

873PH Series Electrochemical Analyzers for pH and ORP Measurements

Style C



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1. Introduction

Quick Start

The purpose of this section is to give you the basic steps to quickly begin using your 873PH Analyzer.

- ◆ Step 1 - Wiring
- ◆ Step 2 - Verify Analyzer Identification
- ◆ Step 3 - Verify Valid Measurements

For connecting and configuring Alarms and Outputs, refer to appropriate sections of the manual.

If you need additional help, please call the Invensys Foxboro Electrochemical Service Center at 1-508-549-2168 in the U.S.A., or call your local Invensys Foxboro representative.

Step 1 - Wiring

—⚠ CAUTION —

Wiring installation must comply with any existing local regulations.

The 873PH Analyzer is supplied in two types – plastic enclosure or metal enclosure. Follow the wiring instructions for the type of enclosure that you have. More wiring information can be found in the sections on “Wiring of Plastic Enclosure” on page 18 and “Wiring of Metal Enclosure” on page 20.

Wiring of Plastic Enclosure

1. Remove optional rear cover assembly BS805QK, if present.
2. Connect H and L alarm wires to TB3 as shown in Figure 1.
3. Connect wires from external circuit for Analyzer measurement output to terminals TB3–1(+) and TB3–2(-). Refer to Figure 1.
4. Remove factory-installed jumper assembly from terminal block TB2 and discard.
5. Connect sensor wires to Analyzer terminal block TB2 as shown in Figure 1.
6. Connect power wires to terminal block TB1 as shown in Figure 1.
7. Attach optional rear panel cover, if present.

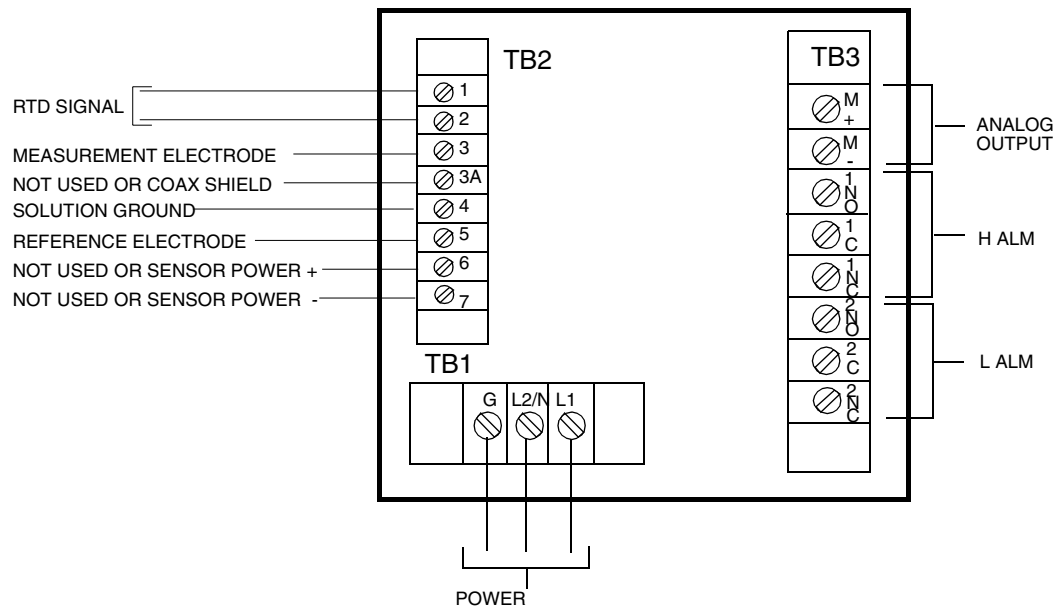


Figure 1. Plastic Enclosure Rear Panel Wiring for Power, Output, and Alarms

Wiring of Metal Enclosure

1. Remove back cover.
2. Connect H and L Alarm wires to TB3 as shown in Figure 2. Refer also to “General Information Alarms” on page 34.
3. Connect wires from external circuits for Analyzer temperature or measurement outputs to terminal TB4. Either or both outputs may be used.
4. Connect sensor wires to Analyzer terminal block TB2 as shown in Figure 2.
5. Connect power wires to terminal block TB1, as shown in Figure 2. The earth (ground) connection from the power cord should be connected to the ground stud located in the bottom of the case. This connection is mandatory for safe operation.

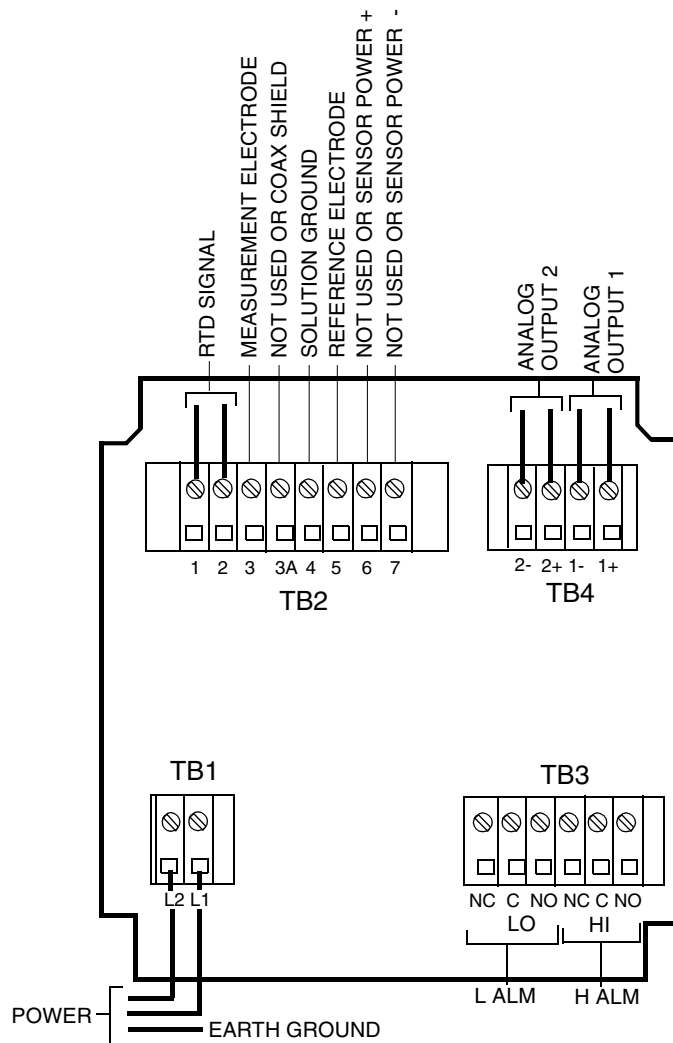


Figure 2. Metal Enclosure Rear Panel Wiring for Power, Output, and Alarms

Step 2 - Verify Analyzer Identification

Verify the information shown on the data label on the side of the instrument. Note especially the range shown beside “CALIB.” This range should encompass your desired measurement range.

To reconfigure your instrument, refer to “Basic Setup Entries” on page 46.

Step 3 - Verify Valid Measurements

Your Analyzer was calibrated at the factory. Therefore, you should not have to calibrate it. However, it is good practice to calibrate your Analyzer with your sensor. See “Calibration” on page 55 for more details.

Follow these steps to calibrate:

1. Unlock Analyzer (see “Unlocking Analyzer Using Security Code” on page 30).
2. Remove the pH sensor from the process stream. Clean the immersion end and rinse with distilled water.
3. Select buffers near or bracketing process pH. The buffers should be at the same temperature and, for best results, near the process temperature. For ISE and ORP, use solutions of known value.
4. Immerse the cleaned sensor in the solution with lower known value. Wait until the measurement stabilizes.
5. Press **Shift** and while holding, press **CAL LO**. Remove fingers from both keys. Use **Next** and Δ until the display reads the value of the solution. Press **Enter**.

— **NOTE** —

For ORP calibration, stop here.

6. Thoroughly rinse the sensor in distilled water and immerse it in the second solution with higher known value. Wait until the measurement stabilizes.
7. Press **Shift** and while holding, press **CAL HI**. Remove fingers from both keys. Use **Next** and Δ until the display reads the value of the second solution. Press **Enter**.
8. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).
9. Press **TEMP** key and note temperature reading. If temperature needs adjustment, refer to “Temperature Cell Factor” on page 58.

General Description

The 873PH pH/ORP Analyzer measures, displays, and transmits the pH/ORP of aqueous solutions. Its measurement display may be read in either mV or pH. Solution temperature is also continuously measured by the 873PH and is used for automatic temperature compensation. It may be displayed whenever the user wants.

The Analyzer provides an isolated output signal proportional to the measurement for transmission to an external receiver. The plastic panel-mounted Analyzer transmits one output signal only, while the metal field-mounted Analyzer can transmit two output signals.

Instrument Features

Described below are some of the features of the 873PH Electrochemical Analyzer:

- ◆ Plastic or Metal Enclosure
- ◆ Dual Alarms
- ◆ Dual Analog Outputs on Metal Enclosure
- ◆ EEPROM Memory
- ◆ Instrument Security Code
- ◆ Hazardous Area Class on Metal Enclosure
- ◆ Front Panel Display
- ◆ Front Panel Keypad
- ◆ Application Flexibility
- ◆ Storm Door Option

Enclosures

The plastic enclosure is intended for panel mounting in general purpose locations, and mounts in 1/4 DIN size panel cutout. It meets the enclosure ratings of NEMA 1, CSA Enclosure 1, and IEC Degree of Protection IP-45.

The metal enclosure is intended for field locations and may be either panel, pipe, or surface mounted. It is constructed of cast aluminum coated with a tough epoxy-based paint. The enclosure is watertight, dusttight, and corrosion-resistant, meeting the enclosure rating of NEMA 4X, CSA Enclosure 4X, and IEC Degree of Protection IP-65. The unit fits in a 92 x 92 mm (3.6 x 3.6 in) panel cutout (1/4 DIN size). The metal enclosure provides protection against radio frequency interference (RFI) and electromagnetic interference (EMI).

Dual Alarms

Dual independent, Form C dry alarm contacts, rated 5A noninductive 125 V ac/30 V dc, are provided. The alarm status is alternately displayed with the measurement on the LED (light-emitting diode) display.

—! CAUTION

When the contacts are used at signal levels of less than 20 W, contact function may become unreliable over time due to the formation of an oxide layer on the contacts. See “Alarm Contact Maintenance” on page 73.

No Battery Backup Required

Non-volatile EEPROM memory is employed to protect all operating parameters and calibration data in the event of power interruptions.

Instrument Security Code

A combination code lock method, user configurable, provides protection of operational parameters from accidental or unauthorized access.

Hazardous Area Classification

The field-mounted, epoxy-painted, aluminum enclosures are designed to meet the requirements for Class I, Division 2, Groups A, B, C and D hazardous locations. The 873 is approved by Factory Mutual and certified by The Canadian Standards Association.

Front Panel Display

The instrument's display consists of a four-digit bank of red LEDs with decimal point, and an illuminated legend area to the right of the LEDs (see Figure 3). The 14.2 mm (0.56 in) display height provides visibility at a distance up to 6 m (20 ft) through a smoke-tinted, nonreflective, protective window on the front panel.

The measurement value is the normally displayed data. If other data is displayed due to prior keypad operations, the display automatically defaults to the measurement value 10 seconds (called “Timing Out”) after the last keypad depression.

If no fault or alarm conditions are detected in the instrument, the measurement value is steadily displayed. If fault or alarm conditions are detected, the display alternates displaying the measurement value and a fault or alarm message at a 1 second rate.

Front Panel Keypad

The instrument's front panel keypad consists of eight keys. Certain keys are for fixed functions; and other keys are for split functions. The upper function (green legends) of a split function key is actuated by pressing the shift key in conjunction with the split function key. Refer to Figure 3.

Application Flexibility

The 873 Analyzer offers application flexibility through its standard firmware package. The software, run on the internal microprocessor, allows the user to define and set operating parameters particular to his application. These parameters fall into four general categories: Measurement Range, Alarm Configuration, Diagnostics, and Output Characterization. These parameters are retained in the EEPROM nonvolatile memory. Following power interruptions, all operating parameters are maintained.

Storm Door Option

This door is attached to the top front surface of the enclosure. It is used to prevent accidental or inadvertent actuation of front panel controls, particularly in field mounting applications. The transparent storm door allows viewing of the display and is hinged for easy access to the front panel controls.

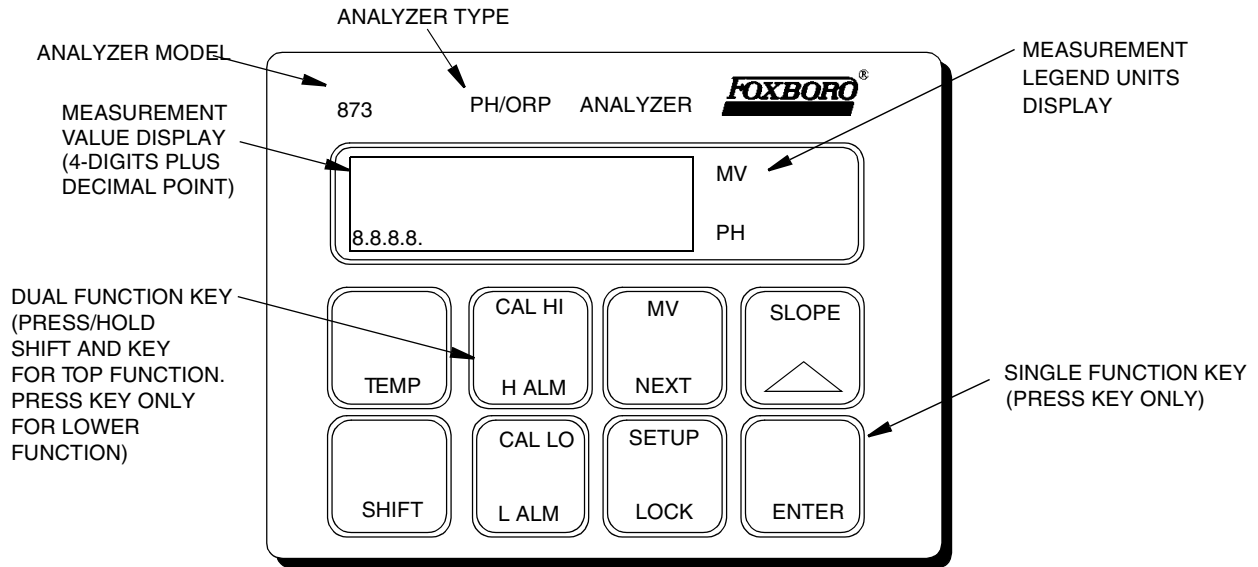


Figure 3. Front Panel Display and Keypad

Analyzer Identification

A data label is fastened to the side surface of the enclosure. This data label provides Model Number and other information pertinent to the particular Analyzer purchased. Refer to Figure 4.

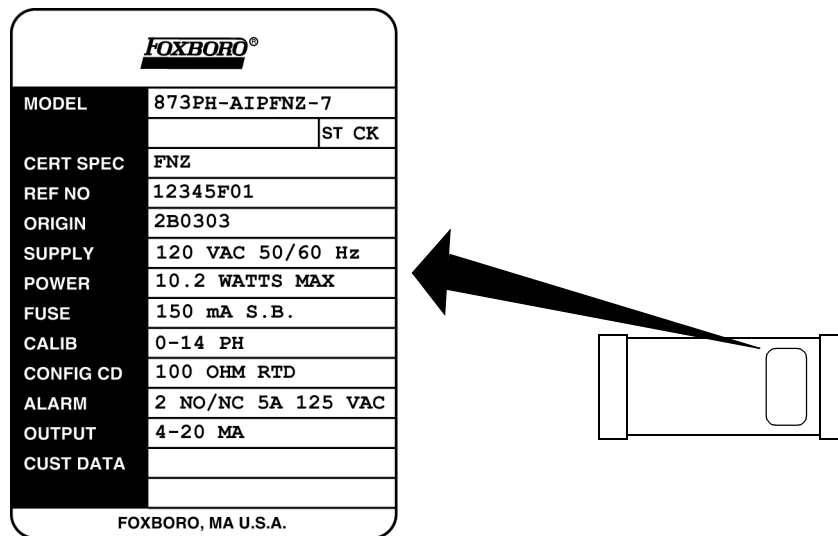


Figure 4. Data Label Location

Standard Specifications

Supply Voltages

–A	120 V ac
–B	220 V ac
–C	240 V ac
–E	24 V ac
–J	100 V ac

Supply Frequency

50 or 60, ± 3 Hz

Output Signal

I	4 to 20 mA isolated
T	0 to 10 V dc isolated
E	0 to 20 mA isolated

Ambient Temperature Limits

–25 to +55°C (–13 to +131°F)

Measurement Ranges

–2 to +16 pH(pH)
–999 to +1400 mV (ORP)

Temperature Measurement Range

–17 to +199°C (0 to 390°F)

Temperature Compensation Range

–5 to +105°C (23 to 221°F)

Relative Humidity Limits

5 to 95%, noncondensing

Accuracy of Analyzer

$\pm 0.1\%$ of upper range limit

Analyzer Identification

Refer to Figure 4.

Dimensions

Plastic 92(H) x 92(W) x 183(L) mm
Metal 92(H) x 92(W) x 259(L) mm

Enclosure/Mounting Options

–P	Plastic Panel Mount
–W	Metal Field Mount/Panel Mount
–X	Metal Field Mount/Surface Mount
–Y	Metal Field Mount/Pipe Mount
–Z	Metal Field Mount/Movable Surface Mount

Approximate Mass

Plastic Enclosure:	0.68 kg	(1.5 lb)
Metal Enclosure (with Brackets):		
Panel Mounting	1.54 kg	(3.4 lb)
Pipe Mounting	2.31 kg	(5.1 lb)
Fixed Surface Mounting	2.22 kg	(4.9 lb)
Movable Surface Mounting	3.13 kg	(6.9 lb)

Instrument Response

Two seconds maximum (when zero measurement damping is selected in Configuration Code). Temperature response is 15 seconds maximum.

Measurement Damping

Choice of 0, 10, 20, or 40 second, configurable from keypad. Damping affects displayed parameters and analog outputs.

Alarms

- ◆ Two alarms configurable via keypad
- ◆ Individual set points continuously adjustable 0 to full scale via keypad
- ◆ Hysteresis selection for both alarms; 0 to 99% of full scale value, configurable via keypad.
- ◆ Three timers for both alarms, adjustable 0 to 99 minutes, configurable via keypad. Allows for trigger timing and on/off control with delay. Timers can be set to allow chemical feed, then delay for chemical concentration control.

Alarm Contacts

Two independent, nonpowered Form C contacts, rated 5 A noninductive, 125 V ac/30 V dc (minimum current rating 1 A). Inductive loads can be driven with external surge-absorbing devices installed across contact terminations.

CAUTION

When the contacts are used at signal levels of less than 20 W, contact function may become unreliable over time due to the formation of an oxide layer on the contacts. See “Alarm Contact Maintenance” on page 73.

Alarm Indication

Alarm status alternately displayed with measurement on LED display.

RFI Susceptibility

(When all sensor and power cables are enclosed in a grounded conduit.)

Plastic Enclosure:	< 0.5 V/m from 27 to 1000 MHz
Metal Enclosure:	10 V/m from 27 to 1000 MHz

Electromagnetic Compatibility (EMC)

The Model 873PH Electrochemical Analyzer, 220 V ac or 240 V ac systems with metal enclosure, comply with the requirements of the European EMC Directive 89/336/EEC

when the sensor cable, power cable, and I/O cables are enclosed in rigid metal conduit. See Table 2.

The plastic case units comply with the EMC Directive 89/336/EEC when mounted in a solid metal enclosure and the I/O cables extending outside the enclosure are enclosed in solid metal conduit. See Table 2.

Product Safety Specifications

Table 1. Product Safety Specifications

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
FM for use in general purpose (ordinary) locations.	---	FGZ
FM nonincendive for use in Class I, II, Division 2, groups A, B, C, D, F, and G, hazardous locations.	For instruments with metal enclosure only. Temperature Class T6.	FNZ
CSA (Canada) for use in general purpose (ordinary) locations.	24 V, 100 V, and 120 V ac (Supply Option -A, -E, -J) only.	CGZ
CSA (Canada) suitable for use in Class I, Division 2, Groups A, B, C, and D, hazardous locations.	For instruments with metal enclosure only. 24 V, 100 V, and 120 V ac (Supply Option -A, -E, -J) only. Temperature Class T6.	CNZ

— NOTE —

The Analyzer has been designed to meet the electrical safety descriptions noted in the table above. For detailed information or status of testing laboratory approvals and certifications, contact your Invensys Foxboro representative.

