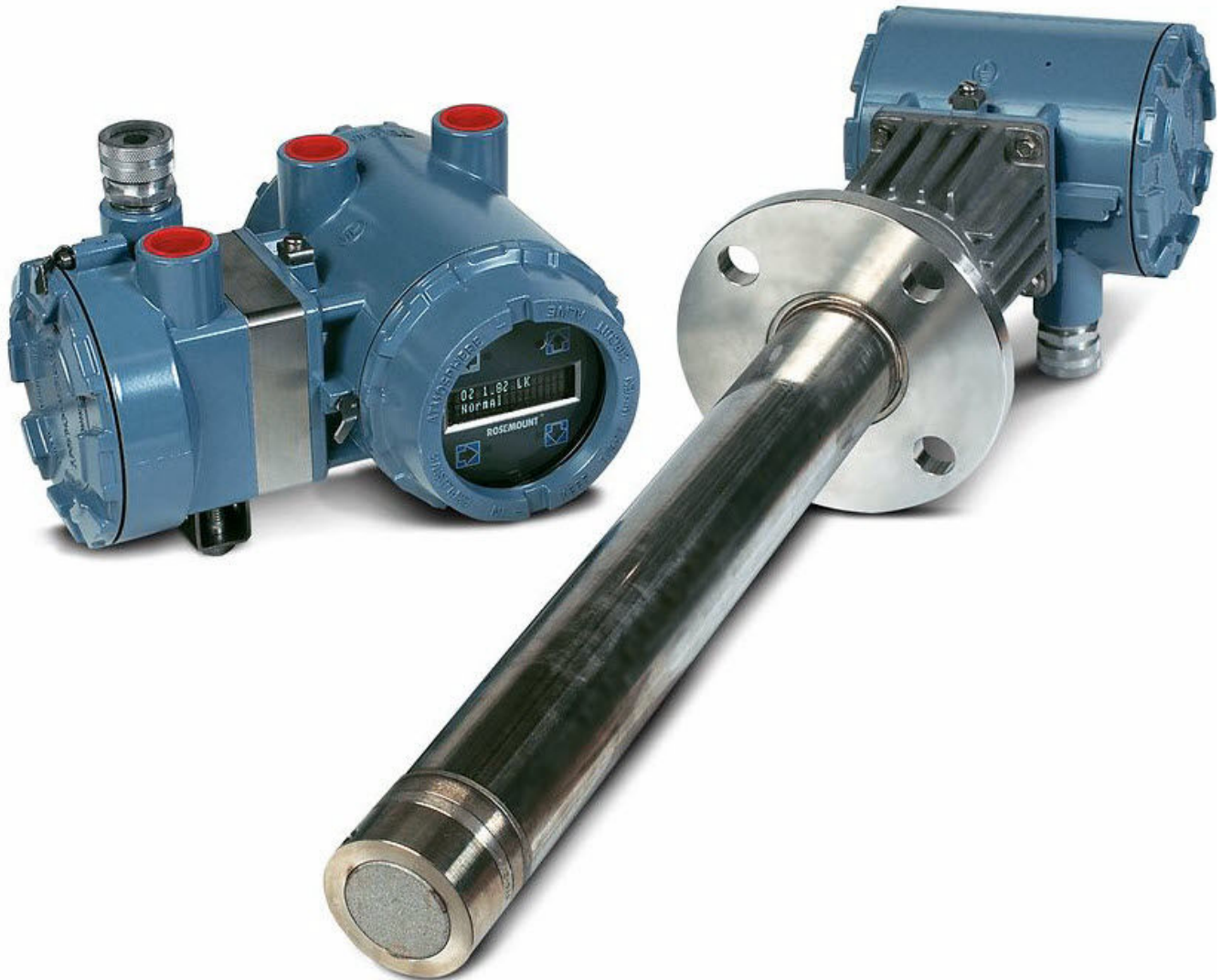


# Rosemount™ Oxymitter 4000

Hazardous Area Oxygen Transmitter



## Essential instructions

Read this page before proceeding!

Emerson designs, manufactures, and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use, and maintain them to ensure they continue to operate within their normal specifications. You must adhere to the following instructions and integrate them into your safety program when installing, using, and maintaining Emerson's Rosemount products. Failure to follow the proper instructions may cause any one of the following situations to occur: loss of life, personal injury, property damage, damage to this instrument, and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, contact your Emerson representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install equipment as specified in the installation instructions of the appropriate Quick Start Guide and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Emerson. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, and may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified people, to prevent electrical shock and personal injury.

---

### Note

The information contained in this document is subject to change without notice.

---

## CAUTION

If a Model 275/375 HART® Communicator is used with this product, the software within the Model 275/375 may require modification.

If a software modification is required, please contact your local Emerson Service Group or National Response Center at 1-800-422-6076 or 1-888-433-6829.

---

## Safety instructions

The following safety instructions apply specifically to all EU member states. They should be strictly adhered to in order to ensure compliance with the Low Voltage Directive. Non-EU states should also comply with the following unless superseded by local or national standards.

## **⚠ WARNING**

Adequate earth connections should be made to all earthing points, internal and external, where provided.

After installation or troubleshooting, all safety covers and safety grounds must be replaced. The integrity of all earth terminals must be maintained at all times.

Main supply cords should comply with the requirements of IEC227 or IEC245.

All wiring shall be suitable for use in an ambient temperature of greater than 221 °F (105 °C).

All cable glands used should be of such internal dimensions as to provide adequate cable anchorage.

To ensure safe operation of this equipment, connection to the mains supply should only be made through a circuit breaker, which will disconnect all circuits carrying conductors during a fault situation. The circuit breaker may also include a mechanically operated isolating switch. If it does not, then another means of disconnecting the equipment from the supply must be provided and clearly marked as such. Circuit breakers or switches must comply with a recognized standard, such as IEC947. All wiring must conform with any local standards.

Where equipment or covers are marked with the symbol below, hazardous voltages are likely to be present beneath. These covers should only be removed when power is removed from the equipment - and then only by trained service personnel.



Where equipment or covers are marked with the symbol below, there is a danger of hot surfaces beneath. These covers should only be removed by trained service personnel when power is removed from the equipment. Certain surfaces may remain hot to the touch.



Where equipment or covers are marked with the symbol below, refer to the reference manual for instructions.



All graphical symbols used in this product are from one or more of the following standards: EN61010, IEC417, and ISO3864.

Where equipment or labels are marked "Do Not Open While Energized" or similar, there is a danger of ignition in areas where an explosive atmosphere is present. This equipment should only be opened when the power is removed and adequate time as specified on the label or in the Reference Manual has been allowed for the equipment to cool down - and then only by trained service personnel.

## **⚠ WARNING**

Cable entry devices and blanking elements shall be Ex d certified. Cables or conductors in conduit, cable entry devices and blanking elements must be rated for 176 °F (80 °C).

## **⚠ WARNING**

### **Physical access**

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

### **Warranty**

Rosemount™ warrants that the equipment manufactured and sold by it will, upon shipment, be free of defects in workmanship or material. Should any failure to conform to this warranty become apparent during a period of one year after the date of shipment, Rosemount shall, upon prompt written notice from the purchaser, correct such nonconformity by repair or replacement, F.O.B.

factory of the defective part or parts. Correction in the manner provided above shall constitute a fulfillment of all liabilities of Rosemount with respect to the quality of the equipment.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL, OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OF FITNESS FOR PURPOSE).

The remedy(ies) provided above shall be purchaser's sole remedy(ies) for any failure of Rosemount to comply with the warranty provisions, whether claims by the purchaser are based in contract or in tort (including negligence).

Rosemount does not warrant equipment against normal deterioration due to environment. Factors, such as corrosive gases and solid particulates, can be detrimental and can create the need for repair or replacement as part of normal wear and tear during the warranty period.

Equipment supplied by Rosemount, Inc. but not manufactured by it will be subject to the same warranty as is extended to Rosemount by the original manufacturer.

At the time of installation it is important that the required services are supplied to the system and that the electronic controller is set up at least to the point where it is controlling the sensor heater. This will ensure, that should there be a delay between installation and full commissioning that the sensor being supplied with ac power and reference air will not be subjected to component deterioration.

### Definitions

The following definitions apply to Warnings, Cautions, and Notes found throughout this publication.

#### **WARNING**

Highlights an operation or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury, death, or long-term health hazards of personnel.

#### **CAUTION**

Highlights an operation or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in damage to or destruction of equipment or loss of effectiveness.

#### **Note**

Highlights an essential operating procedure, condition, or statement.

### Symbols



Earth (ground) terminal



Protective conductor terminal



Risk of electrical shock



Refer to reference manual.

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# 1 Description and specifications

## 1.1 Components checklist

A typical Rosemount™ Oxymitter 4000 should contain the items shown in [Figure 1-1](#). Record the part number, serial number, and order number for each component of your system.

### **⚠ WARNING**

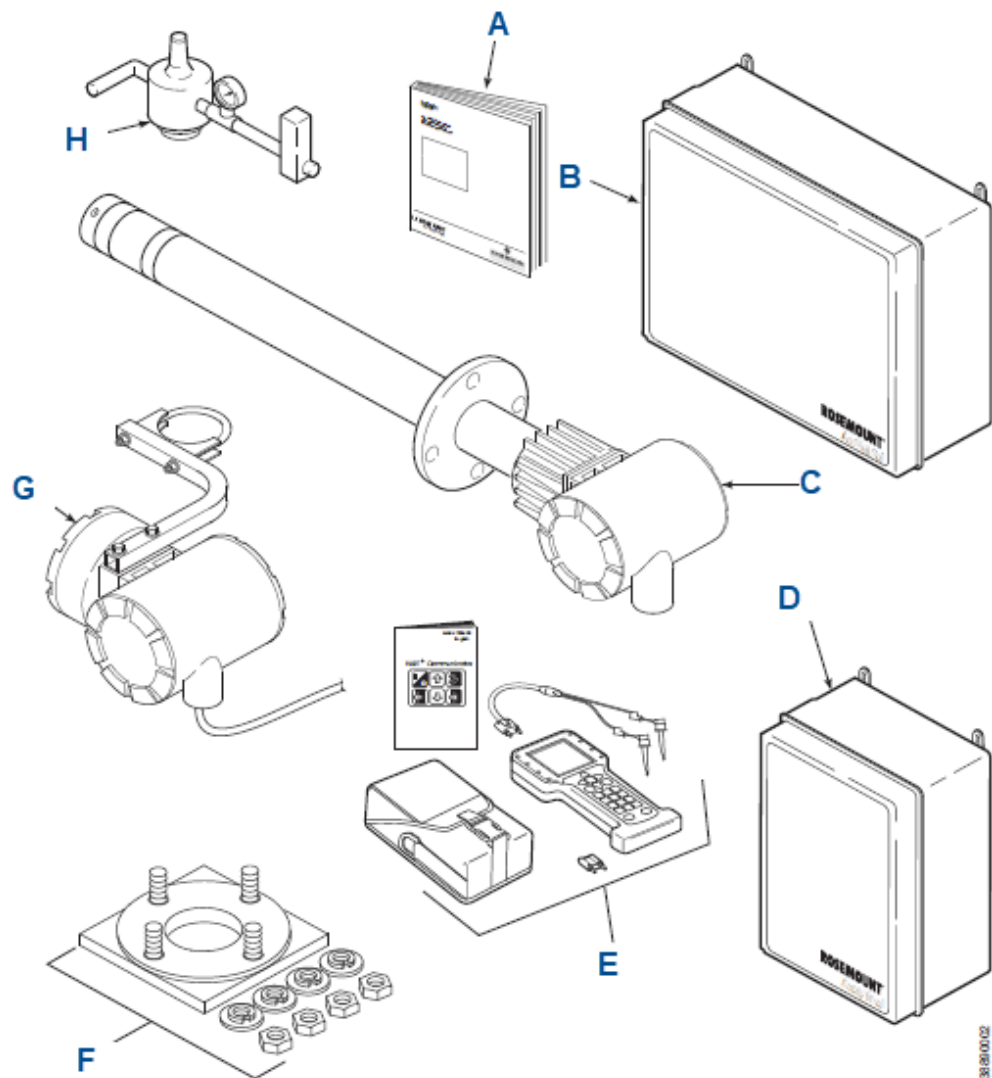
**The Rosemount Oxymitter 4000 is offered in both hazardous area and general purpose configurations.**

The hazardous area version has special markings on the approval label. The general purpose version does not. If you received the general purpose version, ensure you do not install it in a potentially explosive atmosphere.

---

Also use the following tables to compare your order number against your unit. The title of the table defines the model. The rest of the table defines the various options and features of the Rosemount Oxymitter 4000. Ensure the features and options specified by your order number are on or included with the unit.

Figure 1-1: Typical System Package



- A. Quick Start Guide
- B. Rosemount IMPS 4000 Intelligent Multiprobe Test Gas Sequencer (optional)
- C. Rosemount Oxymitter 4000 with integral electronics
- D. Rosemount SPS 4001B Single Probe Autocalibration Sequencer (optional) (safe area only)
- E. HART® Communicator package (optional)
- F. Mounting plate with mounting hardware and gasket
- G. Rosemount Oxymitter 4000 with remote electronics (optional)
- H. Reference air set (used if Rosemount SPS 4001B without reference air option or Rosemount IMPS 4000 is not supplied)

**Table 1-1: Rosemount Oxymitter 4000 Ordering Information**

<b>Code</b>	<b>Sensing probe type with flame arrestor</b>
1	Ceramic diffusion element probe (ANSI 3-in. 150 lb.)
2	Snubber diffusion element (ANSI 3-in. 150 lb.)
3	Ceramic diffusion element probe (DIN 2527): ¼-in. (6.35 mm) tube fittings
4	Snubber diffusion element (DIN 2527): ¼-in. (6.35 mm) tube fittings
7	Ceramic diffusion element (ANSI 3-in. 300 lb.)
8	Ceramic diffusion element (ANSI 4-in. 300 lb.)
<b>Code</b>	<b>Probe assembly</b>
0	18 in. (457 mm) probe
3	3 ft. (0.91 m) probe
5	6 ft. (1.83 m) probe
<b>Code</b>	<b>Mounting adapter - stack side</b>
0	No adapter plate (0 must be chosen under <i>Mounting adapter - probe side</i> below)
1	New installation - square weld plate with studs
2	Model 218 mounting plate (with Model 218 shield removed)
3	Adapter plate required; must reference adapter plate part number.
<b>Code</b>	<b>Mounting adapter - probe side</b>
0	No adapter plate
1	Probe only (ANSI)
4	Probe only (DIN)
<b>Code</b>	<b>Electronic housing &amp; filtered customer termination - Type® 4X, IP66</b>
12	HART integral electronics, transient protected filtered termination, ATEX certification
14	HART remote electronics (requires cable), transient protected termination, ATEX certification
22	HART integral electronics, transient protected termination, CSA certification
24	HART remote electronics (requires cable), transient protected termination, CSA certification
<b>Code</b>	<b>Communications</b>
1	Membrane keypad - HART capable
2	Membrane keypad - HART capable glass window
3	Gas fluorescent LOI HART capable, glass window, English only

**Table 1-1: Rosemount Oxymitter 4000 Ordering Information (continued)**

Code	Language
1	English
2	German <sup>(1)</sup>
3	French <sup>(1)</sup>
4	Spanish <sup>(1)</sup>
5	Italian <sup>(1)</sup>
Code	Termination filtering
00	No option - specified as part of electronic housing
Code	Calibration accessories
00	No hardware
01	Cal/Ref flow meters and ref pressure regulator
Code	Hazardous area approval
00	Specified as part of electronics
Code	Electronics to probe cable
00	No cable
10	20 ft. (6 m) cable
11	40 ft. (12 m) cable
12	60 ft. (18 m) cable
13	80 ft. (24 m) cable
14	100 ft. (30 m) cable
15	150 ft. (45 m) cable
16	200 ft. (61 m) cable

(1) Membrane keypad only.

**Note**

1. Recommended uses: High velocity particulates in flue stream, installation within 11.5 ft. (3.5 m) of soot blowers or heavy salt cake buildup. Applications: pulverized coal, recovery boilers, or lime kiln.
2. Where possible, specify ANSI or DIN designation; otherwise, provide details of existing mounting plate as follows:

Plate with studs	Bolt circle diameter, number and arrangement of studs, stud thread, and stud height above mounting plate
Plate without studs	Bolt circle diameter, number, and arrangement of holes, threads, and depth of stud mounting plate with accessories

- You can use the membrane keypad to start up, calibrate, and operate the transmitter. Remote access and additional functionality available via HART Communications.

**Table 1-2: Rosemount OXT4CDR Oxymitter Probes**

<b>Code</b>	<b>Sensing probe type with flame arrester</b>
1	Ceramic diffusion element probe (ANSI), 115 V heater
2	Snubber diffusion element (ANSI), 115 V heater
3	Ceramic diffusion element probe (DIN), 115 V heater
4	Snubber diffusion element probe (DIN), 115 V heater
7	Ceramic diffusion element probe (ANSI) 3-in. 300 lb. bolt circle, 115 V heater
8	Snubber diffusion element probe (ANSI) 3-in. 300 lb. bolt circle, 115 V heater
A	Ceramic diffusion element probe (ANSI), 44 V heater
B	Snubber diffusion element (ANSI), 44 V heater
C	Ceramic diffusion element probe (DIN), 44 V heater
D	Snubber diffusion element (DIN), 44 V heater
<b>Code</b>	<b>Probe assembly</b>
0	18 in. (457 mm) probe
3	3 ft. (0.91 m) probe
5	6 ft. (1.83 m) probe
<b>Code</b>	<b>Mounting adapter - stack side</b>
0	No adapter plate
1	Probe only (ANSI)
4	Probe only (DIN)
<b>Code</b>	<b>Electronic housing &amp; filter customer termination - Type 4X, IP66</b>
12	Transient protected filtered termination
<b>Code</b>	<b>Existing electronics</b>
03	No hardware, for use with 218A Electronics, World Class IFT, or Oxymitter or X, V Electronics
07	Westinghouse/Rosemount digital 132 electronics
08	Yokogawa ZA-8 series electronics - max. operating temp of junction box is 149 °F (65 °C).
09	Other competitive electronics - specify brand and model
<b>Code</b>	<b>Hazardous area approval</b>
10	ATEX

**Table 1-2: Rosemount OXT4CDR Oxymitter Probes (continued)**

20	CSA
----	-----

**Table 1-3: Rosemount OXT4CNF: Oxymitter 4000 - In Situ Oxygen Transmitter**

<b>Code</b>	<b>Sensing probe without flame arrestor</b>
1	Ceramic diffusion element probe (ANSI 3 in. [76,2 mm] 150 lb. [68 kg])
2	Snubber diffusion element (ANSI 3 in. [76,2 mm] 150 lb. [68 kg])
3	Ceramic diffusion element probe (DIN 2527) - ¼-in. (6.35 mm) tube fittings
4	Snubber diffusion element (DIN 2527) - ¼-in. (6.35 mm) tube fittings
7	Ceramic diffusion element probe (ANSI 3 in. [76.2 mm] 300 lb. [136,1 kg])
8	Ceramic diffusion element probe (ANSI 4 in. [101.6 mm] 300 lb. [136.1 kg])
<b>Code</b>	<b>Probe assembly</b>
0	18 in. (457 mm) probe
3	3 ft. (0.91 m) probe
5	6 ft. (1.83 m) probe
<b>Code</b>	<b>Mounting adapter - stack side</b>
0	No adapter plate (0 must be chosen under <i>Mounting adapter - probe side</i> below).
1	New installation - square weld plate with studs
2	Model 218 mounting plate (with Model 218 shield removed)
3	Adapter plate required - must reference adapter plate part number.
<b>Code</b>	<b>Mounting adapter - probe side</b>
0	No adapter plate
1	Probe only (ANSI)
4	Probe only (DIN)
<b>Code</b>	<b>Electronics housing &amp; filtered customer termination, Type 4X, IP66</b>
12	HART electronics, mounted integral to probe, transient protected termination. ATEX certification
14	HART electronics, mounted remotely, transient protected termination; requires cable. ATEX certification
22	HART electronics, mounted integral to probe; CSA certification
24	HART electronics (requires cable), transient protected termination, CSA certification

**Table 1-3: Rosemount OXT4CNF: Oxymitter 4000 - In Situ Oxygen Transmitter (continued)**

Code	Communications
1	Electronics with membrane keypad with blind cover
2	Electronics with membrane keypad with window cover
3	Electronics with LOI display with window cover (English only)
Code	Language (membrane keypad only)
1	English
2	German
3	French
4	Spanish
5	Italian
Code	Calibration accessories
00	No hardware
01	Cal/ref flow meter & reference pressure regulator
Code	Electronics to probe cable
00	No cable - integral electronics or reusing existing cable
10	20 ft. (6 m) cable
11	40 ft. (12 m) cable
12	60 ft. (18 m) cable
13	80 ft. (24 m) cable
14	100 ft. (30 m) cable
15	150 ft. (45 m) cable
16	200 ft. (60 m) cable

**Table 1-4: Rosemount OXT4CDRNF: Oxymitter 4000 In-Situ Oxygen Transmitter - DR Probe, Optional Rosemount Xi Electronics, Safe Area Only**

Code	Sensing probe type without flame arrestor
1	Ceramic diffusion element probe (ANSI), 115 V heater
2	Snubber diffusion element (ANSI), 115 V heater
3	Ceramic diffusion element probe (DIN), 115 V heater
4	Snubber diffusion element (DIN), 115 V heater
7	Ceramic diffusion element probe (ANSI) 3-in. (76 mm) 300 lb. (136,1 kg) bolt circle for acidic service, 115 V heater
8	Ceramic diffusion element probe (ANSI) 4-in. (102 mm) 300 lb. (136,1 kg) bolt circle for acidic service, 115 V heater

**Table 1-4: Rosemount OXT4CDRNF: Oxymitter 4000 In-Situ Oxygen Transmitter - DR Probe, Optional Rosemount Xi Electronics, Safe Area Only (continued)**

Code	Probe assembly
0	18 in. (457 mm) probe
3	3 ft. (0.91 m) probe
5	6 ft. (1.83 m) probe
Code	Mounting adapter - stack side
0	No adapter plate. For this option, you must select 0 for the mounting adapter, probe side.
1	New installation - square weld plate with stud
2	Model 218 mounting plate (with model 218 shield removed)
3	Adapter plate required; must reference adapter plate part number.
Code	Mounting adapter - probe side
0	No adapter plate
1	Probe only (ANSI)
4	Probe only (DIN)
Code	Electronics housing and filtered customer termination. Type 4X, IP66
12	Transient protected filtered termination
Code	Arrangement
03	No hardware. For use with 218 analog electronics, world-class IFT electronics or Rosemount Oxymitter electronics, Xi electronics
04	(1A) Digital
07	(1A) Model 132 digital
08	Yokogawa Electronics
09	Other competitive electronics: specify brand and mode.
Code	Hazardous area approval
10	ATEX approved
20	CSA approved

**Table 1-5: Calibration Components**

Part number	Description
1A99119G01	Calibration gas kit: Contains 0.4% and 8.0% O <sub>2</sub> bottles, 145.3 gal. (550 L) each (requires two CGA-590 regulators) <sup>(1)</sup>
1A99119G02	Calibration gas regulators kit: Contains two CGA-590 regulators
1A99119G03	Wall bracket kit for two O <sub>2</sub> gas bottles

(1) Calibration gas bottles cannot be shipped via air freight.



**Table 1-6: Rosemount™ Intelligent Multiprobe Test Gas Sequencer Versions (General Purpose Only)**

Part number	Description
3D39695G01	Intelligent multiprobe sequencer (IMPS) - 1 probe
3D39695G02	IMPS - 2 probes
3D39695G03	IMPS - 3 probes
3D39695G04	IMPS - 4 probes
3D39695G05	IMPS with 115 V heater - 1 probe
3D39695G06	IMPS with 115 V heater - 2 probes
3D39695G07	IMPS with 115 V heater - 3 probes
3D39695G08	IMPS with 115 V heater - 4 probes
3D39695G09	IMPS with 220 V heater - 1 probe
3D39695G10	IMPS with 220 V heater - 2 probes
3D39695G11	IMPS with 220 V heater - 3 probes
3D39695G12	IMPS with 220 V heater - 4 probes

## 1.2 Overview

A typical Rosemount™ Oxymitter 4000 should contain the items shown in [Figure 1-1](#). Record the part number, serial number, and order number of each component of your system.

The transmitter comes with the following:

- Signal conditioning electronics that output a 4-20 mA signal representing an O<sub>2</sub> value.
- A membrane keypad or full function local operator interface for setup, calibration, and diagnostics.

You can also access information from the transmitter with a HART® handheld communicator or Asset Management Solution (AMS) software.

## 1.3 Measurement

Emerson designed the Rosemount™ Oxymitter 4000 to measure the net concentration of oxygen in an industrial process (i.e., the oxygen remaining after all fuels have been oxidized). The probe is permanently positioned within an exhaust duct or stack and performs its task without a sampling system.

The equipment measures oxygen percentage by reading the voltage developed across a heated electrochemical cell, which consists of a small yttria stabilized zirconia (YSZ) disc. Both sides of the disc are coated with porous metal electrodes. When the equipment is operated at the proper temperature, the following Nernst equation gives the millivolt output of the cell:

$$EMF = KT \log_{10}(P1/P2) + C$$

Where:

- P2 is the partial pressure of the oxygen in the measured gas on one side of the cell.
- P1 is the partial pressure of the oxygen in the reference air on the opposite side of the cell.
- T is the absolute temperature.
- C is the cell constant.
- K is an arithmetic constant.

---

**Note**

For best results, use clean, dry, instrument air (20.95 percent oxygen) as the reference air.

---

When the cell is at an operating temperature and there are unequal oxygen concentrations across the cell, oxygen ions will travel from the high oxygen partial pressure side to the low oxygen partial pressure side of the cell. The resulting logarithmic output voltage is approximately 50 mV per decade. The output is proportional to the inverse logarithm of the oxygen concentration. Therefore, the output signal increases as the oxygen concentration of the sample gas decreases. This characteristic enables the transmitter to provide exceptional sensitivity at low oxygen concentrations.

The transmitter measures net oxygen concentration in the presence of all the products of combustion, including water vapor. Therefore, it may be considered an analysis on a "wet" basis. In comparison with older methods, such as the portable apparatus, which analyze on a "dry" basis, the "wet" analysis will, in general, indicate a lower percentage of oxygen. The difference between the "dry" and "wet" analyses will be proportional to the water content of the gas stream.

## 1.4 Configuration

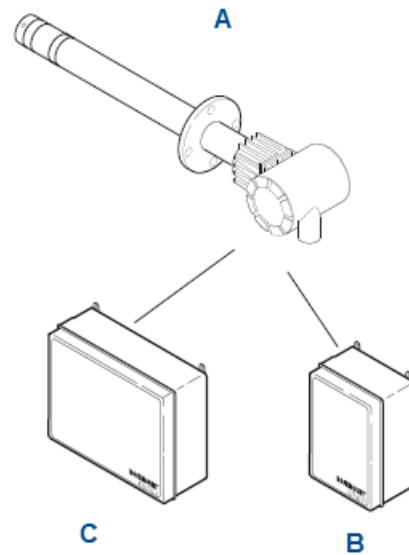
Rosemount™ Oxymitter 4000 Transmitters are available in three length options, giving the operator flexibility to use an in situ penetration appropriate to the size of the stack or duct. The options are:

- Length: 18 in. (457 mm), weight: 29 lb. (13.15 kg)
- Length: 3 ft. (0.91 m), weight: 34 lb. (15.42 kg)
- Length: 6 ft. (1.83 m), weight: 44 lb. (19.96 kg)

The electronics control probe temperature and provide an isolated output, 4-20 mA, that is proportional to the measured oxygen concentration. The power supply can accept voltages of 90 - 250 Vac and 48/62 Hz; no setup procedures are required. Modulating the duty cycle of the probe heater portion of the electronics maintains the oxygen sensing cell at a constant temperature. The electronics accepts millivolt signals generated by the sensing cell and produces the outputs to be used by remotely connected devices. The output is an isolated 4-20 mA current.

The transmitter is available with an integral or remote electronics package. Two calibration gas sequencers are available, the Rosemount IMPS 4000 and the Rosemount SPS 4001B (Figure 1-2). The operator must install the Rosemount IMPS 4000 and the Rosemount SPS 4001B in a nonhazardous, explosive-free environment.

**Figure 1-2: Rosemount Oxymitter 4000 Autocalibration System Options**



- A. Rosemount Oxymitter 4000
- B. Rosemount SPS 40001B (1 probe). Must be installed in a safe area.
- C. Rosemount IMPS 4000 (1 to 4 probes). Must be installed in a safe area or be X- or Z-purged by the customer.

Systems with multiprobe applications may employ an optional Rosemount IMPS 4000 Intelligent Multiprobe Test Gas Sequencer. The Rosemount IMPS 4000 provides automatic calibration gas sequencing for up to four Rosemount Oxymitter 4000 units and accommodates autocalibrations based on the CALIBRATION RECOMMENDED signal from the transmitter, a timed interval set up in HART® or the Rosemount IMPS 4000, or whenever a calibration request is initiated.

For systems with one or two transmitter units per combustion process, the operator can use an optional Rosemount SPS 4001B Single Probe Autocalibration Sequencer with each transmitter to provide automatic calibration gas sequencing. The sequencer performs autocalibrations based on the CALIBRATION RECOMMENDED signal from the transmitter, a timed interval set up in HART, or whenever a calibration request is initiated.

## 1.5 Features

The cell output voltage and sensitivity increase as the oxygen concentration decreases.

The Rosemount™ Oxymitter 4000 includes:

- An optional local operator interface (LOI), which allows continual O<sub>2</sub> display and full interface capability.
- Field replaceable cell, heater, thermocouple, diffuser, and PC boards.
- Rugged 316L stainless steel wetted parts.
- Electronics adaptable for line voltages from 90 - 250 Vac; no configuration is necessary.

- Membrane keypad available in five languages: English, French, German, Italian, and Spanish.

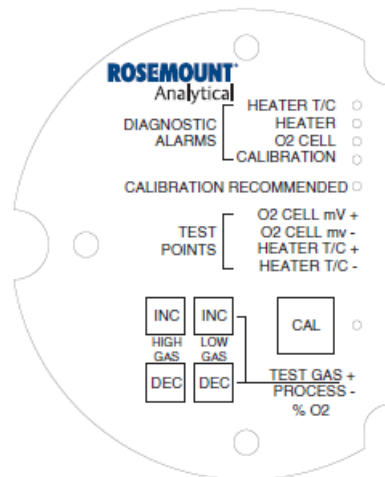
An operator can communicate with the transmitter in one of three ways:

- Membrane keypad
- Local operator interface (LOI)
- Optional HART® interface

## 1.5.1 Membrane keypad

The membrane keypad and HART® communications are standard.

**Figure 1-3: Membrane Keypad**



### ⚠ WARNING

#### Accessing the probe keypad requires opening the electronics housing.

Opening the electronics housing will cause the loss of all hazardous permits. Opening the electronics housing in hazardous areas may cause an explosion resulting in loss of property, severe personal injury, or death.

You may need to get a hot work permit from your company safety officer before opening the electronic housing.

The membrane keypad, housed within the right side of the electronics housing, provides flashing LEDs to indicate faults. You can calibrate from the membrane keypad.

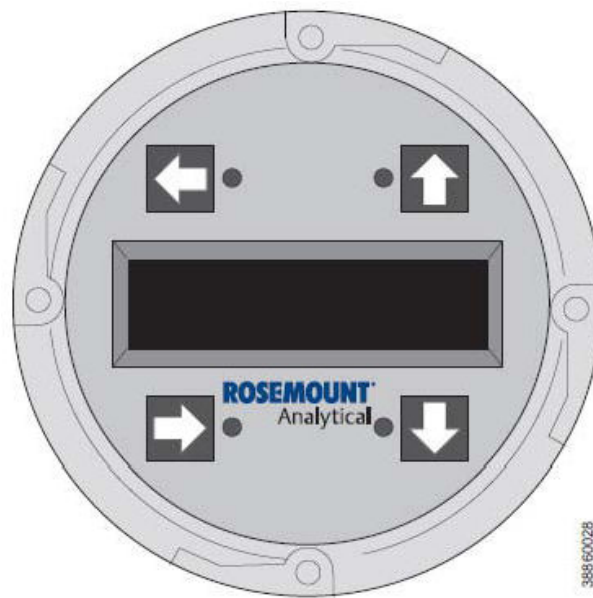
To use the HART capability, you must have either:

- HART handheld communicator.
- Asset Management Solution (AMS) software for the PC.

## 1.5.2 Local operator interface (LOI)

The optional LOI takes the place of the membrane keypad and allows local communication with the electronics.

**Figure 1-4: LOI**



## 1.5.3 Optional HART® interface

The transmitter's 4-20 mA output line transmits an analog signal proportional to the oxygen level. The HART output is superimposed on the 4-20 mA output signal.

### **⚠ WARNING**

**The HART option is not protected by energy limiting barriers.**

Do not interface with the HART option from within the hazardous area.  
Route the 4-20 mA cables and make the connections outside the hazardous area.  
This is the case even when using the intrinsically safe version of the handheld communicator.

You can access HART information through the following:

- Handheld communicator: Requires device description (DD) software specific to the Rosemount™ Oxymitter 4000. The DD software is supplied with many handheld communicator units, but Emerson service technicians can also program it into existing units.
- Personal computer (PC): Requires AMS software available from Emerson.
- Selected distributed control systems: Requires input/output (I/O) hardware and AMS software.

## 1.6 System considerations

Prior to installing the transmitter, make sure you have all the components necessary for installation. Ensure all the components are properly integrated to make the system functional.

### ⚠ CAUTION

#### Handle with care

The Rosemount™ Hazardous Area Oxymitter 4000 is designed for industrial applications. Some probe components are made from ceramics, which are susceptible to shock when mishandled.

Take adequate antistatic precautions to prevent equipment damage when handling printed circuit boards and integrated circuits.

Treat each component of the system with care to avoid physical damage.

After verifying that you have all the components, select mounting locations and determine how each component will be placed in terms of available line voltage, ambient temperatures, environmental considerations, convenience, and serviceability.

### ⚠ WARNING

#### The HART option is not protected by energy limiting barriers.

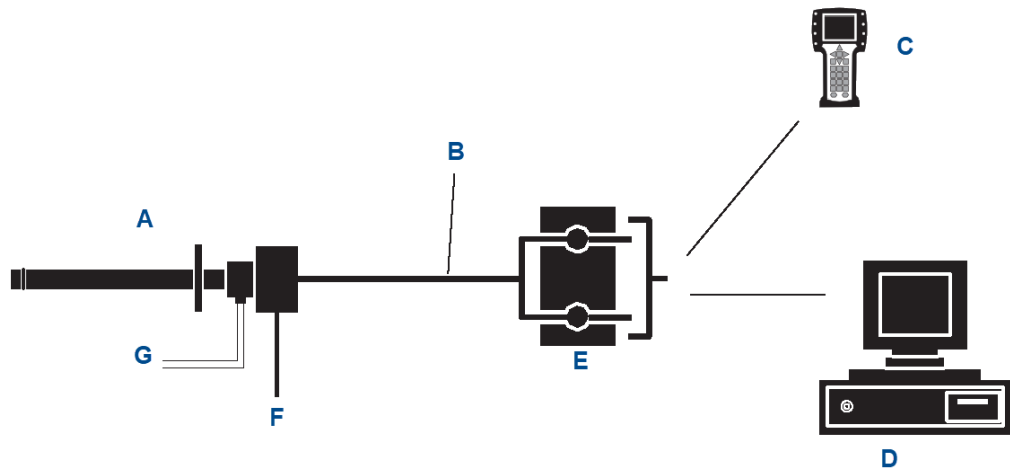
Do not interface with the HART option from within the hazardous area.

