Model 875PH
Intelligent Electrochemical Analyzer
for
pH, ORP, or Ion Selective Electrode (ISE) Measurements

Invensys®

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1. Introduction

The 875PH Analyzer is one of a family of line-powered analyzers. It receives pH, ORP, or Ion Selective measurements from a measuring sensor and provides that information via a front panel display, integral dual analog (4 to 20 mA) outputs, an optional digital communication port, and dual alarm outputs.

The analyzer is available in panel, pipe, and surface mounted versions. The panel mounted version is rated NEMA Type 1. However, the front panel meets NEMA Type 4X requirements when mounted in a panel and gasketed in place with a Invensys Foxboro supplied gasket. The pipe and surface mounted versions are dusttight and weatherproof, as defined by IEC IP65, and provide the environmental and corrosion resistant protection of NEMA Type 4X. The 875PH Analyzers are also designed to meet the electrical safety requirements of major testing laboratories.

The integral display consists of 240 x 128 pixel backlighted Liquid Crystal Display (LCD). Various combinations of pixels create the text and symbols for the entire front panel operating modes.

⚠ **WARNING**

If your analyzer is used in a manner not specified by Invensys Foxboro, the fire and electrical shock protection provided by the analyzer may be impaired.

Reference Documents

The following documents provide additional and related information.

Document[a]	Description
DP 611-164	Dimensional Print - 875 Electrochemical Analyzers
MI 611-206	FM, CSA, and IEC Intrinsically Safe Connector Diagrams and Nonincendive Circuits
MI 611-208[b]	Electrochemical Products Safety Information (for European installations)
MI 611-226	Instruction - 875 Remote Communication Program
PL 611-163	Parts List - 875PH Electrochemical Analyzers

(a) Documents are available on line at **www.foxboro.com** (pull down **Products** menu and select **Documentation**).

(b) Available in many languages on line at www.foxboro.com/us/eng/products/ instrumentation/downloads/ecanalyticalsafety/ecanalyticalsafety.htm.

Factory Default Passcode

The factory default passcode for all three levels of passcode is **0800**.

2. Quick Start

The purpose of this section is to:

♦ Help you to wire your analyzer

♦ Familiarize you with the instrument configuration as received from the factory

♦ Explain normal operation in Measure mode.

Wiring

Connections to your 875PH panel mounted instrument are located on the rear of the housing; those of your pipe or surface mounted instrument are located in the lower compartment. Access to the connection terminals are via openings in the bottom of the enclosure. Make your sensor connections to the top terminal strip and ac power, analog output, alarm output, and digital I/O connections to the lower terminal strip per Figure 1.

⚠ **WARNING**

Wiring installation must comply with any existing local regulations.

⚠ **CAUTION**

Your analyzer was made to accept a certain supply voltage. Check the data plate on the transmitter cover for correct supply voltage before wiring.

NOTE

Refer to MI 611-206 for FM, CSA, and IEC wiring requirements.
Refer to MI 611-208 for European (ATEX) safety information
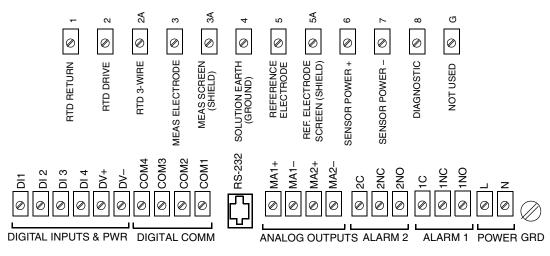
Figure 1. Wiring Connections (Style B)

── **NOTE** ──────────────────────────────

1. The ground connection on Style B panel mounted analyzers is located as shown above. The ground connection on Style B field mounted analyzers is on a case boss just below the power connections.

2. The ground connection for Style A analyzers is shown in Figure 7.

Checking Factory Configuration

Following the structure diagrams in Appendix A and using the arrow keys, you can step through the product structure as configured in the factory. The factory default values are listed in Appendix B. In the table that comprises Appendix B, there is a column provided to make any notations you wish about your specific configuration.

> ─ **NOTE** ──────────────────────
> The factory default passcode for all three levels of passcode is **0800**.

Calibration

After wiring your analyzer and checking/changing the configuration, you should perform a **Manual 2 Point** or **Smart Cal** calibration. To enter the Calibration mode, press the **Mode** key until the **Cal** indicator is illuminated. Press **Enter**. At the prompt, enter the passcode and press **Enter**. Next, enter the calibrator's name and press **Enter**. The analyzer displays **Solution**, the first category in the top level calibration structure. Press **Enter**. Use the **Down** arrow key to select **Manual 2 Point** or **Smart Cal** and press **Enter**. Follow the prompts to calibrate your analyzer.

Basic Operation in Measure Mode

Measure is the normal operating mode of your analyzer. It is indicated by an illuminated **Measure** indicator. When the display is configured for single line measurements or scanning measurements, the measurement title, value, and unit are displayed. For single line measurements, a bar graph showing the percentage of a configured measurement range is also displayed. When configured for dual line measurements, the measurement title, value, and unit for each line is displayed. A bar graph showing the percentage of the Line 1 configured measurement range is also displayed. Any measurement can be temporarily scrolled onto the display by using the **Up** and **Down** arrow keys. These user-selected measurements show the measurement title, units, and value. During the display of these user-selected measurements, the bar graph is inactive. You can return to the configured selection by using the **Up** and **Down** arrow keys. The display automatically returns to the configured selection when the configured Timeout time is reached. Fault messages are also shown on your display while in the Measure mode. Alarm status is shown by two alarm indicators.

Looking for More Information?

For more detailed information, refer to the following sections of this manual:

♦ For installation information, refer to "Installation" on page 11.

♦ For detailed explanation of the controls and indicators, refer to "Controls and Indicators" on page 21.

♦ For detailed configuration instructions, refer to "Configuration Mode" on page 41.

♦ For detailed calibration instructions, refer to "Calibration Mode" on page 34.

For dimensional information, refer to DP 611-164.

If you need additional help, please call 1-866-746-6477 in the U.S.A. or contact your local Invensys Foxboro representative.

3. Specifications

Operating, Storage, and Transportation Conditions

Table 1. Operating, Storage, and Transportation Conditions

Influence	Reference Operating Conditions	Normal Operating Condition Limits	Operative Limits	Storage and Transportation Limits
Ambient Temperature	23±2°C (73±4°F)	-10 and +65°C (-14 and +149°F)	-20 and +75°C (-4 and +167°F) (a)	-4 and +85°C (-4 and +185°F)
Relative Humidity	50±10%	5 and 95% Noncondensing	5 and 95% Noncondensing	5 and 95% Noncondensing
Supply Voltage	Rated Voltage (b) ±1%	Rated Voltage (b) -15 and +10%	Rated Voltage (b) -20 and +15%	Not Applicable
Supply Frequency	50 or 60 Hz, ±1%	50 or 60 Hz, ±3%	50 or 60 Hz, ±3%	Not Applicable
Vibration Field Mount Panel Mount	1 "g" (10 m/s2) between a frequency or 5 and 200 Hz 0.25 "g" (2.5 m/s2) between a frequency or 5 and 200 Hz			Note (c)
Mounting Position	Generally Upright	Any Position	Any Position	Not Applicable

(a) -20 and +60°C (-4 and +140°F) for analyzers with ATEX and IEC certification

(b) Rated voltage is 24, 100, 120, 220, or 240, V ac or 24 V dc.

(c) During transportation, the packaged analyzer can withstand normal shipping and handling conditions without damage.

Functional and Physical Specifications

Supported Sensors:

> Full Compatibility: PH10; ORP10; 871A-1, -3, -4; 871PH-3, -4, -5, -6; All EP460 Series

> Compatibility Less Full Diagnostic Suite: 871A-2; 871PH-1, -2

> Compatibility With Non-Foxboro Sensors:
> The 875PH Analyzer is also compatible with non-Foxboro sensors without integral preamplifiers and with compatible temperature sensing elements. Contact Invensys Foxboro for more specific information.

Minimum Output Span: 5% of full scale

Maximum Output Span: 500% of full scale

Isolated Output Load: 800 ohms maximum

Temperature Compensation Inputs:

    100 ohm platinum RTD (2- or 3-wire)
    1000 ohm platinum RTD (2- or 3-wire)
    3000 ohm Balco RTD (2-wire)

Power Consumption: 17 Watts maximum

Alarm Contacts: Form C rated 5 A at 250 V ac, 2 A at 30 V dc, noninductive. The ATEX and IEC limits are 5 A at 160 V ac and 2 A at 30 V dc.

Digital Inputs/Outputs

    Terminal DV+ Power: 4.5 V ±3% at 10 mA maximum (provided by the analyzer)

    Terminal DV- Power: -20 V +1% at 10 mA maximum (provided by the analyzer)

    Inputs DI1 - DI4 (only used with the +4.5 V/-20 V outputs provided by the analyzer):

        High Logic: User must ensure voltage to be between 2.7 and 10 V

        Low Logic: User must ensure circuit to be open or less than 0.8 V

Data Storage:

    Configuration, calibration, and operating parameters are stored in nonvolatile memory for >5 years.

Remote Configuration:

    Via RS-232 communication. The interface contains three signal lines (RXD, TXD, GND). The cable, connecting the computer to the analyzer, that is part of the optional configurator utility kit is 3 m (10 ft). This distance can be extended to 15 m (50 ft) with an extension cable. It can be further extended with the use of a user-supplied modem.

Optional Digital Communication Interfaces (check with Invensys Foxboro for availability):

    One of the following per model code:

        HART
        FOUNDATION Fieldbus
        Profibus PA
        DeviceNet

Maximum Distance Between Sensor and Analyzer:

    150 m (500 ft) with preamplifier
    15 m (50 ft) without preamplifier

Mounting: Panel, pipe, or surface mounting per model code

Enclosure:

    Panel Mounting: The basic housing meets NEMA 1 requirements for general purpose, indoor applications. However, when installed in a panel and gasketed in place, the front surface provides the environmental and corrosion resistant protection of NEMA Type 4X, CSA Enclosure 4X, and IEC IP65.

    Field (pipe or surface) Mounting: The enclosure provides the environmental and corrosion resistant protection of NEMA Type 4X, CSA Enclosure 4X, and IEC IP65.

Weight (approximate):

Panel Mounted: 1.8 kg (4 lb)
Pipe or Surface Mounted: 3.3 kg (7.3 lb)

European Union and International Directives:

Complies with the Electromagnetic Compatibility Requirements of European EMC Directive 89/336/EEC by conforming to the CENELEC and IEC Standards as follows:

♦ Field Mount: EN50081-2 and EN50082-2. Also complies with NAMUR Part 1 Interference Immunity Requirement (Germany version of EN50081-2 and EN50082-2)

♦ Panel Mount: EN61326, ANNEX A.

Both Field Mounted and Panel Mounted analyzers comply and conform to Applicable European Union Directives ("CE" marking on product).

Pollution Degree: Degree 2 per ANSI/ISA S82.01

Installation Category: Category III per ANSI/ISA S82.01

Product Safety:

The 875 Analyzer has been designed to meet electrical safety descriptions listed in Table 2. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys Foxboro.

Table 2. Product Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
CSA Ordinary locations.	For panel mounted units, see note (a).	C
CSA for Class I, Division 2, Groups A, B, C, and D; Class II, Division 2, Groups F and G; and Class III, Division 2 hazardous locations	Temperature Class T4. For CSA loop certified non-incendive circuits, see MI 611-206. For panel mounted units, see note (a).	
FM Ordinary locations.	For panel mounted units, see note (a).	F
FM nonincendive for Class I, Division 2, Groups A, B, C, and D; Class II, Division 2, Groups F and G; and Class III, Division 2 hazardous locations	Temperature Class T4. For panel mounted units, see note (a).	
ATEX Ex protection 'n' for Zone 2; II 3 G EEx nC[L] IIC. [(b)]	Temperature Class T4 at maximum ambient temperature of 60°C (140°F). See certificate KEMA 02ATEX1329 X	N
IECEx protection 'n' for Zone 2; Ex nA nL nC [nL] IIC	Temperature Class T4 at maximum ambient temperature of 60°C (140°F).	D
UL Ordinary locations	- - -	U

Table 2. Product Safety Specifications (Continued)

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code

(a)Panel-mounted unit must be installed as follows:
   For Ordinary and Class I, Division 2 locations: install in a protective enclosure to prevent access to live parts.
   For Class II and Class III Division 2 locations: install in a dusttight enclosure.

(b) The L means that the unit contains energy limited circuits to the sensor.

4. Installation

Unpacking

1. Remove the analyzer from the shipping container and check for visible damage.

2. Save the container until you determine that no shipping damage has occurred.

3. If the analyzer has been damaged, notify the carrier immediately and request an inspection report. Obtain a signed copy of the report from the carrier and call 1-866-746-6477 in the U.S.A., or contact your local Invensys Foxboro representative.

Identification

A data label, fastened to the top surface of the enclosure on panel-mounted devices and to the right side on surface- or pipe-mounted devices, provides the model number and other information. A second data label, fastened to the right side surface, provides configuration information pertinent to your particular analyzer. In addition, an agency label, showing electrical certification information, is located on the top surface of the enclosure on panel-mounted devices and to the left side on surface- or pipe-mounted devices.
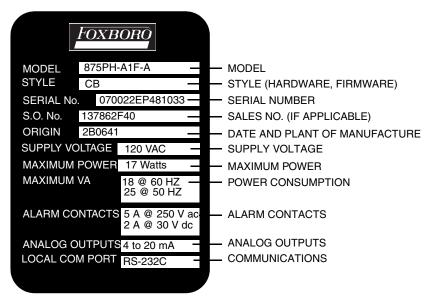
Figure 2.   Sample Information Data Label
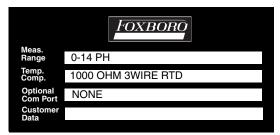
Figure 3. Sample Configuration Data Label

Mounting

Panel Mounting

Panel mounting of the analyzer is shown in Figure 4. For panel cutout size, space requirements, and other dimensional data, see DP 611-164. Place the analyzer into the panel cutout from the front side and fasten it to the panel with appropriate hardware via the four holes in the corners of the analyzer bezel. The basic enclosure of the panel-mounted analyzer meets NEMA 1 requirements for general purpose, indoor applications. However, when mounted in a panel and gasketed in place with the Invensys Foxboro supplied gasket, the front surface provides the environmental and corrosion resistant protection of NEMA Type 4X, CSA encl. 4X, and IEC IP65.

⚠ **WARNING**

1. All wiring connections are located on the rear of the analyzer enclosure. Therefore, to meet electrical safety specifications, the analyzer must be installed in a protective enclosure to prevent accessibility to live parts. For Class II and Class III, Division 2 locations, the analyzer must be installed in a dusttight protective enclosure.
2. Further, to meet CE requirements, a grounded metal enclosure is required. To assure a good ground, the edges of the panel opening that receives the analyzer must **not** be painted.
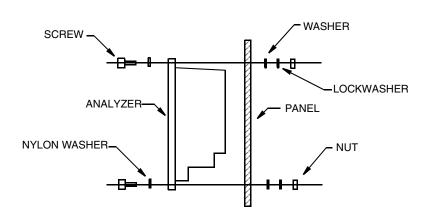
Figure 4. Panel Mounting

Surface Mounting

Surface mounting of the field-mounted analyzer is shown in Figure 5. Fasten the mounting bracket to the analyzer using the screws, washers, and lockwashers provided. Then, fasten the mounting bracket to your surface using appropriate hardware. For space requirements and other dimensional data, see DP 611-164. The field-mounted enclosure provides the environmental and corrosion-resistant protection of NEMA Type 4X, CSA encl. 4X, and IEC IP65.
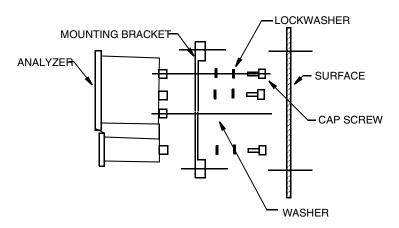
Figure 5.   Surface Mounting

Pipe Mounting

Pipe mounting of the field-mounted analyzer is shown in Figure 6. Fasten the mounting bracket to the analyzer using the screws, washers, and lockwashers provided. Then, fasten the mounting bracket to a DN50 or 2-inch pipe using the hardware provided. For space requirements and other dimensional data, see DP 611-164. The field-mounted enclosure provides the environmental and corrosion-resistant protection of NEMA Type 4X, CSA encl. 4X, and IEC IP65.
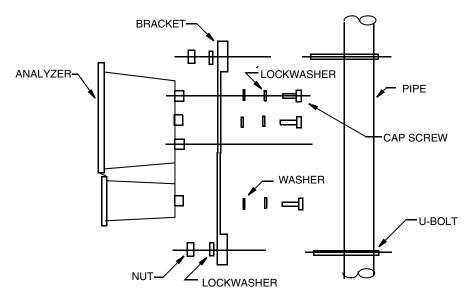
Figure 6.   Pipe Mounting (Vertical Pipe Mounting Shown)

Wiring

⚠ **WARNING**
Wiring must comply with any existing local regulations. To meet CE requirements, this must include a switch or circuit breaker, marked as a disconnecting device, and located in close proximity to the analyzer and within easy reach of the operator.

⚠ **CAUTION**
Your analyzer was made to accept a certain supply voltage. Check the data plate on the transmitter cover for correct supply voltage before wiring.

NOTE
1. To meet CE requirements:
   a. The ac cable must be routed away from all other I/O wiring, especially the sensor cable.
   b. All wiring must be enclosed in grounded metal conduit.
2. Refer to MI 611-206 for FM, CSA, and IEC wiring requirements.
   Refer to MI 611-208 for European (ATEX) safety information

The distance between your analyzer and sensor should be no more than 15 m (50 ft) without a preamplifier or 150 m (500 ft) with a preamplifier. If a preamplifier is not used, the signal quality deteriorates with this distance. A preamplifier is recommended for lengths over 6 m (20 ft).

Panel-Mounted Analyzer

If you have a panel-mounted analyzer, make your wiring connections directly to the terminals on the rear of the housing. Terminal identifications are shown in Figure 7 and described in Table 4.

Pipe- or Surface-Mounted Analyzer

If you have a pipe- or surface-mounted analyzer, the wiring connections are located in the lower compartment of the housing. They are accessible via three openings on the bottom of this compartment. There are also two knockouts for additional field wiring entrance. To remove the knockouts:

1. Perform this procedure with the lower compartment cover in place to give the enclosure extra support.

2. Place a screwdriver blade in the ridge of the knockout.

3. Rap the screwdriver sharply with a hammer until the knockout begins to give way.

4. Repeat Steps 2 and 3 around the circumference of the knockout until the knockout falls out.

To wire your pipe- or surface-mounted analyzer:

1. Remove the lower housing compartment cover by removing the four screws securing it in place.

2. Remove the plastic shipping caps from the three openings on the bottom of the housing and replace with proper fittings.

