.1 YEAR WARRANTY

MADE IN USA

CE

User's Guide

PHCN674 pH/ORP ANALYZER
1/4 DIN Panel Mount

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Manual No. M-3794/0302

PHCN-674
pH/ORP ANALYZER

(Panel-mount 1/4 DIN style;
selectable for pH or ORP measurement)

OPERATING INSTRUCTION MANUAL

PHCN-674
pH/ORP Analyzer

(Panel-mount 1/4 DIN style;
selectable for pH or ORP measurement)

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:

- Line voltage may be present at terminals on TB1 at the back of the analyzer enclosure. This may be hazardous. Always remove line power before going near this area of the analyzer. The front bezel assembly of the analyzer, however, 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. ITS PURPOSE IS TO WARN YOU OF THE POTENTIAL FOR PERSONAL INJURY.

CAUTION:

A CAUTION LOOKS LIKE THIS. ITS PURPOSE IS TO ALERT YOU TO POSSIBLE INSTRUMENT MALFUNCTION OR DAMAGE.

☞ ***NOTE:*** *A note looks like this. Its purpose is to alert you to important operating information.*

Definition of Equipment Symbols

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

This symbol, which appears on the analyzer POWER terminal block (shown in Figure 2-2), **means that this is a protective ground terminal** and alerts the user to connect an earth ground to it.

This symbol **means that there is alternating current present** and alerts the user 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 an Omega 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	Connect to SENSOR Terminal
Yellow	#4 on TB3
Shield	#5 on TB3
Black	#6 on TB3
White	#7 on TB3
Green	#8 on TB3
Red	#1 on TB4

2. The analyzer is supplied factory-set for use with the Omega 5-wire Differential Technique pH sensor. When using a conventional combination electrode, you must change the sensor type (see Part Three, Section 3.2, subheading "Selecting Sensor Type").

3. The analyzer is supplied factory-set for automatic temperature compensation using the 300 ohm (NTC300) temperature element built into most Omega Differential sensors. When using a sensor with a different temperature element, or if you want fixed MANUAL temperature compensation, you must change the temperature element type (see Part Three, Section 3.2, subheading "Selecting Temperature Element Type").

B. CONNECTING LINE POWER

Important: Follow instructions in Part Two, Section 3.6 to connect line power to the analyzer.

C. 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 Part Three, Section 3.2, subheading "Selecting Buffer Type").

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE ANALYZER -- (continued)

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 sub-heading in Part Three, Section 4.2 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 and relays to their active states (MEASURE screen appears).*

3. Press **MENU key** to display
```
≡MAIN MENU
▶CALIBRATE        ↓
```
.

4. Press **ENTER key** to display
```
≡CALIBRATE
▶SENSOR           ↓
```
.

5. Press **ENTER key** again to display
```
≡SENSOR
▶2 POINT BUFFER↓
```
.

6. Press **ENTER key** again to display
```
2 POINT BUFFER?
(HOLD OUTPUTS   )
```
.

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

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE ANALYZER -- (continued)

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 is displayed 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.

D. 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 3 for complete configuration details.

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PART FOUR - SERVICE AND MAINTENANCE

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ILLUSTRATIONS

TABLES

PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Capability Highlights

Sensor Input

The analyzer can be used with any Omega 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

The MEASURE screen (normal display mode) can provide four different readouts of measured data. With the MEASURE screen displayed, press ⇦ **and** ⇨ **key** to show:

1. Measured pH (or ORP, if selected).
2. Measured temperature (°C or °F).
3. Measured Analog Output 1 and 2 values (mA).
4. Measured pH (or ORP) and measured temperature.

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 3.6 for details.

Calibration Methods

Four methods are available to calibrate the analyzer for pH. See Part Three, Section 4.2 for details. For ORP calibration, refer to Section 4.3. The mA values for each analog output can also be calibrated (Section 4.4).

Analog Outputs

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

- Measured pH (or ORP).
- Measured 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).

See Part Three, Section 3.4 for analog output setup details.

Relays

The analyzer has two electromechanical relays with SPDT contacts. Each relay can be set to function as a CONTROL, ALARM, or STATUS relay (for diagnostics only). Each CONTROL or ALARM relay can be assigned to be driven by one of these measurements:

- Measured pH (or ORP).
- Measured temperature.

☞ ***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 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 setup details, see Part Three, Section 3.5.

1.2 Modular Construction

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

Line power must be connected to specifically designated terminals on TB1.

WARNING:

REMOVE LINE POWER BEFORE NEARING THIS AREA TO PREVENT 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 located on 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.

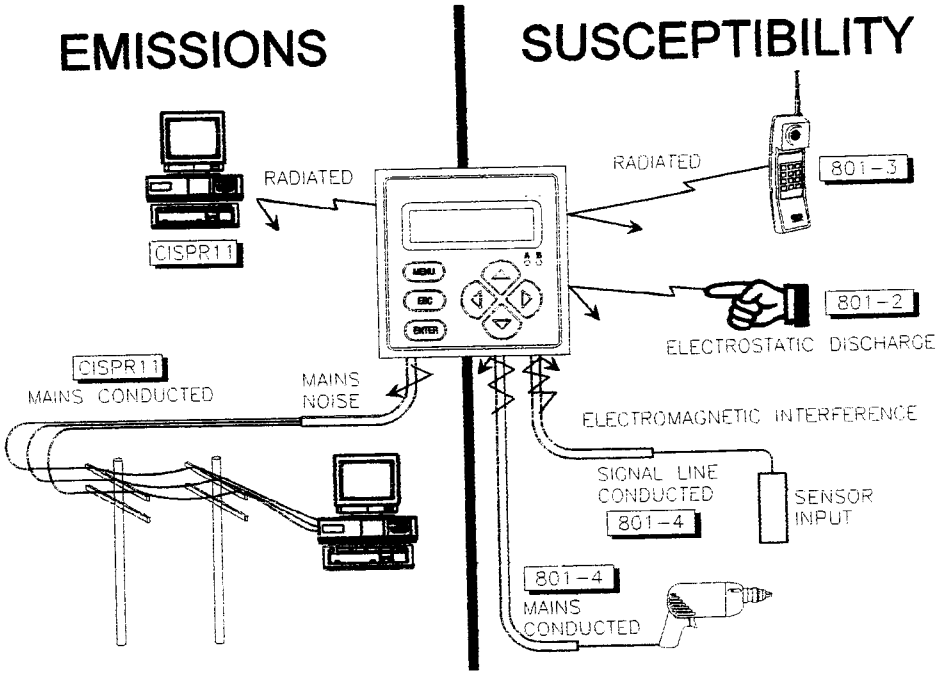


FIGURE 1-1 EMI/RFI Immunity Diagram

SECTION 2
SPECIFICATIONS

2.1 Operational

Display ..... Two-line by 16 character backlit LCD

NOTE: *The measured pH (or ORP) or temperature can be separately displayed, or both measurements can be shown together on a single screen.*

Measurement	Selectable Ranges
pH	-2.0 to 14.0 pH or -2.00 to 14.00 pH
ORP	-2100 to +2100 mV (fixed)
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 electromechanical relays; SPDT (Form C) contacts; U.L. rated 5A 115/230 VAC, 5A @ 30 VDC resistive
- Operational Mode ..... Each relay (A and B) 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 diagnostic WARNING condition exists
- Indicators ..... Relay A and B LEDs indicate respective relay 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 0.0-50.0°C

Sensor-to-Analyzer Distance:
- Omega 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 per foot

Power Requirements ..... 90-130 VAC, 50/60 Hz. (10 VA max.) or 190-260 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 or 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 ..... Enables configuration and retrieval of measured data for one analyzer using IBM-compatible PC

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 50081-2 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 per °C

2.3 Mechanical

Enclosure ..... Polycarbonate with NEMA 4X front panel; general purpose; two zinc-plated steel brackets for panel mounting

Mounting Configuration ..... Panel mounting

Net Weight ..... 1.7 lbs. (0.8 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. Depending on the sensor type, the maximum allowable distance between the sensor and analyzer is:

Omega 5-wire Differential Technique Sensor	Conventional Combination Electrode **with** Preamp	Conventional Combination Electrode **without** Preamp
3000 feet (914 m)	985 feet (300 m)	*100 feet (30 m)

*An Omega preamp can 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.

