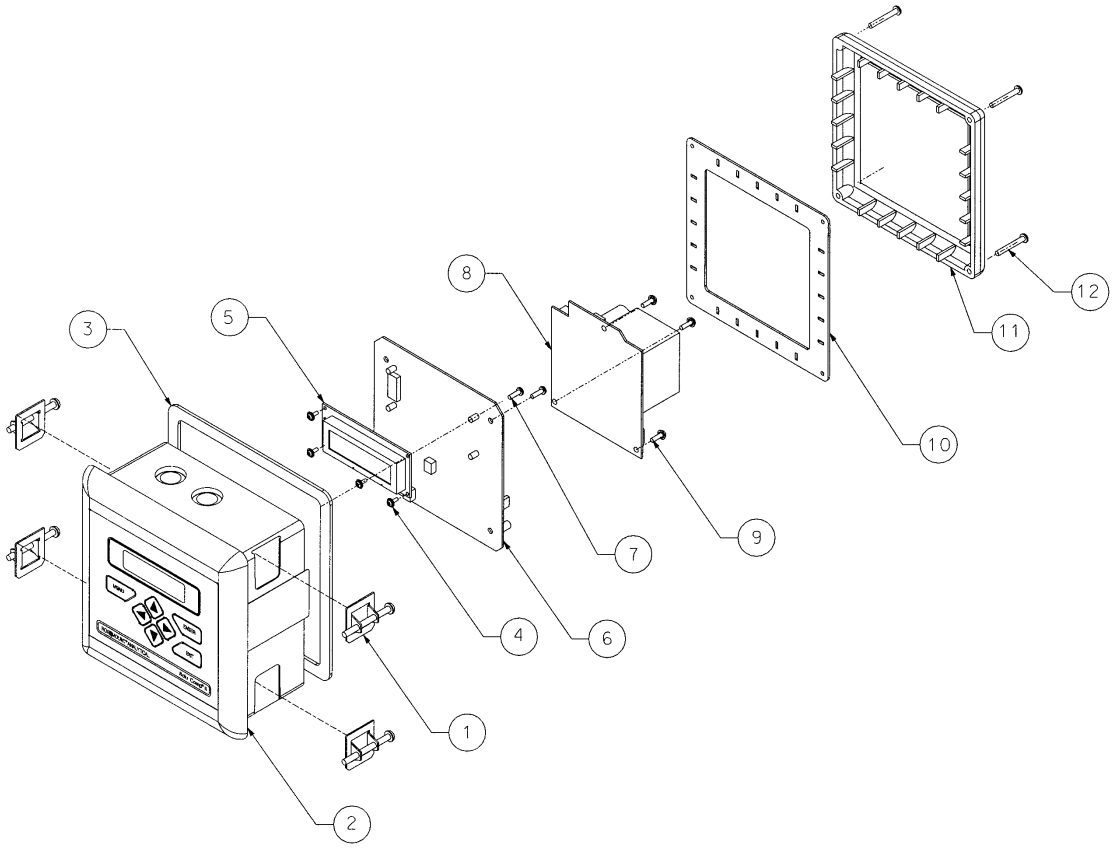


FIGURE 7-1. Exploded View of Model 30 (Panel Mount Version)

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TABLE 7-2. Replacement Parts for Model 30 (Pipe/Surface Mount Version)

Location in Figure 7-2		Description	Shipping Weight
1	note	Screw, 6-32 x 1.38 in.	
2	note	Washer	
3		Enclosure, front, for pipe/surface mount version, includes keypad and hinge	2 lb/1.0 kg
4		Gasket for pipe/surface mount version	2 lb/1.0 kg
5	note	Screw, 2-56 x 0.187 in., with integral washer	
6		Display board, LCD	2 lb/1.0 kg
7	note	PCB, microprocessor	
8	note	Self-tapping screw, #4 x 0.375 in.	
9	note	PCB, power supply, 115/230 Vac or 24 Vdc	
10	note	Screw, 4-40 x 0.31 in., with integral washer	
11		Enclosure, rear, for pipe/surface mount version, includes standoffs and hinge brackets	3 lb/1.5 kg
not shown		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 circuit boards and size of screws and washers is for information only. Circuit boards (other than the display board) and screws and washers cannot be purchased from Broadley Technologies.
Shipping weights are rounded up to the nearest whole lb or 0.5 kg.