Route the 4-20 mA cables and make the connections outside the hazardous area.

This is the case even when using the intrinsically safe version of the handheld communicator.

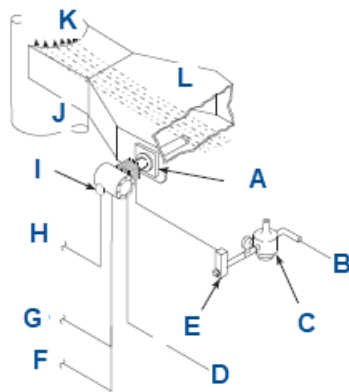
[Figure 1-5](#) shows a typical system wiring. [Figure 1-6](#) shows a typical system installation with integral electronics. [Figure 1-9](#) shows a typical installation with remote electronics.

**Figure 1-5: Rosemount Oxymitter 4000 HART® Connections and AMS Application**



- A. Rosemount Oxymitter 4000 with integral electronics
- B. 4-20 mA output (twisted pairs)
- C. HART handheld interface
- D. Asset Management Solutions
- E. Termination in control room
- F. Line voltage
- G. Two calibration gas lines by customer (300 ft. [90 m]) maximum

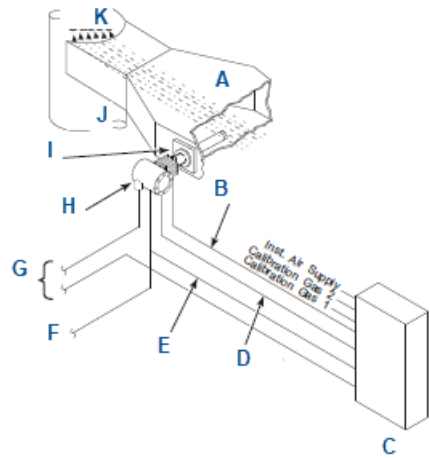
**Figure 1-6: Standard Installation with Integral Electronics**



- A. Adapter plate
- B. Instrument air supply (reference air)
- C. Pressure regulator
- D. Calibration gas
- E. Flow meter
- F. 4 to 20 mA signal
- G. Logic I/O
- H. Line voltage
- I. Rosemount Oxymitter 4000
- J. Stack
- K. Gases
- L. Duct

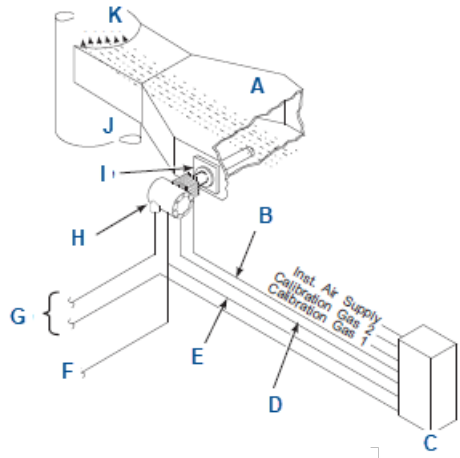


**Figure 1-7: Rosemount IMPS 4000 Multiprobe Autocalibration Option Installation with Integral Electronics**



- A. Duct
- B. Calibration gas
- C. Rosemount IMPS 4000
- D. Reference air
- E. Logic I/O
- F. 4 to 20 mA signal
- G. Line voltage
- H. Rosemount Oxymitter 4000
- I. Adapter plate
- J. Stack
- K. Gases

**Figure 1-8: Rosemount 4001B Single Probe Autocalibration Option (with Reference Air Option) Installation with Integral Electronics**

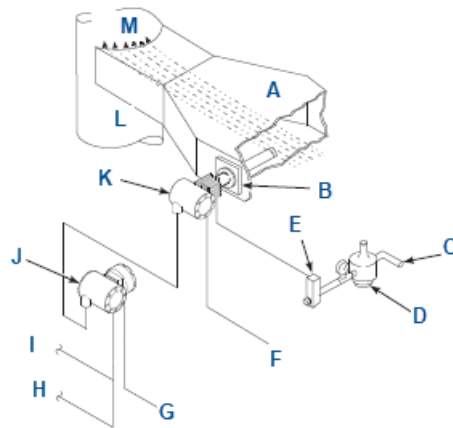


- A. Duct
- B. Calibration gas
- C. Rosemount SPS 4001B
- D. Reference air
- E. Logic I/O
- F. 4 to 20 mA signal
- G. Line voltage
- H. Rosemount Oxymitter 4000
- I. Adapter plate
- J. Stack
- K. Gases

**⚠ WARNING**

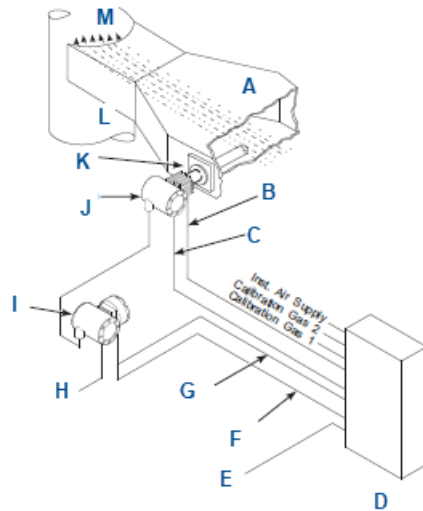
Install the Rosemount IMPS 4000 and SPS 4001B in a non-hazardous, explosive-free environment.

**Figure 1-9: Standard Installation with Remote Electronics**



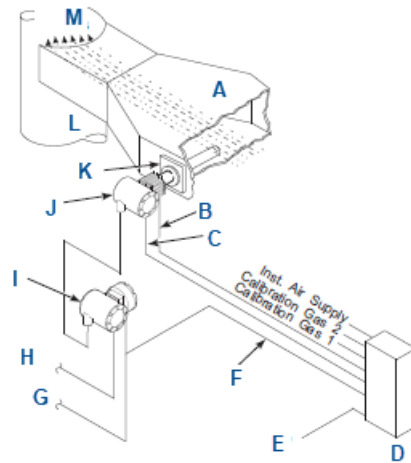
- A. Duct
- B. Adapter plate
- C. Instrument air supply (reference air)
- D. Pressure regulator
- E. Flow meter
- F. Calibration gas
- G. Line voltage
- H. 4 to 20 mA signal
- I. Logic I/O
- J. Remote electronics
- K. Rosemount Oxymitter 4000
- L. Stack
- M. Gases

**Figure 1-10: Rosemount IMPS 4000 Multiprobe Autocalibration Option Installation with Remote Electronics**



- A. Duct
- B. Calibration gas
- C. Reference air
- D. Rosemount IMPS 4000
- E. Line voltage
- F. 4 to 20 mA signal
- G. Logic I/O
- H. Line voltage
- I. Remote electronics
- J. Rosemount Oxymitter 4000
- K. Adapter plate
- L. Stack
- M. Gases

**Figure 1-11: Rosemount SPS 4001B Single Probe Autocalibration Option (with Reference Air Option) Installation with Remote Electronics**



- A. Duct
- B. Calibration gas
- C. Reference air
- D. Rosemount SPS 4001B
- E. Line voltage
- F. Logic I/O
- G. 4 to 20 mA signal
- H. Line voltage
- I. Remote electronics
- J. Rosemount Oxymitter 4000
- K. Adapter plate
- L. Stack
- M. Gases

A source of instrument air is optional at the transmitter for reference air use. Since the unit can be equipped with an in-place calibration feature, you can make provisions to permanently connect calibration gas bottles to the transmitter. If you are permanently connecting the calibration gas bottles, use a check valve next to the calibration fittings on the integral electronics. The check valve is to prevent breathing of the calibration gas and subsequent flue gas condensation and corrosion. The check valve is in addition to the stop valve in the calibration gas kit and solenoid valves in the Rosemount IMPS 4000 or SPS 4001B.

#### Note

The integral electronics is rated Type 4X (IP66) and is capable of operation at temperatures up to 185 °F (85 °C). The optional LOI is also rated for operation at temperatures up to 185 °F (85 °C). The infrared keypad functionality will degrade at temperatures above 158 °F (70 °C).

Retain the transmitter's original packaging in case you need to ship the components to another site. This packaging is designed to protect the product.

## 1.7 Optional Rosemount IMPS 4000

The programmable lead controller (PLC) in the Rosemount IMPS 4000 provides fault indications using flashing LEDs and LCD display messages.

### ⚠ WARNING

Install the Rosemount IMPS 4000 in a non-hazardous, explosive-free environment. Refer to the Rosemount IMPS Intelligent Multiprobe Test Gas Sequencer Reference Manual for more information.

## 1.8 Optional Rosemount SPS 4001B

### ⚠ WARNING

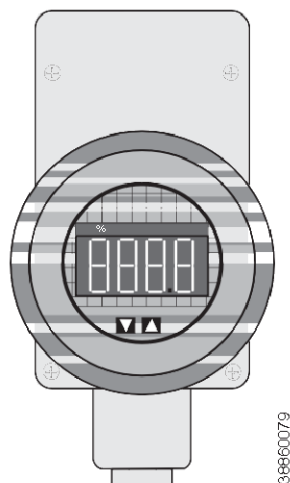
Install the Rosemount SPS 4001B in a non-hazardous, explosive-free environment. For further information, refer to the Rosemount SPS 4001B Single Probe Autocalibration Sequencer [Reference Manual](#).

## 1.9 Rosemount 751 remote powered loop LCD display

The optional Rosemount 751 remote mounted LCD display panel is loop driven by the 4-20 mA output signal representing the O<sub>2</sub> percentage.

The display provides a simple, economical means to obtain accurate, reliable, and remote indication of important process variables. This display operates on the 4-20 mA line from the Rosemount Hazardous Area Oxymitter 4000.

**Figure 1-12: Rosemount 751 Remote Powered Loop LCD Display**



Refer to the Rosemount 751 Remote Powered Loop LCD Display [Reference Manual](#) for calibration and wiring.

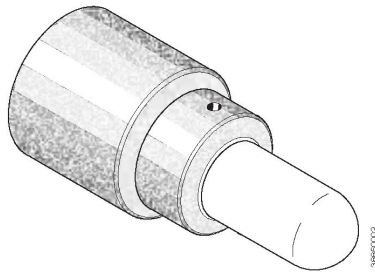
## 1.10 Probe options

### 1.10.1 Diffusion elements

#### Flame arrestor ceramic diffusion assembly

The ceramic diffusion assembly includes a set of baffles between the cell and stack gases. This keeps 1500 °F (816 °C) cell temperatures from igniting unburned fuel in the stack. The ceramic diffusion assembly is also available with a dust seal for use with the abrasive shield assembly.

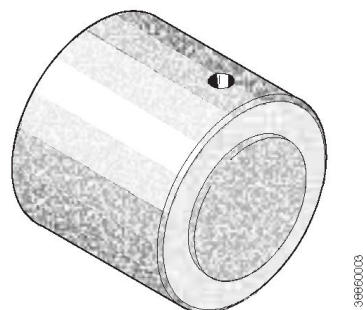
**Figure 1-13: Flame Arrestor Ceramic Diffusion Assembly**



#### Flame arrestor snubber diffusion assembly

The snubber diffusion assembly is satisfactory for most applications. This element is also available with a dust seal for use with an abrasive shield.

**Figure 1-14: Flame Arrestor Snubber Diffusion Assembly**

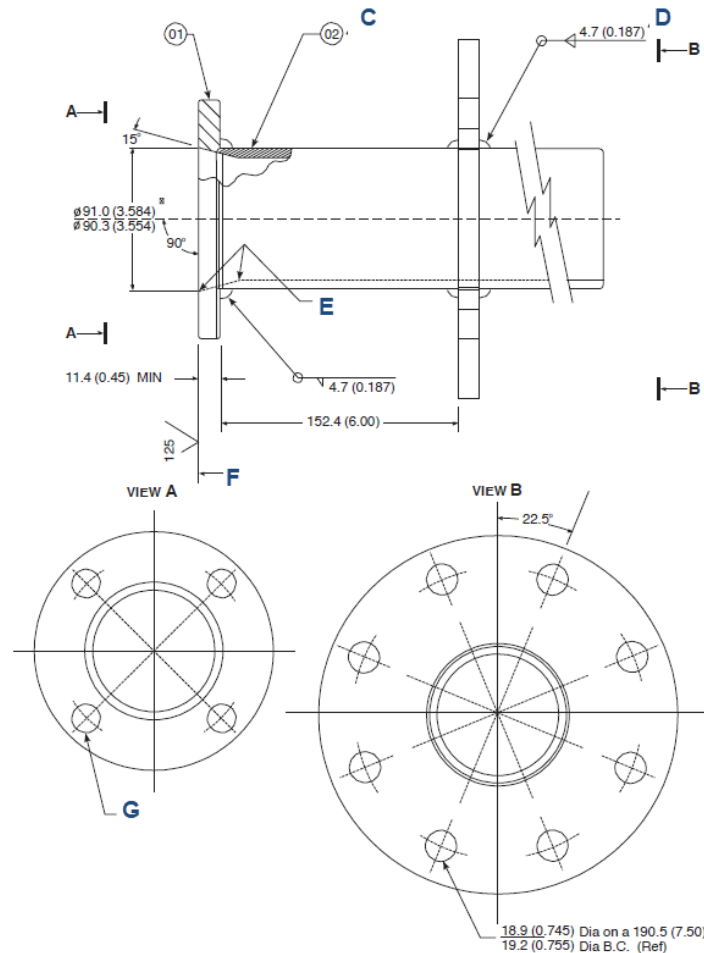


### 1.10.2 Abrasive shield assembly

The abrasive shield assembly is a stainless steel tube that surrounds the probe assembly. The shield protects against particle abrasion and condensations, provides a guide for ease of insertion, and acts as a positive support, especially for longer probes. The abrasive

shield assembly uses a modified diffusor and vee deflector assembly, fitted with dual dust seal packing.

**Figure 1-15: Abrasive Shield Assembly**



Dimensions are millimeters with inches in parentheses.

- A. View A.
- B. View B.
- C. Before welding, butt item 02 with item 01 as shown.
- D. Weld on both sides with expanding chill block.
- E. On inside  $\varnothing$  break for smooth rounded edge on both ends of chamber.
- F. Skin cut face for 90°.
- G.  $\varnothing$  0.75 in. (19 mm) through four places equally spaced on  $\varnothing$  4.75 in. (120.65 mm) B.C.

**Note**


In highly abrasive applications, rotate the shield 90 degrees at normal service intervals to present a new wear surface to the abrasive flow stream.



## 1.11 Specifications

### 1.11.1 Performance specifications

User configurable O <sub>2</sub> range	Variable 0-10% to 0-40% (Rosemount™ Xi electronics offer 0-50% O <sub>2</sub> range)
Temperature limits	Process: 32 to 1300 °F (0 to 705 °C), up to 2400 °F (1300 °C) with optional accessories Electronics housing: -40 to 158 °F (-40 to 70 °C) Electronics package: -40 to 185 °F (-40 to 85 °C) Operating temperature inside of instrument housing, as measured by HART® communicator, Rosemount Asset Management Solutions software) Local operator interface: -40 to 158 °F (-40 to 70 °C), ambient/ -40 to 185 °F (-40 to 85 °C), internal (At temperatures above 158 °F (75 °C) inside infrared housing, the infrared keypad will cease to function, but the transmitter will continue to operate properly.)
Mounting and mounting position	Vertical or horizontal A spool piece (PN 3D39761G02) is available to offset transmitter housing from host ductwork.
Accuracy in oxidizing conditions	±0.75% of reading or 0.05% of O <sub>2</sub> , whichever is greater
Process temperature effect on repeatability	Less than .05% O <sub>2</sub> from 212 to 1292 °F (100 to 700 °C)
Lowest detectable limit	0.02% O <sub>2</sub>
System speed of response to calibration gas	T <sub>initial</sub> < 3 seconds T <sub>90</sub> < 8 seconds Response to process gas changes will vary depending on process gas velocity and particulate loading of the diffuser.
Calibration	Manual, semi-automatic, or automatic
Calibration gas repeatability	±0.02% O <sub>2</sub>
Accuracy in reducing conditions	±0.10% of reading or 0.1% O <sub>2</sub> , whichever is greater
System responses in reducing conditions	Oxidizing to reducing: T <sub>90</sub> in 120 sec. Reducing to oxidizing: T <sub>90</sub> in 30 sec.
Calibration gases	Low: 0.4 to 2% O <sub>2</sub> , balance nitrogen High: 8 to 21% O <sub>2</sub> , balance nitrogen Regulate to 20 psi (137.9 kPa), 5 standard cubic feet in gas per hour (SCFH) (2.36 L/min)
Reference air	2 SCFH (1 L/min), clean, dry, instrument quality air (20.95% O <sub>2</sub> ), regulated to 2.5 psi (34 kPa)
Pollution degree	2
Over voltage category	II

Relative humidity	5 to 95% (non-condensing)
Signals	Analog output/HART: 4-20 mA isolated from power supply, 950 ohms maximum load Logic I/O: Two terminal logic contact configurable as either an alarm output or as a bi-directional calibration handshake signal to Rosemount IMPS 4000 or SPS 4001B, self-powered (+5V) in series with 340 ohms conduit ports: 3/4-in. -14 national pipe thread (NPT) (for analog output and logic I/O signal lines)
Power requirements	Normal operation: 175 W Maximum (warmup): 500 W
Ambient operating temperature (junction box)	200 °F (93 °C) 160 °F (71 °C) maximum for YEW replacement
	Rosemount has satisfied all obligations coming from the European legislation to harmonize the product requirements in Europe.

## 1.11.2 Electrical specifications

### Rosemount Oxymitter power requirements and consumption

<b>Probe heater electrical power</b>	100 to 240 V $\pm$ 10 percent, 50/60 Hz
<b>Power consumption of probe heater</b>	776 VA maximum during warm-up
<b>Electrical power of Rosemount Oxymitter or optional Xi electronics</b>	120 to 240 V $\pm$ 10 percent, 50/60 Hz
<b>Power consumption of Rosemount Xi</b>	10 watts maximum
<b>Transmitter electrical power</b>	12 to 42 Vdc (loop-powered from the control room or from the Rosemount Xi box)

### Rosemount Xi power requirements and consumption

<b>Electrical power</b>	100 to 240 V $\pm$ 10 percent, 50 -60 Hz
<b>Power consumption</b>	Traditional architecture: 776 VA maximum Digital architecture: 12 VA maximum

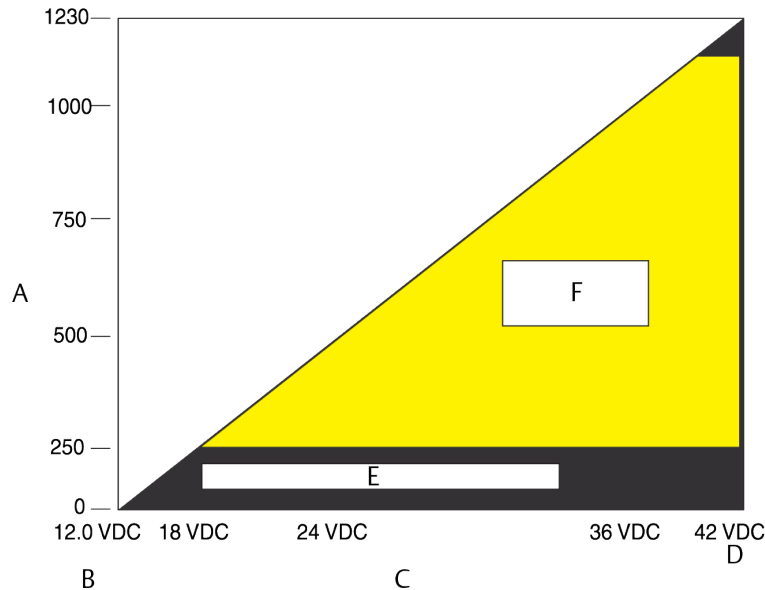
### Rosemount SPS 4001B power requirements

100 to 240 Vac, 50/60 Hz, 15 VA

### Rosemount IMPS 4000 power requirements

85 to 264 Vac, 50/60 Hz, 50 VA

**Figure 1-16: Rosemount Oxymitter Electronics and Rosemount Xi Maximum Loop Resistance is Determined by the Voltage Level of the External Power Supply as Described by**



- A. Load (ohms)
- B. Minimum lift off
- C. Power supply voltage
- D. Maximum
- E. Without HART® communicator
- F. Operating region

### 1.11.3 Physical specifications

<b>Materials of construction</b>	<p>Transmitter probe: Process-wetted materials are 316L or 304 stainless steel.</p> <p>Rosemount Oxymitter Transmitter electronics housing (integral to probe or remote mounted): Low copper aluminum IP66 (Type 4X) with reference air exhaust port piped to clean area</p> <p>Optional Rosemount Xi Electronics: Type 4X, polycarbonite material</p>
<b>Process connections</b>	<p>2-in. 150# (4.75-in. [121 mm] bolt circle); DIN (5.71-in. [145 mm] bolt circle)</p> <hr/> <p><b>Note</b> Flanges are flat-faced and for mounting only. Flanges are not pressure-rated. Spool piece part numbers are available to offset electronics housing from hot ductwork. Many adapter flanges are available to mate to existing flanges.</p> <hr/>
<b>Orientation</b>	<p>Vertical or horizontal mount</p>

**Table 1-7: Probe Lengths and Approximate Shipping Weights**

<b>Length</b>	<b>Weight</b>
18 in. (457 mm)	16 lb. (7.3 kg)
3 ft. (0.91 m)	21 lb. (9.5 kg)
6 ft. (1.83 m)	27 lb. (12.2 kg)
9 ft. (2.74 m)	33 lb. (15.0 kg)
12 ft. (3.66 m)	39 lb. (17.7 kg)
15 ft. (4.57 m)	45 lb. (20.5 kg)
18 ft. (5.49 m)	51 lb. (23 kg)

## 2 Installation

### ⚠ WARNING

#### The instrument is heavy.

Use proper lifting and carrying procedures to avoid personal injury.

### ⚠ WARNING

#### Electrical shock

Failure to install covers and ground leads could result in serious injury or death.

Install all protective equipment covers and safety ground leads after installation.

### ⚠ WARNING

#### Hazardous areas

For Rosemount™ Hazardous Area Oxymitter OXT4CNF (without process side flame arrester), the non-process side of the transmitter can be placed in a hazardous rated area according to the product label. The flue gas side of the Rosemount OXT4CNF shall not be installed in the processes that are rated as hazardous.

For Rosemount Hazardous Area Oxymitter 4000 OXT4C (with process side flame arrester), both the non-process and process sides of the transmitter can be installed in hazardous areas according to the product label. The process side of the probe should be considered a potential source if an explosive gas mixture is present.

All cable entry devices and blanking elements for unused apertures must be certified flameproof and suitable for conditions of use. They must also be properly installed.

Do not open when an explosive atmosphere may be present.

Do not open while energized.

Process temperature at mounting flange location shall not exceed 239 °F (115 °C).

Cable entry devices and blanking elements shall be Ex d certified. Cables or conductors in conduit, cable entry devices, and blanking elements must be rated for  $\geq 176$  °F (80 °C).

Non-flame arrester probe versions "NF" must have the probe tube mounted in a Safe Area.

## 2.1 Mechanical installation

### 2.1.1 Select location

The location of the transmitter in the stack or flue is most important for maximum accuracy in the oxygen analyzing process.

#### Procedure

1. Position the transmitter so that the gas it measures is representative of the process.

You will obtain best results by positioning the transmitter near the center of the duct (40 to 60 percent insertion). Longer ducts may require several transmitter units since the O<sub>2</sub> can vary due to stratification. A point too near the wall of the duct or the inside radius of a bend may not provide a representative sample because of the very low flow conditions. Select the sensing point so the process gas temperature falls within a range of 32 to 1300 °F (0 to 704 °C). [Figure 2-1](#) through [Figure 2-7](#) provide mechanical references.

The ambient temperature of the electronics housing must not exceed 150 °F (70 °C). For higher ambient temperature, Emerson recommends the remote mounted electronics option.

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**Note**

In highly abrasive applications, rotate the shield 90 degrees at normal service intervals to present a new wear surface to the abrasive flow stream.

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2. Check the flue or stack holes for air leakage. Make any necessary repairs or install the transmitter upstream of any leakage.  
Holes and leakage substantially affect the accuracy of the oxygen reading.
3. Ensure that the area is clear of internal and external obstructions that will interfere with probe installation and access to the membrane keypad or LOI. Allow adequate clearance for removal of the transmitter.

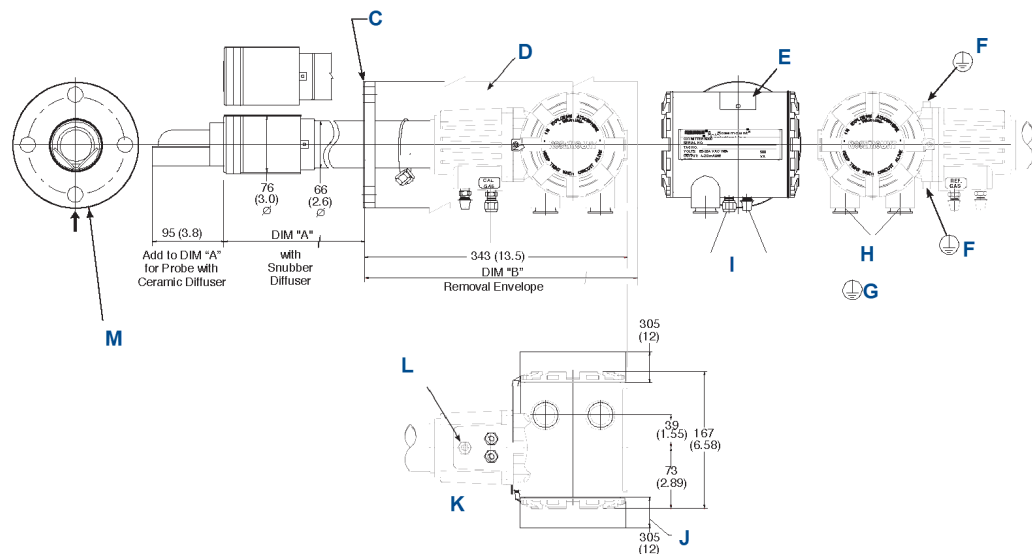
**▲ CAUTION**

Damage to the unit may result.

Do not allow the temperature of the transmitter electronics to exceed 185 °F (85 °C).

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**Figure 2-1: Rosemount™ Oxymitter 4000 Probe Installation**



**Note**

These flat faced flanges are measured to ANSI and DIN patterns and are not pressure rated. All dimensions are in millimeters with inches in parentheses unless otherwise noted.

- A. Dimension A.
- B. Dimension B.
- C. 0.062-in. (1,57 mm) gasket.
- D. Insulate if exposed to ambient weather conditions.
- E. Certification approved label.
- F. External earth.
- G. Internal earth.
- H. Electrical connection ¾ NPT.
- I. See [Table 2-1](#).
- J. Cover removal and access.
- K. Bottom view.
- L. Vent reference air.
- M. See [Table 2-2](#).

**Table 2-1: Calibration Gas and Reference Air**

Calibration gas	Reference air
ANSI	6.34 (¼) tube
DIN	6.35 (¼) tube

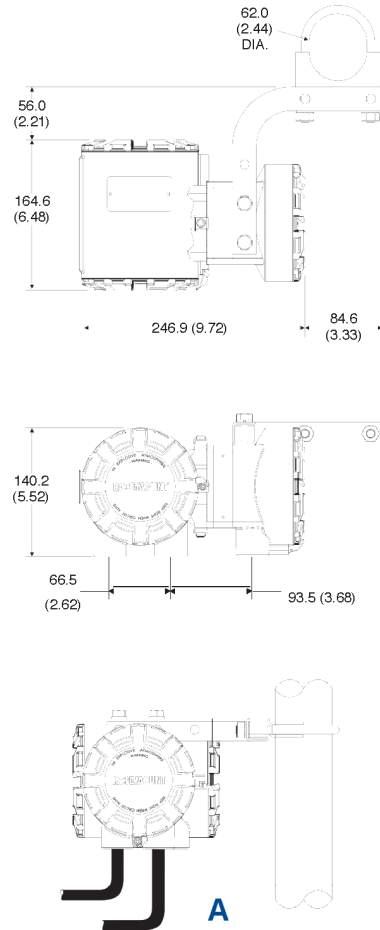
**Table 2-2: Mounting Flange (Gasket Included)**

	ANSI	DIN
Flange diameter	190 (7.5)	210 (8.25)

**Table 2-2: Mounting Flange (Gasket Included) (continued)**

	ANSI	DIN
Hole diameter	19 (0.75)	18 (0.71)
4 holes equally spaced on BC	152,4 (6.00)	170 (6.69)

**Figure 2-2: Remote Electronics with Membrane Keypad and Blind Cover**



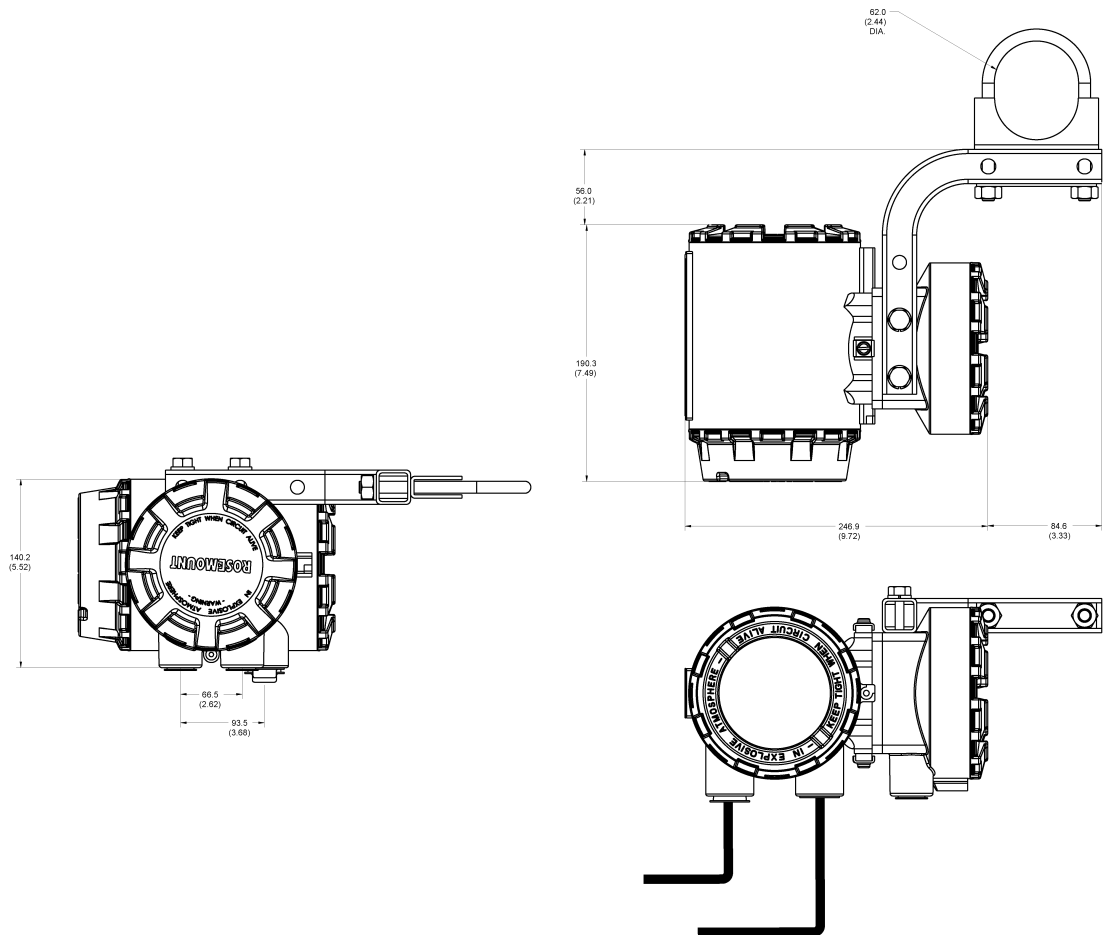
**Note**

All dimensions are in millimeters with inches in parentheses.

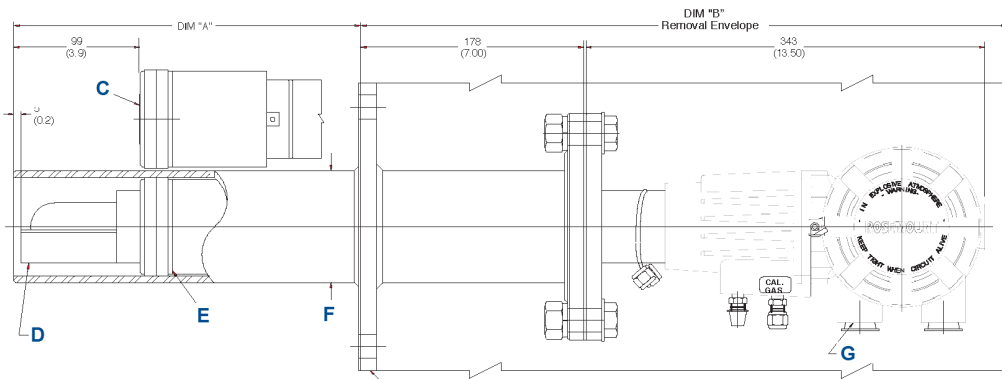
*A. Pipe mount configuration*



**Figure 2-3: Remote Electronics with LOI and Window Cover, Wall Mount Configuration**



**Figure 2-4: Rosemount Hazardous Area Oxymitter 4000 Probe with Abrasive Shield**



**Note**

These flat faced flanges are measured to ANSI and DIN patterns and are not pressure rated. All dimensions are in millimeters with inches in parentheses unless otherwise noted.