Recommendation: Directly connect the sensor to the analyzer to eliminate potential problems caused by wet environments when a junction box is used.

2. 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 analyzer enclosure dimensions and panel mounting details. Use the two supplied brackets to panel mount the analyzer. The brackets may be attached to the top and bottom of the analyzer case, or to each of its sides.

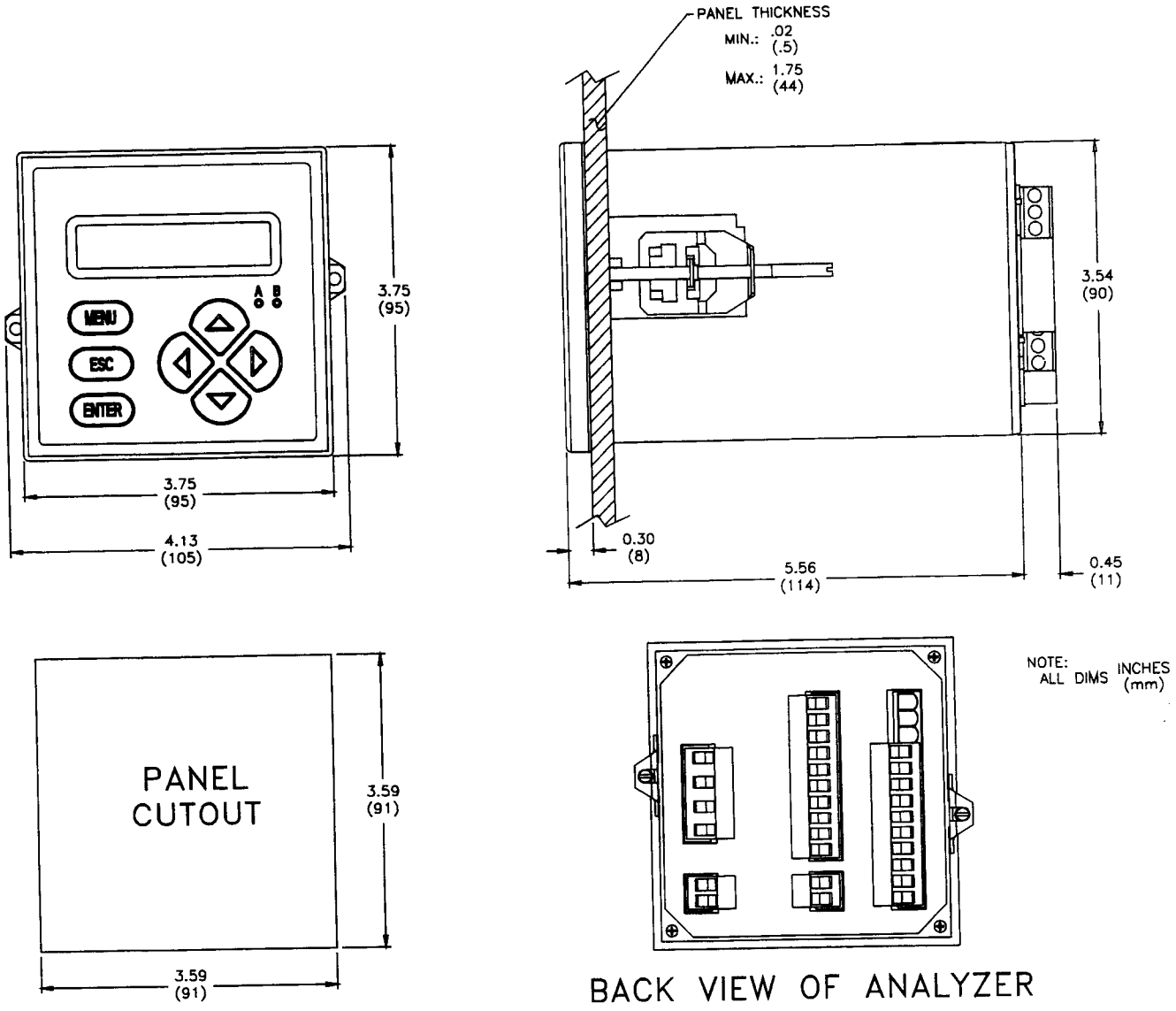


FIGURE 2-1 Analyzer Enclosure Dimensions and Panel Mounting Details

SECTION 3

ELECTRICAL CONNECTIONS

Figure 2-2 shows the terminal block arrangement and terminal designations on the back of the analyzer case.

NOTE: *For easier wiring, terminal blocks can be unplugged from their mating connectors. All terminals are suitable for single wires up to 14 AWG (2.5 mm^2).*

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 and connect them to earth ground.
2. Use Steward ferrite 28 B0590-000 or equivalent on:
   - Mains (line power) cable -- no turns required.
   - Sensor cable -- one turn required.
   - mA analog output cables -- two turns required.
   - Relay cables -- no turns required.
3. In harsh conducted RF conditions, connect the earth ground of the analyzer (Terminal 4 on TB1) to a local, known earth ground source.

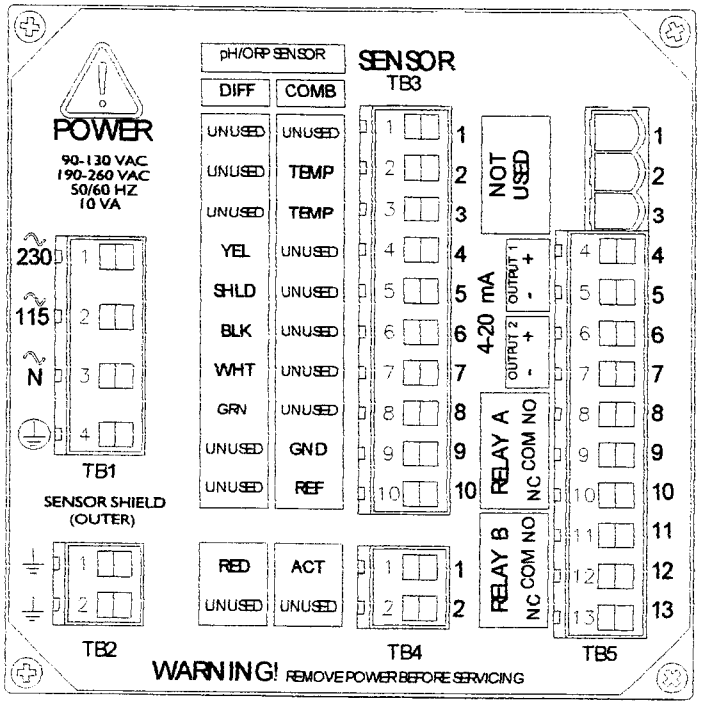


FIGURE 2-2 Analyzer Terminal Block Designations

3.1 Omega 5-Wire Differential Technique Sensor

All Omega 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.

For installations where the distance between sensor and analyzer exceeds the sensor cable length, indirectly connect the sensor to the analyzer using a junction box and interconnect cable.

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

Refer to Figure 2-3 and connect the sensor (or interconnect) cable wires to SENSOR Terminals 4 through 8 on TB3 and Terminal 1 on TB4, matching colors as indicated.

