Instruction

MI 611-194
June 2004

873ARS Ace Series Electrochemical Analyzers for Resistivity Measurements

Style A

(873APH Version Shown)

Invensys®
FOXBORO®

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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 873ARS Electrochemical Analyzer.

- Step 1 - Wiring
- Step 2 - Verify Analyzer Identification
- Step 3 - Verify Valid Measurements
- Step 4 - Enter Sensor parameters into Analyzer

Step 1 - Wiring

⚠ CAUTION

Wiring installation must comply with any existing local regulations.

The 873A 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 (General Purpose Version)" below and "Wiring of Metal Enclosure (Field-mounted Version)" on page 2.

Wiring of Plastic Enclosure (General Purpose Version)

1. Remove optional rear cover assembly BS805QK, if present.
2. Connect ALM 1 and ALM 2 alarm wires to terminal block TB3 as shown in Figure 1. Failsafe operation requires connections be made between NC and C. For details see "Wiring of Alarms" on page 19.
3. Connect wires from external circuit to analog output terminals TB3 (M+) and TB3 (M–). Refer to Figure 1.
4. Remove factory-installed jumper assembly from terminal block TB2 and discard.
5. Connect sensor wires to terminal block TB2 as shown in Figure 1.

NOTE

1. Only sensors with 0.1 cm^{-1} cell factors should be used with the 873ARS Analyzer. Models 500, 900, 910, 920, 921, and 923 Series should not be used with the 873A Analyzer. 871CC Sensors A through F use a 100 kΩ thermistor for temperature compensation. Sensors K through M use a Pt 100 RTD for temperature compensation and are recommended for all measurements at elevated temperature.
2. If sensors are to be used in a solution with a high applied voltage, the outer electrode of each sensor (green wire Terminals 1 and 7) must be connected to earth ground.

6. Connect power wires to terminal block TB1 as shown in Figure 1.
7. Attach optional rear panel cover, if present.

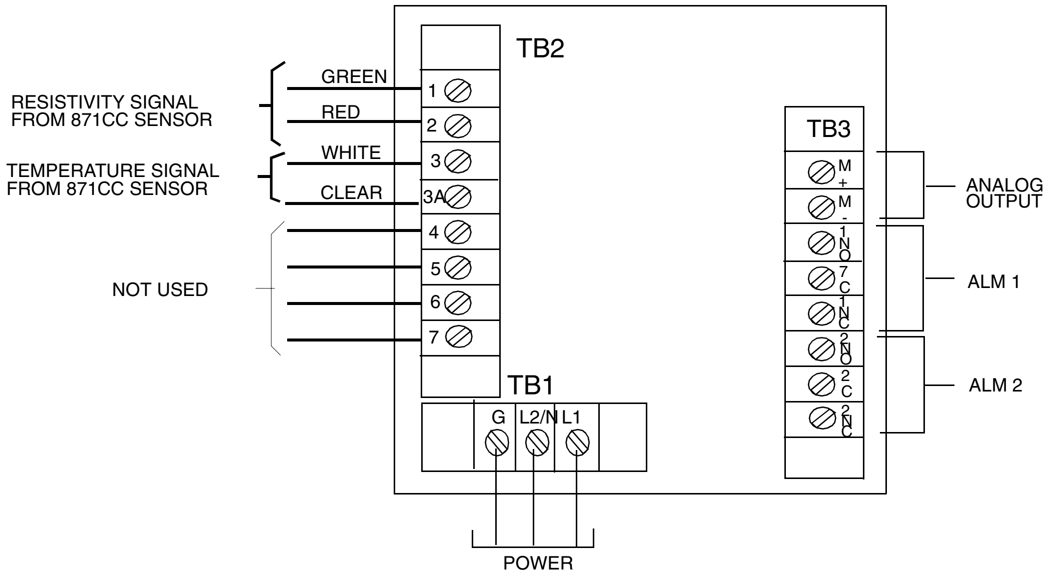

Figure 1. Plastic Enclosure Rear Panel Wiring

Wiring of Metal Enclosure (Field-mounted Version)

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 ratings must be used.
2. Alarm wires should run through the same conduit as the power wires. Sensor wires and analog output wires should be run through separate conduit openings.

1. Remove back cover to access terminal/power board.
2. Connect ALM 1 and ALM 2 alarm wires to terminal block TB3 as shown in Figure 2. Failsafe operation requires connections to be made between contacts NO and C. For details, see “Wiring of Alarms” on page 19.
3. Connect wires from external circuit for analog output to terminal block TB4.
4. Connect sensor wires to analyzer terminal block TB2 as shown in Figure 2.

— **NOTE**

1. Only sensors with 0.1 cm^{-1} cell factors should be used with the 873ARS Analyzer. Models 500, 900, 910, 920, 921, and 923 Series should not be used with the 873A Analyzer. 871CC Sensors A through F use a 100 kΩ thermistor for temperature compensation. Sensors K through M use a Pt 100 RTD for temperature compensation and are recommended for all measurements at elevated temperature.
2. If the sensors are to be used in a solution with a high applied voltage, the outer electrode from each sensor (green wire terminals 1 and 7) must be connected to earth ground.

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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 stud located in the bottom of the case. The stud grounds the instrument and is mandatory for safe operation.

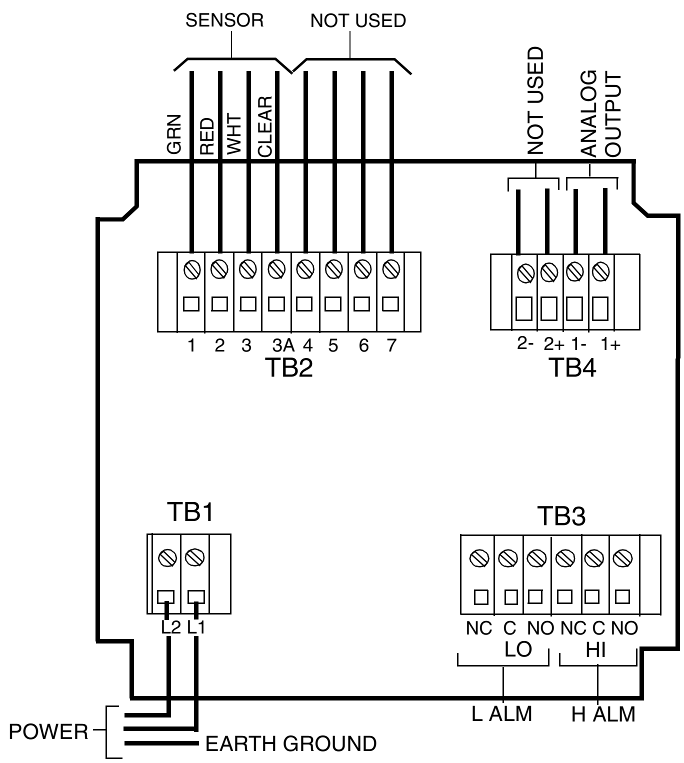


Figure 2. Metal Enclosure Rear Panel Wiring

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 Table 4, "User Configuration Setup Entries," on page 27.

Step 3 - Verifying Valid Measurements

Your analyzer was calibrated at the factory. Therefore, you should not have to calibrate it. However, it is good practice to adjust your analyzer to your sensor. See “Calibrating the Analyzer to a Specific Sensor” on page 36.

Step 4 - Enter Sensor Parameters into Analyzer

871CC resistivity sensors are manufactured to be ±2% accurate of their nominal 0.1 cm^{-1} cell value. These sensors are also tested and labeled with their individual cell factors (CF) as well as the true temperature at which the thermistor is exactly 100 kΩ or RTD is 100 Ω. The overall system accuracy may be improved by entering the individual sensor parameters into the analyzer. “Entering a tCF Value” on page 38 and “Entering a CF Value” on page 38 are the pertinent procedures to follow to configure the 873ARS Analyzer for the individual sensor being used.

Looking for More Information?

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

For installation information, refer to “Installation” on page 11. For dimensional information, refer to DP 611-163.

For detailed explanation of the controls and indicators, refer to “Operation” on page 21.

For detailed configuration instructions, refer to “Configuration” on page 27.

For detailed calibration instructions, refer to “Calibration” on page 33.

If you need additional help, please call the Invensys Foxboro Electrochemical Service Center at 1-508-549-4730 in the U.S.A. or call your local Invensys Foxboro representative.

General Description

The 873ARS Resistivity Analyzer interprets the resistivity of aqueous solutions. Its measurement display reads in megohm-cm (MΩ·cm). Solution temperature is also continuously measured and is used for automatic temperature compensation. It may be displayed at any time. It provides an isolated output signal proportional to the measurement for transmission to an external receiver.