⚠️**CAUTION**

1. To maintain a rating of NEMA 4X, CSA encl. 4X, or IEC IP65, open ports must be sealed and instrument covers secured. Also, wiring methods, conduit, and fittings appropriate to the ratings must be used. Table 3 identifies recommended parts.
2. To minimize RFI/EMI effect, use grounded metal conduit on sensor cable and input power leads.

Table 3. Recommended Conduit and Fittings

Material	Conduit	Fitting
Rigid Metal	1/2 inch Electrical Trade Size	T&B* #370
Semi-Rigid Plastic	T&B #LTC 050	T&B #LT 50P or T&B #5362
Semi-Rigid Plastic Metal Core	Anaconda Type HV, 1/2 inch	T&B #LT 50P or T&B #5362
Flexible Plastic	T&B #EFC 050	T&B #LT 50P or T&B #5362

*T&B = Thomas & Betts Corp., 1001 Frontier Road, Bridgewater, NJ 08807

3. Bring the wires from your input (ac) power in the right opening and connect to terminals at the right end of the bottom terminal strip as shown in Figure 7 and described in Table 4.

NOTE
To meet CE requirements, the ac cable must be routed away from all other I/O wiring, especially the sensor cable.

4. Bring all other wiring (except sensor cable) in the middle opening and connect to appropriate terminals on the bottom terminal strip as shown in Figure 7 and described in Table 4.

5. Bring the sensor cable in the left opening and connect to the appropriate terminals on the top terminal strip as shown in Figure 7 and described in Table 4. If you are using manual temperature compensation and are **not** wiring a temperature measuring device, short terminals 1, 2, and 2A to minimize noise.

6. Connect the remote communications using the RS-232 modular phone plug.

Wiring Connections

NOTE
Connect all cables with user supplied strain relief to prevent excess strain on the terminals.
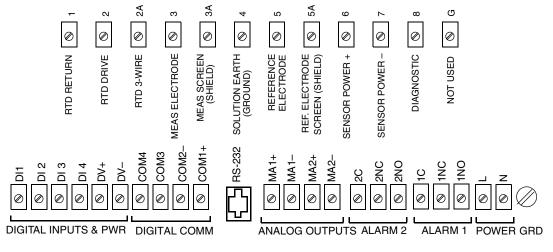
Figure 7. Wiring Connections for 875PH Analyzer

─ **NOTE** ──

The ground connection on panel mounted analyzers is located as shown in Figure 7. The connection on field mounted analyzers is on a case boss just below the power connections.

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Table 4. Terminal Identification

Terminal Designation	Description
Sensor Connections	
1	RTD Return
2	RTD Drive
2A	RTD 3-Wire
3	Measurement Electrode
3A	Measurement Screen (Shield)
4	Solution Earth (Ground)
5	Reference Electrode
5A	Ref. Electrode Screen (Shield)
6	Sensor Power (+)
7	Sensor Power (-)
8	Diagnostic
G	Not Used
Digital, Analog, Alarm, and Power Connections	
DI1	Digital Input for Auto Service 1
DI2	Digital Input for Auto Service 2
DI3	Digital Input for Signaled Hold
DI4	Not used

Table 4. Terminal Identification (Continued)

Terminal Designation	Description
COM1, 2 COM3, 4	HART I/O Communication Not Used
RS-232	Remote Communication (see MI 611-226)
MA1+, MA1– MA2+, MA2–	Analog Output 1 Analog Output 2[a]
1C, 1NC, 1NO 2C, 2NC, 2NO	Alarm 1 Alarm 2
L N G	Power, Line (Black) Power, Neutral (White) Power, Ground (Green)

(a) Not used when HART I/O communication is employed

Digital Input Wiring

The 875PH Analyzer has three digital inputs. Digital input DI1 and DI2 are used to activate the Auto Service 1 and Auto Service 2 functions respectively. Digital input DI3 is used to activate the Signaled Hold function. Digital input DI4 is not used. For configuration information on these functions, see "Auto Service 1 and Auto Service 2" on page 50 and "Signaled Hold" on page 52.

The voltage to set a digital input high is supplied by the analyzer from terminal DV+. The digital input is activated by closure of a switch that is supplied by the user. If the switch is closed, the digital input voltage is high and if the switch is open, the digital input voltage is low.

⚠ **CAUTION**

Digital inputs are **only** to be used with the voltage outputs provided by the analyzer.

The following figures show the most likely wiring connections to the 875 digital input interface.
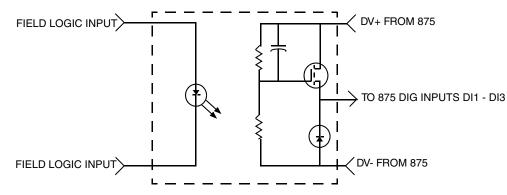
Figure 8. Optically Isolated Interface 24 V dc, FET Output PLC

FIELD LOGIC INPUT   DV+ FROM 875

FIELD LOGIC INPUT   TO 875 FROM DIG INPUTS DI1 - DI3
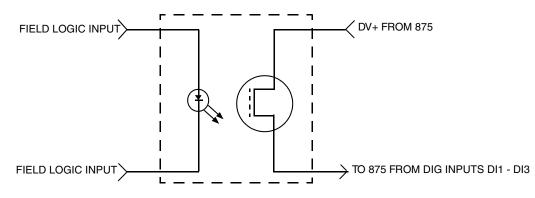
Figure 9. Optical Isolated Analog Switch

FIELD LOGIC INPUT   DV+ FROM 875

FIELD LOGIC INPUT   TO 875 DIG INPUTS DI1 - DI3
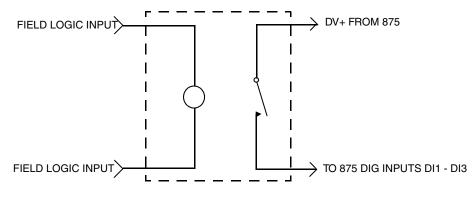
Figure 10. Electromechanical Relay Interface

HART I/O Communication Wiring

If HART Communication (Option -C) is installed, connect your HART loop to the COM1(+) and COM2(-) terminals of the analyzer. See Figure 7. There must be a minimum 250 ohm load in the loop. Therefore, if you are configuring the analyzer on the bench (no loop load) with a HART communicator, you must add a 250 Ω resistor.

Analog Output Wiring

There are two analog (4 to 20 mA) outputs in the analyzer. Connect the Analog 1 output at the MA1+ and MA1- terminals of the analyzer. Connect the Analog 2 output at the MA2+ and MA2- terminals of the analyzer. See Figure 7. Analog 2 is **not** used when HART I/O communication is employed.

Alarm Wiring

You can wire an external device (for example a light bulb or horn) to the analyzer. Each alarm relay provides a contact closure which can be used as a switch to turn the external device on or off. The way you wire the external device to the analyzer must be done in conjunction with the way you configure the alarm Trip State (see page 54).

─ **NOTE** ─────────────────────────────────────
Alarm contacts are Form C rated 5 A at 250 V ac, 2 A at 30 V dc, noninductive.
The ATEX and IEC limits are 5 A at 160 V ac and 2 A at 30 V dc.
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Energized Trip State

ALARM CONDITION   NONALARM CONDITION
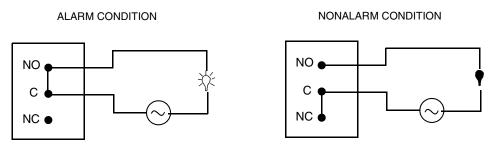
Figure 11. Alarm Wiring in Energized Trip State

De-energized Trip State

ALARM CONDITION
OR LOSS OF POWER   NONALARM CONDITION
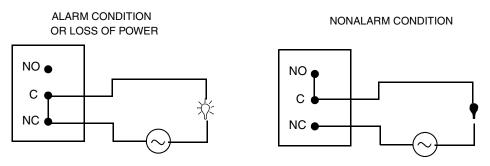
Figure 12. Alarm Wiring in De-energized Trip State

5. Operation Via Local Display

Controls and Indicators

Operator controls and indicators are located on the front panel. Figure 13 shows the panel arrangement. Table 5 identifies the function of each element.
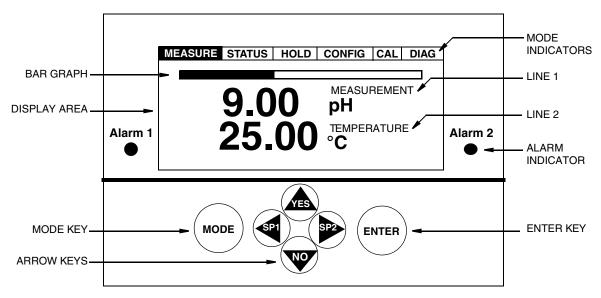
Figure 13. Indicators and Controls

Table 5. Indicators and Controls

Control/Indicator	Function
Mode Indicators	The current operating mode indicator is illuminated. While Hold is active, the Hold indicator blinks.
Display Area	The display is a graphic panel that shows information in combinations of artwork and text.
Bar graph	Displays percent of configured range of the Line 1 value on the display.
Line 1	Displays configured measurements.
Line 2	Displays configured measurements.
Alarm Indicators	Alarm 1 (Alarm 2) indicator is illuminated when Alarm 1 (Alarm 2) is active.
Mode Key	Each press of the **Mode** key selects the next operating mode (Measure, Status, Hold, Configure, Calibrate, and Diagnostic).

Table 5. Indicators and Controls (Continued)

Control/Indicator	Function
Right Arrow Key	Moves you forward through the menu structure. Shifts the cursor to the right in a data entry field. In Measure mode, this key enables you to directly access the menu to change the set point for Alarm 2 (if configured as a setpoint alarm).
Left Arrow Key	Moves you backward through the menu structure. Shifts the cursor to the left in a data entry field. In Measure mode, this key enables you to directly access the menu to change the set point for Alarm 1 (if configured as a setpoint alarm).
Up Arrow Key	Increments a numeric value or character when you are in a data entry field. Shifts the items down when you are in a picklist menu. Answers Yes to a question.
Down Arrow Key	Decrements a numeric value or character when you are in a data entry field. Shifts the items up when you are in a picklist menu. Answers No to a question.
Enter Key	Enters and saves the changed menu picklist choices or numeric value or character data entry.

Display

The display is a 240 x 128 pixel dot-matrix LCD. It is backlighted for viewing under low light conditions.

Dual Measurement Screen

This screen is displayed in Measure mode when the analyzer is configured for dual line measurements.
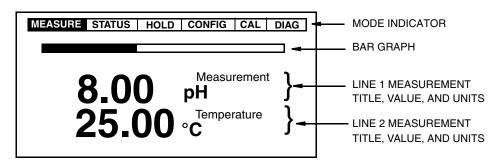
Figure 14. Sample Dual Measurement Screen

Single Measurement Screen

This screen is displayed in Measure mode when the analyzer is configured for single line measurements, scanning measurements, or user selectable measurements.
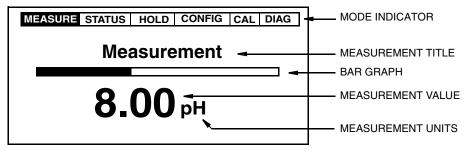
Figure 15. Sample Single Measurement Screen

Fault Messages

While you are in Measure mode, the display alternates between the Measurement screen and the Fault screen when a fault is occurring. In the case of multiple faults, the fault with the highest severity is shown. In general, you can enter the Diagnostic mode to obtain more detail about the fault and receive guidance on how to correct the problem. Fault types are summarized below.

— **NOTE**
Some diagnostic conditions must be configured "enabled" for a fault message to be displayed.

Sensor Fault

Sensor Fault is displayed in Measure mode (if the diagnostic is enabled) when a **Leakage**, **ATC Short**, **ATC Open**, **Glass**, **Low Slope**, **Preamp**, **Aging**, or **Coat** fault is present. The analyzer is still configurable. For **ATC Short** or **ATC Open** faults, measurements are held at the configured value.

Configuration Fault

Configuration Fault is displayed in Measure mode (if the diagnostic is enabled) when the current loop output (**4-20 Range**), the temperature compensation (**Comp Range**), or the display line measurement (**Meas Range**) exceeds the upper or lower bound for the configured range.

Analyzer Fault

Analyzer Fault, which is displayed in Measure mode, indicates an analyzer fault. Depending on the severity of the problem, the analyzer may still be configurable and analog measurements held at the fail-safe value if so configured.

Digital Fault

Digital Fault is displayed in Measure mode when a digital communication problem occurs.

Slope Error

Slope Error is displayed in Configuration mode when errors made during the entry of custom tables cause an invalid slope.

Table Entry Error

Table Entry Error is displayed in Configuration mode when errors are made during entry of custom tables, such as not having at least one custom point high enough in the range.

Passcode Access

Analyzer security is provided by the use of passcodes through the front panel, remote control, or digital communication interfaces. The passcodes for three levels of security can be established in Configuration mode by users having access to Level 1. Table 6 defines passcode access to the different features of the analyzer.

The legend for the table is V = View and X = View and/or change.

> **NOTE**
> 1. Passcode Levels 2 and 3, while less complete that Level 1, are simpler to use because there are fewer selections to step through in the menu trees.
> 2. The factory default pass code for all three levels is **0800**.

Table 6. Passcode Access

Feature	No Passcode	Level 3	Level 2	Level 1
Measurement Mode				
Measurement	V	V	V	V
Status Mode				
Status	V	V	V	V
Hold Mode				
Off		X	X	X
On Present		X	X	X
On Manual		X	X	X
Configuration Mode				
Measurement	V	V	X	X
Meas Units - Custom			V	X
Sensor	V	V	X	X
Tempcomp	V	V	X	X
Custom			V	X

Table 6. Passcode Access (Continued)

Feature	No Passcode	Level 3	Level 2	Level 1
Display	V	V	X	X
Analog	V	V	X	X
HART	V	V	X	X
Diagnostics			V	X
Autoservice			V	X
Signaled Hold			V	X
Alarm		V	X	X
Remote			V	X
Cal Parameters			V	X
Automatic Hold			V	X
Timeouts			V	X
Date and Time			V	X
Analyzer Names			V	X
Passcodes				X
LCD Adjustment			V	X
Factory Defaults			V	X
Calibration				
Solution			X	X
Bench			X	X
Analog			X	X
Auto Service			V	X
Diagnostics				
View Faults	V	V	V	V
View History		V	V	V
Erase History				X
Demand Report		X	X	X

Any time a passcode is required, the display shows **Passcode 0000**. Use the arrow keys to enter your passcode. When the proper digits are shown, press the **Enter** key.

The passcode access expires when you change to another mode.

Viewing and Changing Data

In the Status, Hold, Calibration, Configuration, and Diagnostic modes, you need to move through a structure of parameters (using the arrow keys and **Enter** key) to view (and in some modes, to change) the value or status of a particular parameter. To aid you in configuration, structure diagrams are provided in the following sections and in Appendix A.

Note that the **Up** and **Down** arrow keys scroll through a picklist menu in either direction. Also, note that the arrow keys can be used to increment one position at a time, or advance continuously through a menu or string of values by holding the key in the depressed position.

The following example shows how to use the keys to move through the structure, make a picklist selection and a numeric entry. The example used is that of configuring temperature features in Configuration mode. For the example, assume a glass electrode, a 3-wire, 1000 ohm RTD, Fahrenheit temperature units, an automatic temperature mode, and a fail-safe signal value of 77°F. In following the procedure, refer to Figure 16.
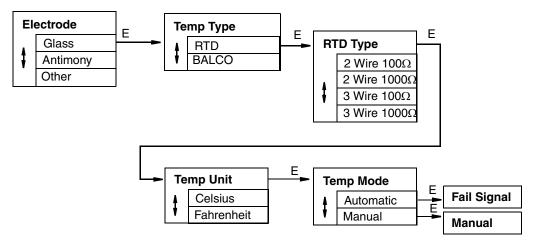
Figure 16. Example of Structure Diagram

1. In the **Electrode** menu, use the **Down** arrow key to select **Glass** if it is not already showing. Press **Enter**. The display moves to **Temp Type.**

2. Use the **Down** arrow key to select **RTD** if it is not already showing. Press **Enter**. The display moves to **RTD Type**.

3. Use the **Down** arrow key to move to **3 Wire 1000**Ω. Press **Enter**. This enters your RTD selection and moves the display to **Temp Unit**.

4. Use the **Down** arrow key to move to **Fahrenheit** and press **Enter**. This enters your Fahrenheit selection and moves the display to **Temp Mode**. Every temperature entry in the analyzer is now in Fahrenheit units.

5. Use the **Down** arrow key to select **Automatic** if it is not already showing. Press **Enter**. This enters your automatic temperature mode selection and moves the display to **Fail Signal**. **000.0**. The tenths digit blinks.

6. Because you do not need to change the tenths digit, use the **Left** arrow key to move to the units digit. Use the **Up** arrow key to change this digit to **7**.

7. Use the **Left** arrow key to move to the tens digit and the **Up** arrow key to change this digit to **7**. You have now achieved your goal of setting the value to 77.0, so press **Enter**. This enters your value of 77. This completes the example.

─ **NOTE** ──
In most situations, repeatedly pressing the **Left** arrow key returns you to previous menus. However, the **Left** arrow key becomes inoperative for this purpose when you are entering numerical values.

Accessing Operating Modes

The operating mode is selected by pressing the **Mode** key on the front panel. Each press of the key selects the next operating mode in sequence. See Figure 17. When you reach the desired mode, press **Enter**.

MEASURE → STATUS → HOLD → CONFIGURE → CALIBRATE → DIAG
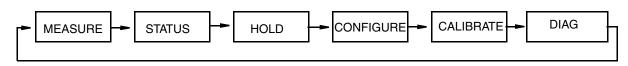
Figure 17. Mode Key Operation

Measure Mode

Measure is the normal operating mode of your analyzer. The analyzer powers up in Measure mode. If another mode is active and you want to go to Measure mode, press the **Mode** key until the **Measure** indicator is illuminated.

Measurements are user configured to display the pH, ORP or ISE measurement, the process temperature, the absolute millivolt signal, or the analog output value.

Measure mode uses one of four display screen presentations: Single, Dual, Scan, or User Selected. The first three are set in Configure mode. User Selected is enabled by the **Up** and **Down** arrow keys. See Figure 18.