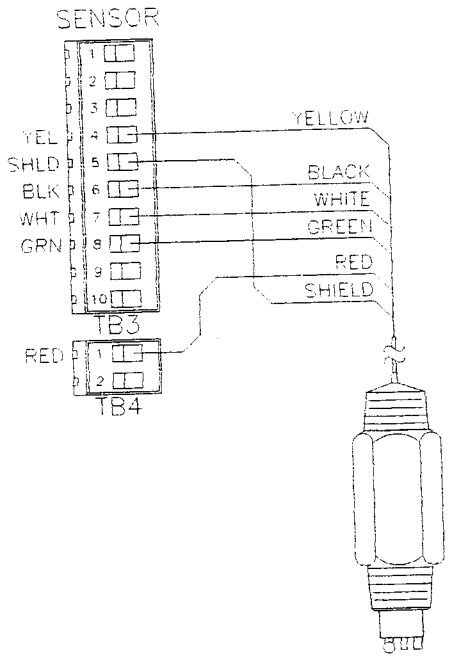


FIGURE 2-3 Connecting Omega 5-wire Differential Technique Sensor

NOTE: *For best immunity to electromagnetic interference, connect the sensor cable's shield wire to a "SENSOR SHIELD (OUTER)" terminal on TB2 instead of to Terminal 5 on TB3.*

3.2 Conventional Combination Electrode

The electrode must be within 100 ft. (30 m) of the analyzer (985 ft./300 m for electrode with preamp). Refer to Figure 2-4 and directly connect the electrode's coaxial cable to the analyzer.

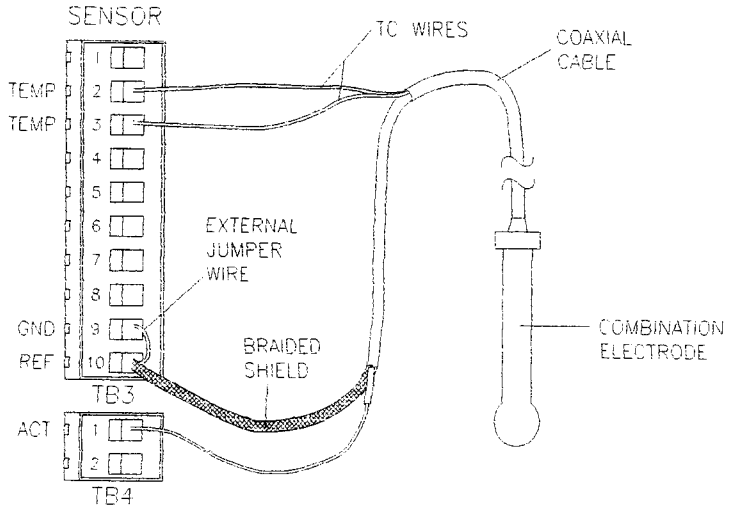


FIGURE 2-4 Connecting Conventional Combination Electrode

1. Connect the electrode's reference signal -- braided shield wire of coaxial cable (black insulated wire for Omega electrode) -- to "REF" Terminal 10 on TB3.
2. Connect the electrode's active signal -- center wire of coaxial cable (clear insulated wire for Omega electrode) -- to "ACT" Terminal 1 on TB4.
3. Connect a jumper between "GND" Terminal 9 and "REF" Terminal 10 on TB3.
4. Connect the electrode's temperature element (typically white and red insulated wires for Omega electrode) to "TEMP" Terminals 2 and 3 on TB3, attaching either wire to either terminal.

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). Refer to Figure 2-5 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 connecting Terminals 9 and 10 on TB3**. Instead, connect the ground rod wire to "GND" Terminal 9.

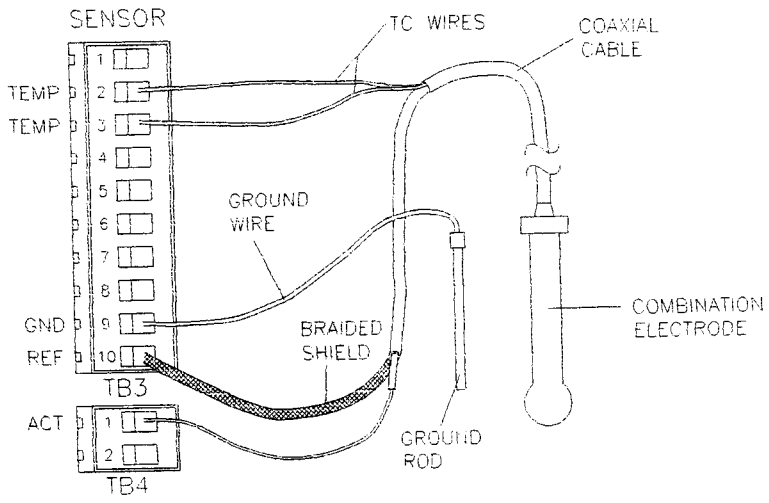


FIGURE 2-5
Connecting Conventional Combination Electrode with Ground Rod

3.4 Analog Outputs

Two analog outputs (1 and 2) are provided. Each output can be set to be 0/4-20 mA, and assigned to represent the measured pH/ORP or temperature. **The outputs are isolated from the inputs and earth ground, but not from each other.** For details on configuring the outputs, see Part Three, Section 3.4.

Wiring Tip! Use high quality, shielded instrumentation cable for connecting the analog outputs.

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

- **Output 1:** Connect the load to Terminals 4 and 5 on TB5, matching polarity as indicated.
- **Output 2:** Connect the load to Terminals 6 and 7 on TB5, matching polarity as indicated.

3.5 Relay Outputs

The analyzer is equipped with two electromechanical relays. For relay setup details, see Part Three, Section 3.5.

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 sets of SPDT relay outputs (Relays A and B) are provided at Terminals 8 through 13 on TB5. **The relay outputs are not powered.** The line power used to power the analyzer may also be used to power control/alarm devices with these relay contacts. Refer to Figure 2-6 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 LINE POWER IS NOT PRESENT WHILE CONNECTING WIRES TO TB5 RELAY TERMINALS.

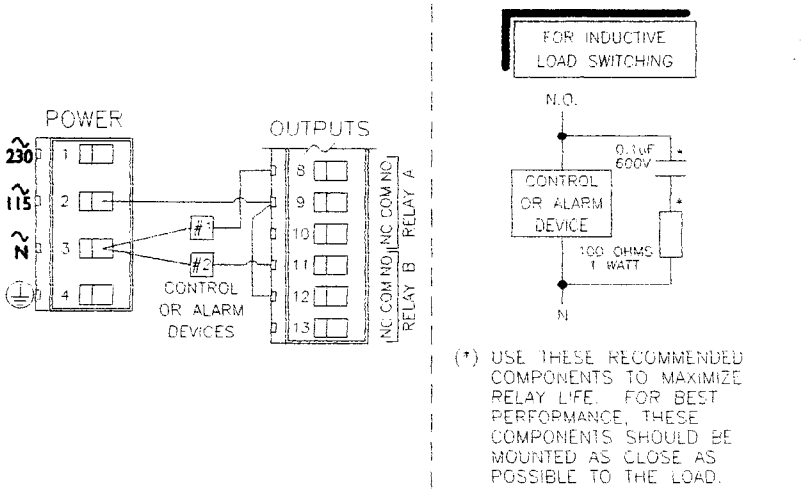


FIGURE 2-6
Connecting Control/Alarm Device(s) to Electromechanical Relay(s)

3.6 Line Power

Refer to Figure 2-7, 2-8 or 2-9 and connect line power to appropriate terminals on TB1 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 TB1 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 "ground symbol" terminal on TB1.*

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.*

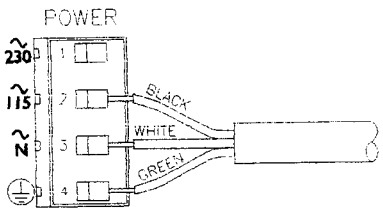


FIGURE 2-7
Connecting 115 Volt
Single Phase Line Power
(90-130 VAC)

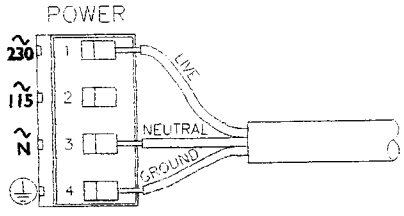


FIGURE 2-8
Connecting 230 Volt
Single Phase Line Power
(190-260 VAC)

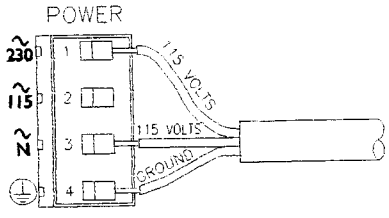


FIGURE 2-9
Connecting 230 Volt
Split Phase Line Power
(190-260 VAC)

PART THREE - OPERATION

SECTION 1
USER INTERFACE

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

1.1 Display

The backlit, high resolution display is factory-set for optimum viewing contrast under all lighting conditions. By using the keypad, you can display three basic types of screens:

- **MEASURE screen** to sequentially show, by pressing the ⇦ **or** ⇨ **key**, the measured pH (or ORP), temperature, analog Output 1 and 2 mA values, and the pH (or ORP) with measured temperature.
- **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 Relay A and B Indicators

Relay A and B red LED indicators light when their respective relay energizes. (When a relay overfeed timer has "timed out," the respective indicator blinks continuously until the overfeed condition is resolved.)