Instrument Features

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

- Plastic or Metal Enclosure
- Dual Alarms
- Analog Output
- EEPROM Memory
- Hazardous Area Classification 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 a 1/4 DIN size panel cutout. It meets the enclosure ratings of NEMA 1 and CSA Enclosure 1.

The metal enclosure is intended for field locations and may be panel, pipe, or surface mounted. The housing is extruded aluminum coated with a tough epoxy-based paint. The enclosure is watertight, dusttight, corrosion-resistant, meeting the enclosure ratings of NEMA 4X, CSA Enclosure 4X, and IEC Degree of Protection IP-65, and 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 5 A 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 41.

No Battery Backup Required

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

Hazardous Area Classification

The metal field-mounted versions are designed to meet the Factory Mutual and the Canadian Standards Association requirements for Class I, Division 2 hazardous locations. See Table 1 for details.

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 because of prior keypad operations, the display automatically defaults to the measurement value about four minutes 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 alternately displays the measurement value and a fault or alarm message at a 1 second rate.

Keypad

The instrument front panel keypad consists of eight keys. Certain keys are for fixed functions; other keys are for split functions. The upper function (green legend) 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 873A Analyzer offers application flexibility through its standard software 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 two general categories: Alarm Configuration 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 door allows viewing of the display and is hinged for easy access to the front panel controls.

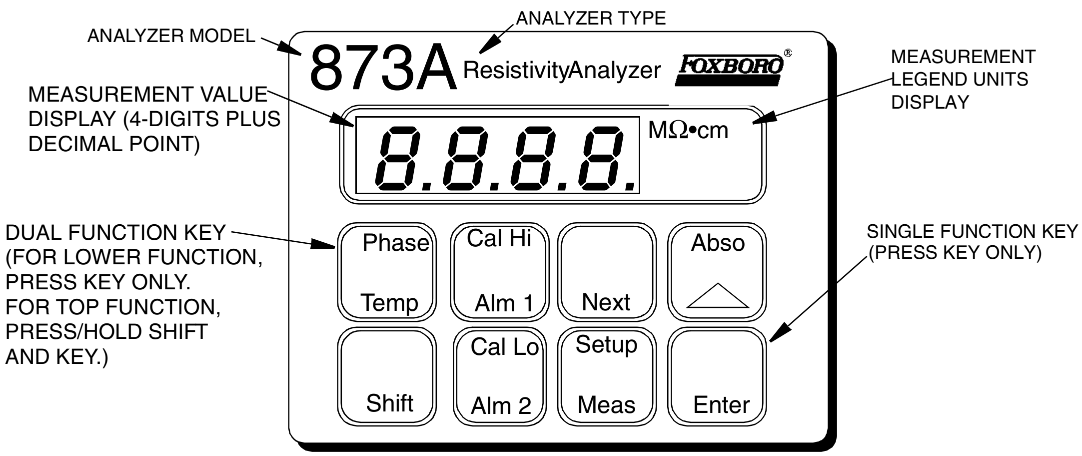


Figure 3. Front Panel Display and Keypad

Analyzer Identification

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

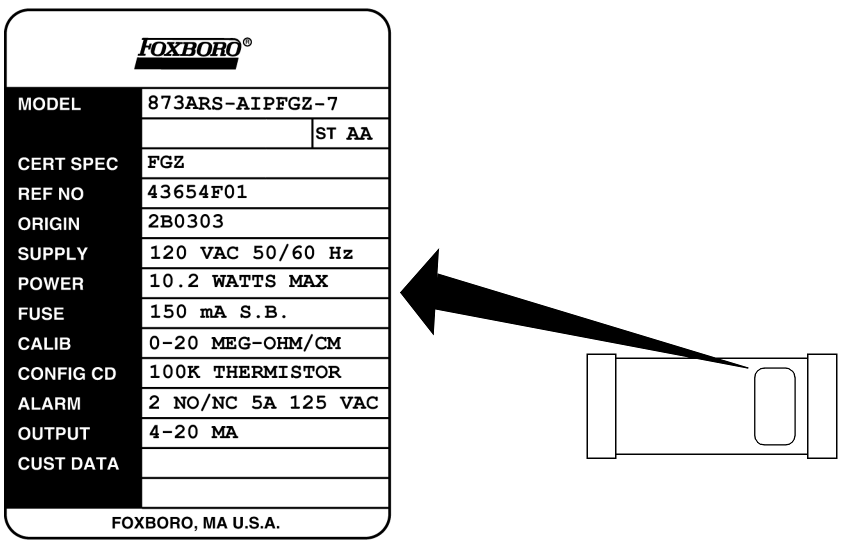


Figure 4. Dataplate Location

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, Division 2, Groups A, B, C, and D and Class II, Division 2, Groups F and G hazardous locations.	Instruments with metal enclosure (codes W, X, Y, and Z) only. Temperature Class T6.	FNZ
CSA (Canada) for use in general purpose (ordinary) locations.	Supply Voltage 24 V, 100 V, and 120 V ac (codes -A, -E, -J) only.	CGZ
CSA (Canada) suitable for use in Class I, Division 2, Groups A, B, C, and D, hazardous locations.	Instruments with metal enclosure (codes W, X, Y, and Z) only. Supply Voltage 24 V, 100 V, and 120 V ac (codes -A, -E, -J) only.	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 873A 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.

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 Hz, ±3 Hz
Output Signal	I 4-20 mA isolated T 0-10 V dc isolated E 0-20 mA isolated
Ambient Temperature Limits	–25 to +55°C (–13 to +131°F)
Measurement Range	0 to 20.00 MΩ·cm
Temperature Measurement Range	–17 to +150°C (0 to 302°F)
Temperature Compensation Range	0 to 120°C (32 to 248°F)
Relative Humidity Limits	5 to 95%, noncondensing
Accuracy of Analyzer	0.1 MΩ•cm at 25°C
Dimensions	Plastic Enclosure: 92(H) x 92(W) x 183(L) mm, 3.6" x 3.6" x 7.6" Metal Enclosure: 92(H) x 92(W) x 259(L) mm, 3.6" x 3.6" x 10.1"
Enclosure/Mounting Options	–P Plastic Panel Mount –W Metal Panel Mount –X Metal Surface Mount –Y Metal Pipe Mount –Z Metal Movable Surface Mount
Approximate Mass	Plastic Enclosure 0.68 kg (1.5 lb) Metal (NEMA 4X) 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. Temperature response is 15 seconds maximum.
Measurement Damping	In Measure mode, damping is set at 10 seconds. Damping affects displayed parameters and analog output.

Alarms	• Two alarms configurable via keypad • Individual set points continuously adjustable 0 to full scale via keypad
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 41.
Alarm Indication	Alarm status alternately displayed with measurement on LED display
Analog Output	0-10 V (minimum load 1 kΩ) 0-20 mA (800 Ω maximum loop resistance) 4-20 mA (800 Ω maximum loop resistance)
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 873ARS 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 are intended for mounting in solid metal consoles or cabinets. The plastic case units will comply with the European 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).

⚠ CAUTION

When replacing covers on the 873A 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. Installation

Mounting to a Panel – Plastic Enclosure, 873ARS-_ _ 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 the analyzer.
3. Insert the analyzer in the panel opening until side spring clips engage on the panel.
4. From the rear of the panel, attach and tighten the top and bottom mounting screws until the analyzer is securely held in place.

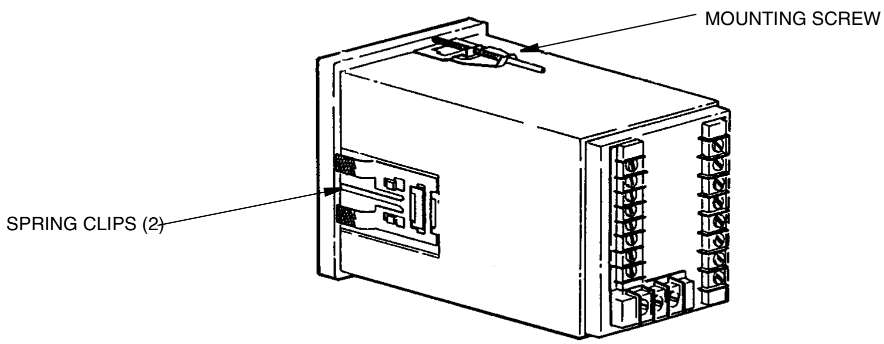


Figure 5. Mounting to Panel - Plastic Enclosure

Mounting to a Panel – Metal Enclosure, 873ARS-_ _ W

The metal enclosure is mounted to a panel as described below:

1. Size panel opening in accordance with dimensions specified on dimensional print DP 611-162.
2. Insert the analyzer through the panel cutout and temporarily hold in place. The rear bezel will have to be removed to perform this procedure.)
3. From the rear of the panel, slide the plastic clamp onto the enclosure until the two clamp latches snap into two opposing slots on longitudinal edges of the enclosure. See Figure 6.
4. Tighten screws (clockwise) on the clamp latches until the enclosure is secured to panel.
5. Reassemble the rear bezel to the enclosure using four screws.