♦ **Single:** The measurement title, value, and unit are displayed. The bar graph shows the value's percentage of full scale.

♦ **Dual:** Two measurement titles, values, and units are displayed. The bar graph shows the first line's percentage of full scale.

♦ **Scan:** Several measurements can be selected to alternate on the display in a designated scan time. When in Scan mode, the bar graph is inactive.

♦ **User Selected:** Any measurement can be temporarily scrolled onto the display by using the **Up** and **Down** arrow keys. The display shows the measurement title, value, and unit. The bar graph is inactive. The display returns to the configured values when you press the **Mode** key or when the Timeout period expires.

Diagnostics are run continuously in Measure mode. If a fault occurs, the display alternates between the Measurement display and a fault display. In the case of multiple faults, the fault with the highest severity is shown. You can then enter the Diagnostic mode to obtain more detail about the fault and receive guidance on how to correct the problem. The alarm and analog outputs also indicate a fault if so configured. If an alarm is based on an fault, suspending the fault in Diagnostic mode does not affect the alarm operation.

```
        ┌─────────────┐
        │   MEASURE   │
        └─────────────┘
               │
               │◄──────────────┐
               ▼               │
      ┌─────────────────┐      │
      │ (Default Screen)│      │
      └─────────────────┘      │
               ▲               │
               ▼               │
      ┌─────────────────┐      │
      │   Measurement   │      │
      └─────────────────┘      │
               ▲               │
               ▼               │
      ┌─────────────────┐      │
      │    Absolute     │      │
      └─────────────────┘      │
               ▲               │
               ▼               │
      ┌─────────────────┐      │
      │   Temperature   │      │
      └─────────────────┘      │
               ▲               │
               ▼               │
      ┌─────────────────┐      │
      │    Analog 1     │      │
      └─────────────────┘      │
               ▲               │
               ▼               │
      ┌─────────────────┐      │
      │    Analog 2     │      │
      │    (or HART     │      │
      │   if installed) │      │
      └─────────────────┘      │
               ▲               │
               └───────────────┘
```
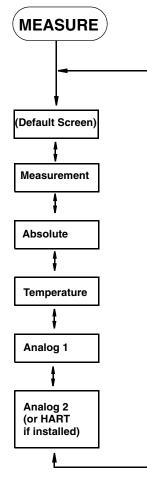
Figure 18. Measure Mode Structure Diagram

You can also view analyzer measurement data on a personal computer by using the Hyperterminal accessory. To do this, connect the RS-232 port on your analyzer to a serial port on your computer. Make sure the port settings on your computer match those on your analyzer. See "Remote" on page 54.

Status Mode

Refer to Figure 20 on page 31.

The Status mode enables you to view the measurement and system parameters and thus assess the performance of the loop. You can not edit them in this mode. All measurements and outputs continue while you are in the Status mode.

```
┌─────────────────────────────────────────┐
│ MEASURE  STATUS  HOLD  CONFIG  CAL  DIAG │ ◄── MODE INDICATOR
│                                          │
│  Status Mode. Use the Up/Down arrows to  │ ◄── HELP MESSAGE
│    scroll through list. Mode returns to  │
│                Measure                   │
│              Temperature         ◄───────│──── PARAMETER
│                                          │
│               25.0 °C            ◄───────│──── CURRENT STATUS
│                                          │
└─────────────────────────────────────────┘
```
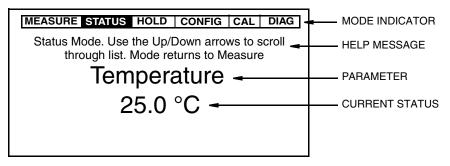
Figure 19. Sample Status Screen

To enter the Status mode, press the **Mode** key until the **Status** indicator is illuminated. Press **Enter**. Move through the menu by using the **Up** and **Down** arrow keys. See Figure 20 on page 31. The display returns to Measure mode when you press the **Mode** key or when the Timeout period expires. The Status menu contains the following parameters:

Table 7. Status Parameters

Parameter	Description	Units	Notes
Temperature	Process temperature of sensor	Temp Unit	
Absolute	Uncompensated measurement signal from sensor	Meas Unit	
ATC Resistance	Resistance of temperature compensator	Ω, $k\Omega$	
Slope %	Deviation in percent of the slope of the most recent calibration compared to the standard	%	
Slope mV	Change in mV/pH or mV/decade of the most recent calibration	mV/pH, mV/decade	If pH or ISE
Asymmetry	Asymmetry potential (mV difference between the theoretical isopotential point and the actual point due to the most recent calibration)	mV	If not ORP
Preamplifier	Preamplifier power	mW	
Cal Person	Name of last calibrator	- - -	
Cal Date	Date of last calibration (mm/dd/yyyy)	- - -	

Table 7. Status Parameters (Continued)

Parameter	Description	Units	Notes
Cal Type	Type of last calibration (solution, factory default, or bench)	- - -	
Cal Temperature	Temperature calibration type of last calibration (default, custom, solution, failsafe, manual)	- - -	
Cal Point One	Values at Calibration Point One	pH and mV	
Cal Point Two	Values at Calibration Point Two	pH and mV	
Analog 1	Analog Output 1	mA	
Analog 2	Analog Output 2 (or HART analog output if installed)	mA	
Tag Name	Tag name	- - -	
Location	Location of measurement	- - -	
Sales Order Number	Sales order number	- - -	
MS Code	Model code	- - -	
Serial Number	Serial number	- - -	
Software Version	Software version	- - -	
Device Name	Device name	- - -	
Device Type	Device type	- - -	
Comm Type	Digital communications type	- - -	If installed
Tag Number	Tag number	- - -	
Line Frequency	ac Line frequency	Hz	
Time	Current time	- - -	
Date	Current date	- - -	
History Log	View up to 10 of the most current history log entries (if present)	- - -	0 to 10 entries shown

```
      ┌─────────────┐
      │   STATUS    │
      └─────────────┘
```

Temperature	Cal Type	MS Code	Date
Absolute	Cal Temperature	Serial Number	HISTORY ENTRY #1
ATC Resistance	Cal Point One	Software Version	HISTORY ENTRY #2
Slope %	Cal Point Two	Device Name	• • •
Slope mV	Analog 1	Device Type	HISTORY ENTRY #10
Asymmetry	Analog 2 (or HART if installed)	Comm Type	
Preamplifier	Tag Name	Tag Number	
Cal Person	Location	Line Frequency	
Cal Date	Sales Order Number	Time	

Figure 20.   Status Mode Structure Diagram

Hold Mode

Refer to Figure 22.

The Hold mode enables you to manually hold the output at a determined value, thus allowing you to configure or calibrate the analyzer or perform sensor maintenance without disturbing the control loop. Outputs are driven to a preconfigured state or held at their current values. During calibration, the analyzer continues performing live measurements.

To enter the Hold mode, press the **Mode** key until the **Hold** indicator is illuminated. Press **Enter**. At the prompt, **Passcode 0000**, enter the passcode for Level 1, 2, or 3 and then press the **Enter** key. If you enter the incorrect passcode, the display returns to **Passcode 0000**. If you enter the correct passcode, the display briefly reads **Unlocked** and then changes to **Hold Mode/Off**. Refer to Figure 22. In the **Hold Mode** menu, select **On Present** to hold all values and states at their current level or **On Manual** to set all values and states at desired levels.

> ⎯ **NOTE** ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
> If you entered the passcode for Level 3 and selected **Manual**, you can engage Hold but cannot change the settings under **Manual**.

Additionally, in Configuration mode, you can use the **Automatic Hold** parameter to automatically activate the Hold feature each time you enter Calibration or Configuration mode. In this Configuration mode parameter, you can select **Off**, **Present**, or **Manual**. However, if you select **Manual**, you must go to Hold mode to set the values.
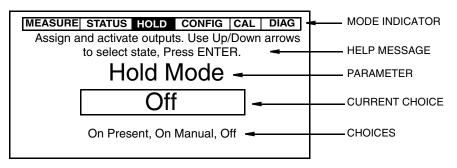
Figure 21. Sample Hold Screen

If you select **On Present** and press the **Enter** key, the display briefly reads **Hold Engaged** and proceeds to Measure mode and the outputs are held.

If you select **On Manual** and press the **Enter** key, the display proceeds to **Alarm 1**, the first of a series of parameters to set values and states to desired levels during hold.

To set the output for **Alarm 1** and **Alarm 2**, select **Maintain** to maintain the alarm in its present condition while in Hold mode, **On** to activate the alarm while in Hold mode, or **Off** to deactivate the alarm while in Hold mode.

To set the output for **Analog 1** and **Analog 2**, select **Live** to not hold the output or **Fixed** to hold the output at a desired value. If you selected **Fixed**, enter a value from 3.8 to 20.5 mA by 0.1 mA increments.

If you have HART or other digital communications installed, you can hold the measurement and temperature values for each digital output at desired values. To do this, enter values for **Digital**

Measure and **Digital Temp**. The measurement units are as configured under "Measurement" on page 43. The value must be within the scale configured. The temperature units are as configured under "Temp Unit" on page 44. The value can be from -20 to +200°C (-4 to +392°F) by 0.1° increments.
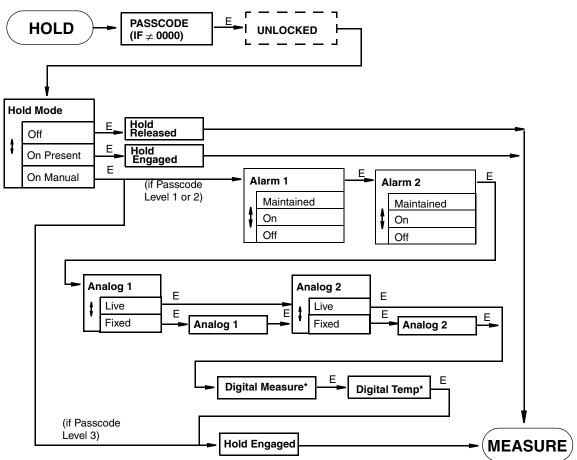
When you have finished making the manual selections, the display briefly reads **Hold Engaged** and proceeds to Measure mode.

While Hold is engaged, the **Hold** indicator blinks while you are in other modes to indicate that your output is being held. Measurement hold can be maintained indefinitely.

To release Hold, press the **Mode** key until the **Hold** indicator is illuminated. At the prompt, **Passcode 0000**, enter the passcode for Level 1, 2, or 3 and then press the **Enter** key. If you enter the incorrect passcode, the display returns to **Passcode 0000**. If you enter the correct passcode, the display briefly reads **Unlocked** and then changes to **Hold Mode/On Present** or **Hold Mode/On Manual**. Use the **Up** or **Down** arrow key to select **Off** and press **Enter**. The display briefly reads **Hold Released** and proceeds to Measure mode.

─ **NOTE** ──────────────────────────────────
If using the **Automatic Hold** feature, simply return to Measure mode to release the hold.
───

Figure 22. Hold Mode Structure Diagram

Calibration Mode

Calibration routines in your analyzer were designed for simplicity and the elimination of faults. Four calibration routines are available. See Figure 24. The first routine, **Solution**, enables you to enter or edit the value(s) of your solution. A manual 1-point (offset) calibration, to bias the measurement by a constant value, or a manual 2-point solution calibration can be performed. A solution 2-point calibration is the primary calibration. It should be used whenever your analyzer is used with a new (different) sensor and at regular intervals dictated by your application. The second routine, **Bench**, is accomplished by connecting a voltage to the analyzer or by returning to the stored "factory default" calibration. This calibration is usually used if you have a problem with your analyzer. However, if you are changing from an ISE measurement to a pH measurement, you should use a bench factory default calibration followed by a 2-point solution calibration. The third routine, **Analog n**, allows you to tune the 4 mA and 20 mA values of the analog outputs. The fourth routine, **Autoservice**, automates the process of cleaning and calibrating sensors. When activated, the analyzer sends a signal to a (user-supplied) control instrument which sequences the removal of the sensor from the process, its cleaning, calibration, and reinstallation, all automatically.

> ⎯ **NOTE** ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
> Invensys Foxboro recommends keeping a record of your calibrations. Recording the mV values and slope can help you establish maintenance and replacement information on your sensors.

To enter the Calibration mode, press the **Mode** key until the **Cal** indicator is illuminated. Press **Enter**. The **Hold** indicator blinks if measurements are held. Use the **Mode** key to exit Calibration mode and return to Measure mode.

Figure 23. Sample Calibration Screen

At the prompt, enter the passcode for Levels 1, 2, or 3 and press the **Enter** key. If you enter a correct passcode, the display responds in one of three ways depending on how **Automatic Hold** is configured. If **Automatic Hold** is configured **Off**, the display cautions you that the instrument is not in hold and to press **Enter** to continue or **Mode** to escape. If **Automatic Hold** is configured **Present**, the display cautions that hold is engaged but that outputs are held at the present level. It then unlocks the mode. If **Automatic Hold** is configured **Manual**, the display briefly displays **Hold Engaged** and **Unlocked.**

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You are then asked to enter the **Calibrator's Name**. After you do this and press the **Enter** key, the analyzer displays the first category in the top level calibration structure, **Calibrate**. Refer to Figure 24.
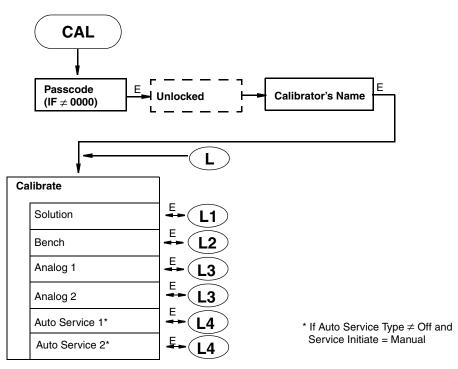
Figure 24. Calibration Category Structure

Solution Calibration

Refer to Figure 25 on page 37 and Figure 26 on page 38.

There are several types of solution calibration. A **Manual 1 Point** or **Manual 2 Point** solution calibration enables you to enter or edit the values of your solution. However, a **Manual 1 Point** calibration can only be used if you have previously done a **Manual 2 Point** calibration with your sensor.

> — **NOTE** —————————————————————————————————
> Only a **Manual 1 Pt** calibration can be used if you are measuring ORP.

A **Smart Cal** solution calibration can be used if you are measuring pH. It provides a buffer recognition mechanism which locks in on the buffer value most closely representing the combination of millivolts and temperature values being reported from the sensor.

If you are doing any of the solution calibrations, specify **Solution** from the top level calibration structure.

If you are using a new (different) sensor, before doing a solution calibration, check that the temperature in Status mode agrees with the actual temperature of your solution. If there is a difference, the actual temperature should be entered before beginning your calibration. To do this, specify **Temp Adjust** from the **Solution Cal** menu. Upon the prompt in the Help Message, put your sensor into its solution and press **Enter**. The solution temperature is displayed. If **Temp Stability** is configured **On**, the display reads **Stabilizing** until stability is achieved. When the

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message disappears, press **Enter**. If **Temp Stability** is configured **Off**, the display reads **Stability Off**. Watch for the measurement to stabilize before proceeding to press **Enter**.

The temperature is now displayed in the edit box. If the reading is not correct, edit it to the correct value and press **Enter**. Values of -20 to 200 °C or -4 to +392 °F in increments of 0.1 can be entered. The units (°C or °F) are determined by your configuration of "Temp Unit" on page 44. When finished, press **Enter**. The Help Message advises **Calibration Completed**. Press **Enter** again to return to the **Calibrate** menu.

Manual Calibrations

If you are doing a manual calibration, after specifying the temperature, select the **Manual 1 Point** or **Manual 2 Point** from the **Solution Cal** menu. The **Manual 1 Point** is used if you are correcting for a shift in system zero.

Upon the prompt in the Help Message, put your sensor into its solution and press **Enter**. If **Meas Stability** is configured **On**, the display reads **Stabilizing** until stability is achieved. When the message disappears, press **Enter**. If **Meas Stability** is configured **Off**, the display reads **Stability Off**. Watch for the measurement to stabilize before proceeding to press **Enter**.

If the reading is not correct, edit it to the correct value and press **Enter**. The Help Message displays **Calibration Completed** (for a 1-point calibration) or an instruction to put your sensor into the second solution (for a 2-point calibration). If you are doing a two-point calibration, repeat the procedure. When complete, press **Enter** to return to the **Calibrate** menu or **Mode** to return to Measure mode.
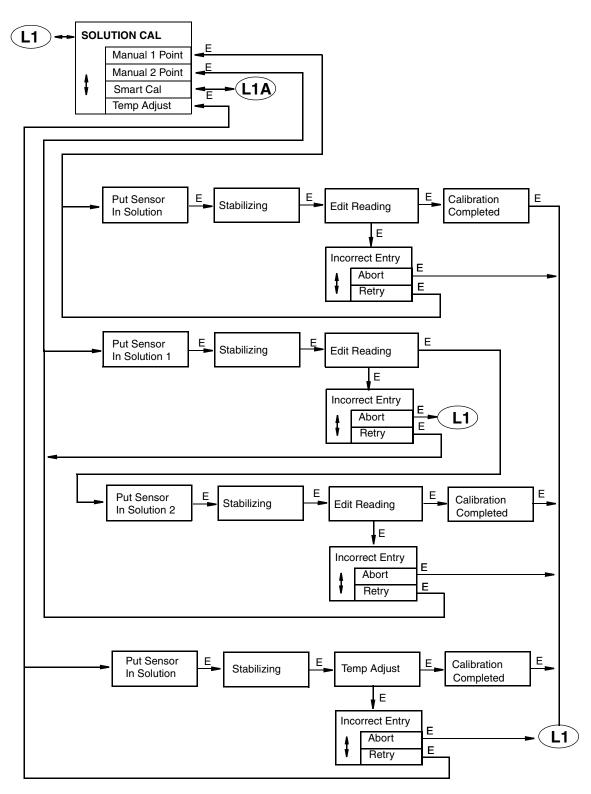
Figure 25. Solution Calibration Structure Diagram

Smart Calibration

If you are doing a **Smart Cal** calibration, after specifying the temperature, select **Smart Cal** from the **Solution Cal** menu.

Upon the prompt in the Help Message, put your sensor into Solution 1 and press **Enter**. If **Meas Stability** is configured **On**, the display reads **Stabilizing** until stability is achieved. When the message disappears, press **Enter**. If **Meas Stability** is configured **Off**, watch for the measurement to stabilize before proceeding to press **Enter**.

