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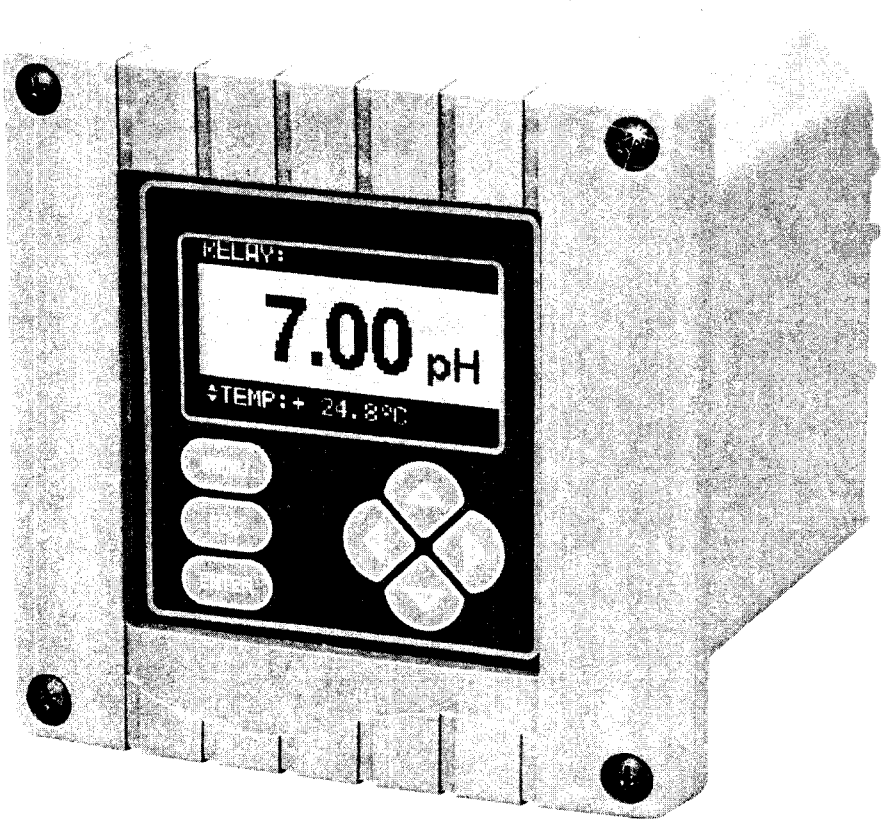
User's Guide



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IMPORTANT SAFETY INFORMATION

This analyzer is compliant with safety standards as outlined in:

FMRC Class Numbers 3600, 3611, and 3810 (U.S.A.)
CSA C22.2 No. 142 and C22.2 No. 213 (Canada)
EN 61010-1 (European Community)

Please read and observe the following:

- Opening the analyzer door exposes you to line power voltage, if present, at terminals on TB2 and TB3 inside the enclosure. This may be hazardous. Always remove line power before entering this area in the analyzer. However, the analyzer door assembly contains only low voltage and is completely safe to handle.
- Wiring or repairs should only be performed by qualified personnel and only to an unpowered analyzer.
- Whenever it appears that analyzer safety is questionable, disable the analyzer to ensure against any unintended operation. For example, an unsafe condition is likely when:
  1) The analyzer appears visibly damaged.
  2) The analyzer fails to operate properly or provide the intended measurements.
  3) The analyzer has been stored for long periods at temperatures above 158°F (70°C).
- This analyzer must be installed by specially trained personnel in accordance with relevant local codes and instructions contained in this operating instruction manual. Observe the analyzer's technical specifications and input ratings. If one line of the line power mains is not neutral, use a double-pole mains switch to disconnect the analyzer.

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may contain WARNINGS pertaining to user safety, CAUTIONS regarding possible instrument malfunction, and NOTES on important, useful operating guidelines.

WARNING:

A WARNING LOOKS LIKE THIS. IT WARNS YOU OF THE POTENTIAL FOR PERSONAL INJURY.

CAUTION:

A CAUTION LOOKS LIKE THIS. IT ALERTS YOU TO POSSIBLE INSTRUMENT MALFUNCTION OR DAMAGE.

☞ ***NOTE:*** *A note looks like this. It alerts you to important operating information.*

Definition of Equipment Symbols

This symbol **means CAUTION** and alerts you to possible danger or instrument malfunction. Refer to this manual before proceeding.

This symbol **means that this is a protective ground terminal** and alerts you to connect an earth ground to it.

This symbol **means that there is alternating current present** and alerts you to be careful.

CONDENSED OPERATING INSTRUCTIONS

This manual contains details for all operating aspects of the instrument. The following condensed instructions are provided to assist you in getting the instrument started up and operating as quickly as possible. **These condensed instructions only pertain to basic pH measurement operation using a PHE-6028-PO Differential pH sensor.** To measure ORP, use a conventional combination electrode, or use specific features of the instrument, refer to the appropriate sections in this manual for instructions.

A. CONNECTING SENSOR/CONFIGURING SENSOR TYPE AND TEMPERATURE ELEMENT

1. After the analyzer is properly mounted (Part Two, Section 2), connect the OMEGA 5-wire Differential Technique pH sensor, matching wire colors to terminals as indicated:

Sensor Wire Colors	Analyzers with "B" Prefix Serial No.	Analyzers with "A" or No Letter Prefix Serial No.
White	Terminal #13 on TB1	Terminal #13 on TB1
Black	Terminal #14 on TB1	Terminal #14 on TB1
Yellow	Terminal #16 on TB1	Terminal #16 on TB1
Shield	Terminal #18 on TB1	Terminal #11 on TB1
Green	Terminal #20 on TB1	Terminal #20 on TB1
Red	Terminal #22 on TB1	Terminal #22 on TB1

2. The analyzer is supplied factory-set for use with the PHE-6028-PO 5-wire Differential Technique pH sensor. When using a conventional combination electrode, you must change the sensor type (see Part Three, Section 4.2, subheading "Selecting Sensor Type").

3. The analyzer is supplied factory-set for use with the 300 ohm (NTC300) temperature element built into the PHE-6028-PO Differential sensors. When using a sensor with a different temperature element or if you want MANUAL temperature compensation, you must change the temperature element type (see Part Three, Section 4.2, subheading "Selecting Temperature Element Type").

B. CONNECTING LINE POWER

Important: Follow instructions in Part Two, Section 3.7 to connect line power to the analyzer.

C. ADJUSTING DISPLAY CONTRAST

Ambient lighting conditions may make it necessary to adjust display contrast to improve visibility. With the MEASURE screen displayed, press and hold the **ENTER key** and simultaneously press the ⇧ **or** ⇩ **key** until attaining the desired contrast.

D. CONFIGURING BUFFER TYPE/CALIBRATING THE ANALYZER

The analyzer must be calibrated so that measured values will correspond to actual process values. Before calibrating for the first time, select the buffer value set that will be used. Then, calibrate using the recommended "2 POINT BUFFER" method which will provide the most accurate pH measurements.

1. The analyzer is supplied factory-set for the common 4.00, 7.00, and 10.00 pH buffers. When using DIN 19267 standard value buffers, you must change the buffer set (see

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

D. CALIBRATING THE ANALYZER -- (continued)

Part Three, Section 4.2, subheading "Selecting Buffer Type").

NOTE: *When using buffers that are not included in either of the analyzer buffer sets, use only the "2 POINT SAMPLE" method for calibration. Refer to that subheading in Part Three, Section 5.2 for instructions.*

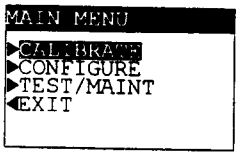
2. Immerse the sensor in the first buffer (preferably pH 7). **Important:** Allow the sensor and buffer temperatures to equalize. Depending on their temperature differences, this may take 30 minutes or more.

NOTE: *An in-progress calibration can always be aborted by pressing the **ESC key**. After the "ABORT: YES?" screen appears, do <u>one</u> of the following:*

- *Press **ENTER key** to abort. After "CONFIRM ACTIVE?" screen appears, press **ENTER key** to display the MEASURE screen and return the analog outputs <u>and</u> relays to their active states.*
- *Use ⇧ **or** ⇩ **key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.*

Calibration Tip! *If, at any time during calibration, the "2 POINT BUFFER: CONFIRM FAILURE?" screen appears, press **ENTER key** to confirm. Then, use the ⇧ **or** ⇩ **key** to select between "CAL REPEAT?" or "CAL EXIT?" and do <u>one</u> of the following:*

- *With the "2 POINT BUFFER: CAL REPEAT?" screen selected, press **ENTER key** to repeat calibration of this point.*
- *With the "2 POINT BUFFER: CAL: EXIT?" screen selected, press **ENTER key**. Then, after the "2 POINT BUFFER: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog outputs <u>and</u> relays to their active states (MEASURE screen appears).*

3. Press **MENU key** to display 

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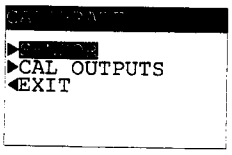
4. With the "CALIBRATE" line selected, press **ENTER key** to display 

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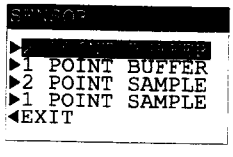
5. With the "SENSOR" line selected, press **ENTER key** to display 

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(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

D. CALIBRATING THE ANALYZER -- (continued)

6. With the "2 POINT BUFFER" line selected, press **ENTER key** to display `2 POINT BUFFER? (HOLD OUTPUTS )`.

7. Press **ENTER key** to "hold" the analog outputs and relays at their present states during calibration. (Outputs can also be transferred to preset values or allowed to remain active.)

8. With the `2 POINT BUFFER: IN 1ST SOLUTION?` screen displayed and the sensor in the first buffer, press **ENTER key** to confirm. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the analyzer waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, the `2 POINT BUFFER: PT1 = 7.00 pH` screen appears for 5 seconds to confirm calibration of this point.

   NOTE: *Any time the "PLEASE WAIT" screen appears during calibration, you can manually complete calibration of the point by pressing the* ***ENTER key****. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in an inaccurate calibration.*

9. After the `2 POINT BUFFER: IN 2ND SOLUTION?` screen appears, remove the sensor from the first buffer, rinse it with clean water, and immerse it in the second buffer (typically pH 4).

10. Press **ENTER key** to confirm. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the analyzer waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, the `2 POINT BUFFER: PT2 = 4.00 pH` screen appears for 5 seconds to confirm calibration of this point.

11. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be 54-62 mV/pH for optimal performance.

12. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

13. Re-install the sensor into the process.

14. Press **ENTER key** to display the active measurement reading on the "2 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

This completes "2 POINT BUFFER" calibration. The analyzer is now ready to measure pH.

E. COMPLETING ANALYZER CONFIGURATION

To further configure the analyzer to your application requirements, use the appropriate CONFIGURE screens to make selections and "key in" values. Refer to Part Three, Section 4 for complete configuration details.

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PART FOUR - SERVICE AND MAINTENANCE

PART FIVE - SPARE PARTS AND ACCESSORIES

TABLE OF CONTENTS (continued)

ILLUSTRATIONS

TABLES

PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Capability Highlights

Sensor Input

The analyzer can be used with the PHE-6028-PO 5-wire Differential Technique pH or ORP sensor, or any conventional combination electrode. The analyzer will accept most common temperature compensator elements used in these sensors (NTC 300 ohm thermistor, Pt 1000 RTD, or Pt 100 RTD).

MEASURE Screen

With the display in the normal MEASURE screen mode, the measured pH (or ORP) is always shown on the main middle line. The bottom auxiliary display line, shown in reverse video, can be changed by pressing the ⇩ **and** ⇧ **keys** to show these measurements:

- Measured temperature (°C or °F)
- Analog Output #1 value (mA)
- Analog Output #2 value (mA)

Passcode-protected Access

For security, you can enable a passcode feature to restrict access to configuration and calibration settings to authorized personnel only. See Part Three, Section 4.6 for details.

Calibration Methods

Four methods are available to calibrate the analyzer for pH. See Part Three, Section 5.2 for details. For ORP calibration, refer to Section 5.3. The mA value for each analog output can also be calibrated (Section 5.4).

Analog Outputs

The analyzer provides two isolated analog outputs (#1 and #2). Each output can be set for 0-20 mA or 4-20 mA, and assigned to represent one of the following:

- Measured pH (or ORP)
- Measured process temperature

Parameter values can be entered to define the endpoints at which the minimum and maximum analog output values are desired.

During calibration, both analog outputs can be selected to:

- Hold their present values (HOLD OUTPUTS).
- Transfer to preset values to operate control elements by an amount corresponding to those values (XFER OUTPUTS).
- Remain active to respond to the measured value (ACTIVE OUTPUTS).

For analog output transfer setup details, see Part Three, Section 4.4 under the subheading "Setting Transfer Value."

Relays

The analyzer may have two or four electromechanical relays, all with SPDT contacts. Each relay can be set to function as a control relay, dual-alarm relay, or a status relay. A control or alarm relay can be assigned to be driven by one of the following:

- Measured pH (or ORP)
- Measured process temperature

Refer to Part Three, Section 4.5 for relay setup details.

☞ ***NOTE:*** *When a relay is set to function as a status relay, it is no longer configurable. Instead, it becomes a dedicated system diagnostic-only alarm relay that automatically energizes when the "WARNING CHECK STATUS" message flashes on the MEASURE screen. This occurs when the analyzer detects a "fail" diagnostic condition. See Part Three, Section 5.1 for more details.*

Except for status relays, during calibration the relay on/off states are affected in the same way as the analog outputs by the "(HOLD/XFER/ACTIVE OUTPUTS)" screen selection. These relays are also held at their present on/off states, transferred to desired preset on/off states, or remain active to respond to measured values. For relay transfer setup details, see Part Three, Section 4.5 under the subheading "Selecting Transfer Mode."

1.2 Modular Construction

The modular construction of the analyzer simplifies field servicing and provides electrical safety. The front door/ keypad assembly uses voltages no greater than 24 VDC, and is completely safe to handle.

Opening the analyzer door accesses terminals inside the enclosure for electrical connections. Line power must be connected to specifically designated terminals on TB3.

WARNING:

REMOVE LINE POWER BEFORE NEARING THIS AREA TO AVOID ELECTRICAL SHOCK.

1.3 Retained Configuration Values

All user-entered configuration values are retained indefinitely, even if power is lost or turned off. The non-volatile analyzer memory does not require battery backup.

1.4 Analyzer Serial Number

A label with the analyzer model number, serial number, build date, and other items is affixed to the top of the enclosure.

1.5 EMI/RFI Immunity

The analyzer is designed to provide protection from most normally encountered electromagnetic interference. This protection exceeds U.S. standards and meets European IEC 801-series testing for electromagnetic and radio frequency emissions and susceptibility. Refer to Figure 1-1 and the specifications in Section 2.1 for more information.