— ⚠ CAUTION —

1. When replacing covers on the 873 metal case, use Loctite (Part No. S0106ML) on the threads for the front cover and Lubriplate (Part No. X0114AT) on the threads for the rear cover. Do not mix.
 2. Exposure to some chemicals may degrade the sealing properties of Polybutylene Teraethalate and Epoxy Magnacraft 276XAXH-24 used in relays K1 and K3. These materials are sensitive to acetone, MEK, and acids. Periodically inspect relays K1 and K3 for any degradation of properties and replace if degradation is found.
-

2. Installation

Mounting to a Panel - Plastic Enclosure 873PH-__ P

The plastic enclosure is mounted in a panel as described below (see Figure 5).

1. Size panel opening in accordance with dimensions specified on DP 611-162.
2. Insert spring clips on each side of Analyzer.
3. Insert Analyzer in panel opening until side spring clips engage on panel.
4. From rear of panel (and Analyzer), attach and tighten the top and bottom mounting screws until Analyzer is securely held in place.

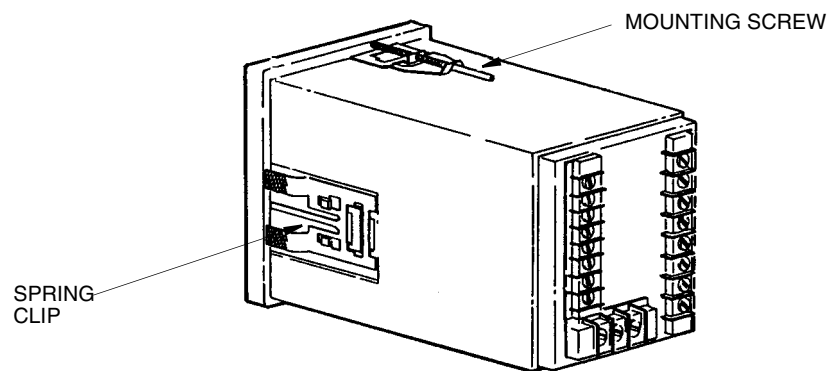


Figure 5. Mounting to Panel - Plastic Enclosure

Mounting to a Panel - Metal Enclosure 873PH-__ W

The metal enclosure can also be mounted to a panel. The procedure is as follows.

1. Make cutout in panel in accordance with DP 611-162.
2. Insert Analyzer through panel cutout and temporarily hold in place. (Rear bezel will have to be removed for this procedure.)
3. From rear of panel, slide plastic clamp onto enclosure until clamp latches (two) snap into two opposing slots on longitudinal edges of enclosure. See Figure 6.
4. Tighten screws (CW) on clamp latches until enclosure is secured to panel.
5. Reassemble rear bezel to enclosure using four screws.

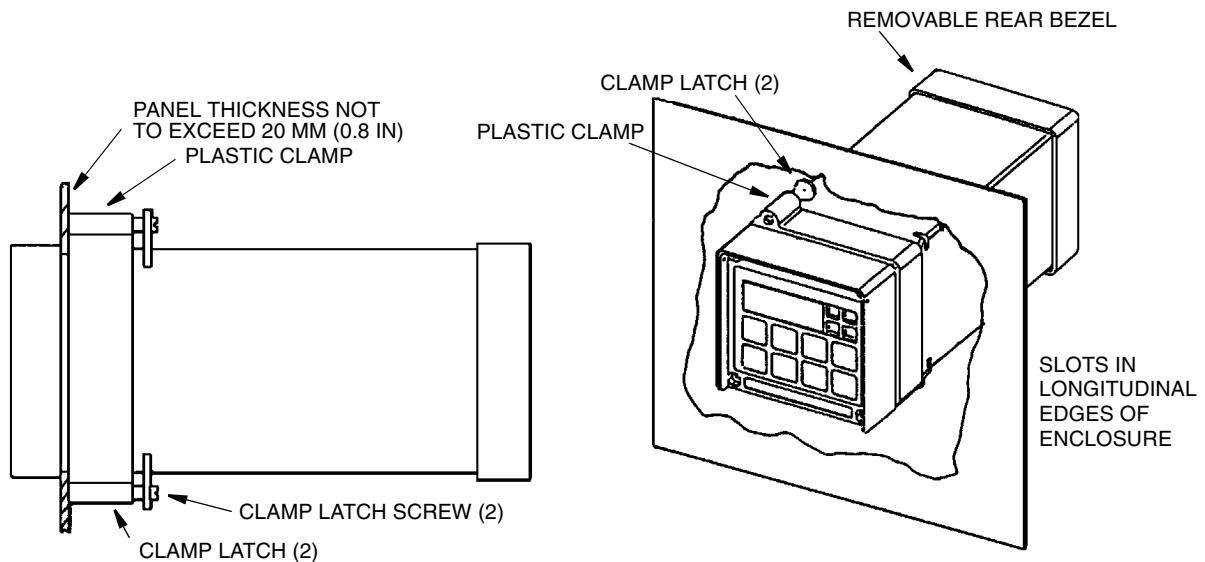


Figure 6. Mounting to Panel - Metal Enclosure

Mounting To Pipe (Metal Enclosure Only) 873PH-__ Y

1. Locate horizontal or vertical DN 50 or 2 inch pipe.
2. Assemble universal mounting as follows:
 - a. Place hex bolts (5) through spacer (3) into support bracket (2).
 - b. Slide nylon washers (11) over bolts (5).
 - c. Slide bolts through pipe mounting bracket (1) and fasten assembly tightly with hardware designated 7, 6, and 13.
 - d. Attach pipe mounting bracket (1) to pipe using U-bolts (12) using hardware designated 6, 7, and 13.
3. Slide Analyzer into support bracket and slide strap clamp (4) onto Analyzer. Using two screws, nuts, and washers, attach strap clamp to support bracket to secure Analyzer.

4. Lift entire assembly of Step 3, and using two U-clamps, nuts, and washers, secure mounting bracket to pipe.

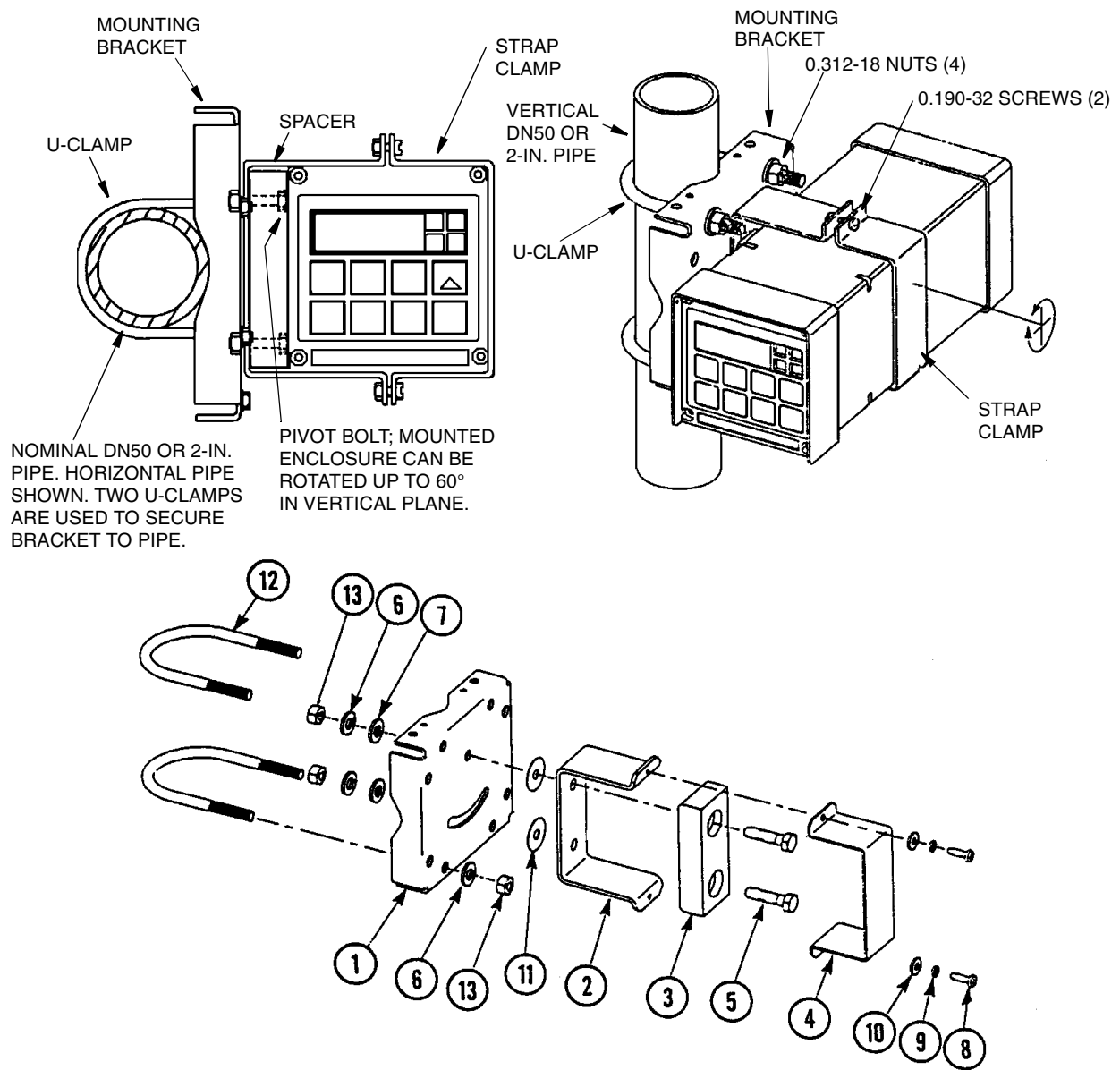


Figure 7. Metal Enclosure - Pipe Mounting

Mounting to Surface, Fixed Mount (Metal Enclosure Only) 873PH-__ X

1. Locate mounting surface for Analyzer.
2. Referring to Figure 8, use mounting bracket as template for drilling four holes into mounting surface. Notice that holes in mounting bracket are 8.74 mm (0.344 in) in diameter. Do not attach mounting bracket to surface at this time.
3. Assemble universal mounting as follows:
 - a. Place hex bolts (5) through spacer (3) into support bracket (2).
 - b. Slide nylon washers (11) over bolts (5).
 - c. Slide bolts through universal mounting bracket (1) and fasten assembly together with hardware designated 7, 6, and 12.
 - d. Attach universal mounting bracket (1) to wall.
4. Slide Analyzer into support bracket and slide strap clamp (4) onto Analyzer. Using two screws, nuts, and washers, attach strap clamp to support bracket to secure Analyzer.
5. Lift entire assembly of Step 4, align mounting bracket holes with mounting surface holes, and use four bolts, nuts, and washers to attach mounting bracket to surface.

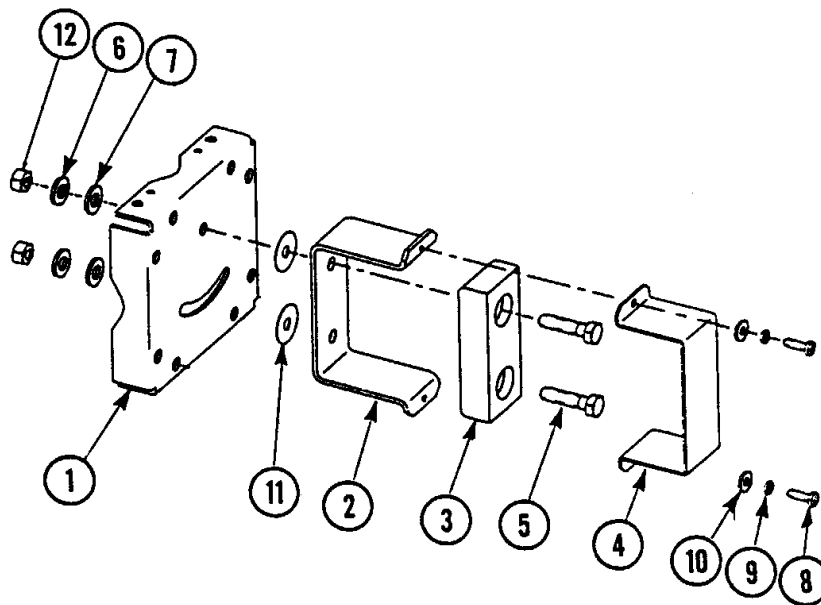
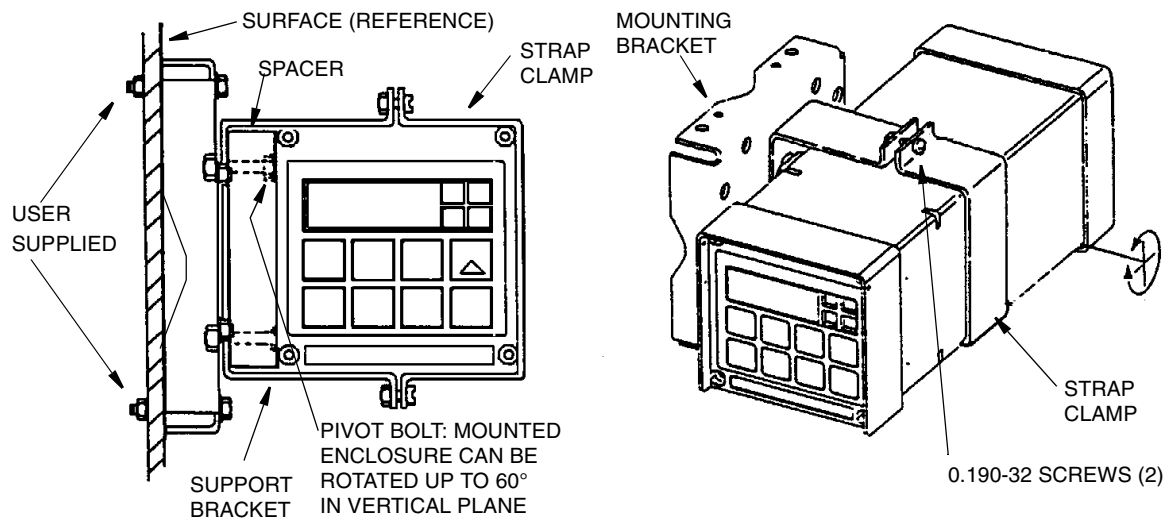


Figure 8. Metal Enclosure - Fixed Mount

Mounting to Surface, Movable Mount (Metal Enclosure Only) 873PH-__ Z

1. Locate surface on which you wish to mount the Analyzer. Also refer to PL 611-016.
2. Referring to Figure 9, use wall bracket (12) as template for drilling four holes into mounting surface. Notice that the holes in the wall bracket are 9.53 mm (0.375 in) in diameter.
3. Attach wall bracket (12) to surface using four bolts, washers, and nuts.
4. Assemble universal mounting as follows:
 - a. Place hex bolts (5) through spacer (3) into support bracket (2).
 - b. Slide nylon washers (11) over bolts (5).
 - c. Slide bolts through universal mounting bracket (1) and fasten assembly finger tight with hardware designated 9, 10, and 16.
5. Slide Analyzer into support bracket and slide strap clamp (4) onto Analyzer. Using two screws, nuts, and washers, attach strap clamp to support bracket to secure Analyzer.
6. Lift entire assembly of Step 5, align mounting bracket and wall bracket pivot bolt holes, and then insert pivot bolt through wall and mounting bracket into nylon washer and locking nut.
7. Rotate bracket and Analyzer assembly in horizontal plane to desired position and lock in place using screw and washer.

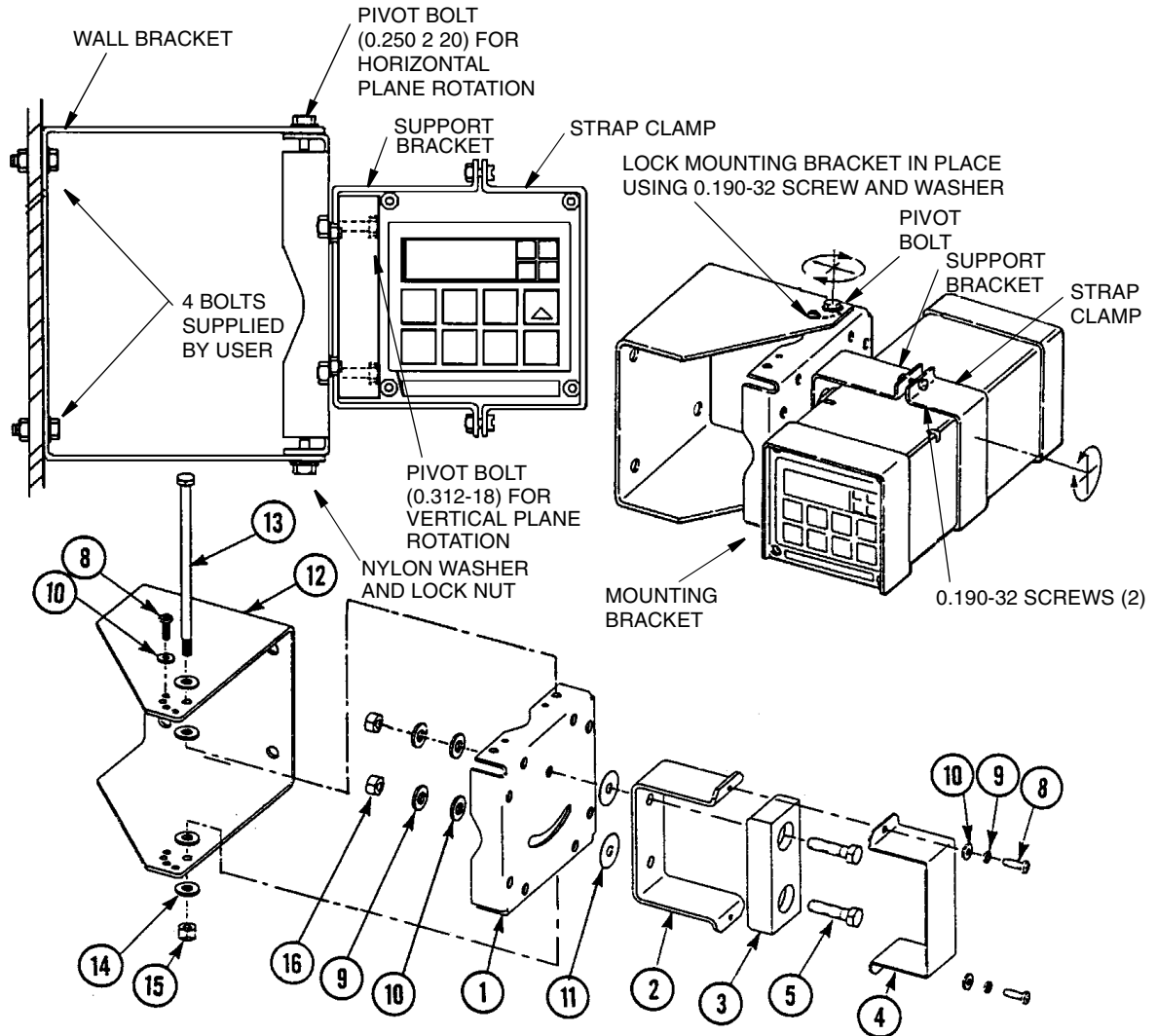


Figure 9. Metal Enclosure - Movable Mount

Wiring of Plastic Enclosure

Wiring installation must comply with any existing local regulations.

1. Remove optional rear cover assembly BS805QK, if present.
2. Connect H and L alarm wires to TB3 as shown in Figure 10.
3. Connect wires from external circuit for Analyzer measurement output to terminals TB3-1(+) and TB3-2(-). Refer to Figure 10.
4. Remove factory-installed jumper assembly from terminal block TB2 and discard.
5. Connect sensor wires to Analyzer terminal block (TB2) in accordance with Figure 11.
6. Connect power wires to terminal block TB1 as shown in Figure 10.
7. Attach optional rear panel cover, if present.