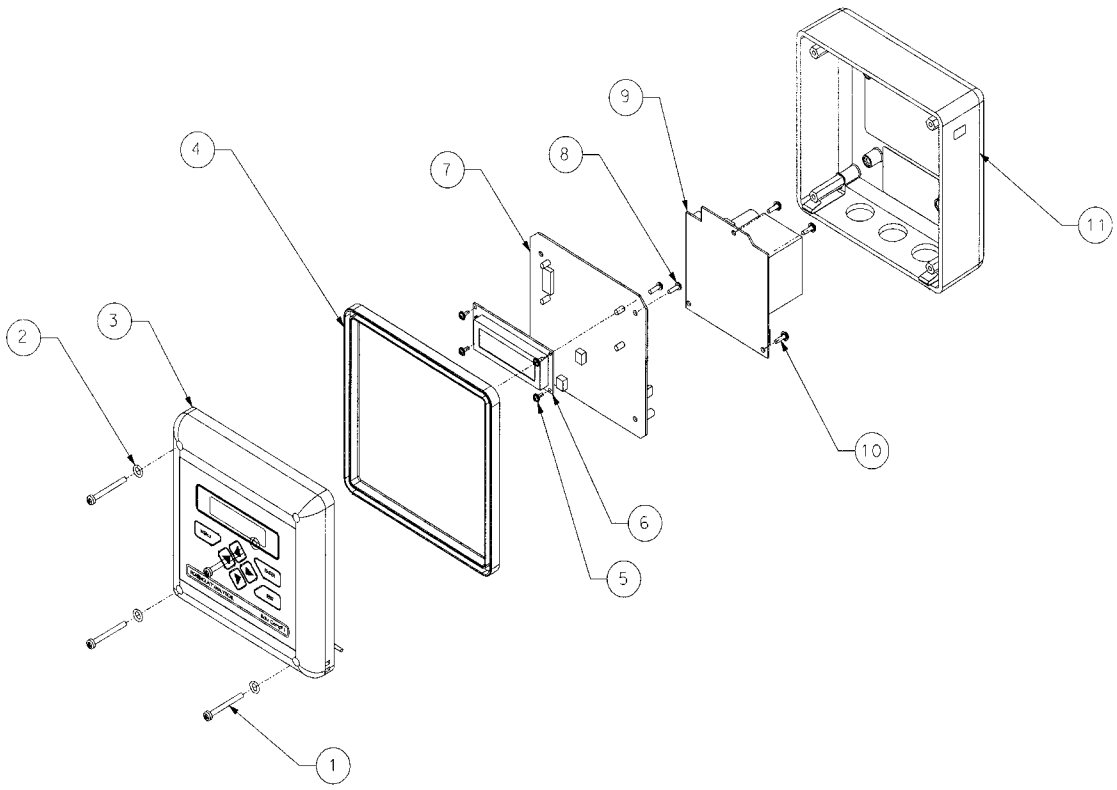


FIGURE 7-2. Exploded View of Model 30 (Pipe/Surface Mount Version)

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SECTION 8.0
TROUBLESHOOTING

8.1 OVERVIEW
8.2 TROUBLESHOOTING USING FAULT CODES
8.3 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — DO
8.4 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — pH
8.5 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — GENERAL
8.6 SIMULATING INPUTS — pH
8.7 SIMULATING TEMPERATURE
8.8 MEASURING REFERENCE VOLTAGE — pH

8.1 OVERVIEW

The Model 30 continuously monitors itself and the sensor for faults. When the transmitter 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 dissolved oxygen, pH, ORP, or temperature. **Press ▲ to display the fault codes.**

8.2 TROUBLESHOOTING USING FAULT CODES

Fault Code	Explanation	See Section
S1 Out of Range	Sensor current exceeded (dissolved oxygen 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 Exceeded

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 3.2. 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.

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8.2.3 pH Sensitive Glass Membrane is Broken

The Model 30 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 8.7.

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

The Model 30 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.

Call the factory at (877) 246-7900.

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8.3 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — DO

Problem	See Section
New temperature during calibration more than 2-3°C different from the live reading	8.3.1
Zero current was accepted, but current is greater than the value in the table in Section 6.3.2	8.3.2
Possible error warning during sensor zero	8.3.2
Sensor cannot be zeroed; sensor zero current is too high	8.3.2
Sensor cannot be zeroed; zero reading is not stable	8.3.3
Sensor can be calibrated, but current is outside the range in the table in Section 6.3.3	8.3.4
Possible error warning during air calibration	8.3.4
Possible error warning during in process calibration	8.3.5
Process readings are erratic	8.3.6
Readings drift	8.3.7

8.3.1 Difference Between Model 30 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. Is the temperature element in the pH sensor completely submerged in the test liquid?