1.3 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 ▶ CALIBRATE" screen). To display the CONFIGURE and TEST/MAINT main branches of the menu tree, press the ⇩ **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 submenu or edit/selection screen, or enters (saves) values/selections.

3. **ESC key:** Pressing this key always takes the display up one level in the menu tree. (Example: With the "MAIN MENU" screen displayed, pressing the **ESC key** once takes the display up one level to the MEASURE screen.) This key can also "abort" the procedure to change a value or selection.

4. ⇦ **and** ⇨ **keys:** Depending on the type of displayed screen, these keys do the following:

   - MEASURE Screen: Changes readout (in continuous loop sequence) to show different measurements.
   - Menu Screens: These 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: These keys are non-functional.
   - Menu Screens: Moves up or down respectively between other same-level menu screens.
   - Edit/Selection Screens: "Fine" adjusts the displayed numerical value (holding key down changes value faster), or moves up or down between choices.

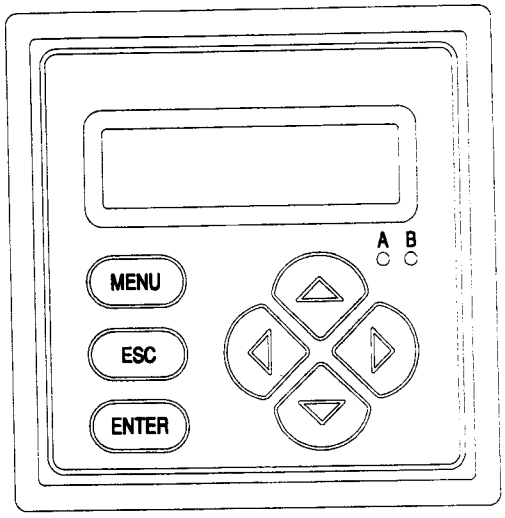
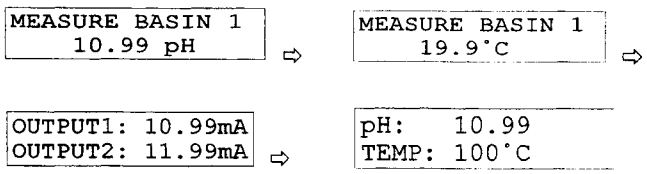


FIGURE 3-1 Analyzer Keypad

1.4 MEASURE Screen (normal display mode)

The MEASURE screen is normally displayed. Pressing the **MENU key** temporarily replaces the MEASURE screen with various screens to calibrate, configure, or test the analyzer. 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.

The MEASURE screen can be viewed in one of four different readout versions. To select between them, in continuous loop sequence, press the ⇦ **or** ⇨ **key**:



☞ ***NOTE:*** *When the analyzer returns to its normal MEASURE screen mode, the appearing MEASURE screen readout is always the version last selected. Note that the upper two MEASURE screen readout examples show "BASIN 1" notations on their top lines, illustrating the analyzer notation feature. To create your own notation, refer to Part Three, Section 3.2, under the subheading "ENTER NOTE (top line of MEASURE screen)."*

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

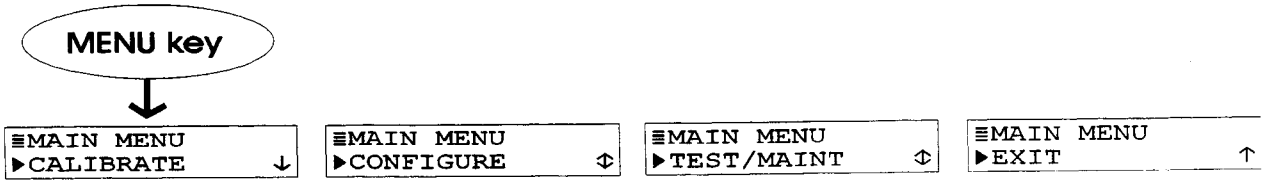
Each layer contains an EXIT screen to return the display up one level to the previous layer of screens.

☞ **Menu Structure Tip!** For operating convenience, the layers within each main branch are organized with the most frequently used function screens at their beginning, rather than the function screens used for initial startup.

2.1 Displaying Main Branch Selection Screens

1. Press **MENU key** to always display the start of the analyzer menu tree (CALIBRATE branch selection screen).

2. Press ⇩ **and** ⇧ **keys** to select between the three main branch selection screens or the EXIT screen:

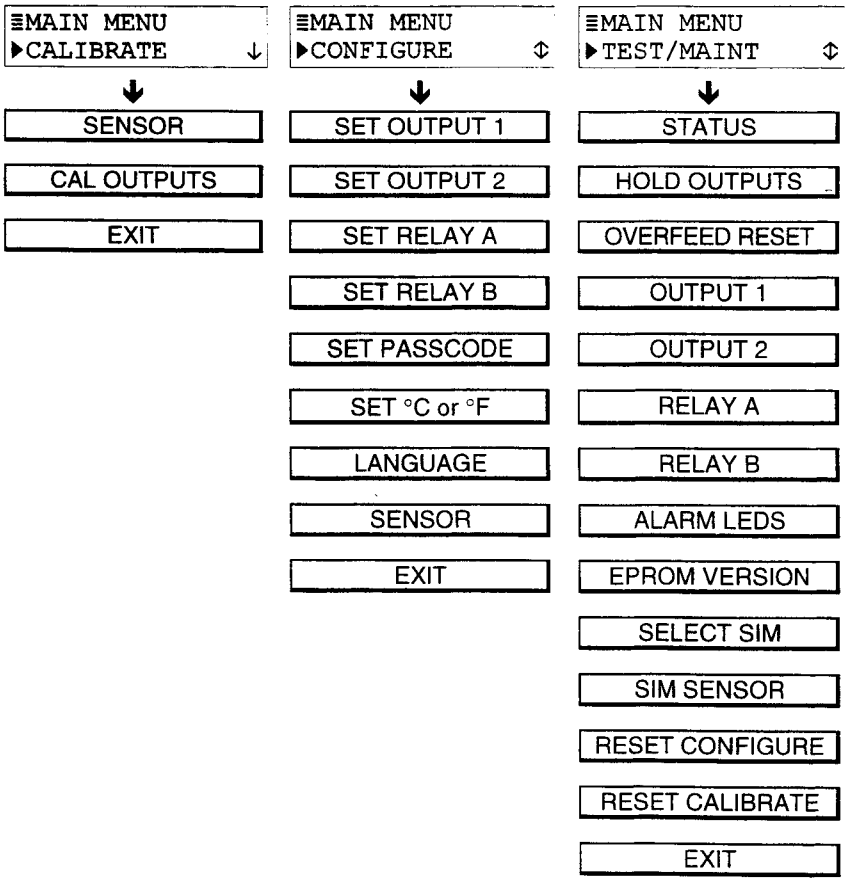


3. With the desired branch selection screen displayed, press **ENTER key** to display the first top-level menu screen within that branch.