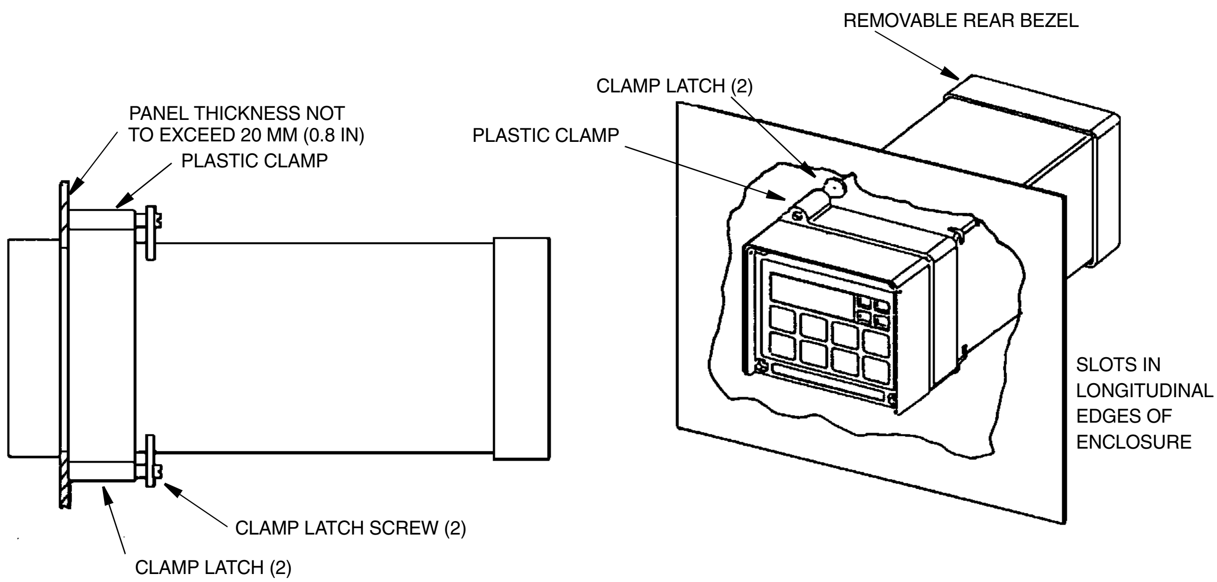


Figure 6. Mounting to Panel - Metal Enclosure

Mounting to a Pipe – Metal Enclosure, 873ARS-_ _ Y

1. Locate a 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) and hardware designated 6 and 13.
3. Slide the analyzer into support bracket (2) and slide strap clamp (4) onto analyzer. Using two screws, nuts, and washers, attach the strap clamp to the support bracket to secure the analyzer.
4. Lift entire assembly of Step 3, and using two U-clamps (12), nuts (13), and washers (6), secure mounting bracket (1) to pipe.

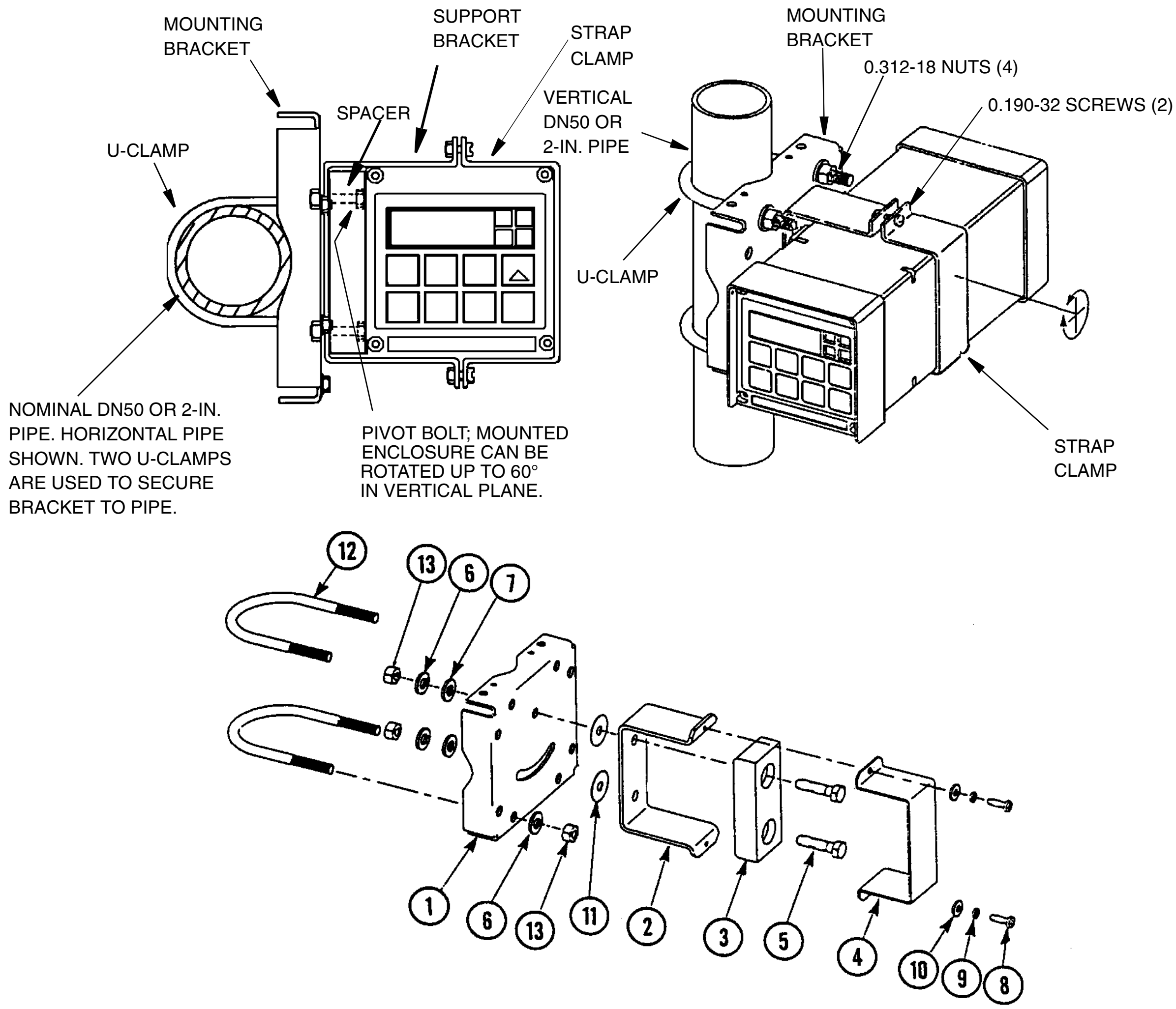


Figure 7. Metal Enclosure - Pipe Mounting

Mounting to a Surface, Fixed Mount – Metal Enclosure, 873ARS-_ _ X

1. Locate the mounting surface for the analyzer.
2. Referring to Figure 8, use mounting bracket (1) as a template for drilling four holes into the mounting surface. Notice that holes in the mounting bracket are 8.74 mm (0.344 in) in diameter. Do not attach the mounting bracket to the 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 the analyzer into support bracket (2) and slide strap clamp (4) onto the analyzer. Using two screws, nuts, and washers, attach the strap clamp to the support bracket to secure the analyzer.