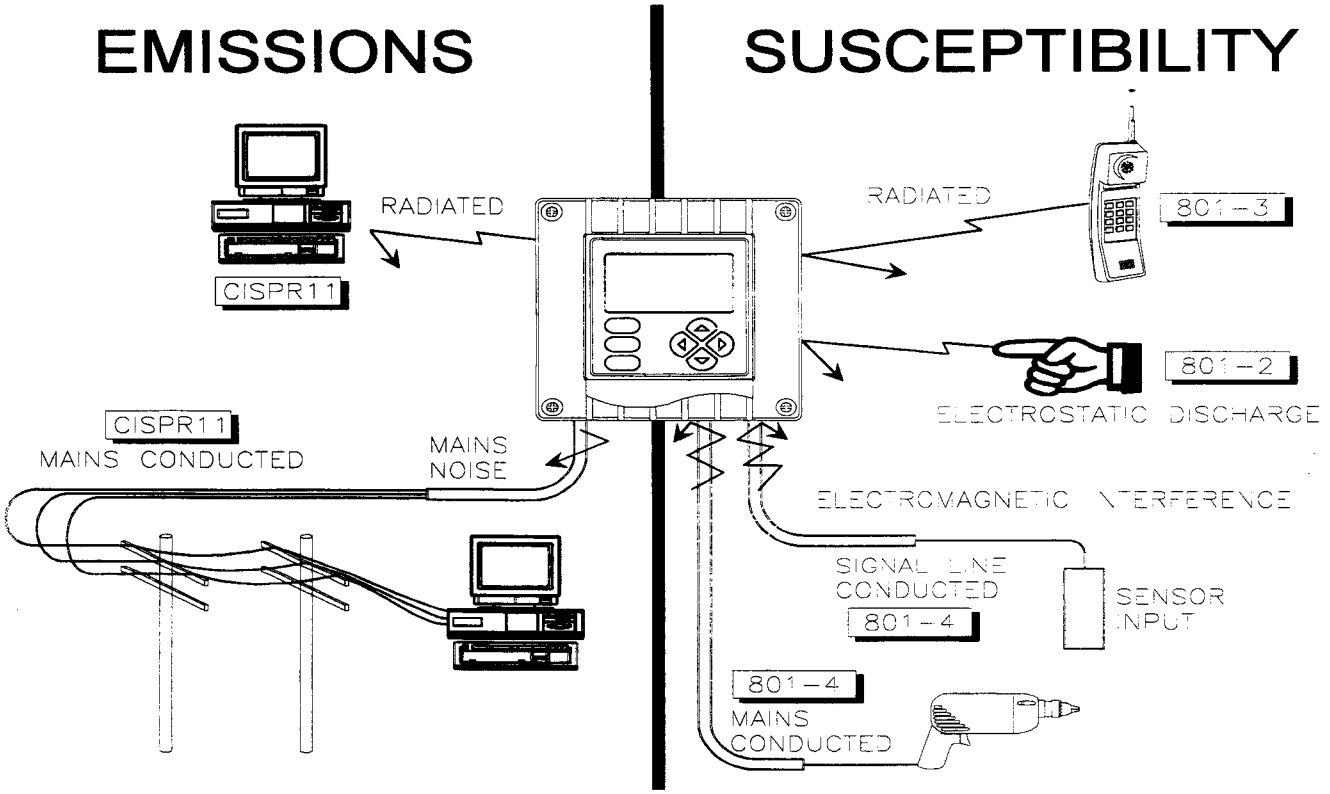


FIGURE 1-1 EMI/RFI Immunity Diagram

SECTION 2
SPECIFICATIONS

2.1 Operational

Display ..... Graphic dot matrix LCD, 128 x 64 pixels with LED backlighting; 1/2 inch (13 mm) main character height; 1/8 inch (3mm) auxiliary information character height; menu screens contain up to six text lines

Measurement	Selectable Ranges
pH	-2.0 to 14.0 pH or -2.00 to 14.00 pH
ORP	-2100 to +2100 mV
Temperature	-20.0 to +200.0°C or -4.0 to +392.0°F
mA Outputs (#1 and #2)	0.00-20.00 mA or 4.00-20.00 mA

Ambient Conditions:

- Operation ..... -4 to +140°F (-20 to +60°C); 0-95% relative humidity, non-condensing
- Storage ..... -22 to +158°F (-30 to +70°C); 0-95% relative humidity, non-condensing

Relays: Types/Outputs ..... Two or four electromechanical relays; SPDT (Form C) contacts; U.L. rated 5A 115/230 VAC, 5A @ 30 VDC resistive

- Operational Mode ..... Each relay (A, B, C, and D) can be assigned to be driven by the measured pH (or ORP) or temperature
- Function Modes:
  - Control ..... Settings for high/low phasing, setpoint, deadband, overfeed timer, off delay, and on delay
  - Alarm ..... Settings for low alarm point, low alarm point deadband, high alarm point, high alarm point deadband, off delay, and on delay
  - Status ..... Not configurable; relay only activates when a sensor or analyzer "fail" diagnostic WARNING condition exists
- Indicators ..... Relay annunciators (A, B, C, and D) indicate respective relay on/off status

Temperature Compensation ..... Automatic or manual, 14.0 to 230.0°F (-10.0 to +110.0°C), with selection for temperature element (NTC 300 ohm thermistor, Pt 1000 ohm RTD, or Pt 100 ohm RTD), or a manually entered value; additional selectable temperature correction factors (ammonia or morpholine) for pure water automatic compensation from 0.0 to 50.0°C

Sensor-to-Analyzer Distance:

- Omega PHE-6028-PO 5-wire Differential Technique Sensor ..... 3000 ft. (914 m) maximum
- Conventional Combination Electrode with preamp ..... 985 ft. (300 m) maximum
- Conventional Combination Electrode without preamp ... 100 ft. (30 m) maximum with electrode cable capacitance of less than 30 pF/foot

Power Requirements ..... 90-130 VAC, 50/60 Hz. (10 VA max.) or 180-260 VAC, 50/60 Hz. (10 VA max.)

Calibration Methods:

- 2 POINT BUFFER (for pH only) ..... Automatic calibration and buffer recognition using two buffers from a selected buffer set*.

NOTE: *When using buffers that are not included in either of the analyzer buffer sets, use only the "2 POINT SAMPLE" method for calibration.*

*Buffer Sets: 4.00, 7.00, and 10.00 and DIN 19267 standard (1.09, 4.65, 6.79, 9.23, and 12.75)

1 POINT Buffer (for pH only) ..... Automatic calibration and buffer recognition using one buffer from a selected buffer set*.

NOTE: *When using a buffer that is not included in either of the analyzer buffer sets, use only the "1 POINT SAMPLE" method for calibration.*

2 POINT SAMPLE (for pH only) ..... Enter known values of two samples (determined by laboratory analysis or comparison reading) or two pH buffers

1 POINT SAMPLE (for pH or ORP) ..... Enter known value of one sample (determined by laboratory analysis or comparison reading), one pH buffer, or one reference solution (for ORP measurement)

Analog Outputs ..... Two isolated 0/4-20 mA outputs; each with 0.004 mA (12-bit) resolution and capability to drive up to 600 ohm loads

NOTE: *Each output can be assigned to represent the measured pH (or ORP) or temperature. Parameter values can be entered to define the end-points at which the minimum and maximum mA output values are desired. During calibration, both outputs can be selected to hold their present values, transfer to preset values to operate control elements by an amount corresponding to those values, or remain active to respond to the measured value.*

Communication: RS-232 ..... For factory setup and configuration only

Memory Backup (non-volatile) ..... All user settings are retained indefinitely in memory (EEPROM)

EMI/RFI Conformance ..... Exceeds U.S. and meets European standards for conducted and radiated emissions and immunity; certified CE compliant for applications as specified by EN 50081-1 for emissions and EN 50082-2 for immunity

Electrical Certifications:
- General Purpose (pending) ..... UL, C-UL, FM, and CENELEC
- Division 2 (pending) ..... UL, C-UL, and FM: Groups A, B, C, D, F and G
- Zone 2 (pending) ..... CENELEC: Group IIC

2.2 Analyzer Performance (Electrical, Analog Outputs)

Accuracy ..... 0.1% of span
Stability ..... 0.05% of span per 24 hours, non-cumulative
Repeatability ..... 0.1% of span or better
Temperature Drift ..... Zero and Span: less than 0.03% of span/°C

2.3 Mechanical

Enclosure ..... NEMA 4X; polycarbonate face panel, epoxy-coated cast aluminum door and case with four 1/2 inch (13 mm) conduit holes, nylon mounting bracket, and stainless steel hardware

Mounting Configurations ..... Panel, surface, and pipe (horizontal and vertical) mounting

Net Weight ..... 3.5 lbs. (1.6 kg) approximately

PART TWO - INSTALLATION

SECTION 1
UNPACKING

After unpacking, it is recommended to save the shipping carton and packing materials in case the instrument must be stored or re-shipped. Inspect the equipment and packing materials for signs of shipping damage. If there is any evidence of damage, notify the transit carrier immediately.

SECTION 2
MECHANICAL REQUIREMENTS

2.1 Location

1. It is recommended to locate the analyzer as close as possible to the installed sensor:

   - **OMEGA PHE-6028-PO 5-wire Differential Technique Sensor:** The maximum allowable distance between this type of sensor and the analyzer is 3000 feet (914 m).
   - **Conventional Combination Electrode <u>without</u> preamp:** The maximum allowable distance between this type of electrode and the analyzer is 100 feet (30 m). A OMEGA Model PHCN-680-PA preamp may be used to extend this distance to 3000 feet (914 m), but the preamp must be located within 100 feet (30 m) of the electrode.

1. Mount the analyzer in a location that is:

   ➥ Clean and dry where there is little or no vibration.

   ➥ Protected from corrosive fluids.

   ➥ Within ambient temperature limits (-4 to +140°F or -20 to +60°C).

CAUTION:

EXPOSING THE ANALYZER TO DIRECT SUNLIGHT MAY INCREASE THE OPERATING TEMPERATURE ABOVE ITS SPECIFIED LIMIT.

2.2 Mounting

Figure 2-1 illustrates the various ways to mount the analyzer using the supplied bracket and hardware. Determine the mounting method and attach the hardware as shown in the respective illustration. Refer to Figure 2-2 for analyzer installation dimension details.

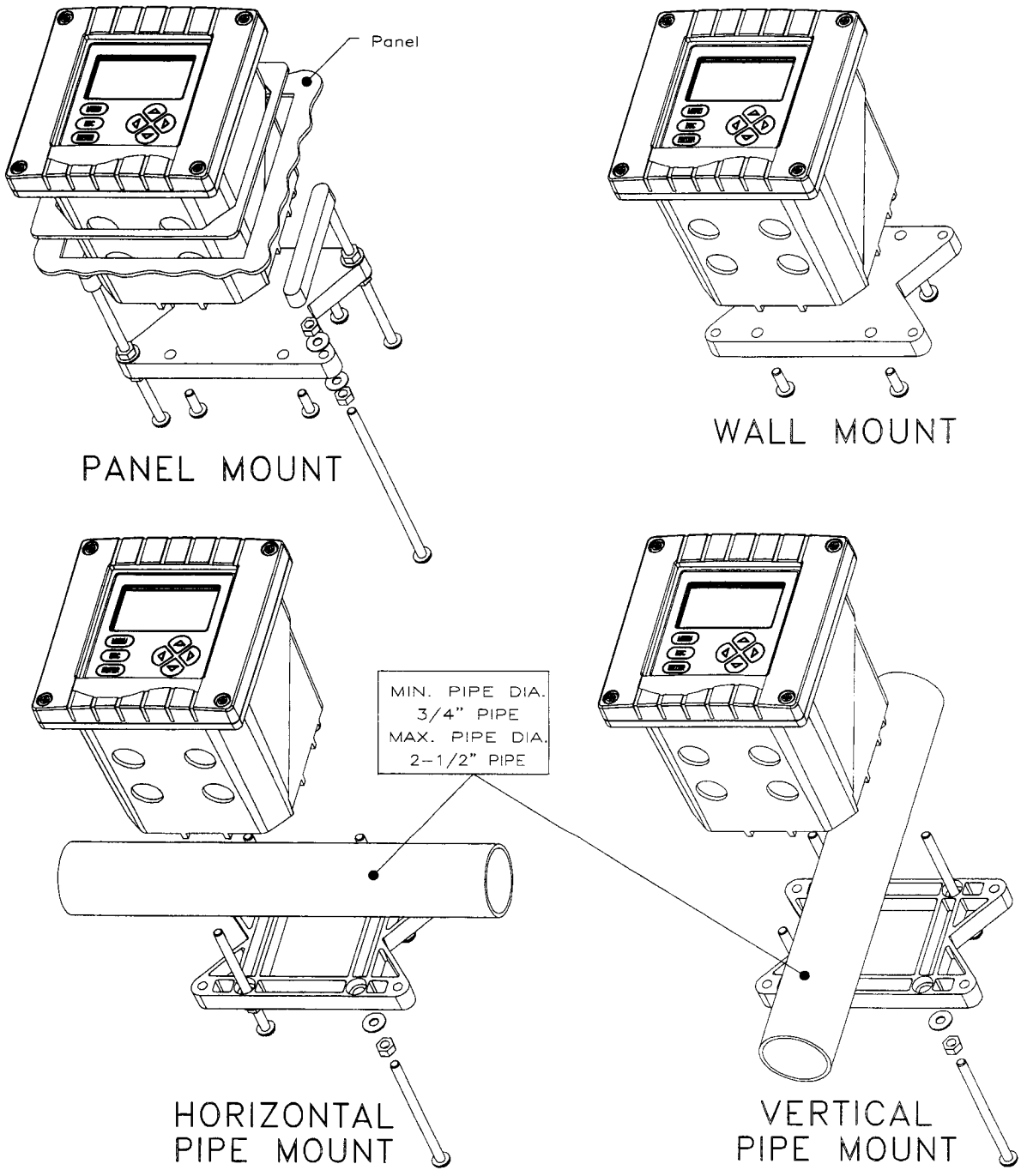


FIGURE 2-1 Analyzer Mounting Arrangements

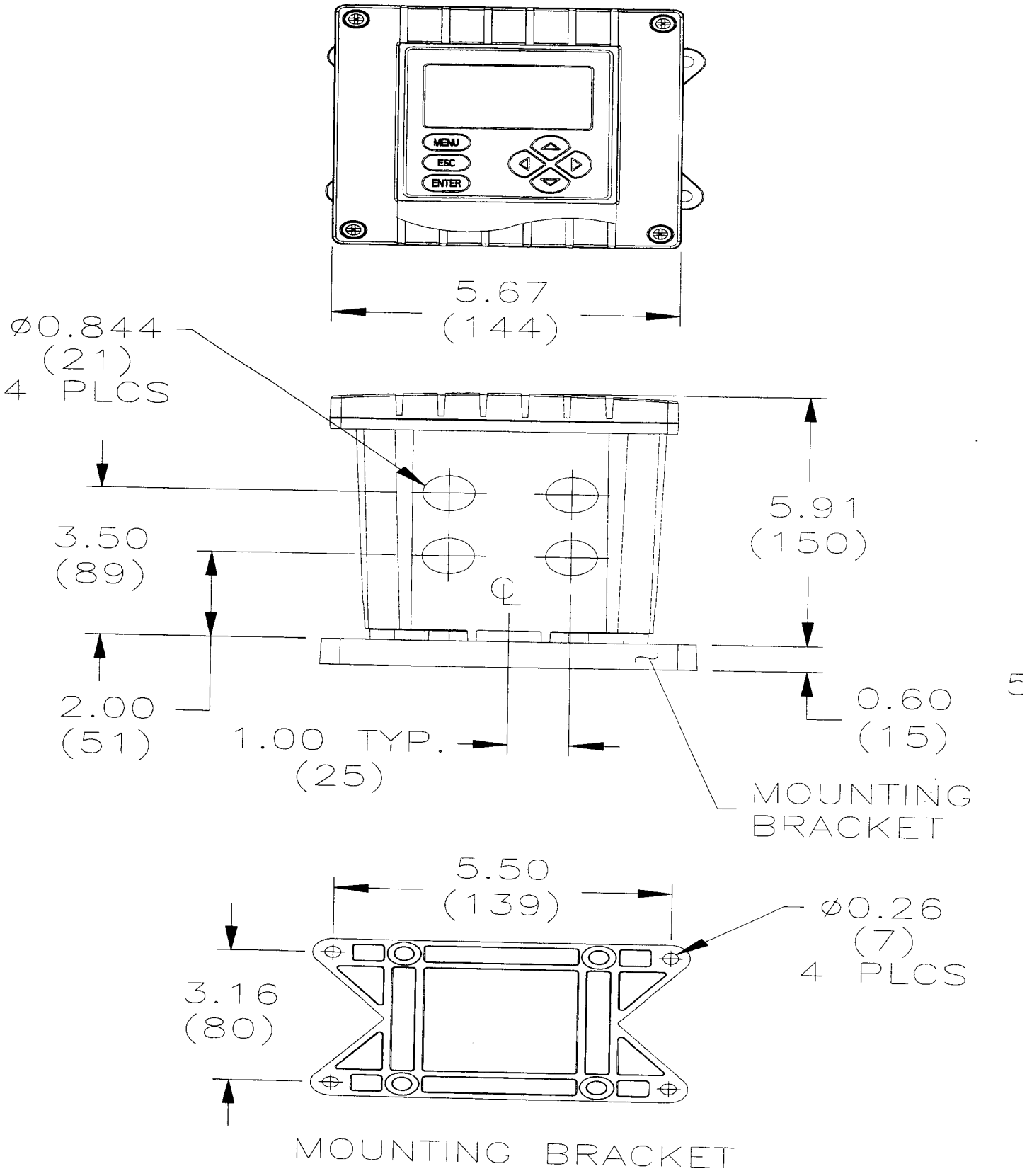


FIGURE 2-2 Analyzer Installation Dimensions Details

2.3 Conduit Hole Requirements

Recommendation: Run all wiring to the analyzer in 1/2-inch, grounded metal conduits. If using only shielded cables, appropriate strain reliefs or cable grips are required. Seal unused cable entry holes with appropriate plugs.