C. Is the standard temperature sensor submerged to the correct level?

D. Review Section 6.2.

8.3.2 Sensor Cannot be Zeroed: High Zero Current

A. Is the sensor properly wired to the transmitter? See section 3.2.

B. Is the membrane completely covered with zero solution and are air bubbles not trapped against the membrane? Swirl and tap the sensor to release air bubbles.

C. Is the zero solution fresh and properly made? Zero the sensor in a solution of 5% sodium sulfite in water. Prepare the solution immediately before use. It has a shelf life of only a few days.

D. If the sensor is being zeroed with nitrogen gas, verify that the nitrogen is oxygen-free and the flow is adequate to prevent back-diffusion of air into the chamber.

E. The major contributor to the zero current is dissolved oxygen in the electrolyte solution. A long zeroing period usually means that an air bubble is trapped in the electrolyte. Ensure that the sensor contains no air bubbles by carefully following the procedure in the sensor manual for filling the sensor. If the electrolyte solution has just been replaced, allow several hours for the zero current to stabilize. On rare occasions, the sensor may require as long as overnight to zero.

F. Check the membrane for damage and replace the membrane if necessary.

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8.3.3 Sensor Cannot Be Zeroed: Zero Reading Is Not Stable.

A. Is the sensor properly wired to the transmitter? See Section 3.2. 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 an hour.

C. Is the space between the membrane and cathode filled with electrolyte solution and is the flow path between the electrolyte reservoir and the membrane clear? Often the flow of electrolyte can be started by simply holding the sensor with the membrane end pointing down and sharply shaking the sensor a few times as though shaking down a clinical thermometer. If shaking does not work, perform the checks below. Refer to the sensor instruction manuals for additional information.

8.3.4 Sensor Current in Air Is Too High or Too Low; Possible Error Warning During Calibration

A. Is the sensor properly wired to the transmitter? See Section 3.2. Verify that all connections are tight.

B. Is the membrane dry? The membrane must be dry. A droplet of water on the membrane during air calibration will lower the sensor current and cause an inaccurate calibration.

C. If the sensor current in air is very low and the sensor is new, either the electrolyte flow has stopped or the membrane is torn or loose. For instructions on how to restart electrolyte flow see Section 8.3.3. To replace a torn membrane, refer to the sensor instruction sheet.

D. Is the membrane fouled or coated? A dirty membrane inhibits diffusion of oxygen through the membrane, reducing the sensor current. Clean the membrane by rinsing it with a stream of water from a wash bottle or by gently wiping the membrane with a soft tissue.

E. If cleaning the membrane does not improve the sensor response, replace the membrane and electrolyte solution. See the sensor instruction sheet for more information.

8.3.5 Possible Error Warning During In-Process Calibration

This error warning appears if the current process reading and the reading it is being changed to, ie, the reading from the standard instrument, are appreciably different.

A. Is the standard instrument properly zeroed and calibrated?

B. Are the standard and process sensor measuring the same sample? Place the sensors as close together as possible.

C. Is the process sensor working properly? Check the response of the process sensor in air and in sodium sulfite solution.

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

8.3.7 Readings drift.

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

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8.4 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — pH.

Problem	See Section
New temperature during calibration more than 2-3°C different from the live reading	8.4.1
Calibration Error warning during two-point calibration	8.4.2
Calibration Error warning during standardization	8.4.3
Invalid Input while manually entering slope	8.4.4
Sensor does not respond to known pH changes	8.4.5
Calibration was successful, but process pH is slightly different from expected value	8.4.6
Calibration was successful, but process pH is grossly wrong and/or noisy	8.4.7

8.4.1 Difference Between Model 30 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. Is the temperature element in the pH sensor completely submerged in the test liquid?

C. Is the standard temperature sensor submerged to the correct level?

D. Review Section 6.2.

8.4.2 Calibration Error During Two-Point Calibration

Once the two-point (manual or automatic) calibration is complete, the Model 30 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:

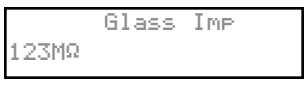
A. Are the buffers accurate? Inspect the buffers for obvious signs of deterioration, such as turbidity or mold growth. Neutral and slightly acidic buffers are highly susceptible to molds. Alkaline buffers (pH 9 and greater), if they have been exposed to air for long periods, may also be inaccurate. Alkaline 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.