The display advises you which buffer is applicable. The Help Message advises to immerse your sensor into the second solution. Repeat the procedure. When complete, press **Enter** to return to the **Calibrate** menu or **Mode** to return to Measure mode.
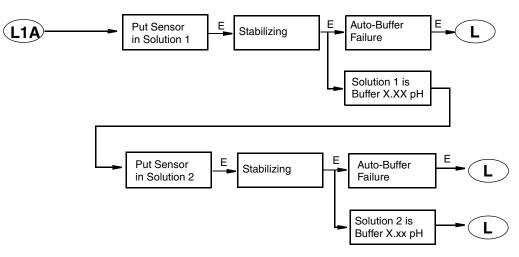
Figure 26. Smart Calibration Structure Diagram

Bench Calibration

Refer to Figure 27 on page 40.

If you are doing a bench calibration, specify **Bench** from the top level calibration structure. Then you have two choices. You can return to the stored factory default calibration by selecting **Default** and pressing **Enter**. However, you can alternatively verify the calibration of your analyzer (without the sensor) with theoretical millivolt inputs. If you want to do so, specify **User Bench** and press **Enter**.

> **NOTE**
> A Bench Calibration does not remove a Calibration Fault. Only a successful Solution Calibration does this.

Then proceed as follows:

1. Disconnect all sensor leads from your analyzer.

2. Connect a millivolt source between sensor input terminals as follows: positive to terminal 3 and negative to terminal 4. Jumper terminals 4 and 5.

3. Upon the prompt in the Help Message, adjust the millivolt supply to your first value as determined by the formula in Table 8 and press **Enter**. If **Meas Stability** is

configured **On**, the display reads **Stabilizing** until stability is achieved. When the message disappears, press **Enter**. If **Meas Stability** is configured **Off**, watch for the measurement to stabilize before proceeding to press **Enter**.

Table 8. Millivolt Supply Formulas

Measurement Mode	mV Power Supply Formula	Examples
Glass pH	(pH-7) x (-59.16)	pH0: (0-7) x (59.16) = +414.1 mV pH14: (14-7) x (59.16) = -414.1 mV
Antimony pH	(pH-1) x (-55)	pH0: (0-1) x (55.00) = +55.0 mV pH7: (7-1) x (55.00) = -330.0 mV
ORP	(mV)	Input absolute millivolt

ISE	(59/n) x log [ppm of sample/ ppm of standard] +mV of standard where n = charge and valence (2, 1, -1, -2)	Fluoride Sensor Assembly, EP459A
		Standard 1 ppm ≅ 118 mV
		Charge is negative and monovalent (n=-1)
		  (59/-1) log [ppmX/1 ppm] + 118 mV
		  ppm1 = 118 mV
		  ppm2 = 100 mV
		  ppm10 = 59 mV

4. If the reading is not correct, edit it to the correct value (to within 0.01%) and press **Enter**.

5. If this part of the calibration is successfully completed, the display prompts you to adjust the millivolt supply to the second value and repeat the procedure.

6. If the calibration is successfully completed, the display reads **Calibration Completed**.

7. If either part of the calibration was not successfully completed, the display reads **Incorrect Entry**. Press **Enter** twice to return to the Calibrate menu.

8. Lastly, reconnect your sensor wires and reconfigure **Temp Mode** to **Automatic** or desired **Manual** setting as necessary.
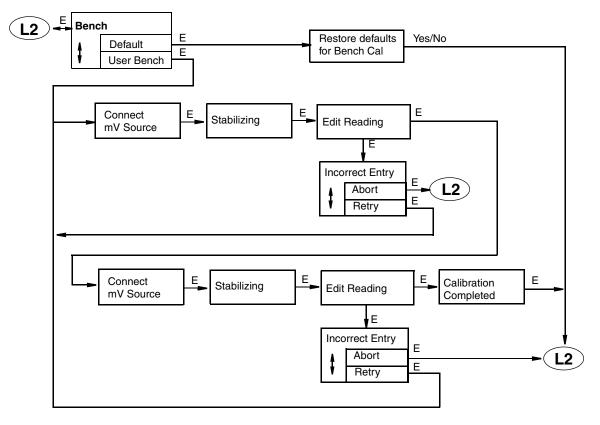
Figure 27. Bench Calibration Structure Diagram

Analog 1 and Analog 2

This subsection allows you to tune the 4 mA and 20 mA values. The procedure is as follows:

1. Connect a digital current meter between terminals MA1+ and MA1- for Analog 1 and MA2+ and MA2- for Analog 2.

2. With **Analog n** displayed, press **Enter**. The display changes to **Analog n 4 mA**.

3. Calibration is performed by having your current meter read 4 mA. Do this by selecting the degree of change required, **Course**, **Medium**, or **Fine,** by using the **Left** and **Right** arrow keys and the direction of the change by using the **Up** and **Down** arrow keys. Repeat this step until your meter reads 4 mA. Then press **Enter**. The display advances to **Analog n 20 mA**.

4. Repeat the procedure shown in Step 3 for 20 mA. The current reading should be 20 mA.
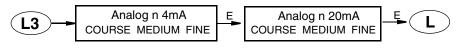
Figure 28. Analog Calibration Structure Diagram

Auto Service 1 and Auto Service 2

In order to perform an Auto Service procedure from the analyzer keypad, **Service Initiate/Manual** must be enabled in Configuration mode. Access the procedure by selecting **Auto Service n** from the **Calibrate** menu. To begin the Auto Service routine, select **Start** and press **Enter**. To exit from this procedure, select **Exit to Cal** and press **Enter**.
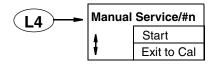
Figure 29. Auto Service Structure Diagram

Configuration Mode

Refer to Structure Diagrams in Appendix A.

Configuration is the process of establishing functional capability in the analyzer firmware for your application. This section helps you to systematically determine and configure the value or status of each parameter required for your application. Invensys Foxboro recommends that you make configuration changes from the beginning of the menu structure forward. This is because menus are forward referencing meaning that if you start at the beginning and work to the end, you achieve a valid configuration. Also, the analyzer validates the configuration when attempting to exit configuration and directs you to any invalid menus.

To enter the Configuration mode, press the **Mode** key until the **Config** indicator is illuminated. Press **Enter**. At the prompt, enter the passcode for Levels 1 or 2 and press the **Enter** key. If you enter an incorrect passcode, the display returns to **Passcode 0000**. If you enter the correct passcode, the display presents a picklist to choose **View** or **Change**. If you entered the Level 3 passcode, you can only view the basic configuration parameters. If you entered the Level 2 passcode, you are allowed to view or change the basic configuration parameters. If you entered the Level 1 passcode, you can view or change any configuration parameter. See Table 6 on page 24 for a listing of passcode access to various configuration parameters.

If you selected **Change**, the display responds in one of three ways depending on how **Automatic Hold** is configured. If **Automatic Hold** is configured **Off**, the display cautions you that the instrument is not in hold and to press **Enter** to continue or **Mode** to escape. If **Automatic Hold** is configured **Present**, the display cautions that hold is engaged but that outputs are held at the present level. It then unlocks the mode. If **Automatic Hold** is configured **Manual**, the display briefly displays **Hold Engaged** and **Unlocked**.

After selecting **View** or **Change**, the first category in the top level configuration structure, **Measurement**, is displayed. To view or change another configuration category, press the **Up** or **Down** arrow key. When you have located the desired category, press the **Enter** key. Each category of parameters is shown in subsequent structure diagrams.

⚠ **CAUTION**

If there are no key presses within the configured Timeout period, the analyzer reverts to Measure mode and all changes are lost.

Making a change to one configuration parameter can cause an invalid selection or out-of-range value in one or more other parameters. To assist you in properly configuring the analyzer, prompts are provided guiding you to these out-of-range parameters.

You can exit the Configuration mode and proceed to another mode at any time by pressing the **Mode** key. If you were in **View**, the analyzer goes directly to Measure mode. If you were in **Change**, the analyzer validates the configuration. If your new configuration **does not** contain invalid entries, the display reads **Configuration OK - Save Changes?** Press the **Yes** key to save the changes or the **No** key to abort the changes. The analyzer then goes to Measure mode. If your new configuration **does** contain invalid entries, the display reads **Configuration Error - Fix It?** Press the **Yes** key to fix the error or the **No** key to abort the changes. If **Yes**, the analyzer takes you to the first menu in error. Once the error is fixed, the analyzer validates the configuration. If **No**, the analyzer goes to Measure mode. Figure 30 shows the logic involved.

> ─ **NOTE** ──
> Changes are not implemented until they are saved and measure mode is restored.
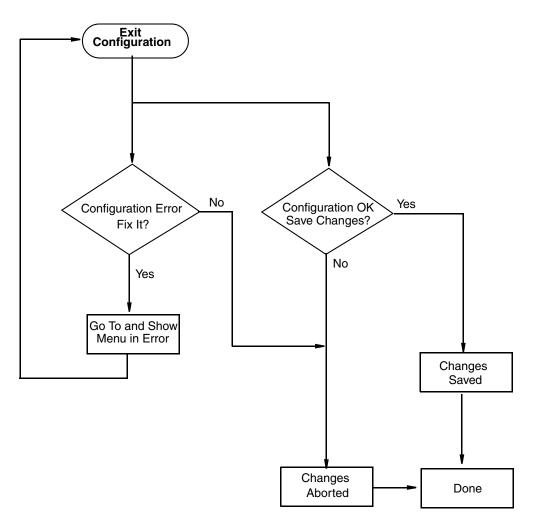
Figure 30. Configuration Mode Exit Flow

Configuration Display

| MEASURE | STATUS | HOLD | **CONFIG** | CAL | DIAG | ◄─── MODE INDICATOR

Alarm 1 ◄─── PARAMETER

Measurement ◄─── CURRENT CHOICE

Current Setting Is Measurement ◄─── CURRENT SETTING

Off, Measurement, ... On Fault ◄─── BEGINNING AND END OF CHOICE LIST
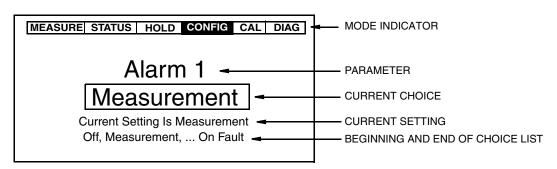
Figure 31. Sample Configuration Screen

Measurement

Refer to Figure A-2 on page 74.

This section of the structure enables you to specify your measurement **Units** as **pH** (for pH measurement), **mV** (for ORP measurement), **ppm** (for ISE measurement), or **Custom**.

If you choose **pH**, you must also specify your **Resolution** as **0.1 pH** or **0.01 pH**.

If you choose **ppm**, you must specify your **Scale** as **0.9999**, **9.999**, **99.99**, **999.9**, or **9999** and chemical compensation (**Chemical Comp**) as **Standard** or **Custom**. Selecting **Custom** requires that you specify a number of points (**Num of Pts**) to plot a compensation curve. The number of points can be specified from 2 through 21. Each point specifies a base value (**Base/Point n**) and a value you want it to be (**Custom/Point n**). The values can be specified from 0 through 2000 ppm.

If you choose **Custom**, you must specify your custom units in 5 characters or less. Then specify your **Custom Scale** as **0.9999**, **9.999**, **99.99**, **999.9**, or **9999**. You also must specify a number of points (**Num of Pts**) to plot the relationship between the base unit and the custom unit. The number of points can be specified from 2 through 21. Each point specifies a base value (**Base/Point n**) and a value you want it to be (**Custom/Point n**).

Lastly, this section of the structure asks you to specify the **Damping** response time (for 90% recovery from an input step). Choices are **None**, **5**, **10**, **20**, **40**, and **120** seconds. To increase damping, use a higher response time. Damping applies only to measurement data, not to temperature data.

Sensor

Refer to Figure A-3 on page 75.

Electrode

If you specified your **Units** as **pH** or **ppm**, you must specify your **Electrode** here.

♦ If measuring pH: Your choices are **Glass**, **Antimony**, or **Other**. **Glass** sets the isopotential point at 7 pH. **Antimony** sets it at 1 pH. **Other** allows the isopotential point to be set manually from -2.0 through 16.0 pH.

♦ If measuring ISE: You must specify the ion polarity as **Positive** or **Negative**. A positive ion selective measurement gets more positive (mV-wise) as the concentration increases (for example, Na^+, K^+). A negative ion selective measurement gets more negative (mV-wise) as the concentration increases (for example, F^-, S^{-2}). For fluoride measurements, this parameter should be set to negative.
Next, select the **Valence** as **Monovalent** or **Divalent**. Then set the isopotential point from -2000 through +2000 mV.

> ─ **NOTE** ─────────────────────────────
> If you specified your **Units** as **mV** or **Custom**, this section does not appear.

Temp Type

First, specify the **Temp Type** as **RTD** or **BALCO**.

If you specify the **Temp Type** as **RTD**, specify 2-wire or 3-wire RTD and its resistance value as **2 Wire 100Ω, 2 Wire 1000Ω, 3 Wire 100Ω,** or **3 Wire 1000Ω**.

Temp Unit

Specify **Temp Unit** as **Celsius** or **Fahrenheit**. All references to temperature appear in the specified units within the analyzer software.

Temp Mode

Specify the **Temp Mode** as **Automatic** or **Manual**.

In **Automatic** mode, the temperature follows the temperature input RTD and you can set a temperature fail signal value (**Fail Signal**), in case the RTD fails, at the temperature at which you expect the process to be operating.

In **Manual** mode, the temperature can be set at a fixed temperature value and resistance inputs on the temperature terminal are ignored.

Temp Comp

Refer to Figure A-4 on page 75.

This section of the structure asks you to specify the temperature compensation if you are measuring pH or ISE.

> ─ **NOTE** ─────────────────────────────
> This section does not appear if you selected **mV** as your **Unit**.

If **pH** was chosen as your **Units**, specify **Standard**, **Ammonia**, or **Custom. Standard** assumes a glass or antimony electrode and applies the Nernst equation. The nominal temperature compensation range is -5 to +105°C (23 to 221°F). **Ammonia** compensates for traces of ammonia in addition to the standard compensation. **Custom** allows you to specify particular solution characteristics into the analyzer's memory. When using this compensation, all measurements are corrected back to a reference temperature measurement value. Therefore, you are asked to specify a reference temperature and a number of points to plot a compensation curve. The reference temperature (**Reference Temp**) can be set from -20 through + 200°C or -4

through +392°F in increments of 0.1 degree but should be within the nominal temperature compensation range. The number of points (**Num of Pts**) can be specified from 2 to 21 points. Each point specifies a value at a certain temperature. The temperatures (**Temp/Point n**) can be set from -20 through + 200°C or -4 through +392°F in increments of 0.1 degree but should be within the nominal temperature compensation range. The temperature units were specified in the previous section. The values (**Value/Point n**) can be specified within the current scale.

> ⌐ **NOTE** ───
> 1. The temperature values must be entered in increasing or decreasing order or the display will read **Slope Error**.
>
> 2. Actual database saving of the compensation table is not performed until the last point pair is entered.

If **ppm** was chosen as your **Units**, you must specify **Standard** or **Custom**. **Custom** causes you to specify a reference temperature and a number of points to plot a compensation curve. The procedure is described immediately above. The values (**Value/Point n**) can be specified from 0 to 2000 ppm.

Display

Refer to Figure A-5 on page 76.

In Measure mode, the display normally shows the information configured in this section. First you must specify the **Line Mode**. The choices are:

♦ **Single:** The measurement title, value, and unit are displayed. If more than one application is configured, the application number replaces the measurement title. The bar graph shows the percent of the configured range of the value on the display.

♦ **Dual:** Two measurement titles, values, and units are displayed. If more than one application is configured, the application number replaces the Line 1 measurement title. The bar graph shows the percent of the configured range of the Line 1 value on the display.

♦ **Scan:** Several measurements can be selected to show in sequence on the display in a designated scan time. When you are in Scan mode, the bar graph is inactive.

If you are in **Single Line Mode**, you must select, in the **Line** parameter, the measurement you want shown on the display. If you are in **Dual Line Mode**, you must select, in the **Line 1** and **Line 2** parameters, the measurements you want shown on the display. Choose from the selections in Table 9.

Table 9. Display Configuration

Selection	Description
Measurement	The pH, ORP, or ISE measurement
Temperature	The temperature measurement
Absolute	The absolute value of the measurement in base units
Analog 1	Analog Output 1
Analog 2 (or HART if installed)	Analog Output 2

Next, enter the minimum (**Bargraph Min**) and maximum (**Bargraph Max**) bar graph values if you selected **Measurement**, **Temperature**, or **Absolute** in **Line** or **Line 1**. See Table 10 for the scale and units that apply to each selection.

Table 10. Bar graph Configuration

Selection	Unit	Scale
Measurement	Per "Measurement" on page 43 pH mV ppm Custom	Per "Measurement" on page 43
Temperature	Per "Temp Unit" on page 44 °C °F	-20 through +200 by 0.1 if °C -4 through +392 by 0.1 if °F
Absolute	mV	-2010 through +2010 mV by 0.01

If in **Scan Mode**, you must specify which measurements you want to display in sequence (**Scan Data**) and the **Scan Time**. The Scan Data selections are from the list shown in Table 9. The **Scan Time** choices are **2**, **5**, **10**, and **20** seconds.

Scan Data choices are selected or deselected by presenting a choice on the display and pressing the **Enter** key. The selected choices appear on the menu preceded by a check sign (√). When you have finished making your selections, choose **Exit**.

Analog 1 and Analog 2

Refer to Figure A-6 on page 76.

There are two analog outputs in the analyzer, **Analog 1** and **Analog 2**. Each analog output is configured independently. On power-up and after configuration changes, the output reflects the fail-safe value as configured until the analyzer has stabilized and has passed the first damping factor.

This section of the structure enables you to specify what measurement each analog output reflects, the minimum and maximum range values for the outputs just specified, and a fail-safe signal for each output.

Measurement

For each analog output (**Analog n**), specify the 4 to 20 mA output to represent one of the following measurements: **Measurement**, **Temperature**, or **Absolute**. You can also specify **Off** if you are not using the output.

Output Range

The nominal output measurement currents are 4 mA and 20 mA. Both can be configured to any measurement value. When the 4 mA level represents the measurement highest value and 20 mA represents the measurement lowest value, the outputs are reverse acting.

Enter the minimum (**Min@4mA/Analog n**) and maximum (**Max@20mA/Analog n**) range values for the output just specified. See Table 10 for the scale and units that apply to each selection. There must be a minimum difference of 5% between the minimum and maximum values.