NOTE: *Use NEMA 4-rated fittings and plugs to maintain the watertight integrity of the NEMA 4X enclosure.*

SECTION 3
ELECTRICAL CONNECTIONS

To access terminal blocks for electrical connections, open the left-hinged enclosure door by unscrewing the four fasteners. Figure 2-3 or 2-4 shows the terminal block arrangement and terminal designations inside the analyzer.

NOTE: *All terminals are suitable for single wires up to 14 AWG (2.5 mm^2). If the analyzer is equipped with only A and B relays, "RELAY C" and "RELAY D" terminals are non-functioning (all relay designations are always shown).*

Wiring Tip! To comply with European Community (CE) electromagnetic compatibility requirements, follow these general wiring guidelines:

1. Keep all cable shields as short as possible inside the analyzer, and connect them to the ground terminals provided. Performance may be improved by using cable glands that enable the shield to directly contact the analyzer chassis.
2. Use Steward ferrite 28 B0590-000 or equivalent on the sensor cable -- two turns required.
3. In harsh conducted RF conditions, connect the earth ground of the analyzer to a local, known earth ground source.

NOTE: *For easier wiring, route line power and relay output wires through the back conduit holes, and use the front conduit holes for all other wiring.*

3.1 OMEGA 5-Wire Differential Technique Sensor

The OMEGA PHE-6028-PO 5-wire Differential Technique sensors have a built-in temperature element for automatic temperature compensation and for measuring process temperature.

Wiring Tip! Route the sensor cable in 1/2-inch, grounded metal conduit to protect it from moisture, electrical noise, and mechanical damage.

Recommended Wiring Arrangement: Indirectly connect the sensor to the analyzer using a junction box and interconnect cable. This makes sensor disconnection more convenient for maintenance or replacement.

NOTE: *Do not route the sensor cable in any conduit containing AC power wiring ("electrical noise" may interfere with the sensor signal).*

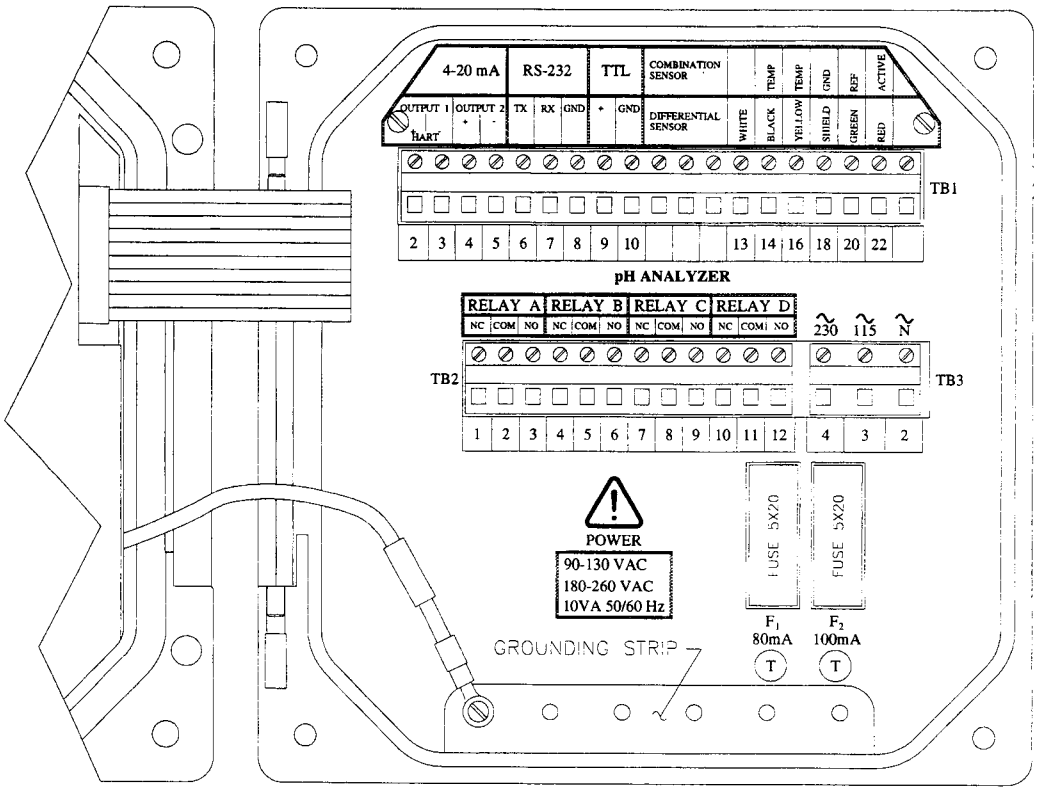


FIGURE 2-3 Terminal Block Designations for Analyzers

See Figure 2-5 and connect the sensor (or interconnect) cable wires to appropriate terminals on TB1, matching colors as indicated.

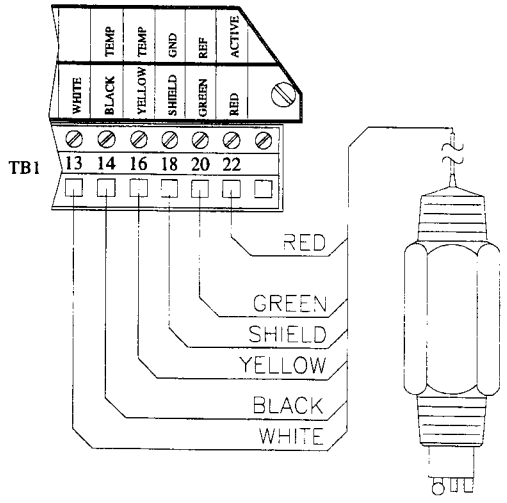


FIGURE 2-5 Connecting OMEGA 5-wire Differential Technique Sensor to Analyzers with "B" Prefix Serial Numbers

3.2 Conventional Combination Electrode

The electrode must be within 100 ft./30 m of analyzer (985 ft./300 m for electrode with preamp). See Figures 2-7 or 2-8 and directly connect electrode's coaxial cable to analyzer.

1. Connect the electrode's reference signal -- braided shield wire of coaxial cable -- (black insulated wire for OMEGA electrode) to Terminal 20 (REF) on TB1.

2. Connect the electrode's active signal -- center wire of coaxial cable -- (clear insulated wire for OMEGA electrode) to Terminal 22 (ACTIVE) on TB1.

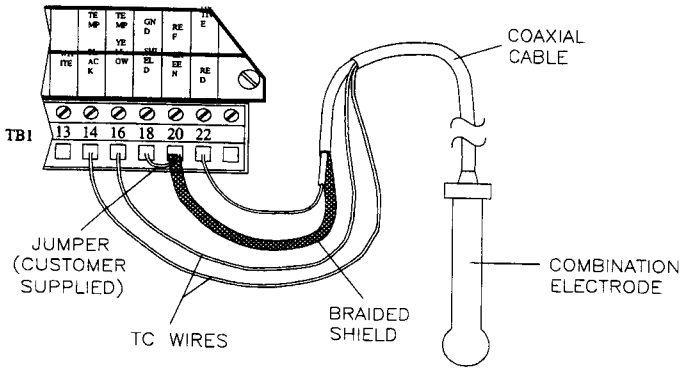


FIGURE 2-7 Connecting Conventional Combination Electrode to Analyzers

3. Connect a jumper between these TB1 terminals:
   - Terminals 18 and 20 for analyzers with "B" prefix serial numbers (Figure 2-7).
   - Terminals 18 and 19 for analyzers with "A" or no letter prefix serial numbers (Figure 2-8).

4. Connect the electrode's temperature element (typically white and red wires for OMEGA electrode) to these "TEMP" terminals on TB1:
   - Terminals 14 and 16 for analyzers with "B" prefix serial numbers, attaching either wire to either terminal (Figure 2-7).
   - Terminals 14 and 15 for analyzers with "A" or no letter prefix serial numbers, attaching either wire to either terminal (Figure 2-8).

3.3 Conventional Combination Electrode with Ground Rod

Some applications require that an external ground rod be used with the combination electrode. The electrode must be within 100 ft./30 m of the analyzer (985 ft./300 m for electrode with preamp). See Figure 2-9 or 2-10 and directly connect the electrode's coaxial cable to the analyzer.

Connect the electrode and temperature element wires in the same way as described in Section 3.2 -- **except eliminate the jumper wire**. Instead, connect the ground rod wire to Terminal 18 on TB1.

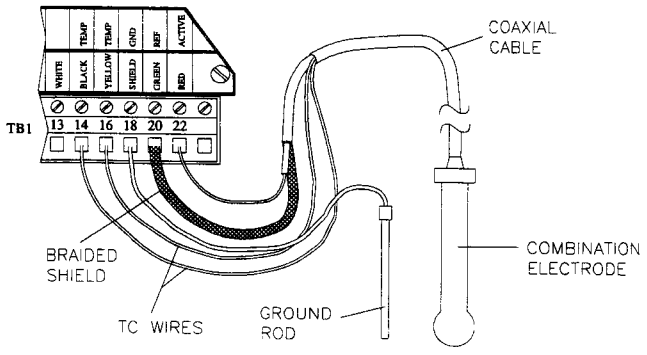


Figure 2-9 Connecting Conventional Combination Electrode with Ground Rod to Analyzers

3.4 Analog Outputs

Two isolated analog outputs (#1 and #2) are provided. Each output can be set to be 0-20 mA or 4-20 mA. Also, each output can be assigned to represent the measured pH (or ORP) or temperature. For details on configuring the outputs, refer to Part Three, Section 4.4.

Wiring Tip! Use high quality, shielded instrumentation cable for connecting the analog outputs. To protect the output signals from EMI/RFI, connect cable shields to:

- The grounding strip at bottom of case (5 open holes, Fig. 2-3) for analyzers with "B" prefix serial numbers.
- The "ground symbol" Terminal 1 on TB1 (Figure 2-4) for analyzers with "A" or no letter prefix serial numbers.

Each 0/4-20 mA output can drive a load of up to 600 ohms.

- For Output #1: Connect the load to Terminals 2 and 3 on TB1, matching polarity as indicated.
- For Output #2: Connect the load to Terminals 4 and 5 on TB1, matching polarity as indicated.

3.5 Relay Outputs

The analyzer may be equipped with two or four electromechanical relays. For relay setup details, refer to Part Three, Section 4.5.

CAUTION:

DO NOT EXCEED THE CONTACT RATING FOR EACH RELAY (5A 115/230 VAC). WHEN SWITCHING LARGER CURRENTS, USE AN AUXILIARY RELAY SWITCHED BY THE ANALYZER RELAY TO EXTEND ANALYZER RELAY LIFE. WHEN USING RELAY OUTPUTS, MAKE SURE THAT LINE POWER WIRING CAN ADEQUATELY CONDUCT THE CURRENT DRAW OF THE SWITCHED LOAD(S).

Two or four sets of SPDT relay outputs (Relays A and B, and C and D) are provided at Terminals 1 through 12 on TB2. **The relay outputs are not powered.** The line power used to power the analyzer may also be used to power the control or alarm devices with these relay contacts. Refer to Figure 2-11 for a general wiring arrangement. Always check control wiring to insure that line power will not be shorted by the relay switching action, and that wiring conforms to local codes.

WARNING:

MAKE SURE THAT LINE POWER IS NOT PRESENT WHILE CONNECTING WIRES TO THE TB2 RELAY TERMINALS.

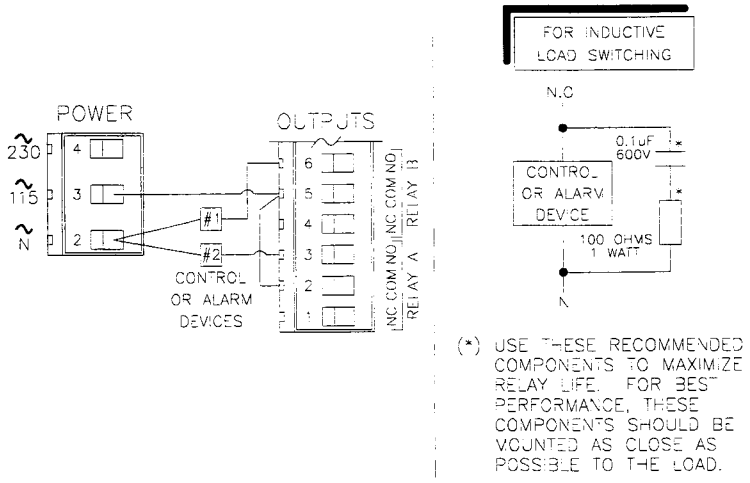


FIGURE 2-11 Connecting Control/Alarm Device(s) To Electromechanical Relay(s)

3.6 Closed Contact Input

The closed contact input feature of the analyzer enables you to conveniently change the analog outputs and all control or alarm relays to their preset transfer states. To use this feature:

1. Preset analog outputs and relays to desired transfer states.
   - Outputs: See Part Three, Section 4.4 under subheading "Setting Transfer Value (mA)."
   - Relays: See Part Three, Section 4.5 under subheading "Selecting Transfer Mode (relay on/off)."
2. Remotely (or locally) jumper Terminals 9 and 10 on TB1 to change analog outputs and relays to their preset transfer states.

3.7 Line Power

Refer to appropriate figures on the next page and connect line power to TB3 terminals using the standard three-wire connection arrangement. **Use wiring practices which conform to local codes** (example: National Electric Code Handbook in the U.S.A.).

WARNING:

REMOVE LINE POWER WHILE CONNECTING LINE POWER WIRES TO THE TB3 TERMINALS. ALSO, USE ONLY THE STANDARD THREE-WIRE CONNECTION ARRANGEMENT FOR SINGLE-PHASE LINE POWER TO PREVENT AN UNSAFE CONDITION, AND TO ENSURE PROPER ANALYZER OPERATION.

NOTE: *In all cases, connect the line power cable ground wire (usually green) to:*

- *The grounding strip at bottom of case (5 open holes -- Figures 2-12, 2-14, or 2-16) for analyzers with "B" prefix serial numbers.*
- *The "ground symbol" Terminal 1 on TB3 (Figures 2-13, 2-15, or 2-17) for analyzers with "A" or no letter prefix serial numbers.*

The "115" and "230" voltage circuits are protected with internal, board-mounted slow-blow fuses.

NOTE: *For 230 volt split phase line power, be sure to conform to local codes with regard to fusing the 115 volt line connected to the "N" terminal.*

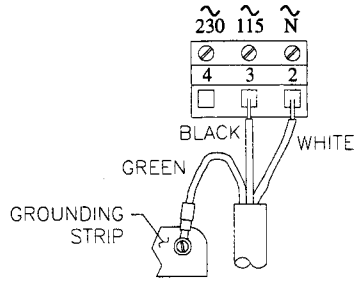


FIGURE 2-12
Connecting 115 Volt Single Phase

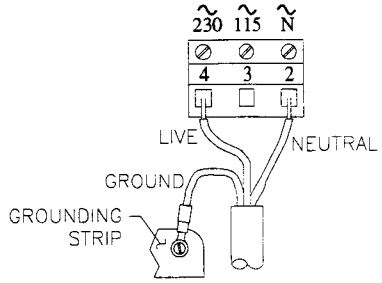


FIGURE 2-14
Connecting 230 Volt Single Phase

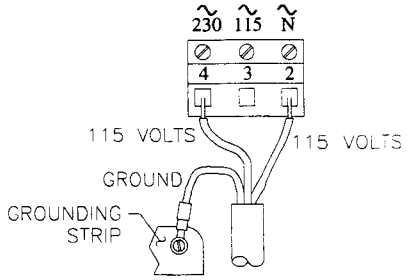


FIGURE 2-16
Connecting230 Volt Spilt

PART THREE - OPERATION

SECTION 1
USER INTERFACE

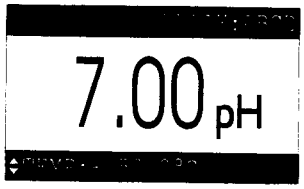
The user interface consists of an LCD display and a keypad with **MENU**, **ENTER**, **ESC**, ⇦, ⇨, ⇧, **and** ⇩ **keys**.