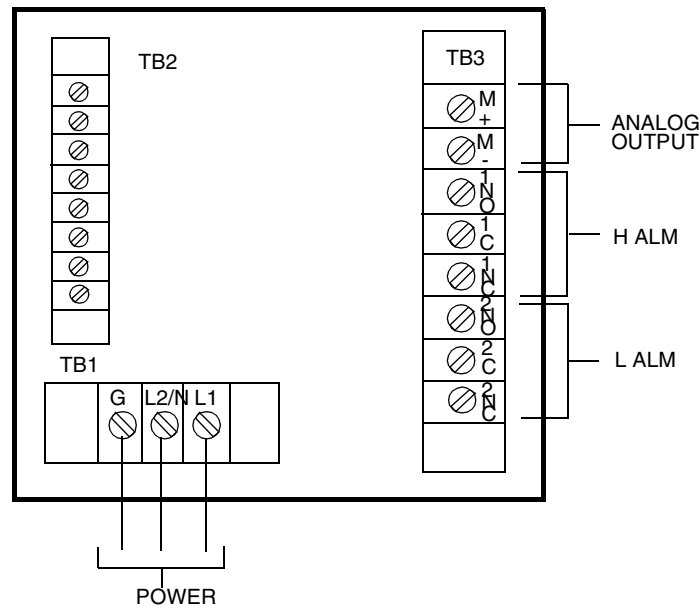


Figure 10. Plastic Enclosure Rear Panel Wiring for Power, Output, and Alarms

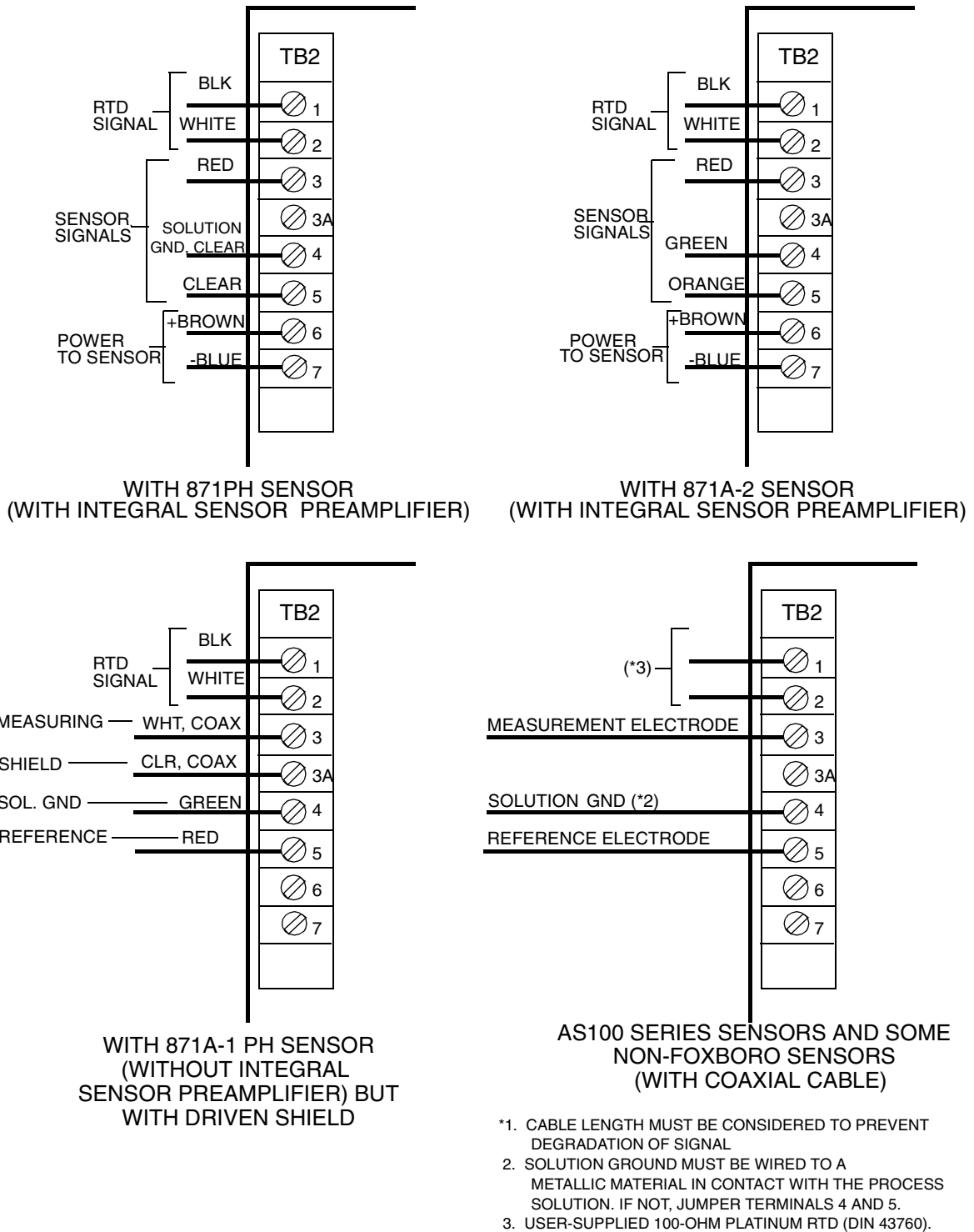


Figure 11. Plastic Enclosure Rear Panel Wiring for Sensor

Wiring of Metal Enclosure

Wiring installation must comply with any existing local regulations.

— **NOTE** —

1. To maintain enclosure tightness such as NEMA 4X, CSA Enclosure 4X, or IEC Degree of Protection IP-65, wiring methods and fittings appropriate to the rating must be used. Table 2 lists the recommended parts.
 2. Alarm wires should run through the same conduit as the analog output wires. Sensor wires and power wires should be run through separate conduits.
-
1. Remove back cover to access terminal/power board.
 2. Connect H and L Alarm wires to TB3 as shown in Figure 12. Failsafe operation requires connections to be made between contacts NC and C, and the alarms to be configured active. Refer also to “General Information Alarms” on page 34.
 3. Connect wires from external circuits for Analyzer temperature or measurement outputs to terminal TB4.
 4. Connect sensor wires to Analyzer terminal block TB2 as shown in Figure 13.
 5. Connect power wires to terminal block TB1, as indicated in Figure 12. The earth (ground) connection from the power cord should be connected to the ground stud located in the bottom of the case. This connection is mandatory for safe operation.

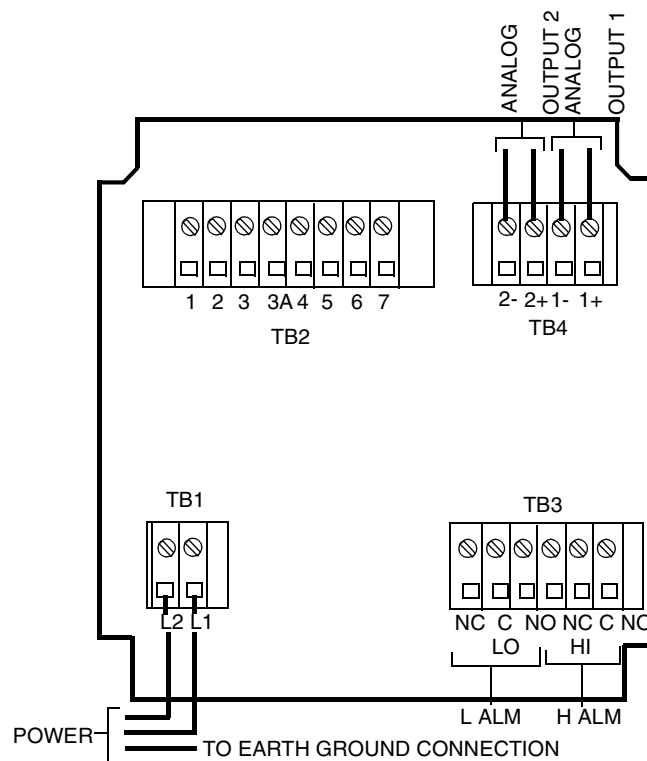


Figure 12. Metal Enclosure Rear Panel Wiring for Power, Output, and Alarms

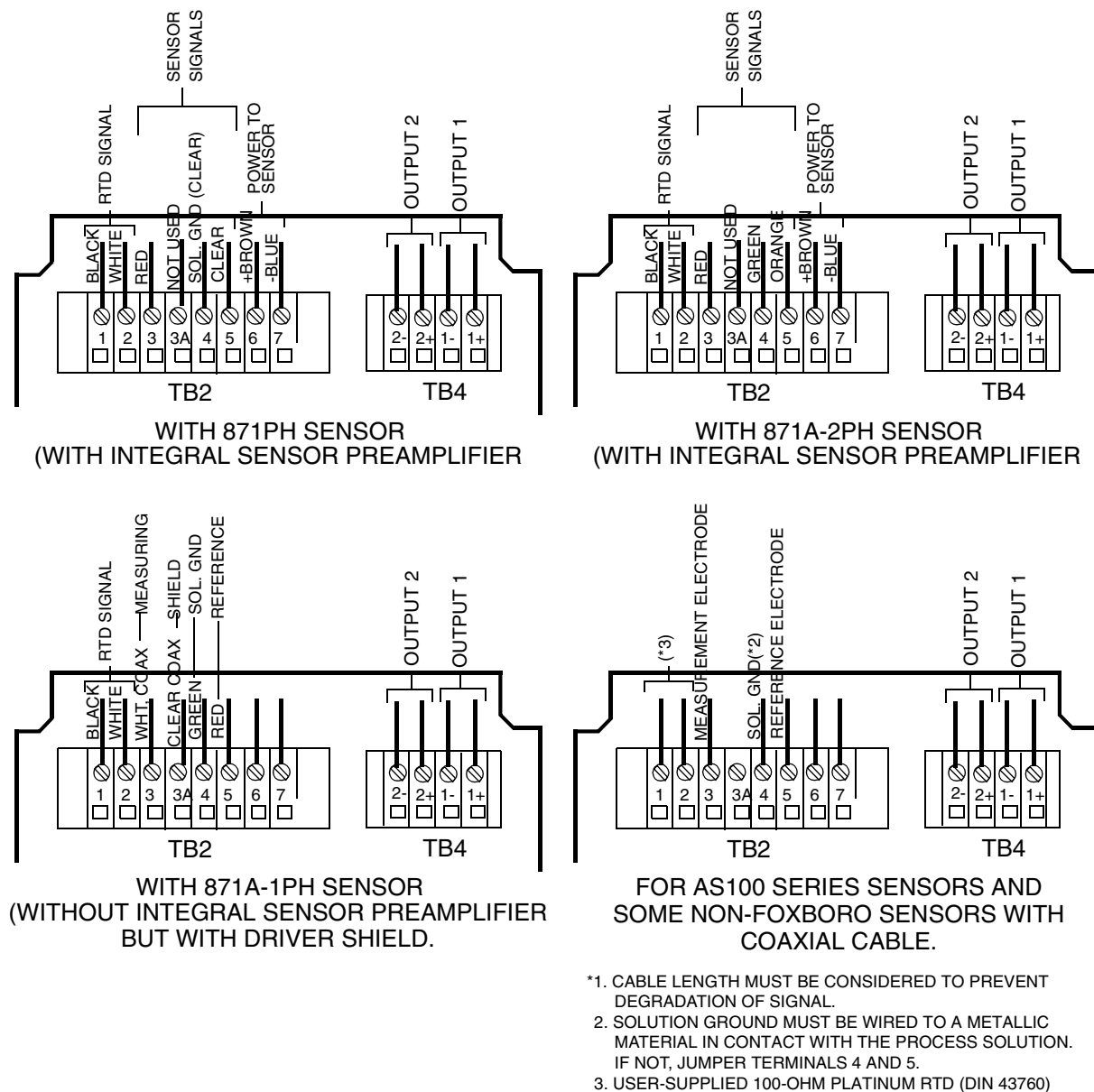


Figure 13. Metal Enclosure Rear Panel Wiring for Sensor

Table 2. Recommended Conduit and Fitting (Due to Internal Size Restraints)

	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 HC, 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

*Thomas & Betts Corp., 1001 Frontier Road, Bridgewater, NJ 08807-0993

3. Operation

Overview

The 873 functions in two modes, OPERATE and CONFIGURE.

In the OPERATE Mode, the 873 automatically displays its measurement, and outputs a proportional analog signal. Also, while in the OPERATE Mode, a user may read all the parameter settings and the solution temperature.

In the CONFIGURE Mode, the user may change any of the parameters previously entered. All 873 Analyzers are shipped configured, either with factory default settings or user defined parameters, as specified.

Utilizing either mode requires understanding the functions of both the keypad and display.

Display

The display, Figure 14, is presented in two parts, a measurement/settings display and backlit engineering units. There are two possible automatic measurement displays as follows:

- ◆ The measurement of pH, expressed in pH.
- ◆ The measurement of ORP, expressed in mV.

To read anything other than the measurement or to make a configuration or calibration change, requires keypad manipulations.

Keypad

The keypad, shown in Figure 14, consists of eight keys, six of which are dual function. The white lettered keys represent normal functions and the green lettered keys represent alternate functions. To operate a white lettered function key, just press the key. To operate a green lettered function key, press/hold the **SHIFT** key and then press the function key. The notation used to describe this operation is **SHIFT + (key)**. All key functions are described in Table 3 on page 25.

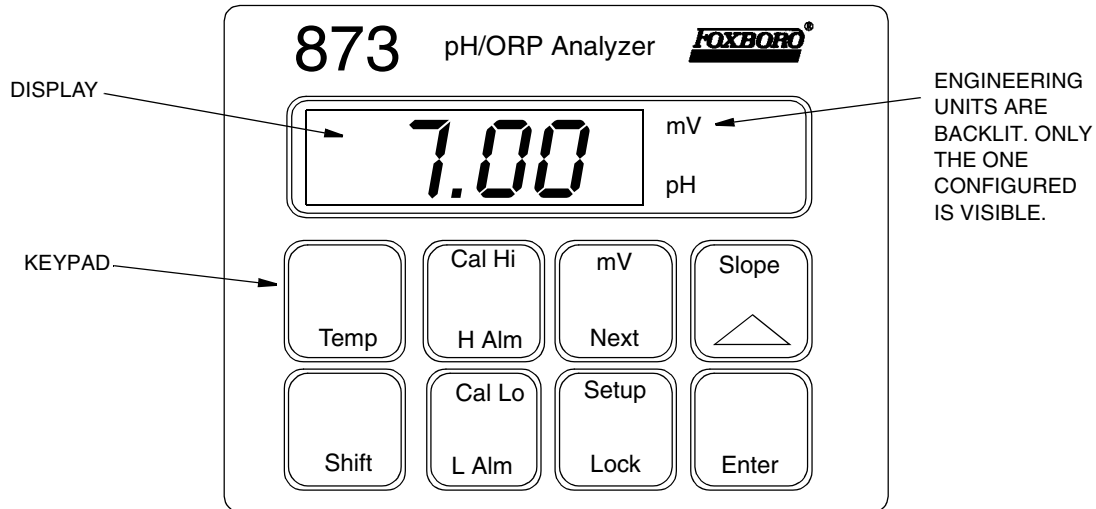





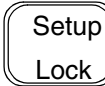

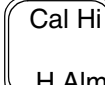


Figure 14. Model 873PH Keypad and Display

Table 3. Keypad Functions

Key	Function
	Press and hold this key to actuate the green dual-function keys. Holding the SHIFT key, after pressing any function key, delays the 10-second time-out; allowing you to view the display as long as you hold the key.
	SLOPE: Used to display Nernst slope (mV/pH) corrected to 25 °C; determined from the last 2-point calibration entered into Analyzer. INCREMENT: Press this key to increase the display count by one. Each press increases the value by one. Press and hold to increase count at a rate of approximately one per second. When 9 is reached, display goes to 0.
	TEMP: Press this key to display the process medium temperature. This may be the actual temperature or a manually set value as configured. The temperature is displayed as with one decimal point which alternates with °C or °F as chosen.
	Press this key to display the value or code of a setup entry. You can also use this key to select a parameter or code by entering the value or code into memory.
	mV: Used to display absolute mV value when in the pH Mode. NEXT: Press this key to select one of the four display digits similar to a cursor except that it causes the digit to flicker. Also used to select the next entry choice of the setup function.
	SETUP: Press/hold SHIFT and press this key to access the configuration entry function. LOCK: Press this key to display and/or change the security lock state of the instrument.
	CAL LO: Press/hold SHIFT and press this key to access the lower calibration function of the Analyzer. (Shifts y-intercept or offset voltage). LALM 2: Press this key to display and/or change the set point of L Alarm.
	CAL HI: Press/hold SHIFT and press this key to access the upper calibration function of the Analyzer. (Changes slope or gain of Analyzer). ALM 1: Press this key to display and/or change the set point of H Alarm.

— NOTE —

1. Pressing NEXT and Δ simultaneously allows you to step backward through the Setup program or digit place movement. Note, however, that you cannot reverse number count by this procedure.
2. Pressing and holding SHIFT and ENTER simultaneously overrides the 10-second wait between Setup entries

Operate Mode

As soon as the 873 Analyzer is powered, it is in the Operate Mode. The instrument first conducts a self diagnostic, then automatically displays the measurement.

While in the Operate Mode, the user may view the measurement, view the temperature, and view all the parameter settings as configured in the Configuration Setup Entries and Basic Setup Entries.

Temp Key

To view the process temperature from the measurement mode:

Push Temp; the display changes from the measurement to the process medium temperature or manually adjusted temperature.

The display is a rounded whole number with the temperature units (C or F) alternating with tenths of degrees. Once the 873 is unlocked (see “Unlocking Analyzer Using Security Code” on page 30), the Temp key, used in conjunction with the increment (Δ) key, allows the temperature to be changed from °C to °F or vice versa, as well as allowing the use of manual temperature compensation at a given temperature (decimal shown after temperature). When Temp is pushed, the process temperature is displayed on the readout. Pushing Δ causes the display to sequence from the displayed value through the following sequence example:

(1) 77.F	(2) 77.F.	(3) 25.C	(4) 25.C.
or	or	or	or
77.0	77.0	25.0	25.0.

When the decimal point after the C or F is present, the process will be temperature compensated manually at the temperature displayed. If another manual compensation temperature is desired, use **Next** and Δ to change the display to the desired temperature; then push Enter. The process will then be compensated to the new displayed temperature. To return to automatic compensation, sequence the display to remove the decimal point after C or F. Automatic temperature compensation cannot be adjusted by this procedure. See “Temperature Cell Factor” on page 58 for adjusting temperature in the automatic mode.

— NOTE —

To make a minus sign appear on the display, make sure that a digit other than zero is present on the display.

For example, to make the display read -20°C, first display 020.°C, and then change the first digit to a minus sign.

View Setup Entries

Setup Entries may be viewed at any time.

To view any of the Setup Entries, follow the procedures given in the Configuration Setup Entries or Basic Setup Entries section but do not “Unlock” the instrument.

When viewing the Setup Entries, you may page through the parameters as rapidly as you wish (**Shift + Setup**, **Next** one or more times). However, once **Enter** is pushed (**Enter** must be pushed to read a parameter value), you must wait 10 seconds (value is displayed for 10 seconds) for the parameter symbol to reappear. The parameter symbols appear for 10 seconds also. If another key is not pushed in 10 seconds, the display defaults to the measurement. This feature is called “timing out.” To avoid “timing out” on any display, push and hold **Shift**.

To make changes to any Configuration Setup Parameter, refer to the Configuration section, starting on page 29.

4. Configuration

Overview

This instrument is shipped with either factory settings (default values) or user defined settings, as specified per sale order. Table 4 (Configuration Setup Entries) lists all the parameters that are more frequently changed and Table 12 (Basic Setup Entries) lists the parameters that are calibration oriented. Both tables list the displayed symbol, the page number to read about the parameter, a description of the display, the factory default value, and a space to write user values.

Configuration is the keypad manipulation of some parameters to make the Analyzer function to the user's specifications. This section explains how to input and change specific data through the keypad. Because reconfiguration may also involve wiring or jumper changes, care must be taken to ensure that all three items are checked before the Analyzer is placed into service either at startup or after any changes are made.

All 873 parameters are entered as 4-digit numerical codes. The code is chosen from tables shown with each parameter. There are several parameters that are entered as direct 4-digit values. Therefore, no table is supplied for those parameters.

Successful configuration requires four simple steps:

- ◆ Write down all your parameters in the spaces provided on the configuration tables. A removable configuration sheet is available for this purpose on page 71 of this manual.
- ◆ Unlock the instrument.
- ◆ Enter the 4-digit codes.
- ◆ Lock the instrument.

Configure Mode

The Configure Mode is protected through two levels of security, one level for "Configuration Setup Entries" and another for "Basic Setup Entries". Any configuration change starts with unlocking the instrument. Unlocking is accomplished by inputting a security code through the keypad.

Security Code

There are two levels of security in the Analyzer. The first level of security protects against unauthorized change of Temp, H Alm, L Alm, Cal Lo, Cal Hi, and all the "Configuration Setup Entries" (of which there are 20) (refer to "Configuration Setup Entries" on page 30). The second level of security protects against the remaining setup entries, called "Basic Setup Entries," of which there are 15, 12 of which may be changed in the field (refer to "Basic Setup Entries" on page 46).