- A. Dimension A (see [Table 2-3](#))
- B. Dimension B (see [Table 2-3](#))
- C. Snubber/dust seal assembly
- D. Deflector assembly
- E. Diffuser/dust seal assembly
- F. 91 (3.6) diameter nominal
- G. 3/4 NPT electrical connection

**Table 2-3: Installation/Removal**

Probe	Dimension A	Dimension B
18 in.	387 (15.3)	912 (35.9)
3 ft.	842 (33.2)	1367 (53.8)
6 ft.	1762 (69.4)	2287 (90.0)

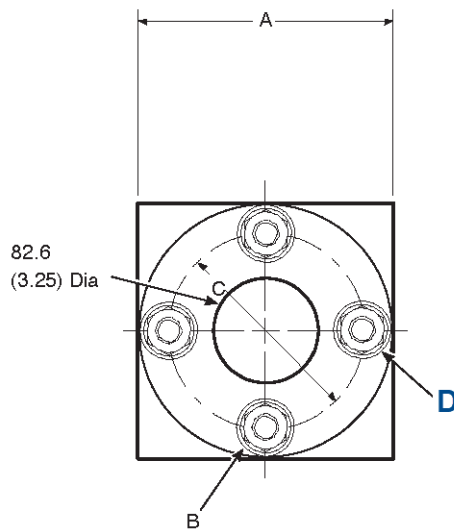
**Table 2-4: Abrasive Shield 3D390003**

Flange	ANSI	DIN
Flange diameter	229 (9.0)	235 (9.25)
Hole diameter	19 (0.75)	24 (0.94)
8 holes equally spaced on BC	191 (7.50)	190 (7.48)

Ref air	Cal gas <sup>(1)</sup>
ANSI	1/4-in. tube
DIN	1/4-in. tube

(1) Add check valve in cal gas line.

**Figure 2-5: Mounting Plate for Rosemount Oxymitter 4000**



**Note**

Dimensions are in millimeters with inches in parentheses.

- A. Dimension A
- B. Dimension B
- C. Dimension C
- D. Four studs, lockwashers, and nuts equally spaced on C diameter B.C.

**Table 2-5: Adapter Plate Dimensions for Rosemount Oxymitter 4000**

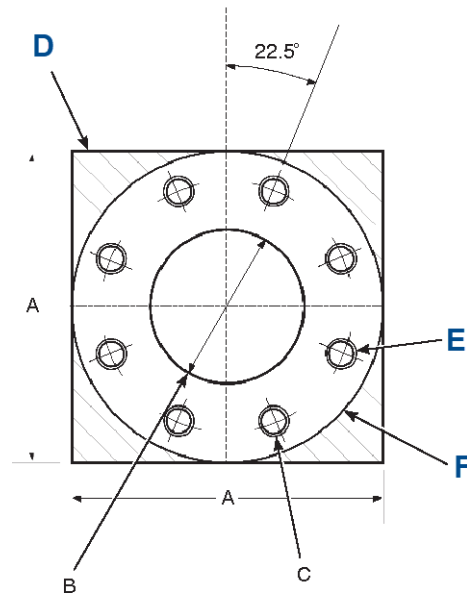
Part numbers for adapter plates include attaching hardware.

Dimensions: mm (in.)	ANSI (PN 4512C34G01)	DIN (PN 4512C36G01)	JIS (PN 451235G01)
A	153 (6.00)	191 (7.5)	165 (5.50)
B thread	0.625-11	(M-16 x 2)	(M-12 x 1.75)
C diameter	121 (4.75)	145 (5.708)	130 (4.118)

**Table 2-6: Mounting Plate Dimensions for Rosemount Oxymitter 4000**

Dimensions in mm (in.)	ANSI	DIN
A	197 (7.75)	216 (8.5)
B: stud size	0.625 - 11	M16 x 2
C: diameter B.C.	142,4 (6.00)	170,0 (6.69)

**Figure 2-6: Mounting Plate for Rosemount Oxymitter 4000 with Abrasive Shield**



**Note**

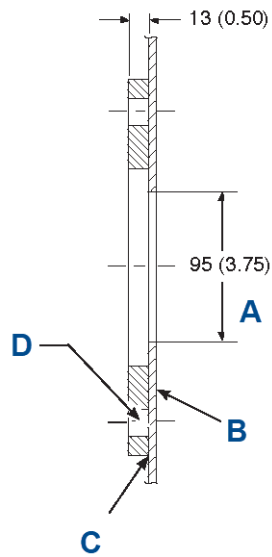
Dimensions are in inches with millimeters in parentheses.

- A. Dimension A.
- B. Dimension B.
- C. Dimension C.
- D. Crosshatched area in four corners may be used to provide additional holes for field bolting of plate to outside wall service.
- E. Eight threaded holes equally spaced on D diameter B.C.
- F. Abrasive shield flange O.D.

**Table 2-7: Adapter Plate Dimensions for Rosemount Oxymitter 4000 with Abrasive Shield**

Dimensions in in. (mm)	ANSI (PN 3536B58G02)	DIN (PN 3535B58G08)
A	9.0 (229)	9.25 (235)
B: diameter	4.75 (121)	3.94 (100)
C: thread	0.625-11	(M-16 x 2)
D: diameter B.C.	7.50 (191)	7.48 (190)

**Figure 2-7: Abrasive Shield Mounting for Metal Wall Stack or Duct Construction**

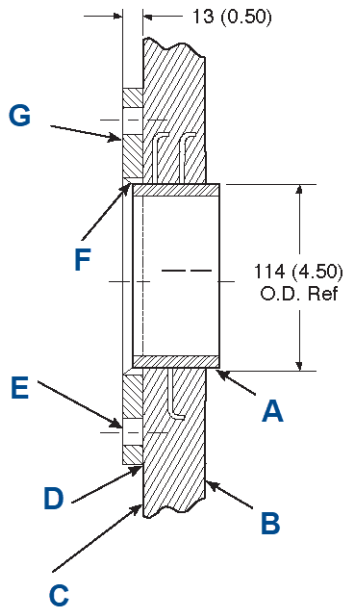


**Note**

- Dimensions are in millimeters with inches in parentheses.
- All masonry stack work and joints except adapter are not furnished by Emerson.

- A. Minimum diameter hold in wall.
- B. Stack or duct metal wall.
- C. Weld or bolt mounting plate to metal wall of stack or duct; joint must be airtight.
- D. Mounting holes shown rotated 45° out of true position.

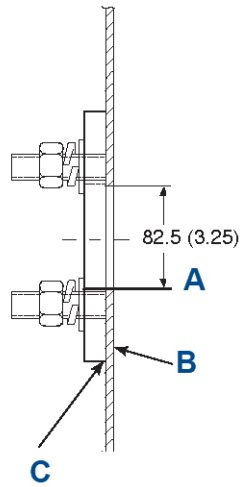
**Figure 2-8: Abrasive Shield Mounting for Masonry Wall Stack Construction**



All masonry stack work and joints except adapter plate not furnished by Rosemount.

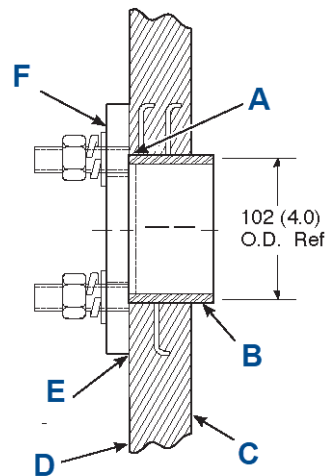
- A. Pipe 101,6 mm (4.00 in.) in sched 40 pipe sleeve (not by Emerson) length by customer.
- B. Masonry stack wall.
- C. Outside wall surface.
- D. Joint must be airtight.
- E. Mounting holes shown rotated 45° out of true position.
- F. Field weld pipe to mounting plate.
- G. Bolt mounting plate to outside wall surface.

**Figure 2-9: Probe Mounting for Metal Wall Stack or Duct Construction**



- A. Minimum diameter hole in wall.
- B. Stack or duct metal wall.
- C. Weld or bolt mounting plate to metal wall of stack or duct. Joint must be airtight.

**Figure 2-10: Probe Mounting for Masonry Wall Stack Construction**



- A. Field weld pipe to mounting plate.
- B. Pipe 88,9 mm (3.5 in.) sched 40 pipe sleeve (not by Emerson) length by customer
- C. Masonry stack wall
- D. Outside wall surface
- E. Joint must be airtight.
- F. Bolt mounting plate to outside wall surface.

## 2.1.2 Install probe

You may install the Rosemount™ Oxymitter 4000 intact, as you have received it.

### Prerequisites

Ensure all components are available to install the transmitter. If equipped with a ceramic diffuser, make sure the diffuser is not damaged.

---

### Note

Emerson recommends an abrasive shield for high velocity particulates in the flue stream (such as those in coal-fired boilers, kilns, and recovery boilers).

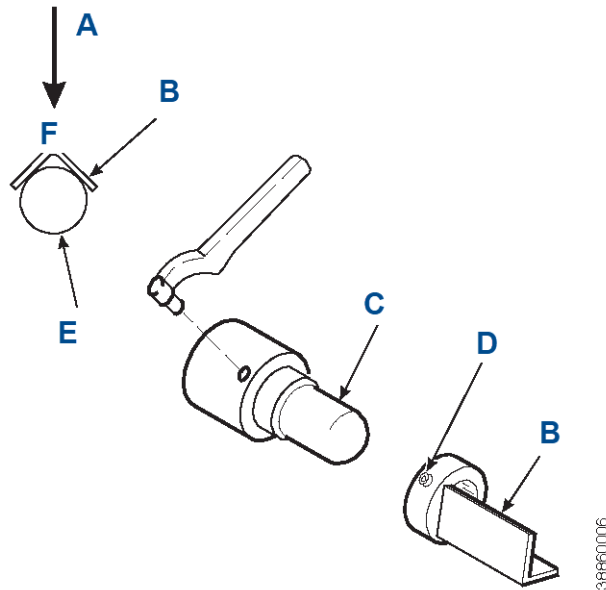
---

### Procedure

1. Weld or bolt mounting plate onto the duct.
2. If using the optional ceramic diffusion element, make sure to correctly orient the vee deflector. Before inserting the transmitter, check the direction of the flow of gas in the duct. Orient the vee deflector so the apex points upstream towards the flow.
  - a) Loosen the setscrews.
  - b) Rotate the vee deflector to the desired position.
  - c) Retighten the setscrews.



Figure 2-11: Orienting the Optional Vee Deflector

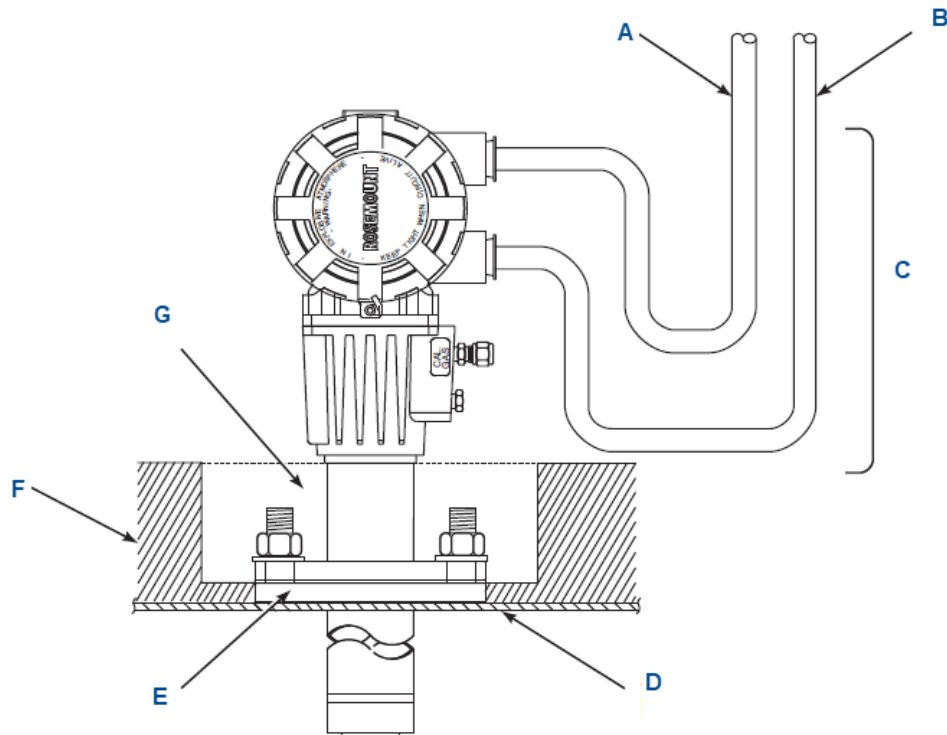


- A. Gas flow direction
- B. Vee deflector
- C. Ceramic diffusion element
- D. Setscrew
- E. Filter
- F. Apex

The ambient temperature of the electronics housing must not exceed 150 °F (70 °C). For higher ambient temperatures, Emerson recommends the remote mounted electronics option.

3. In vertical installations, ensure the system cable drops vertically from the transmitter and the conduit is routed below the level of the electronics housing. This drip loop minimizes the possibility that moisture will damage the electronics.

**Figure 2-12: Installation with Drip Loop and Insulation Removal**



- A. Line voltage.
- B. Logic I/O 4-20 mA signal.
- C. Drip loop.
- D. Stack or duct metal wall.
- E. Mounting plate.
- F. Insulation.
- G. Replace insulation after installing Rosemount Oxymitter 4000.

4. If the system has an abrasive shield, check the dust seal gaskets. Make sure the joints in the two gaskets are staggered 180 degrees and that the gaskets are in the hub grooves as the transmitter slides into the 15 degree forcing cone in the abrasive shield.

**Note**

If process temperatures will exceed 392 °F (200 °C), use anti-seize compound on the stud threads to ease future removal of the transmitter.

5. Insert probe through the opening in the mounting plate and bolt the unit to the plate.

**Note**

To maintain CE compliance, ensure a good connection exists between the mounting plate studs or earthing screws on electronics housing and earth.

6. Ensure the transmitter is properly earthed by way of both internal and external points.

**⚠ CAUTION**

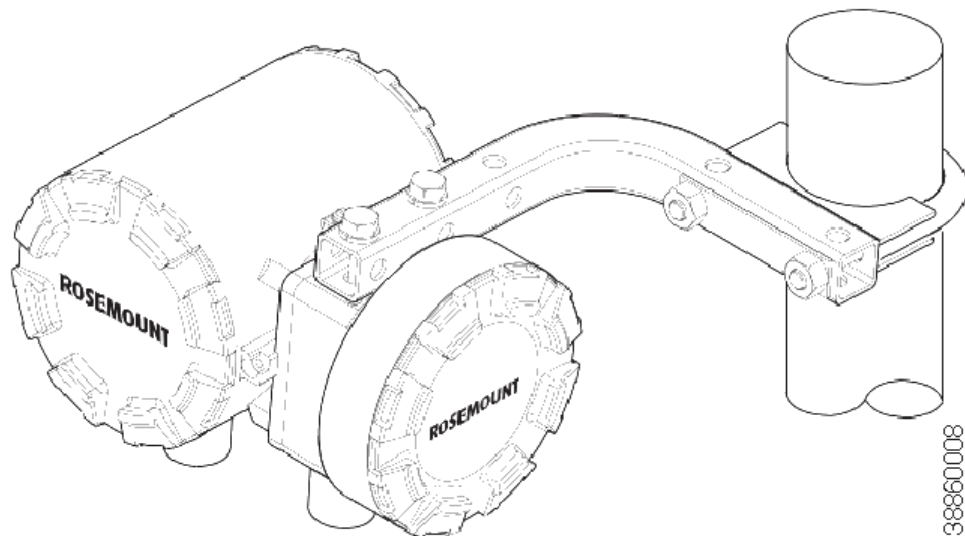
Uninsulated stacks or ducts may cause ambient temperatures around the electronics to exceed 185 °F (85 °C), which may cause overheating damage to the electronics.

If you remove duct work insulation for transmitter mounting, replace the insulation afterwards. See [Figure 2-12](#). Ensure the probe installation does not obscure the warnings on the housing covers.

### 2.1.3 Install remote electronics

For a Rosemount Oxymitter 4000 with the remote electronics option, install the probe according to the instructions in [Install probe](#). Install the remote electronics unit on a wall, stand pipe, or similar structure (see [Figure 2-2](#) and [Figure 2-13](#)).

**Figure 2-13: Remote Electronics Mounting**



## 2.2 Electrical installation with integral electronics

All wiring must conform to local and national codes.

**⚠ WARNING**

Disconnect and lock out power before connecting the unit to the power supply.

### **⚠ WARNING**

Failure to install covers and ground leads could result in serious injury or death.

Install all protective equipment covers and safety ground leads after installation.

### **⚠ WARNING**

To meet the safety requirements of IEC 61010 (EC requirement) and ensure safe operation of this equipment, connect to the main power supply through a circuit breaker (minimum 10 A) which will disconnect all current-carrying conductors during a fault situation.

Make sure this circuit breaker includes a mechanically operated isolating switch.

If there is no switch, locate another external means of disconnecting the power supply close by.

Circuit breakers or switches must comply with a recognized standard, such as IEC 60947.

### **⚠ WARNING**

**The instrument is heavy.**

Use proper lifting and carrying procedures to avoid personal injury.

### **⚠ WARNING**

To maintain explosion-proof protection, all cable entry devices and blanking elements for unused apertures must be certified flameproof and suitable for the conditions of use. Make sure they are properly installed.

#### **Note**

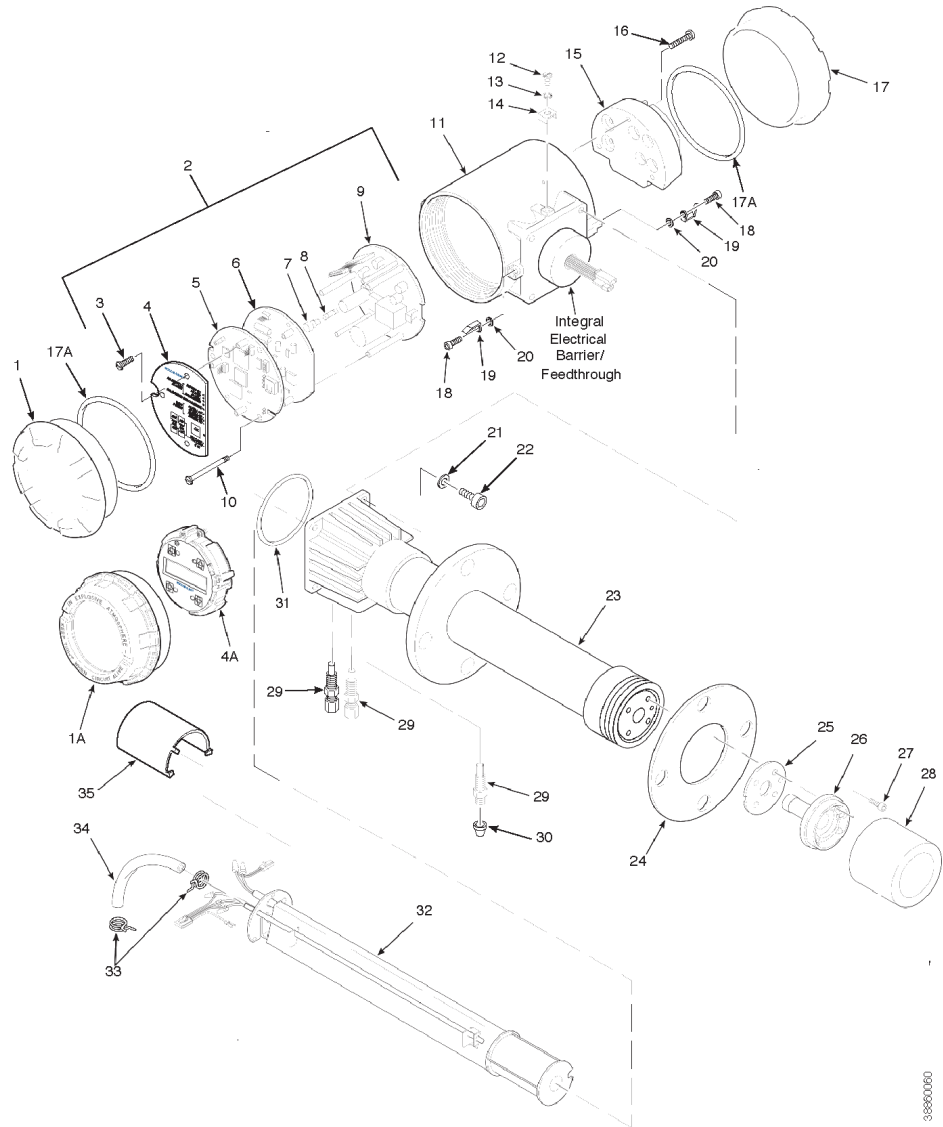
To maintain CE compliance, ensure a good connection exists between the mounting flange bolt and earth.

## 2.2.1 Connect line voltage

### **Procedure**

1. Remove screw, cover lock, and captive washer. Remove cover from terminal block.

**Figure 2-14: Rosemount™ Oxymitter 4000 with Integral Electronics - Exploded View**



**Note**  
Not all parts shown.

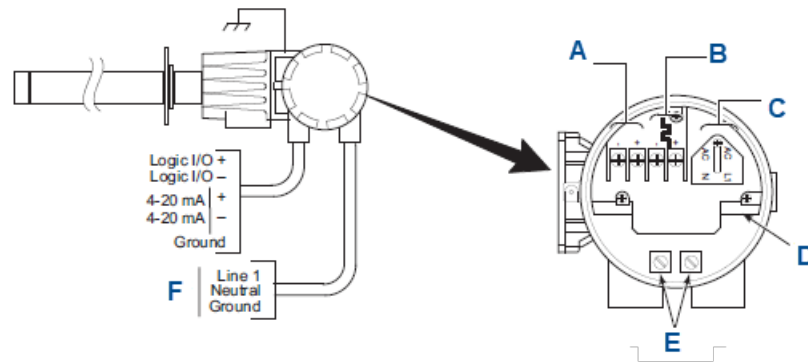
1. Blind cover	12. Screw	24. Gasket
1A. Window cover	13. Lock washer	25. Corrugated seal
2. Electronic assembly <sup>(1)</sup>	14. Cable clamp	26. Cell and flange assembly
3. Screw	15. Terminal block	27. Retainer screw
4. Membrane keypad	16. Captive screw	28. Flame arrestor with snubber diffuser

4A. LOI module	17. Blind cover	29. Flame arrestor fitting.
5. Microprocessor board	17A. O-ring	30. Cap
6. Analog board	18. Screw	31. O-ring
7. Fuse cap	19. Cover lock	32. Heater strut assembly
8. Fuse	20. Captive washer	33. Tube clamp
9. Power supply board	21. Washer	34. Silicone tube
10. Captive screw	22. Screw	35. Strut pressure clamp
11. Housing	23. Probe tube assembly	

(1) The electronic assembly (Item 2) consists of items 3 through 10.

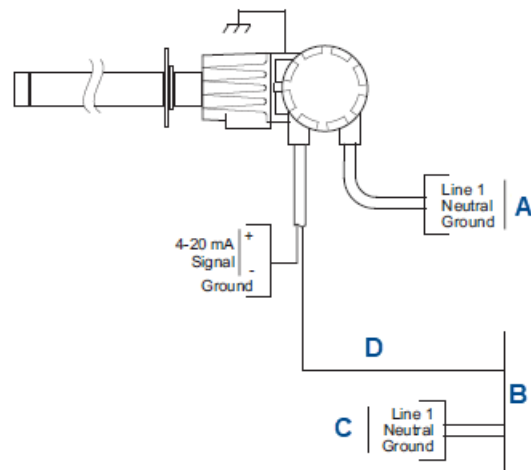
2. Connect the line (or L1) wire to the L1 terminal and the neutral (or L2) wire to the N terminal.

**Figure 2-15: Integral Electronics without Rosemount SPS 4001B**



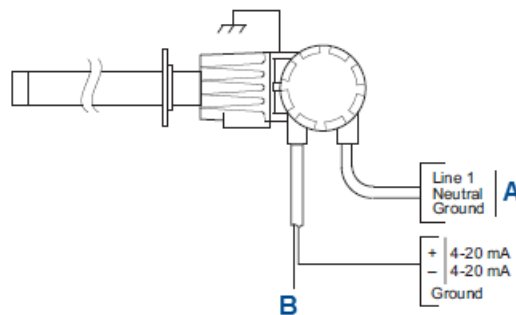
- A. 4-20 mA signal
- B. Calibration handshake/logic I/O
- C. Line voltage
- D. Terminal block
- E. Ground lugs
- F. 90 - 250 Vac, 50-60 Hz line voltage input

**Figure 2-16: Integral Electronics with Remote Rosemount SPS 4001B**



- A. 90-250 Vac, 50-60 Hz line voltage input
- B. Wall-mounted Rosemount SPS 4001B
- C. 90-250 Vac, 50-60 Hz line voltage input
- D. Calibration handshake

**Figure 2-17: Integral Electronics with Remote Rosemount IMPS 4000**



- A. 90-250 Vac, 50-60 Hz line voltage input.
- B. Calibration handshake. Refer to Rosemount IMPS 4000 Reference Manual.

The transmitter will automatically configure itself for 90 to 250 Vac line voltage and 50/60 Hz.

**⚠ WARNING**

**Electrical shock**

Install the power terminal cover.  
AC wiring should be rated for 240 Vac and be at least 14 gauge or greater.

3. Connect 4-20 mA signal and calibration handshake/logic I/O leads.

- a. 4-20 mA signal: The 4-20 mA signal represents the O<sub>2</sub> value and can also operate the Rosemount 751 LCD Loop Display or any other loop-powered display. Superimposed on the 4-20 mA signal is HART® information that is accessible through a handheld communicator or AMS software.

**▲ WARNING**

If using a Rosemount IMPS 4000 or SPS 4001B, install it in a non-hazardous, explosive-free environment.

- b. Calibration handshake/Logic/I/O: You can use this output signal to trigger an alarm or provide a calibration handshake signal to a Rosemount IMPS 4000 or SPS 4001B.

If not using autocalibration, a common bi-directional logic contact is provided for any of the equipment alarms listed in [Table 2-8](#).

**Table 2-8: Diagnostic LEDs**

LED	Flashes	Status	4-20 mA line	Fault	Recoverable
Heater C/T	1	Open	Dependent on position 3 of SW2 <sup>(1)</sup>	1	No
	2	Shortened	Dependent on position 3 of SW2 <sup>(1)</sup>	2	No
	3	Reversed	Dependent on position 3 of SW2 <sup>(1)</sup>	3	No
	4	A/D Comm Error	Dependent on position 3 of SW2 <sup>(1)</sup>	4	No
Heater	1	Open	Dependent on position 3 of SW2 <sup>(1)</sup>	5	No
	2	High High Temp	Dependent on position 3 of SW2 <sup>(1)</sup>	6	No
	3	High Case Temp	Dependent on position 3 of SW2 <sup>(1)</sup>	7	Yes
	4	Low Temp	Dependent on position 3 of SW2 <sup>(1)</sup>	8	Yes
	5	High Temp	Dependent on position 3 of SW2 <sup>(1)</sup>	9	Yes
O <sub>2</sub> cell	1	High mV	Dependent on position 3 of SW2 <sup>(1)</sup>	10	Yes
	3	Bad	Track O <sub>2</sub>	11	Yes
	4	EEPROM Corrupt	Dependent on position 3 of SW2 <sup>(1)</sup>	12	No
Calibration	1	Invalid Slope	Track O <sub>2</sub>	13	Yes
	2	Invalid Constant	Track O <sub>2</sub>	14	Yes
	3	Last Calibration Failed	Track O <sub>2</sub>	15	Yes



**Table 2-8: Diagnostic LEDs (continued)**

LED	Flashes	Status	4-20 mA line	Fault	Recoverable
	(2)	Calibration Recommended	Track O <sub>2</sub>		Yes

- (1) Critical alarm conditions will render the O<sub>2</sub> measurement as unusable, and any of these events will cause the 4-20 mA signal to go to a user-selectable limit of 3.5 mA or 21.6 mA (position 3 of SW2). Factory default value is 3.5 mA. Alarms which are not self-clearing (Self-Clearing = NO) will require a reset. Perform the reset procedure in [Configure transmitter with membrane keypad](#) to continue operation.
- (2) The Calibration Recommended alarm was disabled in 2014, although it remains in the menu.

The assignment of alarms that will actuate this contact is modified by one of seven additional configuration settings (mode 1 through mode 7) listed in [Table 2-9](#).

**Table 2-9: Logic I/O Configuration (as Set at HART®/AMS or LOI)**

Mode	Configuration
0	The unit is not configured for any alarm condition.
1	The unit is configured for a Unit alarm.
2	The unit is configured for Low O <sub>2</sub> .
3	The unit is configured for both a Unit alarm and Low O <sub>2</sub> .
4	The unit is configured for a High AC Impedance/ CALIBRATION RECOMMENDED.
5 <sup>(1)</sup>	The unit is configured for both a Unit alarm and a High AC Impedance/ CALIBRATION RECOMMENDED.
6	The unit is configured for both a Low O <sub>2</sub> and High AC Impedance/ CALIBRATION RECOMMENDED.
7	The unit is configured for a Unit alarm, a low O <sub>2</sub> , and a High AC Impedance/ CALIBRATION RECOMMENDED.
8 <sup>(2)</sup>	The unit is configured for a calibration handshake with Rosemount IMPS 4000 or SPS 4001B. CALIBRATION RECOMMENDED initiates the calibration cycle.
9	The unit is configured for a calibration handshake. CALIBRATION RECOMMENDED will not initiate the calibration cycle with the Rosemount IMPS 4000 or SPS 4001B.

- (1) The default condition for a Rosemount Oxymitter 4000 without a Rosemount IMPS 4000 or SPS 4001B.
- (2) The default condition for a Rosemount Oxymitter 4000 with a Rosemount IMPS 4000 or SPS 4001B.

The logic contact is self powered, +5 Vdc, with a 340 ohm series resistance. An interposing relay is required if the logic alarm will annunciate a higher voltage device, such as a light or horn. An interposing relay may also be required for certain DCS input cards. A Potter & Braunfield model R10s-E1Y1-

J1.OK 3.2 mA DC (or equal) interposing relay will be mounted where the contact wires terminate in the control/relay room.

4. Install cover and secure with captive washer, cover lock, and screw.

## 2.3 Electrical installation with remote electronics

All wiring must conform to local and national codes.

### **⚠ WARNING**

#### **Electrical shock**

Disconnect and lock out power before connecting the unit to the power supply.

### **⚠ WARNING**

Failure to install covers and ground leads could lead to serious injury or death.

Install all protective equipment covers and safety ground leads after installation.

### **⚠ WARNING**

To meet the Safety Requirements of IEC 1010 (EC requirement) and to ensure safe operation of this equipment, connect to the main electrical power supply through a circuit breaker (minimum 10 A) which will disconnect all current-carrying conductors during a fault situation.

This circuit breaker should also include a mechanically operated isolating switch.

If there is no switch, locate another external means of disconnecting the supply from the equipment close by.

Circuit breakers or switches must comply with a recognized standard, such as IEC 947.

### **⚠ WARNING**

#### **The instrument is heavy.**

Use proper lifting and carrying procedures to avoid personal injury.

### **⚠ WARNING**

To maintain explosion-proof protection, all cable entry devices and blanking elements for unused apertures must be certified flameproof and suitable for the conditions of use; they must also be properly installed.

#### **Note**

To maintain CE compliance, ensure a good connection exists between the mounting flange bolts and earth.

## 2.3.1 Connect line voltage

### Procedure

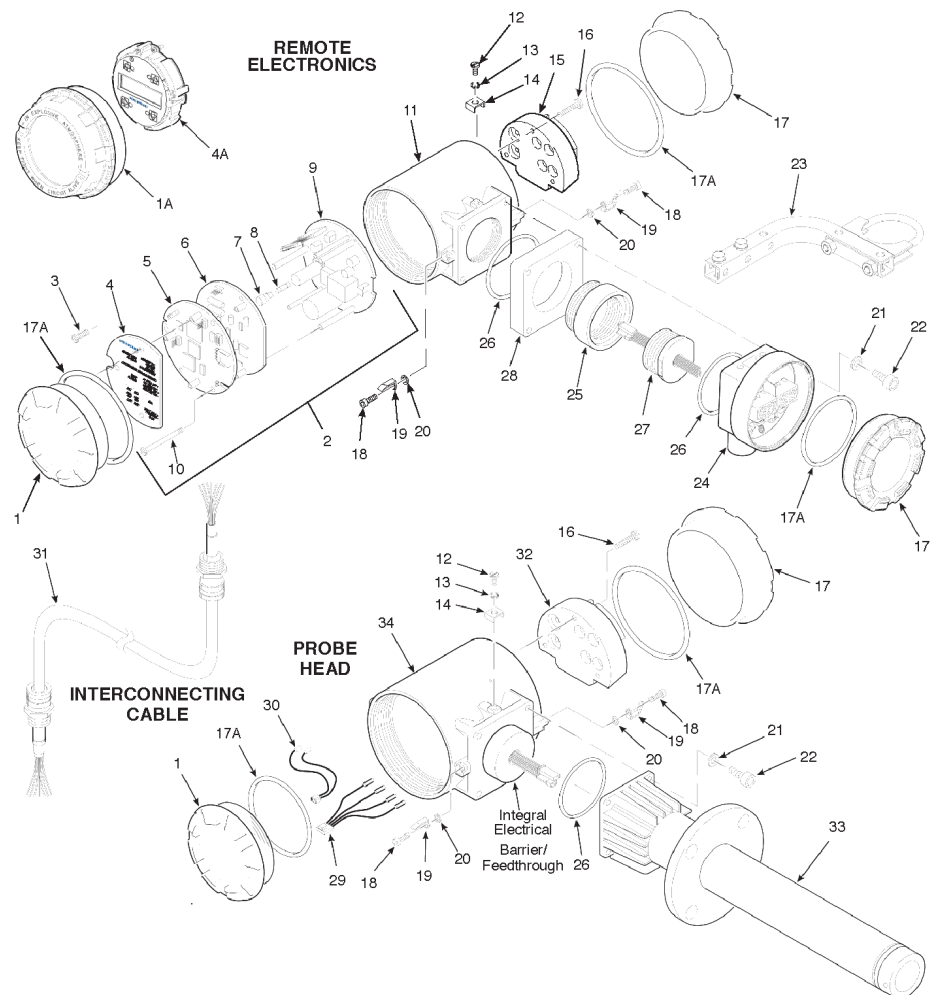
1. Remove screw, cover lock, captive washer, and left side blind cover from the remote electronics.
2. Connect the line (or L1) wire to the L1 terminal and the neutral (or L2) wire to the N terminal.  
The transmitter will automatically configure itself for 90 - 250 Vac line voltage and 50/60 Hz.

### **⚠ WARNING**

#### Electrical shock

Install the power terminal cover.

**Figure 2-18: Electrical Installation: Rosemount™ Hazardous Area Oxymitter 4000 with Remote Electronics**



1. Blind cover	12. Screw	24. Junction box
1A. Window cover	13. Lock washer	25. Adapter ring
2. Electronic assembly	14. Cable clamp	26. O-ring
3. Screw	15. Terminal block	27. Harness assembly
4. Membrane keypad	16. Captive screw	28. Spacer block
4A. LOI module	17. Blind cover	29. Connecting cable, signal
5. Microprocessor board	17A. O-ring	30. Connecting cable, heater
6. Analog board	18. Screw	31. Interconnecting cable
7. Fuse cap	19. Cover lock	32. Terminal block, remote probe head
8. Fuse	20. Captive washer	33. Probe
9. Power supply board	21. Lock washer	34. Housing
10. Captive screw	22. Screw	
11. Housing	23. Mounting kit	

**Note**

The electronic assembly (Item 2) consists of items 3 through 10.