1.1 Display

By using the keypad, you can display three basic types of screens:

- **MEASURE screen** to show measured values. The measured pH (or ORP) is always shown on the display's main middle line. Pressing the ⇩ **and** ⇧ **keys** changes the display's bottom auxiliary line (in reverse video) to show these measurements:
  - ➥ Measured temperature (°C or °F)
  - ➥ Analog Output #1 value (mA)
  - ➥ Analog Output #2 value (mA)

  An example of a typical MEASURE screen is:



  On the MEASURE screen's top line, Relay A, B, C, and D annunciators will appear when their relay operational state changes. When a relay overfeed timer is used and it has "timed out," the respective relay annunciator continuously blinks until the overfeed condition is resolved.

- **MENU screens** to move within the three main branches of the analyzer menu tree, enabling access to edit/selection screens. (EXIT screens indicate the end of a menu branch and enable you, by pressing the **ENTER key**, to move up one level in the menu tree. This is functionally the same as pressing the **ESC key**.)

- **Edit/Selection screens** to enter values/choices to calibrate, configure, and test the analyzer.

1.2 Keypad

The keypad enables you to move throughout the analyzer menu tree. The keys and their related functions are:

1. **MENU key:** Pressing this key always displays the top of the menu tree ("MAIN MENU" selection screen). To display the top-level menu screen for a desired main

branch (CALIBRATE, CONFIGURE or TEST/MAINT), use the ⇩ **and** ⇧ **keys** to select the corresponding line, and press the **ENTER key**. The **MENU key** can also be used to "abort" the procedure to change values or selections.

2. **ENTER key:** Pressing this key displays an available menu or edit/selection screen, or enters (saves) values or selections.

3. **ESC key:** Pressing this key always takes the display up one level in the menu tree. (Example: With the "MAIN MENU" branch selection screen displayed, pressing the **ESC key** once takes the display up one level to the MEASURE screen.)

4. ⇦ **and** ⇨ **keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE and Menu Screens: Keys are non-functional.
   - Edit/Selection Screens: "Coarse" adjusts the displayed numerical value.

5. ⇧ **and** ⇩ **keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE Screen: Changes the bottom auxiliary display line, shown in reverse video, between measured temperature, Output #1 mA value, or Output #2 mA value.
   - Menu Screens: Moves reverse video cursor up or down respectively to select a displayed line item.
   - Edit/Selection Screens: "Fine" adjusts numerical value, enclosed by parenthesis, up or down respectively or moves up or down respectively between choices enclosed by parenthesis.

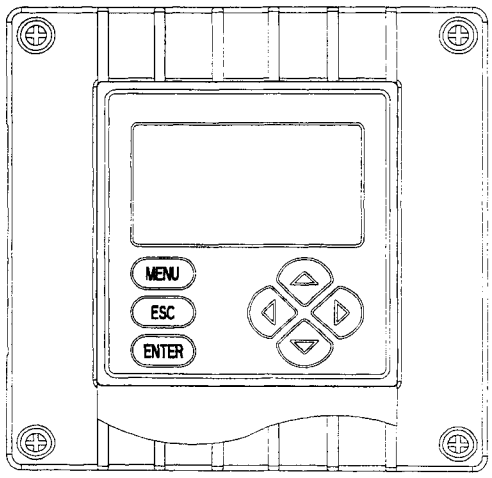
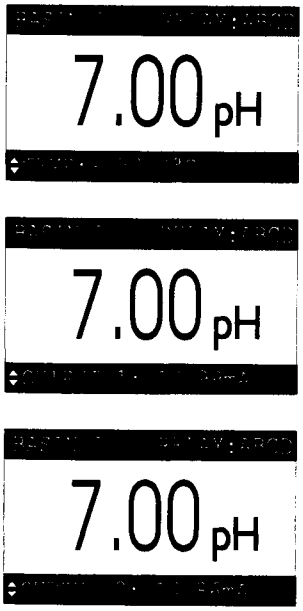


FIGURE 3-1 Analyzer Keypad

1.3 MEASURE Screen (normal display mode)

The MEASURE screen is normally displayed. When the **MENU key** is pressed, various screens to calibrate, configure, or test the analyzer temporarily replace the MEASURE screen. If the keypad is not used within 30 minutes, except during calibration and while using specific analyzer test/ maintenance functions, the display automatically returns to the MEASURE screen. To display the MEASURE screen at any time, press the **MENU key** once and then the **ESC key** once.

By pressing the ⇩ **and** ⇧ **keys** with the MEASURE screen displayed, you can select between other measurements on the bottom auxiliary display line. These MEASURE screen examples illustrate this feature:



☞ ***NOTE:*** *When the analyzer returns to its normal MEASURE screen mode, the appearing MEASURE screen is always the version last selected. Note that these MEASURE screen examples show "BASIN 1" notations on their top lines, illustrating the analyzer notation feature. To create your own notation, refer to Part Three, Section 4.2, under the subheading "Changing Top Line Notation on MEASURE Screen."*

When a measured value is beyond the analyzer measuring range, a series of " + " or " - " screen symbols appear, indicating that the value is respectively above or below range.

SECTION 2

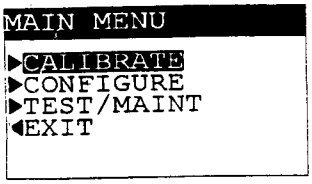
MENU STRUCTURE

The analyzer menu tree is divided into three main branches: CALIBRATE, CONFIGURE, and TEST/MAINT. Each main branch is structured similarly in layers with top-level menu screens, related lower-level submenu screens and, in many cases, sub-submenu screens.

Each layer contains an EXIT line or screen to return the display up one level to the previous layer of screens. For convenience, the layers within each main branch are organized with the most frequently used functions at their beginning, rather than the functions used for initial startup.

2.1 Displaying Main Branch Selection Screen

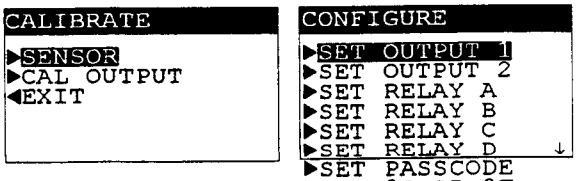
Press the **MENU key** to always display this main branch selection screen:

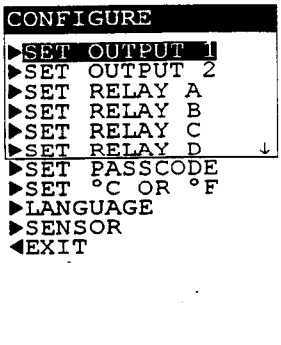


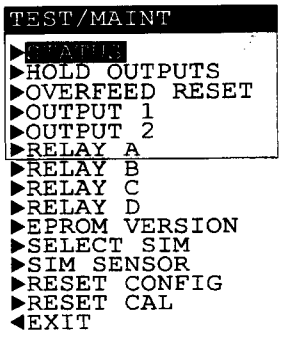
2.2 Displaying Top-level Menu Screens

1. After displaying the main branch selection screen, use the ⇩ **or** ⇧ **keys** to select the line corresponding to the desired branch (shown in reverse video).
2. Press the **ENTER key** to display the top-level menu screen for that branch.

The top-level menu screens for each main branch are:







Menu Structure Tip! The ▶ symbol pointing at each listed item indicates there is a related lower-level submenu screen, sub-submenu screen, or edit/selection screen.

Some menu lists are too long to completely fit on the screen. A ↓ symbol at the bottom right of the list indicates that you can display hidden items by pressing the ⇩ **key**. As you display these items a ↕ symbol appears.

indicating that items now hidden above and below the list can be displayed by respectively pressing the ⇧ **or** ⇩ **key. When a** ↑ **symbol appears, it indicates you have reached the end of the menu list. You can move back up the list using the** ⇧ **key.**

NOTE: *The ▷ symbol pointing at a listed menu item indicates that this item is not relevant to, nor required for, the previously entered setup choices and, therefore, is not available.*

2.3 Displaying Submenu Screens

1. After displaying the top-level menu screen, use the ⇩ **and** ⇧ **keys** to select the line corresponding to the desired lower-level submenu screen.

2. Press the **ENTER key** to display the submenu screen.

When a submenu or sub-submenu screen contains a first line ending with a "?", it is an edit/selection screen. Pressing the ⇩ **or** ⇧ **key** changes the value/choice enclosed by parenthesis (second line on screen).

Example: With this submenu edit screen displayed:

```
SET °C OR °F?
(°C                )
```

pressing the ⇩ **key** displays this related choice:

```
SET °C OR °F?
(°F                )
```

2.4 Adjusting Edit/Selection Screen Values

Edit/selection screens always contain a second line enclosed by parenthesis -- see examples shown above and below. The enclosed value/choice can be edited/changed by using the ⇧ **and** ⇩ **keys**. Pressing the **ENTER key** saves the change.

```
SET PARAMETER?
(SENSOR            )
```

```
SET 4mA VALUE?
(12.33 pH          )
```

Use the ⇦ **and** ⇨ **keys** to "coarse" adjust numerical values. The ⇧ **and** ⇩ **keys** "fine" adjust numerical values up or down respectively. The longer the key is pressed, the faster the number changes.

2.5 Entering (Storing) Edit/Selection Screen Values/Choices

After the desired value/choice is displayed, press the **ENTER key** to enter (store) it into the non-volatile analyzer memory. The previous screen will then re-appear.

NOTE: *You can always press the* ***ESC key*** *to abort saving a new setting. The original setting will be retained.*

SECTION 3
ADJUSTING DISPLAY CONTRAST

Ambient lighting conditions may make it necessary to adjust the analyzer display contrast to improve visibility. With the MEASURE screen displayed, press and hold the **ENTER key** and simultaneously press the ⇧ **or** ⇩ **key** until attaining the desired contrast.

SECTION 4
CONFIGURING THE ANALYZER

☞ ***NOTE:*** *When the passcode feature is enabled (Section 4.6), you must successfully enter the passcode before attempting to enter a configuration setting.*

4.1 Selecting Language to Operate Analyzer

The analyzer can display screens in various languages including English, French (Français), German (Deutsche), Spanish (Español), and others. The analyzer is factory-set for English. To change languages:

1. Press **MENU key** to display
```
MAIN MENU
▶CALIBRATE
▶CONFIGURE
▶TEST/MAINT
◀EXIT
```
. Use ⇩ **key** to select the "CONFIGURE" line.

2. Press **ENTER key** to display
```
CONFIGURE
▶SET OUTPUT 1
▶SET OUTPUT 2
▶SET RELAY A
▶SET RELAY B
▶SET RELAY C
▶SET RELAY D
▶SET PASSCODE
▶SET °C OR °F
▶LANGUAGE
▶SENSOR
◀EXIT
```
. Use ⇩ **key** to select the "LANGUAGE" line.

3. Press **ENTER key** to display
```
LANGUAGE?
(ENGLISH      )
```
. Use ⇩ **and** ⇧ **keys** to view the language choices.

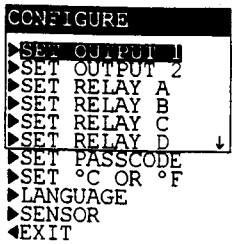
4. With the desired language displayed, press **ENTER key** to enter this selection.

☞ ***NOTE:*** *After a language is selected and entered, all screens will be displayed in that language.*

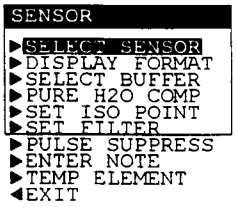
4.2 Configuring Sensor Characteristics

The analyzer must be configured to define the sensor used with it, and other related characteristics such as the temperature element, desired buffer set, input signal filtering, pulse suppression, etc.

Selecting Sensor Type



1. With the screen displayed, use ⇩ **key** to select the "SENSOR" line.



2. Press **ENTER key** to display .

2. With the "SELECT SENSOR" line selected, press **ENTER key** to display SELECT SENSOR? (DIFF pH) . Use ⇩ **and** ⇧ **keys** to view the four choices:

   - **DIFF pH:** Configures analyzer to use a OMEGA 5-wire Differential pH sensor.
   - **COMBINATION pH:** Configures analyzer to use a conventional combination pH electrode.
   - **DIFF ORP:** Configures analyzer to use a OMEGA 5-wire Differential ORP sensor.
   - **COMB ORP:** Configures analyzer to use a conventional combination ORP electrode.

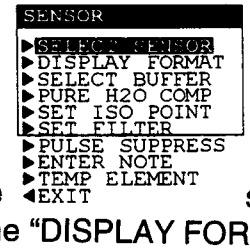
WARNING:

CHANGING THE SENSOR TYPE REPLACES ALL USER-ENTERED VALUES WITH DEFAULT VALUES.

4. With the desired choice displayed, press **ENTER key** to enter this selection.

Selecting Display Format

MEASURE screen resolution can be set to display pH in tenths or hundredths of a pH unit. This setting has no effect on menu or edit/selection screens which always show hundredths of a pH unit resolution. (ORP display resolution is fixed to show mV values in whole numbers only.)



1. With the screen displayed, use ⇩ **key** to select the "DISPLAY FORMAT" line.

2. Press **ENTER key** to display DISPLAY FORMAT? (XX.XX pH). Use ⇩ **and** ⇧ **keys** to view both choices (XX.XX or XX.X).

3. With the desired choice displayed, press **ENTER key** to enter this selection.

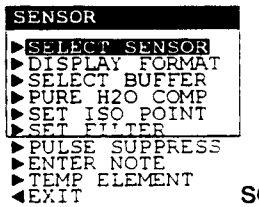
Selecting Buffer Set for pH Calibration

Configure the analyzer to use one of two buffer sets for pH calibration:

- 4.00, 7.00, and 10.00
- DIN 19267 standard (1.09, 4.65, 6.79, 9.23, and 12.75)

☞ ***NOTE:*** *When using buffers that are not included in either of the analyzer buffer sets, disregard selecting the buffer set. In this case, use only the "1 (or) 2 POINT SAMPLE" method for calibration.*

The analyzer automatically recognizes pH values from the selected buffer set and uses its associated built-in table of pH-versus-temperature values to provide improved measurement accuracy. To select a buffer set:



1. With the screen displayed, use ⇩ **key** to select the "SELECT BUFFER" line.

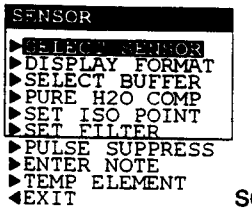
2. Press **ENTER key** to display SELECT BUFFER? (4,7,10). Use ⇩ **and** ⇧ **keys** to view both choices (4, 7, 10 or DIN 19267).

3. With the desired choice displayed, press **ENTER key** to enter this selection.

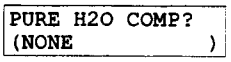
Selecting Pure Water Temperature Compensation

For special cases, use pure water temperature compensation to provide additional temperature correction factors for measuring pH in solutions with the weakly dissociating electrolytes ammonia or morpholine. Pure water compensation adds an associated temperature-dependent offset, from the selected built-in table, to the measured pH. This special compensation is particularly relevant to, and useful for, power plant applications.

☞ ***NOTE:*** *The selected built-in table of pure water offsets is limited to 50°C. If the process temperature is higher, the offset corresponding to 50°C is used.*



1. With the screen displayed, use ⇩ **key** to select the "PURE H2O COMP" line.

2. Press **ENTER key** to display 

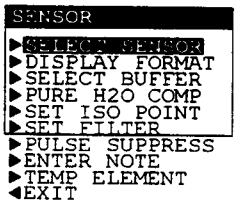
. Use ⇩ **and** ⇧ **keys** to view the three choices (NONE, AMMONIA, or MORPHOLINE).

3. With the desired choice displayed, press **ENTER key** to enter this selection.

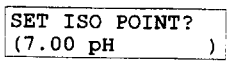
Setting Isopotential for Differential pH Sensor

This configuration setting only applies to the OMEGA PHE-6028-PO Differential pH sensors that contain a special "standard cell" buffer. OMEGA Differential pH sensors normally contain 7.00 pH "standard cell" buffer, providing a theoretical output of zero mV at exactly 7.00 pH. This relationship is called the "isopotential." A sensor with the normal 7.00 pH isopotential provides (-) 59.9 mV per pH at process values higher than 7.00 pH and (+) 59.9 mV per pH at process values lower than 7.00 pH. Special applications may require the sensor to have a special isopotential such as 6.50 pH. For best accuracy, set the analyzer to match the isopotential value of the sensor.