Note that any of the parameters discussed above can be viewed when the Analyzer is in the locked state. When displaying a parameter in the locked state, none of the digits flicker, and an attempt to change the parameter results in the message Loc on the display.

The same security code is used to unlock the unit in both levels of security. When the unit is unlocked at the first level (see “Unlocking Analyzer Using Security Code” on page 30), the unit will remain unlocked until a positive action is taken to lock the unit again (see “Locking Analyzer Using Security Code” on page 30).

However, when the unit is unlocked using the bL entry at the second level of security (see “Unlocking Basic Setup Entries (bL)” on page 47), it will remain unlocked only as long as any of the Basic Setup Entries are being accessed. As soon as the Analyzer defaults to the current measurement value, the second level of security automatically locks again, so an unlock procedure is required to reaccess the Basic Setup Entries.

Unlocking Analyzer Using Security Code

1. Press **Lock**. Display will read Loc.
2. Press **Next** and then use the **Next** and increment (Δ) keys until security code is displayed (0800 from factory).
3. Press **Enter**. Analyzer will read uLoc, indicating unlocked state.

Locking Analyzer Using Security Code

1. Press **Lock**. Display will read uLoc.
2. Press **Next** and then use the **Next** and increment (Δ) keys until security code is displayed (0800 from factory).
3. Press **Enter**. Analyzer will read Loc, indicating locked state.

Configuration Setup Entries

The configuration setup entries consist of 20 parameters. These parameters are process oriented and access to them is passcode protected. Table 4 lists each parameter (in the same sequence as seen on the display), the page on which a complete description can be found, its applicable symbol, factory default, and a space for recording your setting. Descriptions of each parameter are given in the following text.

Table 4. Configuration Setup Entries

Displayed Symbol	Reference (Page No.)	Parameters and Values Accessed	Factory Default	User Settings
CELL	32	Configuration of Analog Outputs	1013	
Hold	32	Holds and sets the Analog Output Value in Hold	0000	
Cd	33	Compensation and Damping Damping Factor Chemical Temperature Compensation	0001	
ISO	34	Isopotential Point	0000	
HAC	36	H Alarm Configuration Measurement Selection Low/High/Instrument plus Passive/Active State % Hysteresis	1403	
HAtt	37	High Alarm Trigger Time	00.00	
HAFt	37	High Alarm Feed Time	00.00	
HAdL	37	High Alarm Delay Time	00.00	
LAC	39	L Alarm Configuration Measurement Selection Low/High/Instrument plus Passive/Active State % Hysteresis	1203	
LAtt	41	Low Alarm Trigger Time	00.00	
LAft	41	Low Alarm Feed Time	00.00	
LAdL	41	Low Alarm Delay Time	00.00	
UL	43	User-defined Upper Measurement Limit	16.00	
LL	44	User-defined Lower Measurement Limit	00.00	
UtL	44	User-defined Upper Temperature Limit	100.0	
LtL	44	User-defined Lower Temperature Limit	00.00	
HO1	45	100% Analog Output - Channel 1	14.00	
LO1	45	0% Analog Output - Channel 1	0.00	
HO2	45	100% Analog Output - Channel 2	100.0	
LO2	46	0% Analog Output - Channel 2	00.00	

To change any of the Configuration Setup parameters, use the following procedure:

1. Unlock Analyzer (see “Unlocking Analyzer Using Security Code” on page 30).
2. Press **Shift** and while holding, press **Setup**. Release fingers from both keys.
3. Press **Next** one or more times until the parameter to be changed is displayed.
4. Press **Enter**.
5. Use **Next** and Δ until the desired code or value is displayed.
6. Press **Enter**.
7. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).

— **NOTE** —

The configuration Setup parameters should be set after any changes are made to FSC. To prevent time-out while in the middle of this procedure, press and hold SHIFT key.

CELL Output Configuration (CELL)

The General Purpose plastic version has only one analog output. Configure Digit 3 (Output 1) to correspond to this output. With the metal field-mounted unit, two output signals and full configurability are available. Possible combinations include:

- ◆ pH Signal and Temperature Signal
- ◆ Both outputs corresponding to the measurement signal, but spanned differently.

Table 5. CELL Code – Display and Output Configuration

Digit 1	Digit 2	Digit 3	Digit 4
NOT USED 1	NOT USED 0	OUTPUT 1 1 = pH or mV 3 = Temperature	OUTPUT 2 1 = pH or mV 3 = Temperature

Holding the Analog Output (HOLD)

HOLD consists of a 4-digit code used to freeze the analog output(s) to a particular value. The 4-digit code is shown in Table 6. When the first digit of this code is 1, 2, or 3, the display flashes between the word HOLD and “a value” corresponding to the parameter set in Setup Parameter CELL. The outputs are frozen at a value corresponding to a % of the analog output scale. This percentage is set by the last three digits of the HOLD code. While in one of the HOLD modes, the Analyzer will continue to monitor and display the value the sensor observes. The sensor may be cleaned or replaced, and the system calibrated, while in this mode.

The analog output can also be simulated for chart recorder alignment by using this function. Zero percent is equivalent to the Lower output value and one hundred percent corresponds to the higher output value.

If an alarm is configured as a High, Low, or Instrument alarm (HAC or LAC; second digit in code 1-6), the alarm status while in the HOLD mode may be selected by the first digit in the HOLD code.

If an alarm is configured as a HOLD alarm (HAC or LAC; second digit 7 or 8), the alarm will trigger when the HOLD is activated. This feature will allow a control room or alarm device (light, bell, etc.) to know the Analyzer is in a HOLD mode, not a “RUN” mode. The ALARM will be activated when HOLD is implemented when the first digit in the HOLD code is 1, 2, or 3.

Example 1: HOLD at a Percent of the Analog Output

For an analog output of 4 to 20 mA, 50% will always equal 12 mA, and 0% will equal 4 mA.

To HOLD on the value being displayed at the present time, the value displayed must be converted to a percent value by the following equation:

$$\frac{\text{Value Displayed} - \text{LO1}}{\text{HO1} - \text{LO1}} \times 100$$

Example 2: HOLD at the value presently read on the display

The presently displayed value for the sensor is 7.2 pH. H01 is set at 10 pH, L01 is set at 4 pH. To set HOLD at 7.2 pH, the last two digits of HOLD must be 58.

$$\frac{7.2 - 4}{10 - 4} \times 100 = \frac{3.2}{6} \times 100 = 53.3$$

The HOLD code should read 1058. If two outputs are present, both will HOLD at 53% of their analog output ranges.

Table 6. HOLD Code - Hold Analog Output Values

Digit 1	Digits 2, 3, and 4
0 = No HOLD HOLD On, Analog Output on HOLD 1 = Alarms held in present state 2 = Alarms held in off state 3 = Alarms held in on state	000 to 100% of Analog Output Range

— NOTE —

Trying to enter a digit with no assigned function will result in the code ERR.

Compensation and Damping (Cd)

Cd consists of a 4-digit code pertaining to the type of temperature compensation desired and the amount of damping applied to the measurement. Table 7 displays Cd options. Only two digits of the code may be activated.

Damping time refers to an interval over which all measurement readings are averaged. Damping will affect temperature displayed and analog outputs also.

The fourth digit of the Cd code is used to set the type of temperature compensation that is applied to a measurement. When measuring ORP or Redox potential of a solution, no temperature correction should be applied; the code should read X000. A pH measurement with a glass pH electrode, such as an 871PH-1F1A or 871A-2F pH, requires the code to be set to X001. The temperature transducer in the sensor will send a signal to the 873, and the Analyzer will use this value to adjust the Nernst slope factor and, consequentially, the pH value displayed; the actual pH of the process at the temperature of measurement. No temperature correction is applied to a measurement (by definition) at pH 7 when the code is X001.

A pH measurement with an antimony pH sensor, such as the Invensys Foxboro 871PH-1B1A, requires the code X002. A pH measurement with an antimony sensor applies no temperature correction to a measurement (by definition) at pH 1.

If the 873 is used as a pION analyzer, the code should be set to X003. An isopotential point can be moved to correspond to the actual sensor pair (see “ISO” on page 34). The Analyzer displays mV in this measurement.

The fifth choice of temperature compensation is used for measurements with a glass sensor in water samples with traces of ammonia. Two types of compensation are used with this setting; the

Nernst slope adjustment is applied to the reading, and an additional correction is also applied. The pH value the sample would read at 25 °C is then displayed on the 873. This compensation should only be used for water-NH₃ samples. The Cd code should be set to X004.

Table 7. Cd Code – Compensation and Damping

Digit 1	Digit 2	Digit 3	Digit 4
DAMPING	NOT USED	NOT USED	TEMPERATURE COMPENSATION
0 = none 1 = 10 second 2 = 20 second 3 = 30 second	0	0	0 = Absolute (no compensation/ORP only) 1 = Glass Sensor (isopotential pt. = pH 7) 2 = Antimony Sensor (isopotential pt. = pH 1) 3 = pIon (adj. isopotential point) 4 = 1 ppm Ammonia

ISO

This 4-digit value is used when the instrument is utilized as a pIon analyzer. This code allows the user to input an isopotential point (millivolt value that reads the same at every temperature) of a sensor. This value is also called the isothermal point. The code can be set anywhere between and including -999 to 1400 mV. The value should be left at 0.0 mV for pH or ORP Analyzer operation.

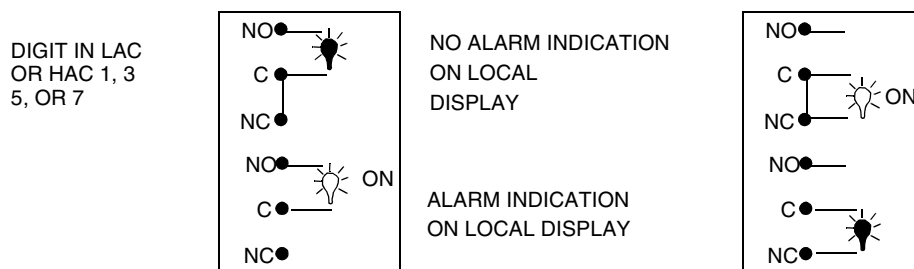
General Information Alarms

Dual independent, Form C dry alarm contacts, rated at 5A noninductive, 125 V ac/30 V dc are provided. The alarm status is alternately displayed with the measurement on the LED display. Alarms are set using a code for low, high, hold, or instrument watchdog alarms, with active or passive relays, having a deadband or time delay. Wiring information for the alarms may be found in the Wiring Sections, page 18 and page 20, of this instruction. See Example in Figure 15.

CAUTION

When the contacts are used at signal levels of less than 20 W, contact function may become unreliable over time due to the formation of an oxide layer on the contacts. See “Alarm Contact Maintenance” on page 73.

CONFIGURED PASSIVE – WHEN ACTIVATED RELAY IS ENERGIZED AND LOCAL DISPLAY INDICATES ALARM STATE



CONFIGURED ACTIVE – WHEN ACTIVATED, RELAY IS NOT ENERGIZED AND LOCAL DISPLAY INDICATES ALARM STATE.

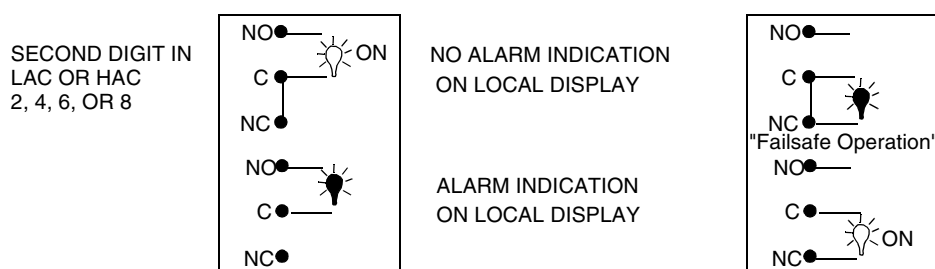


Figure 15. Possible Alarm Wiring and Configuration Choices

NOTE

1. Alarms will have to be reset if any changes are made to FSC.
2. Upon powering the instrument: Alarm operation is delayed for a time period proportional to the damping time set in Cd (damping selection). Alarms will remain "OFF" until the measurement has stabilized.

Check that the alarm configurations are configured as desired. Refer to "H Alarm Configuration (HAC)" on page 36 and "L Alarm Configuration (LAC)" on page 39.

Setting Alarm Level(s)

NOTE

This procedure is relevant only when the alarms are configured as Low and/or High Measurement Alarms. When the alarms are configured as Watchdog or Hold alarms, alarm level settings have no relevance.

1. Unlock Analyzer (see "Unlocking Analyzer Using Security Code" on page 30).
2. To set high alarm, press **H Alm**. Then use **Next** and Δ to achieve the desired value on the display.
3. Press **Enter**.
4. To set low alarm, press **L Alm**. Then use **Next** and Δ to achieve the desired value on the display.

5. Press **Enter**.
6. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).

— **NOTE** —

If use of the alarms is not desired, set the H Alm and L Alm values outside of normal measurement range.

H Alarm Configuration (HAC)

The HAC 4-digit code configures the alarm designated as “H ALM”. See Table 8. There are three configurable parameters associated with each alarm. The first digit of this code allows the alarm to be configured to correspond to one of two alarm measurement selections. The second digit of this code configures the alarm as a Measurement alarm, Instrument alarm, or Hold alarm.

The third and fourth digits set the alarm hysteresis (deadband). This parameter is associated with the alarms used as measurement alarms. The hysteresis may be varied from 0 to 99% of the FSC range chosen in increments of 1%.

When used as a measurement alarm, four configurations are possible. These are as a low passive or active, or a high passive or active alarm, i.e., digit 2 is 1-4.

A low alarm relay will trip on decreasing measurement.

A high alarm relay will trip on increasing measurement.

Passive or active (failsafe) configurations are also chosen by this digit choice. In the active (failsafe) configuration, a loss of power to the Analyzer will result in a change from active to passive relay state, providing contact closure and an indication of a power problem. Correct wiring of the contacts is necessary for true failsafe operation. For wiring information, refer to page 18 or page 20 of this document.

Alternative to a measurement alarm, the H alarm has the option of being used as an Instrument Alarm. In this “Watchdog” state, the alarm can communicate any diagnostic error present in the system. When used as a diagnostic alarm, the H alarm cannot be used as a conventional measurement alarm. However, one of the configurable diagnostic parameters is “measurement error,” so when programmed properly, the H alarm can report either diagnostic or high measurement problems. Set digit 2 in this code as either 5 or 6, as applicable.

When the H alarm is configured as a diagnostic error communicator, it will report any system problem. It cannot selectively report a given problem. The type of hardware/software conditions that will cause an alarm include:

- ◆ A/D converter error
- ◆ EEPROM checksum error
- ◆ RAM error
- ◆ ROM error
- ◆ Processor task time error (watchdog timer)

In addition to these diagnostics, the user may program several temperature and measurement error limits which, if exceeded, will cause an alarm condition. These programming options are explained in “User-Defined Upper Measurement Limit (UL)” on page 43 through “User-Defined Lower Temperature Limit (LtL)” on page 44.

Refer to the “Error Codes” on page 69, for identifying error messages.

The H alarm may also be configured and used as a HOLD alarm. When used as a HOLD alarm, the H alarm cannot be used as a conventional measurement alarm. When the alarm is configured as a HOLD alarm (HAC; 2nd digit a 7 or 8), the alarm will trigger when the HOLD is activated. This feature will allow a control room or alarm device (light, bell, etc.) to know the Analyzer is in a HOLD mode, not a “RUN” mode. The ALARM will be activated when HOLD is implemented when the first digit in the HOLD code is 1, 2, or 3.

Table 8. HAC Code - H Alm Configuration

Digit 1	Digit 2	Digits 3 and 4
H ALARM SELECTION	CONFIGURATION	HYSTERESIS
1 = pH or ORP 3 = Temperature	1 = Low/Passive 2 = Low/Active 3 = High/Passive 4 = High/Active 5 = Instrument/Passive 6 = Instrument/Active 7 = HOLD/Passive 8 = HOLD/Active	00 to 99% of Full Scale

Alarm Timers (HAtt, HAFt, and HAdL)

There are three timers associated with the H Alarm:

1. *HAtt (H Alarm Trigger Time)*
Programmable timer to prevent alarm from triggering unless the measurement *remains in the alarm state for a user-defined period of time.*
2. *HAFt (H Alarm Feed Time)*
Programmable timer to keep alarm ON for a user-defined period of time once it has been tripped.
3. *HAdL (H Alarm Delay Time)*
Programmable timer to keep the alarm OFF for a user-defined period of time once the HAFt time has expired.

Each of these timers will be explained fully in the following paragraphs and their relationships illustrated in Figure 16 and the flow diagram in Figure 17.

H Alarm Trigger Timer (HAtt) may be used with or without the other alarm timers (HAFt and HAdL). HAtt is used when H Alarm is configured as a *measurement* alarm only. The purpose of this timer is to prevent the alarm from activating due to transient conditions such as air bubbles or other spikes. After the timer has counted down, that alarm will activate *only* if the measurement has remained in an alarm state during the *entire* trigger time. HAtt resets any time the measurement passes through the alarm set point. Table 9 shows the code designation.

H Alarm Feed Time (HAFt) is activated by entering a time in the code parameter HAFt. When the H Alarm is triggered, the alarm will remain ON for this time period regardless of what the measurement value is with respect to the alarm set point (i.e., H Alarm will remain ON even if the measurement returns to normal). Table 9 shows the code designation.

H Alarm Delay Time (HAdL) is activated by entering a time in the code parameter HAdL. Upon time-out of HAFt, the alarm will stay OFF for this time period regardless of what the measurement value is with respect to the alarm set point (i.e., H Alarm will remain OFF even if the measurement goes back into alarm). Table 9 shows the code designation.

Table 9. HAtt, HAFt, and HAdL Time Codes

Digits 1 and 2	Digit 3	Digit 4
00 to 99 minutes	0 to 9 tenths of minutes	0 to 9 hundredths of minutes

Examples:

05.15 means 5 minutes, 9 seconds

20.50 means 20 minutes, 30 seconds

After time-out of HAdL, the 873 reverts to normal run mode. If the measurement has remained in an alarm state for the entire period (HAFt + HAdL), the sequence of HAFt and HAdL repeats itself. If, however, the measurement has gone out of alarm at any time during the cycle, it must remain in alarm for the trigger time before reactivating the cycle.

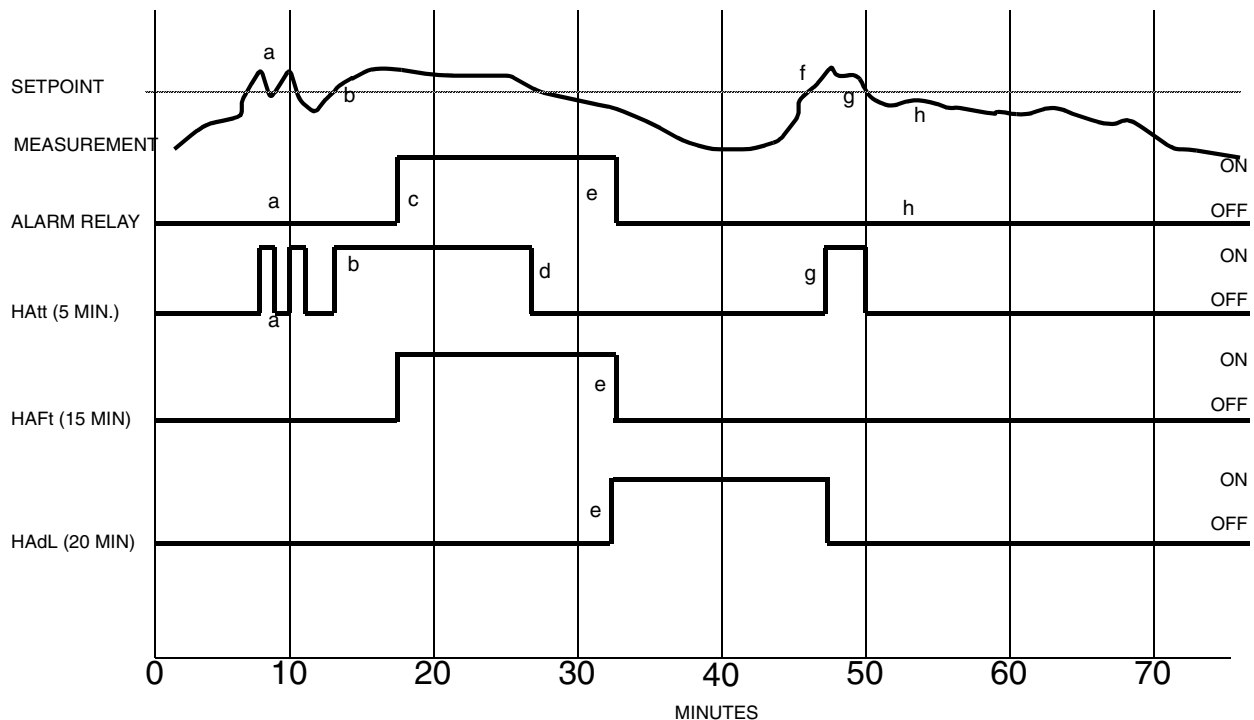


Figure 16. ON/OFF relationship between HAtt, HAFt, and HAdL

The following explanatory notes, coupled with the foregoing illustration, demonstrate the function of the three 873 Analyzer timers.