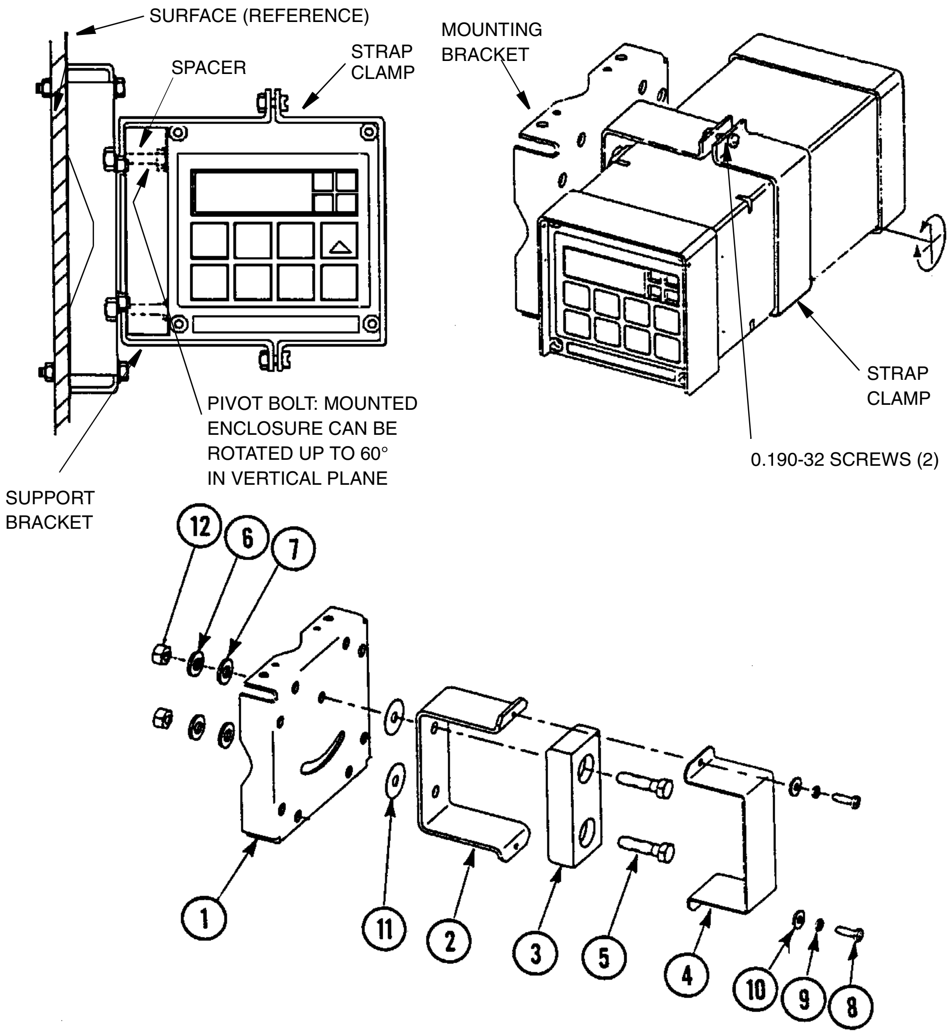


Figure 8. Metal Enclosure - Fixed Mount

Mounting to a Surface, Movable Mount – Metal Enclosure, 873ARS-_ _ Z

1. Locate the mounting surface for 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 (2) and slide strap clamp (4) onto the analyzer. Using two screws, nuts, and washers, attach the strap clamp to the support bracket to secure the analyzer.

6. Lift entire assembly of Step 5, align mounting bracket (1) and wall bracket pivot bolt holes, and then insert pivot bolt (13) through wall and mounting brackets into nylon washer (14) and locking nut (15).

7. Rotate bracket and analyzer assembly in horizontal plane to desired position and lock in place using the screw and washer.

8. Tilt the analyzer to the desired angle and lock in place with the hardware fastened finger tight in Step 4c.

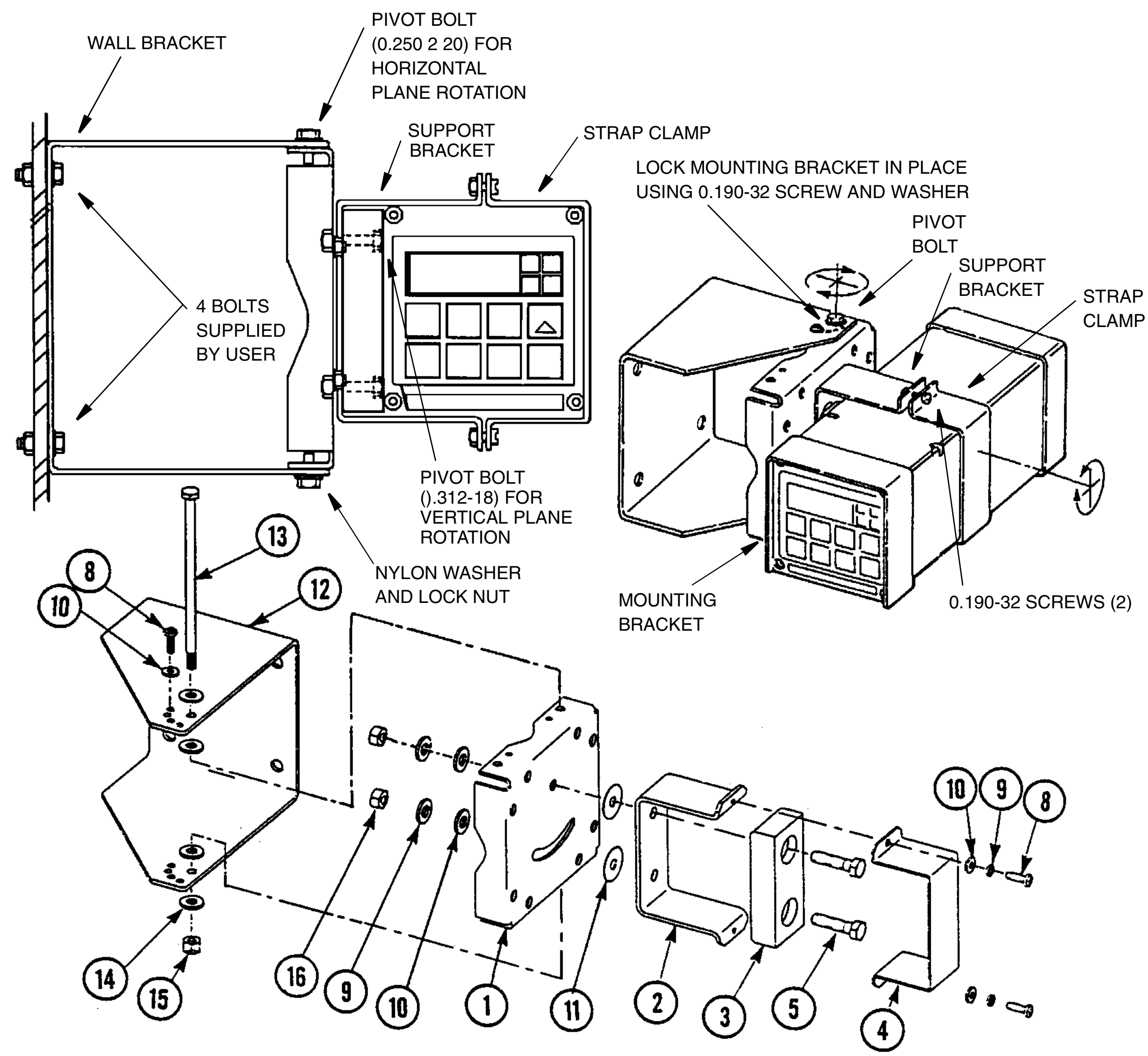


Figure 9. Metal Enclosure - Movable Mount

Wiring of Plastic Enclosure (General Purpose Version)

CAUTION
Wiring installation must comply with any existing local regulations.

1. Remove optional rear cover assembly BS805QK, if present.
2. Connect ALM 1 and ALM 2 alarm wires to terminal block TB3 as shown in Figure 10. Also see “Wiring of Alarms” on page 19.
3. Connect wires from external circuit for analog output to terminals TB3 (M+) and TB3 (M–). Refer to Figure 10.
4. Remove factory-installed jumper assembly from terminal block TB2 and discard.
5. Connect sensor wires to terminal block TB2 as shown in Figure 10.

NOTE
1. Only sensors with 0.1 cm^{-1} cell factors should be used with the 873ARS Analyzer. Models 500, 900, 910, 920, 921, and 923 Series should not be used with the 873A Analyzer. 871CC Sensors A through F use a 100 kΩ thermistor for temperature compensation. Sensors K through M use a Pt 100 RTD for temperature compensation and are recommended for all measurements at elevated temperature.
2. If sensors are to be used in a solution with a high applied voltage, the outer electrode of each sensor (green wire Terminals 1 and 7) must be connected to earth ground.