2.2 Displaying Top-level Menu Screens

With the first top-level menu screen within the desired main branch displayed, use the ⇩ **and** ⇧ **keys** to scroll through other top-level screens to access a desired screen.

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



☞ **Menu Structure Tip!** A menu screen with a horizontal bar symbol (≡) at the start of its first line indicates there is a related submenu or edit/selection screen.

A menu screen with a "▶" symbol at the start and a "↓" symbol at the end of its second line indicates that you can select other screens within the same layer by pressing the ⇩ **key**. A "↕" symbol at the end of the second line indicates that you can move up or down between screens by respectively pressing the ⇧ **or** ⇩ **key**. When a "↑" symbol appears, it indicates you have reached the end of the screens in that layer. You can select previous screens using the ⇧ **key**.

2.3 Displaying Submenu Screens

After selecting a top-level menu screen, press the **ENTER key** to display a related submenu or edit/selection screen:

- **Submenu Screens** always have a first line starting with a horizontal bar symbol. Pressing the ⇩ **key** displays one or more related menu screens within this same level.

  Example: With this submenu screen displayed:

  ```
  ≣SET OUTPUT 1
  ▶SET PARAMETER ↓
  ```

  pressing the ⇩ **key** displays this related, same-level submenu screen:

  ```
  ≣SET OUTPUT 1
  ▶SET 4mA VALUE ↕
  ```

- **Edit/Selection Screens** always have a first line ending with a "?". Pressing the ⇩ **or** ⇧ **key** changes the value/choice enclosed by parenthesis (second line on screen).

  Example: With this submenu 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
CONFIGURING THE ANALYZER

NOTE: *When the passcode feature is enabled (Section 3.6), you must successfully enter the passcode before attempting to enter a configuration setting.*

3.1 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      ↓
```
.
2. Press ⇩ **key** once to display
```
≡MAIN MENU
▶CONFIGURE      ↕
```
.
3. Press **ENTER key** to display
```
≡CONFIGURE
▶SET OUTPUT 1   ↓
```
.
4. Press ⇩ **key** six times to display
```
≡CONFIGURE
▶LANGUAGE       ↕
```
.
5. Press **ENTER key** to display
```
LANGUAGE?
(ENGLISH        )
```
. Use ⇩ **and** ⇧ **keys** to view the language choices.
6. With the desired language displayed, press **ENTER key** to enter this selection.

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

3.2 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 for calibration, input signal filtering, pulse suppression, etc.

SELECT SENSOR Type

1. With the
```
≡CONFIGURE
▶LANGUAGE       ↕
```
screen displayed, press ⇩ **key** once to display
```
≡CONFIGURE
▶SENSOR         ↕
```
.

2. Press **ENTER key** to display
```
≡SENSOR
▶SELECT SENSOR ↓
```
.

3. Press **ENTER key** again to display a screen like
```
SELECT SENSOR?
(DIFF pH      )
```
. Use ⇩ **and** ⇧ **keys** to view the four choices:

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

WARNING:

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

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

Select DISPLAY FORMAT

The MEASURE screen can be set to display pH in a XX.X or XX.XX format. The format setting has no effect on edit/ selection menu screens which always show pH resolution as XX.XX. (For ORP, the display resolution is fixed to show mV values only in whole numbers.)

1. With the
```
≡SENSOR
▶SELECT SENSOR ↓
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▶DISPLAY FORMAT↕
```
.

2. Press **ENTER key** to display a screen like
```
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.

SELECT BUFFER Set for pH Calibration

Configure the analyzer to use one of the following 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 ≡SENSOR ▶DISPLAY FORMAT⇕ screen displayed, press ⇩ **key** <u>once</u> to display ≡SENSOR ▶SELECT BUFFER ⇕ .
2. Press **ENTER key** to display a screen like SELECT BUFFER? (4,7,10) . Use ⇩ **and** ⇧ **keys** to view both choices (4, 7, and 10, or DIN 19267).
3. With the desired choice displayed, press **ENTER key** to enter this selection.

Select PURE H2O COMP (for special applications)

Only for Special Applications: When measuring pH in solutions with the weakly dissociating electrolytes ammonia or morpholine, use this pure water temperature compensation feature to provide additional temperature correction factors. 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 ≡SENSOR ▶SELECT BUFFER ⇕ screen displayed, press ⇩ **key** <u>once</u> to display ≡SENSOR ▶PURE H2O COMP ⇕ .

2. Press **ENTER key** to display a screen like
```
PURE H2O COMP?
(NONE          )
```
. 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.

SET ISO POINT (isopotential for special Differential pH sensor)

This configuration setting only applies to Omega 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 special Omega Differential pH sensor.

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

1. With the
```
≡SENSOR
▶PURE H2O COMP ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▶SET ISO POINT ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET ISO POINT?
(7.00 pH       )
```
.

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

SET 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
```
≡SENSOR
▸SET ISO POINT ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▸SET FILTER    ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS     )
```
.

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.)

Select PULSE SUPPRESS (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
```
≡SENSOR
▸SET FILTER    ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▸PULSE SUPPRESS⇳
```
.

2. Press **ENTER key** to display a screen like
```
PULSE SUPPRESS?
(OFF           )
```
. Use ⇩ **and** ⇧ **keys** to view both choices (OFF or ON).

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

ENTER NOTE (top line of 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
```
≡SENSOR
▶PULSE SUPPRESS⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▶ENTER NOTE      ⇳
```
.

2. Press **ENTER key** to display
```
ENTER NOTE?
([P]H            )
```
. Create desired notation within second line parenthesis:

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

   B. Press ⇨ **key** once to select the next character, and use ⇧ **and** ⇩ **keys** to select its desired character.

   C. Repeat procedure until desired notation is displayed.

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

Select TEMP ELEMENT Type

Configure the analyzer to define the temperature element being used for temperature compensation.

NOTE: *When not using a temperature element, select "MANUAL" for the element type and enter a rem-perature value. This prevents (or clears) a "WARNING: CHECK STATUS" message due to the analyzer detecting no temperature element.*

1. With the
```
≡SENSOR
▶ENTER NOTE      ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR
▶TEMP ELEMENT    ⇳
```
.

2. Press **ENTER key** to display
```
≡TEMP ELEMENT
▶SELECT TYPE     ⇩
```
.

3. Press **ENTER key** again to display a screen like
```
SELECT TYPE?
(NTC 300         )
```
. 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 temp. comp. when not using a temperature element.

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

   A. With the ≡TEMP ELEMENT / ▶SELECT TYPE ↓ screen displayed, press ⇩ **key** once to display ≡TEMP ELEMENT / ▶SET MANUAL ⇕.

   B. Press **ENTER key** to display a screen like SET MANUAL? / (25.0°C).

   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.)

3.3 SET °C or °F (temperature display format)

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 "XX.X."

1. With the ≡TEMP ELEMENT / ▶SELECT TYPE ↓ or ≡TEMP ELEMENT / ▶SET MANUAL ⇕ screen displayed, press **ESC key** twice to display the ≡CONFIGURE / ▶SENSOR ⇕ screen.

2. Press ⇧ **key** -- not ⇩ **key** -- twice to display the ≡CONFIGURE / ▶SET °C OR °F ⇕ screen.

3. Press **ENTER key** to display a screen like SET °C OR °F? / (°C). Use ⇩ **and** ⇧ **keys** to view both choices (°C or °F).

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

3.4 Configuring Analog Outputs (1 and 2)

The analyzer provides two isolated analog outputs (1 and 2). During normal operation, the outputs can be held at their present values for up to 30 minutes by using the "HOLD OUTPUTS" function in the TEST/MAINT menu. **The listed configuration instructions are for Output 1. Configure Output 2 in the same way using its respective menu screens.**

SET PARAMETER (representation)

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

1. With the
```
≡CONFIGURE
▶SET °C OR °F   ⇕
```
screen displayed, press ⇧ **key** -- not ⇩ **key** -- five times to display
```
≡CONFIGURE
▶SET OUTPUT 1  ↓
```
.