☞ ***NOTE:*** *Changing the isopotential setting requires you to re-calibrate the analyzer. When using a conventional combination electrode, the isopotential value does not apply and is irrelevant.*



1. With the screen displayed, use ⇩ **key** to select the "SET ISO POINT" line.

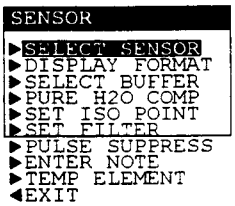
2. Press **ENTER key** to display 

.

3. Adjust the displayed value to match the sensor's isopotential value, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Setting Sensor Signal Filter Time

A time constant (in seconds) can be set to filter or "smooth out" the sensor signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what sensor signal filter time to use is a compromise. The higher the filter time, the longer the sensor signal response time will be to a change in the actual process value.



1. With the screen displayed, use ⇩ **key** to select the "SET FILTER" line.

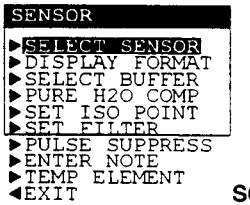
2. Press **ENTER key** to display 

.

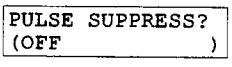
3. Adjust the displayed value to the desired filter time, and press **ENTER key** to enter the value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Selecting Pulse Suppression (on/off)

Sometimes an external interference may occasionally cause the measurement system to provide unstable readings. Common causes include entrained gas bubbles in the process, and electromagnetic interference (EMI or "electrical noise" pulses). The analyzer has a pulse suppression feature to counteract this condition and stabilize readings. Example: Suppose the analyzer reading is steadily showing 7.3 pH, then suddenly jumps to 9.8 pH for a few seconds, and returns to 7.3 pH. By turning on this feature, the analyzer will perceive this as a temporary upset, "suppressing" most of this pulse change and providing a smoother measurement reading.



1. With the screen displayed, use ⇩ **key** to select the "PULSE SUPPRESS" line.

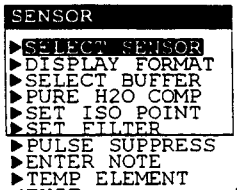
2. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to view both choices (OFF or ON).

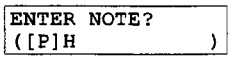
3. With the desired choice displayed, press **ENTER key** to enter this selection.

Changing Top Line Notation on MEASURE Screen

The top line of the MEASURE screen is factory set to read "PH." This notation can be changed, for example, to "BASIN 1" to tailor the analyzer MEASURE screen to the application. The top line would then be "MEASURE BASIN 1." The notation is limited to eight characters which can be a combination of capital letters A through Z, numbers 0 through 9, and spaces.



1. With the screen displayed, use ⇩ **key** to select the "ENTER NOTE" line.

2. Press **ENTER key** to display 

. Create the desired notation within the second line's parenthesis:

   A. Starting with the extreme left character position, use ⇧ **and** ⇩ **keys** to select the desired first character.

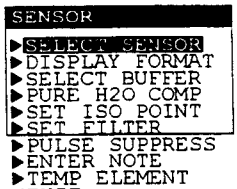
   B. Press ⇨ **key** to access the second character position. Use ⇧ **and** ⇩ **keys** to select the desired second character.

   C. Repeat procedure until desired notation is displayed.

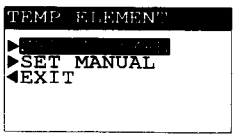
3. Press **ENTER key** to enter the displayed notation.

Selecting Temperature Element Type

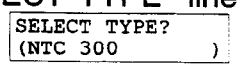
Configure the analyzer to define the temperature element being used for temperature compensation. If an element is not used, you must select MANUAL temperature compensation and enter a specific temperature value.



1. With the screen displayed, use ⇩ **key** to select the "TEMP ELEMENT" line.

2. Press **ENTER key** to display 

.

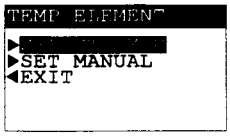
3. With the "SELECT TYPE" line selected, press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to view the four choices:

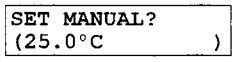
- **NTC300:** Configures analyzer for use with an NTC 300 ohm thermistor temperature element (used in most OMEGA 5-wire Differential pH and ORP sensors).
- **PT1000:** Configures analyzer for use with a Pt 1000 RTD temperature element.
- **PT100:** Configures analyzer for use with a Pt 100 RTD temperature element.
- **MANUAL:** Configures analyzer for fixed manual temperature compensation when not using a temperature element.

NOTE: *When not using a temperature sensor, the MEASURE screen will flash "WARNING: CHECK STATUS." To clear this message, select "MANUAL" using this "SELECT TYPE?" screen.*

4. With the desired choice displayed, press **ENTER key** to enter this selection. If "MANUAL?" was selected, you must set the specific manual temperature compensation value:



   A. With the screen displayed, use ⇩ **key** to select the "SET MANUAL" line.

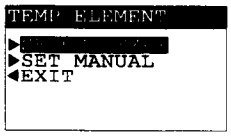
   B. Press **ENTER key** to display 

.

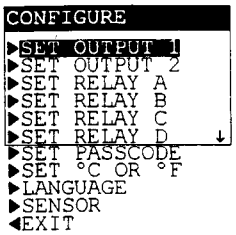
   C. Adjust displayed value to the desired fixed temperature, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

4.3 Selecting Temperature Display Format (°C or °F)

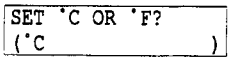
The MEASURE screen can be set to display temperature values in °C or °F. In either case the display resolution for measured temperature is always in tenths of a degree.

1. With the 

sub-submenu screen displayed, press **ESC key** twice to display:



2. Use ⇩ **key** to select the "SET °C OR °F" line.

3. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to view both choices.

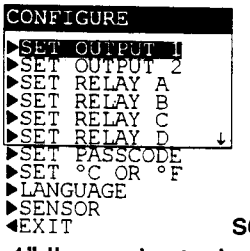
4. With the desired choice displayed, press **ENTER key** to enter this selection.

4.4 Configuring Outputs (1 and 2)

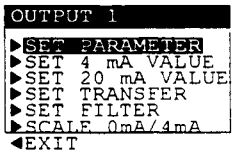
The analyzer provides two isolated analog outputs (#1 and #2). Configure both outputs in the same way using their respective menu screens.

Assigning Representative Parameter

Each output can be assigned to represent the measured pH (or ORP) or temperature.

1. With the 

screen displayed and the "SET OUTPUT 1" line selected, press **ENTER key** to display:



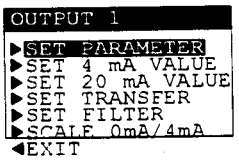
2. With the "SET PARAMETER" line selected, press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to view both choices (SENSOR or TEMPERATURE).

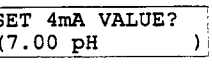
3. With the desired choice displayed, press **ENTER key** to enter this selection.

Setting Parameter Values for 0/4 mA and 20 mA

You can set the pH (or ORP) or temperature values to define the endpoints at which the minimum and maximum output values are desired.

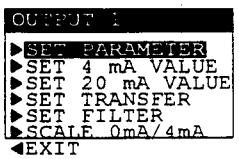
1. With the 

screen displayed, use ⇩ **key** to select the "SET 4 mA VALUE" line.

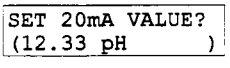
2. Press **ENTER** to display 

.

3. Set the displayed value at which 0/4 mA is desired, and press **ENTER key** to enter the value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

4. After the 

screen re-appears, use ⇩ **key** to select the "SET 20 mA VALUE" line.

5. Press **ENTER key** to display 

.

6. Set the displayed value at which 20 mA is desired, and press **ENTER key** to enter the value.

☞ ***NOTE:*** *If the same values are set for 0/4 mA and 20 mA, the output automatically goes to, and remains at, 20 mA.*

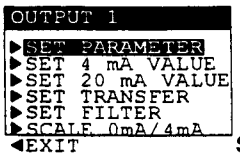
Setting Transfer Value (mA)

Each analog output is normally active (responds to the measured value of its assigned parameter). During calibration, however, both outputs can be set to:

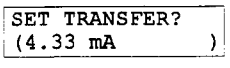
- Hold their present values.
- Transfer to preset values to operate control elements by amounts corresponding to those values.
- Active to respond to the measured values.

☞ ***NOTE:*** *The analog outputs can be held at any time by selecting the "HOLD OUTPUTS" line in the TEST/MAINT menu and pressing the* ***ENTER key****.*

If your application requires it, assign a mA transfer value for the analog output.



1. With the screen displayed, use ⇩ **key** to select the "SET TRANSFER" line.

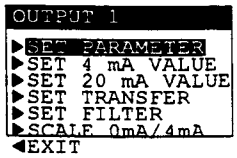
2. Press **ENTER key** to display 

.

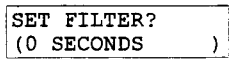
3. Set the displayed value to the desired transfer value, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Setting Output Filter Time

A time constant (in seconds) can be set to filter or "smooth out" the output signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what output filter time to use is a compromise. The higher the filter time, the longer the output signal response time will be to a change in the measured value.



1. With the screen displayed, use ⇩ **key** to select the "SET FILTER" line.

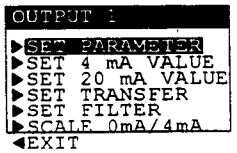
2. Press **ENTER key** to display 

.

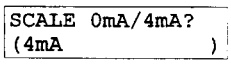
3. Adjust the displayed value to the desired filter time, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Setting Output Scale Low Endpoint (0/4 mA)

Each output can be set to be 0-20 mA or 4-20 mA.



1. With the screen displayed, use ⇩ **key** to select the "SCALE 0mA/4mA" line.

2. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to view both choices.

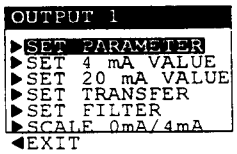
3. With the desired choice displayed, press **ENTER key** to enter this selection.

4.5 Configuring Relays (A, B, C, and D)

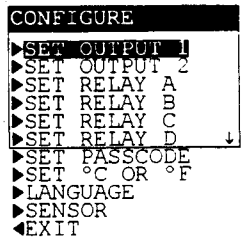
The analyzer may be equipped with two or four electromechanical relays (A and B, and C and D). Each relay can be set to function as a control, alarm, or status relay. Only a control or alarm relay operates in response to the measured value. **A status relay is not configurable.** It is a dedicated system diagnostic-only alarm relay that automatically energizes when the "WARNING CHECK STATUS" message flashes on the MEASURE screen. This occurs when the analyzer detects a sensor or analyzer "fail" diagnostic condition. Configure all relays in the same way using their respective menu screens.

Assigning Representative Parameter

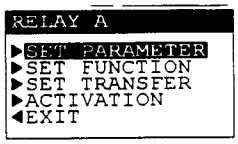
Each control or alarm relay can be assigned to use the measured pH (or ORP) or temperature for its operation.

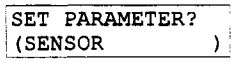
1. With the


screen displayed, press **ESC key** once to display:



2. Use ⇩ **key** to select the "SET RELAY A" line, and press **ENTER key** to display:



3. With the "SET PARAMETER" line selected, press **ENTER key** to display


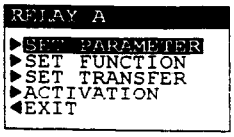
. Use ⇩ **and** ⇧ **keys** to view both choices (SENSOR or TEMPERATURE).

4. With the desired choice displayed, press **ENTER key** to enter this selection.

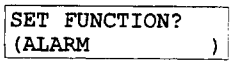
Selecting Function Mode (alarm, control, or status)

Each relay can be selected to function as a:

- Dual-alarm relay (with separate high and low alarm points and deadbands)
- Control relay (with phasing, setpoint, deadband, and overfeed timer)
- Status relay that is not configurable.

1. With the 

screen displayed, use ⇩ **key** to select the "SET FUNCTION" line.

2. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to view the choices (ALARM, CONTROL, or STATUS).

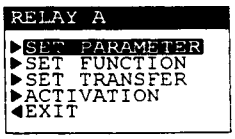
3. With the desired choice displayed, press **ENTER key** to enter this selection.

Selecting Transfer Mode (relay on or off)

Each control or alarm relay is normally active, responding to the measured value of its assigned parameter. During calibration, however, the relays can be set to:

- Hold their present on/off states.
- Transfer to preset on/off states.
- Active to respond to the measured values.

If your application requires it, assign a relay on/off transfer state:

1. With the 

screen displayed, use ⇩ **key** to select the "SET TRANSFER" line.

2. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to view both choices (DE-ENERGIZED or ENERGIZED).

3. With the desired choice displayed, press **ENTER key** to enter this selection.

Setting Activation (Configuration) Values

The group of configuration settings available to a relay is dependent on its selected function mode (alarm or control). **Relays set for status function mode are not configurable.** Table A describes all relay configuration settings, categorized by relay function mode:

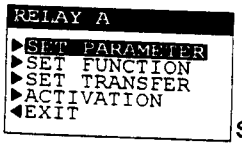
Table A -- RELAY CONFIGURATION SETTINGS	
Setting	Description
For Alarm Relay	
Low Alarm	Sets the value at which the relay will turn on in response to decreasing measured value.
High Alarm	Sets the value at which the relay will turn on in response to increasing measured value.
Low Deadband	Sets the range in which the relay remains on after the measured value increases above the low alarm value.
High Deadband	Sets the range in which the relay remains on after the measured value decreases below the high alarm value.
Off Delay	Sets a time (0-300 seconds) to delay the relay from normally turning off.
On Delay	Sets a time (0-300 seconds) to delay the relay from normally turning on.
For Control Relay	
Phase	A "high" phase assigns the relay setpoint to respond to increasing measured value; conversely, a "low" phase assigns the relay setpoint to respond to decreasing measured value.
Setpoint	Sets the value at which the relay will turn on.
Deadband	Sets the range in which the relay remains on after the measured value decreases below the setpoint value (high phase relay) or increases above the setpoint value (low phase relay).
Overfeed Timer	Sets the time (0-999.9 min.) to limit how long the relay can remain "on." For more details on overfeed timer operation, see Part Three, Section 7.
Off Delay	Sets a time (0-300 seconds) to delay the relay from normally turning off.
On Delay	Sets a time (0-300 seconds) to delay the relay from normally turning on.

NOTE: *When a relay is set to function as a status relay, the ▷ symbol at the start of the "ACTIVATION" line denotes that this menu item is not relevant and, therefore, not available.*

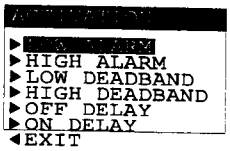
Also, it is possible to enter values that always keep a relay active or inactive. To avoid this, be sure that "low" values are lower than "high" values.

The "off delay" and "on delay" settings, available to control or alarm function relays, may be beneficial in eliminating process "overshoot" when there are long process pipe runs or delays in mixing.

To set Relay A configuration values:

1. With the 

screen displayed, use ⇩ **key** to select the "ACTIVATION" line.

2. Press **ENTER key** to display 

.

3. Use ⇩ **key** to select the appropriate relay setting line, and press **ENTER key** to display its corresponding edit/selection screen.

4. Use the same basic keypad operations described in previous setup procedures to enter the desired value for the displayed relay activation setting.

5. Repeat this procedure for each relay activation setting.

4.6 Enabling/Disabling Passcode

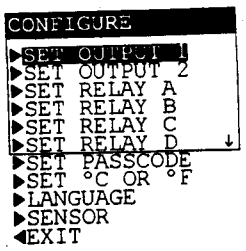
The analyzer has a passcode feature to restrict access to configuration and calibration settings to only authorized personnel.

- **DISABLED:** With passcode disabled, all configuration settings can be displayed and changed, and the analyzer can be calibrated.

- **ENABLED:** With passcode enabled, all configuration settings can be displayed -- but they cannot be changed, and the analyzer cannot be calibrated. When you attempt to change a setting by pressing the **ENTER key**, a displayed notification requests passcode entry. A valid passcode entry saves the changed setting and returns the display to the "MAIN MENU" branch selection screen. An incorrect passcode entry causes the display to momentarily show an error notification and return to the "MAIN MENU" branch selection screen. There is no limit on attempts to enter a valid passcode.

The factory-set passcode is: 3456

To enable or disable the passcode feature:



1. With the top-level menu screen displayed, use ⇩ **key** to select the "SET PASSCODE" line.

2. Press **ENTER key** to display SET PASSCODE? (DISABLED). Use ⇩ **and** ⇧ **keys** to view both choices (DISABLED or ENABLED).