6. Connect power wires to terminal block TB1 as shown in Figure 10.
7. Attach optional rear panel cover, if present.

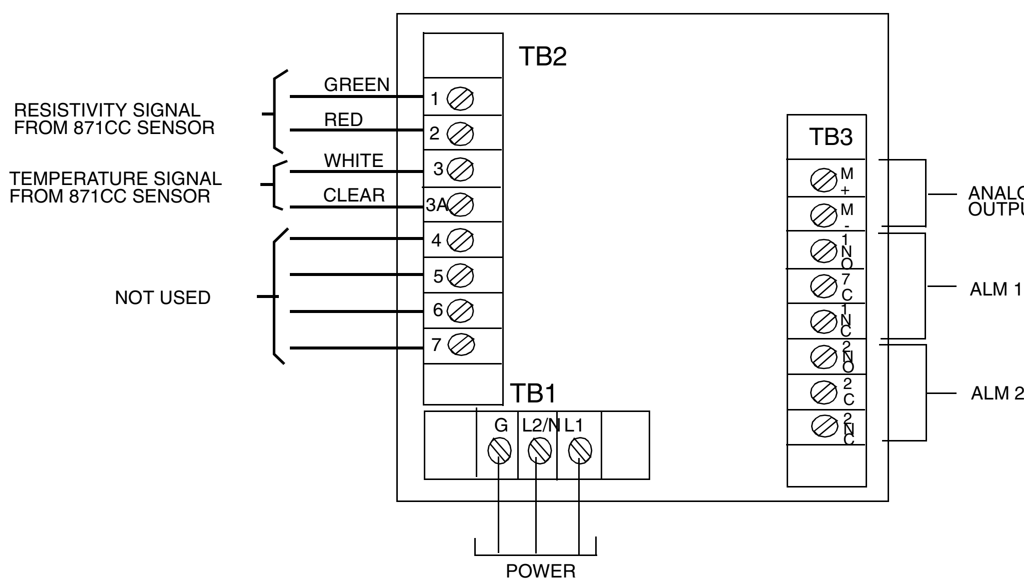


Figure 10. Plastic Enclosure Rear Panel Wiring

Wiring of Metal Enclosure (Field-Mounted Version)

CAUTION

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 ratings must be used. Table 2 identifies appropriate parts.
2. Alarm wires should run through the same conduit as the power wires. Sensor wires and analog output wires should be run through separate conduit openings.

1. Remove back cover to access terminal/power board.

2. Connect ALM 1 and ALM 2 alarm wires to terminal block TB3 as shown in Figure 11. Also see "Wiring of Alarms" on page 19.

3. Connect wires from external circuit for analog output to terminal block TB4.

4. Connect sensor wires to analyzer terminal block TB2 as shown in Figure 11.

NOTE

1. Only sensors with 0.1 cm^{-1} cell factors should be used with the 873ARS Analyzer. Models 500, 900, 910, 920, 921, and 923 Series should not be used with the 873A Analyzer. 871CC Sensors A through F use a 100 kΩ thermistor for temperature compensation. Sensors K through M use a Pt 100 RTD for temperature compensation and are recommended for all measurements at elevated temperature.
2. If the sensors are to be used in a solution with a high applied voltage, the outer electrode from each sensor (green wire terminals 1 and 7) must be connected to earth ground.

5. Connect power wires to terminal block TB1 as shown in Figure 11. The earth (ground) connection from the power cord should be connected to the stud located in the bottom of the case. The stud grounds the instrument and is mandatory for safe operation.

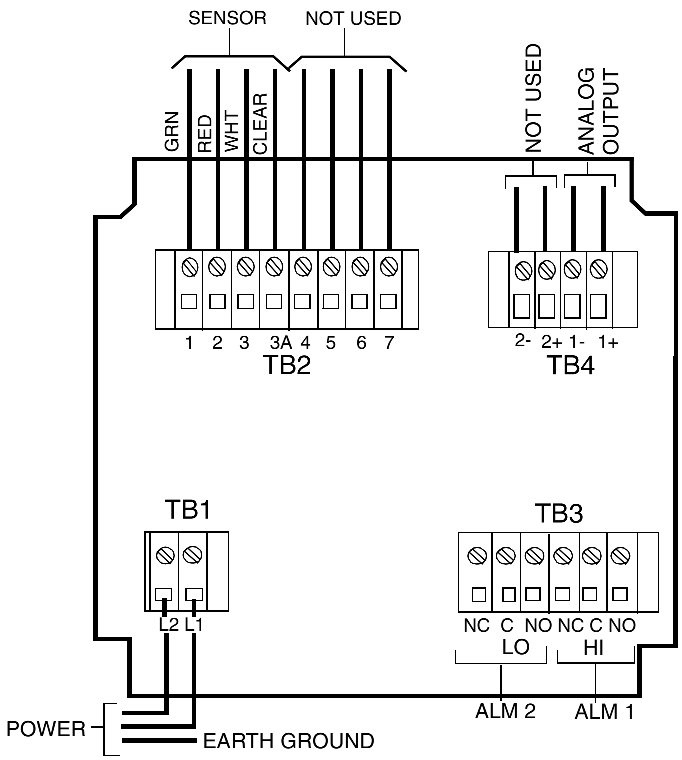


Figure 11. Metal Rear Panel Wiring

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

— NOTE

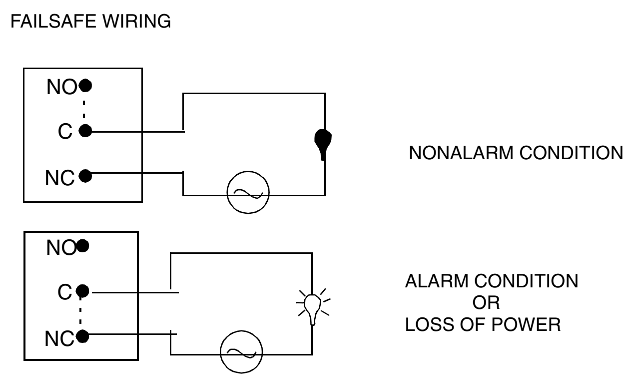
1. The cover screws are self-tapping and have a limited number of uses. Do not repeatedly remove and tighten these screws.
2. When replacing covers on the 873A metal case, use Loctite (Part No. S0106ML) and Lubriplate (Part No. X0114AT) on the threads for the rear cover. Do not mix.
3. It is recommended that sensor and interconnect cable be run in 1/2-in conduit for protection against moisture and mechanical damage. Do not run power or control wiring in the same conduit.

Wiring of Alarms

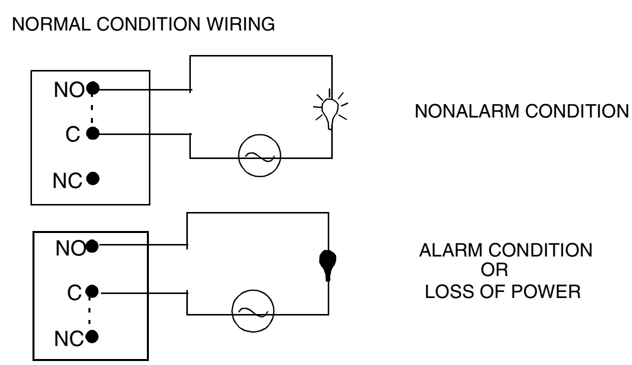
Alarm relays in the 873A Analyzer are "active" relays. This means that the relay is energized when the analyzer is powered and there is no alarm condition.

You can wire an external device (e.g., light bulb) to the analyzer in either of two ways. Each alarm relay provides a contact closure which can be used as a switch to turn an externally powered device on or off.

- Between NC and C so that the external device is activated when there is an alarm condition or a loss of power to the analyzer. This is referred to as "failsafe."



- Between NO and C so that the external device is activated in the normal condition (i.e., instrument is powered and no alarm condition exists.



! 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 41.

3. Operation

The 873A functions in two main modes, OPERATE and CONFIGURE.

As soon as the 873A Analyzer is powered, it is in the OPERATE mode. The instrument first conducts a self diagnostic, then it automatically displays the measurement and outputs a proportional analog signal. Any error or alarm condition is alternately displayed with the measurement on the LED display. If two or more errors/alarms exist simultaneously, the analyzer will flash only the one with the highest priority. If the highest priority error/alarm is cleared and a lower priority error/alarm still remains, the analyzer will then flash the highest priority of those remaining.

Also, while in the OPERATE Mode, you may view the process temperature and all the parameter settings configured in the Configuration Setup Entries.

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

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

Display

The display, Figure 12, is presented in two parts, a measurement/settings display and backlit engineering units. To read anything other than the measurement or to make a configuration or calibration change requires keypad manipulations.