2. Press **ENTER key** to display
```
≡SET OUTPUT 1
▶SET PARAMETER ↓
```
.

3. Press **ENTER key** again to display a screen like
```
SET PARAMETER?
(SENSOR         )
```
. Use ⇩ **and** ⇧ **keys** to view both choices (SENSOR or TEMPERATURE).

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

SET 0/4 and 20 mA VALUES

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
```
≡SET OUTPUT 1
▶SET PARAMETER ↓
```
screen displayed, press ⇩ **key** once to display
```
≡SET OUTPUT 1
▶SET 4mA VALUE ⇕
```
.

2. Press **ENTER key** to display a screen like
```
SET 4mA VALUE?
(7.00 pH      )
```

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
```
≡SET OUTPUT 1
▶SET 4mA VALUE ⇳
```
screen re-appears, press ⇩ **key** once to display
```
≡SET OUTPUT 1
▶SET 20mA VALUE⇳
```

5. Press **ENTER key** to display a screen like
```
SET 20mA VALUE?
(12.33 pH      )
```

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.*

SET TRANSFER Value (mA)

Normally, each analog output is active, responding to the measured value of its assigned parameter (pH or ORP, or temperature). During calibration, however, you can transfer (XFER) each output to a preset value to operate a control element by an amount corresponding to that value.

To set a milliamp transfer value for an analog output to suit your application:

1. With the
```
≡SET OUTPUT 1
▶SET 20mA VALUE⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SET OUTPUT 1
▶SET TRANSFER  ⇳
```

2. Press **ENTER key** to display a screen like
```
SET TRANSFER?
(20.00 mA      )
```

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.)

SET 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
```
≡SET OUTPUT 1
▶SET TRANSFER  ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SET OUTPUT 1
▶SET FILTER    ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS      )
```
.

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.)

Select SCALE 0 mA/ 4 mA (low endpoint)

Select each output to be 0-20 mA or 4-20 mA.

1. With the
```
≡SET OUTPUT 1
▶SET FILTER    ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SET OUTPUT 1
▶SCALE 0mA/4mA ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SCALE 0mA/4mA?
(4mA            )
```
. Use ⇩ **and** ⇧ **keys** to view both choices (0mA or 4mA).

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

3.5 Configuring Relays (A and B)

The analyzer is equipped with two electromechanical relays (A and B). 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. For details on each relay function, see subsection "SET FUNCTION Mode."

During calibration, CONTROL and ALARM relays can be held, transferred to preset on/off states, or remain active. During normal measurement operation, these relays can be held in their present on/off states for up to 30 minutes by using the "HOLD OUTPUTS" function in the TEST/MAINT menu.

The listed configuration instructions are for Relay A. Configure Relay B in the same way using its respective menu screens.

SET PARAMETER (representation)

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

1. With the
```
≡SET OUTPUT 1
▶SCALE 0mA/4mA ⇳
```
screen displayed, press **ESC key** once to display
```
≡CONFIGURE
▶SET OUTPUT 1  ↓
```
.

2. Press ⇩ **key** twice to display
```
≡CONFIGURE
▶SET RELAY A   ⇳
```
.

3. Press **ENTER key** to display
```
≡SET RELAY A
▶SET PARAMETER ↓
```
.

4. Press **ENTER key** again to display a screen like
```
SET PARAMETER?
(SENSOR        )
```
. Use ⇩ **and** ⇧ **keys** to view both choices (SENSOR or TEMPERATURE).

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

SET FUNCTION Mode (alarm, control, or status)

Each relay can be selected to function as a:

- **ALARM relay** (with separate high and low alarm points and deadbands) that operates in response to the measured pH (or ORP) or temperature.
- **CONTROL relay** (with phasing, setpoint, deadband, and overfeed timer) that operates in response to the measured pH (or ORP) or temperature.
- **STATUS relay** that 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 (see Part Three, Section 5.1 for details.)

1. With the
```
≡SET RELAY A
▶SET PARAMETER ↓
```
screen displayed, press ⇩ **key** once to display
```
≡SET RELAY A
▶SET FUNCTION  ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FUNCTION?
(ALARM          )
```
. Use ⇩ **and** ⇧ **keys** to view the choices (ALARM, CONTROL, or STATUS).

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

SET TRANSFER Mode (relay on or off)

Normally, each CONTROL or ALARM relay is active, responding to the measured value of its assigned parameter (pH or ORP, or temperature). During calibration, however, you can transfer each relay to a preset on/off transfer state to suit your application:

1. With the
```
≡SET RELAY A
▶SET FUNCTION  ⇳
```
screen displayed, press ⇩ **key** once to display
```
≡SET RELAY A
▶SET TRANSFER  ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET TRANSFER?
(DE-ENERGIZED   )
```
. Use ⇩ **and** ⇧ **keys** to view both choices (DE-ENERGIZED or ENERGIZED).

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

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 6.
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 STATUS Relay	
No settings available – status relay is not configurable.	

NOTE: *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 relays, may be beneficial in eliminating process "overshoot" when

there are long process pipe runs or delays in mixing.

Suppose Relay A is an ALARM. To set configuration values:

1. With the ≡SET RELAY A / ▶SET TRANSFER ↕ screen displayed, press ⇩ **key** once to display ≡SET RELAY A / ▶ACTIVATION ↕.
2. Press **ENTER key** to display the first relay "ACTIVATION" screen setting.
3. Use the same basic keypad operations described in previous setup procedures to enter the desired value for the displayed relay activation setting.
4. Repeat this procedure for each relay activation setting.

3.6 SET PASSCODE (feature enabled/ disabled)

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

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

- **ENABLED:** With the passcode feature 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 passcode is factory-set to "**3 4 5 6**." It cannot be changed.

To enable or disable the passcode feature:

1. With the
```
≡CONFIGURE
▶SET OUTPUT 1  ↓
```
screen displayed, press ⇩ **key** four times to display
```
≡CONFIGURE
▶SET PASSCODE  ↕
```
.

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.

3.7 Configuration Setting Summary

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	All Outputs: 12 mA	
SET FILTER?	0-60 seconds	All Outputs: 0 seconds	
SCALE 0mA/4mA?	0 mA or 4 mA	All Outputs: 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	All Relays: 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	All Relays: DE-ENERGIZED	
OFF DELAY?	0-300 seconds	All Relays: 0 seconds	
ON DELAY?	0-300 seconds	All Relays: 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 or 0.0°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 or 0.0°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 or 0.0°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 4
CALIBRATING THE ANALYZER

4.1 Things to Know About Calibration

Four methods are available to calibrate the analyzer for pH measurement (Section 4.2). For ORP calibration, use only the 1-POINT SAMPLE method described in Section 4.3. The mA value for each analog output can also be calibrated (Section 4.4).

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.6), you must successfully enter the passcode before attempting to calibrate the analyzer.*

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

Aborting an In-progress Calibration

An in-progress calibration can always be aborted:

1. Press **ESC key** to display the "ABORT: YES?" screen. (Pressing ⇧ **or** ⇩ **key** displays "ABORT: NO?" screen. Then pressing **ENTER key** continues calibration.)
2. Press **ENTER key** to abort calibration.

3. With the "CONFIRM ACTIVE?" screen displayed, press **ENTER key** to return the analog outputs and relays to their active states (MEASURE screen appears).

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

- With "CAL REPEAT?" screen selected, press **ENTER key** to repeat calibration of the point.
- With "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).

4.2 pH Calibration

Based on convenience and your application requirements, use one of the four available methods for pH calibration.

☞ ***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 requires 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 3.2 under subheading "Selecting Buffer Type" for selection details.)

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

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. Press **ENTER key** to display
```
≣CALIBRATE
▶SENSOR                ↓
```
.