3. With the desired choice displayed, press **ENTER key** to enter this selection.

4.7 Summary of Configuration Settings

Table B lists all configuration settings and their entry ranges/ choices and factory defaults, categorized by basic functions.

Table B -- ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS)

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
LANGUAGE Configuration Setting			
LANGUAGE?	ENGLISH, FRENCH, GERMAN, SPANISH, etc.	ENGLISH	
SENSOR Configuration Settings			
SELECT SENSOR?	DIFF pH, COMBINATION pH, DIFF ORP, or COMBINATION ORP	DIFF pH	
DISPLAY FORMAT?	XX.XX pH or XX.X pH	XX.XX pH	
SELECT BUFFER?	4, 7, 10 or DIN 19267	4, 7, 10	
PURE H2O COMP?	NONE, AMMONIA, or MORPHOLINE	NONE	
SET ISO POINT?	2.00-10.00 pH	7.00 pH	
SET FILTER?	0-60 seconds	0 seconds	
PULSE SUPPRESS?	OFF or ON	OFF	
ENTER NOTE?	Enter up to eight characters to replace PH	PH	
TEMP ELE:SELECT TYPE?	NTC300, PT1000, PT100, or MANUAL	NTC300	
TEMP ELE:SET MANUAL?	0.0-100.0°C	25.0°C	
TEMPERATURE Display Configuration Setting			
CONFIGURE: °C OR °F?	°C or °F	°C	
OUTPUT Configuration Settings			
SET PARAMETER?	SENSOR (pH or ORP) or TEMPERATURE	Output 1: SENSOR Output 2: TEMPERATURE	
SET 4mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 0.00 pH ORP: 0 mV TEMP: 0.0°C or 32.0°F	
SET 20mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 14.00 pH ORP: +2100 mV TEMP: 200.0°C or 392.0°F	
SET TRANSFER?	0-20 mA or 4-20 mA	Outputs 1 and 2: 12 mA	
SET FILTER?	0-60 seconds	Outputs 1 and 2: 0 seconds	
SCALE 0mA/4mA?	0 mA or 4 mA	Outputs 1 and 2: 4 mA	
RELAY Configuration Settings			
Settings Common To Alarm and Control Relays:			
SET PARAMETER?	SENSOR (pH or ORP) or TEMPERATURE	Relay A: SENSOR Relay B: TEMPERATURE	
SET FUNCTION?	ALARM, CONTROL, or STATUS	Relays A and B: ALARM	

(Table B continued on next page.)

Table B – ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS – continued)			
Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
RELAY Configuration Settings (continued)			
Settings Common To Alarm and Control Relays (continued):			
SET TRANSFER?	DE-ENERGIZED or ENERGIZED	Relays A and B: DE-ENERG.	
OFF DELAY?	0-300 seconds	0 seconds	
ON DELAY?	0-300 seconds	0 seconds	
Settings For Alarm Relays Only:			
LOW ALARM?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 0.00 pH ORP: 0 mV TEMP: 0.0°C or 32.0°F	
HIGH ALARM?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 14.00 pH ORP: +2000 mV TEMP: 200.0°C or 392.0°F	
LOW DEADBAND?	pH: 0-10% of range ORP: 0-10% of range TEMP: 0-10% of range	pH: 0.00 pH ORP: 0 mV TEMP: 0.0°C/°F	
HIGH DEADBAND?	pH: 0-10% of range ORP: 0-10% of range TEMP: 0-10% of range	pH: 0.00 pH ORP: 0 mV Temp: 0.0°C/°F	
Settings For Control Relays Only:			
PHASE?	HIGH or LOW	Relays A and B: HIGH	
SET SETPOINT?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 14.00 pH ORP: +2000 mV TEMP: 200.0°C or 392.0°F	
DEADBAND?	pH: 0-10% of range ORP: 0-10% of range TEMP: 0-10% of range	pH: 0.00 pH ORP: 0 mV TEMP: 0.0°C/°F	
OVERFEED TIMER?	0-999.9 minutes	0 minutes	
PASSCODE Configuration Setting			
SET PASSCODE?	DISABLED or ENABLED	DISABLED	
TEST/MAINTENANCE Simulation Function Settings			
SELECT SIM?	SENSOR (pH or ORP) or TEMPERATURE	SENSOR	
SIM SENSOR?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	Present measured value of selected parameter (pH, ORP, or temperature)	

SECTION 5
CALIBRATING THE ANALYZER

5.1 Things to Know About Calibration

Four methods are available to calibrate the analyzer for pH measurement (Section 5.2). For ORP calibration, use only the 1-POINT SAMPLE method described in Section 5.3. The mA value for each analog output can also be calibrated (Section 5.4).

☞ ***NOTE:*** *When the passcode feature is enabled (Section 4.6), you must successfully enter the passcode before attempting to calibrate the analyzer.*

An in-progress calibration can always be aborted by pressing the ***ESC key****. After the "ABORT: YES?" screen appears, do one of the following:*

- *Press* ***ENTER key*** *to abort. After the "CONFIRM ACTIVE?" screen appears, press* ***ENTER key*** *to return the analog outputs and relays to their active states (MEASURE screen appears).*
- *Press ⇧* ***or*** *⇩* ***key*** *to choose the "ABORT: NO?" screen, and press* ***ENTER key*** *to continue calibration.*

Calibrate At Regular Intervals

To maintain best measurement accuracy, periodically calibrate the analyzer. Performance of the pH or ORP sensor slowly degrades over time, eventually causing inaccurate readings. The time period between calibrations, and the rate of system drift, can vary considerably with each application and its specific conditions.

☞ **Calibration Tip!** Establish a maintenance program to keep the sensor relatively clean and the analyzer calibrated. The periodic intervals for maintenance (days, weeks, etc.) will be influenced by the characteristics of the process solution, and can only be determined by operating experience.

Temperature-corrected pH Measurement

The analyzer is factory-calibrated for accurate temperature measurement. It will provide pH readings that are automatically corrected for temperature changes when the analyzer:

- Receives a temperature input signal from a pH sensor with a built-in temperature element (or from a separate temperature element).
- Has been correctly set for the type of temperature element being used for automatic compensation.

Calibration Tip! If at any time during calibration, the "CONFIRM FAILURE?" screen appears, press **ENTER key** to confirm. Then, use ⇧ **or** ⇩ **key** to select between "CAL REPEAT?" or "CAL EXIT?" and do one of the following:

- With the "CAL REPEAT?" screen selected, press **ENTER key** to repeat calibration of the point.
- With the "CAL EXIT?" screen selected, press **ENTER key**. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog outputs and relays to their active states (MEASURE screen appears).

5.2 pH Calibration

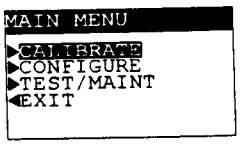
Based on convenience, and depending on your application and accuracy requirements, use one of the four methods to calibrate the analyzer for pH measurement.

NOTE: *When calibrating a sensor for the first time, always use a two-point method.* ***Important:*** *During any calibration, it is very important to allow the temperatures of the sensor and buffers to equalize.*

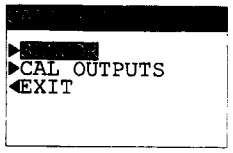
2 POINT BUFFER Method

This recommended method uses two buffers, typically pH 7 and pH 4. (pH 10 buffer is also readily available but is not as stable, particularly at extreme temperatures.) This method automatically recognizes buffers from the buffer set you selected. Therefore, you must use buffers that match values in the buffer set. (See Part Three, Section 4.2 under subheading "Selecting Buffer Type" for setup details.)

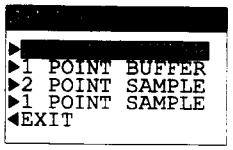
NOTE: *When using buffers that are not included in either of the analyzer buffer sets, disregard this calibration method and use only the "2 POINT SAMPLE" method for calibration.*

1. Immerse the sensor in the first pH buffer (preferably pH 7). **Important:** Allow the sensor and buffer temperatures to equalize. Depending on their temperature differences, this may take 30 minutes or more.
2. Press **MENU key** to display 

.
3. With the "CALIBRATE" line selected (shown in reverse video), press **ENTER key** to display:



4. With the "SENSOR" line selected, press **ENTER key** to display:



5. With the "2 POINT BUFFER" line selected, press **ENTER key** to display `2 POINT BUFFER? (HOLD OUTPUTS )`. Use ⇧ **or** ⇩ **key** to view the three states that the analog outputs (and relays) can be in during calibration:
   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

6. With the desired choice displayed, press **ENTER key** to enter this selection.

7. With the `2 POINT BUFFER: IN 1ST SOLUTION?` screen displayed and the sensor in the first buffer, press **ENTER key** to confirm.

   While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the analyzer waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point.

   Thereafter, the `2 POINT BUFFER: PT1 = 7.00 pH` screen appears for 5 seconds to confirm calibration of this point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration, you can manually complete calibrate of the point by pressing the* ***ENTER key****. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in an inaccurate calibration.*

8. After the `2 POINT BUFFER: IN 2ND SOLUTION?` screen appears, remove the sensor from the first buffer, rinse it with clean water, and immerse it in the second buffer (typically 4 pH).

9. Press **ENTER key** to confirm.

   While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the analyzer waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point.

   Thereafter, the `2 POINT BUFFER: PT2 = 4.00 pH` screen appears for 5 seconds to confirm calibration of this point.

10. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be 54-62 mV/pH range for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve performance. If the slope remains low and you are using a OMEGA Differential sensor, replace the salt bridge and standard cell buffer (see sensor instruction manual for details). If using a conventional combination electrode, consider replacing it.

11. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

12. Re-install the sensor into the process.

13. Press **ENTER key** to display the <u>active</u> measurement reading on the "2 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs <u>and</u> relays to their active states (MEASURE screen appears).

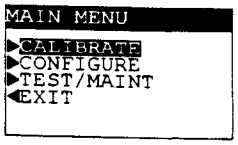
This completes "2 POINT BUFFER" calibration.

1 POINT BUFFER Method

This method is similar to the 2 POINT BUFFER method except that only one buffer is used to calibrate one point. This method also automatically recognizes buffers from the buffer set you selected. Therefore, you must use a buffer that matches a value in the buffer set. (See Part Three, Section 4.2 under subheading "Selecting Buffer Type" for setup details.)

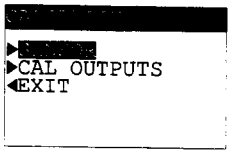
☞ ***NOTE:*** *When using a buffer that is not included in either of the analyzer buffer sets, disregard this calibration method and use only the "1 POINT SAMPLE" method for calibration.*

1. Immerse the sensor in the pH buffer. **Important:** Allow the sensor and buffer temperatures to equalize. Depending on their temperature differences, this may take 30 minutes or more.

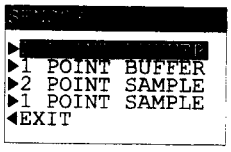
2. Press **MENU key** to display 

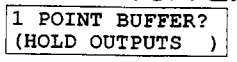
.

3. With the "CALIBRATE" line selected (shown in reverse video), press **ENTER key** to display:



4. With the "SENSOR" line selected, press **ENTER key** to display:

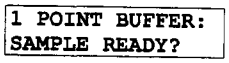


5. Use ⇩ **key** to select the "1 POINT BUFFER" line and press **ENTER key** to display 

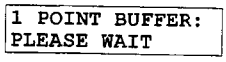
.

6. Use ⇧ **or** ⇩ **key** to view the three states that the analog outputs (and relays) can be in during calibration:
   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

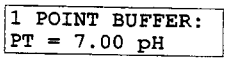
7. With the desired choice displayed, press **ENTER key** to enter this selection.

8. With the 

screen displayed and the sensor in the buffer, press **ENTER key** to confirm.

   While the 

screen is displayed, the analyzer waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates the point.

   Thereafter, the 

screen appears for 5 seconds to confirm calibration of the point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration, you can manually complete calibrate of the point by pressing the* ***ENTER key****. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in an inaccurate calibration.*

9. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be 54-62 mV/pH range for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve performance. If the slope remains low and you are using a OMEGA Differential sensor, replace the salt bridge and standard cell buffer (see sensor instruction manual for details). If using a conventional combination electrode, consider replacing it.

10. Press **ENTER key** to end calibration ("1 POINT BUFFER: CONFIRM CAL OK?" screen appears).

11. Re-install the sensor into the process.

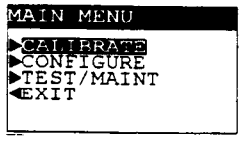
12. Press **ENTER key** to display the active measurement reading on the "1 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their normal states (MEASURE screen appears).

This completes "1 POINT BUFFER" calibration.

2 POINT SAMPLE Method

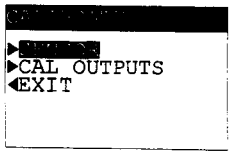
This method requires you to enter the known pH values of two process samples (determined by laboratory analysis or a comparison reading), or two pH buffers.

1. Immerse the sensor in the first sample (or buffer). **Important:** Allow the sensor and sample temperatures to equalize. Depending on their temperature differences, this may take 30 minutes or more.

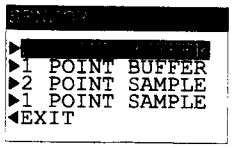
2. Press **MENU key** to display 

.

3. With the "CALIBRATE" line selected (shown in reverse video), press **ENTER key** to display:



4. With the "SENSOR" line selected, press **ENTER key** to display:



5. Use ⇩ **key** to select the "2 POINT SAMPLE" line and press **ENTER key** to display `2 POINT SAMPLE? (HOLD OUTPUTS)`.

6. Use ⇧ **or** ⇩ **key** to view the three states that the analog outputs (and relays) can be in during calibration:

   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

7. With the desired choice displayed, press **ENTER key** to enter this selection.

8. With the `2 POINT SAMPLE: IN 1ST SOLUTION?` screen displayed and the sensor in the first sample, press **ENTER key** to confirm. This active `2 POINT SAMPLE: PT1 = X.XX pH` screen appears showing the measurement reading.

9. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `2 POINT SAMPLE? (X.XX pH )` screen appears showing the "last" measured value.

10. Determine the pH value of the first sample using laboratory analysis or a calibrated portable pH meter. (When a pH buffer is used, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

11. With the static [2 POINT SAMPLE? (X.XX pH)] screen displayed, use ⇧ **and** ⇩ **keys** to adjust the displayed value to exactly match the known pH value of the first sample (or buffer).

12. Press **ENTER key** to enter the value, completing calibration of the first point.

13. After the [2 POINT SAMPLE: IN 2ND SOLUTION?] screen appears, remove the sensor from the first sample, and rinse it with clean water.

14. Immerse the sensor in the second sample, and press **ENTER key** to confirm. This active [2 POINT SAMPLE: PT2 = X.XX pH] screen appears showing the measurement reading.

15. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static [2 POINT SAMPLE? (X.XX pH)] screen appears showing the "last" measured value.

16. Determine the pH value of the second sample using laboratory analysis or a calibrated portable pH meter.

17. With the static [2 POINT SAMPLE? (X.XX pH)] screen displayed, use ⇧ **and** ⇩ **keys** to adjust the displayed value to exactly match the known pH value of the second sample (or buffer).

18. Press **ENTER key** to enter the value, completing calibration of the second point.

19. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be 54-62 mV/pH range for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve performance. If the slope remains low and you are using a OMEGA Differential sensor, replace the salt bridge and standard cell buffer (see sensor instruction manual for details). If using a conventional combination electrode, consider replacing it.

20. Press **ENTER key** to end calibration ("2 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

21. Re-install the sensor into the process.

22. Press **ENTER key** to display the active measurement reading on the "2 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

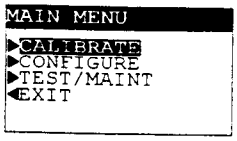
This completes "2 POINT SAMPLE" calibration.

1 POINT SAMPLE Method

This method is similar to the 2 POINT SAMPLE method except that only one sample (or buffer) is used to calibrate one point. This method requires you to enter the known pH value of that sample (determined by laboratory analysis or comparison reading) or pH buffer.

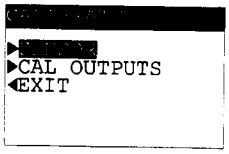
1. Immerse the sensor in the sample (or buffer). **Important:** Allow the sensor and sample temperatures to equalize. Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display

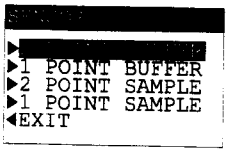


.