- a. Measurement exceeds set point but does not remain above set point for the time period set in HAtt (5 minutes). Alarm relay remains inactive. Note that HAtt resets when the measurement falls below set point.

- b. Measurement exceeds set point once again, activating HAtt, and remains continuously above set point for the time period set in HAtt (5 minutes).
- c. After measurement has remained above set point for the entire trigger time (5 minutes), the alarm relay is activated.
- d. HAtt is reset when measurement falls below set point once again. Note that the alarm relay remains activated despite the fact that the measurement has fallen below the set point. The alarm relay will remain activated for the time period set in HAFt (15 minutes).
- e. After the alarm relay has been activated for the feed time (15 minutes), HAFt times out and the alarm relay is deactivated. The alarm relay will remain deactivated for the time period set in HAdL (20 minutes).
- f. Measurement exceeds set point, but the alarm relay remains deactivated because the delay time (20 minutes) has not expired.
- g. After the delay time has expired, the measurement is still in alarm, so HAtt is activated.
- h. The measurement drops below set point before the trigger time (5 minutes) expires, so the alarm relay does not activate and HAtt is reset.

The following flow diagram should also serve to illustrate the logic of the three alarm timers:

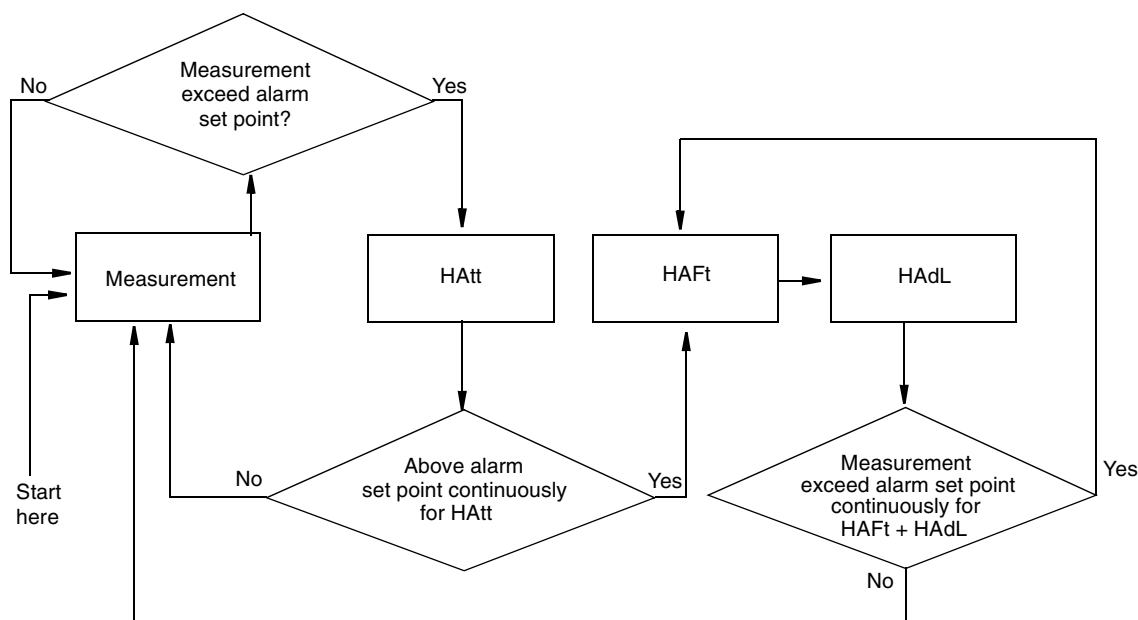


Figure 17. Flow Diagram for Alarm Timer Logic

L Alarm Configuration (LAC)

The LAC 4-digit code configures the alarm designated as “L ALM”. See Table 10. There are three configurable parameters associated with this alarm. The first digit of this code allows the alarm to be configured to correspond to one of two alarm measurement selections. The second digit of the code configures the alarm as a Measurement alarm, Instrument alarm, or HOLD alarm.

The third and fourth digits set the alarm hysteresis (deadband). This parameter is associated with the alarm when used as a measurement alarm. The deadband may be varied from 0 to 99% of FSC range chosen in increments of 1%.

When used as a measurement alarm, four configurations are possible. These are as a low passive or active, or a high passive or active alarm. Set Digit 2 as 1-4, as applicable.

A low alarm relay will trip on decreasing measurement.

A high alarm relay will trip on increasing measurement.

Passive or active (failsafe) configurations are also chosen by this digit choice. In the active (failsafe) configuration, a loss of power to the Analyzer will result in a change from active to passive relay state, providing contact closure and an indication of a power problem. Correct wiring of the contacts is necessary for true failsafe operation. For wiring information, consult page 18, page 20, and Figure 15 of this document.

Alternative to a measurement alarm, the L alarm has the option of being used as an Instrument Alarm. In this “Watchdog” state, the alarm can communicate any diagnostic error present in the system. When used as a diagnostic alarm, the L alarm cannot be used as a conventional measurement alarm. However, since one of the configurable diagnostic parameters is “measurement error,” the L alarm, when programmed properly, can report either diagnostic or measurement problems. Set Digit 2 in this code as either a 5 or 6, as applicable.

When the L alarm is configured as a diagnostic error communicator, it will report any system problem. It cannot selectively report a given problem. The type of hardware/software conditions which will cause an alarm include:

- ◆ A/D converter error
- ◆ EEPROM checksum error
- ◆ RAM error
- ◆ ROM error
- ◆ Processor task time error (watchdog timer)

In addition to these diagnostics, the user may program several temperature and measurement error limits which, if exceeded, will cause an alarm condition. These programming options are explained in “User-Defined Upper Measurement Limit (UL)” on page 43 through “User-Defined Lower Temperature Limit (LtL)” on page 44.

Refer to the “Error Codes” on page 69 for identifying error messages.

The L alarm may also be configured and used as a HOLD alarm. When used as a HOLD alarm, the L alarm cannot be used as a conventional measurement alarm. When the L alarm is configured as a HOLD alarm (LAC; 2nd digit a 7 or 8), the alarm will trigger when the HOLD is activated. This feature will allow a control room or alarm device (light, bell, etc.) to know the Analyzer is in a HOLD mode, not a “RUN” mode. The ALARM will be activated when HOLD is implemented when the first digit in the HOLD code is 1, 2, or 3.

Table 10. LAC Code - L Alarm Configuration

Digit 1	Digit 2	Digits 3 and 4
L Alarm Selection	Configuration	Hysteresis
1 = pH or ORP 3 = Temperature	1 = Low/Passive 2 = Low/Active 3 = High/Passive 4 = High/Active 5 = Instrument/Passive 6 = Instrument/Active 7 = HOLD/Passive 8 = HOLD/Active	00 to 99% of Full Scale

Alarm Timers (LAtt, LAft, and LAdL)

Three timers are associated with the H Alarm:

1. *LAtt (L Alarm Trigger Time)*
Programmable timer to prevent alarm from triggering unless the measurement remains in the alarm state for a user-defined period of time.
2. *LAft (L Alarm Feed Time)*
Programmable timer to keep alarm ON for a user-defined period of time once it has been tripped.
3. *LAdL (L Alarm Delay Time)*
Programmable timer to keep the alarm OFF for a user-defined period of time once the LAft time has expired.

Each of these timers is explained fully in the following paragraphs and their relationships illustrated in Figure 18 and the flow diagram in Figure 19.

L Alarm Trigger Timer (LAtt) may be used with or without the other alarm timers (LAft and LAdL). LAtt is used when L Alarm is configured as a *measurement* alarm only. The purpose of this timer is to prevent the alarm from activating due to transient conditions such as air bubbles or other spikes. After the timer has counted down, that alarm will activate *only* if the measurement has remained in an alarm state during the *entire* trigger time. LAtt resets whenever the measurement passes through the alarm set point. Table 4 shows the code designation.

L Alarm Feed Time (LAft) is activated by entering a time in the code parameter LAft. When the L Alarm is triggered, the alarm will remain ON for this time period regardless of what the measurement value is with respect to the alarm set point (i.e., L Alarm will remain ON even if the measurement returns to normal). Table 4 shows the code designation.

L Alarm Delay Time (LAdL) is activated by entering a time in the code parameter LAdL. Upon time-out of LAft, the alarm will stay OFF for this time period regardless of what the measurement value is with respect to the alarm set point (i.e., L Alarm will remain OFF even if the measurement goes back into alarm). Table 4 shows the code designation.

Table 11. LAtt, LAFt, and LAdL Time Codes

Digits 1 and 2	Digit 3	Digit 4
00 to 99 minutes	0 to 9 tenths of minutes	0 9 hundredths of minutes

Examples:

05.15 means 5 minutes, 9 seconds

20.50 means 20 minutes, 30 seconds

After time-out of LAdL, the 873 reverts to normal run mode. If the measurement has remained in an alarm state for the entire period (LAFt + LAdL), the sequence of LAFt and LAdL repeats itself. If, however, the measurement has gone out of alarm at any time during the cycle, it must remain in alarm for the trigger time before reactivating the cycle.

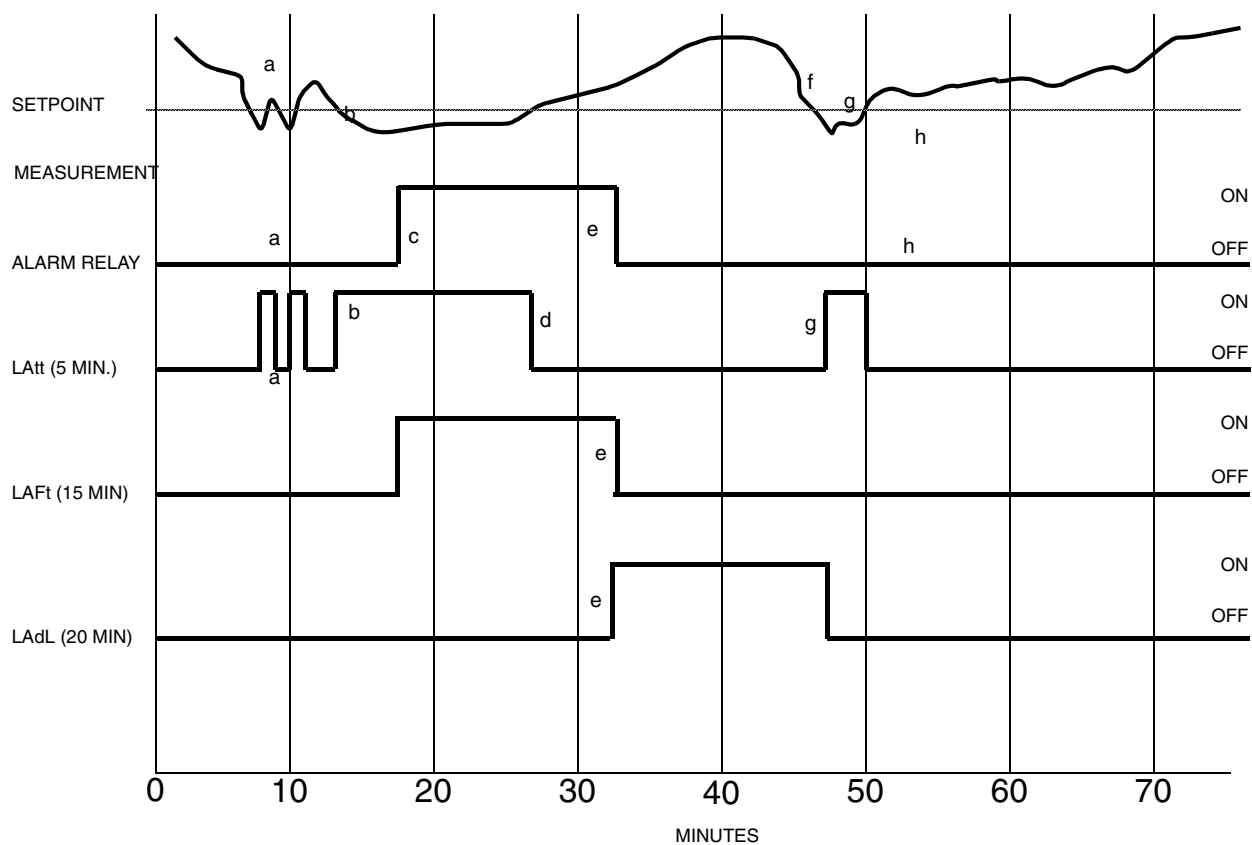


Figure 18. ON/OFF Relationship between LAtt, LAFt, and LAdL

The following explanatory notes, coupled with the illustration above, demonstrate the function of the three 873 Analyzer timers.

- a. Measurement drops below set point but does not remain below set point for the time period set in LAtt (5 minutes). Alarm relay remains inactive. Note that LAtt resets when the measurement rises above set point.
- b. Measurement drops below set point once again, activating LAtt, and remains continuously below set point for the time period set in LAtt (5 minutes).

- c. After measurement has remained below set point for the entire trigger time (5 minutes), the alarm relay is activated.
- d. HAtt is reset when measurement rises above set point once again. Note that the alarm relay remains activated despite the fact that the measurement has risen above the set point. The alarm relay will remain activated for the time period set in LAFt (15 minutes).
- e. After the alarm relay has been activated for the feed time (15 minutes), LAFt times out and the alarm relay is deactivated. The alarm relay will remain deactivated for the time period set in LAdL (20 minutes).
- f. Measurement drops below set point, but the alarm relay remains deactivated because the delay time (20 minutes) has not expired.
- g. After the delay time has expired, the measurement is still in alarm, so LAtt is activated.
- h. The measurement rises above set point before the trigger time (5 minutes) expires, so the alarm relay does not activate and LAtt is reset.

The following flow diagram illustrates the logic of the three alarm timers:

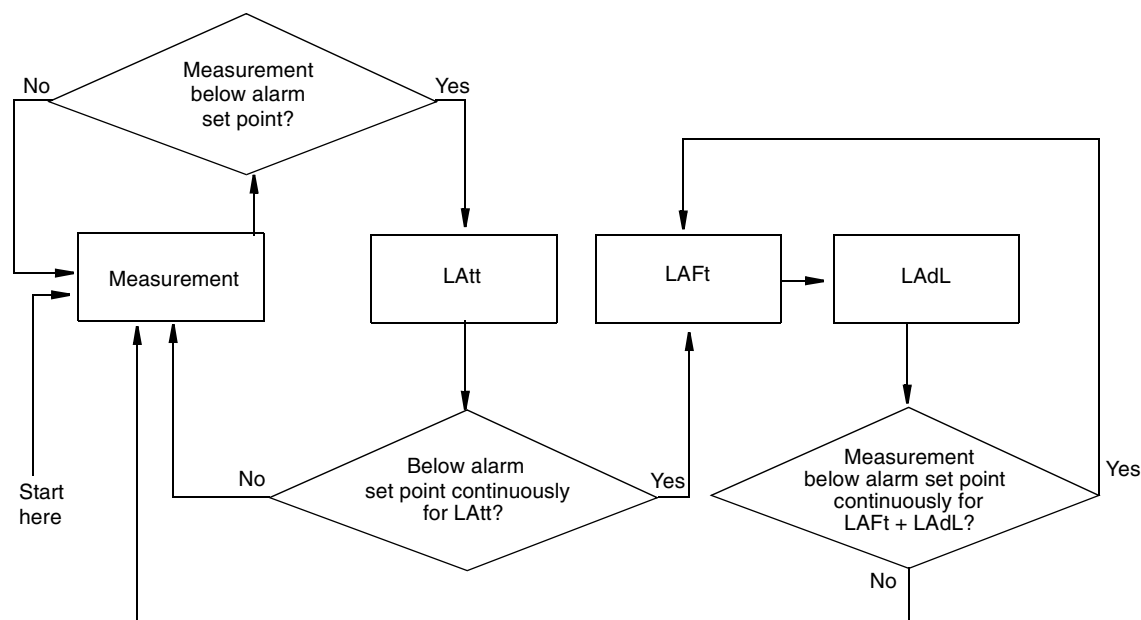


Figure 19. Flow Diagram for Alarm Timer Logic

User-Defined Upper Measurement Limit (UL)

This enables the user to define an upper measurement limit which, if exceeded, gives an error message on the display (see Table 16 on page 69), and when used in conjunction with the configurable alarms (see “Configuration Setup Entries” on page 30), provides a relay contact.

The primary use of UL is as a sensor diagnostic tool. Should a problem develop with the sensor that causes the measurement signal sent to the 873 Monitor to be ridiculously low or high for the process that is being monitored (such as a shorted or intermittent connection), an alarm can be triggered. By setting UL at a value that could never be achieved in a normal process situation, the

activation of a UL alarm would indicate either a severe sensor failure, miscalibration, or process out of control. The upper limit on UL is 16.00 pH or 1600 mV.

— **NOTE** —

Invensys Foxboro preconfigures the UL value equal to the specified full scale measurement per Sales Order.

User-Defined Lower Measurement Limit (LL)

This parameter is similar to the previously described UL parameter, except that it allows programming of a lower measurement limit. The lower limit on LL is -9.99 pH or -999 mV.

— **NOTE** —

To make a minus sign appear on the display requires a digit other than zero to be present on the display.

User-Defined Upper Temperature Limit (UtL)

This parameter enables the user to define an upper temperature measurement value which, if exceeded, will give an E3 message on the display (“Error Codes” on page 69) and when used in conjunction with the configurable alarms (see “Configuration Setup Entries” on page 30), provides a relay contact.

The UtL function may be used in a few different ways. First, the user may wish to alarm on high process temperature. For example, in a pH measurement which is normally between 80°F and 100°F, the user may wish to set UtL to 120°F to indicate a problem with the process temperature. Another use of UtL is as a sensor diagnostic tool. If the RTD in the pH sensor develops a fault, it may produce erroneous temperature readings at either extreme of the temperature scale.

By setting UtL at a temperature outside of any conceivable process temperature, an alarm will indicate a problem with the pH sensor temperature transducer. The upper limit on UtL is 200°C or 392°F.

User-Defined Lower Temperature Limit (LtL)

This parameter is similar to the previously described UtL parameter, except that it allows programming of a lower temperature measurement limit. The lower limit on LtL is -20°C or -5°F. Invensys Foxboro preconfigures the LtL value to be 0°C.

— **NOTE** —

To make a minus sign appear on the display requires that a digit other than zero be present on the display. Example: To make the display read -20°C, first display 020.0°C, then change the first digit to a negative sign.

Scaling the Analog Outputs:

Each 873 Analyzer has one or two analog output signals as standard. Each output signal is linearly proportional to the measured parameter. The analog outputs are designated in the CELL parameter of the Setup configuration. See “CELL Output Configuration (CELL)” on page 32. Both outputs on the metal NEMA 4X version may be used for the process measurement, if desired, and can be scaled over different ranges to improve sensitivity of the analog output in the

range of interest. Alternately, one may be set to measurement, and the second to temperature. If one or both of the outputs are not used, set these values to the extremes of ranges to prevent “. . .” from flashing across the display.

The maximum range span that should be set on the Analyzer is the FSC value. The minimum range span that should be set on the Analyzer is 10% of the FSC value. Although it is physically possible to set the Analyzer for a smaller range, a loss of accuracy is possible. The analog output could develop steps instead of following the measurement in a continuum.

Output #1's 100% Analog Value (H01)

This 4-digit code may be set to any value between -9.99 and 16.00 pH or -999 and 1600 mV. The value set by this code will correspond to 100% of the analog output, i.e., 20 mA or 10 volts, depending upon output configuration. This value may be lower than L01, if desired. The H01 value is tied to CELL Code Digit 3.

Example:

Output 1 has been configured to correspond to the pH of the process. The CELL code is 1013. You wish to have 20 mA correspond to 4.00 pH. Once in H01 mode, use **Next** and Δ to display 4.00 pH. The correct units will appear if FSC and CELL were configured correctly. Press **Enter**.