4. Press **ENTER key** to display
```
≣SENSOR
▶2 POINT BUFFER↓
```
.

5. 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 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, making calibration inaccurate.*

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 within a 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 its 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 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.

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 3.2 under subheading "Selecting Buffer Type" for selection details.)

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

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
```
≡MAIN MENU
▶CALIBRATE      ↓
```
.

3. Press **ENTER key** to display
```
≡CALIBRATE
▶SENSOR         ↓
```
.

4. Press **ENTER key** to display
```
≡SENSOR
▶2 POINT BUFFER↓
```
.

5. Press ⇩ **key** <u>once</u> to display
```
≡SENSOR
▶1 POINT BUFFER↕
```
.

6. Press **ENTER key** to display
```
1 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 value.

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

8. With the
```
1 POINT BUFFER:
SAMPLE READY?
```
screen displayed and the sensor in the buffer, press **ENTER key** to confirm.

   While the
```
1 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 the point.

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

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration, you can <u>manually</u> 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, making calibration inaccurate.*

9. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be within a 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 its performance. If the slope remains low and you are using an 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 active states (MEASURE screen appears).

This completes "1 POINT BUFFER" calibration.

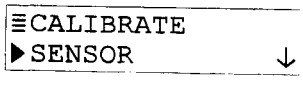
2 POINT SAMPLE Method

This method requires you to enter the known pH values of two pH buffers or two process samples. Determine sample values using laboratory analysis or comparison readings.

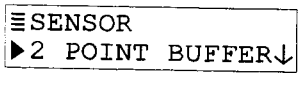
1. Immerse the sensor in the first sample (or buffer). **Important:** Allow the sensor and sample temperatures to equalize. Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display

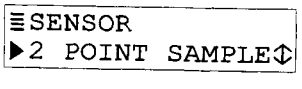

.

3. Press **ENTER key** to display


.

4. Press **ENTER key** to display


.

5. Press ⇩ **key** twice to display


.

6. Press **ENTER key** to display `2 POINT SAMPLE? (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.

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 using a pH buffer, 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 and complete 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 screen appears showing the measurement reading.

```
2 POINT SAMPLE:
PT2 = X.XX pH
```

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 within a 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 its performance. If the slope remains low and you are using an 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 the pH buffer or sample. Determine the sample value using laboratory analysis or a comparison reading.

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
```
≡MAIN MENU
▶CALIBRATE          ↓
```
.