**Note**

Refer to [Figure 2-14](#) for component parts of probe.

3. Connect 4-20 mA signal and calibration handshake/logic/I/O leads.

## 2.3.2 4-20 mA signal

The 4-20 mA signal represents the O<sub>2</sub> value and can also operate the Rosemount™ 751 Loop LCD Display or any other loop powered display. Superimposed on the 4-20 mA signal is HART® information that is accessible through a handheld communicator or AMS software.

## 2.3.3 Rosemount™ World Class Intelligent Field Transmitter setup

The DR probe operates with a 115 Vac heater. Ensure that the voltage selection jumpers in the IFT or HPS, if used, are set properly.

Always disconnect line voltage from intelligent field transmitters before changing jumpers.

Line voltage selection	Jumper (install)
100 Vac	JM3, JM7, JM2
120 Vac	JM8, JM7, JM1
220 Vac	JM6, JM5, JM2

Line voltage selection	Jumper (install)
240 Vac	JM6, JM5, JM1

Probe heater voltage selection	Jumper (install)
World Class probe (44 V)	JM10
218 probe (115 V)	JM9
Rosemount World Class "Direct Replacement" Probe (115 V) or Rosemount Oxymitter Direct Replacement Probe (115 V)	JM9

**⚠ CAUTION**

If you select incorrect heater voltage, damage to the transmitter may occur.

Always update the relevant labeling to reflect the set voltage.

Always disconnect the voltage from heater power supply and analog electronics (if used) before changing jumpers.

Line voltage selection	Jumper (install)
100/120 Vac <sup>(1)</sup>	JM4, JM1
220/240 Vac	JM5

*(1) 100 Vac operation requires transformer part number 1M02961G02.*

Heater power	Jumper
Remote	Remove JM2
On	Install JM2

Probe heater voltage selection	Jumper (install)
Rosemount World Class probe (44 V)	JM7
218 probe (115 V)	JM8
Rosemount Direct Replacement World Class or DR Oxymitter	JM8

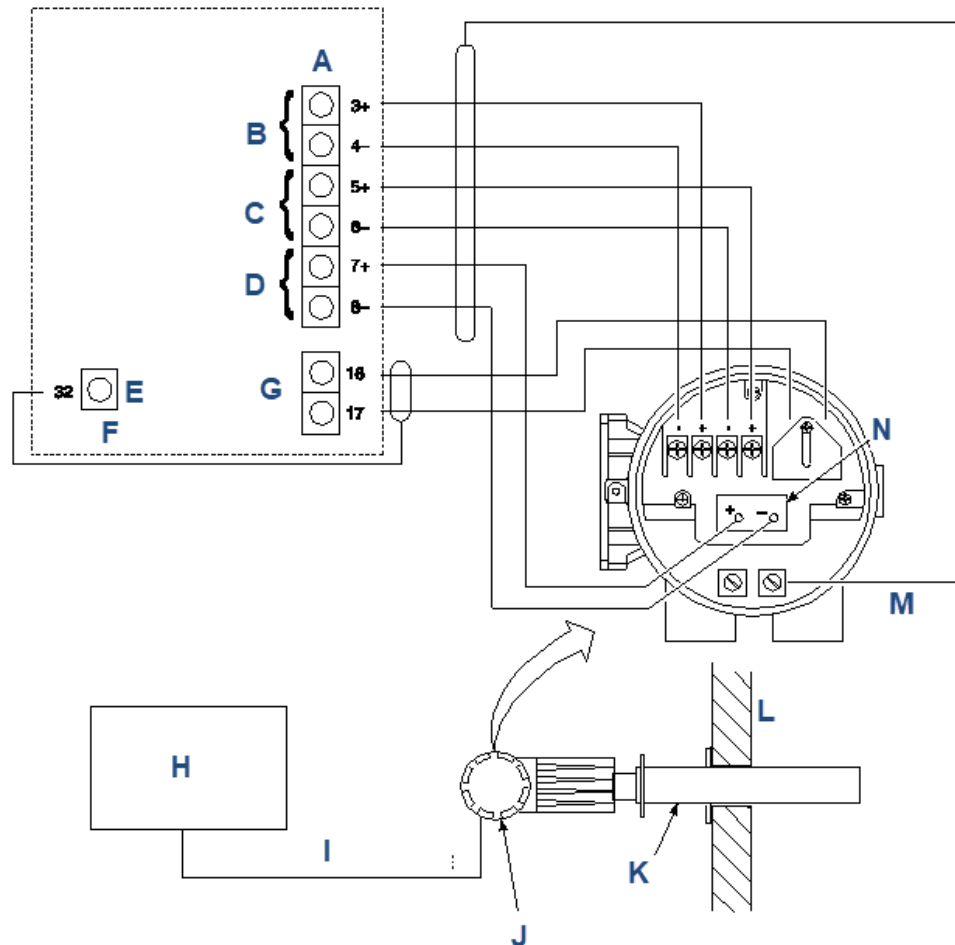
Electronics selection	Jumper
Analog (existing)	Install JM3, JM6
Digital (next generation)	Remove JM3, JM6

## 2.3.4 Yokogawa® ZA8C and AV8C Converter Electronics setup

You can wire the Rosemount Oxymitter DR Probe to work with the Yokogawa ZA8C and AV8C Converters.

Connect the cabling from the Yokogawa ZA8C or AV8C terminal to the probe terminal in the junction box as shown below.

**Figure 2-19: Rosemount Oxymitter DR Probe Wired to the Yokogawa ZA8C or AV8C Converter**



**Note**

- A. Heater temperature set to 1380 °F (750 °C).
- B. The greater mass of the Rosemount Oxymitter Direct Replacement Probe requires a longer time to heat up. Upon start-up, the Yokogawa Electronics may indicate an error because the probe has not reached temperature setup in the normal time. Remove power from the Yokogawa Electronics or probe module to clear the error and restore power. You may have to do this a couple of times before the transmitter reaches the operating temperature.

- A. ZA8C or AV8C terminal
- B. Cell
- C. Thermocouple
- D. Cold junction
- E. Ground shield
- F. ZA8C or AV8c
- G. Probe heater
- H. ZA8C or AV8C converter

- I. Heater and signal cable
- J. Rosemount Oxymitter DR probe with adapter flange
- K. Existing mounting
- L. Stack wall
- M. Shield
- N. Cold junction device

### **▲ WARNING**

If using a Rosemount IMPS 4000 or SPS 4001B, install it in a non-hazardous, explosive-free environment.

## 2.3.5 Calibration handshake logic I/O

You can use the output signal to trigger an alarm or to provide a calibration handshake signal to a Rosemount™ IMPS 4000 or SPS 4001B.

1. If you are not using autocalibration, the transmitter provides a common bi-directional logic contact for any of the equipment alarms listed in [Table 2-8](#). The assignment of alarms that will actuate this contact is modified by one of seven additional configuration settings (mode 1 through mode 7) listed in [Table 2-9](#).
2. The logic contact is self powered, +5 Vdc with a 340 ohm series resistance. An interposing relay is required if the logic contact will annunciate a higher voltage device, such as a light or horn. An interposing relay may also be required for certain DCS input cards. A Potter & Brumfield model R10S-E1Y1.OK 3.2 mA DC (or equal) interposing relay will be mounted where the contact wires terminate in the control/relay room.

Install cover ([Figure 2-14](#)) and secure with captive washer, cover lock, and screw.

## 2.3.6 Install interconnecting cable

### **Note**

If you did not purchase the interconnecting cable with the transmitter, consult the factory for the proper wire type and gauge.

### **Procedure**

1. Remove cover from the junction box. Connect the electronics end of the interconnecting cable to the FROM PROBE side of the terminal block ([Figure 2-18](#)).

### **▲ WARNING**

If using a Rosemount™ IMPS 4000 or SPS 4001B, install it in a non-hazardous, explosive-free environment.

2. Loosen screw, cover lock, and washer at the probe head. Remove cover.



3. See [Figure 2-18](#). Connect the heater power leads, the thermocouple leads, and the oxygen signal leads of the interconnecting cable to the terminal block. The cable leads are tagged for polarity.

**⚠ WARNING**

**Electrical shock**

Install the heater power terminal cover.

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4. Install covers and secure with captive washers, cover locks, and screws.

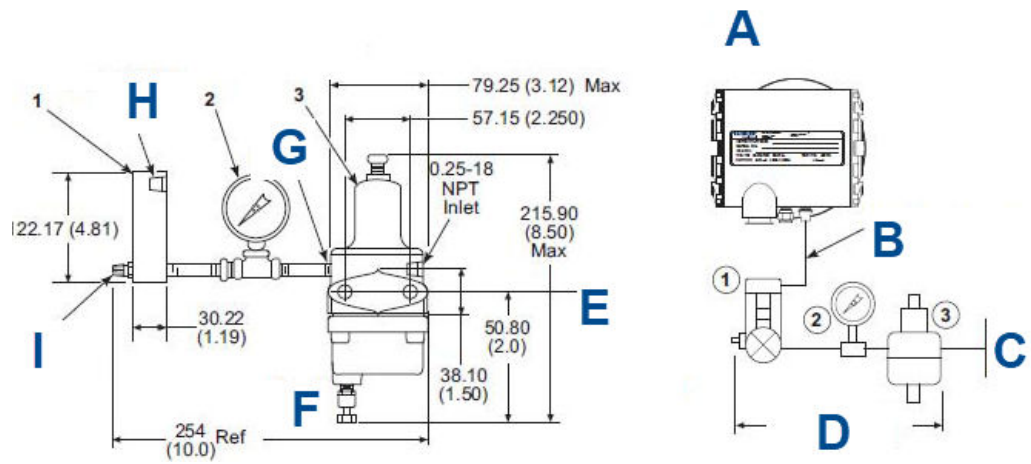
## 2.4 Pneumatic installation

### 2.4.1 Reference air package

After the Rosemount Oxymitter 4000 is installed, connect the reference air set to the transmitter.

Refer to [Figure 2-20](#).

**Figure 2-20: Air Set, Plant Air Connection**



**Note**

Dimensions are in millimeters with inches in parentheses. All piping specified in US standards.

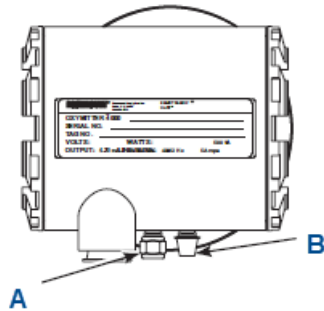
- A. Schematic hookup for reference air supply to Rosemount Oxymitter 4000 probe head
- B. 0.250 in. or 6 mm O.D. tubing (supplied by customer)
- C. Instrument air  
69-1551 kPa gage (10-225 psig) maximum
- D. Reference air set: 263C152G01
- E. Mounting holes: 81.03 (3.19) Lg for 7.92 (0.312) diameter through bolts
- F. Drain valve
- G. Outlet
- H. 0.125-27 NPT outlet
- I. Flow set point knob

**Table 2-10: Replacement Parts**

1	Flow meter	0.006-0.057 scmh (0.1 - 2.0 scfh)	771B635H02
2	Pressure gage	0-103 kPa gage (0-15 psig)	275431-006
3	Combination filter-regulator	0-207 kPa gage (0-30 psig)	4505C21G01

- Instrument air (reference air): 68.95 kPa gage (10 psig) minimum, 1551.38 kPa gage (225 psig) maximum at 0.25 L/min (0.5 scfh) maximum; less than 40 parts per million total hydrocarbons.
- Set regulator outlet pressure at 35 kPa (5 psi).

Figure 2-21: Rosemount Hazardous Area Oxymitter 4000 Gas Connections



- A. Calibration gas
- B. Reference air

## 2.4.2 Calibration gas

### ⚠ CAUTION

Failure to use proper gases will result in erroneous readings.

Do not use 100 percent nitrogen as a low gas (zero gas).

Emerson suggests that gas for the low (zero) be between 0.4 percent and 2.0 percent O<sub>2</sub>.

Do not use gases with hydrocarbon concentrations of more than 40 parts per million.

Use two calibration gas concentrations with the transmitter: low gas - 0.4 percent O<sub>2</sub> and high gas - 8 percent O<sub>2</sub>. See [Figure 2-21](#) for connections.

### ⚠ WARNING

If using a Rosemount IMPS 4000 or SPS 4001B, install it in a non-hazardous, explosive-free environment.

## 2.5 Rosemount™ IMPS 4000 connections

Ensure that the Rosemount IMPS 4000 is installed in a safe (non-hazardous and explosive-free) area and verify the wiring and pneumatic connections per the Rosemount IMPS 4000 Intelligent Multi-probe Test Gas Sequencer Reference Manual.

## 2.6 Rosemount SPS 4001B connections

Ensure that the Rosemount SPS 4001B is installed in a safe (non-hazardous, explosive-free) area and verify the wiring and pneumatic connections per the Rosemount SPS 4001B Single Probe Autocalibration Sequencer Reference Manual.

### ⚠ CAUTION

**Upon completing installation, ensure that the Rosemount Oxymitter 4000 is turned on and operating prior to firing up the combustion process.**

Damage can result from having a cold Rosemount Oxymitter 4000 exposed to the process gases.

During outages, if possible, leave all Rosemount Oxymitter 4000 units running to prevent condensation and premature aging from thermal cycling.

### ⚠ WARNING

If the ducts will be washed down during outage, ensure that the transmitter units are powered down and removed from the was area.

## 3 Configure transmitter with membrane keypad

### 3.1 Verify installation

#### **⚠ WARNING**

Failure to install covers and ground leads could result in serious injury or death.  
Install all protective equipment covers and safety ground leads after installation.

---

### 3.2 Mechanical installation

Ensure the transmitter is installed correctly.  
See [Install](#).

#### **⚠ WARNING**

Opening the electronics housing in hazardous areas may cause an explosion resulting in severe injury or death.  
You may need to get a hot work permit from your company safety officer before you open the housing.

---

### 3.3 Wire terminal block

See [Figure 2-14](#) or [Figure 2-18](#).

#### **Procedure**

1. Remove screw, cover lock, and captive washer that secure cover on left side of housing. Remove the cover.
2. Check the terminal block wiring. Be sure the 4-20 mA signal and the logic outputs are properly connected and secure. For units with remote electronics, check the terminal block wiring at the probe and at the remote electronics unit.

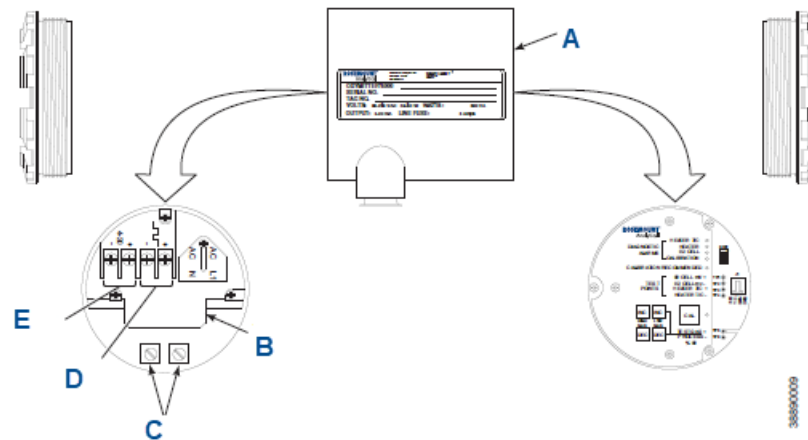
#### **⚠ WARNING**

##### **Electrical shock**

Install the power terminal cover.

---

Figure 3-1: Electronics Housing Terminals and Membrane Keypad



- A. Rosemount™ Hazardous Area Oxymitter 4000 electronics housing
- B. Terminal block
- C. Ground lugs
- D. Logic I/O
- E. 4-20 mA signal

3. Install the cover over terminal block and secure with captive washer, cover lock, and screw.

## 3.4 Configuration

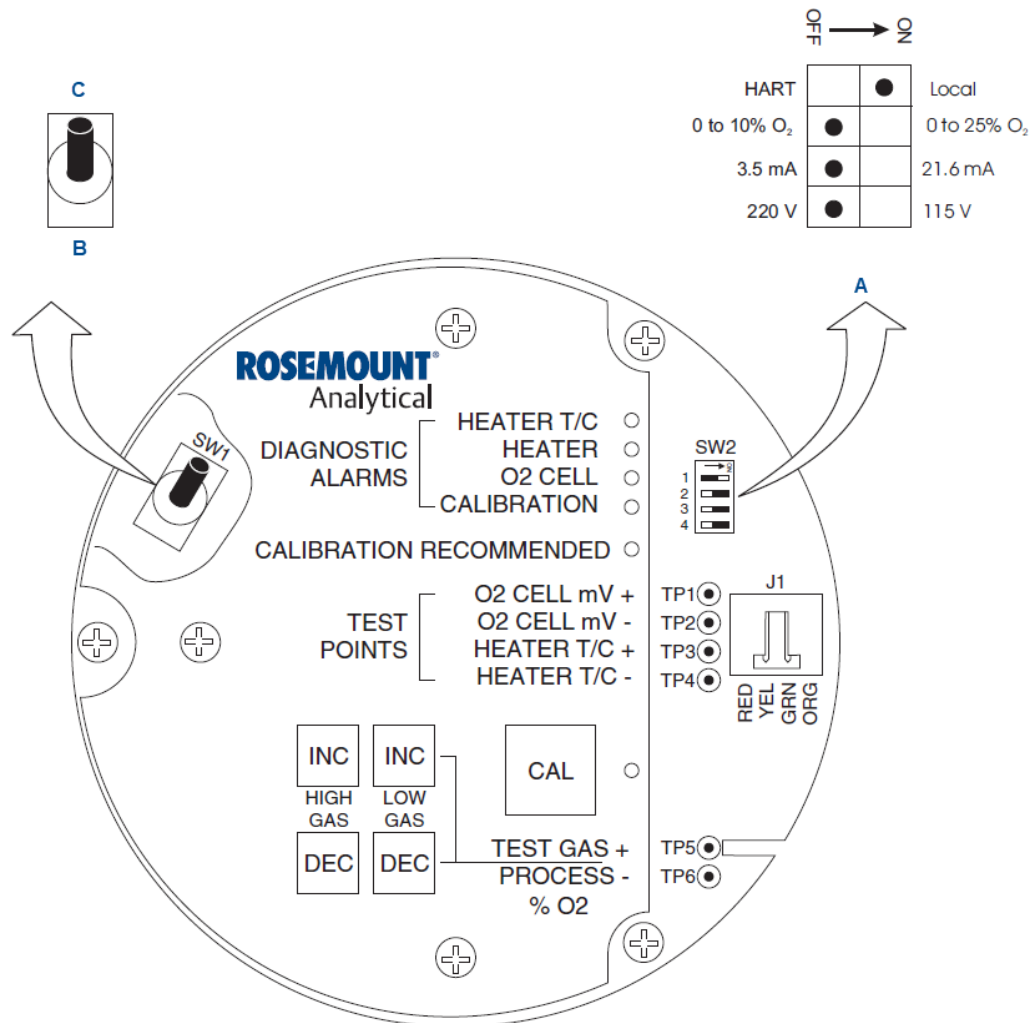
Located on the microprocessor board, the top board, are two switches that configure outputs for the transmitter.

### **⚠ WARNING**

**The HART® option is not protected by energy limiting barriers.**

Do not interface with the HART option from within the hazardous area.  
Route the 4-20 mA cables and make the connections outside the hazardous area.  
This is the case even when using the intrinsically safe version of the handheld communicator.

**Figure 3-2: Defaults: Rosemount™ Hazardous Area Oxymitter 4000 with Membrane Keypad**



- A. Default position (ex-factory).
- B. 4-20 mA requires external power.
- C. 4-20 mA is internally powered (default).

SW1 determines if the 4-20 mA signal is internally or externally powered. SW2 determines:

- Transmitter status: HART or LOCAL
- Oxygen range: 0 to 10% O<sub>2</sub> or 0 to 25% O<sub>2</sub>. (0 to 40% O<sub>2</sub> is also configurable only through HART/AMS).
- 4-20 mA signal, at fault or power up: 3.5 mA or 21.6 mA

**⚠ CAUTION**

If you change defaults under power, damage to the electronics package may occur.

Remove power from the transmitter before changing defaults.

### 3.4.1 SW1 setting

You can set SW1 to either internally or externally power the 4-20 mA signal. The factory setting is to internally power the 4-20 mA signal.

### 3.4.2 SW2 setting

The factory sets this switch as follows:

1. Position 1 is HART<sup>®</sup>/LOCAL. This switch setting controls the configuration of the transmitter. The defaults cannot be changed via HART/AMS unless the switch is in the HART position. Placing SW2, position 1 in the LOCAL position forces the O<sub>2</sub> range to the setting of position 2. The position 1 switch must be in the LOCAL position or changes in SW2, position 2 will have no effect.
2. Position 2 determines the O<sub>2</sub> range. You can set it to either 0 to 10 percent O<sub>2</sub> or 0 to 25 percent O<sub>2</sub>. The factory default setting is 0 to 10 percent O<sub>2</sub>. If necessary, you can configure the O<sub>2</sub> range from 0 to 40 percent O<sub>2</sub>. To select values within this range, set SW2, position 1 to HART and then enter the range via HART/AMS. Do not change SW2 position 1 to LOCAL unless you want to operate in the range specified by SW2, position 2.

**⚠ WARNING**

**Typically, the probe's sensing cell, in direct contact with the process gases, is heated to approximately 1357 °F (736 °C).**

The external temperature of the probe body may exceed 842 °F (450 °C). If operating conditions also contain high oxygen levels and combustible gases, the transmitter may self-ignite.

3. Position 3 determines the output at start-up or at an alarm. The settings are 3.5 mA or 21.6 mA. The factory setting is 3.5 mA. At start-up, the analog output is 3.5 mA or 21.6 mA.
4. You can use position 4 to set the heater for 115 or 220 Vac operation. This switch is functional only when the software is set for manual voltage selection (Auto Tune = No). Otherwise, the internal electronics auto detect the input line voltage and set the heater voltage accordingly (Auto Tune = Yes).



### 3.4.3 Read O<sub>2</sub> concentration

Once the cell is up to operating temperature, you can read O<sub>2</sub> percentage.

1. Access TP5 and TP6 next to the membrane keypad. Attach a multimeter across TP6 and TP6. You can now monitor the calibration and process gases. Press **INC** or **DEC** once to switch the output from process gas to calibration gas. Press **INC** or **DEC** a second time to increase or decrease the calibration gas parameter. If the keys have been inactive for one minute, the output reverts to the process gas. When you have initiated a calibration, the value at TP5 and TP6 is the %O<sub>2</sub> seen by the cell. Oxygen levels, as seen on the multimeter are:
  - 8.0% O<sub>2</sub> = 8.0 Vdc
  - 0.4% O<sub>2</sub> = 0.4 Vdc
2. HART®/AMS

#### **⚠ WARNING**

**The HART option is not protected by energy limiting barriers.**

Do not interface with HART from within the hazardous area.

Route the 4-20 mA cables and make the connections outside the hazardous area.

This is the case even when using the intrinsically safe version of the handheld communicator.

3. Rosemount™ 751: the loop driven LCD display

## 3.5 Logic I/O

You can configure the two-terminal logic contact either as a solid-state relay-activated alarm or as a bi-directional calibration handshake signal to a Rosemount™ IMPS 4000 or SPS 4001B.

The configuration of this signal depends on the setting of the Logic I/O PIN MODE via HART®/AMS or LOI. The ten different modes available are explained in [Table 2-9](#).

### 3.5.1 Alarm

When configured as an alarm, this signal alerts you to an out-of-spec condition. The output is +5 Vdc in series with a 340 ohm resistor.

For optimum performance, Emerson recommends connecting the output to a Potter & Brumfield 3.2 mA DC relay (PN R105-E1Y1-J1.OK).

Of the 10 modes in [Table 2-9](#), modes 0 through 7 are the alarm modes. The factory default is mode 5 for a Rosemount™ Oxymitter 4000 without a Rosemount IMPS 4000 or SPS 4001B. In this mode, the output will signal when a unit alarm or a CALIBRATION RECOMMENDED indication occurs.

## 3.5.2 Calibration handshake signal

If using an optional Rosemount IMPS 4000 or SPS 4001B, you must configure the logic I/O for calibration handshaking.

Of the 10 modes in [Table 2-9](#), only modes 8 and 9 are configured for calibration handshaking. For a transmitter with a Rosemount IMPS 4000 or an SPS 4001B, the factory sets the default to mode 8. In this mode, the logic I/O is used to communicate between the transmitter and the sequencer.

## 3.6 Recommended configuration

### 3.6.1 4-20 mA signal on critical alarm

Emerson recommends using the factory default. The 4-20 mA signal will go to the 3.5 mA level upon any critical alarm, which will cause the O<sub>2</sub> reading to be unstable.

The customer can also select 21.6 mA as the failure setting if normal operations cause the O<sub>2</sub> readings to go below the zero % O<sub>2</sub> (3.5 mA) level. If using the O<sub>2</sub> measurement as part of an automatic control loop, place the loop into manual upon this failure event or take other appropriate action.

### 3.6.2 Calibration

Emerson recommends using an autocalibration system actuated by the `Calibration recommended` diagnostic.

New O<sub>2</sub> cells may operate for more than a year, but older cells may require recalibration every few weeks as they near the end of their lives. This strategy ensures that the O<sub>2</sub> reading is always accurate and eliminates many unnecessary calibrations based on calendar days or weeks since previous calibration. When using the Rosemount™ SPS 4001B or IMPS 4000, consider wiring some or all associated alarm contacts.

1. CALIBRATION INITIATE: Contact from the control room to a Rosemount SPS4001B or IMPS 4000 (one per probe) provides the ability to manually initiate a calibration at any time from the control room. Note that calibrations can also be initiated from a HART® handheld communicator, from Asset Management Solutions software, or from the keypad on the Rosemount Oxymitter 4000.
2. IN CALIBRATION: One contact per probe provides notification to the control room that the `Calibration recommended` diagnostic has initiated an automatic calibration through the Rosemount SPS 4001B or IMPS 4000. If the O<sub>2</sub> signal is being used in an automatic control loop, use this contact to place the control loop into Manual during calibration.
3. CALIBRATION FAILED: One contact per probe from a Rosemount SPS 4001B or IMPS 4000 to the control room for notification that the calibration procedure has failed. A pressure switch, which indicates when the calibration gas bottles are empty, is grouped with this alarm.
4. 4-20 mA SIGNAL DURING CALIBRATION: You can configure the 4-20 mA signal to respond normally during any calibration or to hold the last O<sub>2</sub> value upon the

initiation of calibration. The factory default is for the 4-20 mA signal to track (operate normally) throughout calibration. Holding the last O<sub>2</sub> value may be useful if several probes are being averaged for the purpose of automatic control. Unless you are averaging several probes, always place control loops that are using the O<sub>2</sub> signal into the Manual mode prior to starting the calibration.



## 4 Configure transmitter with LOI

### 4.1 Verify installation

#### **⚠ WARNING**

Failure to install covers and ground leads could result in serious injury or death.

Install all protective equipment covers and safety ground leads after installation.

---

### 4.2 Mechanical installation

Ensure the transmitter is installed correctly.

See [Install](#).

#### **⚠ WARNING**

Opening the electronics housing in hazardous areas may cause an explosion resulting in severe injury or death.

You may need to get a hot work permit from your company safety officer before you open the housing.

---

### 4.3 Wire terminal block

See [Figure 2-14](#) or [Figure 2-18](#).

#### **Procedure**

1. Remove screw, cover lock, and captive washer that secure cover on left side of housing. Remove the cover to expose the terminal block.
2. Check the terminal block wiring. Be sure the power, 4-20 mA signal, and the logic outputs are properly connected and secure. For units with remote electronics, check the terminal block wiring at the probe and at the remote electronics unit.

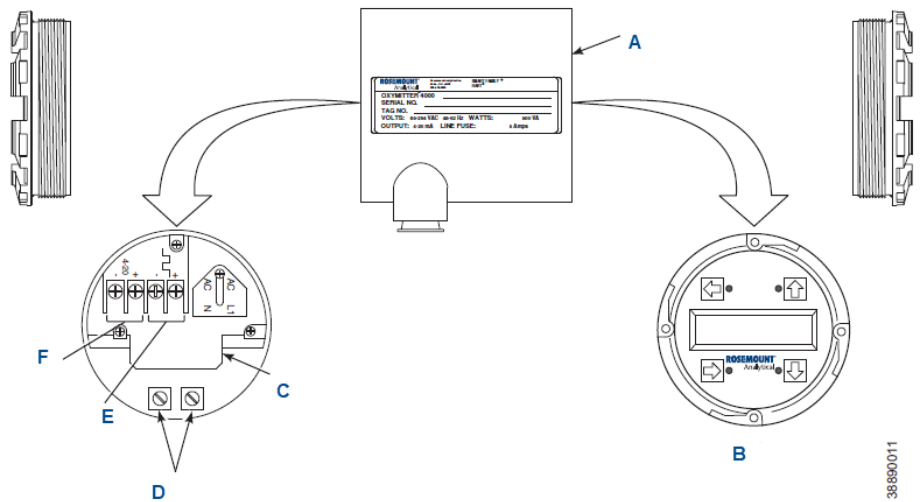
#### **⚠ WARNING**

##### **Electrical shock**

Install the power terminal cover.

---

Figure 4-1: Electronics Housing Terminals with LOI



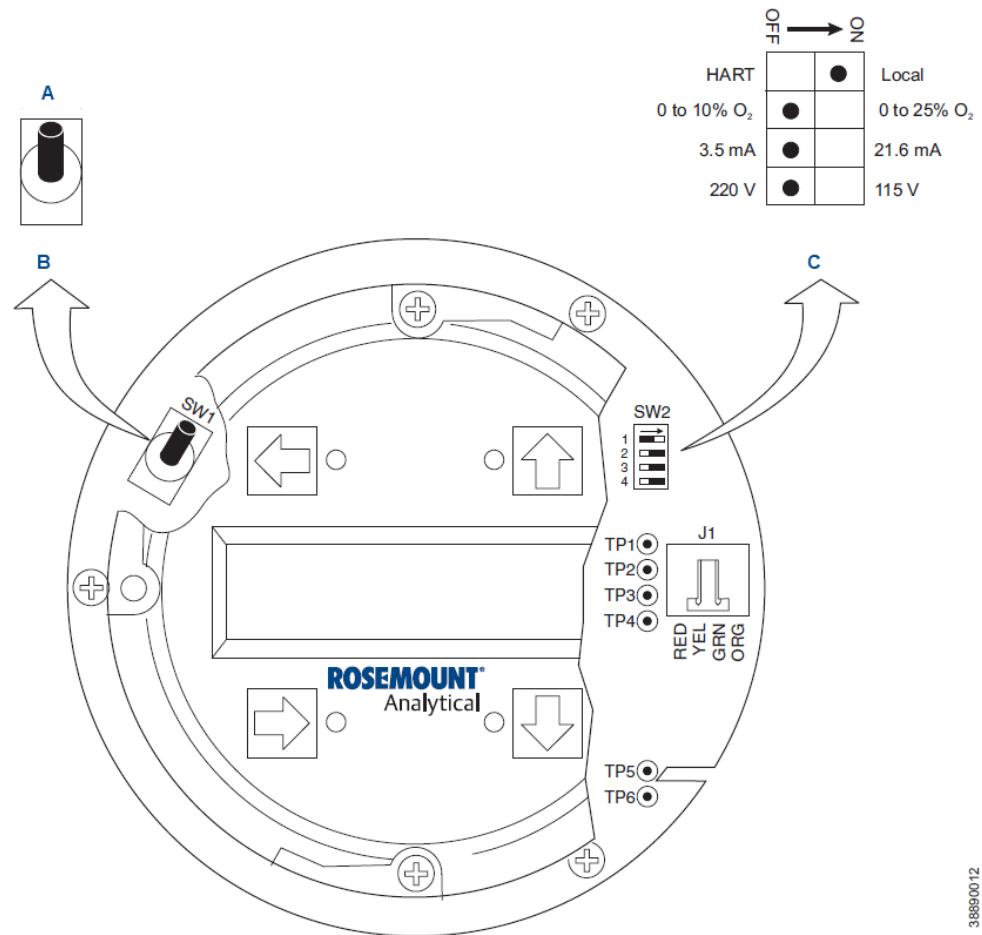
- A. Rosemount™ Oxymitter 4000 electronics housing
- B. LOI
- C. Terminal block
- D. Ground lugs
- E. Logic I/O
- F. 4-20 mA signal

3. Install the cover over terminal block and secure with captive washer, cover lock, and screw.

## 4.4 Configuration

Two switches that configure the transmitter outputs are located on the microprocessor board. To access these switches, remove the LOI module.

**Figure 4-2: Defaults: Rosemount™ Hazardous Area Oxymitter 4000 with LOI**



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### Note

The 115 V option at switch SW2 position 4 is active only when the heater voltage option is set to manual in the software.

- A. 4-20 mA is internally powered (default).
- B. 4-20 mA requires external power.
- C. Default position (ex-factory).

**⚠ WARNING****The HART option is not protected by energy limiting barriers.**

Do not interface with the HART option from within the hazardous area.  
Route the 4-20 mA cables and make the connections outside the hazardous area.  
This is the case even when using the intrinsically safe version of the handheld communicator.

SW1 determines if the 4-20 mA signal is internally or externally powered. SW2 determines:

- Transmitter status: HART or LOCAL
- Oxygen range: 0 to 10% O<sub>2</sub> or 0 to 25% O<sub>2</sub>. (You can only configure 0 to 40% O<sub>2</sub> through HART/AMS).
- The 4-20 mA signal at fault or power up: 3.5 mA or 21.6 mA

**⚠ CAUTION**

If you change defaults under power, damage to the electronics package may occur.  
Remove power from the transmitter before changing defaults.

### 4.4.1 SW1 setting

You can set SW1 to either internally or externally power the 4-20 mA signal. The factory setting is to internally power the 4-20 mA signal.

### 4.4.2 SW2 setting

The factory sets this switch as follows:

1. Position 1 is HART<sup>®</sup>/LOCAL. This switch setting controls the configuration of the transmitter. The defaults cannot be changed via HART/AMS or the LOI unless the switch is in the HART position. Placing SW2, position 1 in the LOCAL position forces the O<sub>2</sub> range to the setting of position 2. The position 1 switch must be in the LOCAL position or changes in SW2, position 2 will have no effect.
2. Position 2 determines the O<sub>2</sub> range. You can set it to either 0 to 10% O<sub>2</sub> or 0 to 25% O<sub>2</sub>. The factory default setting is 0 to 10% O<sub>2</sub>. If necessary, you can configure the O<sub>2</sub> range from 0 to 40% O<sub>2</sub>. To select values within this range, set SW2, position 1 to HART and then enter the range via HART/AMS or the LOI. Do not change SW2 position 1 to LOCAL unless you want to operate in the range specified by SW2, position 2.



### **⚠ WARNING**

**Typically, the probe's sensing cell, in direct contact with the process gases, is heated to approximately 1357 °F (736 °C).**

The external temperature of the probe body may exceed 842 °F (450 °C). If operating conditions also contain high oxygen levels and combustible gases, the transmitter may self-ignite.