Output #1's 0% Analog Value (L01)

This 4-digit code may be set to any value between -9.99 and 16.00 pH or -999 and 1600 mV. The value set by this code will correspond to 0% of the analog output, i.e., 0 mA, 4 mA, 0 V, depending upon output configuration. This value may be higher than H01, if desired. The L01 value is tied to CELL Code Digit 3.

Example:

Output 1 has been configured to correspond to the pH of the process. The CELL code is 1013. You wish to have 4 mA correspond to 10.00 pH. Once in L01 mode, use **Next** and Δ to display 10.00 pH. The correct units will appear if FSC and CELL were configured correctly. Press **Enter**.

— NOTE —

To make a minus sign appear on the display, a digit other than zero must be present on the display. Example: To make the display read -1.00, first display 01.00. The change the first digit to a minus sign.

Output #2's 100% Analog Value (H02)

— NOTE —

Only use on field-mounted units; general purpose units use H01 only.

Configures second output to 100% of the analog output. The parameter is similar to H01. This H02 value is tied to CELL Code Digit 4. This value may be lower than L02, if desired.

Example:

Output 2 has been configured to correspond to the temperature of the process. The CELL code is 1013. You wish to have 20 mA correspond to 90 °F. Once in H02 mode, use Next and Δ to display 90 °F. The correct units of Fahrenheit will appear if TEMP was left in the Fahrenheit mode, and CELL was configured correctly. Press Enter.

Output #2's 0% Analog Value (L02)

NOTE

Only use on field-mounted units; general purpose units use L01 only.

Configures second output to 0% of the analog output. This parameter is similar to L01. This L02 value ties to CELL Code Digit 4. This value may be higher than H02, if desired.

Example:

Output 2 has been configured to correspond to the temperature of the process. The CELL code is 1013. You wish to have 4 mA correspond to 60 °F. Once in L02 mode, use Next and Δ to display 60 °F. The correct units of Fahrenheit will appear if TEMP was left in Fahrenheit mode, and CELL was configured correctly. Press Enter.

Basic Setup Entries

The Basic Setup entries consist of 15 parameters. These parameters are calibration oriented and access to them has two levels of passcode protection. Changes to most of these parameters require the Analyzer to be recalibrated. DO NOT make any changes before reading the following text for each parameter.

Table 12 lists each parameter, with its applicable symbol, in the same sequence as seen on the display. Procedures that use these parameters follow the table. The procedures are called: Unlocking Basic Setup Entries, Changing the Full Scale Range, Calibrating the RTD Circuitry, Changing the Analog Output, and Changing the Security Code.

Table 12. Basic Setup Entry Selection

Display Symbol	Reference	Parameter and Value Accessed	Factory Default	User Settings
bL	page 47	Basic Setup Lock Control	0800	
FSC	page 47	Full Scale Value	16.00	
tCF1	page 58	Temperature Cell Factor	25.00	
tCL1	page 48	RTD Low Temperature Electronics Calibration	100.0	
tCC1	page 48	RTD Mid Temperature Electronics Calibration	150.00	
tCH1	page 48	RTD High Temperature Electronics Calibration	200.0	
LCC	page 54	Lock Code Change	0800	
LCO1	page 51	Analog Out 1 Electronics Lower Calibration	000.0	
HCO1	page 51	Analog Out 1 Electronics Upper Calibration	100.0	
LCO2	page 51	Analog Out 2 Electronics Lower Calibration	000.0	
HCO2	page 51	Analog Out 2 Electronics Upper Calibration	100.0	

Table 12. Basic Setup Entry Selection (Continued)

Display Symbol	Reference	Parameter and Value Accessed	Factory Default	User Settings
PC	page 59	Probe Calibration	0	
SFt		Software Version Number	N/A	
SOH		Sales Order High	N/A	
SOL		Sales Order Low	N/A	

Unlocking Basic Setup Entries (bL)

To change any of the Basic Setup Entries, use the following procedure.

1. Unlock Analyzer at the first security level (see “Unlocking Analyzer Using Security Code” on page 30).
2. Press **Shift** and while holding, press Setup. Release finger from both keys.
3. Press **Next** eighteen times until bL is displayed.
4. Press **Enter**. LOC appears on the display.
5. Press **Next**.
6. Use **Next** and Δ until security code is displayed (0800 from factory).
7. Press **Enter**. ULOC appears on the display.
8. When display returns to bL, press **Next** one or more times until parameter to be changed appears on the display.
9. Press **Enter**.
10. Use **Next** and Δ until the desired value is displayed.
11. Press **Enter**.
12. When display defaults to the current measurement value, the Analyzer is automatically locked at the second level (bL) of security.
13. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).

Changing the Full Scale Range (FSC)

This parameter allows the user to select whether the 873 will function in, mV or pH. When changing ranges, the units displayed will automatically change also. This parameter is not the output scaling range.

— NOTE —

1. Altering the FSC range via the Keypad requires the unit to be bench calibrated before use.
 2. Pressing Enter in FSC mode (even if range was not changed) requires the unit to be bench calibrated before use. If the range is set at the FSC you require, allow unit to time out. Do not press **Enter**.
-

After changing FSC, Configuration Setup Entries should be checked and altered if necessary. Invensys Foxboro preconfigures the FSC value per Sales Order.

The procedure to change FSC is as follows:

1. Unlock Analyzer (see “Unlocking Analyzer Using Security Code” on page 30).
2. Press **Shift** and while holding, press **Setup**. Release fingers from both keys.
3. Press **Next** several times until the code bL (Basic Setup Lock) is displayed (bL will be the 19th message to be displayed).
4. Press **Enter**, then use **Next** and Δ until personal security code is displayed (0800 from factory).
5. Press **Enter**.
6. When display returns to bL, press **Next**. The code FSC (Full Scale Range Change) will be displayed.
7. Press **Enter**. The present full scale range will be displayed. If this is your desired FSC, allow unit to time out. **DO NOT PRESS ENTER**. Entering any FSC will cause Er4 to flash on the display. A bench calibration then must be performed.
8. Press Δ until the desired range is displayed.
9. Press **Enter**.
10. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).

— **NOTE** —

Calibration is required after full scale range is changed. Error code Er4 will flash until calibration is accomplished. Refer to Calibration Section 5.

Calibrating the RTD Circuitry

RTD Temperature Electronics Calibrations (tCL1, tCC1, and tCH1) are factory calibrated to offset calibration error due to electronics. This calibration aligns the electronics to the theoretical temperature transducer values at 25°C. It should not be necessary to perform these procedures in the field unless:

1. You suspect a problem with the temperature calibration.
2. You wish to verify temperature electronics calibration.

RTD Temperature Calibration (tCL1, tCC1, and tCH1)

Required: one each, 100 Ω , 150 Ω , and 200 Ω , precision resistors (or precision resistance decade box with 0.1% accuracy.)

1. Connect a 100 Ω precision resistor between Terminals 1 and 2. See Figure 20.

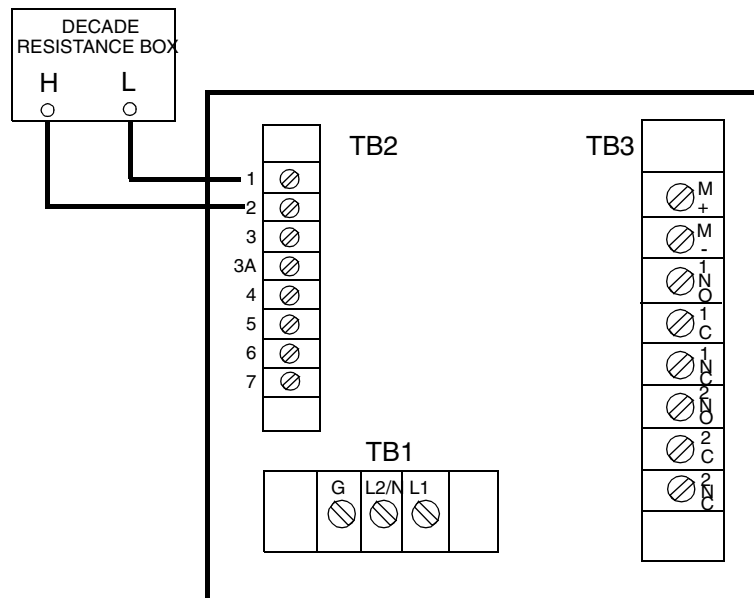


Figure 20. Decade Box Connections

2. Unlock Analyzer using security code (see “Unlocking Analyzer Using Security Code” on page 30).
3. Press **Shift** and while holding, press **Setup**. Release fingers from both keys.
4. Press **Next** several times until the code bL (Basic Lock Setup) is displayed (bL will be the 19th message displayed).
5. Press **Enter**, then use **Next** and Δ until the personal security code is displayed (0800 from factory).
6. Press **Enter**.
7. When display returns to bL, press **Next** until tCL1 is displayed. Press **Enter**.

— **NOTE** —

Holding the Shift key will keep the display from timing out.

8. Display will show 100.0 (Ω). Press **Shift** and hold for 20 seconds, then press **Enter**. Keep finger on **Shift** to prevent unit from timing out.
9. Replace the 100 Ω resistor with a 150 Ω precision resistor. See Figure 20.
10. Release **Shift**; when display returns to tCL1, press Δ once to display tCC1. Press **Enter**.
11. Display will show 150.0 (Ω). Press **Shift** and hold for 20 seconds, then press **Enter**. Keep finger on **Shift** to prevent the unit from timing out.
12. Replace the 150 Ω resistor with a 200 Ω precision resistor. See Figure 20.
13. Release **Shift**. When display returns to tCC1, press Δ once to display tCH1. Press **Enter**.
14. Display will show 200.0 (Ω). Press **Shift** and hold for 20 seconds, then press **Enter**.

15. Remove 200 Ω resistor and allow unit to time out. This completes the RTD Temperature Calibration.
16. Lock Analyzer using Security Code.

Changing the Analog Output

To change one or both of your analog outputs to a different output than the Analyzer was ordered with, jumpers must be moved and a recalibration performed.

To Reposition Jumpers

1. Remove power to the unit.
2. On plastic (General Purpose) version: remove optional rear cover. Remove the four screws holding back panel in place.

On the metal (Field-Mounted) version: remove the four front corner screws holding the display panel in place. Remove rear cover. Disconnect the green earth (ground) cable; then feed wire from sensors and power connection through seals to allow free movement of circuit boards.

—! CAUTION —————
 The four screws are self-tapping. Do not repeatedly remove and tighten these screws.

3. Slide circuit assembly out to access the upper circuit board designated AS700DZ-02. The plastic version slides out from the rear of its housing. The metal version slides out from the front of its housing.
4. Refer to Figure 21 to identify jumper locations.
5. Use Table 13 to locate appropriate jumper positions.

Table 13. Jumper Positions for the Various Analog Outputs

Output	J5	J6	J7	J10
4 - 20 mA	2 - 3	2 - 3	2 - 3	2 - 3
0 - 20 mA	2 - 3	2 - 3	2 - 3	2 - 3
0 - 10 V dc	1 - 2	1 - 2	1 - 2	1 - 2

6. Move each jumper to its appropriate position.
7. Replace board assembly inside unit.

—! CAUTION —————
 On the plastic version, a string must be rigged through the loop in the ribbon cable such that when the board assembly is slid into the housing, the string/ribbon cable may be pulled back simultaneously, thus preventing damage to the cable. See Figure 21.

8. Replace cover. Use Loctite (Part No. S0106ML) on the threads of the front screws and Lubriplate (Part No. X0114AT) on threads of the rear screws of all metal enclosures
9. An analog output calibration will now be necessary. Refer to next section.
10. Make appropriate changes to the Analyzer identification label.

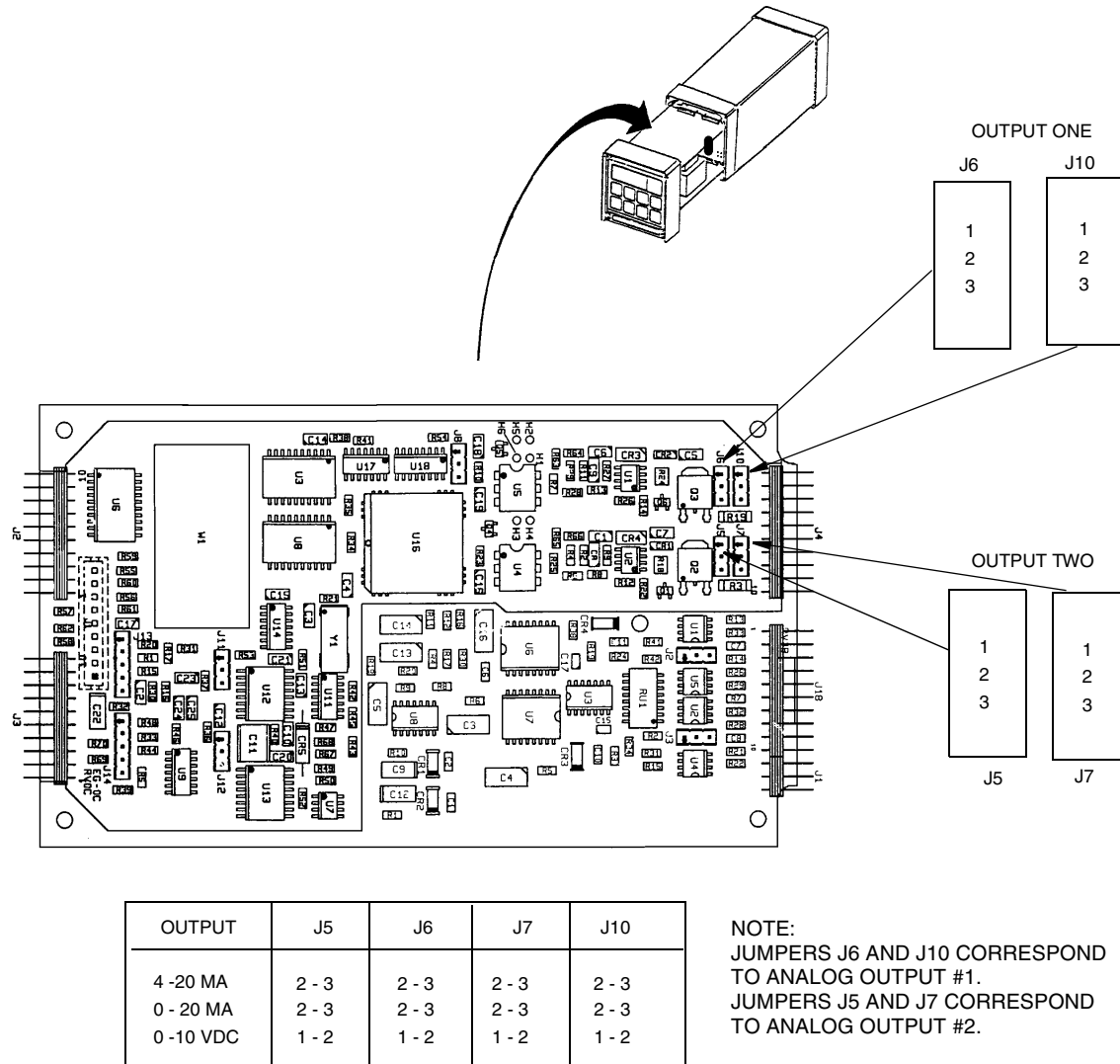


Figure 21. Jumpers for Changing Analog Output

Analog Output Calibration (LC01, HC01, LC02, HC02)

This procedure is used to calibrate the Analog output(s). This has been done at the factory and should not require recalibration unless type of output has been changed. An ammeter or voltmeter is required.

1. Connect an ammeter/voltmeter to the analog output terminals. See Figure 22 and “Wiring of Plastic Enclosure” on page 18 or “Wiring of Metal Enclosure” on page 20.

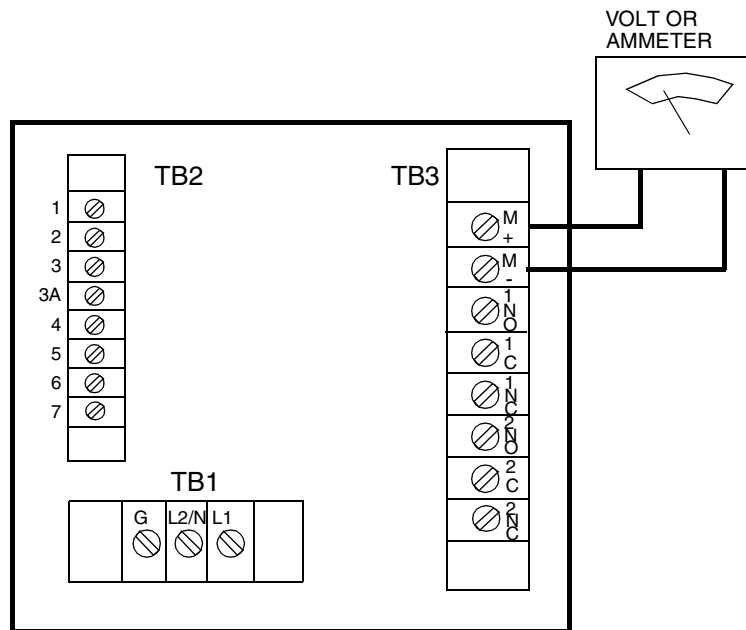


Figure 22. Output Terminals and Volt/Ammeter (Plastic Version Shown)

2. Unlock the Analyzer using the security code.
3. Press **Shift** and while holding, press **Setup**. Release fingers from both keys.
4. Press **Next** several times until the code bL is displayed. Press **Enter**.
5. Use **Next** and Δ until the personal security code is displayed (0800 from the factory). Press **Enter**.
6. When display returns to bL, press **Next** until LC01 is displayed. Press **Enter**.
7. Calculate the low % input required by using the following formula:

$$\text{Percent} = \frac{\text{Observed Reading} - \text{Desired Reading}}{\text{Analog High}} \times 100$$

Example:

$$\frac{3.78 - 4.00\text{mA}}{20.00\text{mA}} \times 100 = -1.1\text{percent}$$

8. Use **Next** and Δ until the calculated value from Step 7 is displayed. Press **Enter**.

— **NOTE** —

Iteration of the above procedure may be required. Repeat Steps 7 and 8 until Observed Value is equal to the Desired Value. Example: To make the display read -1.1%, first display 01.1%, then change first digit to a negative sign.

9. When the display returns to LC01, press **Next** once to display HC01. Press **Enter**.
10. Calculate the high % required using the following formula:

$$\text{Percent} = \frac{\text{Observed Reading}}{\text{Desired Reading}} \times 100$$

Example:

$$\frac{10.42\text{V}}{10.00} \times 100 = 104.2 \text{ percent}$$

11. Use **Next** and Δ until the calculated value from Step 10 is displayed. If necessary, repeat Steps 10 and 11 until Observed Value is equal to the Desired Value. Press **Enter**.

— NOTE

Procedure complete here for plastic version.

12. For metal version with second output, move ammeter to second set of terminals. Repeat Steps 3-5, then **Next** until LC02 is displayed. Press **Enter**.
13. Calculate the low % input required by using the following formula:

$$\text{Percent} = \frac{\text{Observed Reading} - \text{Desired Reading}}{\text{Analog High}} \times 100$$

Example:

$$\frac{3.78 - 4.00\text{mA}}{20.00\text{mA}} \times 100 = -1.1 \text{ percent}$$

14. Use **Next** and Δ until the calculated value from Step 13 is displayed. Press **Enter**.

— NOTE

Iteration of the above procedure may be required. Repeat Steps 13 and 14 until Observed Value is equal to Desired Value.

15. When the display returns to LC02, press **Next** once to display HC02. Press **Enter**.
16. Calculate the high % required using the following formula:

$$\text{Percent} = \frac{\text{Observed Reading}}{\text{Desired Reading}} \times 100$$

Example:

$$\frac{10.42\text{V}}{10.00} \times 100 = 104.2 \text{ percent}$$

17. Use **Next** and Δ until the calculated value from Step 16 is displayed. Press **Enter**.

— NOTE

Repeat Steps 16 and 17 until Observed Value is equal to the Desired Value.

18. Lock Analyzer using procedure in “Locking Analyzer Using Security Code” on page 30.

This completes the Analog Output Calibration Procedure.

Changing the Security Code (LCC)

The following procedure is used to change the security code to another 4-digit code.

— **NOTE** —

If existing security code is forgotten, a new security code cannot be entered using this procedure. In this case, contact Invensys Foxboro.