Fail-Safe Output

A fail-safe output is delivered for all analyzer faults and for certain sensor diagnostic faults (ATC Short, ATC Open, Glass, and Preamp) when so configured. Select **Off** under **Failsafe** to omit this feature. Select **On** to specify a fixed output when in a failed condition. Select **Pulse** if you want to have this signal outputted with a pulsed saw-tooth waveform of 0.5 mA (as shown below) for greater visibility on a chart recorder or data display. The waveform has a frequency of 10 Hz with 10 steps of 0.1 mA increments.

If **On** is selected, further specify the **DC mA/Analog n** output between 3.8 and 20.5 mA. If **Pulse** is selected, further specify the **Average mA/Analog n** output between 3.8 and 20.5 mA.

An example of how to use this feature follows.

Suppose you are using your 4 to 20 mA signal to control a valve that diverts high pH water. You also wish to divert the flow if the measurement system is suspect due to a configuration error. To configure your analyzer to do this:

1. Configure your output so that 20 mA is the upper limit of acceptable water before diverting flow.

2. Configure **Failsafe** as **On** and set the **DC mA/Analog 1** value as 20.5.

3. In **Diagnostic**, enable the **4-20 Range**, **Comp Range**, and **Meas Range** selections and disable the **ATC Short**, **ATC Open**, **Glass**, and **Preamp** selections.

HART Analog

Refer to Figure A-7 on page 77.

The analyzer can have an optional communication module that allows measurement, status, and configuration information to be exchanged between the analyzer and the connected host. HART is one of these modules.

The **HART Analog** parameter enables you to specify what measurement the analog output reflects, the minimum and maximum range values for the output just specified, and a fail-safe signal for the output. See "Analog 1 and Analog 2" on page 46 for an explanation of how to configure these parameters.

─ **NOTE** ───
1. The **Failsafe (HART)** parameter does not have a **Pulse** selection.

2. To configure your HART digital communication parameters, see "HART Digital" on page 54.

HART Digital Outputs

The analyzer can have an optional communication module that allows measurement, status, configuration, calibration, and diagnostic information to be exchanged between the analyzer and the connected host.

There are four HART measurements:

HART Measurement	875 Configuration Parameter
Primary Variable (PV)	Analog 1
Secondary Variable (SV)	HART Analog
Tertiary Variable (TV)	HART TV
Fourth Variable (FV)	HART FV

HART PV (Analog 1)

The primary variable (PV) is the measurement configured for Analog 1. Analog 1 can be configured to represent **Measurement**, **Temperature**, or **Absolute** measurements. It is frequently configured to be the **Measurement** such as pH, ORP, or ppm. You can also specify **Off** if you are not using this output.

HART SV (HART Analog)

The secondary variable (SV) is the measurement configured for HART Analog. Hart Analog can be configured to represent **Measurement**, **Temperature**, or **Absolute** measurements. It is frequently configured to **Temperature**. You can also specify **Off** if you are not using this output.

HART TV

The tertiary variable (TV) can be configured to represent **Measurement**, **Temperature**, or **Absolute** measurements. It is frequently configured to **Absolute**. You can also specify **Off** if you are not using this output.

HART FV

The fourth variable (FV) can be configured to represent **Measurement**, **Temperature**, or **Absolute** measurements. You can also specify **Off** if you are not using this output. It is usually configured to **Off**.

Diagnostics

Refer to Figure A-8 on page 77.

This section of the structure allows you to configure fault messages that can appear on your display. In **Select Diag**, you can elect to enable or disable **All Diags** messages, or enable or disable each of the following individually: **Leakage**, **ATC Short**, **ATC Open**, **4 - 20 Range**, **Comp Range**, **Meas Range**, **Glass**, **Low Slope**, **Preamp**, **Aging**, and **Coating**. Each of these is discussed below. A typical approach is to initially disable **All Diags** messages and to enable selected messages later when you find out that you require them.

Choices are selected or deselected by presenting a choice on the display and pressing the **Enter** key. The selected choices appear on the menu preceded by a check sign (√). When you have finished making your selections, choose **Exit**. The menu returns to **Select Diag**.

> ── **NOTE** ──────────────────────────────────
> Diagnostics that are enabled and triggered can also force a fail-safe analog output
> signal, if desired. See "Analog 1 and Analog 2" on page 46.

If you have enabled **Glass**, **Low Slope**, **Preamp**, or **Coating**, use the **Down** arrow in the Diagnostic menu to select **Set Diag Limits**. When you have finished setting the limits, the menu returns to **Select Diag Limits**. Go to **Select Diag** with the **Up** arrow key and to **Diagnostics** with the **Left** arrow key.

Leakage

This message reports a problem of severe liquid leakage into the sensor which causes an ATC short to a measurement electrode. The message can be enabled or disabled. A **Sensor Fault** message is displayed if this diagnostic is enabled and this fault occurs.

ATC Short, ATC Open

This message reports a problem if the resistance of the temperature compensator is greater or less than the expected resistance of the device configured. The message for each can be enabled or disabled. A **Sensor Fault** message is displayed if this diagnostic is enabled and this fault occurs.

4 to 20 Range

This message reports that the measurement tied to the analog output (measurement, absolute measurement, or temperature) is outside the range configured for the currently running application. The message can be enabled or disabled. A **Configuration Fault** message is displayed if this diagnostic is enabled and this fault occurs.

Comp Range

This message reports that the measured temperature or absolute conductivity or resistivity measurement is outside the temperature or chemical compensation curve configured for the currently running application. The message can be enabled or disabled. A **Configuration Fault** message is displayed if this diagnostic is enabled and this fault occurs.

Meas Range

This message reports that the measurement is over or under the measurable range that is configured for the currently running application. The message can be enabled or disabled. A **Configuration Fault** message is displayed if this diagnostic is enabled and this fault occurs.

Glass

This message reports a problem in the resistance of a glass electrode in the sensor. Resistance of a glass electrode is checked versus solution ground. A **Sensor Fault** message appears if the resistance is less than the user-set limit. Besides enabling and disabling the message, you can limit

the message to resistances below a set value. The **Glass Lo Limit** value can be set from 0.1 through 1.1 MΩ in increments of 0.1 MΩ. You can also specify a cutoff temperature above which this feature is disabled. **Glass Cutoff Temp** can be set from -20 through +200 °C or -4 through 392 °F in increments of 1 degree. The resistance of a glass bulb decreases (roughly is halved) for every 10 °C increase in temperature.

> ─ **NOTE** ───────────────────────────────────
> This message does not appear for ORP measurement.

Low Slope

This message reports a problem usually associated with an aging glass electrode. A **Sensor Fault** message appears after a 2-point calibration in buffer solutions when the Nernst slope of the sensor becomes less than the user set limit. The limit can be set from 0 through 100 percent in increments of 1 percent. The message can be enabled or disabled.

> ─ **NOTE** ───────────────────────────────────
> This message does not appear for ORP measurement.

Preamp

This message reports a failed preamplifier. If the voltage out of the preamp exceeds +2.5 V a **Sensor Fault** is reported. Also, a **Sensor Fault** message appears when the power consumed by the sensor is greater than the user set limit. The limit can be from 0 through 70 mW in increments of 1 mW. The message can be enabled or disabled.

Aging

This message reports an aging glass electrode. A **Sensor Fault** message appears after a 2-point calibration in pH buffer solutions when the Nernst slope of the sensor has decreased sequentially five times. The message can be enabled or disabled.

Coating

This message reports an increase in reference junction resistance possibly resulting from a fouled reference junction. The diagnostics check the resistance against solution ground. A **Sensor Fault** message appears if the resistance is greater than the user set limit. The limit can be set from 0 through 100 kΩ. The message can be enabled or disabled.

Auto Service 1 and Auto Service 2

Refer to Figure A-9 on page 78.

The analyzer Auto Service feature automates the process of cleaning and calibrating sensors. When activated, the analyzer sends a signal to a (user-supplied) control instrument which sequences the removal of the sensor from the process, its cleaning, calibration, and reinstallation, all automatically.

To configure this feature, first specify the type of auto service desired. The choices are **Auto-Clean**, **One point Cal**, **Two Point Cal**, **Clean + 1Pt Cal**, and **Clean + 2Pt Cal**. The type can also be set to **Off**.

Methods of Initiation

Next specify the method or methods to **Initiate** the auto service. The choices are **Manual** (from the analyzer keypad), **Signaled** (by an input trigger), **Scheduled** (by a set date or period), **Diagnostic** (by a fault), and **All Selects** (all of the above). Choices are selected or deselected by presenting a choice on the display and pressing the **Enter** key. The selected choices appear on the menu preceded by a check sign (√). When you have finished making your selections, choose **Exit**.

If you selected **Signaled**, you must specify the **Input Trigger** as **High** or **Low**. If **High**, Auto Service is initiated when the input switch is closed. If **Low**, it is initiated when the input switch is open.

> ─ **NOTE** ───
> The input trigger for this signal is from digital input DI1 for Auto Service 1 and DI2 for Auto Service 2.

If you selected **Diagnostic**, you must select the specific fault you want to initiate the auto service feature. The choices are **Low Slope**, **Coat**, or **All Selects** (all of the above). Choices are selected or deselected by presenting a choice on the display and pressing the **Enter** key. The selected choices appear on the menu preceded by a check sign (√). When you have finished making your selections, choose **Exit**.

If you selected **Scheduled**, you must select the schedule. The choices are **Daily**, **Weekly**, **Monthly**, **Period by Days**, and **Period by Hours**. If you selected **Weekly** or **Monthly**, you must specify the days of the week (**All Days** or **Monday**, **Tuesday**, ... **Sunday**) or the days of the month (**Al Days** or **1**, **2**, **3**, ...**28**) respectively. Choices are selected or deselected by presenting a choice on the display and pressing the **Enter** key. The selected choices appear on the menu preceded by a check sign (√). When you have finished making your selections, choose **Exit**. If you selected **Daily**, **Weekly**, or **Monthly**, you must specify the **Time of Day**.

If you selected **Period by Days**, you must specify the **Period of Day/#n** from 1 to 365. For example, to do the procedure once every 10 days, select 10. If you selected **Period by Hours**, you must specify the **Period of Hour/#n** from 1 to 8760. For example, to do the procedure once every 8 hours, select 8. In both cases, you must also specify the **Start Date** from 1/01/9999 to 12/31/2098 and the Start Time from 00:00 to 23:59.

Calibration Solution

In selecting your calibration solutions, you can choose between **User Solutions** and **Smart Cal Buff**. If you selected **User Solutions**, you must specify the **Solution Value/#n** for a one-point calibration or **Solution Value 1/#n** and **Solution Value 2/#n** for a two-point calibration. The value can be 0 to full scale.

> ─ **NOTE** ───
> **Smart Cal Buff** is not available with a one point calibration. Therefore, the structure goes directly to **Solution Value 1/n** if **Auto Service Type** is **One Point Cal** or **Clean + 1Pt Cal**.

Auto-Clean and Calibration Times

Next you must establish times for the various steps in the auto service procedure. The **T1 Setup Time** is the time for cleaning, purging, and setup. Next is the **T2 Hold Time** (time in Solution 1) and **T3 Setup Time** (for cleaning, purging, and set up) if you are doing a calibration. Lastly is **T4 Hold Time** (time in Solution 2) and **T5 Setup Time** (for cleaning, purging, and set up) if you are doing a two-point calibration. The Setup and Hold times can be set from 15 to 999 seconds.

Trip State and Hold

Lastly, specify the **Trip State** as **Energized** or **Deenergized**. Also specify the **Hold** parameter as **Off**, **On Present** (to hold all values and states at their present level) or **On Manual** (to set all values and states at the levels specified in Hold mode).

Signaled Hold

Refer to Figure A-11 on page 79.

This parameter enables to configure your analyzer to go into Hold mode upon receiving a digital signal. To configure this parameter, specify the **Signaled Hold Mode** as **On Present** (to hold all values and states at their current level), **On Manual** (to set all values and states at the levels specified in Hold mode), or **Off** (if you choose not to use this feature). Then specify **Signaled Input Trig** as **High** or **Low**. If **High**, Hold is initiated when input switch DI3 is closed. If **Low**, it is initiated when the input switch is open.

Alarm 1, Alarm 2

Refer to Figure A-12 on page 80.

The analyzer has two sets of alarm contacts. Each is configured independently. On power-up and after configuration changes, alarm action is inhibited until the analyzer has stabilized and has passed the first damping factor. The alarm output may not be in the desired state until that time.

> **NOTE**
> **Auto Service** must be configured **Off** for **Alarm 1** to be available for configuration.

Measurement Condition

For each alarm (**Alarm n**), specify the alarm to one of the following measurements or conditions: **Measurement**, **Temperature**, **Absolute**, or **On Fault**. You can also specify **Off** if you are not using the alarm.

Alarm Activation

Next, specify in **Trip n** if you want the alarm to be:

- ♦ **Trip Low**: Active (energize relay) on a low going condition
- ♦ **Trip High**: Active (energize relay) on a high going condition

Specify the trip point (**Set Point n**) value. This is in the units previously configured and within the scale previously specified. Then specify **Control n** as **Hysteresis** or **Timed**. Both are used to minimize chatter around the setpoint. **Hysteresis** does this by using the measurement; **Timed**,

by using time. If **Control n** is specified as **Hysteresis**, enter the hysteresis value. If you choose not to use either hysteresis or timed control, select **Hysteresis** and set the hysteresis value to zero.
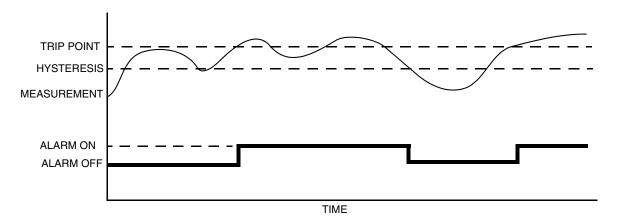
Figure 32. High Alarm with Hysteresis

If **Control** is specified as **Timed**, three timers are involved in the alarm:

♦ A **Trig Time n** (trigger time) wherein the condition must exist continuously for at least this time period before the alarm condition is met

♦ An alarm **On Time n** (feed time)

♦ An alarm **Off Time n** (delay time) before the alarm can trigger again.

The values can be set from 00.00 to 99.99 minutes.
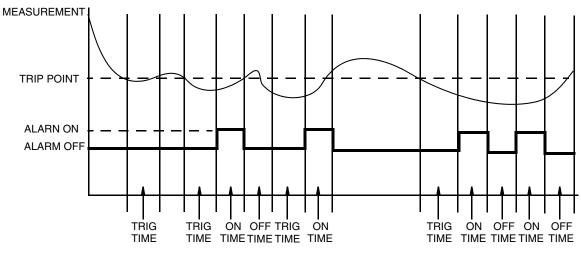
Figure 33. Timed Low Alarm

If you are logged on at Passcode Level 1, you are asked to specify the alarm fault action. If you are not logged on at Passcode Level 1, the structure advances you to the next parameter, **Trip State**. Set **Alm Fault Act** as **Meas Value**, **Meas + Fault**, or **Valid Meas**.

Meas Value enables an alarm only when the measurement exceeds the alarm set point.

Meas + Fault enables an alarm when the measurement exceeds the set point and if one of the selected faults is present. You can select the **Faults** that you want to activate the alarm. The choices are **All Faults**, **Analyzer Faults**, **Comm Faults**, **Leakage**, **Temp**, **ATC Short**, **ATC Open**, **4-20 Range**, **Comp Range**, **Meas Range**, **Glass**, **Low Slope**, **Preamp**, **Aging**, and **Coat**. Choices are selected or deselected by presenting a choice on the display and pressing the **Enter** key. The selected choices appear on the menu preceded by a check mark (√). When you have finished making your selections, choose **Exit**.

Valid Meas validates the cause when the measurement exceeds the setpoint. If the cause is a fault and not process related, the alarm is disabled.

Lastly, specify the **Trip State** as **Energized** or **Deenergized**. In an alarm condition, **Energized** provides a contact closure between 1C and 1NO (2C and 2NO) and an open contact between 1C and 1NC (2C and 2NC); **Deenergized** provides a contact closure between 1C and 1NC (2C and 2NC) and an open contact between 1C and 1NO (2C and 2NO). To provide alarm capability on loss of power, select **Deenergized**.

> ┌─ **NOTE** ───
> The way you configure the alarm trip state must be done in conjunction with the way you wire the external device to the analyzer. See "Alarm Wiring" on page 19.

Remote

Refer to Figure A-13 on page 81.

The analyzer can be operated via a remote personal computer program on a PC operating on Windows 95, Windows 98, Windows NT, or Windows 2000. To enable this capability, several parameters must be configured in this section of the structure.

Begin by setting **Configure Remote**, to **Port Settings**. Then, set the **Baud Rate** to **300**, **600**, **1200**, **2400**, **4800**, **9600**, or **19200**, the **Data Parity** to **7 Odd**, **7 Even**, **8 Odd**, **8 Even**, or **8 None** and the **Stop Bits** to **1** or **2**.

Next, go back and set **Configure Remote** to **Update Rate**. Set the **Update** frequency as every **5**, **10**, **30**, **60**, **120**, **300**, **600**, **1200**, or **3600** seconds. You can also set this parameter to **Off**. The analyzer updates the remote port with measurement information at the configured update rate.

HART Digital

Refer to Figure A-14.

This section of the structure enables you to specify your HART digital communication parameters. First, specify the **Poll Address** of 0 to 15. Then, specify the **Preambles** value of 5 to 255.

> ┌─ **NOTE** ───
> To configure your HART analog output, see "HART Analog" on page 47.
> To configure your HART digital output, see "HART Digital Outputs" on page 48.

Cal Parameters

Refer to Figure A-15.

This section of the structure asks you to specify the buffers to be used if you are measuring pH and using the **Smart** solution calibration feature described on page 38. It also asks you to define the parameters used by the analyzer in checking for measurement and temperature stability when performing a calibration.

Buffers

In **Smart** calibration, the pH value calculated with values from the last calibration is used to decide which buffer is in use. The algorithm checks each buffer starting with Buffer 1 and selects the first one for which this pH is within the configured **Tolerance** of the average pH for the buffer. You can select between **American**, **NIST**, **European**, and **Special** buffers as standard buffer table choices. The **Tolerance** of auto-buffer recognition can be set from 0.0 through 2.0 pH.

If you select **Special**, you must specify the number of points (**Buf#n Num Points**) between 2 and 21 for Buffer 1, 2, and 3. Each point specifies a value at a certain temperature. The temperatures (**Buf#n Temp n**) can be specified from -20 to +200 °C by 0.1°C or -4 to 392 °F by 0.1 °F. The values (**Buf#n Value n**) can be specified from -2.00 to +16.00 pH.