3. Position 3 determines the output at start-up or at an alarm. The settings are 3.5 mA or 21.6 mA. The factory setting is 3.5 mA. At start-up, the analog output is 3.5 mA or 21.6 mA.
4. You can use position 4 to set the heater for 115 or 220 Vac operation. This switch is functional only when the software is set for manual voltage selection (Auto Tune = No). Otherwise, the internal electronics auto detect the input line voltage and set the heater voltage accordingly (Auto Tune = Yes).

## 4.4.3 Read O<sub>2</sub> concentration

Once the cell is up to operating the temperature, you can read the O<sub>2</sub> percentage.

### **Procedure**

1. To access TP5 and TP6 under the LOI module (Figure 4-2), power down the transmitter and remove the LOI module.
2. Attach alligator leads from a multimeter across TP5 and TP6.
3. Install the LOI module and power up the transmitter. Allow time for the cell to reach operating temperature.

You can now monitor the calibration and process gases. When you have initiated a calibration, the value at TP5 and TP6 is the % O<sub>2</sub> seen by the cell. Oxygen levels, as seen on the multimeter, are:

- 8.0% O<sub>2</sub> = 8.0 Vdc
- 0.4% O<sub>2</sub> = 0.4 Vdc

You can also read the O<sub>2</sub> concentration on:

- HART®/AMS

### **⚠ WARNING**

**The HART option is not protected by energy limiting barriers.**

Do not interface with the HART option from within the hazardous area. Route the 4-20 mA cables and make the connections outside the hazardous area. This is the case even when using the intrinsically safe version of the handheld communicator.

- Rosemount™ 751, loop-driven LCD display

## 4.5 Logic I/O

You can configure the two-terminal logic contact either as a solid-state relay-activated alarm or as a bi-directional calibration handshake signal to a Rosemount™ IMPS 4000 or SPS 4001B.

The configuration of this signal depends on the setting of the Logic I/O PIN MODE via HART®/AMS or LOI. The ten different modes available are explained in [Table 2-9](#).

### 4.5.1 Alarm

When configured as an alarm, this signal alerts you to an out-of-spec condition. The output is +5 Vdc in series with a 340 ohm resistor.

For optimum performance, Emerson recommends connecting the output to a Potter & Brumfield 3.2 mA DC relay (PN R105-E1Y1-J1.OK).

Of the 10 modes in [Table 2-9](#), modes 0 through 7 are the alarm modes. The factory default is mode 5 for a Rosemount™ Oxymitter 4000 without a Rosemount IMPS 4000 or SPS 4001B. In this mode, the output will signal when a unit alarm or a CALIBRATION RECOMMENDED indication occurs.

### 4.5.2 Calibration handshake signal

If using an optional Rosemount IMPS 4000 or SPS 4001B, you must configure the logic I/O for calibration handshaking.

Of the 10 modes in [Table 2-9](#), only modes 8 and 9 are configured for calibration handshaking. For a transmitter with a Rosemount IMPS 4000 or an SPS 4001B, the factory sets the default to mode 8. In this mode, the logic I/O is used to communicate between the transmitter and the sequencer.

## 4.6 Recommended configuration

### 4.6.1 4-20 mA signal on critical alarm

Emerson recommends using the factory default. The 4-20 mA signal will go to the 3.5 mA level upon any critical alarm, which will cause the O<sub>2</sub> reading to be unstable.

The customer can also select 21.6 mA as the failure setting if normal operations cause the O<sub>2</sub> readings to go below the zero % O<sub>2</sub> (3.5 mA) level. If using the O<sub>2</sub> measurement as part of an automatic control loop, place the loop into manual upon this failure event or take other appropriate action.

### 4.6.2 Calibration

Emerson recommends using an autocalibration system actuated by the Calibration recommended diagnostic.

New O<sub>2</sub> cells may operate for more than a year, but older cells may require recalibration every few weeks as they near the end of their lives. This strategy ensures that the O<sub>2</sub>

reading is always accurate and eliminates many unnecessary calibrations based on calendar days or weeks since previous calibration. When using the Rosemount™ SPS 4001B or IMPS 4000, consider wiring some or all associated alarm contacts.

1. CALIBRATION INITIATE: Contact from the control room to a Rosemount SPS4001B or IMPS 4000 (one per probe) provides the ability to manually initiate a calibration at any time from the control room. Note that calibrations can also be initiated from a HART® handheld communicator, from Asset Management Solutions software, or from the keypad on the Rosemount Oxymitter 4000.
2. IN CALIBRATION: One contact per probe provides notification to the control room that the Calibration recommended diagnostic has initiated an automatic calibration through the Rosemount SPS 4001B or IMPS 4000. If the O<sub>2</sub> signal is being used in an automatic control loop, use this contact to place the control loop into Manual during calibration.
3. CALIBRATION FAILED: One contact per probe from a Rosemount SPS 4001B or IMPS 4000 to the control room for notification that the calibration procedure has failed. A pressure switch, which indicates when the calibration gas bottles are empty, is grouped with this alarm.
4. 4-20 mA SIGNAL DURING CALIBRATION: You can configure the 4-20 mA signal to respond normally during any calibration or to hold the last O<sub>2</sub> value upon the initiation of calibration. The factory default is for the 4-20 mA signal to track (operate normally) throughout calibration. Holding the last O<sub>2</sub> value may be useful if several probes are being averaged for the purpose of automatic control. Unless you are averaging several probes, always place control loops that are using the O<sub>2</sub> signal into the Manual mode prior to starting the calibration.



# 5 Start up and operate transmitter with membrane keypad

## 5.1 Power up

### 5.1.1 Start-up display

When the operator applies power to the probe, the cell heater turns on. It takes approximately half an hour for the cell to heat to operating temperature.

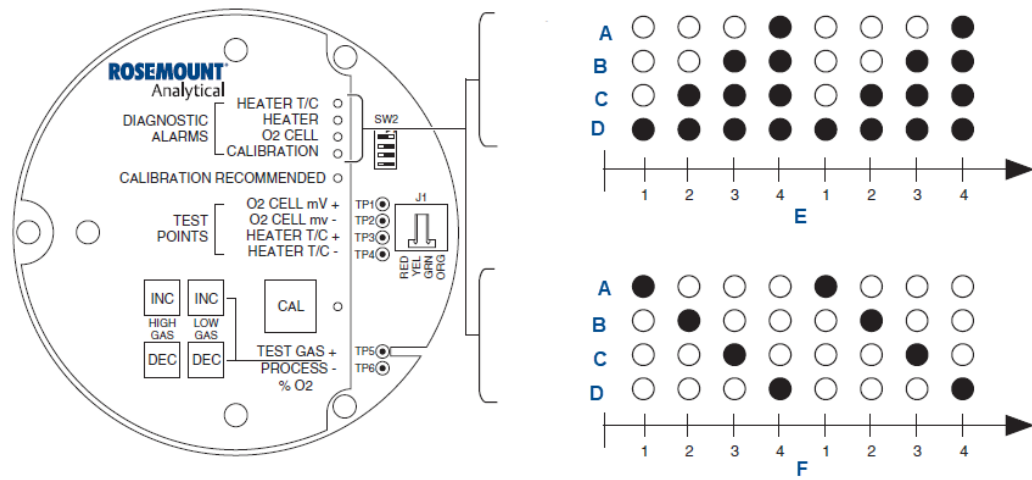
This condition is indicated by the top four LEDs (diagnostic alarms) on the membrane keypad. Starting with the **CALIBRATION** LED, the LEDs light in ascending order until all four LEDs are on. At this point, all four turn off, and the cycle starts again. This ramp cycle continues until the cell is up to operating temperature.

### 5.1.2 Operating display

The ramp cycle turns into a cycle where the diagnostic LEDs light in sequence from the top to the bottom, one at a time.

After the bottom LED turns on, the sequence starts again at the top with the **HEATER T/C** LED.

Figure 5-1: Defaults: Rosemount™ Oxymitter 4000 with LOI



- A. Heater thermocouple
- B. Heater
- C. O<sub>2</sub> cell
- D. Calibration
- E. Lighting sequence during warm up (start-up display)
- F. Lighting sequence during normal operation (operating display)

### 5.1.3 Error

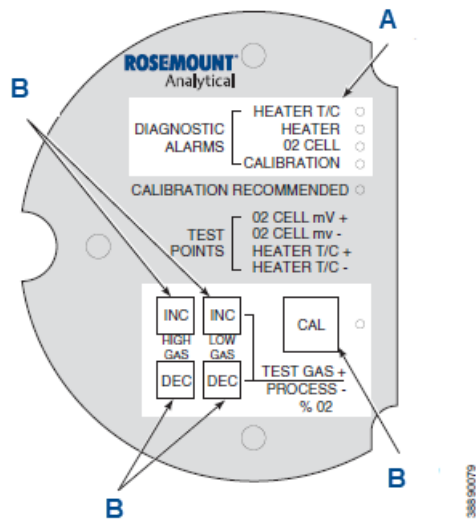
If there is an error condition at start-up, one of the diagnostics LEDs will be blinking.

Refer to [Troubleshoot](#) to determine the cause of the error. Clear the error and cycle power; the operating display should return.

## 5.1.4 Keypad

During calibration, only use the five membrane keys on the membrane keypad to adjust the high and low gas and to initiate the calibration sequence.

**Figure 5-2: Calibration Keys**



- A. Diagnostic LEDs
- B. Membrane keys

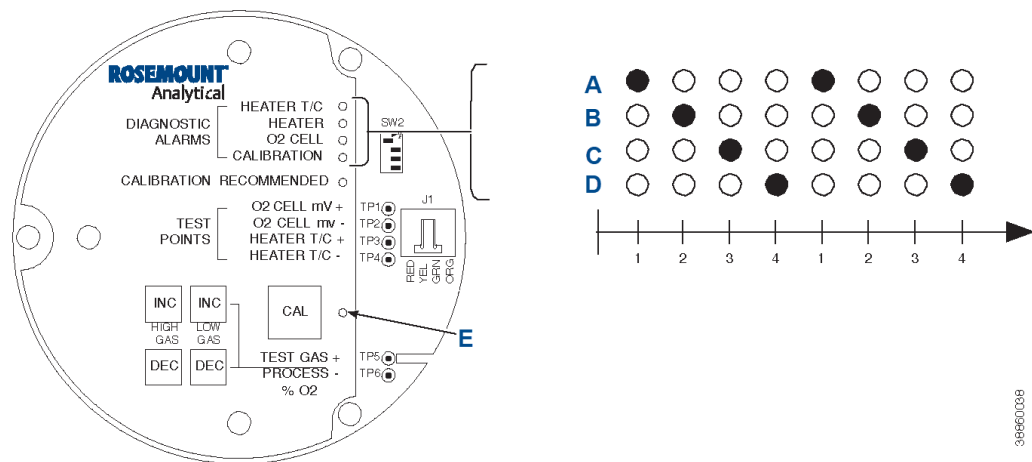
## 5.1.5 Reference air

Ensure reference air, if used, is set to 0.25 L/min (0.5 SCFH).

## 5.2 Operate

Ensure the transmitter is at normal operation. The diagnostic LEDs will display the operating cycle. All other LEDs should be off.

Figure 5-3: Normal Operation



- A. Heater thermocouple
- B. Heater
- C. O<sub>2</sub> cell
- D. Calibration
- E. Calibration LED

### 5.2.1 Diagnostic alarm LEDs

If there is an error in the system, one of these LEDs will flash various blink codes. In the case of multiple errors, only one LED will flash based on a priority system.

Correct the problem and cycle power. The operating display will return to normal, or the next error will be displayed. The alarms are:

- HEATER T/C
- HEATER
- O<sub>2</sub> CELL
- CALIBRATION



## 5.2.2 Calibration Recommended LED

This LED when the system determines that a calibration is recommended.

### Note

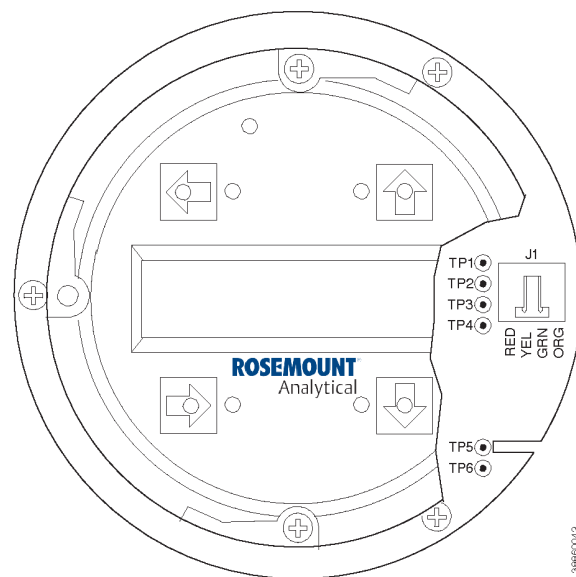
The Calibration Recommended alarm was discontinued in 2014. It is still available on the Rosemount™ 6888 product.

## 5.2.3 Test points

Test points 1 through 6 allow you to monitor the following with a multimeter: the heater thermocouple, the O<sub>2</sub> cell millivolt value, and the process O<sub>2</sub>.

- TP1 and TP2 monitor the oxygen cell millivolt output, which equates to the percentage of oxygen present.
- TP3 and TP4 monitor the heater thermocouple.
- TP5 and TP6 monitor the process gas or the calibration gas procedures.

Figure 5-4: Test Points



## 5.2.4 Cal LED

The Cal LED is on steady or flashing during calibration.

### Keys

Use the **INC** and **DEC** keys to set the values of the calibration gases. Attach a multimeter across TP5 and TP6. You can now monitor the calibration and process gases. Press the **INC** or **DEC** once to switch the output from the process gas to the calibration gas. Press **INC** or **DEC** a second time to increase or decrease the calibration gas parameter. If the keys have

been inactive for one minute, the output reverts to the process gas. When you have initiated a calibration, the value at TP5 and TP6 is the % O<sub>2</sub> seen by the cell.

Oxygen levels, as seen on the multimeter, are:

- 8.0% O<sub>2</sub> = 8.0 Vdc
- 0.4% O<sub>2</sub> = 0.4 Vdc

## 5.2.5 Cal

The **Cal** key can:

- Initiate a calibration.
- Sequence through calibration.
- Abort the calibration.

### Keys

Refer to the *Remote Powered Loop LCD* Reference Manual for calibration and operation.

## 6 Start up and operate transmitter with LOI

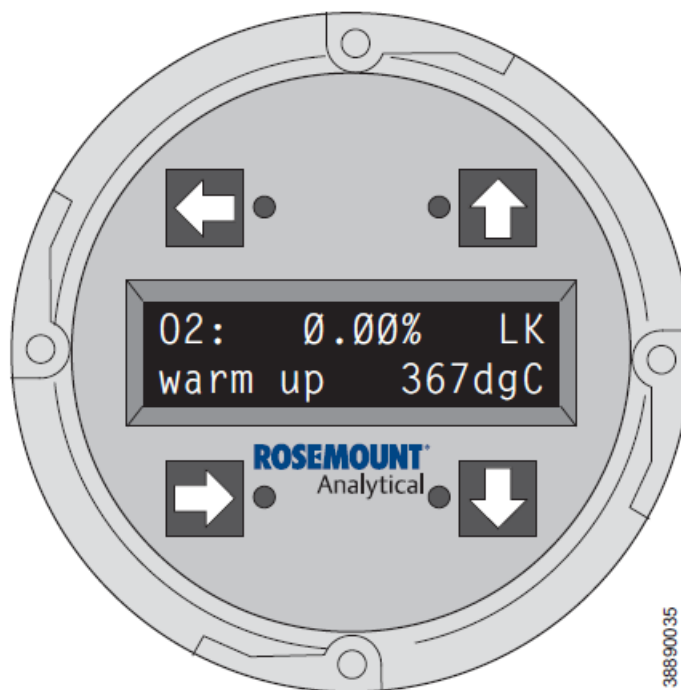
### 6.1 Power up

#### 6.1.1 Start-up display

When you apply power to the probe, the cell heater turns on. It takes approximately half an hour for the cell to heat to operating temperature.

This condition is indicated by a `warm up` display on the LOI. The message will continue to display until the cell is up to operating temperature.

**Figure 6-1: Start-up Display**

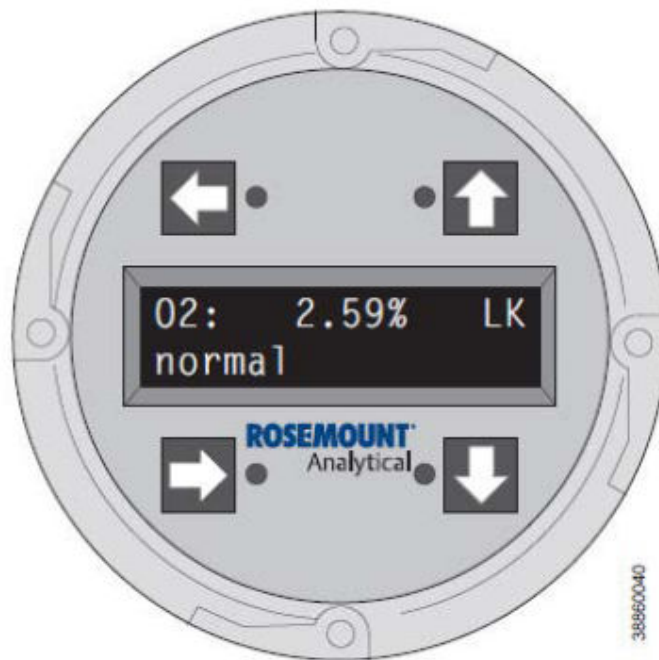


#### 6.1.2 Operating display

The normal operating display is the % O<sub>2</sub> concentration.

The normal display is shown in [Figure 6-2](#).

Figure 6-2: Normal Display



### 6.1.3 Error

If there is an error condition at start-up, an alarm message will be displayed.

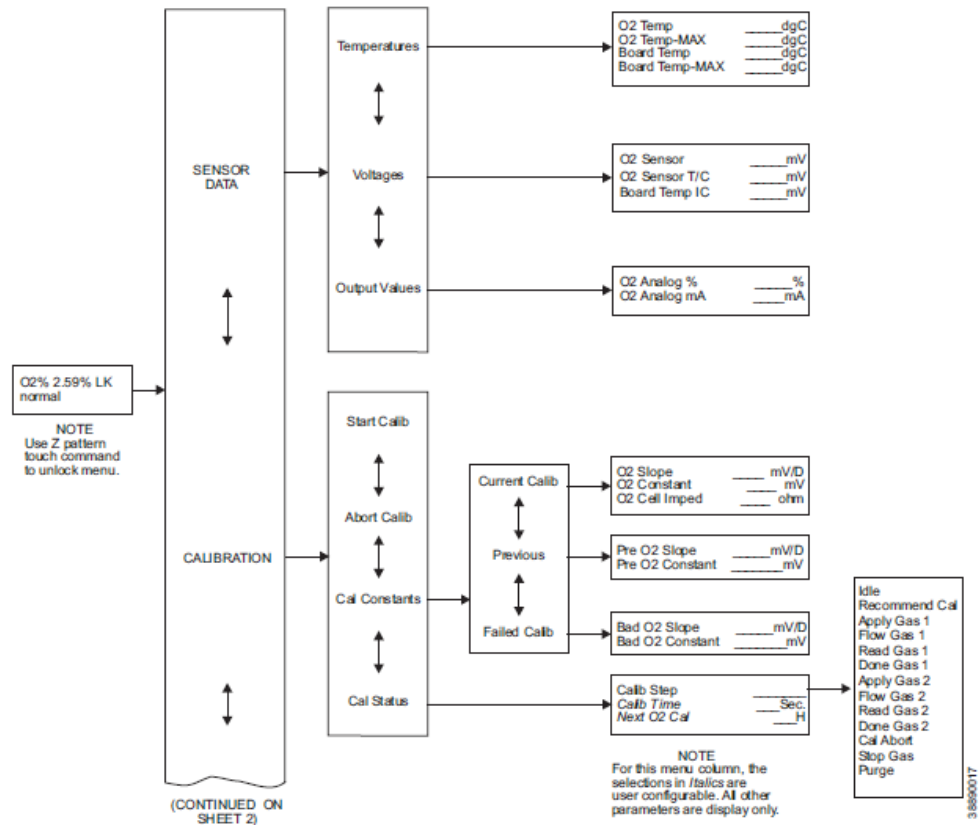
Refer to [Troubleshoot](#) to determine the cause of the error. Clear the error and cycle the power; the % O<sub>2</sub> display should return.

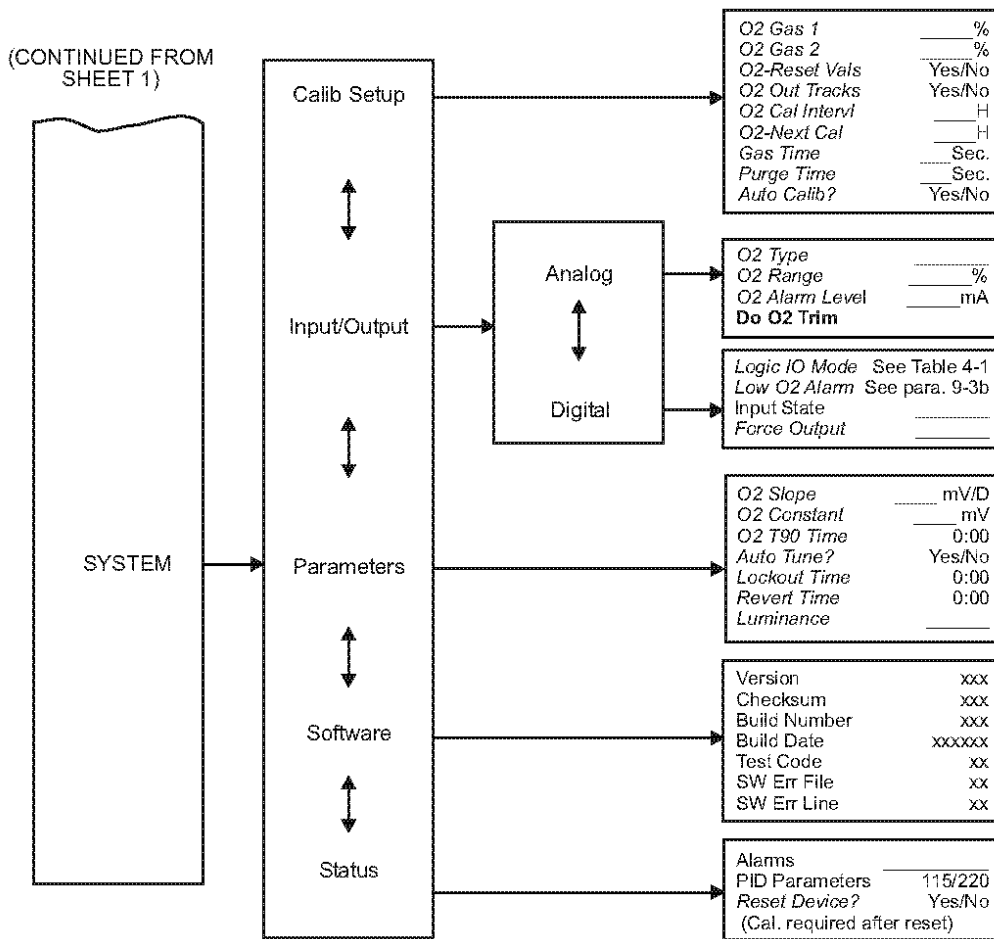
### 6.1.4 LOI

You can use the local operator interface to adjust the high and low gas settings and to initiate the calibration sequence.

Refer to [Figure 6-3](#).

Figure 6-3: Local Operator Interface Menu Tree





## 6.1.5 Reference air

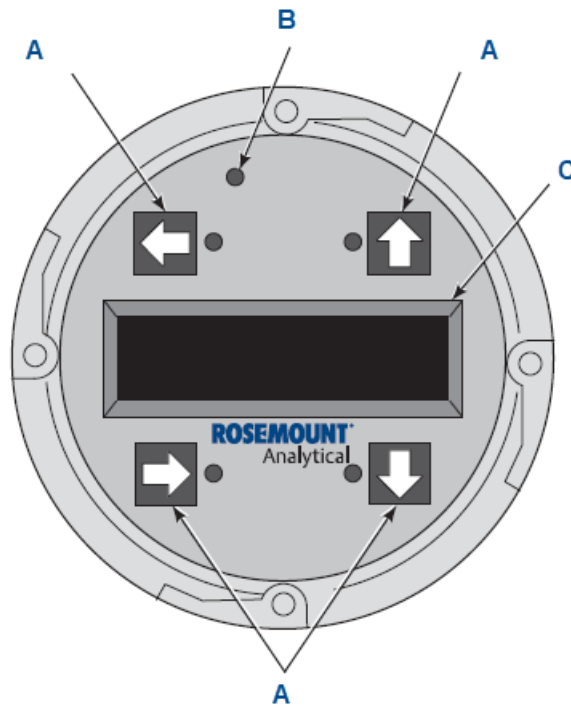
Ensure reference air, if used, is set to 0.25 L/min (0.5 SCFH).

## 6.2 Navigating the local operator interface

### 6.2.1 Overview

The local operator interface (LOI) uses a bright blue gas-fluorescent display.

**Figure 6-4: LOI Features**



38890054

- A. Selection arrow
- B. Touch confirmation LED
- C. LCD display window

You can adjust the intensity of the display. There is an infrared LED source and a detector for each key. The detectors can detect a finger placed above the button through the glass window. There is no need to open the instrument in bad weather or in hazardous areas in order to access the electronics.

The transmitter also uses HART® communications, permitting access to all instrument functionality anywhere the 4-20 mA signal terminates via a HART handheld communicator.

## 6.2.2 Lockout

The LOI has a lockout feature that prevents nuisance actuation by someone brushing against the glass window, raindrops, dirt, insects, etc.

This lockout mode is automatically established when no buttons are pushed for 30 seconds (default). You can configure the countdown to lockout.

To unlock the display, input a Z pattern. First, push the top left (gray) arrow, then the top right, followed by the bottom left, and finally the bottom right. The LK notation in the upper right corner of the display disappears. Push the gray arrow at the top left hand corner once more to enter into the menu structure. Once you move deeper into the menu structure, the transmitter gives you additional time, so that the lockout initiation doesn't become a nuisance. This additional revert time is defaulted at one hour and is also user-configurable.

### ⚠ CAUTION

**Excessive dust can prevent the LOI from entering lockout.**

This condition can cause uncommanded operations to occur

Always clean the dust and soil away from the LOI screen each time you use the LOI.

## 6.3 LOI key designations

The gray key (top left) moves one level higher in the menu structure. When entering numbers, this key moves the cursor to the left.

This key also doubles as an **Enter** key once numbers are entered and when the cursor is moved to its leftmost position. The new data entry value appears in the top line of the LOI display once it is accepted.

The blue key (bottom left) acts as a selector when choosing from among a number of menu items. This key also moves the cursor to the right when entering numbers.

**Up/Down** keys (to the left side of the keypad) are used to increment up and down when selecting from a series of menu picks. You can also use them to increment values up and down when inputting data.

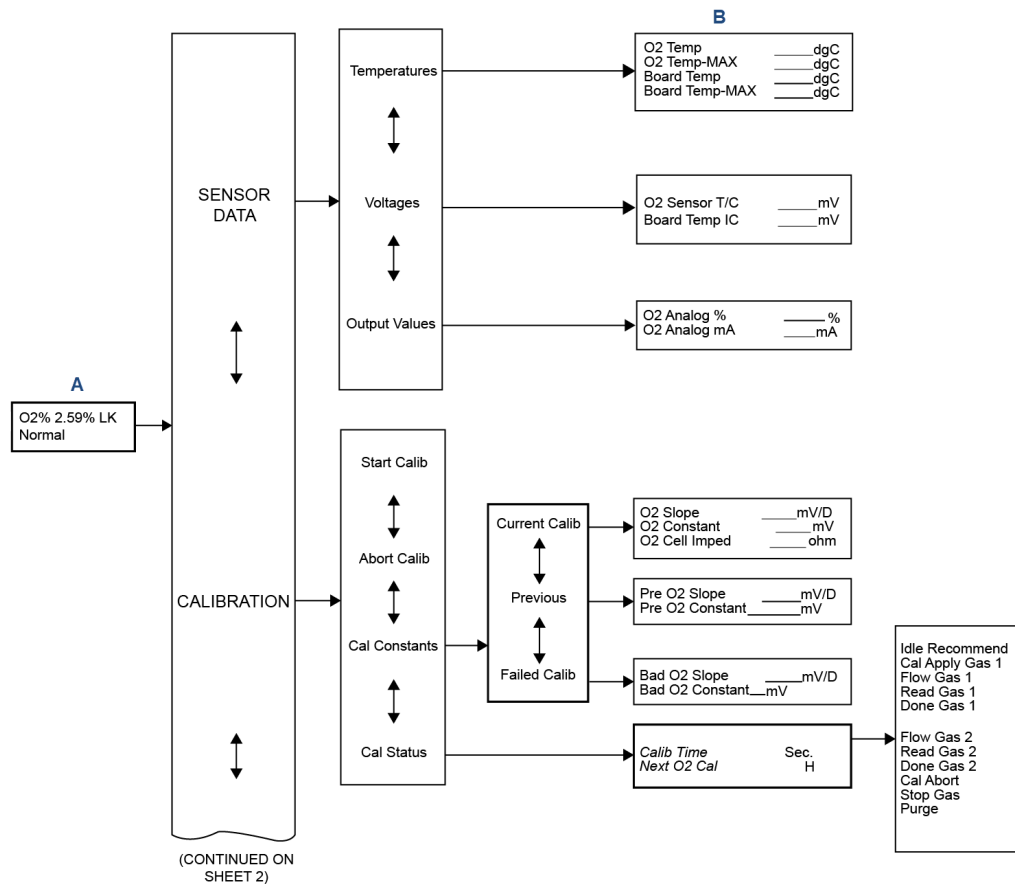
## 6.4 LOI menu tree

The following menu tree is specific to the Rosemount™ Oxymitter 4000 and will assist you in navigating the LOI.

Menu items in normal text display information only. Menu items in italics permit data entry.

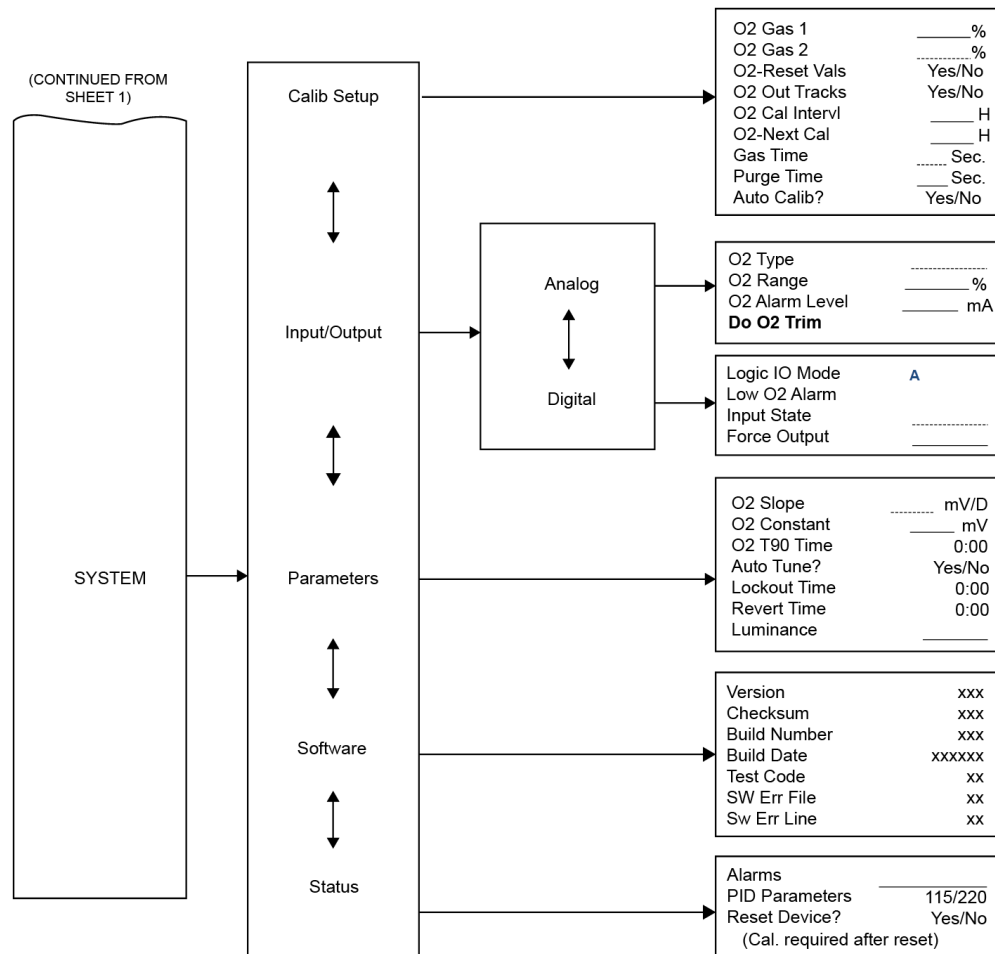


Figure 6-5: Local Operator Interface Menu Tree (Sheet 1 of 2)



- A. Use Z pattern touch command to unlock menu.
- B. For this menu column, the selections in italics are user configurable. All other parameters are display only.

Figure 6-6: Local Operator Interface Menu Tree (Sheet 2 of 2)



A. See Table 2-9.

## 6.5 Setup at the LOI

In setting up the transmitter from the LOI, it's best to start at the *SYSTEM/Calibration Setup* menu.

### SYSTEM/ Calibration Setup

O<sub>2</sub> Gas #1: Enter the high or low cal gas value (the order is not important).

O<sub>2</sub> Gas #2: Enter the second cal gas value.

#### Note

See [Maintenance and service](#) for calibration instructions.

#### Note

Emerson recommends 0.4% O<sub>2</sub> and 8% O<sub>2</sub> for calibration gases.