3. Press **ENTER key** to display
```
≡CALIBRATE
▶SENSOR             ↓
```
.

4. Press **ENTER key** to display
```
≡SENSOR
▶2 POINT BUFFER↓
```
.

5. Press ⇩ **key** three times to display
```
≡SENSOR
▶1 POINT SAMPLE⇕
```
.

6. Press **ENTER key** to display
```
1 POINT SAMPLE?
(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.

7. With the desired screen 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 using a pH buffer, 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 within a 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 its performance. If the slope remains low and you are using an 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.

4.3 ORP Calibration

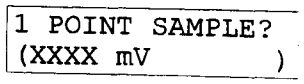
Calibrate the analyzer for ORP measurement using only this "1 POINT SAMPLE" method.

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 reference solution or sample. Determine the sample value using laboratory analysis or a comparison reading.

1. Immerse the sensor in the sample (or reference solution).
2. Press **MENU key** to display `≡MAIN MENU ▶CALIBRATE ↓`.
3. Press **ENTER key** to display `≡CALIBRATE ▶SENSOR ↓`.
4. Press **ENTER key** to display `≡SENSOR ▶1 POINT SAMPLE↓`.
5. Press **ENTER key** to display `1 POINT SAMPLE? (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 screen displayed, press **ENTER key** to enter this selection.
7. 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.
8. 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.

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

10. With the static 

screen displayed, use ⇧ **and** ⇩ **keys** to adjust the displayed value to exactly match the known mV value of the sample (or reference solution).

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

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

This completes ORP calibration.

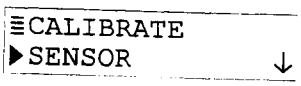
4.4 Analog Outputs (1 and 2) Calibration

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.**

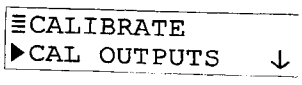
☞ ***NOTE:*** *When an output is configured to be 0-20 mA, the analyzer will calibrate the 4 mA and 20 mA values (not the 0 mA value). Also, the analyzer adjustment range for output values during calibration is ± 2 mA.*

1. Press **MENU key** to display 

.

2. Press **ENTER key** to display 

.

3. Press ⇩ **key** once to display 

.

4. Press **ENTER key** to display
```
≡CAL OUTPUTS
▶CAL OUTPUT 1 ↓
```
.

5. Press **ENTER key** again to display
```
≡CAL OUTPUT 1
▶CAL OUT 1 4mA ↓
```
.

6. Press **ENTER key** again to display a screen like
```
CAL OUT 1 4mA?
(XXX          )
```
. The displayed value is "counts" -- not mA -- that dynamically change when the output is adjusted.

7. Use a calibrated digital multimeter to measure Output 1's actual minimum value provided at Terminals 4 and 5 on the TB5.

8. 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.

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

10. After the
```
≡CAL OUTPUT 1
▶CAL OUT 1 4mA ↓
```
screen re-appears, press ⇩ **key** once to display
```
≡CAL OUTPUT 1
▶CAL OUT 1 20mA↕
```
.

11. Press **ENTER key** to display a screen like
```
CAL OUT 1 20mA?
(XXXX         )
```
. Once again, the displayed value is "counts" -- not mA -- that dynamically change when the output is adjusted.

12. Use a calibrated digital multimeter to measure Output 1's actual maximum value.

13. 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.

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

This completes Output 1 calibration.

SECTION 5
TEST/MAINTENANCE

The analyzer has TEST/MAINT menu screens to:

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

5.1 STATUS Checking (analyzer, sensor, and relays)

The system diagnostic capabilities of the analyzer enable you to 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 sensor or analyzer "FAIL" diagnostic condition has been detected. To determine the condition causing the warning, display the "STATUS" screens.

1. Press **MENU key** to display
```
≡MAIN MENU
▶CALIBRATE          ↓
```
.

2. Press ⇩ **key** <u>twice</u> to display
```
≡MAIN MENU
▶TEST/MAINT         ↕
```
.

3. Press **ENTER key** to display
```
≡TEST/MAINT
▶STATUS             ↓
```
.

4. Press **ENTER key** again 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: TEMP 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 measuring range.

6. With the "STATUS: TEMP OK" screen displayed, press **ENTER key** once to view the "STATUS: RLY A" screen. Press the **ENTER key** again to view the "STATUS: RLY B" screen. 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 system diagnostic 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 or high alarm point. Status Relay: Analyzer has not detected system diagnostic condition.
TIMEOUT (Relay not energized; LED is blinking.)	Control Relay: Overfeed timer has timed out; manually reset it. ***NOTE:*** *TIMEOUT only applies to control relays.*
COUNTING (Relay energized; LED is on.)	Control Relay: Overfeed timer is counting, but has not timed out. ***NOTE:*** *COUNTING only applies to control relays.*

7. To end status checking, press **ESC** or **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.2 HOLD OUTPUTS

The analyzer has a convenient feature to hold both analog outputs (1 and 2) at their present mA values for up to 30 minutes, suspending operation of any connected devices.

1. With the
```
≣TEST/MAINT
▶STATUS                    ↓
```
screen displayed, press ⇩ **key** once to display
```
≣TEST/MAINT
▶HOLD OUTPUTS              ↕
```
.

2. Press **ENTER key** to immediately hold the analog outputs ("HOLD OUTPUTS: ENTER TO RELEASE" screen appears, acknowledging hold is operating).

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 end output hold at any time and return analog outputs back to their "active" states, press **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.3 OVERFEED RESET (relay timers)

When a relay overfeed timer "times out," as indicated by its blinking LED, the timer must be manually reset using TEST/MAINT menu screens. The LED stops blinking after reset. **All overfeed timers are manually reset at once.**

1. With the
```
≣TEST/MAINT
▶STATUS                    ↓
```
screen displayed, press ⇩ **key** twice to display
```
≣TEST/MAINT
▶OVERFEED RESET↕
```
.

2. Press **ENTER key** to reset all overfeed timers at once ("OVERFEED RESET: DONE" screen appears, acknowledging reset has occurred).

3. To return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.4 Output (1 and 2) Analog Test Signals

The analyzer can provide analog output test signals of a desired mA value to confirm operation of connected devices. **This procedure only provides an Output 1 test signal. Provide an Output 2 test signal in the same way using its respective menu screens.**

1. With the
```
≡TEST/MAINT
▶STATUS                ↓
```
screen displayed, press ⇩ **key** until you display
```
≡TEST/MAINT
▶OUTPUT 1              ↕
```
.

2. Press **ENTER key** to display a screen like
```
OUTPUT 1?
(XX.XXmA          )
```
.

NOTE: *The mA test signal for Output 1 is now active. Its value is shown on this screen.*

3. Adjust the displayed value to obtain a desired mA test signal. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

4. To remove the output test signal and return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.5 RELAY (A and B) Operating Test

Relays A and B can be tested to confirm their operation. **This procedure only tests Relay A. Test Relay B in the same way using its respective menu screens.**

NOTE: *The front panel alarm LEDs will not operate during this test.*

1. With the
```
≡TEST/MAINT
▶STATUS                ↓
```
screen displayed, press ⇩ **key** until you display
```
≡TEST/MAINT
▶RELAY A               ↕
```
.

2. Press **ENTER key** to display
```
RELAY A?
(ENERGIZE         )
```
. Relay A should be energized. Confirm this by checking NO and NC relay output terminals with a continuity meter.

3. Press ⇧ **or** ⇩ **key** once to display
```
RELAY A?
(DE-ENERGIZE      )
```
. Relay A should now be de-energized. Confirm this by checking NO and NC relay output terminals with a continuity meter.

4. To end this test and return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.6 ALARM LEDs Operating Test

Both front panel alarm LEDs can be simultaneously tested.

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶ALARM LEDS ↕.
2. Press **ENTER key** to display ALARM LEDS: ALTERNATE ON/OFF. Both front panel LEDs should continuously blink on and off.
3. To end this test and return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.7 EPROM VERSION Checking

You can check the EPROM version used in your analyzer.

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶EPROM VERSION ↕.
2. Press **ENTER key** to view the EPROM version.
3. To return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.8 SELECT SIM Measurement

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 5.9.

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶SELECT SIM ↕.
2. Press **ENTER key** to display screen like SELECT SIM? (SENSOR). Use ⇩ **and** ⇧ **keys** to view both choices:
   - **SENSOR:** 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 previous level of the TEST/MAINT menu branch.

5.9 SIM Setting

After selecting the type of simulated measurement (subsection 5.8), set the desired simulation value.

1. With the ≡TEST/MAINT ▶SELECT SIM ↕ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶SIM SENSOR ↕.

2. Press **ENTER key** to display a screen like SIM SENSOR? (X.XX pH).

☞ ***NOTE:*** *The value shown on this screen is now active, providing a corresponding mA value for both analog output signals. (Both 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 simulation and return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.10 RESET CONFIGURE Values to Factory Defaults

You can conveniently reset stored configuration settings simultaneously to factory-set defaults (see Table B). **This excludes calibration settings.**

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶RESET CONFIGURE.

2. Press **ENTER key** to display the "RESET CONFIGURE: 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 all stored configuration settings -- not calibration settings -- to factory defaults ("RESET CONFIGURE: DONE" screen appears, acknowledging reset has occurred).

4. To return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.11 RESET CALIBRATE Values to Factory Defaults

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

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≣TEST/MAINT ▶RESET CALIBRATE.

2. Press **ENTER key** to display the "RESET CALIBRATE: 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 ("RESET CALIBRATE: DONE" screen appears, acknowledging reset has occurred).

4. To return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

SECTION 6
RELAY OVERFEED TIMER FEATURE

The useful relay overfeed timer feature, **only available to a CONTROL relay**, is described in more detail in this section.

6.1 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.

6.2 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.

6.3 Overfeed Timer "Timeout" Operation

When a CONTROL relay is on and its overfeed timer "times out," its LED indicator 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 LED stops blinking. (Both relay overfeed timers are reset simultaneously.)

6.4 Resetting Overfeed Timers

To manually reset <u>both</u> relay overfeed timers, please refer to Part Three, Section 5.3.

6.5 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 5.3).
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 5.3).
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/MAINT 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/MAINT 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 internal, board-mounted fuses (80 mA and 100 mA type T slow-blow; 5 mm x 20 mm size). The fuses protect the 115 and 230 volt line power circuits.

WARNING:

DISCONNECT LINE POWER TO PREVENT POSSIBLE ELECTRICAL SHOCK.

1. After disconnecting line power, unplug all terminal strip connectors to enable removal of the back panel.
2. Remove the four screws fastening the back panel and remove the panel. The board-mounted fuses are located on the left circuit board.
3. Remove the blown fuse and replace it with an Omega fuse or an equivalent.
4. Reinstall the back panel and attach all terminal connectors.

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 call the Omega Customer Service Dept. for relay replacement.

SECTION 2
PRESERVING MEASUREMENT ACCURACY

2.1 Keeping Sensor Clean

To maintain measurement accuracy, periodically clean the sensor. Operating experience will help you determine when to clean the sensor (intervals of 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 4.2.
- ORP Calibration: Use only the method described in Part Three, Section 4.3.

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 a Ground Loop

- 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 ground terminal on TB1 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 TB1 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 PREVENT POSSIBLE 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 jumper between Terminals 6 (black) and 8 (green) on TB3.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 8 (green) on TB3 and Terminal 1 (red) on TB4, with the (+) lead on Terminal 1 of TB4.

C. Connect a 1% tolerance, 301 ohm resistor between Terminals 4 (yellow) and 8 (green) on TB3.

D. Make sure analyzer is configured for a 300 ohm NTC temperature element (Part Three, Section 3.2 under "Selecting Temperature Element").

■ For Conventional Combination Electrode

A. Connect a jumper between Terminals 9 (ground) and 10 (reference) on TB3.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 9 (ground) on TB3 and Terminal 1 (active) on TB4, with the (+) lead on Terminal 1 of TB4.

C. Connect a 1% tolerance, 1000 ohm resistor between Terminals 2 and 3 on TB3.

D. Make sure the analyzer is configured for a Pt 1000 temperature element (Part Three, Section 3.2 under "Selecting Temperature Element").

3. Reconnect line power to the analyzer.

WARNING:

WHEN LINE POWER IS PRESENT, BE CAREFUL TO PREVENT ELECTRICAL SHOCK.

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

Millivolt Generator Output	Analyzer pH Reading
Zero mV	Approximately 7 pH
(-)175 mV	Approximately 10 pH
(+)175 mV	Approximately 4 pH

5. Change the analyzer MEASURE screen to show temperature.

- For an Omega 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:

WHEN LINE POWER IS PRESENT, BE CAREFUL TO PREVENT ELECTRICAL SHOCK.

1. After disconnecting line power, remove the millivolt generator, temperature simulation resistor, and the jumper from the analyzer's 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.

WARNING:

WHEN LINE POWER IS PRESENT, BE CAREFUL TO PREVENT ELECTRICAL SHOCK.

4. Use a two-point method to calibrate the analyzer. (For ORP measurement, use only the "1 POINT SAMPLE" method described in Part Three, Section 4.3.)

   If calibration was:

   - Successful: Analyzer and sensor are operating properly, but interconnect cable is probably faulty.

   - Unsuccessful: Sensor is probably inoperative.

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