If the average pH values of two **Special** buffers are less than 1 pH unit apart, using this procedure might result in the wrong buffer being selected. In this case, the buffer selection is based on the midpoint between the two buffers. It is not necessary to configure all three **Special** buffers. If only two are used, they should be Buffers 1 and 2. If one is used, it should be Buffer 1. Enter Special buffer tables in the increasing order of the average pH for the buffer. The average pH is estimated as (first entry + last entry) / 2.

Tables of buffer values for nominal 4, 7, and 10 pH for American, NIST, and European buffers are listed below.

Table 11. American Buffer Tables

Temperature °C	4.00 pH	7.00 pH	10.01 pH
	pH Value	pH Value	pH Value
0	4.00	7.12	10.32
5	4.00	7.09	10.25
10	4.00	7.06	10.18
15	4.00	7.04	10.12
20	4.00	7.02	10.06
25	4.00	7.00	10.01
30	4.01	6.99	9.97
35	4.02	6.99	9.93
40	4.03	6.98	9.89
45	4.04	6.98	9.86
50	4.06	6.97	9.83

> ⎯ **NOTE** ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
>
> Values in Table 11 are based on common (nominal value) technical buffer systems.
> pH values are at 25°C. Chemical formulas are as follows:
>
> 4.00 pH: 0.05 molar Potassium Hydrogen Phthalate
> 7.00 pH: 0.041 molar Disodium Hydrogen Phosphate;
>   0.026 molar Potassium Dihydrogen Phosphate
> 10.01 pH: 0.025 molar Sodium Carbonate;
>   0.025 molar Sodium Bicarbonate

Table 12. NIST Buffer Tables

Temperature °C	4.01 pH	6.86 pH	9.18 pH
	pH Value	pH Value	pH Value
0	4.00	6.98	9.46
5	4.00	6.95	9.40
10	4.00	6.92	9.33
15	4.00	6.90	9.28
20	4.00	6.88	9.23
25	4.01	6.86	9.18
30	4.02	6.85	9.14
35	4.03	6.84	9.10
40	4.04	6.84	9.07
45	4.05	6.83	9.04
50	4.06	6.83	9.01

> ⎯ **NOTE** ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
>
> Values in Table 12 are based on NIST Primary Buffer Systems. pH values are at
> 25°C. Chemical formulas are as follows:
>
> 4.01 pH: 0.05 molar Potassium Hydrogen Phthalate
> 6.86 pH: 0.025 molar Potassium Dihydrogen Phosphate;
>   0.025 molar Disodium Hydrogen Phosphate
> 9.18 pH: 0.01 molar Sodium Tetraborate Decahydrate (Borax)

Table 13. European Buffer Tables

Temperature °C	4.61 pH pH Value	7.00 pH pH Value	9.21 pH pH Value
0		7.12	9.52
5		7.09	9.45
10	4.64	7.06	9.38
15	4.62	7.04	9.32
20	4.61	7.02	9.26
25	4.61	7.00	9.21
30	4.61	6.99	9.16
35	4.62	6.98	9.11
40	4.63	6.97	9.07
45	4.64	6.97	9.03
50	4.66	6.97	8.99
55	4.67	6.97	8.96
60	4.69	6.98	8.93
70	4.71	7.00	8.88
80		7.04	8.83
90		7.09	8.79
95		7.12	8.77

— **NOTE** —
Values in Table 13 are based on commercially available technical buffers used in some parts of Europe. pH values are at 25°C. Chemical formulas are as follows:
4.61 pH: 0.1 molar Sodium Acetate; 0.1 molar Acetic Acid
7.00 pH: 0.026 molar Potassium Dihydrogen Phosphate;
0.041 molar Disodium Hydrogen Phosphate
9.21 pH: 0.05 molar Sodium Tetraborate Decahydrate (Borax)

Measurement and Temperature Stability

When performing a calibration (see "Calibration Mode" on page 34), the analyzer checks for stability in absolute measurement (**Meas Stability**) and temperature (**Temp Stability**) before accepting a change. This section enables you to configure the time (**Stability Time**) in seconds allowed to attain stability and the amount of fluctuation (**Stability Var**) in 0.1° increments allowed during the calibration. Both **Stability Time** and **Stability Var** are configured individually in **Meas Stability** and **Temp Stability**.

First, configure **Meas Stability** as **On** or **Off**. If you configure this as **On**, you need to specify the **Stability Time** between 5 and 60 seconds (in 5-second increments) and the **Stability Var** between 1 and 9. A longer time period and a smaller measurement value assures more stability during calibration.

Then repeat the procedure for **Temp Stability**. If you configure this as **On**, you need to specify the **Stability Time** between 5 and 60 seconds (in 5-second increments) and the **Stability Var** between 1 and 9 (°C or °F).

Automatic Hold

Refer to Figure A-16 on page 82.

This parameter enables to configure your analyzer to go into a Hold state whenever you are in Calibration or Configuration mode without setting the Hold each time. It also automatically removes the Hold when you leave Calibration or Configuration mode. To configure this parameter, specify **Automatic Hold** as **Present** (to hold all values and states at their current levels), **Manual** (to set all values and states at the levels specified in Hold mode), or **Off** (if you choose not to use this feature).

Timeouts

Refer to Figure A-17 on page 83.

This section of the structure asks you to specify the time in which the instrument brings you back to the Measure mode from another on-line mode (Status, Diagnostics, or Configuration) when no keyboard input has occurred. In Measure mode, **Timeouts** also limits the time to view a secondary display other than that configured in "Display" on page 45. The timeout can be configured separately for front panel (**Front Panel Timeout**), remote (**Remote Timeout**), and digital communication (**Dig Comm Timeout**) operation. The time can be specified between 5 and 999 seconds.

Date and Time

Refer to Figure A-18 on page 83.

The analyzer contains a real-time clock device that maintains the correct time and date even with loss of power.

To configure this parameter, enter the **Date** in the form mm/dd/yyyy and the **Time** as hh:mm. The time is on the basis of 24 hours.

Analyzer Names

Refer to Figure A-19 on page 83.

This section of the structure asks you to identify your analyzer. You can specify its Tag Number, Tag Name, Location, and Device Name. Each can have a maximum number of characters listed below.

Tag Number	12 characters
Tag Name	16 characters
Location	14 characters
Device Name	8 characters.

These identifications then appear in Status mode.

Passcode

Refer to Figure A-20 on page 83.

Analyzer security is provided by the use of passcodes. This is described in detail in "Passcode Access" on page 24. The passcodes for the three levels of security can be established in this parameter. Enter the passcode for **Level 1**, **Level 2**, and **Level 3**. Each can be from 0000 to 9999.

Adjust LCD

Refer to Figure A-21 on page 83.

You can adjust the brightness on your display. Do this, in this section of the structure, by changing the **LCD Adjustment** number using the **Up** and **Down** arrow keys. The numbers (-9 to 0 to +9) shown on the display should only be used as an indication of where you are in the range of adjustment. Use the **Up** arrow key to darken the display and the **Down** arrow key to lighten it. When the display brightness is satisfactory, press **Enter**.

Default

Refer to Figure A-22 on page 83.

At the display **Config to Defaults**, you can leave the parameters as presently set by selecting **Exit to Config**. Alternatively, you can reset your configuration back to the factory default settings by selecting **Load Defaults**. The factory default settings are shown in bold print in Appendix B. If you do the latter, you are asked **Are You Sure?** Respond with the **Yes** or **No** key.

> ⚠️ **CAUTION**
> Loading factory defaults permanently removes your present configuration.

Diagnostic Mode

The Diagnostic mode enables you to:

- ♦ View pending faults and temporarily suspend those faults
- ♦ Resume any suspended faults
- ♦ View the diagnostic history log
- ♦ Send the history log to a remote port
- ♦ Erase the history log.

To enter the Diagnostic mode, press the **Mode** key until the **Diag** indicator is illuminated. Press **Enter**. Use the **Mode** key to exit Diagnostic mode and go to Measure mode. If there are no key presses within the configured Timeout period, the analyzer reverts to Measure mode and the outputs remain on hold.
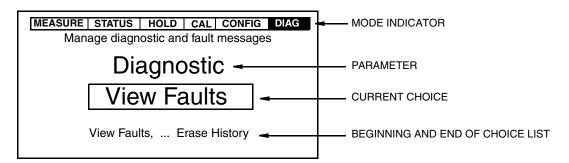
```
┌──────────────────────────────────────────┐
│ MEASURE │ STATUS │ HOLD │ CAL │ CONFIG │ DIAG │ ◀── MODE INDICATOR
│         Manage diagnostic and fault messages │
│                                            │
│          Diagnostic ◀────────────────────── PARAMETER
│       ┌─────────────────┐                  │
│       │   View Faults   │ ◀──────────────── CURRENT CHOICE
│       └─────────────────┘                  │
│                                            │
│     View Faults, ... Erase History ◀────── BEGINNING AND END OF CHOICE LIST
│                                            │
└──────────────────────────────────────────┘
```

Figure 34. Sample Diagnostic Screen

Figure 35 shows the top-level Diagnostic mode structure diagram.

Select **View Faults** to view and possibly suspend each fault. Use the **Up** and **Down** (or **Right**) arrow keys to view other faults. If there are no faults, the display reads **No Faults**. Press the **Enter** key to suspend a displayed fault. The display asks for your passcode. An incorrect passcode returns you to the start of the Diagnostic menu. A correct passcode causes the prompt **Suspend Fault?** to be displayed. If you answer **Yes**, the message **XXXXX Suspended** is displayed where **XXXXX** is the name of the fault that was displayed. After either a **Yes** or **No** reply, the next fault is shown. When all faults have been suspended or if there are no faults, the message **No Faults** appears. Each suspended fault is inhibited from reoccurring for one hour from the time the Diagnostic mode is entered.

Select **View History** and use the arrow keys to view the diagnostic history.

Select **Demand Report** to send the history log out to a remote port. To do this, connect the RS-232 port on your analyzer to your printer or a serial port on your computer. If you are downloading the report to a computer, use the Hyperterminal accessory. Make sure the port settings on your computer match those on your analyzer. See "Remote" on page 54.

If you are downloading the report to a printer, the printer must be a "serial port" printer and have continuous paper feed. If you do not have this type of printer, you can download the report to a computer and then print it.

Select **Erase History** to erase the history log. This function is passcode protected. If you are not already in Level 1, the display asks for the Level 1 passcode. An incorrect passcode returns you to

the start of the Diagnostic menu. A correct passcode causes the message **History Erased** to appear.
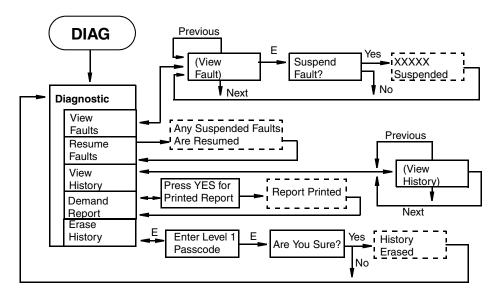

Figure 35. Top Level Diagnostic Mode Structure

Remote Data Logging

The 875 Analyzer is designed to allow its RS232 serial port to be connected to a remote printer having RS232 input. All fundamental measurements are reported to the RS232 port in a printable format at periodic intervals. The exact interval is selected in the Configuration Mode (see "Remote" on page 54). The first report is made immediately after power up, any calibration, or any configuration change. Thereafter the update rate is used.

Connection between the 875 Analyzer and the printer is made with a 3 m (10 ft) Serial Cable BS809WH, which has a connector at one end for plugging into the 875 Analyzer RS232 port and a standard DB9 connector at the other end that is suitable for plugging directly into a PC port. Different printers have different connectors and any adapters or null modems required between the DB9 and the printer must be supplied by the user. The 875 Analyzer remote settings must be configured to match the printer's RS232 settings (for example, baud rate).

You can similarly use a PC and dumb terminal program (for example, Hyperterminal) to produce an electronic log of 875 Analyzer measurements. As with the printer, the above mentioned serial cable is required and the RS232 settings in the terminal program must match those in the 875 Analyzer Remote configuration. Once the 875 Analyzer measurements start appearing in the dumb terminal window, simply use the program's log-to-file function to record them in the PC.

The standard format recorded in this way is difficult to use in a spreadsheet. Therefore, the firmware in the 875PH Analyzer has an additional configuration parameter to select the report format for a **Printer** or **Spreadsheet** (See Figure A-13). The spreadsheet option produces a single line per update with all values separated by commas to generate a Comma Separated Variable (.CSV) format recognized by most spreadsheets. It is recommended that such a log file be created with a .CSV extension. This format is difficult to read unless it is imported into a spreadsheet program. The columns are:

Tag
Date,
Time,
Hold State,
Fault Severity (0=OK, 1=warning, 2=soft, 3=hard),
Active Measurement,
Measurement Units,
Active Temperature,
Temperature Units,
Active Absolute Measurement,
Absolute Units,

Once a set of .CSV updates is imported into a spreadsheet, it is easy to make trend plots or other calculations.

6. Operation Via HART Communicator

Description

The 875 Series Analyzers with HART communications may be configured, operated, and calibrated using the HART Communicator.

The HART Communicator is used in two environments: Offline (not connected to an analyzer) and Online (connected to an analyzer). The Main menu (shown in Figure 36) is displayed when not connected to an analyzer. The Online Menu (shown in Figure 37) is displayed when connected to an analyzer.

Overview of Top Level Menus

Figure 36 shows the Main menu structure of the HART Communicator. Figure 37 shows the top level Online menu for the 875 Series Analyzers.

Figure 36. HART Communicator Main Menu

1 Measure	Display the measurement (process variable) and related data.
2 Status	Display the measurement and system parameters
3 Hold	Hold the output at a determined value
4 Calibrate	Perform calibration functions.
5 Config	Perform configuration functions
6 Diag	Perform diagnostic functions
7 Logon Passcode	Enter the passcode
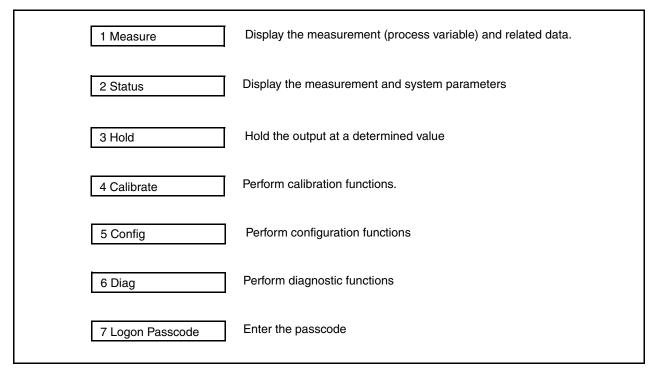
Figure 37. 875 Series Analyzers Top Level Online Menu

Connecting the HART Communicator

Connect the HART Communicator to the COM1(+) and COM2(-) terminals of the analyzer that are shown in Figure 7 or any other convenient place in the loop. There must be a minimum 250 Ω load in the loop. Therefore, if you are configuring the analyzer on the bench (no loop load) with a HART communicator, you must add a 250 Ω resistor.
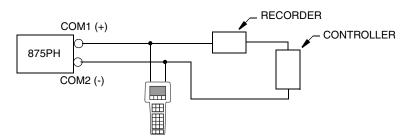
Figure 38. HART Communicator Connection

Communicator Keyboard and Display

Refer to the HART user manual supplied with the communicator.

Offline Configuration

The offline configuration feature is not available at this time.

Online Configuration

Online Flowchart

2 Online		Temp Abs ATC Resistance Slope % Slope mV
	1 MEASURE →	1 Meas 2 Abs 3 Temp 4 AO1 5 HART AO

```
2 Online
    │
    ├── 1 MEASURE ──── 1 Meas
    │                  2 Abs
    │                  3 Temp
    │                  4 AO1
    │                  5 HART AO
    │
    ├── 2 STATUS ───── 1 Status
    │                  2 History Status
    │
    ├── 3 HOLD ─────── Off
    │                  On Present
    │                  On Manual
    │
    ├── 4 CALIBRATE ── Save/Abort
    │                  Bench
    │                  Solution
    │                  Auto Service 1*
    │                  Auto Service 2*
    │                  Cal Analog
    │                  Logon Passcode
    │                     * if enabled
    │
    ├── 5 CONFIG
    │
    ├── 6 DIAG ─────── 1 View Faults
    │                  2 Resume Faults
    │                  3 View History
    │                  4 Erase History
    │                  5 Demand Report
    │                  6 DD Rev
    │
    └── 7 Logon Passcode
```

Temp
Abs
ATC Resistance
Slope %
Slope mV
Asymmetry
Glass Bulb
Reference
Pre amp
Cal Person
Cal Date
Cal Type
Cal Temp
Cal Point One
Cal Point One
Cal Point Two
Cal Point Two
AO1
HART AO
Tag Name
Location
Sales Order
MS Code
Serial Number
Software Version
Dev Name
Model
Line Frequency
Time
Date

Save/Abort
Measurement
Sensor
Temp Comp
Display
Save/Abort
Analog 1
HART
Diags
Autoservice
Save/Abort
Alarms
Hold Config
Remote
Cal
Timeouts
Save/Abort
Date Time
Analyzer Names
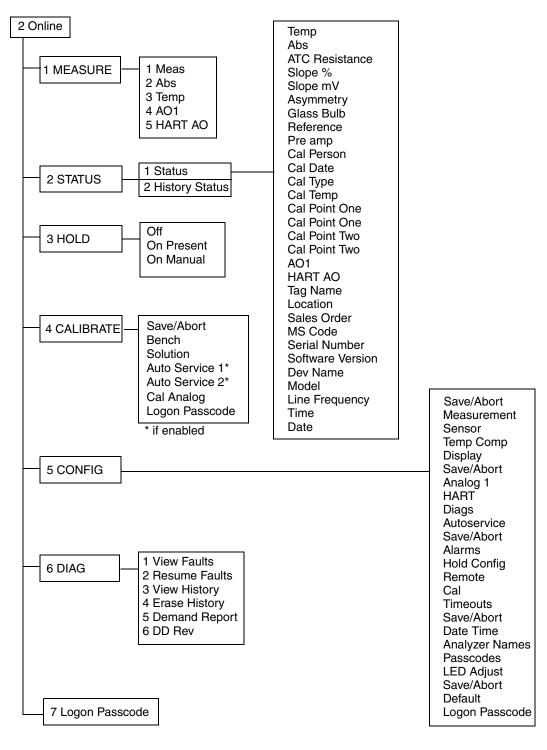Passcodes
LED Adjust
Save/Abort
Default
Logon Passcode

Figure 39. Online Configuration Flowchart

Online Modes

Measurement

To display the measurement on the communicator, select **1 Measure** from the Online menu. The display will show:

1 Meas	The measurement value in engineering units.
2 Abs	The uncompensated measurement in millivolts.
3 Temp	The temperature measurement in engineering units.
4 A01	Analog Output 1 (PV) in mA.
5 HART AO	HART Analog Output (SV) in mA.