**O<sub>2</sub> Reset Values** Resets factory default values.

<b>O<sub>2</sub> Output Tracks</b>	4 to 20 mA signal can be held at the last value during calibration, or the signal can be left to track the cal gases.
<b>O<sub>2</sub> Cal Interval</b>	If you select automatic calibration, this selects the interval between calibrations.
<b>O<sub>2</sub> Next Cal</b>	If you select automatic calibration, this selects the time until the initial calibration takes place.
<b>Gas Time</b>	How long each cal gas should flow. The factory default is 300 seconds, but the operator may want to vary this depending upon the length of calibration gas tubing runs.
<b>Purge Time</b>	Used if the O <sub>2</sub> output is selected to hold the last value during calibration. Determines how long until the sensor comes back to the normal process reading and when the 4-20 mA signal can be released after the second cal gas is removed.
<b>Auto Calib?</b>	Select <b>Yes</b> if a Rosemount SPS or IMPS autocalibration system is part of the system.
<b>SYSTEM/Input/Output</b>	<ul style="list-style-type: none"><li>• Analog: Pertaining to the analog 4-20 mA signal representing O<sub>2</sub>.<ul style="list-style-type: none"><li>— O<sub>2</sub> Type: 4-20 mA signal may be configured to increase with increasing O<sub>2</sub> or the reverse.</li><li>— O<sub>2</sub> Range: Upper O<sub>2</sub> range is user-selectable.</li><li>— O<sub>2</sub> Alarm Level: Operator can configure the digital output to alarm at a given O<sub>2</sub> level.</li><li>— Do O<sub>2</sub> Trim: Procedure for calibrating the 4-20 mA signal to a precision mA source. Procedure is intuitive.</li></ul></li><li>• Digital: The operator may configure a bi-directional logic signal as an alarm or as a calibration handshake signal.<ul style="list-style-type: none"><li>— Logic I/O Mode: One of nine different conditions can be set for the digital signal. See <a href="#">Table 8-2</a>.</li><li>— Low O<sub>2</sub> Alarm: If any of the conditions noted above include a low O<sub>2</sub> process alarm, set the value here.</li><li>— Input State: Notes the current condition of the bi-directional signal.</li><li>— Force Output: Forces the output state of the signal to either open or closed. This is used primarily when diagnosing potential problems with this signal.</li></ul></li></ul>

## 6.6 SYSTEM/Parameters

<b>O<sub>2</sub> Slope</b>	Data regarding the strength of the calibration output. The transmitter automatically collects this information after a calibration, and the operator does not normally input this data.
----------------------------	---

<b>O<sub>2</sub> Constant</b>	Amount of voltage a cell generates with ambient air as the calibration gas. The transmitter normally calculates this after calibration; the operator does not normally input this data.
<b>O<sub>2</sub> T90 Time</b>	Some operators may feel that the O <sub>2</sub> reading is too active for certain processes. This feature permits the operator to dampen the O <sub>2</sub> signal. The default value is zero seconds dampening.
<b>Auto Tune</b>	The electronics detects the line voltage powering the instrument automatically and picks proper algorithms for heater control. The operator can force a high or low voltage algorithm, but Auto Tune is the default that Emerson recommends.
<b>Lockout Time</b>	Once an operator goes one level deep into the menu structure, the transmitter provides an additional <i>revert time</i> to prevent nuisance lockouts. One hour is the default; this is user-configurable.
<b>Revert Time</b>	Used if the O <sub>2</sub> output is selected to hold the last value during calibration. After the operator removes the second cal gas, how long until the sensor comes back to the normal process reading and the 4-20 mA signal can be released.
<b>Luminance</b>	Gas fluorescence brightness is user-adjustable.

## 6.7 SYSTEM/Status

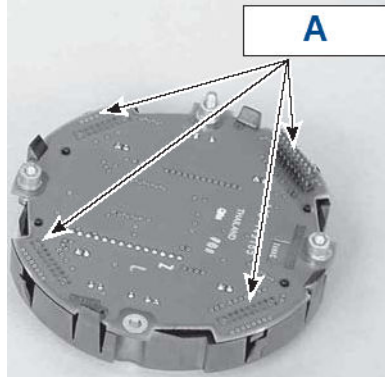
<b>Alarms</b>	Diagnostic alarms. See <a href="#">Troubleshoot</a> .
<b>PID Parameter</b>	Displays the line voltage powering the transmitter and infers the temperature control algorithm used to control heater temperature.
<b>Reset Device</b>	The operator can reset the device here as opposed to re-powering it. The transmitter will lose calibration parameters.
<b>SYSTEM/Software</b>	Data regarding the transmitter's software version and errors that may have occurred.
<b>Sensor Data</b>	Displays information about the O <sub>2</sub> cell and thermocouple.
<b>Temperatures</b>	<p>O<sub>2</sub> Temp: Indicates the thermocouple temperature at the sensing cells; this should always be 1357 °F (736 °C).</p> <p>O<sub>2</sub> Temp Max: Maximum temperature the cell has seen. (Some process temperatures can exceed the 1357 °F (736 °C) setpoint temperature, and this will indicate this condition.)</p> <p>Board Temp: The temperature inside the transmitter's electronics housing. (185 °F [85 °C] is the maximum.)</p> <p>Board Temp Max: This is the maximum temperature that the electronics has experienced over time.</p>

## 6.8 LOI installation

The LOI connects to the top of the electronic assembly in the electronics housing.

There are four matching connectors on the back of the LOI module that allow the LOI to be oriented as desired.

**Figure 6-7: LOI Module Rear View - LOI Connector Receptacles**



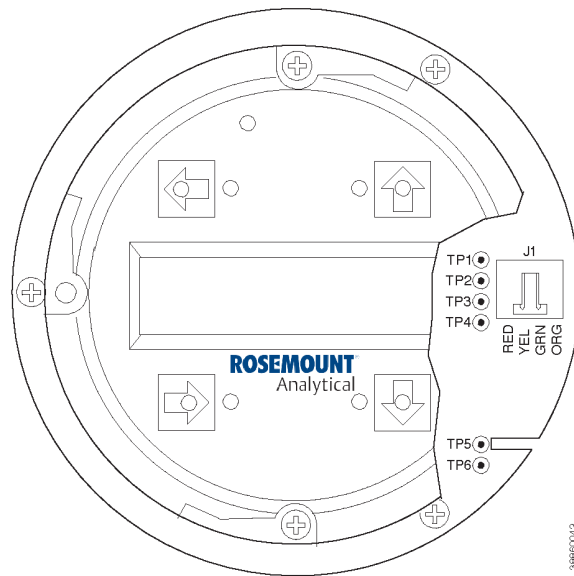
*A. Connector receptacles*

## 6.9 Test points

Test points 1 through 6 allow you to monitor the following with a multimeter: the heater thermocouple, the O<sub>2</sub> cell millivolt value, and the process O<sub>2</sub>.

- TP1 and TP2 monitor the oxygen cell millivolt output, which equates to the percentage of oxygen present.
- TP3 and TP4 monitor the heater thermocouple.
- TP5 and TP6 monitor the process gas or the calibration gas procedures.

**Figure 6-8: Test Points**



## 6.10 Remote powered loop LCD display (optional)

Refer to the *Remote Powered Loop LCD* manual for calibration and operation.

# 7 HART®/AMS

## ▲ WARNING

**The HART option is not protected by energy limiting barriers.**

Do not interface with the HART option from within the hazardous area.  
Route the 4-20 mA cables and make the connections outside the hazardous area.  
This is the case even when using the intrinsically safe version of the handheld communicator.

## 7.1 Overview

The HART® communicator is a handheld communications device. It provides a common communications link to all microprocessor-based instruments that are HART compatible.

The handheld communicator contains an 8 x 21 character liquid crystal display (LCD) and 25 keys. A pocket-sized manual, included with the HART Communicator, details the specific functions of each key.

To interface with the transmitter, the HART Communicator requires a termination point along the 4-20 mA current loop and a minimum load resistance of 250 ohms between the communicator and the power supply.

The HART Communicator accomplishes its task using a frequency shift keying (FSK) technique. With FSK, high-frequency digital signals are superimposed on the transmitter's 4-20 mA current loop. The HART Communicator does not disturb the 4-20 mA signal, since no net energy is added to the loop.

You can interface to the HART Communicator with a personal computer (PC) after installing the special software. To connect the HART Communicator to a PC, you need an interface adapter. Refer to the proper HART Communicator documentation to learn more about the PC interface option.

## 7.2 HART® Communicator signal line connections

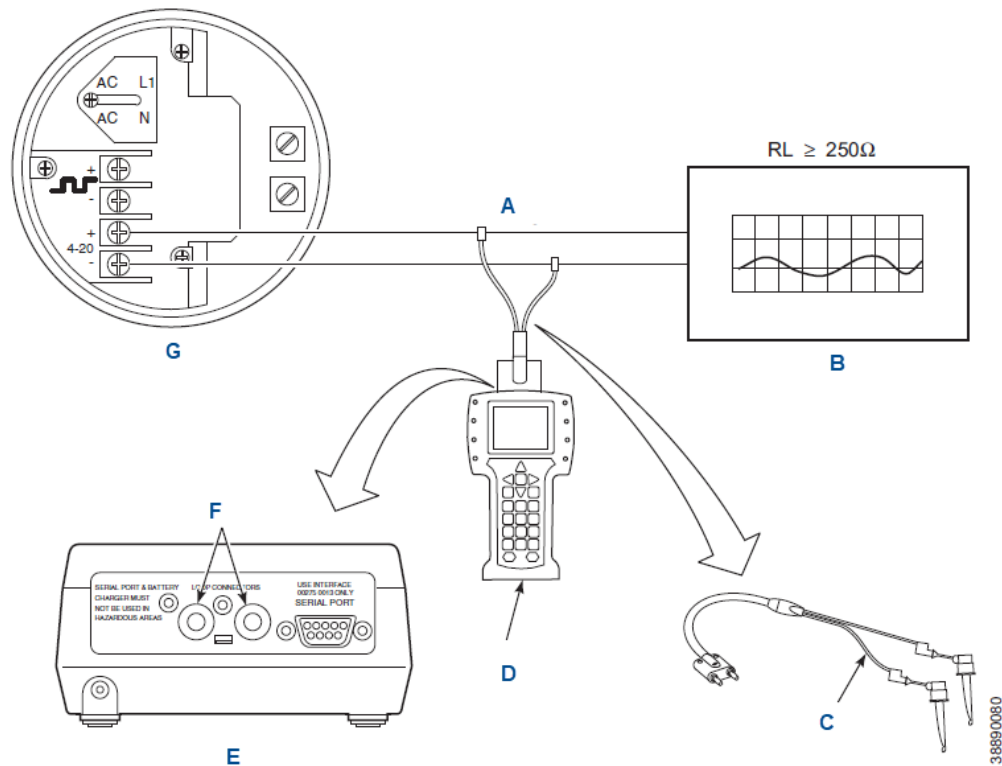
The HART Communicator can connect to the transmitter's analog output signal line at any wiring termination in the 4-20 mA current loop.

There are two methods of connecting the HART Communicator to the signal line. For applications in which the signal line has a load resistance of 250 ohms or more, refer to Method 1. For applications in which the signal line load resistance is less than 250 ohms, refer to Method 2.

## 7.2.1 Method 1, for load resistance $\geq 250$ ohms

Refer to the following steps to connect the HART® Communicator to a signal line with 250 ohms or more of load resistance.

**Figure 7-1: Signal Line Connections,  $\geq 250$  Ohms Load Resistance**



### **⚠ WARNING**

#### **Explosions**

Explosions can result in death or serious injury.

Do not make connections to the HART Communicator's serial port, 4-20 mV signal line, or NiCad recharger jack in an explosive atmosphere.

- A. 4-20 mA signal line
- B. Analog output device
- C. Lead set
- D. HART Communicator
- E. HART Communicator rear panel
- F. Loop connectors
- G. Terminal block



### Procedure

1. Using the supplied lead set, connect the HART Communicator in parallel with the transmitter.
2. Use any wiring termination points in the analog output 4-20 mA signal line.

## 7.2.2 Method 2, for load resistance < 250 ohms

Refer to the following steps to connect the HART® Communicator to a signal line with < 250 ohms of load resistance.

### **⚠ WARNING**

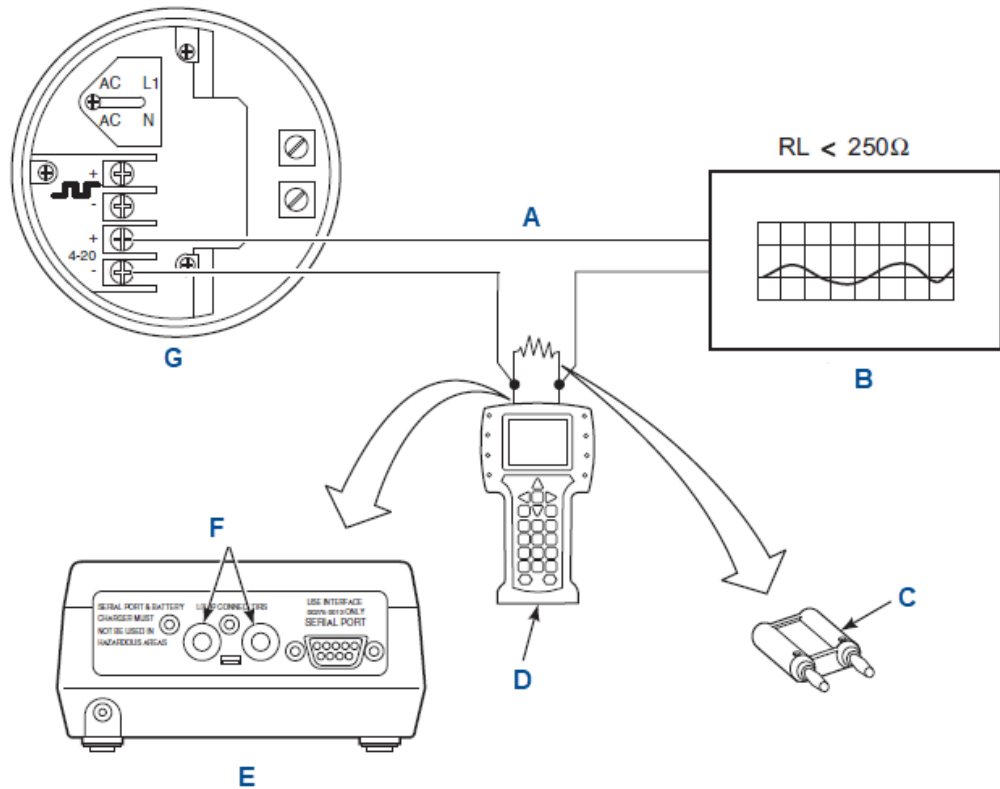
#### **Explosions**

Explosions could result in death or serious injury.

Do not make connections to the HART Communicator's serial port, 4-20 mV signal line, or NiCad recharger jack in an explosive atmosphere.

---

Figure 7-2: Signal Line Connections, < 250 Ohms Load Resistance



- A. 4-20 mA signal line
- B. Analog output device
- C. 250 ohm load resistor<sup>(1)</sup>
- D. HART Communicator
- E. HART Communicator rear panel
- F. Loop connectors
- G. Terminal block

### Procedure

1. At a convenient point, break the analog output 4-20 mA line signal and install the optional 250 ohm load resistor.
2. Plug the load resistor into the loop connectors (located on the rear panel of the HART Communicator).

<sup>(1)</sup> The signal loop must be broken to insert the optional 250 ohm load resistor.

## 7.3 Connect HART® Communicator to a PC

There is an option to interface the HART Communicator with a personal communicator.

### Procedure

1. Load the designated AMS software into the PC.
2. Link the HART Communicator to the PC using the interface PC adapter that connects to the serial port (on the communicator rear panel).  
Refer to the proper HART Communicator documentation in regard to the PC interface option.

## 7.4 Off-line and on-line operations

You can operate the HART® Communicator both off-line and on-line.

In off-line operations, the communicator is not connected to the transmitter. Off-line operations can include interfacing the HART Communicator to a PC. Refer to applicable HART documentation regarding HART/PC applications.

In the on-line mode, the communicator is connected to the transmitter's 4-20 mA signal line. The communicator is located in parallel to the transmitter or in parallel to the 250 ohm load resistor.

### Note

If the HART Communicator is turned on while connected to the 4-20 mA analog output signal line, an undefined status indicator appears while the communicator warms up. Wait until the warming period ends.

The opening menu displayed on the LCD is different for on-line and off-line operations. When powering up a disconnected (off-line) communicator, the LCD will display the **Main Menu**. When powering up a connected (on-line) communicator, the LCD will display the On-Line Menu. Refer to the HART Communicator manual for detailed menu information.

## 7.5 Logic I/O configurations

You can configure the transmitter's logic I/O output for ten different modes through HART®/AMS.

The factory default condition is Mode 5. A list of possible configurations appears in [Table 7-1](#).

**Table 7-1: Logic I/O Configuration (as Set at HART/AMS or LOI)**

Mode	Configuration
0	The unit is not configured for any alarm conditions.
1	The unit is configured for a Unit alarm.
2	The unit is configured for Low O <sub>2</sub> .
3	The unit is configured for both a Unit alarm and Low O <sub>2</sub> .

**Table 7-1: Logic I/O Configuration (as Set at HART/AMS or LOI) (continued)**

Mode	Configuration
4	The unit is configured for a High AC Impedance. <i>Calibration recommended.</i>
5 <sup>(1)</sup>	The unit is configured for both a Unit alarm and a High AC Impedance. <i>Calibration recommended.</i>
6	The unit is configured for both a Low O <sub>2</sub> and High AC Impedance. <i>Calibration recommended.</i>
7	The unit is configured for a Unit Alarm, a Low O <sub>2</sub> , and a High AC Impedance. <i>Calibration recommended.</i>
8 <sup>(2)</sup>	The unit is configured for a calibration handshake with a Rosemount IMPS 4000 or SPS 4001B. <i>Calibration recommended will initiate the calibration cycle.</i>
9	The unit is configured for a calibration handshake. <i>Calibration recommended will not initiate the calibration cycle with the Rosemount IMPS 4000 or SPS 4001B.</i>

(1) *The default condition for a Rosemount™ Hazardous Area Oxymitter 4000 without a Rosemount IMPS 4000 or SPS 4001B.*

(2) *The default condition for a Rosemount Hazardous Area Oxymitter 4000 with a Rosemount IMPS 4000 or SPS 4001B.*

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**Note**

The *Calibration recommended* alarm was discontinued in 2014. It is still available in the Rosemount 6888 product.

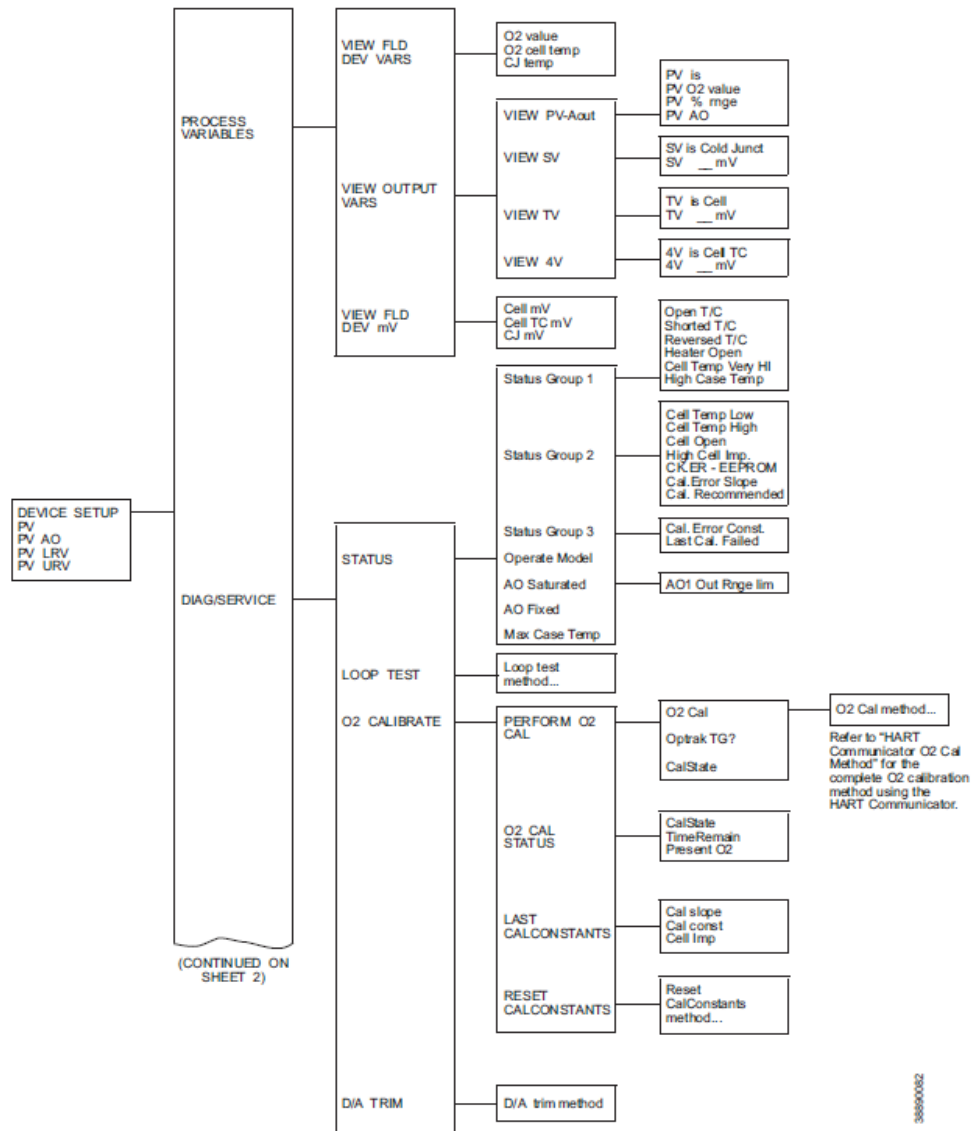
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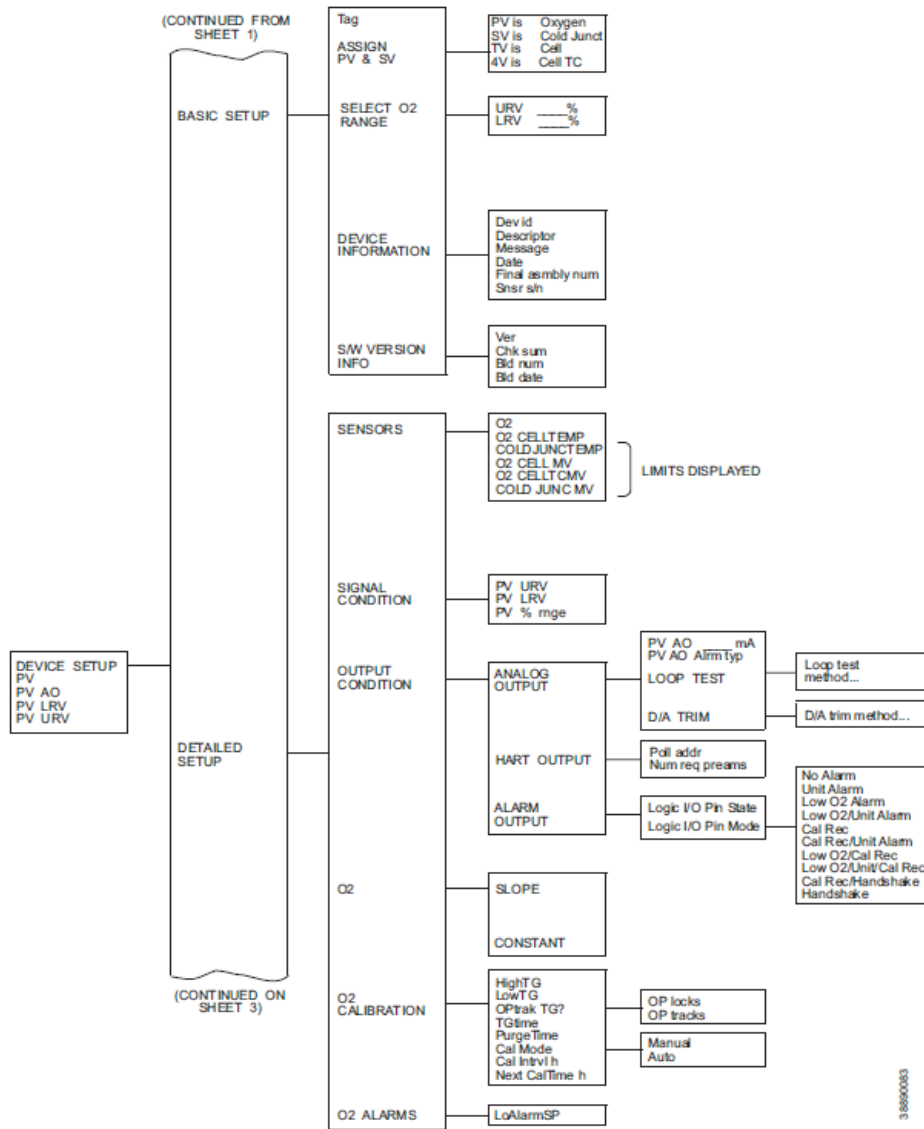
The Unit Alarm configuration available for modes 1, 3, 5, and 7 refers to the diagnostic alarm faults in .

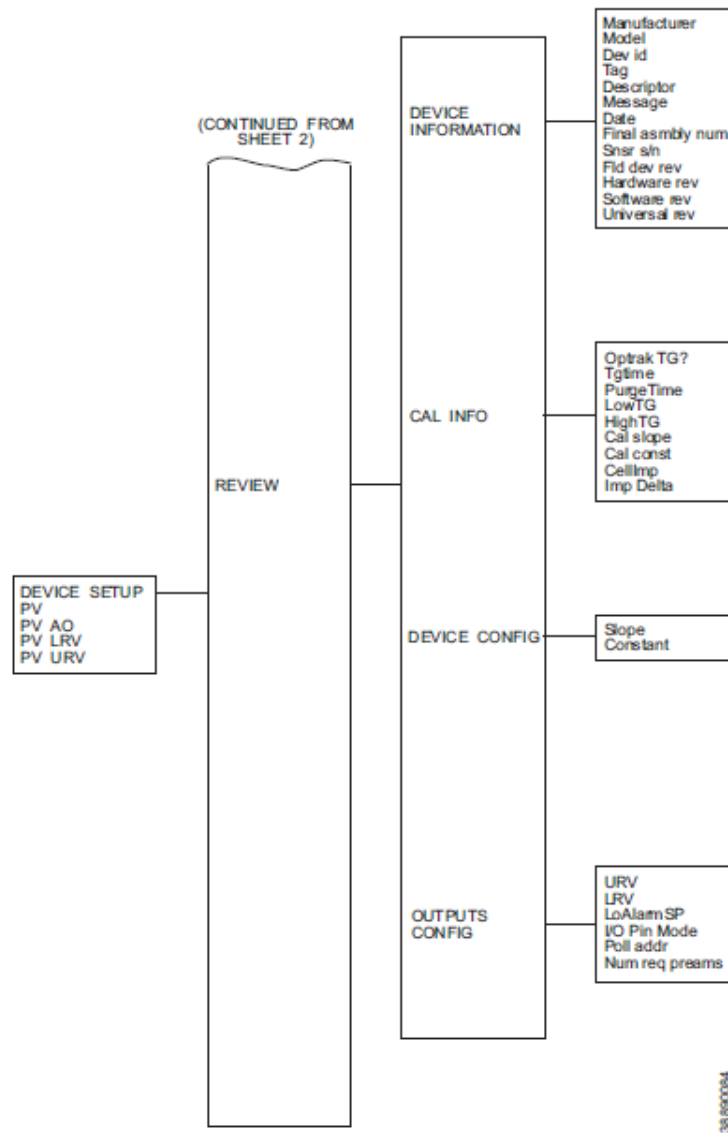
## 7.6 HART® menu tree

This menu tree is specific to the Rosemount™ Hazardous Area Oxymitter 4000 applications.

Figure 7-3: HART/AMS Menu Tree







## 7.7 Calibrate O<sub>2</sub> with HART®

Use the following procedure to calibrate the transmitter with the HART Communicator.  
If necessary, use [Figure 7-3](#) for reference.

### Note

To select a menu item, either use the **Up** or **Down** arrow keys to scroll to the menu item and press the **Right** arrow key or use the number keypad to select the menu item number. To return to a preceding menu, press the **Left** arrow key.

## Procedure

1. From the **PERFORM O2 CAL** screen, select menu item 1, **O2 CAL**, to access the O<sub>2</sub> calibration procedure.

### **▲ WARNING**

Failure to remove the Rosemount™ Oxymitter 4000 from automatic control loops prior to performing this procedure may result in a dangerous operating condition.

Remove the Rosemount Oxymitter 4000 from automatic control loops before starting this procedure.

---

In the first **O2 CAL** screen, a `Loop should be removed from automatic control warning` appears.

2. Remove the transmitter from any automatic control loops and press **OK**.  
The next three screens indicate the calibration status.
3. At each of the following status prompts, select menu item 2, **NEXT CAL STEP**.  
**COMPLETE** → **CAL RECOMMENDED** → **APPLY GAS** → **GAS 1 FLOW**
4. Select menu item 4, **EXIT**, to leave the O<sub>2</sub> calibration procedure.
5. To monitor the transmitter's calibration status:
  - From the **PERFORM O2 CAL** screen, view menu item 3, **CALSTATE**.
  - From the **O2 CALIBRATE** screen, go to **O2 CAL STATUS** → **CAL-STATE** → **TIME REMAIN** → **PRESENT O2**.
6. When **CALSTATE** displays **APPLY GAS 2**, return to the O<sub>2</sub> calibration procedure.
7. When the `Loop should be removed from automatic control warning` appears, press **OK**.
8. At the **APPLY GAS 2** status prompt, select menu item 2, **NEXT CAL STEP**.
9. When the status displays **GAS 2 FLOW**, select menu item 4, **EXIT** to leave the O<sub>2</sub> calibration procedure.
10. To monitor the transmitter's calibration status:
  - From the **PERFORM O2 CAL** screen, view menu item 3, **CALSTATE**.
  - From the **O2 CALIBRATE** screen, go to **O2 CAL STATUS** → **CAL-STATE** → **TIME REMAIN** → **PRESENT O2**.
11. When **CALSTATE** displays **STOP GAS**, return to the O<sub>2</sub> calibration procedure.
12. When the `Loop should be returned to automatic control message` appears, return the transmitter to the automatic control loops and press **OK**.
13. At the **STOP GAS** status prompt, select menu item 2, **NEXT CAL STEP**.
14. When the status displays **PURGING**, select menu item 4, **EXIT**, to leave the O<sub>2</sub> calibration procedure.
15. To monitor the transmitter's calibration status:
  - From the **PERFORM O2 CAL** screen, view menu item 3, **CALSTATE**.



- From the *O2 CALIBRATE* screen, go to *O2 CAL STATUS* → *CAL-STATE* → *TIME REMAIN* → *PRESENT O2*.

When *CALSTATE* displays *COMPLETE*, the calibration is finished.

## 7.8 Automatically calibrate with HART®

Use the following procedure to specify a time interval (in hours) at which the transmitter will be automatically calibrated.

If necessary, use the menu tree in [Figure 7-3](#) for reference.

---

### Note

To select a menu item, either use the **Up** and **Down** arrow keys to scroll to the menu item and press the **Right** arrow key or use the number keypad to select the menu item number. To return to a preceding menu, press the **Left** arrow key.

---

### Procedure

1. From the *DEVICE SETUP* screen, select *DETAILED SETUP*.
2. From the *DETAILED SETUP* screen, select *O2 CALIBRATION*.
3. From the *O2 CALIBRATION* screen, select menu item 6, *CAL MODE*. Set the *CAL MODE* to *AUTO*.
4. Return to the *O2 CALIBRATION* screen and select menu item 7, *CAL INTRVL*.
5. At the prompt, input a time interval (in hours) at which you want the automatic calibration to occur; then press **ENTER**.

## 7.9 D/A trim

Use the D/A trim procedure to calibrate the 4-20 mA output signal to a precision mA measurement device, such as a calibrated digital ammeter. The procedure is interactive and stored in the Rosemount™ Oxymitter 4000 software.

### Procedure

1. Use the Z pattern key entry to access the LOI menu.
2. Press the **Down** key twice to access the SYSTEM menu.
3. Press the **Down** key once to access the Input/Output menu.
4. Select *Analog* and press the **Right** key to display the Analog submenu.
5. Press the **Down** key as needed to access *Trim O2 Out*.
6. Press the **ENTER** key to start the trim procedure. Follow the LOI display prompts to perform the trim procedure.



# 8 Troubleshoot

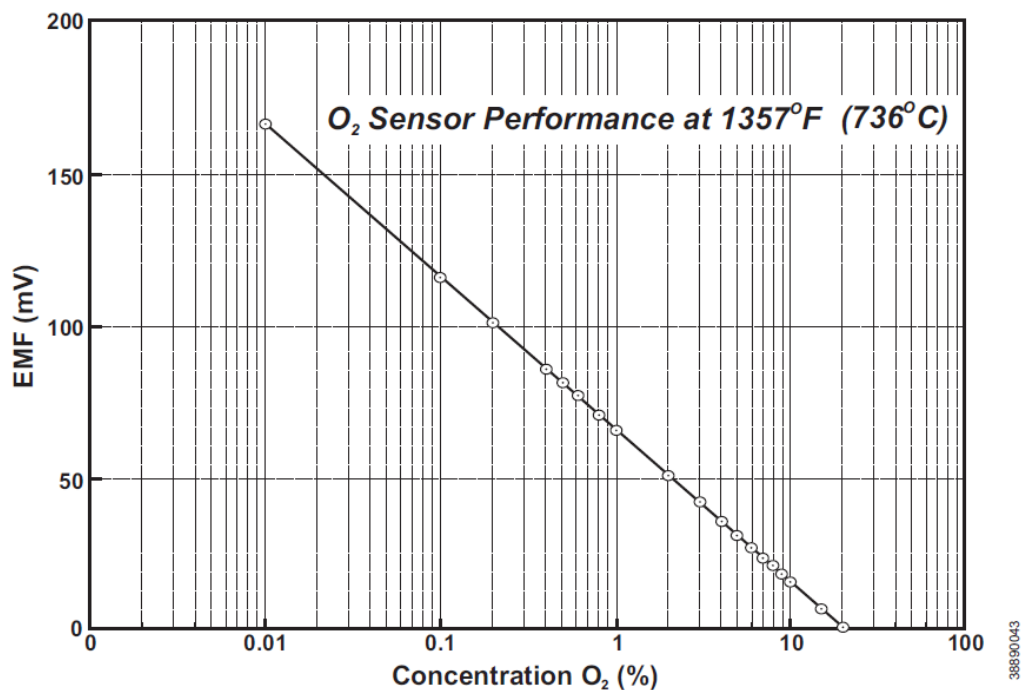
## 8.1 Overview

While the transmitter electronics provides a significant number of diagnostic alarms to assist in troubleshooting potential problems, it is important to place these alarms in perspective with respect to the instrument's operating principles.

When the zirconium oxide sensing cell is heated to its setpoint (1357 °F [736 °C]), the cell will generate a voltage that represents the difference between the process O<sub>2</sub> percentage and the reference O<sub>2</sub> percentage inside the probe (20.95 percent O<sub>2</sub> ambient air).

Test points (Figure 8-1) are provided to read the raw millivolt value generated by the thermocouple that controls both the cell temperature and the raw cell signal.

**Figure 8-1: O<sub>2</sub> Sensor mV Readings vs. Percent O<sub>2</sub> at 1357 °F (736 °C) (Reference Air, 20.95 Percent O<sub>2</sub>)**



**Table 8-1: Logic I/O Configuration (as Set at HART/AMS or LOI)**

O <sub>2</sub> %	EMF (mV)
100	-34
20	1.0
15	7.25
10	16.1

**Table 8-1: Logic I/O Configuration (as Set at HART/AMS or LOI) (continued)**

O <sub>2</sub> %	EMF (mV)
9	18.4
8	21.1
7	23.8
6	27.2
5	31.2
4	36.0
3	42.3
2	51.1
1	66.1
0.8	71.0
0.6	77.5
0.5	81.5
0.4	86.3
0.2	101.4
0.1	116.6
0.01	166.8

**⚠ WARNING**

Failure to install covers and ground leads could result in serious injury or death.  
Install all protective covers and safety ground leads after troubleshooting.