1. Leave power on.
2. Press **Lock**. Display will show either Loc or Uloc.
3. If uLoc is displayed, proceed to Step 4. If Loc is displayed, unlock the Analyzer using the procedure explained in “Unlocking Analyzer Using Security Code” on page 30. Display will read uLoc.
4. Press **Shift** and while holding, press **Setup**. Release fingers from both keys.
5. Press **Next** several times until the code bL (Basic Setup Lock) is displayed. Press **Enter**.
6. Then use **Next** and Δ until existing security code is displayed (0800 from factory).
7. Press **Enter**.
8. When display returns to bL, press **Next** several times until the code LCC (Lock Code Change) is displayed.
9. Press **Enter**, then use the **Next** and increment (Δ) keys until new desired security code is displayed.
10. Press **Enter**. The new code will have to be used on all future entries.
11. Lock the Analyzer using the procedures explained in “Locking Analyzer Using Security Code” on page 30.

5. Calibration

The Calibration section is divided into two main parts.

“Calibration of a Sensor” below, provides calibration procedures and standardization techniques for individual sensors and solutions. These procedures are recommended to verify individual electrode function and to obtain the best system accuracy. “Temperature Cell Factor” on page 58, fine tunes the RTD temperature signal to agree with actual temperature. This procedure must be implemented when long cable lengths are involved.

“Electronic Bench Calibration” contains the procedures for calibrating the 873PH Analyzer with theoretical mV inputs. An additional electronic calibration procedure (see “PC Calibration” on page 63) is also included. The PC procedure should not be used during a routine bench calibration. It establishes the relationship between sensor output and mV viewed when **Shift/mV** keys are pressed. If this procedure is required, it should be performed before “Electronic Bench Calibration.”

— **CAUTION** —

On metal units, do not remove four front panel screws and remove electronics package for calibration. The self-tapping screws will not function properly with repeated insertions.

Calibration of a Sensor

General Information (pH)

Under many circumstances, a sensor used on an Analyzer with an electronic bench calibration may provide sufficient accuracy to the user. The electronic bench calibration establishes an approximate relationship between pH values displayed and expected mV output from a pH sensor. In these cases, the sensor should be connected to the Analyzer without further calibration.

A single point standardization using one buffer, preferably near the process pH, is often suitable for routine measurements. For the best possible system accuracy, a two point standardization, preferably bracketing the process control point, should be implemented. This is also the best way to determine how the sensor is performing. A grab sample calibration offers the user the advantage of keeping the sensor installed in the process during the standardization. The other three commonly used techniques will be discussed in the following sections. In addition, a correction can be implemented to correct temperature measurements that may differ from actual values (such as when sensor cable length exceeds 50 feet). These procedures should be done prior to the sensor standardization in buffers.

In all cases, these general guidelines should be observed:

- ◆ Sensors should be thoroughly cleaned before standardization.
- ◆ Fresh standards should be used.
- ◆ Sufficient time must be allowed for sensor and thermo-compensator thermal equilibrium. The temperature should display the correct temperature of the buffer.

- ◆ The correct pH value of the buffer should be used during the standardization. pH buffers have different values at different temperatures.
- ◆ Sufficient time for chemical equilibrium must be allowed.
- ◆ pH sensors must be properly grounded in pH buffers during the standardization. The black threads of the Model 871A sensors must be immersed in the buffer also.

General Information (ORP)

An ORP sensor measures the absolute solution voltage directly. Under most circumstances, an electronic bench calibration of the Analyzer will produce sufficient accuracy for the measurement. In this case, the sensor should be connected to the Analyzer without further calibration. The displayed value should then agree with the voltage displayed when SHIFT and mV keys are depressed.

A single point calibration in an ORP standard or a grab sample calibration may also be used to verify ORP sensor calibration.

These techniques can correct for small voltage offsets that may be contributed from an integral preamplifier or reference liquid junction. Freshly made solutions of pH low range buffers (0-7pH) saturated with quinhydrone and stable ORP standards are suggested ORP standards. Consult with our pH/ORP product specialist for additional information.

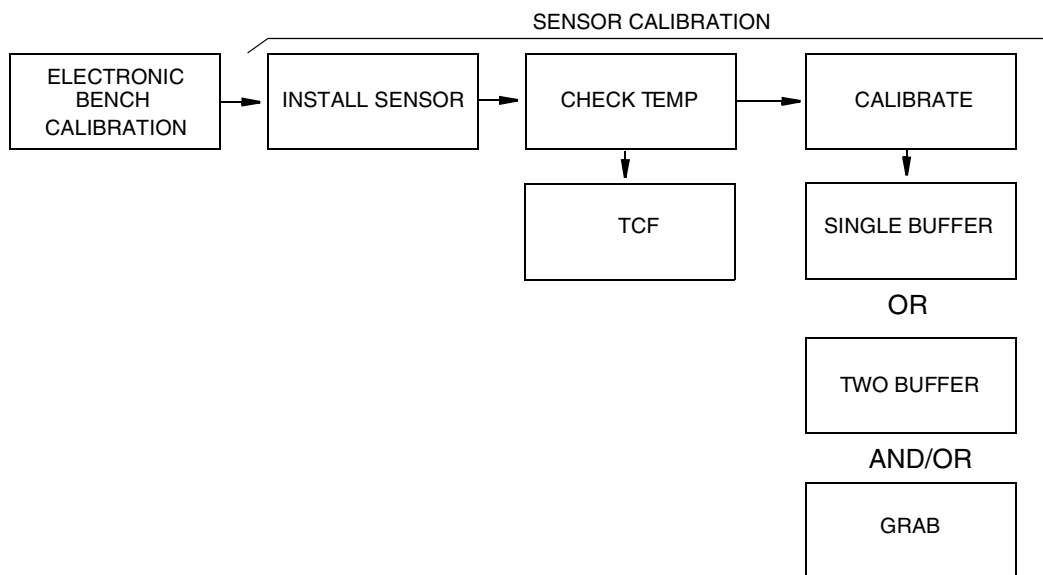


Figure 23. Flow Chart for Sensor Calibration

One and Two Buffer Calibration

Flow Chart for Single Buffer Calibration (After Bench Calibration)

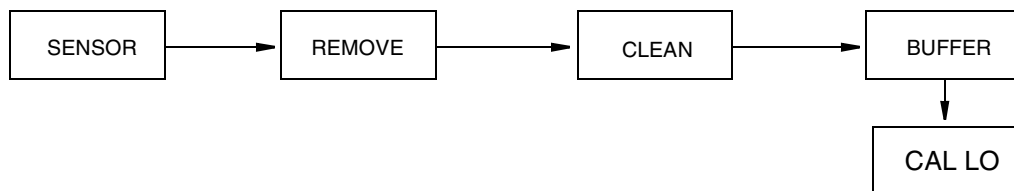


Figure 24. Flow Chart for Single Buffer Calibration (After Bench Calibration)

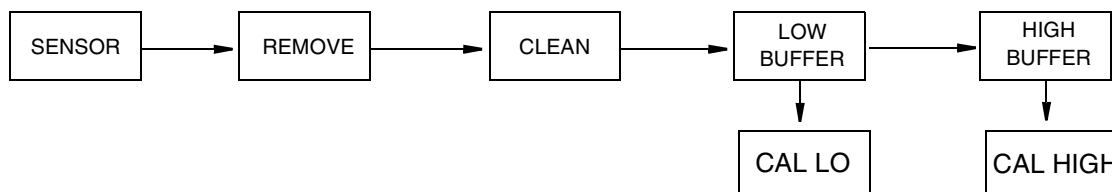


Figure 25. Flow Chart for Two Buffer Calibration

— NOTE

The single point calibration is suitable for the calibration of ORP sensors also. Substitute an ORP standard for the pH buffer.

1. Unlock Analyzer (see “Unlocking Analyzer Using Security Code” on page 30).
2. Remove the pH sensor from the process stream. Clean the immersion end and rinse with distilled water.
3. Select buffers near or bracketing process pH. The buffers should be at the same temperature and, for best results, near the process temperature.
4. Immerse the cleaned sensor in the buffer solution with lower known pH. Wait until the sensor has reached chemical and thermal equilibrium.
5. Press **Shift** and while holding, press **CAL LO**. Remove fingers from both keys. Use **Next** and Δ until the display reads the pH of the buffer at the temperature of measurement. Press **Enter**.

— NOTE

For single point standardization, stop here. The slope (gain) from the previous bench or wet calibration will be used to calculate pH.

6. Thoroughly rinse the sensor in distilled water and immerse it into the second buffer with higher known pH value. Allow the sensor to come to chemical and thermal equilibrium.
7. Press **Shift** and while holding, press **CAL HI**. Remove fingers from both keys.
8. Use **Next** and Δ until display reads pH of the second buffer. Press **Enter**.
9. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).

Grab Sample Standardization

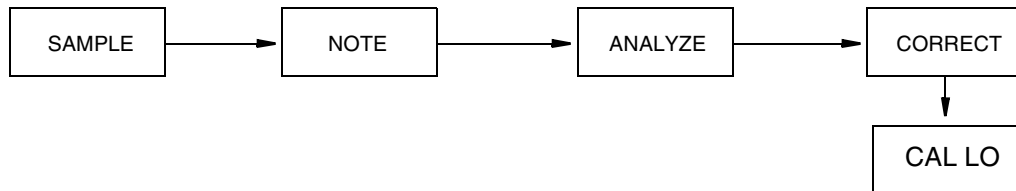


Figure 26. Flow Chart for Grab Calibration

1. Unlock Analyzer (see “Unlocking Analyzer Using Security Code” on page 30).
2. Note the present pH reading while extracting a sample from the process stream.
3. Determine the pH of the sample using laboratory techniques suitable for the precision required. The laboratory measurement should include precise standardization and temperature compensation of the laboratory sensor, protection of the sample from atmosphere and temperature change.
4. Determine the difference between the laboratory pH value and process reading taken when the sample was removed.
5. Using the CAL LO sequence, adjust the present reading by the difference calculated.

Example:

When the sample was taken, the Analyzer read 8.25 pH. The grab sample was found by the laboratory to be 8.40 pH. When you returned to the Analyzer, the display read 8.30 pH. This value should be increased by +.15 pH units ($8.40 - 8.25 = .15$) to 8.45 with the **CAL LO** key and Δ .

6. Press **Shift** and while holding, press **CAL LO**. Remove fingers from both keys.
7. Use **Next** and Δ until the display reads the corrected pH of the process. Press **Enter**.
8. Repeat Steps 2 through 7 to verify the standardization.

Temperature Cell Factor

An accurate temperature signal is required for proper temperature compensation, especially when measuring over a large temperature gradient. The temperature cell factor (tCF1) is used to offset a deviation from ideal due to cable resistance. The procedures found in the following sections are recommended for installations that utilize a longer cable. A 100 Ω RTD circuit is used for automatic temperature compensation on the 873 Analyzer. Use this procedure before buffer or grab sample calibrations.

Determining tCF

1. Place the pH sensor and an accurate Centigrade thermometer (with .10 °C resolution) into a container of liquid. Allow the system to reach thermal equilibrium.
2. Press **Temp**. Put the Analyzer into Automatic Temperature Compensation (no decimal after the C). If there is a decimal after the C, it should be removed. Press Δ once after pressing **Temp**; then press **Enter**.
3. Read the temperature displayed on the 873 to the hundredths place.
4. When **Temp** is pressed, the current temperature value with tenths place will alternate with the C legend. The value read by the 873 must now be viewed to the hundredths place. Press **Temp** following by **Next** five times. Only three numbers may be viewed on the display, and the first digit will not be visible (e.g., 25.20 will be displayed as 5.20).
5. Determine the difference in values between the two temperature devices; e.g., the thermometer reads 24.70°C, and the 873 says (2)5.20 C; the 873 is reading higher by 0.50 C.
6. Subtract this value from 25.00 (e.g., $25.00 - .50 = 24.50$). This is your new tCF value.

— **NOTE** —

If the 873 value is less than the thermometer, the difference should be added to 25.00.

Entering a tCF Value

1. Unlock Analyzer (see “Unlocking Analyzer Using Security Code” on page 30).
2. Press **Shift** and while holding, press **Setup**. Release fingers from both keys.
3. Press **Next** several times until the code bL (Basic Setup Lock) is displayed.
4. Press **Enter** and then use **Next** and Δ until personal security code is displayed (0800 from factory).
5. Press **Enter**.
6. When display returns to bL, press **Next** several times until the entry tCF1 is displayed.
7. Press **Enter** and then use **Next** and Δ until desired value is displayed.
8. Press **Enter**.
9. Recheck any differences that exist between a thermometer and temperature displayed on the 873, using the technique described in “Determining tCF” on page 59.
10. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).

Electronic Bench Calibration

This procedure is used to calibrate 873 Analyzers with theoretical mV inputs.



Figure 27. Flow Chart for Electronic Bench Calibration

— NOTE

1. Invensys Foxboro calibrates and configures all 873 Analyzers before leaving the factory. Calibration may be verified by inputting the mV values into the unit. Verification of proper operation of the 873 electronics can be an aid in troubleshooting a problem installation. If the unit operates properly in this calibration, it may be ruled functional in the installation.
 2. Units should be bench calibrated if the FSC was changed from the factory configured range. Do not press **Enter** if you are checking the calibration.
 3. Once a sensor connected to the 873PH is calibrated in pH buffers, the theoretical values entered during the electronic bench procedure will be removed.
-

Required:

Precision mV standard (0 to 1000 mV dc \pm .1%), and a 110 Ω resistor for temperature simulation.

Procedure:

1. Disconnect all sensor leads from terminal strip TB2.
2. Unlock Analyzer (see “Unlocking Analyzer Using Security Code” on page 30).
3. Checking the Temperature circuit calibration
 - a. Connect a 110 Ω resistor across Terminals 1 and 2 on Terminal Strip TB2. Refer to Figure 28.
 - b. Press **Temp**. The unit should be in the Automatic Temperature mode: No decimal should be visible after the “C” or “F” legend. If there is a decimal after the “C” or “F” legend, it should be removed. Press Δ once after pressing **Temp**; then press **Enter**. This removes the decimal.
 - c. Reset tCF1 to 25.00 (the theoretical temperature transducer value). “Entering a tCF Value” on page 59 describes this operation.
 - d. Press **Temp**. The display should read approximately “25.C” or “77.F”. If the display does not read either of these values, reset the temperature electronics for recalibration. See “Calibrating the RTD Circuitry” on page 48.
 - e. The unit should now be put into manual temperature mode. There should be a decimal to the right of the legend. Press **Temp**. Use Δ until the display reads “25.C.” Press **Enter**.

Use **Next** and Δ until the display reads “(2)5.00 °C.”. The first digit “2” will not be displayed. Press **Enter**.

4. Reset the Full Scale value of the Analyzer. Refer to “Changing the Full Scale Range (FSC)” on page 47. Even if the existing Full Scale Value is the desired value, it is important to reenter the same value. When the FSC value is entered, error code “Er4” should begin to flash on the display.

— **NOTE** —

1. If an Error Code of higher priority is present, it will preempt the Er4 message.
 2. Holding the **Shift** key between entries will prevent the Analyzer from timing out and leaving the Setup entries.
-

5. Check and adjust the Cd code of the unit. Refer to “Compensation and Damping (Cd)” on page 33. Set this code to read “000X”. The unit should have no damping and should utilize the type of compensation being used on the Analyzer. (X = 0 for ORP, 1 for glass pH, 2 for antimony pH.)
6. Zero and Span Calibration
 - a. Connect a mV power supply to Terminals 3 and 5 of TB2 (see Figure 29).
 - b. Connect a jumper between Terminals 4 and 5 on TB2 (see Figure 29).
 - c. Adjust the mV supply to the desired low value as determined by the formula in Table 14. Wait at least 15 seconds for the electronics to stabilize.*
 - d. Press **Shift** and while holding, press **CAL LO**. Release fingers from both keys. Use **Next** and Δ until the display reads the desired low value. Press **Enter**.
 - e. Calculate the mV input required for Calibrate High Value. The CAL HI value should fall within the range of the FSC that has been chosen. *(ORP see note below).
 - f. Input mV value corresponding to calculated CAL HI value. Wait at least 15 seconds for the electronics to stabilize.
 - g. Press **Shift** and while holding, press **CAL HI**. Release fingers from both keys. Use **Next** and Δ until the display reads desired CAL HI value. Press **Enter**.

— **NOTE** —

The Er4 code should stop flashing. An error of lower priority may begin to flash. See “Error Codes” on page 69.

7. Lock Analyzer (see “Locking Analyzer Using Security Code” on page 30).

This completes the Standard Electronics Bench Calibration.

Table 14. mV Supply Formulas

Measurement Mode	mV Power Supply Formula	Examples
Glass pH	$(\text{pH} - 7) \times -59.16$	pH 0: $(0 - 7) \times (-59.16) = +414.1 \text{ mV}$ pH 14: $(14 - 7) \times (-59.16) = -414.1 \text{ mV}$
Antimony pH	$(\text{pH} - 1) \times (-55)$	pH 0: $(0 - 1) \times (-55.00) = +55.0 \text{ mV}$ pH 7: $(7 - 1) \times (-55.00) = -330.0 \text{ mV}$
ORP or pIon	(mV)*	Input absolute mV

— NOTE

*ORP NOTE: Do not exceed an input voltage of 1700 mV. Suggested ORP calibration range is $\pm 900 \text{ mV}$. The lower limit is -999 mV , the upper limit is 1400 mV . Values up to 1700 mV can be displayed on the unit. Above this value, 9999 is displayed. Input voltages exceeding 2000 mV will cause an Er 1 to occur.

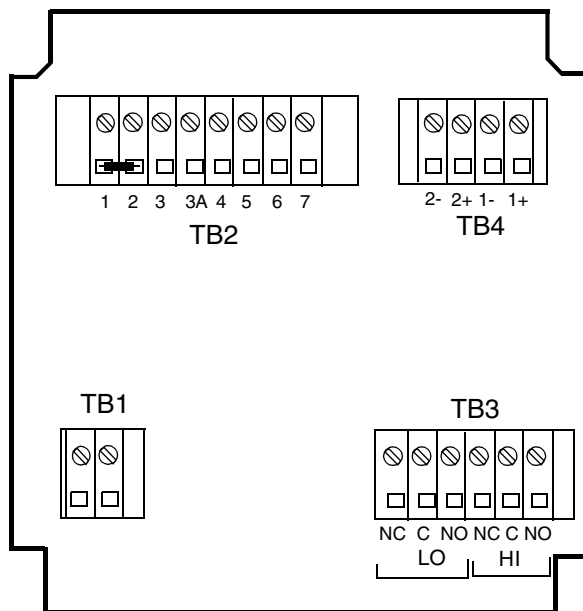


Figure 28. Temperature Simulation (Metal Unit Shown)

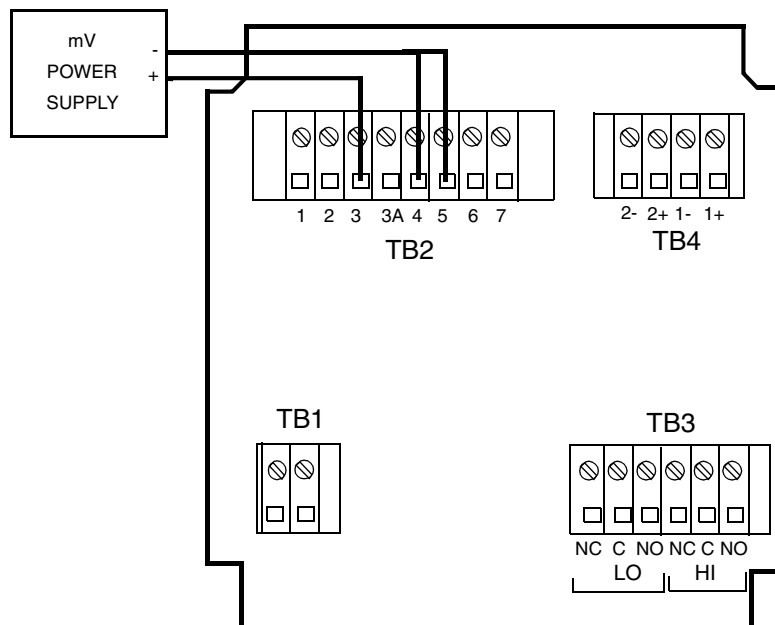


Figure 29. Bench Calibration (Metal Unit Shown)

PC Calibration



Figure 30. Flow Chart for mV Code Calibration

— NOTE —

This procedure is performed at the factory and should not have to be repeated in the field. It is included in the manual in case the factory calibration becomes erased by inadvertent key pushing in the PC mode. Do not perform procedure as part of the routine bench calibration. This procedure is used to calibrate the mV scale that can be read in the pH mode. If required, this procedure should be performed prior to the Electronic Bench Calibration in “Calibration of a Sensor” on page 55.