Keypad

The keypad, shown in Figure 12, consists of eight keys, five 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.

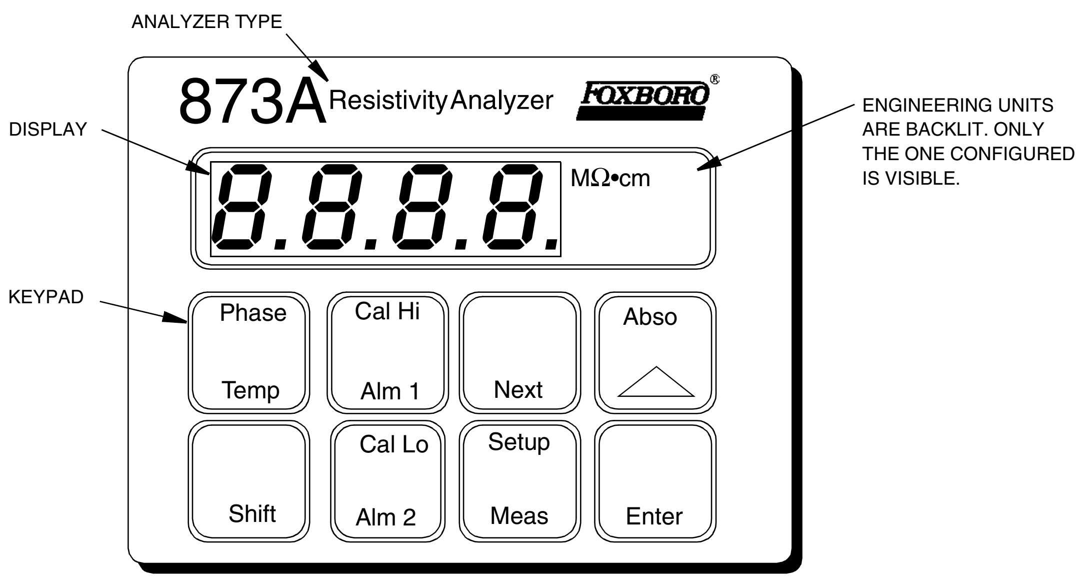


Figure 12. Display and Keypad

Table 3. Key Functions

Shift	**Shift:** Press and hold this key to actuate the green dual-function keys.
Abso △	**Abso:** Press/hold Shift and press this key to display the absolute resistivity value of cell, no temperature compensation. **Increment (D):** Press this key to increase the display count. Each press increases the value by one. Press and hold to increase the count at a rate of approximately one per second. When 9 is reached, display goes to 0.
Phase / Temp	**Phase:** This key is used during bench calibration only to implement a phase calibration. Phase calibration provides calibration of the quadrature measurement circuitry. This accurately allows compensation of the resistivity measure for cable and sensor capacitance. **Temp:** Press this key to display the process 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.
Enter	**Enter:** 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.
Next	**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 / Meas	**Setup:** Press/hold SHIFT and press this key to access the configuration entry function. **Meas:** Press this key at any time to return to Measure mode from other modes.
Cal Lo / Alm 2	**Cal Lo:** Press/hold SHIFT and press this key to access the lower calibration function of the analyzer. (Bias voltage). **Alm 2:** Press this key to display and/or change the set point of Alarm 2.
Cal Hi / Alm 1	**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 Alarm 1.

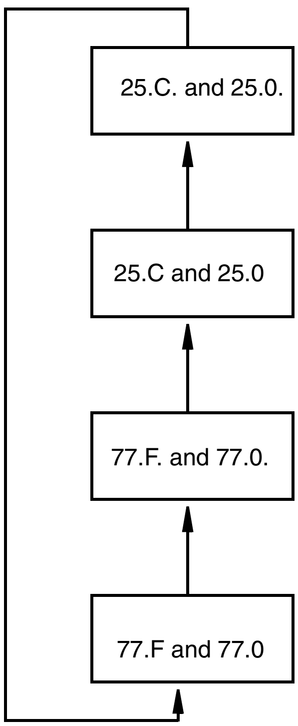
— NOTE

1. Pressing **Next** and Δ simultaneously allows the user to step backward through the Setup program or digit place movement. One cannot reverse number count by this procedure.
2. Pushing **Shift** and **Enter** simultaneously circumvents the wait between Setup entries.

To View Process Temperature

To view the process temperature from the measurement mode, press the **Temp** key. The display changes from the measurement to the process temperature or manually adjusted temperature. The display is a rounded whole number with the temperature units (C or F) alternating with tenths of degrees and no units.

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 pressed, the process temperature is displayed on the readout. Pressing Δ causes the display to sequence from the displayed value through the following sequence:



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 press **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 page 37 for adjusting temperature in the automatic mode.

— NOTE

To make a minus sign appear on the display, make sure that a number other than zero is present on the display and change the first digit of the number to a minus sign.

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

To View Setup Entries

Setup Entries may be viewed at any time. To view any of the Setup Entries, do the following:

1. Press **Shift + Setup**.
2. If necessary, press **Next** until the desired parameter to be viewed is displayed.
3. Press **Enter**.

When viewing the Setup Entries, you may page through the parameters as rapidly as you wish (**Shift** + **Setup** and then **Next** one or more times). However, once **Enter** is pressed (**Enter** must be pressed to read a parameter value), you must wait (value is displayed for approximately four minutes) for the parameter symbol to reappear.

NOTE
Pressing **Shift + Enter** overrides this wait.

The parameter symbols appear for about four minutes also. If another key is not pressed in this period, the display defaults to the measurement.

To make changes to any Configuration Setup parameter, refer to “Configuration” on page 27.

4. Configuration

Overview

This instrument is shipped with either factory default settings or user defined settings, as specified per sales order. Table 4 lists all the parameters that can be changed. It lists the displayed symbol, a description of the display, the factory default value and a space to write user values.

Table 4. User Configuration Setup Entries

Displayed Symbol	Parameters and values Accessed	Factory Default	User Settings
U_tC	Units and Temperature Compensation	H2o	
AL_1	Alarm 1 Off/Hi/Lo Active	1oFF	
AL_2	Alarm 2 Off/Hi/Lo Active	2oFF	
Aohi	Analog Output High (100%)	20.00	
Aolo	Analog Output Low (0%)	00.00	
CF	Cell Factor	1000	
tCF	Temperature Cell Factor	25.00	
LAdJ	Analog Out Electronics Lower Calibration	- - -	
HAdJ	Analog Out Electronics Upper Calibration	- - -	

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

1. Press **Shift** + **Setup**.
2. If necessary, Press **Next** until the desired parameter to be changed is displayed.
3. Press **Enter**.
4. Use **Next** and Δ until the desired code or value is displayed.
5. Press **Enter**.
6. Press **Meas** to return to the measure mode.

Units and Temperature Compensation (U_tC)

This procedure is used to set the instrument's temperature compensation and damping.

1. Press **Shift** + **Setup**.
2. If necessary, press **Next** until "U_tC" appears on the display.
3. Press **Enter**.
4. Press **Next** until desired U_tC state is displayed.

.

U_tC Values	Meaning
H2o	Ultrapure water temperature correction applied. MΩ·cm is referenced to 25°C, with 10 second damping, based on the ultrapure water characteristics at 18.2 MΩ•cm with increasing contributions (NaCl assumed) as the resistivity decreases.
bCAL	Absolute with no compensation and no damping.

5. Press **Enter** to set state.
6. Press **Meas** to return to the measure mode or **Shift + Enter** to return to setup menu item “U_tC”.

Alarms

General Information About Alarms

Dual Independent, Form C dry alarm contacts, rated at 5A noninductive, 125 V ac/30 V dc are provided. Each of the two alarms is configured as off or as a high or low alarm. A *low alarm* relay will trip on decreasing measurement. A *high alarm* relay will trip on increasing measurement. Therefore, combinations of high, low, high/low, low/low, and high/high alarms are possible. The alarm deadband is always set at 20 MΩ•cm.

! 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 41.

Correct wiring of the contacts is necessary for failsafe operation. See “Wiring of Alarms” on page 19 for wiring information.

Alarm conditions (AL 1, AL 2, or A1A2) are alternately displayed with the measurement on the LED display.

NOTE

Upon powering the instrument, alarm operation is delayed for a time period proportional to the 10 second factory set damping time. Alarms will remain “OFF” until the measurement has stabilized.

Alarm Configuration

You can configure each alarm to be a high alarm, a low alarm or in the off state.