## 8.2 Factors to consider when troubleshooting

This chapter describes how to identify and isolate faults that may develop in the transmitter. When troubleshooting, consider the following:

### 8.2.1 Grounding

It is essential to take adequate grounding precautions when installing the system.

Thoroughly check both the probe and electronics to ensure the grounding quality has not degraded during fault finding. The system provides facilities for 100 percent effective grounding and the total elimination of ground loops.

## 8.2.2 Electrical noise

Emerson has designed the transmitter to operate in the type of environment normally found in a boiler room or control room. Noise suppression circuits are employed on all field terminations and main inputs.

When fault finding, evaluate the electrical noise being generated in the immediate circuitry of a faulty system. Ensure all cable shields are connected to earth.

## 8.2.3 Loose integrated circuits

The transmitter uses a microprocessor and supporting integrated circuits (ICs). If someone handles the electronics roughly during installation or locates them where they are subjected to severe vibration, the ICs could work loose.

Before troubleshooting the system, ensure all ICs are fully seated.

## 8.2.4 Electrostatic discharge

Electrostatic discharge can damage the ICs used in the electronics.

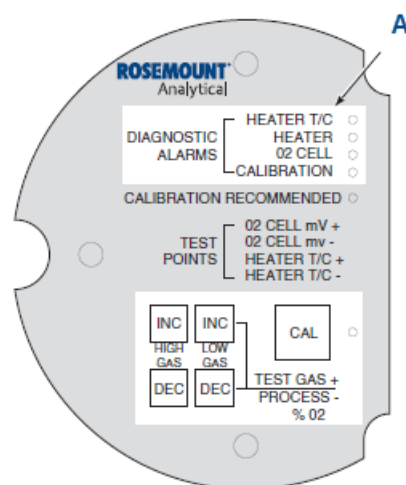
Before removing or handling the processor board of the ICs, ensure you are at ground potential.

## 8.3 Alarm indications

The majority of the fault conditions for the transmitter will be indicated by one of the four LEDs referred to as diagnostic or unit alarms on the operator's keypad.

An LED flashes a code that corresponds to an error message. Only one LED blinks at a time. Emerson provides an alarm code guide inside the screw-on cover of the electronics.

**Figure 8-2: Diagnostic LEDs**



A. Diagnostic LEDs

Alarm indications are also available via the optional LOI or the HART® handheld communicator and Rosemount's™ Asset Management software. When the error is corrected and/or power is cycled, the diagnostic alarms will clear or the next error on the priority list will appear.

## 8.4 Alarm contacts

If not using autocalibration, Emerson provides a common bi-directional logic contact for any of the diagnostic alarms listed in [Table 2-8](#). You can modify the assignment of alarms that can actuate this contact to one of seven additional groupings (mode 0 through mode 7) listed in [Table 2-9](#).

The logic contact is self-powered, +5 Vdc with a 340 ohm series resistance. An interposing relay will be required if using this contact to annunciate a higher voltage device, such as a light or horn. You may also need an interposing relay for certain DCS input cards.

A Potter & Brumfield R101-E1Y1-J1.0K 3.2 mA DC or an equal interposing relay will be mounted where the contact wires terminate in the control/relay room.

If using autocalibration systems, the bi-directional logic contact is used as a "hand-shake" signal between the autocalibration system (Rosemount™ SPS 4001B or IMPS 4000) and is unavailable for alarming purposes. The autocalibration systems provide the following additional contacts.

### 8.4.1 Rosemount™ SPS 4001B and IMPS 4000: 1 to 4 probes

- One contact closure per probe from the control room to the Rosemount SPS 4001B or IMPS 4000 for `calibration initiate`.
- One contact output per probe from the Rosemount SPS 4001B or IMPS 4000 to the control room for `in calibration notification`.
- One contact output per probe from the Rosemount SPS 4001B or IMPS 4000 to the control room for `calibration failed notification`. (Includes output from pressure switch indicating `cal gas bottles empty`.)

### 8.4.2 Additional Rosemount™ IMPS 4000 alarm contacts

- One contact per Rosemount IMPS 4000 for `low calibration gas flowing`.
- One contact per Rosemount IMPS 4000 for `high calibration gas flowing`.

---

#### Note

You can configure the 4-20 mA signal to respond normally during any calibration or to hold the last O<sub>2</sub> value upon the initiation of calibration. The factory default is for the 4-20 mA signal to operate normally through calibration.

---

#### Note

Holding the last O<sub>2</sub> value may be useful if several probes are being averaged for the purpose of automatic control. Unless averaging several probes, always place any control loops using the O<sub>2</sub> signal into manual prior to calibrating.

---

## 8.5 Identify and correct alarm indications

For a transmitter with a membrane keypad, four diagnostic or unit alarm LEDs indicate faults. A pattern of repeating blinks defines the problem. There is a condensed table of errors and the corresponding blink codes on the inside right cover of the electronics housing.

[Table 2-8](#) also identifies the blink code and fault status of each LED as well as the output of the 4-20 mA signal line and a fault number that corresponds to the troubleshooting instructions provided in this section.

For a transmitter with the optional LOI, alarm messages are displayed on the LOI display window, and you can access the alarm status display via the LOI menu. [Table 8-2](#) displays a list of alarm/fault messages and the related fault status descriptions and numbers.

**Table 8-2: Alarm Messages**

Message	Status	Fault number	Self clearing
O2 T/C Open	Heater thermocouple open	1	No
O2 T/C Shorted	Heater thermocouple shorted	2	No
O2 T/C Reversed	Heater thermocouple polarity reversed	3	No
ADC Error	A/D communications error	4	No
O2 Heater Open	O <sub>2</sub> heater open	5	No
Very Hi O2 Temp	Very high process temperature	6	No
Board Temp Hi	Electronics overheated	7	Yes
O2 Temp Low	Low process temperature	8	Yes
O2 Temp Hi	High process temperature	9	Yes
O2 Cell Open	O <sub>2</sub> cell open	10	Yes
O2 Cell Bad	O <sub>2</sub> cell failed	11, 13, 14	Yes
EEprom Corrupt	EEprom Failed	12	No
Calib Failed	Last calibration failed	15	Yes
Line Freq Error	Incorrect line frequency detected on power up	`	No

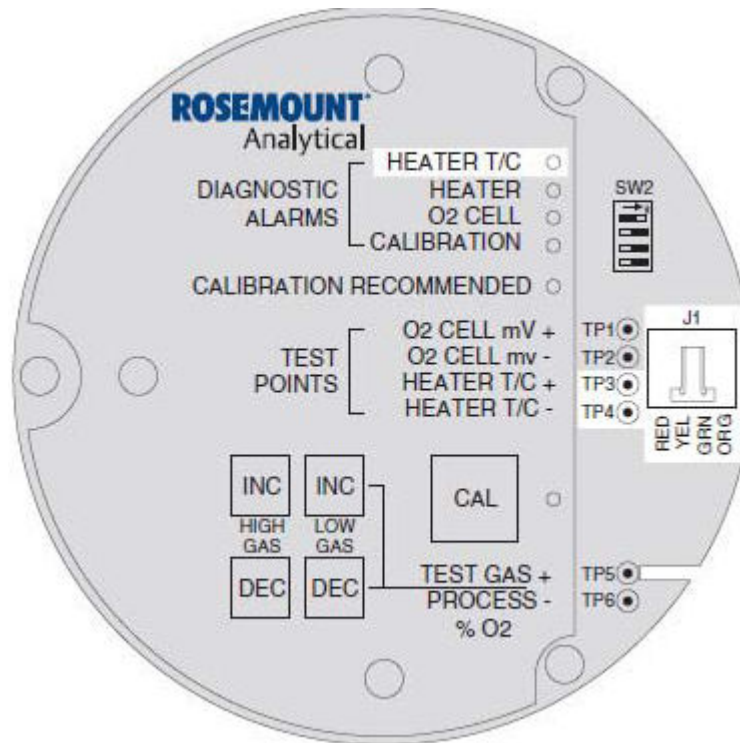
### 8.5.1 Fault 1, Open Thermocouple

The figures below show the electronic assembly for a transmitter with a membrane keypad and a transmitter with an LOI. The membrane keypad figure also shows J1 and test points TP1 through TP6, located on the microprocessor board, below the membrane keypad or the LOI module.

#### Fault 1, membrane keypad

The **HEATER T/C** LED flashes once, pauses for three seconds, and repeats.

Figure 8-3: Fault 1, Open Thermocouple on Membrane Keypad



#### Recommended actions

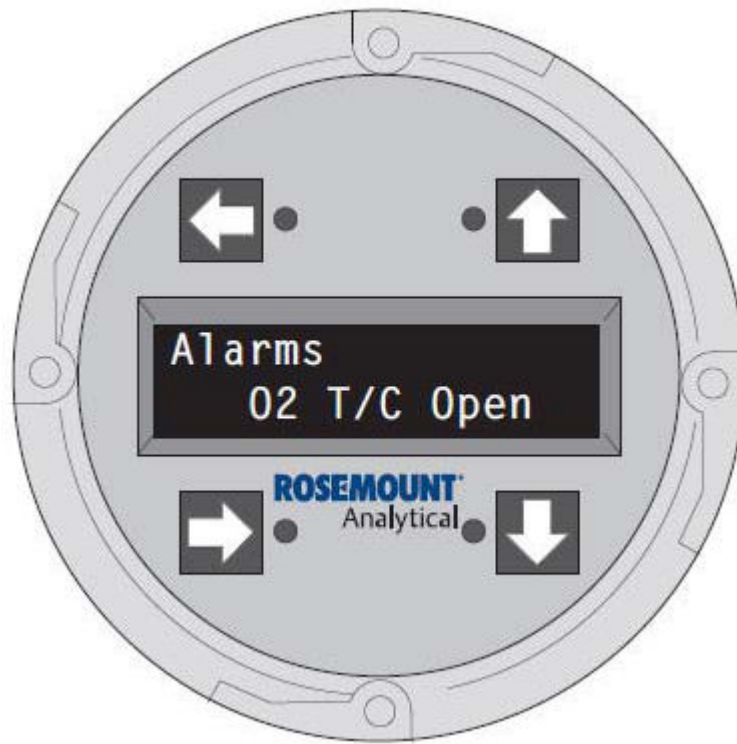
1. Check connector J1. Ensure the connector is properly seated.
2. Using a multimeter, measure the voltage from TP3+ to TP4-. If the reading is  $1.2 \text{ Vdc} \pm 0.1 \text{ Vdc}$ , the thermocouple is open.
3. Remove power. Disconnect J1. Measure the resistance across the red and yellow thermocouple leads. The resistance should be approximately 1 ohm.
4. If the thermocouple is open, see .

#### Fault 1, LOI

When Fault 1 is detected, the LOI displays the O2 T/C Open message.



Figure 8-4: O2 T/C Open Message on LOI



**Recommended actions**

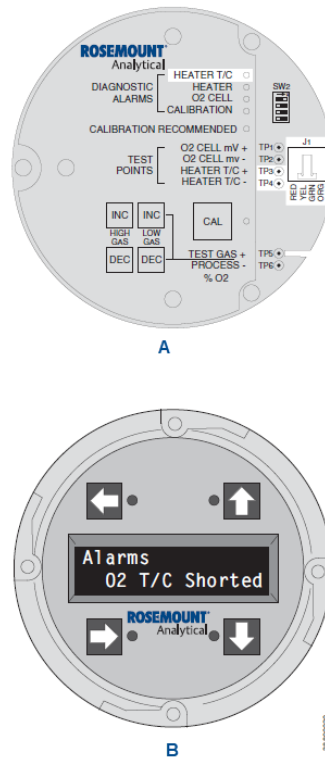
1. Remove power. Unscrew and remove the LOI module from the electronic assembly.
2. Reconnect power to the transmitter.
3. Perform the recommended actions in [Fault 1, membrane keypad](#).

## 8.5.2 Fault 2, Shorted Thermocouple

The figure below show the electronic assembly for a transmitter with a membrane keypad and a transmitter with an LOI.

The transmitter with the membrane keypad also shows J1 and test points TP1 through TP6, located on the microprocessor board, below the membrane keypad on the LOI module.

Figure 8-5: Fault 2, Shorted Thermocouple



- A. Membrane keypad
- B. LOI

## Fault 2, membrane keypad

When Fault 2 is detected, the HEATER T/C LED flashes twice, pauses for two seconds, and repeats.

### Recommended actions

1. Using a multimeter, measure the voltage from TP3+ to TP4-.  
If the reading is  $0 \pm 0.5$  mV, then a shorted thermocouple is likely.
2. Remove power and disconnect J1.
3. Measure the resistance from TP3+ to TP4-.  
The reading should be approximately 20 K ohms. If it is, the short is not on the PC board. The thermocouple wiring or the thermocouple is shorted. See [Replace heater strut](#).

## Fault 2, LOI

When Fault 2 is detected, the LOI displays the O2 T/C Shorted message.

**Recommended actions**

1. Remove power. Unscrew and remove the LOI module from the electronic assembly.
2. Reconnect power to the transmitter.
3. Perform the recommended actions in [Fault 2, membrane keypad](#).

### 8.5.3 Fault 3, Reversed Thermocouple Wiring or Faulty PC Board

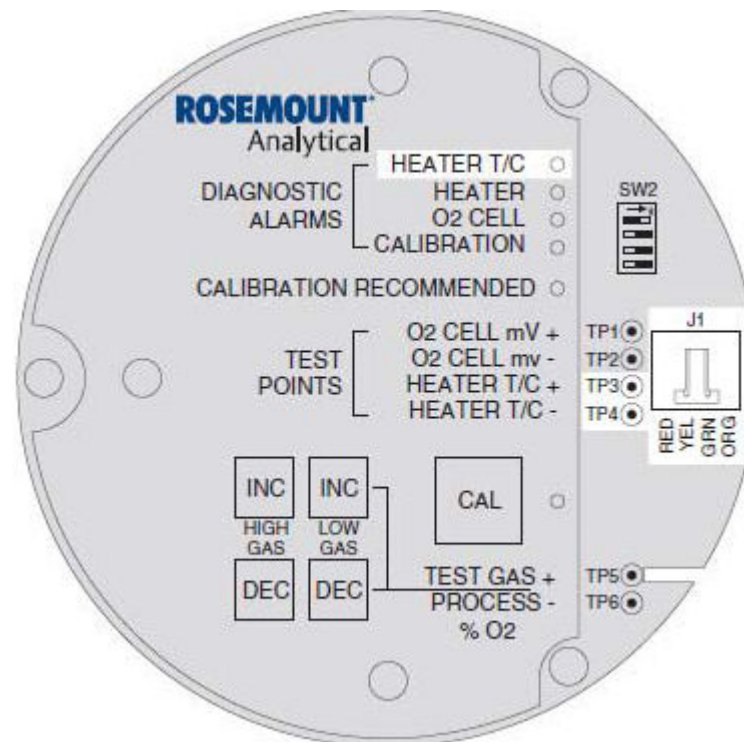
The figures below show the electronic assembly for a transmitter with a membrane keypad and a transmitter with an LOI.

The membrane keypad also shows J1 and test points TP1 through TP6 located on the microprocessor board, below the membrane keypad or the LOI module.

#### Fault 3, membrane keypad

When Fault 3 is detected, the HEATER T/C LED flashes three times, pauses for three seconds, and repeats.

**Figure 8-6: HEATER T/C LED Alarm on Membrane Keypad**



**Recommended actions**

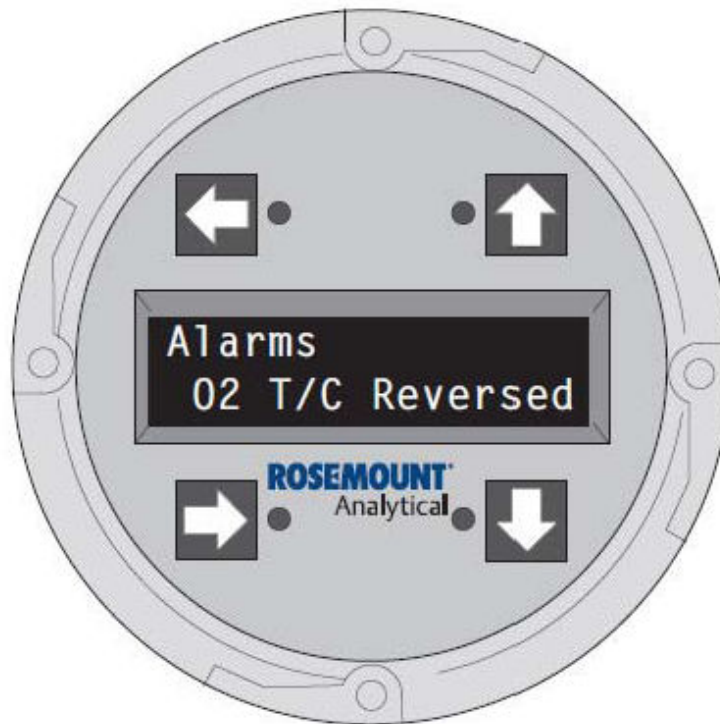
1. Using a multimeter, measure the voltage from TP3+ to TP4-. If the reading is negative, the thermocouple wiring is reversed.

2. Check red and yellow wires in the J1 connector for the proper placement. If the wiring is correct, the fault is in the PC board. See [Replace electronic assembly](#).

### Fault 3, LOI

When Fault 3 is detected, the LOI displays the O<sub>2</sub> T/C REVERSED message.

**Figure 8-7: O<sub>2</sub> T/C REVERSED Message on LOI**



#### Recommended actions

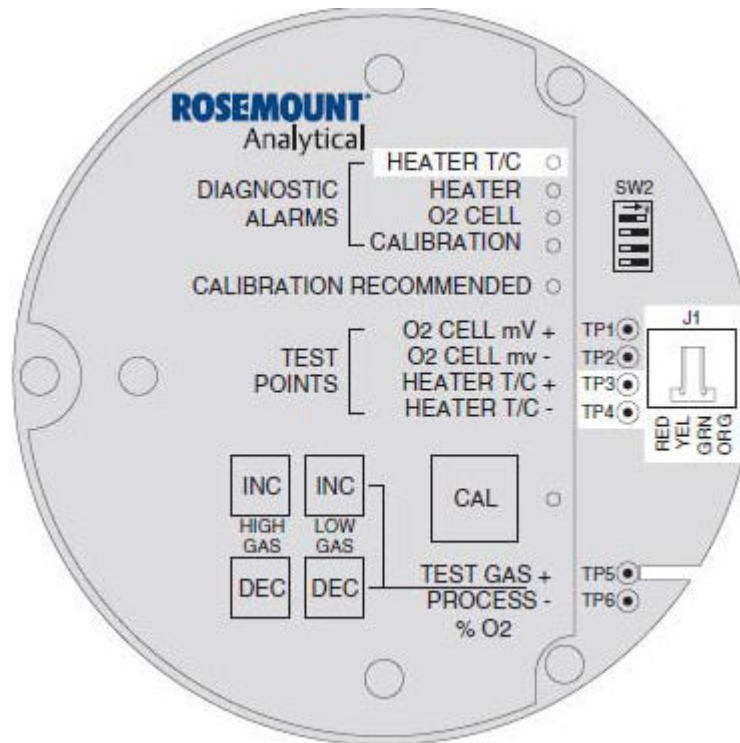
1. Remove power. Unscrew and remove the LOI module from the electronic assembly.
2. Reconnect power to the transmitter.
3. Perform the recommended actions in [Fault 3, membrane keypad](#).

## 8.5.4 Fault 4, A/D Comm Error

### Fault 4, membrane keypad

When Fault 4 is detected, the HEATER T/C LED flashes four times, pauses for three seconds, and repeats.

Figure 8-8: HEATER T/C LED on Membrane Keypad



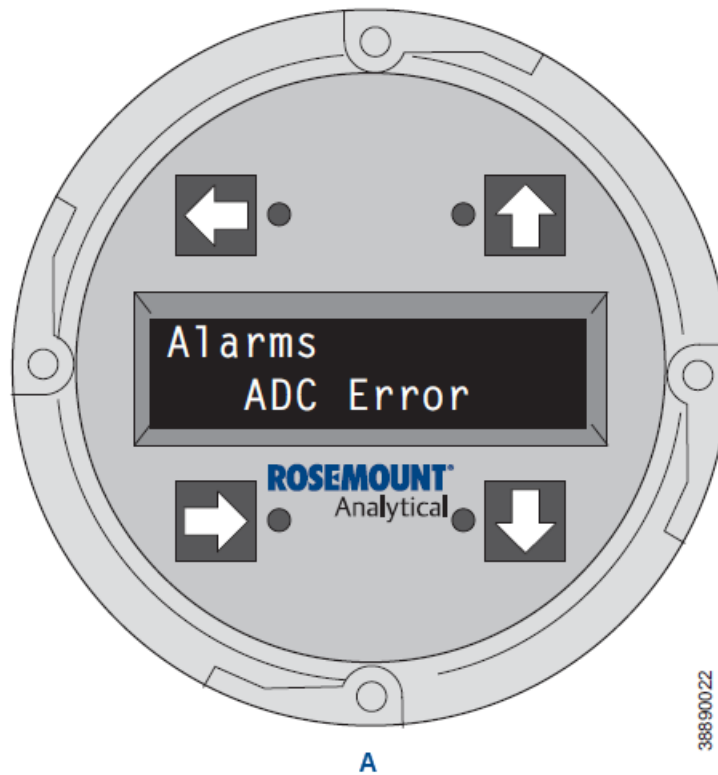
**Recommended action**

Call the factory for assistance.

**Fault 4, LOI**

When Fault 4 is detected, the LOI displays the ADC Error message.

Figure 8-9: ADC Error Message on LOI



A. LOI

**Recommended action**

Call the factory for assistance.

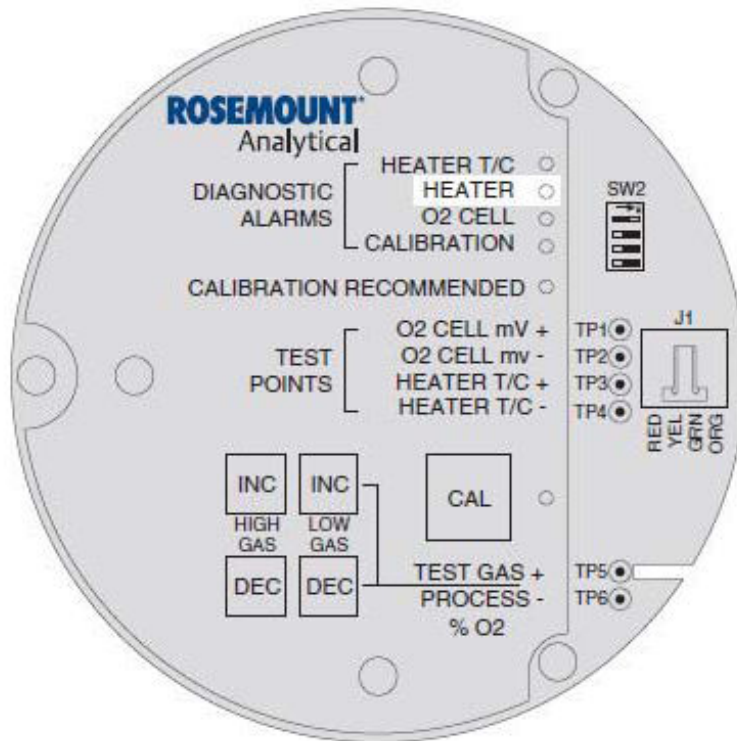
## 8.5.5 Fault 5, Open Heater

The figures below show the electronic assembly for the transmitter with a membrane keypad and the transmitter with an LOI.

### Fault 5, membrane keypad

When Fault 5 is detected, the HEATER LED flashes once, pauses for three seconds, and repeats.

Figure 8-10: HEATER LED on Membrane Keypad



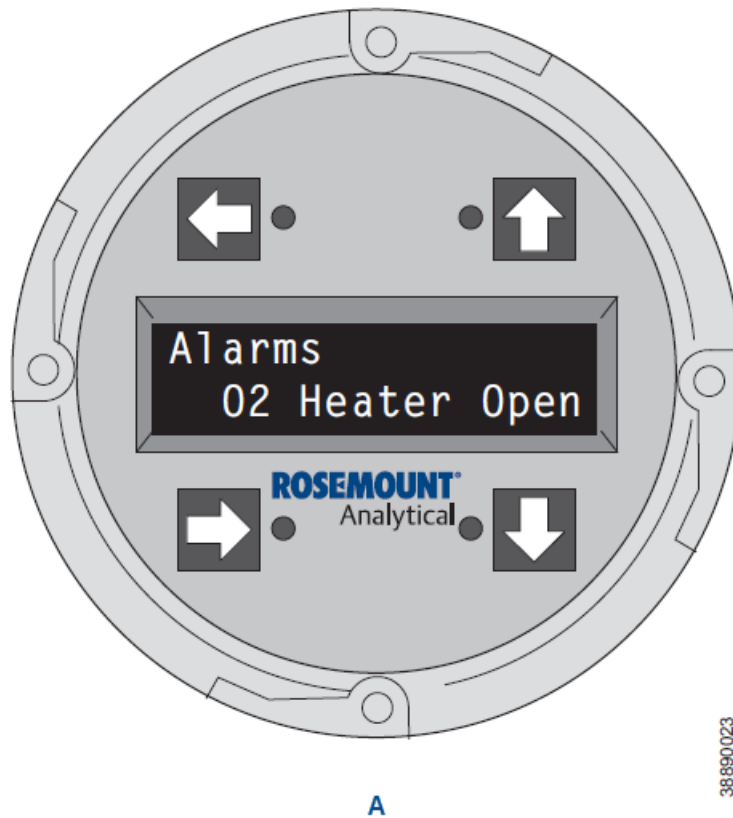
#### Recommended actions

1. Remove power.
2. Remove the electronic assembly per .
3. Using a multimeter, measure the resistance across the terminals of heater connector, J8.  
The measurement should be approximately 72 ohms. If the heater is open, see [Replace heater strut](#).

### Fault 5, LOI

When Fault 5 is detected, the LOI displays the O2 Heater Open message.

**Figure 8-11: O2 Heater Open Message on LOI**



A. LOI

**Recommended actions**

1. Remove power. Unscrew and remove the LOI module from the electronic assembly.
2. Perform the recommended actions in [Fault 5, membrane keypad](#).

## 8.5.6 Fault 6, High High Heater Temp

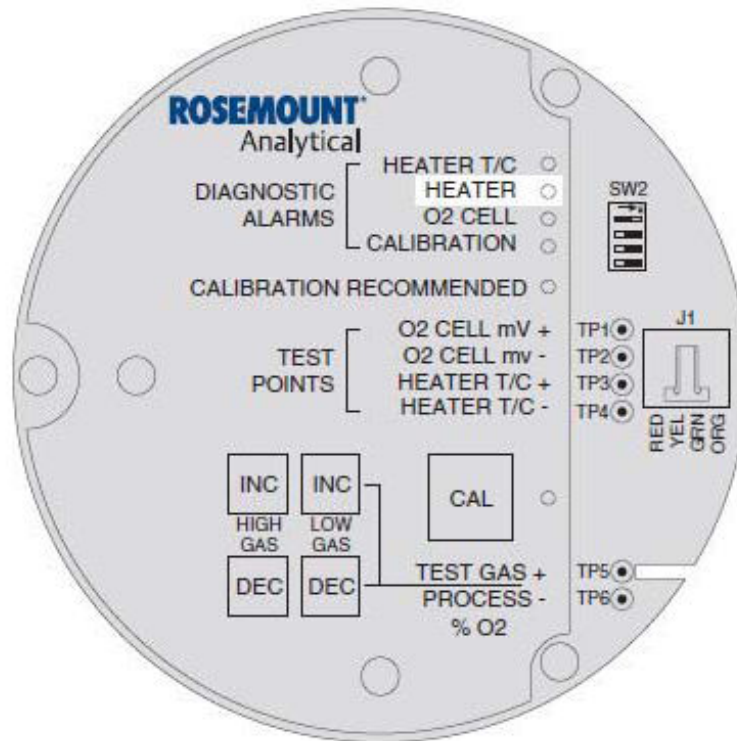
The figures below show the electronic assembly for a transmitter with a membrane keypad and a transmitter with an LOI.

### Fault 6, membrane keypad

When Fault 6 is detected, the HEATER LED flashes twice, pauses for three seconds, and repeats. The high high heater temp alarm will activate when the thermocouple produces a voltage of 37.1 mV (1652 °F [900 °C]).



Figure 8-12: HEATER LED on Membrane Keypad



### Potential cause

The triac and temperature control may be at fault.

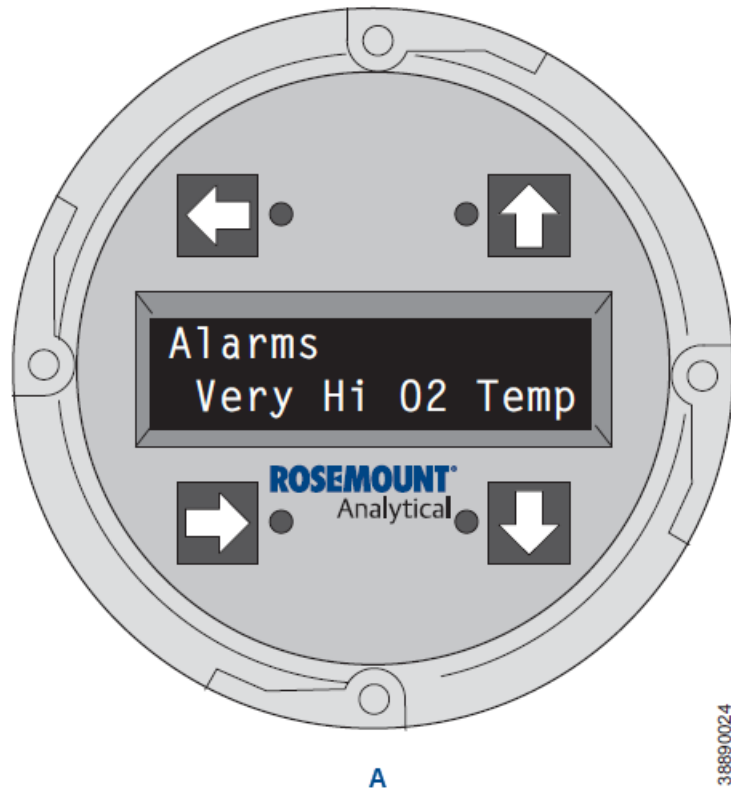
### Recommended actions

1. Remove power. Allow the transmitter to cool for five minutes. Restore power.
2. If the condition repeats, replace the electronic assembly per [Replace electronic assembly](#).

### Fault 6, LOI

When Fault 6 is detected, the LOI displays the `Very Hi O2 Temp` message. The very high O2 temperature alarm will activate when the thermocouple produces a voltage of 37.1 mV (1652 °F [900 °C]).

Figure 8-13: Very Hi O2 Temp Message on LOI



A. LOI

#### Potential cause

The triac and the temperature control may be at fault.

#### Recommended actions

1. Remove power. Allow the transmitter to cool for five minutes. Restore power.
2. If the condition repeats, replace the electronic assembly per [Replace electronic assembly](#).

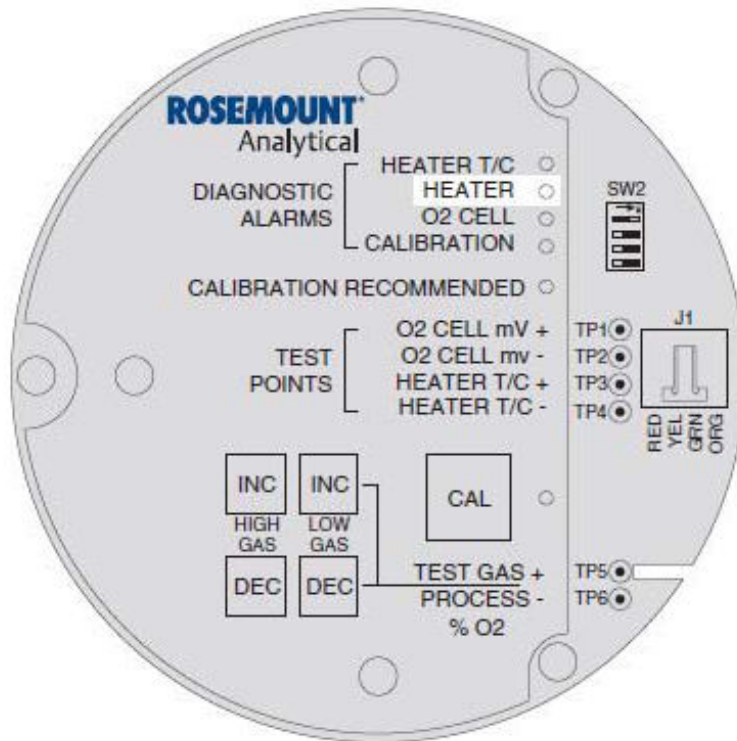
## 8.5.7 Fault 7, High Case Temp

The figures below show the electronic assembly for a transmitter with a membrane keypad and a transmitter with an LOI.

### Fault 7, membrane keypad

When Fault 7 is detected, the HEATER LED flashes three times, pauses for three seconds, and repeats. If the case temperature exceeds 185 °F (85 °C), the temperature control will shut off and the 4-20 mA signal output will go to the default value.

Figure 8-14: HEATER LED on Membrane Keypad



### Potential cause

The environment where the transmitter is installed exceeds the ambient temperature requirements, or the heat due to convection is causing case temperature to rise above the limit.

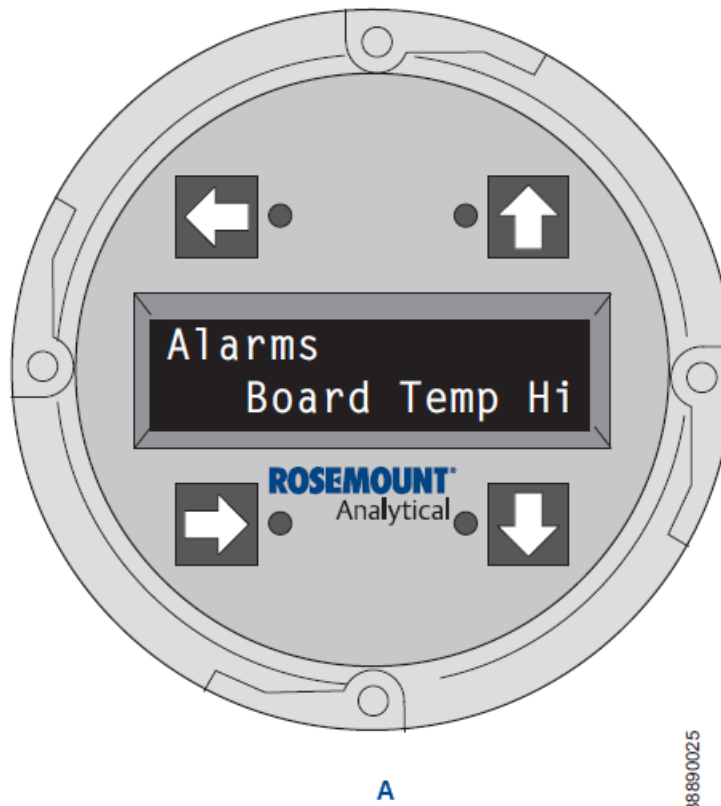
### Recommended actions

1. Place a spool piece between the stack flange and the transmitter flange.
2. Relocate the transmitter to a cooler area.