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 on the following page 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 8.6.

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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.

8.4.3 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 Model 30 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. Check the reference voltage.

8.4.4 Invalid Input While Manually Entering Slope.

If the sensor slope is known from other sources, it can be entered directly into the analyzer. The Model 30 will not accept a slope (at 25°C) outside the range 45 to 60 mV/pH. See section 8.4.2 for troubleshooting sensor slope problems.

8.4.5 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 transmitter?

C. Is the glass bulb cracked or broken? Check the glass electrode impedance. See Section 8.4.2.

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

8.4.6 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 6.5.

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8.4.7 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). Connect a second jumper wire between the REFERENCE IN and SOLUTION GROUND terminals.
   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.

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8.5 TROUBLESHOOTING WHEN NO ERROR MESSAGE IS SHOWING — GENERAL

Problem	See Section
Current output is too low	8.5.1
Alarm relays do not operate when setpoint is exceeded	8.5.2
Display is unreadable — too faint or all pixels dark	8.5.3

8.5.1 Current Output Too Low.

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

8.5.2 Alarm Relays Do Not Work

A. Verify the relays are properly wired.

B. Replace power supply PCB.

8.5.3 Display is Unreadable.

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

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8.6 SIMULATING INPUTS — pH

8.6.1 General

This section describes how to simulate a pH input into the Model 30 transmitter. To simulate a pH measurement, connect a standard millivolt source to the transmitter. If the transmitter is working properly, it will accurately measure the input voltage and convert it to pH. Although the general procedure is the same, the wiring details depend on the location of the preamplifier.

8.6.2 Simulating pH input when the preamplifier is in the transmitter.

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.

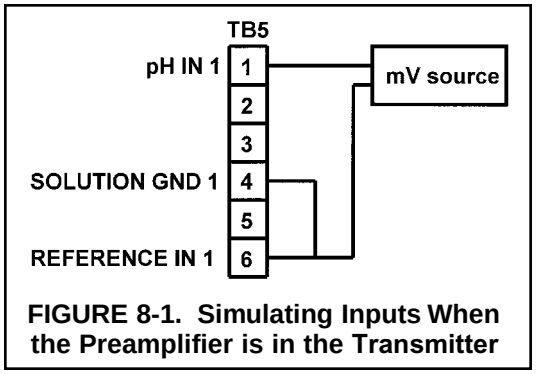


FIGURE 8-1. Simulating Inputs When the Preamplifier is in the Transmitter

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 8-1. 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.

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

8.6.3 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 8-2.

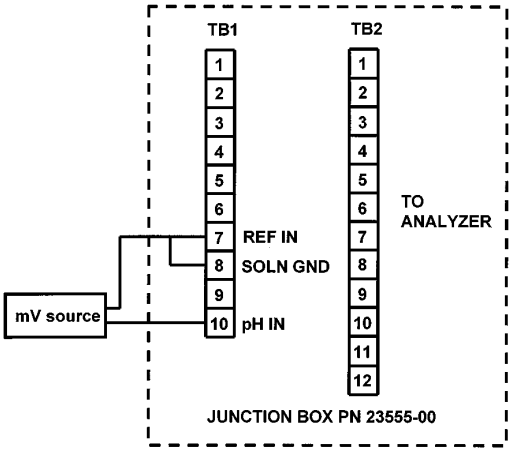


FIGURE 8-2. Simulating pH Input When the Preamplifier is in the Sensor.

8.6.3 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 8.4.1.

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8.7 SIMULATING TEMPERATURE

8.7.1 General.

The Model 30 accepts either a Pt100 RTD (for pH) or a 22k NTC thermistor (for DO sensors). The Pt100 RTD is in a three-wire configuration. See Figure 8-3. The 22k thermistor has a two-wire configuration.

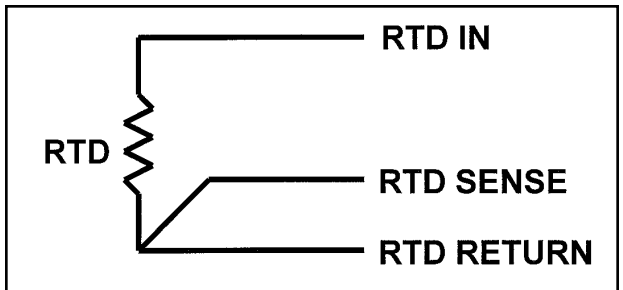


FIGURE 8-3. Three-Wire RTD Configuration.

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.