To configure Alarm 1:

1. Press **Shift + Setup**.
2. If necessary, press **Next** until “AL_1” appears on the display.
3. Press **Enter.**

4. Press **Next** until desired alarm state is displayed.

AL_1 states	1oFF	1_Hi	1_Lo

5. Press **Enter** to set state. The configured state appears on the display (e.g., 1_Lo).
6. Press **Meas** to return to measure mode or **Shift + Enter** to return setup menu item “AL_1”.

To configure Alarm 2:

1. Press **Shift + Setup**.
2. If necessary, press **Next** until “AL_2” appears on the display.
3. Press **Enter.**
4. Press **Next** until desired alarm state is displayed.

AL_2 states	2oFF	2_Hi	2_Lo

5. Press **Enter** to set state. The configured state appears on the display (e.g., 2_Hi).
6. Press **Meas** to return to measure mode or **Shift + Enter** to return setup menu item “AL_2”.

Setting Alarm Set Points

This procedure is relevant only when the alarms were configured as Low or High Alarms as explained in the previous section. When the alarms are configured as Off, alarm level settings have no relevance.

To set the level of Alarm 1:

1. Press **Alm 1**.
2. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected.
3. Press **Enter**.

To set the level of Alarm 2:

1. Press **Alm 2**.
2. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected.
3. Press **Enter**.

Press **Meas** to return to measure mode.

Output

Scaling the Analog Output

The maximum span that should be set on the analyzer is 20 MΩ•cm. The minimum span that should be set is 2 MΩ•cm. 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.

Analog Output High (Aohi)

This enables the user to assign a measurement value to the maximum analog output (either 10 V or 20 mA dc). For example, a user may wish to retransmit 4 to 20 mA dc over a resistivity range of only 15 to 18 MΩ•cm. This parameter would allow the assignment of the 20 mA dc output to a value of 18 MΩ•cm.

1. Press **Shift** + **Setup**.
2. If necessary, press **Next** until "Aohi" appears on the display.
3. Press **Enter.**
4. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the value 18 MΩ•cm is displayed.
5. Press **Enter.**
6. Press **Meas** to return to measure mode or **Shift** + **Enter** to return setup menu item "Aohi".

— NOTE
Invensys Foxboro preconfigures the High value to be equal to 20 MΩ•cm.

Analog Output Low (Aolo)

This enables the user to assign a measurement value to the minimum analog output (either 0 V, 0 mA or 4 mA dc). In the above example, the user would assign the minimum analog output to a value of 15 MΩ•cm.

1. Press **Shift** + **Setup**.
2. If necessary press **Next** until "Aolo" appears on the display.
3. Press **Enter**.
4. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the value 15 MΩ•cm is displayed.
5. Press **Enter**.
6. Press **Meas** to return to measure mode or **Shift** + **Enter** to return setup menu item "Aolo".

Analog Output Calibration (LAdJ, HAdJ)

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

1. Connect an ammeter/voltmeter to the analog output terminals. See "Wiring of Plastic Enclosure (General Purpose Version)" on page 16 and "Wiring of Metal Enclosure (Field-Mounted Version)" on page 17.

2. Press **Shift + Setup**.
3. If necessary, press **Next** until “LAdJ” or “HAdJ” appears on the display.
4. Press **Enter**, the display will show “Linc”.
5. Press **Next** to select the desired adjustment value:
   - Linc - Large increment ~ +0.3 mA or ~ +0.15V
   - inc - increment ~ +0.025 mA or ~ +0.01V
   - Sinc - Small increment smallest possible + adjustment 1/20 the size of inc
   - LdEc - Large decrement ~ -0.3 mA or ~ -0.15V
   - dEc - decrement ~ -0.025 mA or ~ -0.01V
   - SdEc - Small decrement smallest possible - adjustment 1/20 the size of dEc
6. Press **Enter** to change analog output and observe the new reading on your meter.
7. Repeat Steps 5 and 6 until desired meter value is observed.
8. Press **Meas** to return to measure mode or **Shift + Enter** to return setup menu item “LAdJ” or “HAdJ”.

5. Calibration

This section is divided into three parts:

"Calibration Verification" is a procedure to quickly verify that the 873ARS Analyzer is calibrated.

"Electronic Bench Calibration" on page 34 contains the procedure for calibrating the 873ARS Analyzer with precision resistors and their theoretical sensor signal values. In many cases this calibration produces sufficient accuracy for the user application.

"Calibrating the Analyzer to a Specific Sensor" on page 36 is recommended to obtain the best system accuracy. These procedures ***must be used*** when additional extension cables or junction boxes are used in an installation.

Calibration Verification

Required Tools

0.001 µF polycarbonate capacitor (available from Invensys Foxboro as Part No. H0176AA).

Calibration Kit (BS805YZ provided with your analyzer). The resistors in this kit are only 1% resistors. Therefore, the observed readings will be within 1%.

Procedure

1. Disconnect all sensor leads from Terminal Block TB2.
2. Produce a short across Terminals 1 and 2 on Terminal Block TB2.
3. Press **Shift + Abso**. Unit should read 00.00 ±0.1 MΩ•cm. If not, unit must be Bench Calibrated.
4. Remove short and connect 2.00 MΩ resistor between Terminals 1 and 2 on TB2.
5. Press **Shift + Abso**. Unit should read 20.00 ±0.3 MΩ•cm. If not, unit must be Bench Calibrated.
6. Connect a 0.001 µF capacitor in parallel with the 2.00 MΩ resistor connected across Terminals 1 and 2 of TB2 in Step 4.
7. Press **Shift + Abso**. Unit should read ±10.00 MΩ•cm of the previous reading. If not, unit must be Bench Calibrated.

Electronic Bench Calibration

This procedure is used to calibrate the 873ARS Analyzer with precision resistors and theoretical sensor signal values. After this procedure is completed, the **Cal Lo**, **Cal Hi**, and **Phase** keys ***should not be touched.***

> **⚠ CAUTION**
> Invensys Foxboro calibrates and configures all 873ARS Analyzers with resistors of 0.10% accuracy. Calibration of your unit with resistors of less accuracy will compromise its accuracy specifications. Do not use a resistance decade box for this procedure because the cable connection will add quadrature during the calibration. This will result in erroneous resistivity values.

Required Tools

Precision 2 MΩ resistor.

A 100 kΩ or 110 Ω resistor for temperature simulation.

A 0.001 µF polycarbonate capacitor (available from Invensys Foxboro as Part H0176AA).

Procedure

Calibration of Cell Channel

1. Disconnect all sensor leads from Terminal Block TB2.
2. Set the “U_tC” parameter to “bCAL”.
   a. Press **Shift + Setup**.
   b. Press **Next** until “U_tC” is displayed.
   c. Press **Enter**.
   d. Press **Next** until “bCAL” is displayed.
   e. Press **Enter**.
3. Reset parameter “CF” to 1000, the theoretical cell factor.
   a. Press **Shift + Setup**.
   b. Press **Next** until “CF” is displayed.
   c. Press **Enter**.
   d. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the display reads 1000.
   e. Press **Enter**.
4. Reset parameter “tCF” to 25.00, the theoretical temperature transducer value.
   a. Press **Shift + Setup**.
   b. Press **Next** until “tCF” is displayed.
   c. Press **Enter**.

d. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the display reads 25.00.

e. Press **Enter**.

f. Press **Meas**.

Checking the Temperature Circuit Calibration

1. Check the CONFIG CD entry on the data label to determine which type of temperature compensation your analyzer has and then connect a 100 kΩ or 110 Ω resistor across Terminals 3 and 3A of Terminal Board TB2.
2. Put unit in Automatic Temperature mode.

   a. Press **Temp**, no decimal point should be visible after the "C" or "F" value. If there is it must be removed. See "To View Process Temperature" on page 24.

   b. Press **Enter**.

   The display should read *approximately* 25°C or 77°F. If the display does not read these values, verify that the correct resistor is being used and ensure that it is correctly installed. If these measures do no improve the value, return unit to Invensys Foxboro.
3. Press **Meas**.

Zero and Span Calibration

1. Produce a short across Terminals 1 and 2 on Terminal Block TB2.
2. Wait at least 15 seconds for the electronics to stabilize. Then perform the **Cal Lo** procedure.

   a. Press **Shift + Cal Lo**.

   b. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the value 00.00 is displayed.

   c. Press **Enter**.

   d. Press **Meas**.
3. Remove short and connect 2.00 MΩ resistor across Terminals 1 and 2 of TB2.
4. Wait at least 15 seconds. Then perform the **Cal Hi** procedure.

   a. Press **Shift + Cal Hi**.

   b. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the display reads 20.00 MΩ.

   c. Press **Enter**.

   d. Press **Meas**.