You can then select what you wish to display.

Status

To display the status on the communicator, select **2 Status** from the Online menu. You can then select to view the Current Status or the History Status and view the status of a number of parameters.

Hold

To access the Hold functions from the communicator, select **3 Hold** from the Online menu. Access requires you to have previously entered the proper passcode. You can then select **Off** to not use the Hold function, **Present** to hold all values and states at their current value, and **Manual** to set values and states at desired levels. In **Manual**, the Hold function does not take effect until all the values are entered.

Calibrate

To access the Calibration functions from the communicator, select **4 Calibrate** from the Online menu. Access requires you to enter the proper passcode. You can then select **Bench**, **Solution**, or **Cal Analog** calibration. You can also start **Auto Service 1** or **Auto Service 2** (if enabled). If you select **Cal Analog**, you must further define the output as **AO1** or **HART**.

> — **NOTE** ——————————————————————————
> If **Save/Abort** appears in the Calibration menu, there are configuration changes pending. **Save/Abort** must be selected before any calibration is allowed.

Configure

To access the Configuration functions from the communicator, select **5 Config** from the Online menu. Access requires you to enter the proper passcode. You can then configure a number of parameters from the menu that is presented.

> — **NOTE** ——————————————————————————
> Before leaving the Configure mode, you must activate **Save/Abort** if it is visible.

Diagnostics

To access the Diagnostic functions from the communicator, select **6 Diag** from the Online menu. You can then select **View Faults**, **Resume Faults**, **View History**, **Erase History**, **Demand Report**, or **DD Rev**. The proper passcode is required to suspend a fault or to erase the history log.

> ─ **NOTE** ──
> The DD Rev may not change with upgrade to subsequent firmware versions.

Logon Passcode

To access certain functions from the HART Communicator, you must enter the Level 1, Level 2, or Level 3 passcode (that was configured into the analyzer) into the HART Communicator. To do this, select **7 Logon Passcode** from the Online menu.

> ─ **NOTE** ──
> 7 Logon Passcode can also be used to 'lock' the analyzer by entering an invalid passcode.

Glossary of Online Parameters

Parameter	Explanation
Measure Mode	
Abs	Displays the absolute (uncompensated) measurement
AO1 [a]	Displays the Analog Output 1 (PV) measurement in mA or volts
HART AO [a]	Displays the HART Analog Output (SV) measurement in mA
Meas	Displays the measurement in specified engineering units
Temp	Displays the process temperature measurement in specified engineering units
Status Mode [b]	
Abs	Displays the absolute measurement
AO1	Displays the value of Analog Output 1 (PV) in mA or volts
Asymmetry	Displays the asymmetry potential (mV difference between the theoretical isopotential point and the actual point due to the most recent calibration
ATC Resistance	Displays the resistance of the temperature compensator
Cal Date	Displays the date of the last calibration in the form mm/dd/yy
Cal Person	Displays the name of the last calibrator
Cal Point One	Displays the values at calibration point one in pH and then in mV
Cal Point Two	Displays the values at calibration point two in pH and then in mV
Cal Temp	Displays the temperature calibration type of last calibration (default, custom, solution, failsafe, manual)
Cal Type	Displays the type of the last calibration (bench, solution, factory default)
Date	Displays the current date
Dev Name	Displays the device name of the analyzer
Glass Bulb	Displays the glass bulb resistance
HART AO	Displays the HART analog output (SV) in mA
History Status	Displays up to 10 of the most current history log entries (if present)
Line Frequency	Displays the ac line frequency of the analyzer
Location	Displays the location of the measurement
Model	Displays the model number of the analyzer
MS Code	Displays the analyzer model code
Pre amp	Displays the preamplifier power
Reference	Displays the reference junction resistance
Sales Order	Displays the analyzer sales order number
Serial Number	Displays the analyzer serial number
Slope %	Displays the deviation in percent of the slope of the most recent calibration compared to the standard

Parameter	Explanation
Slope mV	Displays the change in the mV/pH or mV/decade of the most recent calibration
Software Version	Displays the software version of the analyzer
Status	Displays the current status of the analyzer
Tag Name	Displays the tag name of the analyzer
Temp	Displays the process temperature of the sensor
Time	Displays the current time
Hold Mode	
Off	Used to release the analyzer from Hold state
On Manual	Used to hold all values and states at desired levels
On Present	Used to hold all values and states at their current level
Calibrate Mode [c]	
Auto Service n	Used to perform an automatic cleaning of the sensor and/or a 1-point or 2-point calibration as configured
Bench	Used to perform a calibration using theoretical inputs or to return to the stored factory default calibration
Cal Analog	Used to tune the 4 mA and 20 mA values of the AO1 or HART analog outputs
Logon Passcode	Used to enter the passcode to access Calibration mode
Pure H2O	Used to perform a pure water calibration.
Solution	Used to perform a calibration using real solutions
Config Mode	
Alarms	Used to specify each alarm to represent measurement, temperature, absolute, or a fault and then subparameters associated with each
Analog 1	Used to specify the Analog 1 output (PV) to represent measurement, temperature, or absolute; minimum (LRV) and maximum (URV) range values; and failsafe output
Analyzer Names [d]	Used to specify the tag number, tag name, location, and device name
Auto Service [e]	Used to configure auto service related parameters
Cal	Used to specify the options to be used with a solution calibration
Datetime	Used to set the date and time for the real time clock
Default	Used to reset the configuration back to the factory default values
Diags	Used to specify what fault messages can appear on your display
Display	Used to configure the display as single, dual, or scan and then subparameters associated with each
HART	Used to specify the HART outputs (SV, TV, FV) to represent measurement, temperature, or absolute; minimum (LRV) and maximum (URV) range values; and failsafe output. Also used to specify the Polling Address and the Preambles value.

Parameter	Explanation
Hold Config	Used to configure all values and states to be held at their current level (On Present) or at a desired level (On Manual) when triggered by a digital signal or when going into Calibration or Configuration mode
LED Adjust	Used to adjust the brightness of the front panel display
Logon Passcode	Used to enter the passcode to access Configuration mode
Measurement	Used to configure units, damping, and other measurement parameters
Passcodes	Used to establish or change the Level 1, 2, and 3 passcodes
Remote	Used to configure parameters associated with a remote personal computer or RS232 printer
Sensor	Used to configure sensor related parameters
Temp Comp	Used to configure the temperature compensation for the chemical being measured
Timeouts	Used to specify the time for front panel, remote, and digital communication timeouts
Diag Mode	
DD Rev	Used to display the DD version
Demand Report	Used to send the history log out to the remote RS232 port
Erase History	Used to erase the history log (requires Level 1 passcode)
Logon Passcode	Used to enter the passcode to perform functions requiring a passcode
Logon Passcode Mode	
Resume Faults	Used to resume any suspended faults
View Faults	Used to view any faults and possibly suspend each fault
View History	Used to view the diagnostic history

(a) If configured **Off**, display reads **NaN.**

(b) At message "Ignore next 50 occurrences of status?", reply "YES".

(c) If a disconnect occurs during calibration, recycle power or attempt another calibration.

(d) Use upper case letters for Tag Number.

(e) Auto Service monthly must schedule days 16 at a time in two entries.

7. Maintenance

⚠ **WARNING**

This product contains components that have critical safety characteristics. Do **not** substitute components. Replace components only with identical, factory-supplied components. Component substitution may impair the electrical safety of this equipment and its suitability for use in hazardous locations.

⚠ **CAUTION**

Your analyzer uses printed wiring assemblies with MOS devices that are highly susceptible to damage from electrostatic discharge. Relatively low static potential can rupture MOS devices resulting in shorted gate or degraded device characteristics. It is recommended that assemblies with MOS devices be handled with the user earthed (grounded) by wearing a conductive wrist strap or by standing on an ESD mat.

Maintenance of the 875PH Analyzer is limited to the replacement of the display assembly and printed wiring assemblies. See PL 611-158 (Style A) or PL 611-163 (Style B) for part numbers. Attempts by the user to repair printed wiring assemblies could result in damage and voiding of the warranty. The recommended repair procedure is replacement of the PWAs or return of the PWAs to the factory for repair.

Appendix B. Configuration Table

This appendix contains information that helps you configure your analyzer. The information is presented in the form of a table containing each prompt/parameter, its limits, and its factory default value. It also provides space for you to record your specific configuration and notations.

— **NOTE** ———————————————————————————————

Bold print in the Factory Configuration column indicates the configuration resulting from the Configure Factory Defaults menu.
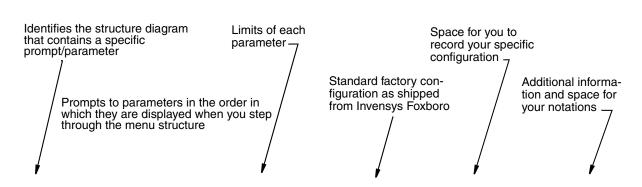
Identifies the structure diagram that contains a specific prompt/parameter

Limits of each parameter

Space for you to record your specific configuration

Prompts to parameters in the order in which they are displayed when you step through the menu structure

Standard factory configuration as shipped from Invensys Foxboro

Additional information and space for your notations

Figure	Prompt/Parameter	Parameter Limits	Factory Configuration	User Configuration	Remarks and Notes
A-1	Config	Measurement Sensor Temp Comp Display Analog 1 Analog 2 (if not HART or Analog) HART Analog (if installed) Diagnostics Auto Service 1 Auto Service 2 Signaled Hold Alarm 1 Alarm 2 HART Digital Remote Cal Parameters Automatic Hold Timeouts Date and Time Analyzer Names Passcodes LCD Adjustment Factory Defaults	Measurement		
A-2	Measurement	- - -	- - -		
	Units	pH, mV(ORP), ppm (ISE), Custom	pH		
	Resolution	0.1 pH, 0.01 pH	0.01		If Units = pH
	Scale	0.9999, 9.999, 99.99, 999,9, 9999	0.9999		If Units = PPM
	Chemical Comp	Standard, Custom	Standard		

Figure	Prompt/Parameter	Parameter Limits	Factory Configuration	User Configuration	Remarks and Notes
A-2 (Cont.)	Cust Units	(5 characters maximum)			If Units = Custom
	Custom Scale	0.9999, 9.999, 99.99, 999.9, 9999	0.9999		
	Num of Points	2 through 21	2		
	Base/Point n	0 through 2000	0		
	Custom/Point n	0 through 2000	0.0000		
	Damping	None, 5, 10, 20, 40, 120 Seconds	None		
A-3	Sensor	- - -	- - -		
	Electrode	Glass, Antimony, Other Negative, Positive	Glass		If Units = pH If Units = ppm
	Slope	mv/pH mV/dec	-59.16		If Electrode = Other
	Valence	Monovalent, Divalent			If Units = ppm
	Isopotential	-2.0 to +16.0 pH -2000 to +2000 mV	7.0 1.0		If Electrode = Other If Units = ppm
	Temp Type	RTD, BALCO	RTD		
	RTD Type	2 Wire 100Ω, 2 Wire 1000Ω, 3 Wire 100 Ω, 3 Wire 1000Ω	3 Wire 1000Ω		Temp Type = RTD
	Temp Unit	Celsius, Fahrenheit	Celsius		
	Temp Mode	Automatic, Manual	Automatic		
	Fail Signal	-20 through +200 by 0.1°C -4 through +392 by 0.1°F	25.0		Temp Mode = Auto
	Manual	-20 through +200 by 0.1°C -4 through +392 by 0.1°F	0.00		Temp Mode = Manual
A-4	Temp Comp	Standard, Ammonia, Custom	Standard		
	Ref Temp	-20 through +200 by 0.1°C -4 through +392 by 0.1°F	0.00		If Temp Comp = Custom
	Num of Points	2 through 21	2		
	Temp/Point n	-20 through +200 by 0.1°C -4 through +392 by 0.1°F	0.00		
	Value/Point n	Current Scale	0.0		
A-5	Display	Single, Dual, Scan	Dual		
	Scan Time	2, 5, 10, 20	2		If Display = Scan
	Scan Data	Exit, Measurement, Temperature, Absolute, Analog 1, Analog 2 (or HART)	None selected		
	Line, Line 1, or Line 2	Measurement, Temperature, Absolute, Analog 1, Analog 2 (or HART)	Line or Line 1 = Measurement Line 2 = Measurement		Line if Line Mode = Single, Line 1 or Line 2 if Line Mode = Dual
	Bargraph Min	See Scale	0		If Line or Line 1 = Measurement, Temperature, or Absolute
	Bargraph Max	See Scale	14		

Figure	Prompt/Parameter	Parameter Limits	Factory Configuration	User Configuration	Remarks and Notes
A-6	Analog n	Off, Measurement, Temperature, Absolute	Analog 1 = Measurement Analog 2 = Measurement		
	Min mA/Analog n		0.0		If Analog n ≠ Off
	Max mA/Analog n		14.0		If Analog n ≠ Off
	Failsafe/Analog n	Off, On, Pulse	Off		
	dc mA/Analog n	3.8 to 20.5	20.50		If Failsafe = On
	Average mA/ Analog n	3.8 to 20.5	10.00		If Failsafe = Pulse
A-7	HART Analog	Off, Measurement, Temperature, Absolute	Measurement		
	Min mA (HART)	See Scale	0.0		
	Max mA (HART)	See Scale	Full Scale		
	Failsafe (HART)	Off, On	Off		
	DC mA (HART)	3.8 to 20.5	20.50		If Failsafe = On
	HART TV	Same as for HART Analog	Off		If HART installed
	HART FV	Same as for HART Analog	Off		If HART installed
A-8	Diagnostics	Select Diag, Set Diag Limits	Select Diags		
	Select Diag	Exit, All Diags, Leakage, ATC Short, ATC Open, 4-20 Range, Comp Range, Meas Range, Glass, Low Slope, Preamp, Aging, Coating	All Diags disabled		
	All Diags	Enabled, Disabled	Disabled		
	Leakage	Enabled, Disabled	Disabled		
	ATC Short	Enabled, Disabled	Disabled		
	ATC Open	Enabled, Disabled	Disabled		
	4-20 Range	Enabled, Disabled	Disabled		
	Comp Rng	Enabled, Disabled	Disabled		
	Meas Rng	Enabled, Disabled	Disabled		
	Glass	Enabled, Disabled	Disabled		
	Set Diag Limits	- - -	- - -		If Glass, Low Slope, Preamp, and/or Coat enabled
	Glass Lo Limit	0.1 through 1.1 by 0.1 mΩ	0.5 mΩ		If Glass enabled
	Glass Cutoff Temp	-20 through +200°C -4 through 392°F	50°C 122°F		
	Low Slope	Enabled, Disabled	Disabled		
	Slope Limit	0 through 100 by 1%	80%		If Low Slope enabled
	Preamp	Enabled, Disabled	Disabled		
	Preamp Limit	0 through 70 mW by 1 mW	40 mW		If Preamp enabled
	Aging	Enabled, Disabled	Disabled		
	Coat	Enabled, Disabled	Disabled		
	Coat Limit	0 through 100 kΩ by 10 kΩ	10 kΩ		If Coat enabled

Figure	Prompt/Parameter	Parameter Limits	Factory Configuration	User Configuration	Remarks and Notes
A-9	Auto Service Type	Off, Auto-Clean, One Point Cal, Two Point Cal, Clean + 1Pt Cal, Clean + 2Pt Cal	Off		
	Service Initiate	Exit, All Selects, Manual, Signaled, Scheduled, Diagnostic	All disabled		If Auto Service Type ≠ Off
	Input Trigger	High, Low	High		If Service Initiate = Signaled
	Select Diagnostic	Exit, All Selects, Low Slope, Coat	All disabled		If Service Initiate = Diagnostic
	Scheduled	Daily, Weekly, Monthly, Period by Days, Period by Hours	Daily		If Service Initiate = Scheduled
	Period of Hours	1 to 8760	1		If Scheduled = Period by Hours
	Period of Days	1 to 365	1		If Scheduled = Period by Days
	Start Date	1/01/1999 to 12/31/2098	1/01/2000		If Scheduled = Period by Days or Period by Hours
	Start Time	00:00 to 23:59	00:00		
	Day of Month	All Days and 1 through 28	1		If Scheduled = Monthly
	Day of Week	All Days and Monday through Sunday	All Disabled		If Scheduled = Weekly
	Time of Day	00:00 to 23:59	00:00		
	Solutions	User Solutions, Smart Cal Buff	User Solutions		
	Solution Value, Solution Value n	-2 through +16 pH -2010 through +2010 mV 1 to Full Scale	0.0		If Units = pH If Units = mV (ORP)If Units = ppm (ISE)
	T1 Setup Time	15-999	15		
	T2 Hold Time	15-999	15		If any 1 Point Cal
	T3 Setup Time	15-999	15		
	T4 Hold Time	15-999	15		If any 2 Point Cal
	T5 Setup Time	15-999	15		
	Trip State	Energized, Deenergized	Energized		
	Service Hold	Off, On Present, On Manual	Off		
A-11	Signaled Hold	- - -	- - -		
	Signaled Hold Mode	Off, On Present, On Manual	Off		
	Signaled Input Trig	High, Low	High		