8.7.2 Simulating temperature

To simulate the temperature input, wire a decade box to the transmitter or junction box as shown in Figure 8-4.

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 Model 30 is measuring temperature correctly if the difference between the 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.

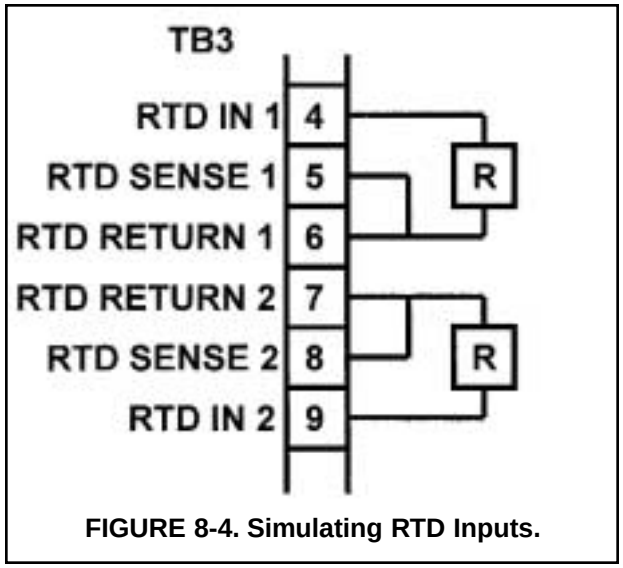


FIGURE 8-4. Simulating RTD Inputs.

Temp. (°C)	Pt 100 (Ω)	22k NTC (kΩ)
0	100.0	64.88
10	103.9	41.33
20	107.8	26.99
25	109.7	22.00
30	111.7	18.03
40	115.5	12.31
50	119.4	8.565
60	123.2	6.072
70	127.1	4.378
80	130.9	3.208
85	132.8	2.761
90	134.7	2.385
100	138.5	1.798

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8.8 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 8-5. If the reference electrode is good, the voltage difference should be no more than about 20 mV. A poisoned reference electrode usually requires replacement.

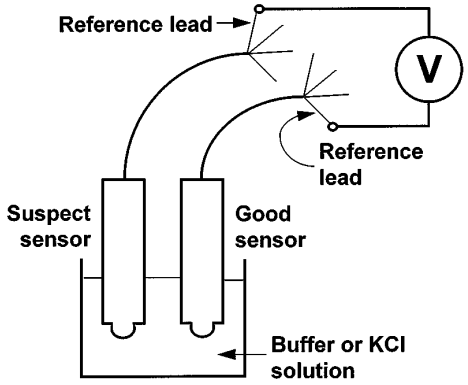


FIGURE 8-5. Checking for a Poisoned Reference Electrode.

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.

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SECTION 9.0
RETURN OF MATERIAL

9.1 GENERAL
9.2 WARRANTY REPAIR
9.3 NON-WARRANTY REPAIR

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 1-877-246-7900 for a Return Materials Authorization (RMA) number.

9.2 WARRANTY REPAIR.

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

1. Call Broadley Technologies 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:

Broadley Technologies
19 Thomas
Irvine, CA 92618

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 Broadley Technologies 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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WARRANTY

Goods and part(s) (excluding consumables) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Consumables, pH electrodes, membranes, liquid junctions, electrolyte, O-rings, etc. are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. Goods, part(s) and consumables proven by Seller to be defective in workmanship and / or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, parts(s), or consumables are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) month period of warranty in the case of goods and part(s), and in the case of consumables, within the ninety (90) day period of warranty. This warranty shall be in effect for replacement or repaired goods, part(s) and consumables for the remaining portion of the period of the twelve (12) month warranty in the case of goods and part(s) and the remaining portion of the ninety (90) day warranty in the case of consumables. A defect in goods, part(s) and consumables of the commercial unit shall not operate to condemn such commercial unit when such goods, parts(s) or consumables are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or to any other person, for the loss or damage, directly or indirectly, arising from the use of the equipment or goods, from breach of any warranty or from any other cause. All other warranties, expressed or implied are hereby excluded.

IN CONSIDERATION OF THE STATED PURCHASE PRICE OF THE GOODS, SELLER GRANTS ONLY THE ABOVE STATED EXPRESS WARRANTY. NO OTHER WARRANTIES ARE GRANTED INCLUDING, BUT NOT LIMITED TO, EXPRESS AND IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

RETURN OF MATERIAL

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

Broadley Technologies
19 Thomas
Irvine, CA 92618

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.

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