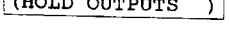
3. With the "CALIBRATE" line selected (shown in reverse video), press **ENTER key** to display:



4. With the "SENSOR" line selected, press **ENTER key** to display:



5. Use ⇩ **key** to select the "1 POINT SAMPLE" line and press **ENTER key** to display



.

6. Use ⇧ **or** ⇩ **key** to view the three states that the analog outputs (and relays) can be in during calibration:
   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

7. With the desired choice displayed, press **ENTER key** to enter this selection.

8. With the `1 POINT SAMPLE:` / `SAMPLE READY?` screen displayed and the sensor in the sample, press **ENTER key** to confirm. This active `1 POINT SAMPLE:` / `PT = X.XX pH` screen appears showing the measurement reading.

9. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `1 POINT SAMPLE?` / `(X.XX pH )` screen appears showing the "last" measured value.

10. Determine the pH value of the sample using laboratory analysis or a calibrated portable pH meter. (When a pH buffer is used, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

11. With the static `1 POINT SAMPLE?` / `(X.XX pH )` screen displayed, use ⇧ **and** ⇩ **keys** to adjust the displayed value to exactly match the known pH value of the sample (or buffer).

12. Press **ENTER key** to enter the value, completing calibration of the point.

13. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be 54-62 mV/pH range for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve performance. If the slope remains low and you are using a OMEGA Differential sensor, replace the salt bridge and standard cell buffer (see sensor instruction manual for details). If using a conventional combination electrode, consider replacing it.

14. Press **ENTER key** to end calibration ("1 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

15. Re-install the sensor into the process.

16. Press **ENTER key** to display the active measurement reading on the "1 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

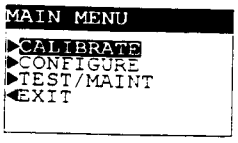
This completes "1 POINT SAMPLE" calibration.

5.3 ORP Calibration

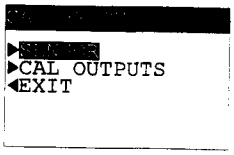
Calibrate the analyzer for ORP measurement using only this "1 POINT SAMPLE" method.

☞ ***NOTE:*** *A two-point calibration method is purposely excluded since it could provide bad results when immersing the sensor into one reference solution and then into the other. This could contaminate electrochemical components of the sensor.*

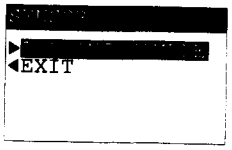
This method requires you to enter the known mV value of a sample (determined by laboratory analysis or a comparison reading) or reference solution.

1. Immerse the sensor in the sample or reference solution.
2. Press **MENU key** to display 

.
3. With the "CALIBRATE" line selected (shown in reverse video), press **ENTER key** to display:



4. With the "SENSOR" line selected, press **ENTER key** to display:



5. With the "1 POINT SAMPLE" line selected, press **ENTER key** to display `1 POINT SAMPLE?` `(HOLD OUTPUTS )`.

6. Use ⇧ **or** ⇩ **key** to view the three states that the analog outputs (and relays) can be in during calibration:
   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

7. With the desired choice displayed, press **ENTER key** to enter this selection.

8. With the `1 POINT SAMPLE:` `SAMPLE READY?` screen displayed and the sensor in the sample (or reference solution), press **ENTER key** to confirm. This active `1 POINT SAMPLE:` `PT = XXXX mV` screen appears showing the measurement reading.

9. Wait for the reading to stabilize. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `1 POINT SAMPLE?` `(XXXX mV )` screen appears showing the "last" measured value.

10. Determine the mV value of the sample using laboratory analysis or a calibrated portable ORP meter.

11. With the static `1 POINT SAMPLE?` `(XXXX mV )` screen displayed, use ⇧ **and** ⇩ **keys** to adjust the displayed value to exactly match the known mV value of the sample (or reference solution).

12. Press **ENTER key** to enter the value, completing calibration of the point.

13. Press **ENTER key** again to end calibration ("1 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

14. Re-install the sensor into the process.

15. Press **ENTER key** to display the active measurement reading on the "1 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

This completes ORP calibration.

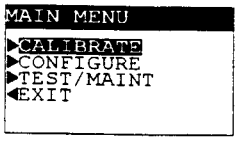
5.4 Analog Outputs (1 and 2) Calibration

The analyzer analog outputs are factory-calibrated. However, they can be re-calibrated at any time if desired. Calibrate each output in the same way using its respective menu screens.

NOTE: *When the passcode feature is enabled (Section 4.6), you must successfully enter the passcode before attempting to calibrate the analog outputs.*

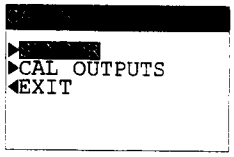
When an output is configured to be 0-20 mA, the analyzer will calibrate the 4 mA and 20 mA values (not the 0 mA value). Also, the analyzer adjustment range for output values during calibration is ± 2 mA.

1. Press **MENU key** to display

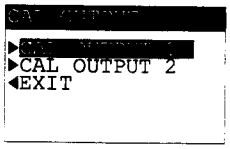


.

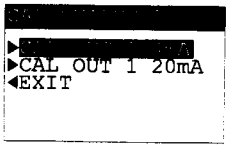
2. With the "CALIBRATE" line selected (shown in reverse video), press **ENTER key** to display:



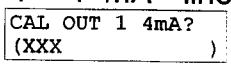
3. Use ⇩ **key** to select the "CAL OUTPUTS" line, and press **ENTER key** to display:



4. With the "CAL OUTPUT 1" line selected, press **ENTER key** to display:



5. With the "CAL OUT 1 4 mA" line selected, press **ENTER key** to display

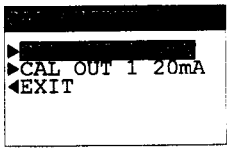


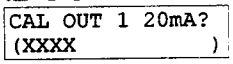
.

6. The displayed value is "counts" -- not mA -- that dynamically change when the output is adjusted. Use a calibrated digital multimeter to measure Output 1's actual <u>minimum</u> value provided at OUTPUT 1 Terminals 2 and 3 on TB1.

7. Use ⇨ **and** ⇦ **keys** (coarse adjust) and ⇧ **and** ⇩ **keys** (fine adjust) to adjust Output 1's minimum value to read exactly "4.00 mA" on the digital multimeter -- not the analyzer display.

8. Press **ENTER key** to complete calibration of the minimum endpoint value.

9. After the 

screen re-appears, press ⇩ **key** once to select the "CAL OUT 1 20 mA" line, and press **ENTER key** to display 

.

10. Once again the displayed value is "counts" -- not mA -- that dynamically change when the output is adjusted. Use a calibrated digital multimeter to measure Output 1's actual maximum value.

11. Use ⇨ **and** ⇦ **keys** (coarse adjust) and ⇧ **and** ⇩ **keys** (fine adjust) to adjust Output 1's maximum value to read exactly "20.00 mA" on the digital multimeter -- not the analyzer display.

12. Press **ENTER key** to complete calibration of the maximum endpoint value.

This completes Output 1 calibration.

SECTION 6
TEST/MAINTENANCE

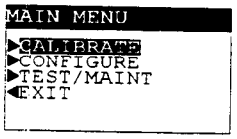
The analyzer has TEST/MAINT menu screens to:

- Check system status of analyzer, sensor and temperature inputs, and relays.
- Hold analog outputs.
- Manually reset all relay overfeed timers.
- Provide analog output test signals to confirm operation of connected devices.
- Test relay operation (energize or de-energize).
- Identify analyzer EPROM version.
- Simulate pH (or mV) or temperature signal to exercise measurement loop.
- Reset configuration -- not calibration -- values to defaults.
- Reset calibration -- not configuration -- values to defaults.

6.1 Checking Analyzer, Sensor, and Relay Status

With the analyzer's system diagnostic capabilities you can check the operating status of the analyzer, sensor (measurement and temperature inputs), and relays. The MEASURE screen will flash the "WARNING CHECK STATUS" message when a system diagnostic condition has been detected. To determine the condition causing the warning, display the "STATUS" screens:

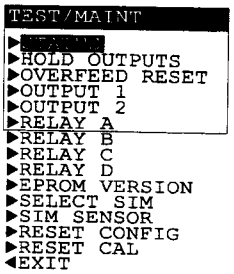
1. Press **MENU key** to display



.

2. Use ⇩ **key** to select the "TEST/MAINT" line.

3. Press **ENTER key** to display



4. With the "STATUS" line selected, press **ENTER key** to display the "STATUS: ANALYZER OK" screen. This screen confirms that the analyzer is operating properly. If "FAIL" appears, it may mean:
   - EPROM failure (data is not valid).
   - Scaling card not present or not recognized.
   - Analog-to-digital converter not responding.
   - RAM failure.
   - Internal serial communications failure.

5. Press **ENTER key** once to view the "STATUS: SENSOR OK" screen. Then press the **ENTER key** again to view the "STATUS: TEMPERATURE OK" screen. If FAIL appears on either input status screen, it may indicate:
   - Sensor is disconnected or incorrectly wired.
   - Signal is very noisy or exceeds the measuring range.

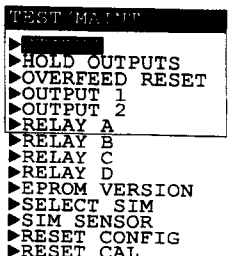
6. With the "STATUS: TEMPERATURE OK" screen displayed, press **ENTER key** once to view the "STATUS: RLY A" screen. Subsequent **ENTER key** presses display status screens for Relay B, C, and D. Status indications can be:

Status Indication	Meaning
ACTIVE (Relay energized; LED is on.)	Control Relay: Measured value exceeds setpoint. Alarm Relay: Measured value exceeds low or high alarm point. Status Relay: Existing sys. diag. condition has been detected.
INACTIVE (Relay not energized; LED is off.)	Control Relay: Measured value does not exceed setpoint. Alarm Relay: Measured value does not exceed low/high alarm pt. Status Relay: Analyzer has not detected system diag. condition.
TIMEOUT (Relay not energized; LED is blinking.)	Control Relay: Overfeed timer has timed out; manually reset it. ***NOTE:*** *TIMEOUT status only applies to control relays.*
COUNTING (Relay energized; LED is on.)	Control Relay: Overfeed timer is counting, but has not timed out. ***NOTE:*** *COUNTING status only applies to control relays.*

7. To end relay status checking, press **ESC** or **ENTER key**.

6.2 Holding Outputs

The analyzer has a convenient feature to hold the analog outputs, suspending operation of any connected devices.



1. With the screen displayed, use ⇩ **key** to select the "HOLD OUTPUTS" line.

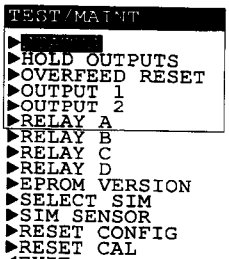
2. Press **ENTER key** to <u>immediately</u> <u>hold</u> the analog outputs ("HOLD OUTPUTS" screen appears, acknowledging that hold has occurred).

NOTE: *If the keypad is not used within 30 minutes, the analog outputs will automatically change back to their active states and the display will return to the MEASURE screen.*

3. To return the analog outputs back to their "active" states, press **ENTER key** at any time.

6.3 Resetting Overfeed Timers

When a relay overfeed timer "times out," as indicated by its blinking annunciator, the timer must be <u>manually</u> reset using TEST/MAINT menu screens. The relay annunciator stops blinking after reset.



1. With the screen displayed, use ⇩ **key** to select the "OVERFEED RESET" line.

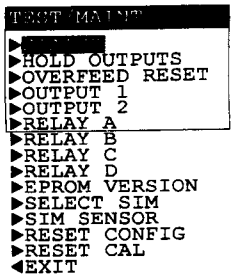
2. Press **ENTER key** to display "OVERFEED RESET" screen.

3. Press **ENTER key** again to reset <u>all</u> relay overfeed timers. The "OVERFEED RESET: DONE" screen appears, acknowledging that reset has occurred.

4. To return to the "TEST/MAINT" top-level menu screen, press **ESC** or **ENTER key**.

6.4 Providing Output (1 and 2) Test Signals

The analyzer can provide analog output test signals of a desired milliamp value to confirm operation of connected devices. Test signals can be provided for both outputs in the same way using their respective menu screens.



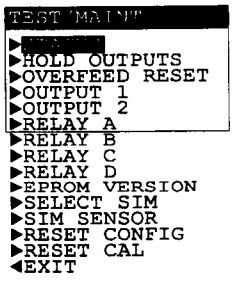
1. With the screen displayed, use ⇩ **key** to select the "OUTPUT 1" line.
2. Press **ENTER key** to display `OUTPUT 1?` / `(XX.XXmA )`.

☞ ***NOTE:*** *Pressing **ENTER key** immediately provides the test signal. Its mA value is shown on this screen.*

3. Adjust the displayed value to obtain the desired mA output at the Output #1 terminals. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇩ **and** ⇧ **keys** for fine adjust.)
4. To end the output test signal and return to the "TEST/MAINT" top-level menu screen, press **ESC** or **ENTER key**.

6.5 Testing Relay (A, B, C, and D) Operation

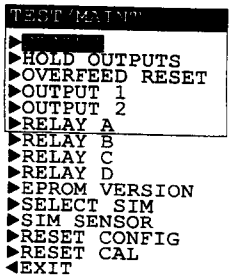
Relays A, B, C, and D can be tested to confirm their operation. Test each relay in the same way using its respective menu screens.



1. With the screen displayed, use ⇩ **key** to select the "RELAY A" line.
2. Press **ENTER key** to display `RELAY A?` / `(ENERGIZE )`.
3. Relay A should be energized. Confirm this by checking the NO and NC relay output terminals with a continuity meter.
4. Press ⇧ **or** ⇩ **key** once to display `RELAY A?` / `(DE-ENERGIZE )`. Relay A should now be de-energized. Confirm this by checking the NO and NC relay output terminals with a continuity meter.
5. To end this test and return to the "TEST/MAINT" top-level menu screen, press **ESC** or **ENTER key**.

6.6 Checking EPROM Version

You can check the version of EPROM used in the analyzer.



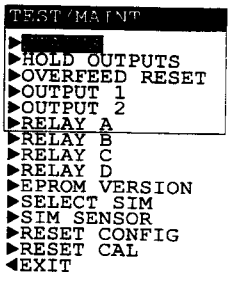
1. With the screen displayed, use ⇩ **key** to select the "EPROM VERSION" line.

2. Press **ENTER key** to view the EPROM version screen.

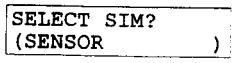
3. To return to the "TEST/MAINT" top-level menu screen, press **ESC** or **ENTER key**.

6.7 Selecting Type of Simulated Value

You can simulate a measured value to make the relays and analog outputs respond accordingly. First, select the type of simulated value using this subsection. Then, set the desired simulation value following the steps in subsection 6.8.



1. With the screen displayed, use ⇩ **key** to select the "SELECT SIM" line.

2. Press **ENTER key** to display 

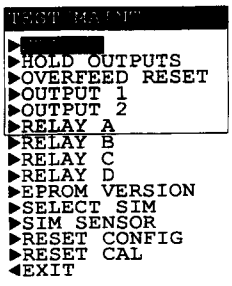
. Use ⇩ **and** ⇧ **keys** to view both choices:

   - **SENSOR:** Depending on the configured measurement, selects the simulated value to be a pH or ORP value.
   - **TEMPERATURE:** Selects the simulated value to be a temperature value.

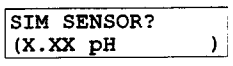
3. With the desired choice displayed, press **ENTER key** to enter this selection and return to the "TEST/MAINT" top-level menu screen.

6.8 Setting Simulation Value

After selecting the type of simulated value (subsection 6.7), set the desired simulation value.



1. With the screen displayed, use ⇩ **key** to select the "SIM SENSOR" line.

2. Press **ENTER key** to display 

.

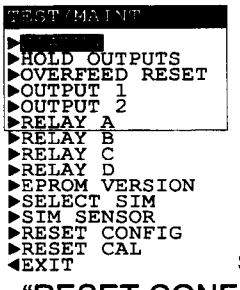
   The value shown on this screen is now active, providing a corresponding mA value for both analog output signals. (The relays, depending on their configured settings, may also respond to this simulation value.)