1. Connect a precision voltage source to terminal strip TB2 as shown in Figure 29. Short terminals 4 and 5.
2. Set voltage source to -900 mV.
3. Unlock Analyzer using security code (see “Unlocking Analyzer Using Security Code” on page 30).
4. Press **Shift** and while holding, press **Setup**. Release both keys.
5. Press **Next** several times until the code bL is displayed. Press **Enter**.
6. Use **Next** and Δ until the personal security code is displayed (0800 from factory). Press **Enter**.
7. When display returns to bL, press **Next** once to display FSC. Press **Enter**.

8. Use Δ to display 1400 mV. Press **Enter**.
9. When the display returns to FSC, press **Next** several times until the code PC is displayed. Press **Enter**.
10. Use Δ to change the code from 0 to 1. Press **Enter**. Allow Analyzer to time out.
11. Press **Shift** and while holding, press **Setup**. Release fingers from both keys.
12. Press **Next** twice to display the code Cd. Press **Enter**.
13. Using **Next** and Δ , make the display read 0000. Press **Enter**. *Enter must be pressed even if the display was previously 0000.*
14. Press **Shift** and while holding, press **CAL LO**.
15. Using **Next** and Δ , make the display read -900 mV. Press **Enter**.
16. Set the voltage source to **+900 mV**.
17. Press **Shift** and while holding, press **CAL HI**.
18. Using **Next** and Δ , make the display read 0900 mV. Press **Enter**.

This completes the PC calibration. The code will automatically reset back to 0. To read pH, FSC and Cd must be configured appropriately and a Standard Bench Calibration performed.

6. Diagnostics

Troubleshooting

Using the 873 pH Analyzer to Troubleshoot a Sensor Problem

The best test of a sensor is to hook it up to an Analyzer and to calibrate it in pH buffers. If the sensor calibrates, one can be sure it is fully functional. On the 873, error flags help in the diagnosis of problems that may occur. Make sure the buffers are fresh and not contaminated, and that the sensor has time to reach thermal and chemical equilibrium with the buffers. You must do a low buffer calibration first.

873 Error Code Action

Er 1: Verify Factory installed jumper has been removed from plastic NEMA 1 version. Disconnect sensor/power down Analyzer. Try sensor on another unit.

Er 2: The temperature sensor used on the 873 is a 100 Ω RTD. At temperatures around 25 $^{\circ}\text{C}$ (77 $^{\circ}\text{F}$), it should read 110 Ω

Table 15. Temperature vs. Resistance Table for Pt 100 RTD

Temperature	Ohms	Temperature	Ohms
-5	98.04	40	115.54
0	100.0	50	119.40
5	101.95	60	123.24
10	103.90	70	127.07
15	105.85	80	130.89
20	107.79	90	134.70
25	109.73	100	138.50
30	111.67	110	142.29
35	113.6140		

Verify UtL and LtL are set beyond the temperature value observed. Then press Temp (Auto mode). If the display is reading incorrectly, determine whether the Analyzer or sensor is to blame. Place 110 Ω resistor across 1 and 2 of terminal TB2. Does the Analyzer read “25 C”? Measure the resistance between wires 1 and 2 of sensor (black and white).

At normal room temperatures, the resistance should be approximately 110 Ω . If the resistance between 1 and 2 of the sensor is reading a value which deviates greatly from 110 Ω , it is not functioning properly and

should be replaced. For the short term, if the process measurement does not change temperature, is close to 7 pH, or has very wide accuracy specifications, manual temperature operation may be chosen.

Er 4:

During 2-point calibration with fresh non-contaminated buffers, a sensor will cause Er 4 to occur because it is not generating a large enough voltage difference between the buffers for the temperature the Analyzer thinks the sensor sees. If the sensor is sufficiently conditioned, and relatively stable in each solution, more conditioning time may improve the response. Soak your electrode in dilute KCl solution without silver chloride. Verify temperature and adjust tCF1 if necessary.

A new sensor installation may experience this problem also. The sensor recovery may be hastened by immersing the sensor in a warmed KCl solution, then allowing it to cool to room temperature while immersed in this solution.

If the sensor reads the same value in every buffer, a short due to breakage is suspected. Replacement of the pH module should correct the problem.

The 873PH Analyzer will accept a 2-buffer calibration (Er 4 not activated) as long as the SLOPE (mV/pH) exceeds ~50 mV. The slope value is accessed by pressing **Shift** and **Slope** keys. The slope is always displayed at a temperature of 25.0 °C, no matter what temperature the calibration occurred at. If the slope falls below 50.3, the calibration will still be accepted into the unit, but Er 4 will flash intermittently with the sample value. Invensys Foxboro recommends sensor servicing on all sensors whose slope is below 53.3 mV/pH (90% efficiency). See Item 2 in “Additional Troubleshooting” section.

Verify the temperature in the automatic temperature mode. See “Temp Key” on page 26.

Use the correct buffer values at the temperature of measurement.

Additional Troubleshooting

1. Sensor Does Not Appear to be Functioning.

For sensors with a preamplifier: Leave all sensor leads connected to the Analyzer. Leave power on to the 873. Connect a volt meter to 4 and 6, then 4 and 7 of TB2; ± 6 V should be measured. If 6 V are not present, disconnect sensor and repeat this procedure at the Analyzer. If it can be measured at the terminal, a problem existed with the sensor. If the voltage is not present, an Analyzer problem exists. If the sensor and Analyzer pass this test, continue to Item 2.

2. Low Slope.

Leave all sensor leads connected to the powered Analyzer. Clean the “business end” of the sensor off and place into a beaker of 7 buffer. Use the **mV** key to display the measured absolute voltage generated by your sensing and reference electrodes. The value should be 0 V ± 20 mV. The reading should change approximately 59 mV per pH unit, when the

sensor is cleaned and placed into a second buffer (25 °C). In 10.0 buffer, the mV reading should be less than the 7 buffer reading by approximately 174 mV (177.3 theoretically). In 4.00 buffer, the mV value should be greater than the mV value in 7 buffer by 174 mV. If the sensor passes this test and there is still a problem with the measurement, an Analyzer problem may exist. Verify that the sensor temperature is in automatic mode and reading correctly. See Figure 31.

HINT! It is a good idea to keep records of your calibrations. Recording the mV values and Slope can help you establish maintenance and replacement information on your sensors.

3. Erratic.

On 871PH pH/ORP only: Measure between wire #4 (clear) and the knurled screw on the immersion end of the sensor with a resistance measuring device. The resistance should be 0 (shorted) or very small. If not, you have a grounding problem with your sensor.

For an 871A, make sure grounding threads are in contact with the solution. Teflon tape around these threads may prevent a ground to be made.

Troubleshooting a ground loop or grounding problem may also be done in a beaker of buffer. Immerse a sensor in buffer (not at pH 7) and note pH. Attach a wire to a piece of metal (paper clip will do) and to an earth ground (metal pipe, outlet ground). Now place the metal piece into the beaker and watch the pH of the Analyzer. It should not change. A change in pH during this procedure indicates a problem exists.

5. Slow.

If the sensor is very slow in responding, a blockage may have occurred on the reference junction. (Soak sensor in a container of warmed KCl solution until completely cooled. This procedure will dissolve dried salts, or replace dehydrated reference solution.

Trapped air bubbles can also cause problems by increasing resistance in this circuit. A firm shakedown, like is done to a clinical thermometer, and soaking sensor can often help.

Slow response can also indicate a coated or dehydrated pH glass. Cleaning or cleaning and soaking may help correct this phenomenon. pH electrode replacement may be indicated. Also see Er 4 troubleshooting earlier in this section.

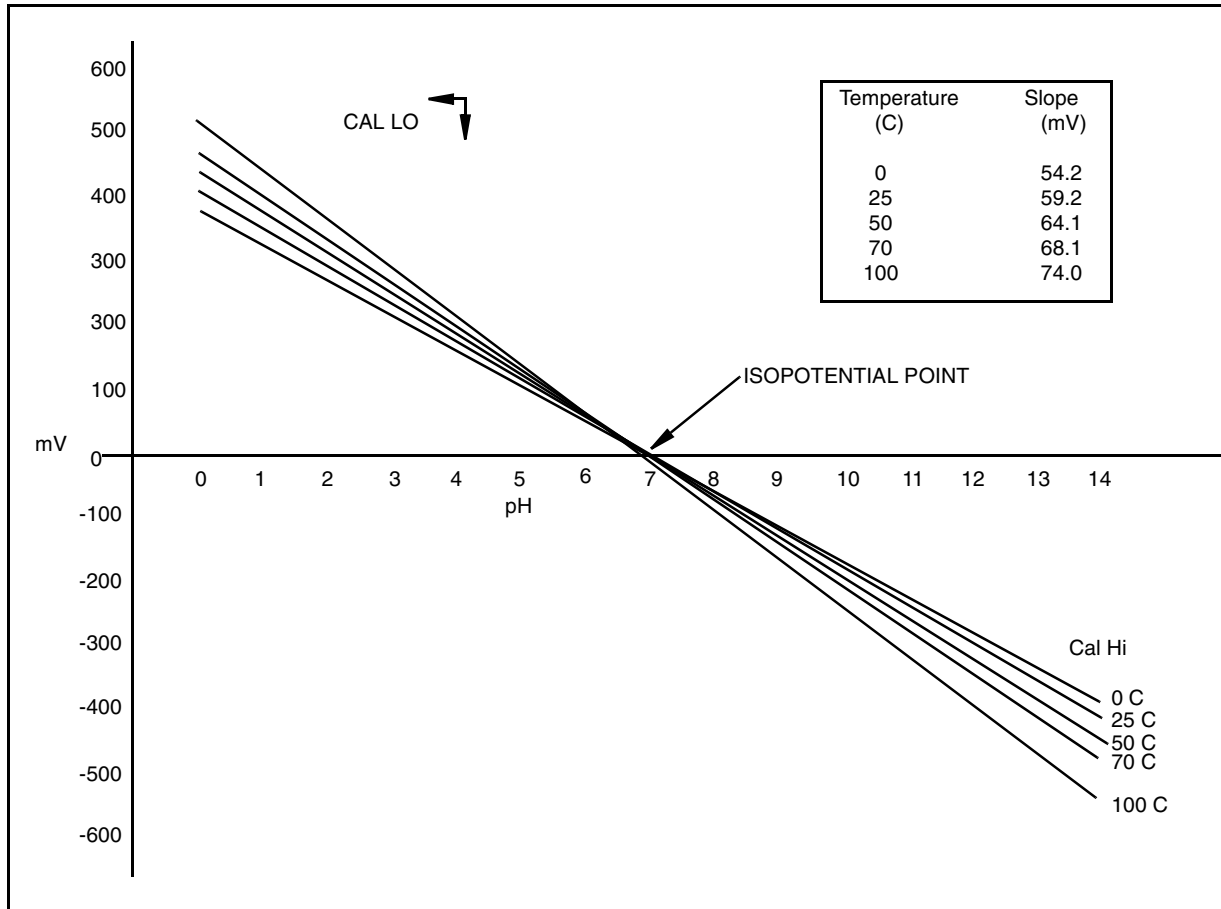


Figure 31. Relationship between pH and mV at Different Temperatures for a Standard Glass pH Sensor and Ag/AgCl Reference Electrode.

Error Codes

When the Analyzer is operating normally, the measurement value is displayed constantly. If error or alarm conditions exist, the display alternates between the measurement value and the error/alarm message at a one second rate. The alternate (error/alarm) messages are shown in Table 16.

Table 16. Error/Alarm Messages

Alternate Display	Condition	Priority	Action Required to Clear Message
Er 1	Instrument Fault, RAM/ROM, software watchdog timer	1 (Highest)	1. Reenter security code using procedure. 2. Power down unit. 3. Verify factory installed jumper has been removed from TB2 (plastic unit only).
Er 2	User-defined temperature range error or temperature measurement error	2	1. Change user-defined temperature limits. UtL or LtL. 2. Replace sensor. 3. Place temperature in manual mode (e.g.,25.C.). 4. See “Calibrating the RTD Circuitry” on page 48.
Er 3	User-defined measurement range error	4	1. Change user-defined measurement limits, UL or LL. 2. Replace sensor.
Er 4	Slope Measurement calibration is less than acceptable	3	Recalibrate Analyzer using Bench Calibration procedure. Also see Sensor Troubleshooting.
A Hi	Measurement in Hi alarm	6	
A HH	Measurement in HiHi alarm	5	
A LO	Measurement in Lo alarm	8	
A LL	Measurement in LoLo alarm	7	
****	Measurement over or under range of analog output limits	9	
Err	Incorrect code or parameter attempted	2	Check code and reenter.

— NOTE —

If two or more errors exist simultaneously, the Analyzer will flash only the error with the highest priority. If the highest priority error is cleared and a lower priority error still remains, the Analyzer will then flash the highest priority error of the remaining errors.

Detachable Configuration Field Sheet

Configuration Setup Entries			
Displayed Symbol	Parameters and Values Accessed	Factory Default	User Settings
CELL	Configuration of Analog Outputs	1013	
Hold	Holds and sets the Analog Output Value in Hold	0000	
Cd	Compensation and Damping Damping Factor Chemical Temperature Compensation	0001	
ISO	Isopotential Point	0000	
HAC	H Alarm Configuration Measurement Selection Low/High/Instrument plus Passive/Active State % Hysteresis	1403	
HAtt	High Alarm Trigger Time	00.00	
HAFt	High Alarm Feed Time	00.00	
HAdL	High Alarm Delay Time	00.00	
LAC	L Alarm Configuration Measurement Selection Low/High/Instrument plus Passive/Active State % Hysteresis	1203	
LAtt	Low Alarm Trigger Time	00.00	
LAFt	Low Alarm Feed Time	00.00	
LAdL	Low Alarm Delay Time	00.00	
UL	User-defined Upper Measurement Limit	16.00	
LL	User-defined Lower Measurement Limit	0.00	
UtL	User-defined Upper Temperature Limit	100.0	
LtL	User-defined Lower Temperature Limit	0.00	
HO1	100% Analog Output - Channel 1	14.00	
LO1	0% Analog Output - Channel 1	0.00	
HO2	100% Analog Output - Channel 2	100.00	
LO2	0% Analog Output - Channel 2	0.00	

CELL Code—Display and Output Configuration			
Digit 1	Digit 2	Digit 3	Digit 4
NOT USED 1	NOT USED 0	OUTPUT 1 1 = pH or mV 3 = Temperature	OUTPUT 1 1 = pH or mV 3 = Temperature

HOLD Code—Hold Analog Output Values	
Digit 1	Digits 2, 3, and 4
0 = No Hold Hold On, Analog Output on HOLD 1 = Alarms held in present state 2 = Alarms held in off state 3 = Alarms held in on state	000 to 100% of Analog Output Range

CD Code—Compensation and Damping			
Digit 1	Digit 2	Digit 3	Digit 4
DAMPING 0 = none 1 = 10 second 2 = 20 second 3 = 30 second	NOT USED 0	NOT USED 0	TEMPERATURE COMPENSATION 0 = Absolute (no compensation/ORP only) 1 = Glass Sensor (isopotential pt. = pH 7) 2 = Antimony Sensor (isopotential pt. = pH 1) 3 = plon (adj. isopotential point) 4 = 1 ppm Ammonia

Basic Setup Entry Selection			
Display Symbol	Parameter and Value Accessed	Factory Default	User Settings
bL	Basic Setup Lock Control	0800	
FSC	Full Scale Value	16.00	
tCF1	Temperature Cell Factor	25.00	
tCL1	RTD Low Temperature Electronics Calibration	100.0	
tCC1	RTD Mid Temperature Electronics Calibration	150.00	
tCH1	RTD High Temperature Electronics Calibration	200.0	
LCC	Lock Code Change	0800	
LCO1	Analog Out 1 Electronics Lower Calibration	000.0	
HCO1	Analog Out 1 Electronics Upper Calibration	100.0	
LCO2	Analog Out 2 Electronics Lower Calibration	000.0	
HCO2	Analog Out 2 Electronics Upper Calibration	100.0	
PC	Probe Calibration	0	
SFt	Software Version Number	N/A	
SOH	Sales Order High	N/A	
SOL	Sales Order Low	N/A	

HAC and LAC Codes—High Alarm Configuration		
Digit 1	Digit 2	Digits 3 and 4
Measurement Selection 1 = pH or ORP 3 = Temperature	Configuration 1 = Low/Passive 2 = Low/Active 3 = High/Passive 4 = High/Active 5 = Instrument/Passive 6 = Instrument/Active 7 = Hold/Passive 8 = Hold/Active	Hysteresis 00 to 99% of Full Scale

Error/Alarm Messages			
Alternate Display	Condition	Priority	Action Required to Clear Message
Er 1	Instrument Fault, RAM/ROM, software watchdog timer	1 (Highest)	1.Reenter security code using procedure. 2.Power down unit. 3.Verify factory installed jumper has been removed from TB2 (plastic unit only).
Er 2	User-defined temperature range error or temperature measurement error	3	1.Change user-defined temperature limits. UtL or LtL. 2.Replace sensor. 3.Place temperature in manual mode (e.g., 25.C). 4.See “Calibrating the RTD Circuitry” on page 48
Er 3	User-defined measurement range error	4	1.Change user-defined measurement limits, UL or LL. 2.Replace sensor.
Er 4	Measurement calibration incorrect	2	Recalibrate Analyzer using Bench Calibration procedure.
A Hi	Measurement in Hi alarm	6	
A HH	Measurement in HiHi alarm	5	
A LO	Measurement in Lo alarm	8	
A LL	Measurement in LoLo alarm	7	
****	Measurement over or under range of analog output limits	9	
Err	Incorrect code or parameter attempted	2	Check code and reenter.

NOTE: If two or more errors exist simultaneously, the Analyzer will flash only the error with the highest priority. If the highest priority error is cleared and a lower priority error still remains, the Analyzer will then flash the highest priority error of the remaining errors.

HAtt, HAft, and HAoL Time Codes		
Digits 1 and 2	Digit 3	Digit 4
00 to 99 minutes	0 to 9 tenths of minutes	0 9 hundredths of minutes
UL =	The Upper Limit is 16.00 Ph or 1600 Mv.	
LL =	The Lower Limit is -9.99 pH or -999 mV.	
UtL =	The Upper Limit is 200 °C (392 °F).	
LtL =	The Lower Limit is -20 °C (-5 °F).	
H01, L01, =	May be set to any value between -9.99 and +16.00 pH	
H02, L02 =	or -999 and +1600 mV.	

7. Alarm Contact Maintenance

The alarm relay contacts are selected to switch loads equal to or greater than 20 watts. The minimum contact current is 1 ampere. The silver alloy contacts rely on the very slight arc generated during switching to eliminate oxide layers that form on the contacts. When the contacts are used at low (signal) levels, contact function may become unreliable over time due to the formation of an oxide layer on the contacts.

When contacts must be used at low levels, attention must be paid to contact condition. The maximum contact resistance for new relays is 100 milliohms. Values above this level or unstable values indicate deterioration of the contact surface as noted above and may result in unreliable alarm function.

The contact surfaces can be restored as follows:

1. Disconnect the alarm wiring from the analyzer.
2. Connect a load of 20 W or more as shown in Figure 32 so that both NO and NC contacts are exercised.
3. Use the analyzer to switch the alarm relay several times.
4. Disconnect the load installed in Step 2 and reconnect the wiring removed in Step 1.
5. Check to ensure that the alarms are functioning properly.

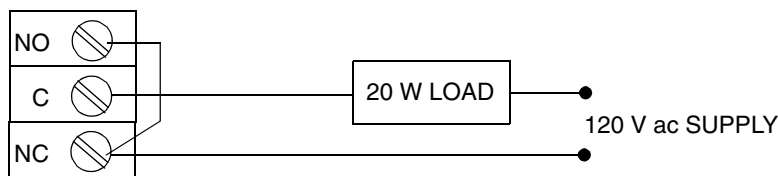


Figure 32. Alarm Contact Reconditioning Circuit

8. Warranty

Thank you for buying an Invensys Foxboro 873PH Electrochemical Analyzer. We also supply resistivity, contacting conductivity, and electrodeless conductivity analyzers and equipment. Contact us for your analysis needs.

For sales information or to place an order, contact your local Invensys Foxboro representative.

For Warranty Information.....	1-866-746-6477
For Electrochemistry Analyzer Repair/Troubleshooting Information	508-549-2168
For Electrochemistry Technical Assistance and Application Support.....	508-549-4730
Or by FAX.....	508-549-4734

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