Figure	Prompt/Parameter	Parameter Limits	Factory Configuration	User Configuration	Remarks and Notes
A-12	Alarm n	Off, Measurement, Temperature, Absolute, On Fault	Off		
	Trip	Trip High, Trip Low	Trip High		
	Set Point	See Scale	10.0		
	Control	Hysteresis, Timed	Hysteresis		
	Hysteresis	See Scale	0		If Control = Hysteresis
	Trig Time	00.00 to 99.99	0.0		If Control = Timed
	On Time	00.00 to 99.99	0.0		Time in minutes
	Off Time	00.00 to 99.99	0.0		
	Alarm Fault Act	Meas Value, Meas and Fault, Valid Meas	Valid Meas		Accessible from Level 1 Passcode only
	Fault	Exit, All Faults, Analyzer Faults, Comm Faults, Leakage, Temp, ATC Open, 4-20 Range, Comp Range, Meas Range, Glass, Low Slope, Preamp, Aging, Coat	All Faults		If Alarm Fault Act = Meas and Fault
	Tripped State	Energized, De-energized	De-energized		
A-13	Remote Options	Port Settings, Update Rate	- - -		
	Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200	19200		If Remote Options = Port Settings
	Data & Parity	7 Odd, 7 Even, 8 Odd, 8 Even, 8 None	8 None		
	Stop Bits	1, 2	1		
	Update	Off, 5, 10, 30, 60, 120, 300, 600, 1200, 3600	600		If Remote Options = Update
	Format	Printer, Spreadsheet			
A-14	HART Digital	- - -	- - -		If HART is installed
	Poll Address	0 to 16777215 by 1	0		
	Preambles	5 to 255 by 1	5		
A-15	Cal Parameters	American, NIST, European, Special	American		
	Tolerance	0.0 through 2.0	0.5		pH
	Meas Stability	Off, On	Off		
	Stability Time	5 through 60 by 5	5		If Meas Stability = On
	Stability Var	1 through 9 by 1	9		
	Temp Stability	Off, On	Off		
	Stability Time	5 through 60 by 5	5		If Temp Stability = On
	Stability Var	1 through 9 by 1	9		
	Special	Buffer1, Buffer2, Buffer3			If Cal = Special
	Buf #n Num Points	2 through 21	2		
	Buf #n Temp n	-20 through +200 by 0.1°C -4 through +392 by 0.1°F	0.0°C 32.00°F		
	Buf #n Value n	-2.00 through +16.00 pH	0.0		
	Automatic Hold	Off, Present, Manual	Manual		
A-16	Timeouts	- - -	- - -		
	Front Panel Timeout	5 to 999	600		
	Remote Timeout	5 to 999	600		
	Dig Comm Timeout	5 to 999	600		If Dig Comm installed
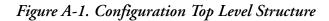
Figure	Prompt/Parameter	Parameter Limits	Factory Configuration	User Configuration	Remarks and Notes
A-17	Date and Time	- - -	- - -		
	Date	1/01/1999 to 12/31/2098	Real date		
	Time	00:00 to 23:59	Real time		24-hour format
A-18	Analyzer Names	- - -	- - -		
	Tag Number	12 characters	(blank)		
	Tag Name	16 characters	(blank)		
	Location	14 characters	(blank)		
	Device Name	8 characters	(blank)		
A-19	Passcodes	- - -	- - -		
	Level 1	0000 to 9999	0800		
	Level 2	0000 to 9999	0800		
	Level 3	0000 to 9999	0800		
A-20	LCD Adjustment	-9 to 0 to +9	0		
A-21	Config To Defaults	Exit to Config, Load Defaults	Exit to Config		

Appendix A. Structure Diagrams

CONFIGURE		
Measurement	E	C1
Sensor	E	C2
Temp Comp (If not ORP)	E	C3
Display	E	C4
Analog 1	E	C5
Analog 2 (if not HART)	E	C5
HART Analog (If installed)	E	C6
HART TV (If installed)	E	C6
HART FV (If installed)	E	C6
Diagnostics	E	C8
Auto Service 1		C9
Auto Service 2	E	C9
Signaled Hold	E	C10
Alarm 1	E	C11
Alarm 2	E	C11
Remote	E	C12
HART Digital (if installed)	E	C13
Cal Parameters	E	C14
Automatic Hold	E	C15
Timeouts	E	C16
Date and Time		C17
Analyzer Names	E	C18
Passcodes	E	C19
LCD Adjustment	E	C20
Factory Defaults	E	C21

C →

NOTE: Before entering Configuration mode, you must first enter a proper passcode. The factory default passcode is **0800**. Then you must pick **View** (to view configuration parameters) or **Change** (to change configuration parameters) from the picklist presented.

Figure A-1. Configuration Top Level Structure
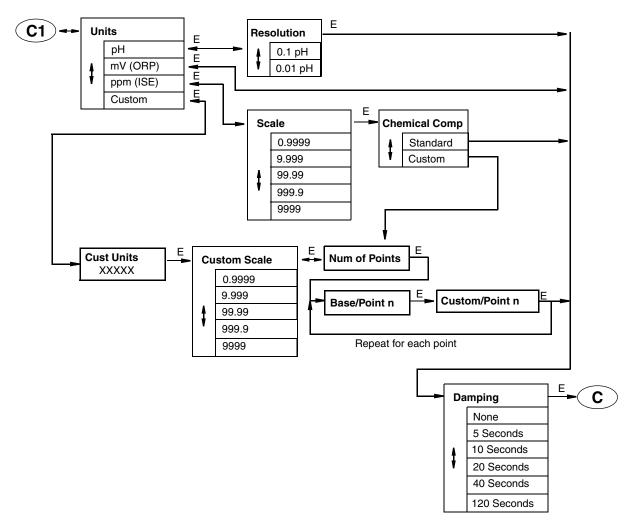
Figure A-2. Configure Measurement Structure
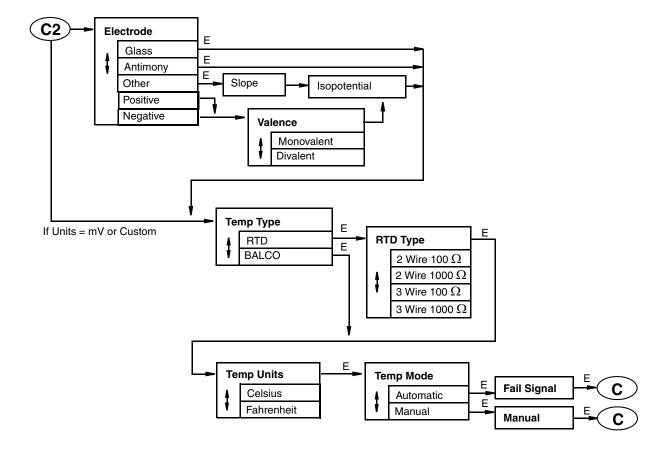
Figure A-3. Configure Sensor Structure
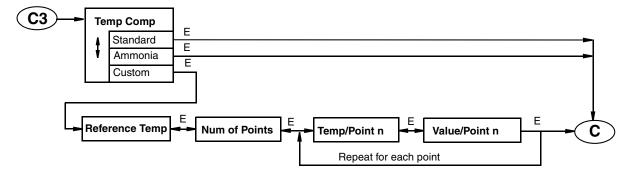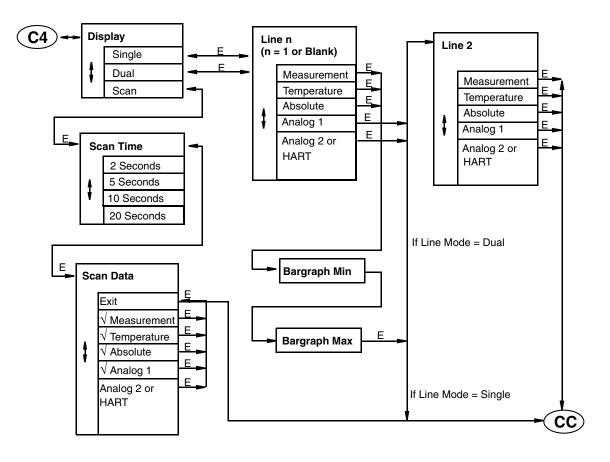
Figure A-4. Configure Tempcomp Structure

C4 → **Display**
- Single
- Dual
- Scan

E
E

Line n
(n = 1 or Blank)
- Measurement — E
- Temperature — E
- Absolute — E
- Analog 1 — E
- Analog 2 or HART — E

Line 2
- Measurement — E
- Temperature — E
- Absolute — E
- Analog 1 — E
- Analog 2 or HART — E

E

Scan Time
- 2 Seconds
- 5 Seconds
- 10 Seconds
- 20 Seconds

If Line Mode = Dual

E

Scan Data
- Exit — E
- √ Measurement — E
- √ Temperature — E
- √ Absolute — E
- √ Analog 1 — E
- Analog 2 or HART — E

Bargraph Min

Bargraph Max — E

If Line Mode = Single

CC

Choices selected have preceding "√".
Pressing Enter toggles choice as selected or not selected.

Figure A-5. Configure Display Structure

C5 ↔ **Analog n**
(n = 1 or 2)
- Off
- Measurement
- Temperature
- Absolute

E

Min@4mA/Analog n — E — **Max@20mA/Analog n**

E

Failsafe/Analog n
- Off
- On — E
- Pulse — E

E

DC mA/Analog n — E

Average mA/Analog n — E

CC
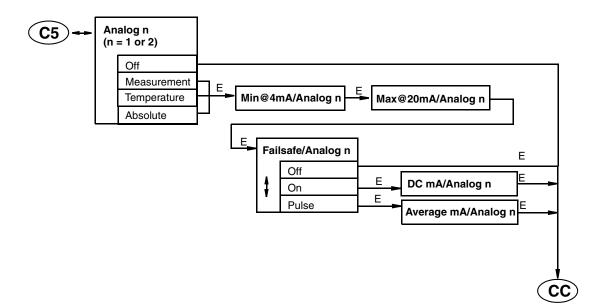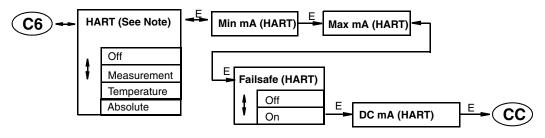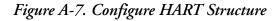
Figure A-6. Configure Analog Structure

NOTE: HART Analog, HART TV, or HART FV

Figure A-7. Configure HART Structure
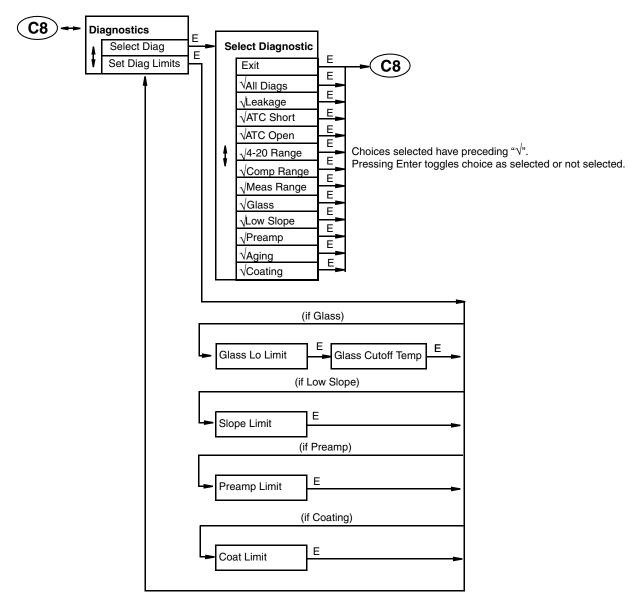
Figure A-8. Configure Diagnostics Structure
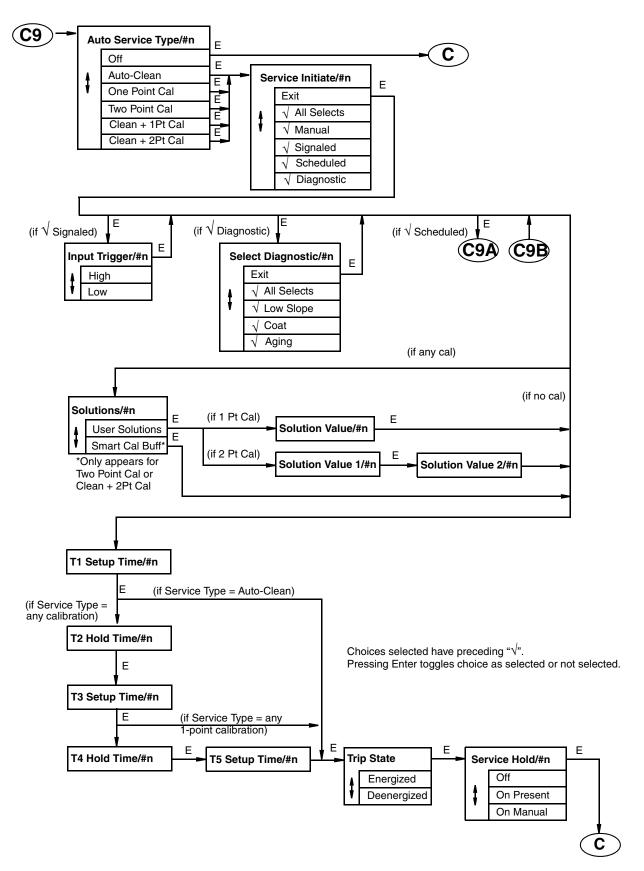
Figure A-9. Configure Auto Service Structure
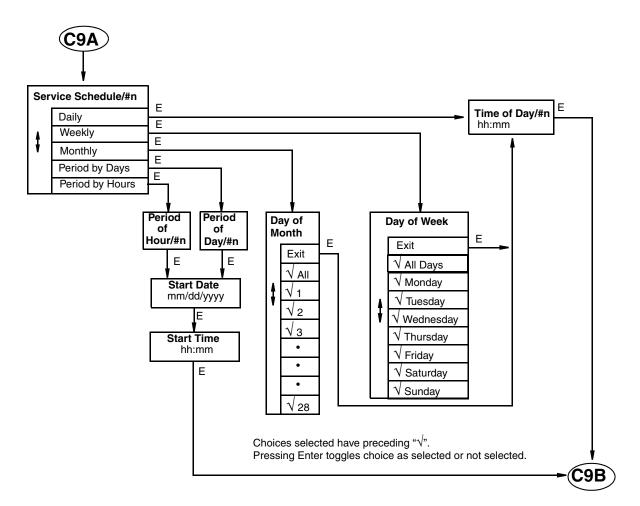
Figure A-10. Configure Auto Service Structure (Continued)
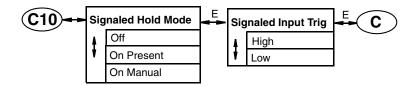
Figure A-11. Configure Signaled Hold Structure
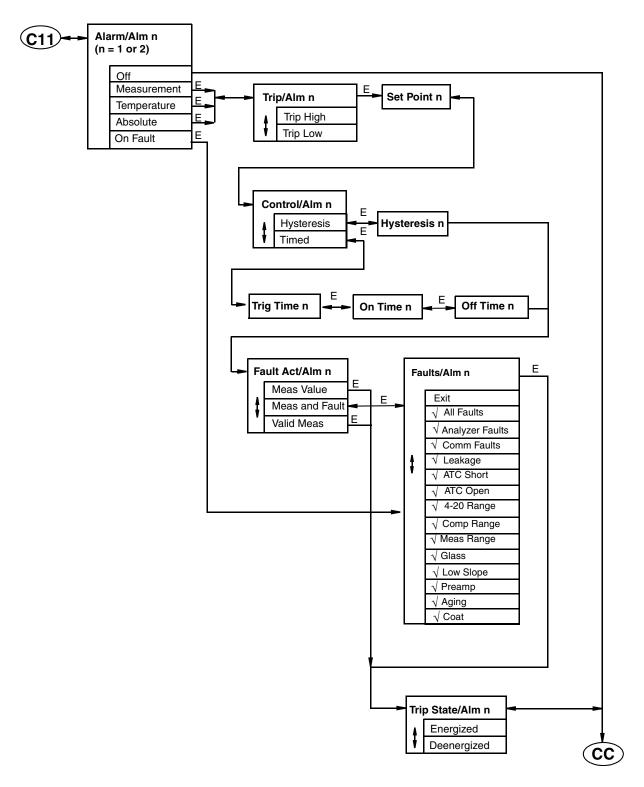
Figure A-12. Configure Alarm Structure
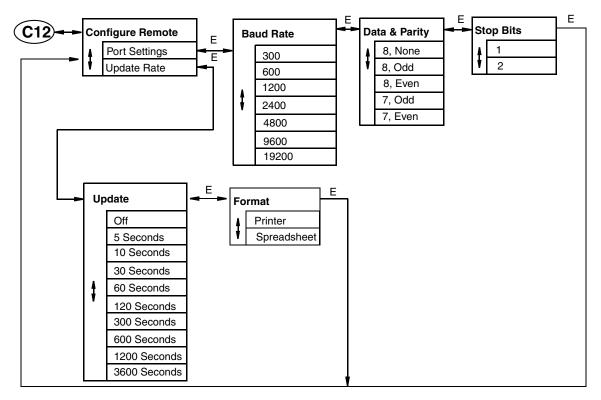
Figure A-13. Configure Remote Structure

Figure A-14. Configure HART Digital Structure Diagram
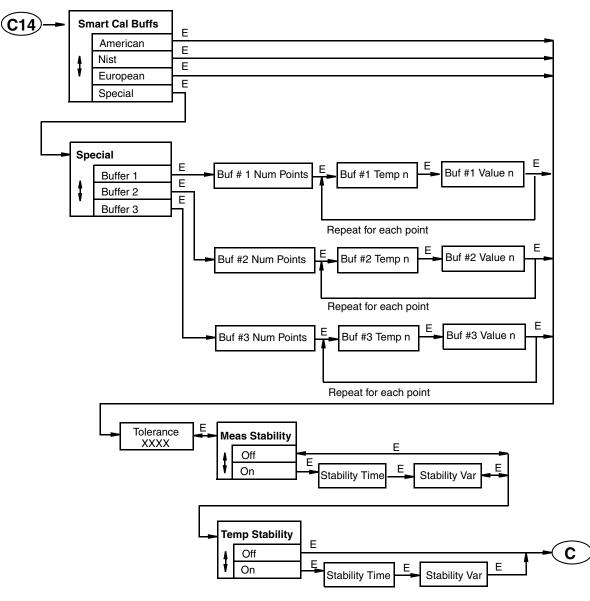
Figure A-15. Configure Cal Parameters Structure
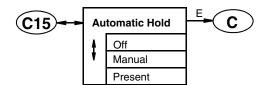
Figure A-16. Configure Automatic Hold Structure

Figure A-17. Configure Timeout Structure
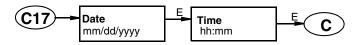
Figure A-18. Configure Date and Time Structure
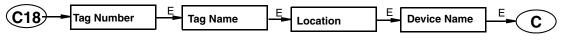
Figure A-19. Configure Analyzer Names Structure
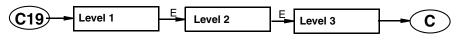
Figure A-20. Configure Passcode Structure
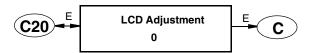
Figure A-21. Configure Adjust LCD Structure
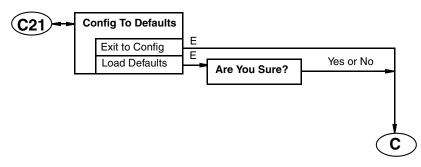
Figure A-22. Configure Default Structure

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