Phase Calibration

This part of the Bench Calibration procedure adjusts the analyzer for changes in capacitance that may be introduced by the cable or sensor.

1. Connect a 0.001 µF capacitor in parallel with the 2.00 MΩ resistor previously connected across Terminals 1 and 2.
2. Wait at least 15 seconds for the electronics to stabilize. Then perform the **Phase** procedure.
   a. Press **Shift + Phase**. The display will read the **Cal Hi** setting
   b. Press **Enter**.
   c. Remove the capacitor from terminals 1 and 2 of TB2 but leave the resistor connected.
   d. Press **Shift + Cal Hi**.
   e. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the display reads 20.00 MΩ.
   f. Press **Enter**.
   g. Press **Meas**.
3. Remove resistor and reconnect sensor.
4. Reset parameter “U_tC” to “H2o”.
   a. Press **Shift + Setup**.
   b. If necessary press **Next** until “U_tC” appears on the display.
   c. Press **Enter**.
   d. Press **Next** until “H2o” is displayed.
   e. Press **Enter**.
   f. Press **Meas**.

Calibrating the Analyzer to a Specific Sensor

Invensys Foxboro resistivity sensors are manufactured under strict guidelines for quality and uniformity. Even with the stringent specifications of our assembly procedures, small offsets from theoretical values are possible. In many applications, the sensor can be connected to the analyzer and used without further calibration. For the best possible system accuracy of an 873ARS and 871CC sensor, additional calibrations are required to standardize these small offsets.

An accurate temperature signal is required for proper temperature compensation, especially when measuring over a large temperature gradient. The Temperature Cell Factor (tCF) is used to offset a small deviation from the ideal. This procedure **must** be used when extension cables are used. At 25.0°C, a 0.1°C error in temperature can result in a resistivity error of 1.1%.

Additionally, individual sensors with 0.1 cm^{-1} cell factors may differ slightly from their nominal constant of .1000 cm^{-1}. The Cell Factor adjustment (CF) is used to offset the small deviation of the sensor from the ideal.

871CC Sensors with 0.1 cm^{-1} nominal cell constants are stamped with a 4-digit number (e.g., .1001), which is the Cell Factor (CF) of that particular cell when tested in our factory. These cell are also stamped with a temperature value (tCF) (e.g., 24.97°C), which is the temperature where that particular transducer read its theoretical resistance value. See Figure 13. When the sensor is connected directly to the analyzer, these factors may be input directly into the 873ARS to correct for these offsets. Alternatively, the procedures that follow may be used to determine these offset values, and **must** be used when additional cable lengths are used with the sensors.

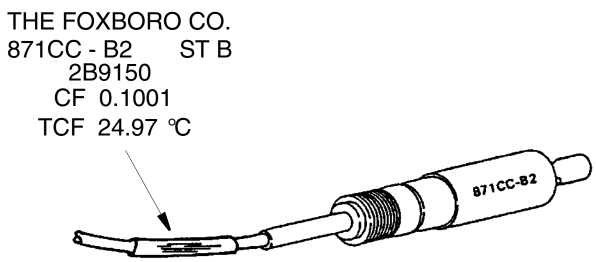


Figure 13. Sensor Identification

Determining Temperature Cell Factor (tCF)

1. Place the sensor and an accurate Celsius thermometer (with 0.10°C resolution) into a container of liquid. Allow the system to reach thermal equilibrium.
2. Press **Temp**. Then using the Δ key, put the analyzer into Automatic Temperature Compensation with a Celsius readout (no decimal point after the C). See “To View Process Temperature” on page 24. Press **Enter**. The current temperature is displayed as a whole number with the unit C alternating with the value expressed to the tenths place.
3. The value read by the 873A must now be viewed to the hundredths place. To do this, press **Temp** and then press **Next** five times. Because only three digits plus the decimal may be viewed on the display, the first digit will not be visible (e.g. 25.20 will be displayed as 5.20).
4. Determine the temperature difference of the two devices by subtracting the 873A reading from the thermometer reading; e.g., the thermometer reads 24.70°C and the 873A says (2)5.20°C; the difference is 24.70°C – 25.20°C = –0.50°C.
5. Add this value to 25.00°C (e.g., 25.00°C + (–0.50°C) = 24.50°C. This is your temperature cell factor. Now that you’ve determined the tCf, enter it as described in the next section.

Entering a tCF Value

1. Press **Shift** + **Setup**.
2. Press **Next** until “tCF” appears on the display.
3. Press **Enter.**
4. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the desired value is displayed.
5. Press **Enter**.
6. Recheck any differences that exist between the thermometer and temperature displayed on the 873A, using the technique described in the previous section.

Determining/Verifying a CF

1. Install sensor into a flowing clean water loop whose resistivity is known or along with an 871CC sensor whose cell factor is known.
2. Allow sensor to reach steady state equilibrium. Allow one hour or more for this to occur; the values displayed on the analyzer should stop changing. The cell actually will be “cleaning” itself off during this time.
3. Adjust the “U_tC” parameter to “bCAL”, see “Units and Temperature Compensation (U_tC)” on page 27.
4. Adjust and enter the “CF” parameter to .1000, see “Entering a CF Value” below.
5. Read the apparent resistivity displayed for the sensor.
6. Calculate the cell factor for the sensor using:

$$\frac{\text{Apparent Resistivity} \times 0.100}{\text{Known Solution Resistivity}} = \text{CELL FACTOR}$$

7. Enter the new “CF” parameter value, see “Entering a CF Value” on page 38.
8. Adjust the “U_tC” parameter to “H2o” if desired, see “Units and Temperature Compensation (U_tC)” on page 27.

Entering a CF Value

1. Press **Shift + Setup**.
2. Press **Next** until “CF” appears on the display.
3. Press **Enter**.
4. Use the **Next** key to select each digit and the Δ key to change the value of the digit selected until the desired value is displayed.
5. Press **Enter**.
6. Press **Meas** to return to the measure mode.

6. Diagnostics

Troubleshooting

Table 5. Troubleshooting Symptoms

Symptom	Approach
Noisy Signal	May be flow related. 1. Check Analyzer noise by simulating sensor signal with a resistor. 2. Reorient sensor.
Resistivity Increases	Gas bubbles may be trapped.
Temperature Reads Incorrectly	1. Check to see if correct tCF is being used. Extension cables and junction box use will require a new TCF be determined. 2. Verify 873A is set up for proper temperature transducer.
Accuracy	1. Accuracy of the sensor may be affected by deposits from the process liquid. Consult sensor MI for cleaning recommendations. 2. Check to see if CF was entered correctly. Extension cables and junction boxes require a new tCF.

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 messages are shown in Table 6.

Table 6. Error/Alarm Messages

Alternate Display	Condition	Priority	Action Required to Clear Message
Er 1	Instrument Fault, RAM/ROM, software watchdog timer.	1 (Highest)	Power down unit.
Err	Incorrect code of parameter entered.	2	Check code and reenter.

Table 6. Error/Alarm Messages (Continued)

Alternate Display	Condition	Priority	Action Required to Clear Message
t Er	Temperature out of range.	3	1. Replace sensor. 2. Place temperature in manual mode (e.g., 25.C.). 3. Incorrect sensor used. Check sensor material with data label.
LCAL	Low calibration required.	4	Calibrate analyzer.
HCAL	High calibration required.	4	Calibrate analyzer.
A1A2	Both alarm relays activated.	5	1. Measurement returns to within alarm bounds. 2. Alarm 1 and Alarm 2 are turned off.
Al 1	Alarm 1 relay activated.	6	1. Measurement returns to within alarm bounds. 2. Alarm 1 is turned off.
Al 2	Alarm 2 relay activated.	7	1. Measurement returns to within alarm bounds. 2. Alarm 2 is turned off.

— 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.

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 14 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.

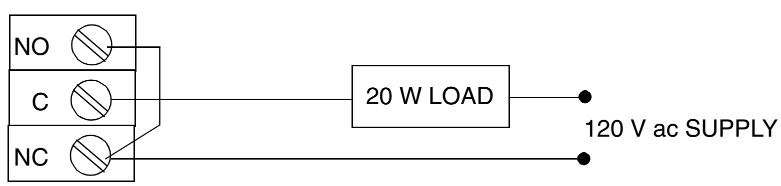


Figure 14. Alarm Contact Reconditioning Circuit

8. Warranty

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

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

WARRANTY

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