3. Adjust the displayed simulation value to the desired value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

4. To end the simulation and return to the "TEST/MAINT" top-level menu screen, press **ESC** or **ENTER key**.

6.9 Resetting Configuration Values to Factory Defaults

You can conveniently reset stored configuration settings simultaneously to factory-set defaults. **This excludes calibration settings.**



1. With the screen displayed, use ⇩ **key** to select the "RESET CONFIG" line.

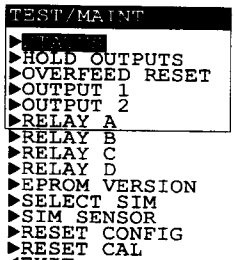
2. Press **ENTER key** to display the "RESET CONFIG: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (If you want to abort this action, press **ESC key** now.)

3. Press **ENTER key** to reset <u>all</u> stored configuration settings -- not calibration settings -- to factory defaults. The "RESET CONFIG: DONE" screen appears, acknowledging that reset has occurred.

4. To return to the "TEST/MAINT" top-level menu screen, press **ESC** or **ENTER key**.

6.10 Resetting Calibration Values to Factory Defaults

You can conveniently reset stored calibration settings to factory-set defaults. **This excludes all other configuration settings.**



1. With the screen displayed, use ⇩ **key** to select the "RESET CAL" line.

2. Press **ENTER key** to display the "RESET CAL: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (If you want to abort this action, press **ESC key** now.)

3. Press **ENTER key** to reset <u>all</u> stored calibration settings -- not configuration settings -- to factory defaults. The "RESET CAL: DONE" screen appears, acknowledging that reset has occurred.

4. To return to the "TEST/MAINT" top-level menu screen, press **ESC** or **ENTER key**.

SECTION 7
RELAY OVERFEED TIMER FEATURE

The useful relay overfeed timer feature, **only available to a relay set for the "control" function,** is described in more detail in this section.

7.1 Why Use an Overfeed Timer

Suppose that you configure a control relay with a high phase to operate in response to increasing measured value. The control relay will then turn on whenever the measured value exceeds its preset setpoint. When the measured value decreases below the setpoint by an amount you preset (the deadband setting), the relay will turn off. But what if a damaged sensor or a process upset condition keeps the measured value above the setpoint or deadband setting? The control element (valve, pump, etc.) switched by that relay would then continue to operate. Depending on the application control scheme, this may excessively dispense costly chemical additives or overly drain or divert the process. Also, the control element itself could be damaged due to excessive continuous or unusual operation such as a pump that is running dry. The useful overfeed timer prevents undesirable conditions like these from happening. It restricts how long the relay and its connected control element will remain on regardless of conditions.

7.2 Configuring Relay Overfeed Timers

To set a relay overfeed timer, use its respective configuration menu screen. The time you set to restrict how long the relay stays on (0-999.9 minutes) should be just enough to provide acceptable results. An excessive setting may waste chemicals or the process itself. Initially, set this time as an estimate. Then, by experimenting and observing the response, periodically "fine tune" to optimize the setting.

7.3 Overfeed Timer "Timeout" Operation

When a control relay is on and its overfeed timer "times out," its annunciator will blink. This indicates that the relay is now off and will remain off until you manually reset the overfeed timer. After reset, the relay annunciator stops blinking. (All overfeed timers are reset simultaneously.)

7.4 Resetting Overfeed Timers

To manually reset all relay overfeed timers, please refer to Part Three, Section 6.3.

7.5 Interactions with Other Analyzer Functions

A relay overfeed timer can, and often will, interact with other analyzer functions while those functions are in use. Table C on the next page explains common overfeed timer interactions.

Table C -- RELAY OVERFEED TIMER INTERACTIONS WITH OTHER ANALYZER FUNCTIONS

Function Conditions		Resulting Action of Overfeed Timer
Manually Holding Relay Operation (When Outputs are Held at Start of Calibration)		
Off relay held in "off"	Overfeed timer was off	Overfeed timer remains off. After you change back to ACTIVE from the HOLD mode, the overfeed timer will remain off until the measured value (or a value you simulate) causes the relay to turn on.
On relay held in "on"	Overfeed timer was counting	Overfeed timer continues its "count down" until it turns the relay off. If you release HOLD before the timer "times out," the timer continues its "count down" until it turns the relay off or the timer automatically resets when the measured value (or a value you simulate) causes the relay to turn off. If you release HOLD after the timer has "timed out," it must be manually reset (Part Three, Section 6.3).
On relay held in "on"	Overfeed timer was timed out	Overfeed timer remains off which keeps the relay turned off. You must manually reset the timer (Part Three, Section 6.3).
Manually Transferring Relay Operation (When Outputs are Transferred at Start of Calibration)		
Off relay is transferred to "on"	Overfeed timer was off	Overfeed timer starts its "count down" until it turns the relay off. After you change the "on" relay back to "off," the overfeed timer automatically resets.
On relay is transferred to "off"	Overfeed timer was counting	Overfeed timer automatically resets. After you change the "off" relay back to "on," the overfeed timer starts its "count down" until it turns the relay off, or the timer automatically resets again when the measured value (or a value you simulate) causes the relay to turn off.
On relay is transferred to "off"	Overfeed timer was timed out	
Manually Testing Relay Operation (By Using TEST/MAINTENANCE Menu Screens)		
Off relay is changed to "on"	Overfeed timer was off	Overfeed timer starts its "count down" until it turns the relay off. After you change the "on" relay back to "off," the overfeed timer automatically resets.
On relay is changed to "off"	Overfeed timer was counting	Overfeed timer automatically resets. After you change the "off" relay back to "on," the overfeed timer starts its "count down" until it turns the relay off, or the timer automatically resets again when the measured value (or a value you simulate) causes the relay to turn off.
On relay is changed to "off"	Overfeed timer was timed out	
Operating a Relay By Simulating a Value (Using TEST/MAINTENANCE Menu Screens)		
Off relay is turned "on" by simulated value	Overfeed timer was off	Overfeed timer starts its "count down" until it turns the relay off. After you change the "on" relay back to "off," the overfeed timer automatically resets.
On relay is turned "off" by simulated value	Overfeed timer was counting	Overfeed timer automatically resets. After you change the "off" relay back to "on," the overfeed timer starts its "count down" until it turns the relay off, or the timer automatically resets again when the measured value (or a value you simulate) causes the relay to turn off.
On relay is turned "off" by simulation value	Overfeed timer was timed out	

PART FOUR - SERVICE AND MAINTENANCE

SECTION 1
GENERAL INFORMATION

1.1 Inspecting Sensor Cable

If a measurement problem exists and you suspect the sensor cable, inspect it for physical damage. If an interconnect cable is used, disconnect the cable at both ends (sensor and analyzer) and, using an ohmmeter, check its wires for continuity and internal shorts.

1.2 Replacing Fuse(s)

The analyzer is equipped with two board-mounted fuses (type T slow-blow; 5 mm x 20 mm size). Fuse values are shown next to each fuse (Figure 2-3 or 2-4). The fuses protect the 115 and 230 volt line power circuits.

WARNING:

DISCONNECT LINE POWER TO AVOID THE POSSIBILITY OF ELECTRICAL SHOCK.

1. After disconnecting line power, open the analyzer door and locate the fuses (shown in Figure 2-3 or 2-4).
2. Remove the blown fuse and replace it with a OMEGA fuse or an equivalent. Refer to Part Five -- Spare Parts -- for OMEGA fuse kit part number.
3. Reconnect line power and close the analyzer door.

1.3 Replacing Relays

The analyzer relays are soldered into a complex, multi-layered circuit board. To avoid the possibility of damaging this board while attempting to replace a relay:

- Simply return the complete analyzer to the OMEGA Customer Service Dept. or your local factory-authorized service organization for relay replacement.

-- or --

- Replace the complete scaling board assembly containing the relays. Refer to Part Five -- Spare Parts -- for the OMEGA scaling board assembly part number.

SECTION 2
PRESERVING MEASUREMENT ACCURACY

2.1 Keeping Sensor Clean

To maintain measurement accuracy, periodically clean the sensor. Operating experience will help you determine the intervals between cleanings (days, weeks, or months). Use the recommended cleaning procedure described in the OMEGA sensor operating instruction manual.

2.2 Keeping Analyzer Calibrated

Depending on the circumstances of the application, periodically calibrate the analyzer to maintain measurement accuracy.

☞ **Maintenance Tip!** Upon startup, frequently check the system until operating experience can determine the optimum time between calibrations that provides acceptable measurement results.

- pH Calibration: Use one of the methods described in Part Three, Section 5.2.
- ORP Calibration: Use only the method described in Part Three, Section 5.3.

Calibrating the analyzer with old, contaminated, or diluted pH buffers may cause measurement errors. **Do not reuse buffers.** Never pour the portion of buffer used for calibration back into the buffer bottle -- always discard it. Note that the pH value of a buffer changes slightly as its temperature changes. (Always refer to the pH value-versus-temperature table on the buffer bottle). Therefore, always allow the temperatures of the sensor and buffer to equalize while calibrating.

2.3 Avoiding Electrical Interference

☞ **Recommendation:** Do not run the sensor cable (and interconnect cable, if used) in the same conduit with line power.

Maintenance Tip! Excess cable should not be coiled near motors or other equipment that may generate electrical or magnetic fields. Cut cables to proper length during installation to avoid unnecessary inductive pickup ("electrical noise" may interfere with sensor signal).

SECTION 3
TROUBLESHOOTING

3.1 Ground Loops

The analyzer may be affected by a "ground loop" problem (two or more electrically grounded points at different potentials).

Symptoms Indicating A Possible Ground Loop

- Analyzer reading is offset from the actual value by a consistent amount, or ....
- Analyzer reading is frozen on one value, or ....
- Analyzer reading is "off scale" (upscale or downscale).

Although the source of a ground loop is difficult to determine, there are several common causes.

Common Causes of Ground Loops

- Components, such as recorders or computers, are connected to non-isolated analog outputs.
- Not using shielded cabling or failure to properly connect all cable shields.
- Moisture or corrosion in a junction box.

Determining if Ground Loop Exists

The following simple test can help to determine if there is a ground loop:

1. With the pH MEASURE screen displayed, put the sensor in a non-conductive container (plastic or glass) filled with a known value pH buffer. Note the analyzer reading for this solution.
2. Connect one end of a wire to a known earth ground, such as the analyzer grounding strip (at bottom of case) or a metal water pipe. Place the other end of this wire into the buffer next to the sensor.
3. Note the analyzer reading now and compare it with the reading taken in step 1. If the reading changed, a ground loop exists.

Finding Source of Ground Loop

Sometimes the source of a ground loop is easy to find, but it usually takes an organized approach to isolate the problem.

Troubleshooting Tip! Use a systematic troubleshooting method. If possible, start by grounding all shields and electrical grounds at one stable point. One at a time, turn off all pumps, motors and switches that are in contact with the process. Each time you do this, check if the ground loop still exists. Since the process media being measured is electrically conductive, the source of the ground loop may not be readily apparent.

3.2 Isolating Measuring System Problem

When experiencing problems, try to determine the primary measurement system component causing the problem (sensor, analyzer, or interconnect cable, if used):

Checking Electrical Connections

1. Verify that line power exists at the appropriate analyzer TB3 terminals.

2. Check all analyzer cable connections to ensure they are properly connected.

Verifying Sensor Operation

To verify sensor operation, refer to the procedure in the troubleshooting section of the sensor instruction manual.

Verifying Analyzer Operation

WARNING:

DISCONNECT LINE POWER TO AVOID THE POSSIBILITY OF ELECTRICAL SHOCK.

1. After disconnecting line power from the analyzer, disconnect the sensor.

2. Depending on the type of sensor, simulate the pH (or ORP) and temperature input signals by doing the following:

   - For OMEGA 5-wire Differential Technique Sensor

     A. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 20

(green) and Terminal 22 (red) on TB1, with the (+) lead wire on Terminal 22.

B. Connect a 1% tolerance, 301 ohm resistor between Terminals 14 (black) and 16 (yellow) on TB1.

C. Make sure the analyzer is configured for a 300 ohm NTC temperature element (Part Three, Section 4.2 under "Selecting Temperature Element").

■ For Conventional Combination Electrode

A. Keep the jumper connected. For analyzers with:

- "B" prefix serial numbers, jumper is between Terminals 18 and 20 on TB1.
- "A" or no letter prefix serial numbers, jumper is between Terminals 18 and 19 on TB1.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 20 (reference) and Terminal 22 (active) on TB1, with the (+) lead on Terminal 22.

C. Connect a 1% tolerance, 1000 ohm resistor between Terminals 14 and 15 on TB1.

D. Make sure the analyzer is configured for a Pt 1000 temperature element (Part Three, Section 4.2 under "Selecting Temperature Element").

3. Reconnect line power to the analyzer.

WARNING:

LINE POWER IS PRESENT. BE CAREFUL TO AVOID ELECTRICAL SHOCK.

4. Set the millivolt generator to provide each of the following outputs, checking the analyzer MEASURE screen each time for these corresponding pH (or mV) readings:

When Using Millivolt Generator	Analyzer pH Reading
Zero mV	Approximately 7 pH
(-)175 mV	Approximately 10 pH
(+)175 mV	Approximately 4 pH
When Using Only Jumper	**Analyzer pH Reading**
Zero mV	Approximately 7 pH

5. Change the MEASURE screen to show temperature:

   - For a OMEGA PHE-6028-PO 5-wire Differential Technique sensor, the temperature value should be approximately "25°C."
   - For a conventional combination electrode, the temperature value should be approximately "0°C."

If these readings are achieved, the analyzer is operating properly, but the sensor or interconnect cable (if used) may be inoperative. If you cannot get these readings, the analyzer is probably inoperative.

Verifying Interconnect Cable Integrity

WARNING:

LINE POWER IS PRESENT. BE CAREFUL TO AVOID ELECTRICAL SHOCK.

1. After disconnecting line power, remove the millivolt generator and temperature simulation resistor. (When using the OMEGA PHE-6028-PO 5-wire Differential Technique sensor, also remove the jumper from the analyzer TB1 terminals.)

2. Reconnect the sensor directly to the analyzer (purposely bypassing the interconnect cable and junction box, if used).

3. Reconnect line power to the analyzer.

4. Use a two-point method to calibrate the analyzer. (For ORP measurement, use the "1 POINT SAMPLE" method described in Part Three, Section 5.3.) If calibration is accomplished, the analyzer and sensor are operating properly. If the system cannot be calibrated, the sensor is probably inoperative.

5. If the interconnect cable was excluded in step 1, and it was determined that the analyzer and sensor are operating properly, the interconnect cable is probably faulty.

SECTION 4
ANALYZER REPAIR/RETURN

4.1 Customer Assistance

If you need spare parts, assistance in troubleshooting, or repair service, please contact your local OMEGA representative, or the OMEGA Customer Service Department at: 1-800-622-2378

4.2 Repair/Return Policy

All analyzers returned for repair or replacement must be freight prepaid and include the following information:

1. A clearly written description of the malfunction.
2. Name of person to contact and the phone number where they can be reached.
3. Proper return address for shipping analyzer(s) back. Include preferred shipping method (UPS, Federal Express, etc.) if applicable.
4. A purchase order if analyzer(s) is out of warranty to cover costs of repair.

NOTE: *If the analyzer is damaged during return shipment because of inadequate packaging, the customer is responsible for any resulting repair costs. (**Recommendation:** Use the original OMEGA shipping carton or an equivalent.)*

Also, OMEGA will not accept analyzers returned for repair or replacement unless they are thoroughly cleaned and all process material is removed.

PART FIVE - SPARE PARTS AND ACCESSORIES

	Description	Part Number
Analyzers with "B" Prefix Serial Numbers	Complete Door Assembly:	P53A2010-003
	Power Supply/Scaling Board Assembly	P53A2020-001
	Ribbon Interconnect Cable	1000A3355-001
Analyzers with "A" Prefix Serial Numbers	Complete Door Assembly	P53G1010-201
	Power Supply/Scaling Board Assembly	P53G1040-101
	Ribbon Interconnect Cable	1000A3334-001
Analyzers with No Letter Prefix Serial Numbers	Complete Door Assembly	P53G1010-201
	Power Supply/Scaling Board Assembly	P53G1040-101
	Ribbon Interconnect Cable	4W001

The following parts are common to all P53 Analyzers:

Fuse Kit (one 80 mA fuse and one 100 mA fuse per package)	1000G3315-101
Mounting Hardware Kit	1000G3228-101

MADE IN USA

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Industrial Water & Wastewater Treatment
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