### Fault 7, LOI

When Fault 7 is detected, the LOI displays the Board Temp Hi message.

**Figure 8-15: Board Temp Hi Message on LOI**



A. LOI

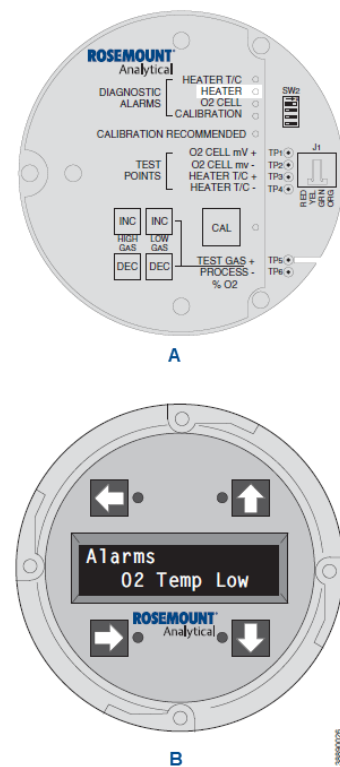
**Recommended action**

Refer to the recommended actions in [Fault 7, membrane keypad](#).

## 8.5.8 Fault 8, Low Heater Temp

The figure below shows the electronic assembly for a transmitter with a membrane keypad and a transmitter with an LOI.

**Figure 8-16: Low Heater Temp on Membrane Keypad and LOI**



- A. Membrane keypad
- B. LOI

## Fault 8, membrane keypad

When Fault 8 is detected, the HEATER LED flashes four times, pauses for three seconds, and repeats. The low heater temperature alarm is active when the thermocouple reading has dropped below 28.6 mV. If the thermocouple reading continues to ramp downward for one minute and does not return to the temperature set point of approximately 29.3 mV, than an Open Heater fault will be displayed.

### Recommended actions

1. Power down the electronics. Remove the electronic assembly per [Replace electronic assembly](#). Using a multimeter, measure the resistance across the terminals of heater connector J8.  
If the heater is good, the reading will be approximately 70 ohms.
2. If the heater is open, see [Replace heater strut](#).

## Fault 8, LOI

When Fault 8 is detected, the LOI displays the O<sub>2</sub> Temp Low message.

### Recommended action

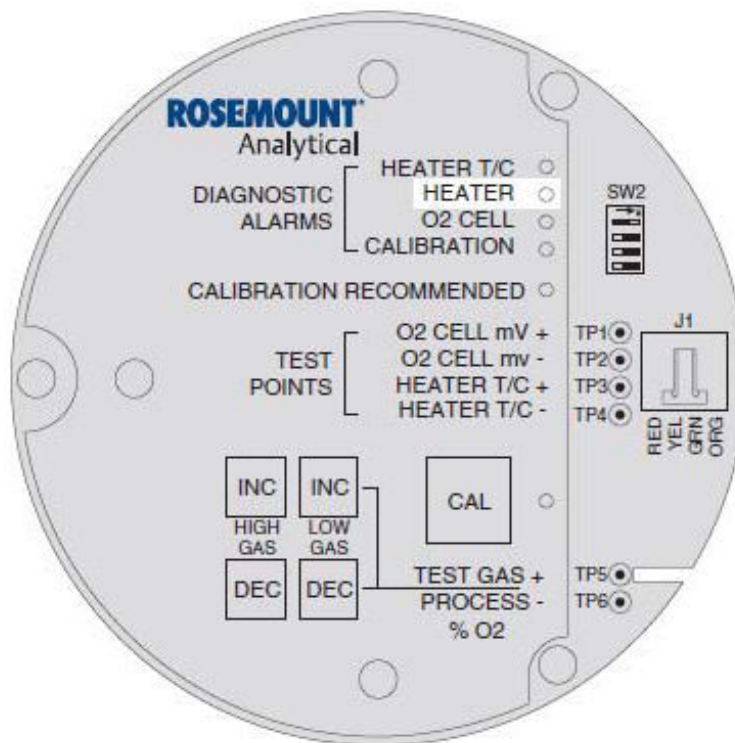
See the recommended actions in [Fault 8, membrane keypad](#).

## 8.5.9 Fault 9, High Heater Temp

### Fault 9, membrane keypad

When Fault 9 is detected, the HEATER LED flashes five times, pauses for three seconds, and repeats. If the thermocouple produces a voltage in excess of approximately 30.7 mV, the high heater temp alarm activates. The 4-20 mA signal returns to the default value (4 or 20 mA).

Figure 8-17: HEATER LED on Membrane Keypad



### Recommended action

This alarm is self-clearing.

When temperature control is restored and the thermocouple voltage returns to the normal range, the alarm clears. If the temperature continues to rise, the next alarm will be the high high heater alarm.

## Fault 9, LOI

When Fault 9 is detected, the LOI displays the message O<sub>2</sub> Temp Hi.

### Recommended actions

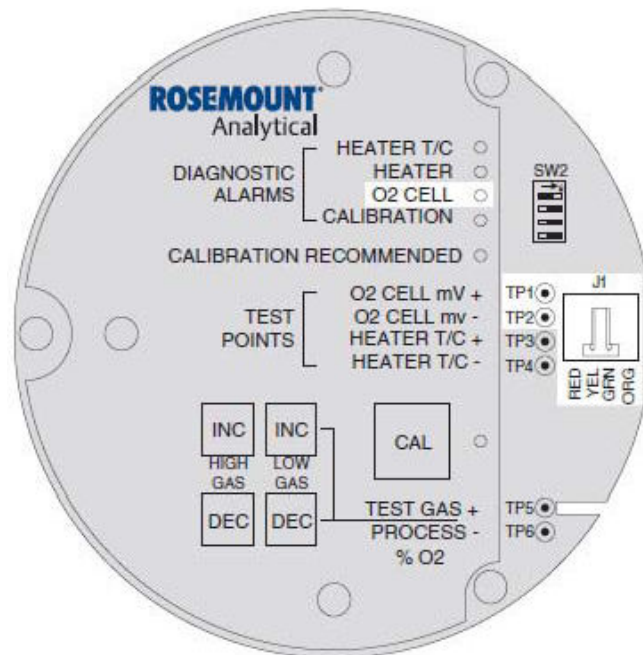
1. Remove power. Unscrew and remove the LOI module from the electronic assembly.
2. Reconnect power to the transmitter.
3. Perform the Recommended actions in [Fault 9, membrane keypad](#).

## 8.5.10 Fault 10, High Cell mV

### Fault 10, membrane keypad

When Fault 10 is detected, the O<sub>2</sub> Cell LED flashes once, pauses for three seconds, and then repeats.

Figure 8-18: O<sub>2</sub> Cell LED on Membrane Keypad



### Potential causes

The orange or green wire has come loose from the crimped connection in connector J1.

### Recommended actions

1. Using a multimeter, measure across TP1+ to TP2-. If you measure 104 mV to 1 volt DC, the cell reading is due to high combustibles. This is a self-clearing alarm. If you measure 1.2 Vdc, the cell wires, either orange or green, have become detached from the input.
2. Replace heater strut per [Replace heater strut](#).

### Potential cause

The platinum pad has broken free from the back of the cell.

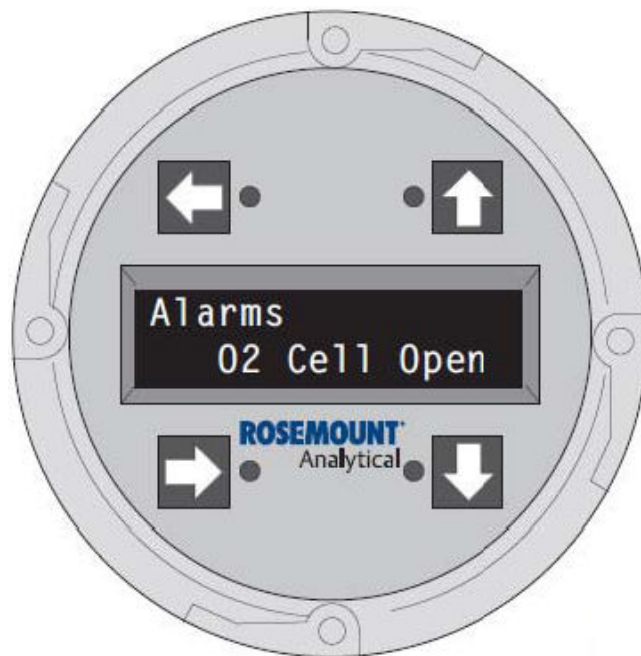
### Recommended action

Replace the cell and flange assembly per [Replace cell](#).

## Fault 10, LOI

When Fault 10 is detected, the LOI displays the O<sub>2</sub> Cell Open message.

**Figure 8-19: O<sub>2</sub> Cell Open Message on LOI**



### Recommended actions

1. Remove power. Unscrew and remove the LOI module from the electronic assembly.
2. Reconnect power to the transmitter.
3. Perform the Recommended actions in [Fault 10, membrane keypad](#).

## 8.5.11 Fault 11, Bad Cell

### Fault 11, membrane keypad

When Fault 11 is detected, the O<sub>2</sub> CELL LED flashes three times, pauses for three seconds, and repeats.

### Potential cause

The bad cell alarm activates when the cell exceeds the maximum resistance value.



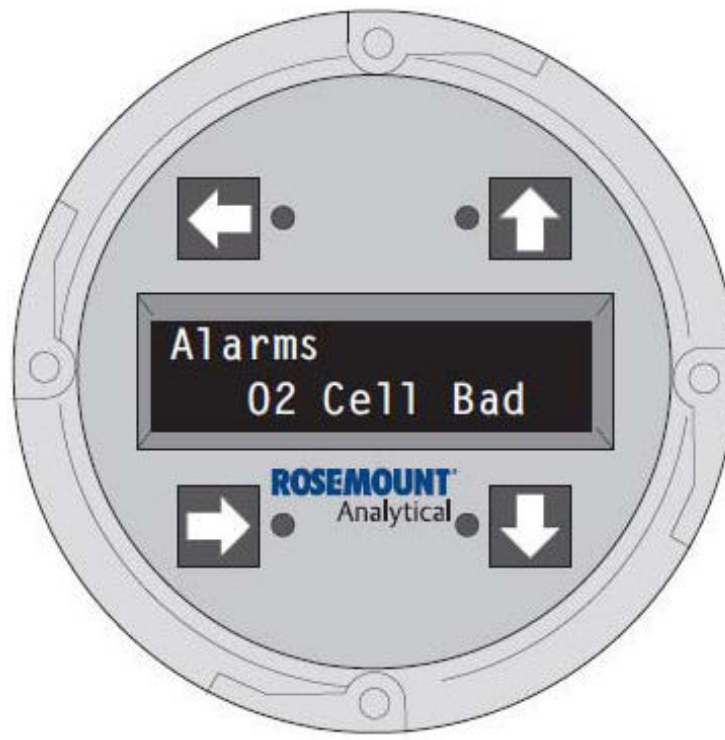
**Recommended action**

Replace the cell.  
See for [Replace cell](#) cell replacement instructions.

**Fault 11, LOI**

When Fault 11 is detected, the LOI displays the O<sub>2</sub> Cell Bad message.

**Figure 8-20: O<sub>2</sub> Cell Bad Message on LOI**



**Recommended action**

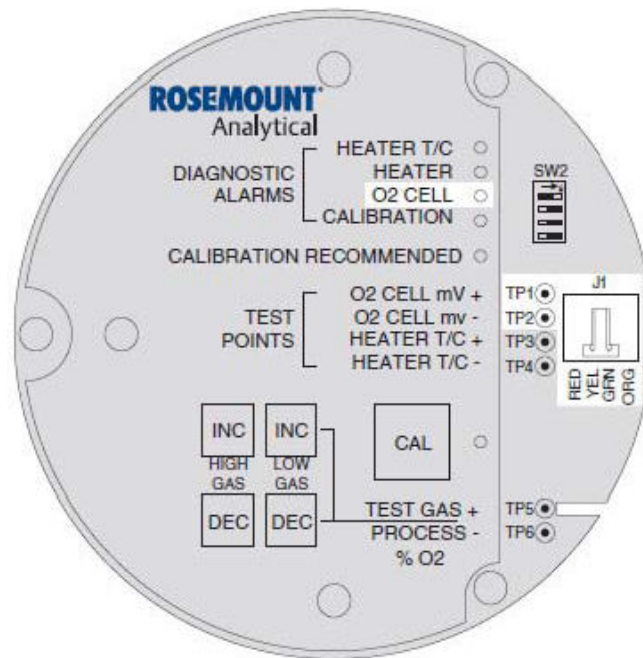
See the recommended action in [Fault 11, membrane keypad](#).

**8.5.12 Fault 12, EEprom Corrupt**

**Fault 12, membrane keypad**

When Fault 12 is detected, the O<sub>2</sub> CELL LED flashes four times, pauses for three seconds, and repeats.

Figure 8-21: O2 CELL LED on Membrane Keypad



#### Potential cause

The EEprom has been changed for a later version and at power-up, the EEprom does not update.

#### Recommended actions

1. Power down.
2. Restore power.

#### Potential cause

If the alarm occurs while the unit is running, there is a hardware problem on the microprocessor board.

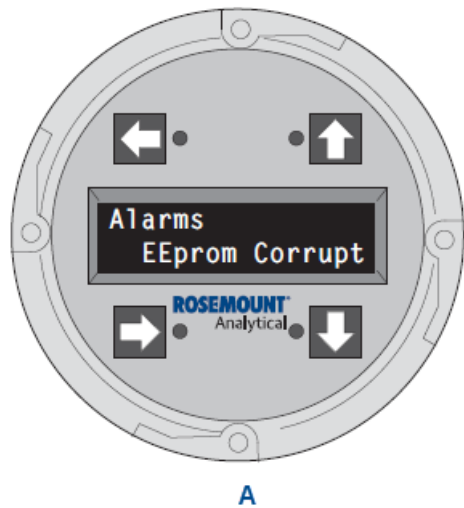
#### Recommended action

Replace the electronic assembly.  
See [Replace electronic assembly](#).

### Fault 12, LOI

When Fault 12 is detected, the LOI displays the EEprom Corrupt message.

Figure 8-22: EEprom Corrupt Message on LOI



A. LOI

**Recommended action**

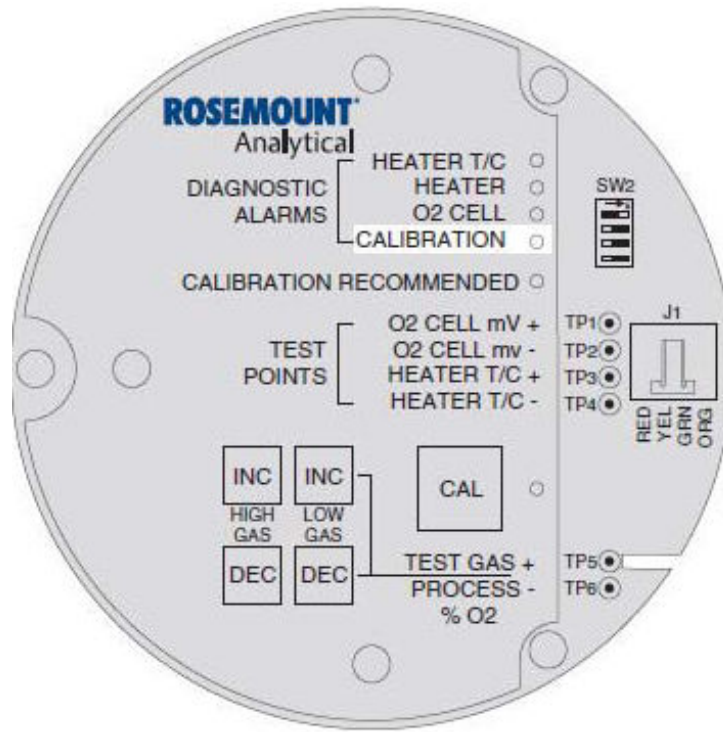
Refer to [Fault 12, membrane keypad](#).

### 8.5.13 Fault 13, Invalid Slope

#### Fault 13, keypad

When Fault 13 is detected, the CALIBRATION LED flashes once, pauses for three seconds, and repeats.

Figure 8-23: CALIBRATION LED on Membrane Keypad



### Potential cause

During a calibration, the electronics calibrates a slope value. If the value of the slope is less than 35 mV/dec or more than 52 mV/dec, the slope alarm will be active until the end of the purge cycle.

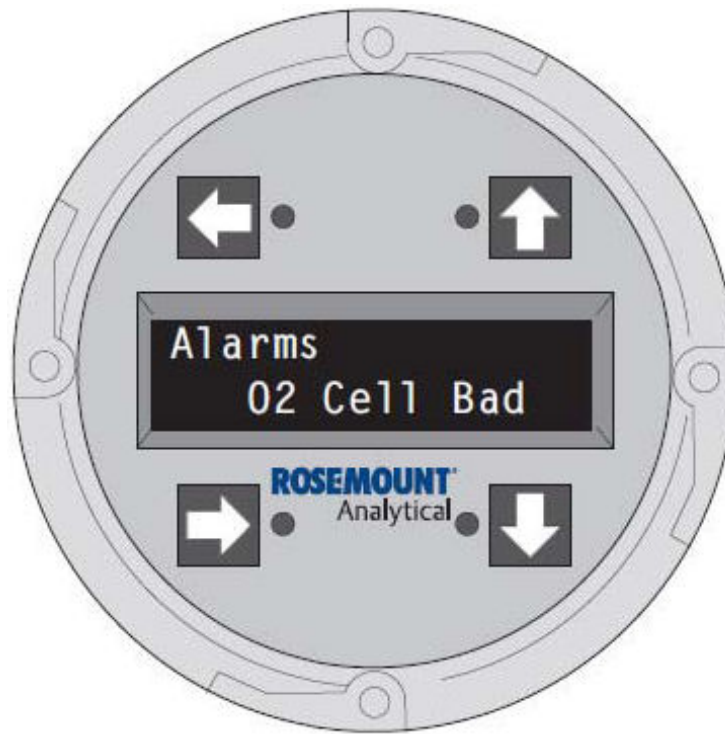
### Recommended actions

1. Ensure the calibration gases match the calibration gas parameters.  
See [Replace cell](#). If you attach a multimeter to TP1+ and TP2-, sample gas measurements are:
  - 8% O<sub>2</sub>: 23 mV
  - 0.4% O<sub>2</sub>: 85 mV
2. Power down the transmitter and remove it from the stack.
3. Replace the cell per .

### Fault 13, LOI

When Fault 13 is detected, the LOI displays the O<sub>2</sub> Cell Bad message.

Figure 8-24: O2 Cell Bad Message on LOI



**Recommended action**

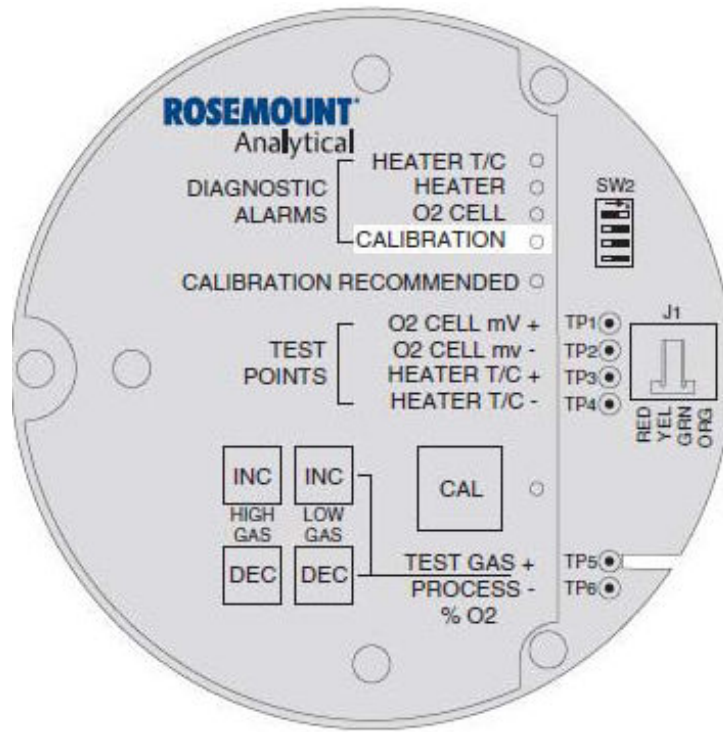
See [Fault 13, keypad](#).

## 8.5.14 Fault 14, Invalid Constant

### Fault 14, membrane keypad

When Fault 14 is detected, the CALIBRATION LED flashes twice, pauses for three seconds, and repeats.

Figure 8-25: CALIBRATION LED on Membrane Keypad



After calibration, the electronics calculates a cell constant value. If the cell constant value is outside the range, -4 mV to 10 mV, the alarm activates. See [Calibrate with keypad](#) and verify the last calibration was performed correctly.

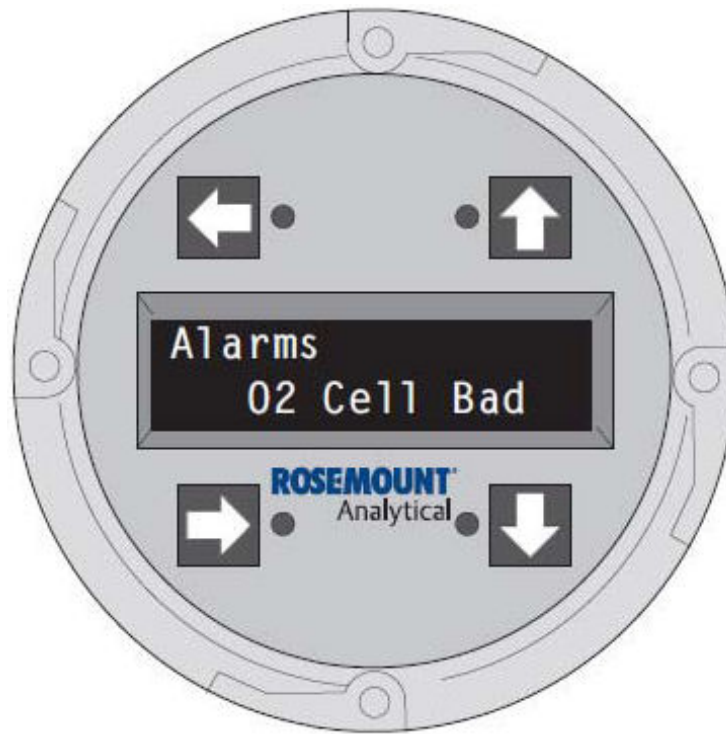
#### Recommended actions

1. Power down the transmitter and remove it from the stack.
2. Replace the cell per [Replace cell](#).

### Fault 14, LOI

When Fault 14 is detected, the LOI displays the O2 Cell Bad message.

Figure 8-26: O2 Cell Bad Message on LOI



**Recommended action**

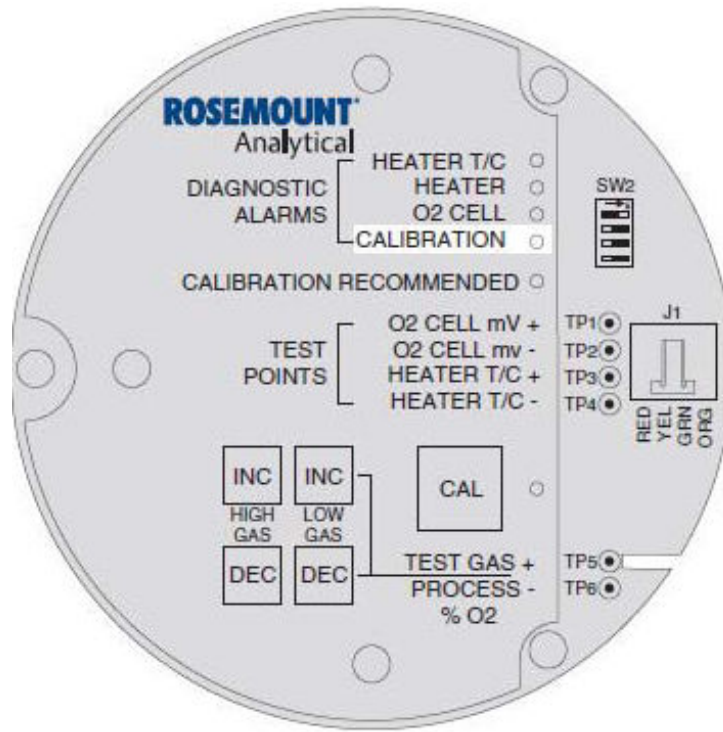
See [Fault 14, membrane keypad](#).

## 8.5.15 Fault 15, Last Calibration Failed

### Fault 15, membrane keypad

When Fault 15 is detected, the CALIBRATION LED flashes three times, pauses for three seconds, and repeats.

Figure 8-27: CALIBRATION LED on Membrane Keypad



The Last Calibration Failed alarm activates when the slope and constant values calculated are out of range and the unit reverts to using the previous calibration values.

**Recommended action**

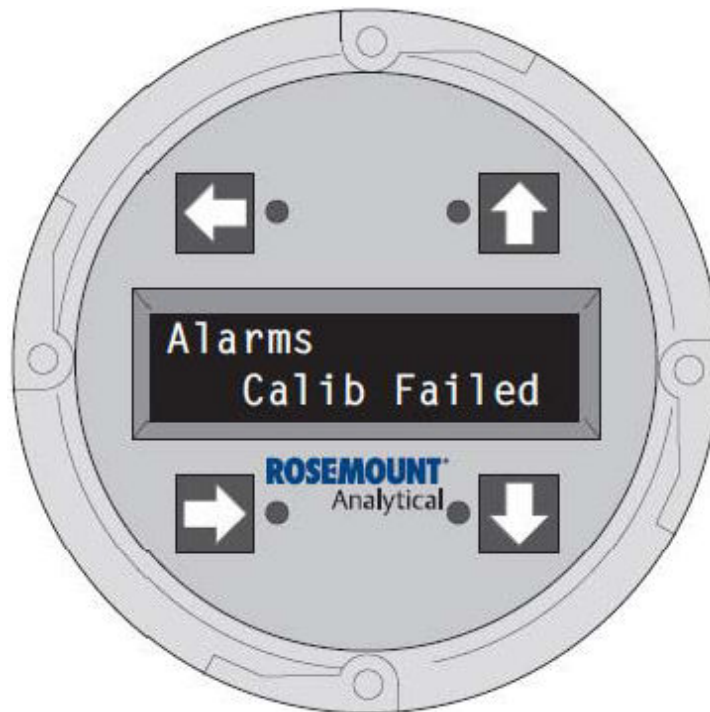
Replace the cell.  
See [Replace cell](#).

**Fault 15, LOI**

When Fault 15 is detected, the LOI displays the Calib Failed message.



Figure 8-28: Calib Failed Error Message



**Recommended action**

See [Fault 15, membrane keypad](#).

## 8.6 Heater not open, but unable to reach 1357 °F (736 °C) setpoint

**Potential cause**

The temperature setpoint of 1357 °F (736 °C) cannot be reached, because the transmitter has an `Auto Tune` function for establishing heater control parameters. Probes mounted into processes that operate at above 1112 °F (600 °C) may have a hard time controlling the temperature with the `Auto Tune` function enabled.

**Recommended actions**

1. Go to `System` → `Parameters` → `Auto Tune?`.
2. Select `No` to disable the `Auto Tune` function.

## 8.7 Calibration passes, but still reads incorrectly

There are a few conditions where no alarm indication is present and the probe passes calibration, but the O<sub>2</sub> reading is still incorrect.

### 8.7.1 Probe passes calibration, but still appears to read too high

#### Potential cause

There may be a leak that is permitting ambient air to mix with the process gases. Since many combustion processes are slightly negative in pressure, ambient air can be sucked into the cell area, biasing the O<sub>2</sub> reading upward.

#### Recommended actions

1. Ensure that the calibration gas line is capped tightly between calibrations. If using Autocal, make sure to check the valve seating properly.
2. If an abrasive shield is installed to protect the entire probe from particulate erosion, a leak in the probe flange gasket can allow ambient air to migrate down the annular space between the probe and shield and then into the cell. Always install a new probe flange gasket when reinstalling a probe.
3. Check calibration gas hoses or tubing for leaks. Repair leaks in hose or tubing.
4. Check cell flange corrugated seal for leaks. Replace seal.

#### Potential cause

There may be a leak inside the probe itself, permitting the reference air (20.95 percent O<sub>2</sub>) to mix with the process gases at the cell.

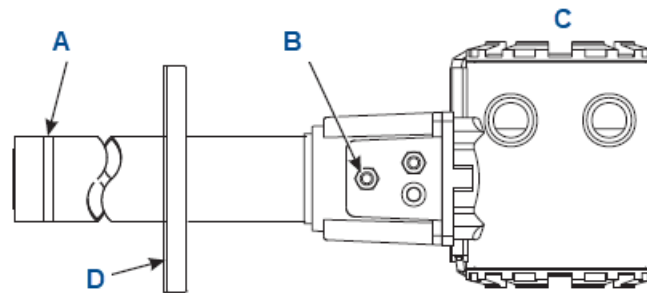
#### Recommended actions

1. To confirm this leak condition, connect instrument air for reference. Pressurize the inside (reference side) of the probe by plugging the reference air exhaust port with your finger for one minute. The O<sub>2</sub> reading should decrease slightly. If the O<sub>2</sub> reading increases during this test, there is a leak inside the probe.

Acid condensation inside the probe can degrade the red silicone tube that carries the cal gas to the cell.

2. Remove the housing to inspect this hose.  
See [Maintenance and service](#).

**Figure 8-29: Probe Leakage Paths, Bottom View**



- A. Corrugated seal
- B. Reference air exhaust port
- C. Probe head
- D. Probe flange gasket

The sensing cell is bolted to the end of the probe and uses a corrugated metallic seal.

3. This seal can only be used one time, so always replace this seal when replacing a cell. Always apply anti-seize compound on both sides of the corrugations.

## 8.7.2 Probe passes calibration, but still appears to read too low

### Potential cause

The diffusion element at the end of the probe is a passive filter. It plugs very slowly since there is no active flow being drawn across it. In applications that have a heavy particulate loading (coal or wood fired boilers, cement and lime kilns, catalyst regeneration, recover boilers, etc.) the diffusion element will eventually plug. This may cause a calibration shift.

### Recommended actions

1. Do not pressurize the sensing cell during calibrations by flowing excessive cal gas against a plugged diffuser.
2. Only set calibration flow rates when a new diffuser is installed.
3. As the diffuser plugs, do not adjust the flow rates upward.

### Detecting a plugged diffuser

When a diffuser is plugged, the O<sub>2</sub> signal's speed of response will degrade. The O<sub>2</sub> trend in the control room will become smoother. When calibrating, the calibration gas flow rate will be noted to be lower.

Never readjust this flow upwards. Adjust this flow only when a new diffuser is installed.

Always note the time it takes for the cell to recover to the normal process value after the cal gas is removed. As the diffuser plugs, this recovery time will get longer and longer. Use [Calibration record](#).

## Calibrate a badly plugged diffuser

It may not be possible to immediately replace a plugged diffuser while the process is on-line. You can calibrate the probe without pressurizing the cell by adjusting the calibration gas flow rate downward before calibration.

For instance, say the process is at three percent, and the first calibration gas is eight percent.

### **⚠ WARNING**

Failure to install covers and ground leads could result in serious injury or death.

Install all protective equipment covers and safety ground leads after installation.

### **Procedure**

1. Adjust the flow of cal gas downward until the reading begins to migrate from eight percent to lower values, indicating that process gases are now mixing with the calibration gases.
2. Adjust the flow rate back up until this mixing is just eliminated.
3. Calibrate at this flow rate.
4. Replace the diffuser at the first opportunity.

## 9 Maintenance and service

### 9.1 Overview

This section identifies the calibration methods available and provides the procedures to maintain and service the transmitter.

#### **⚠ WARNING**

When working on the laboratory bench, be aware that the transmitter, probe tube, and flame arrestor hub can be hot (up to 572 °F [300 °C]) in the region of the probe heater.

#### **⚠ WARNING**

Failure to install covers and ground leads could result in serious injury or death.

Install all protective equipment covers and safety ground leads after installation.

### 9.2 Calibrate

## 9.2.1 Calibration record

Probe serial number:

Probe tag number:

Probe location:

Date placed into service:

Date	Slope	Constant	Impedance	Response <sub>initial</sub>	Response <sub>final</sub>

---

### Note

Response<sub>initial</sub>: When the second calibration gas is turned off, note the number of seconds required for the O<sub>2</sub> value to begin migrating back to the process value.

Response<sub>final</sub>: When the second calibration gas is turned off, note the number of seconds required for the O<sub>2</sub> value to settle out at the process value.

---

## 9.2.2 Calibrate with keypad

To calibrate, apply two calibration gases with known O<sub>2</sub> concentrations to the transmitter. The transmitter calculates slope and constant values from the two calibration gases to determine if it is correctly measuring the net concentration of O<sub>2</sub> in the industrial process.

See [Calibration record](#) to track transmitter performance.

Before calibrating, verify that the calibration gas parameters are correct by setting the gas concentrations used when calibrating the unit and by setting the calibration gas flow

meters. See [Cal LED](#) to calibrate with the keypad or [LOI menu tree](#) to calibrate with the LOI.

The calibration gas flow meter regulates the calibration gas flow and must be set to 5 scfh. However, only adjust flow meters to 5 scfh after placing a new diffuser on the end of the probe. Adjusting the flow meter at any other time can pressurize the cell and bias the calibration.

In applications with a heavy dust loading, the O<sub>2</sub> probe diffusion element may become plugged over time, causing a slower speed of response. The best way to detect a plugged diffusion element is to note the time it takes the transmitter to return to the normal process reading after the last calibration gas is removed and the calibration gas line is blocked off. A slightly lower reading on the flow meter can indicate a plugged diffusion element.

Change the diffusion element when the calibration gas flow meter reads slightly lower during calibration or when response to the process flue gases becomes very slow. Each time you change the diffusion element, reset the calibration gas flow meter to 5 scfh and calibrate the transmitter. To change the diffusion element, refer to [Replace ceramic diffusion element](#).

Three types of calibration methods are available: automatic, semi-automatic, and manual.

#### **⚠ WARNING**

The HART® option is not protected by energy limiting barriers. Do not interface with the handheld communicator option from within a hazardous area. This is the case even when using the intrinsically safe version of the handheld communicator.

#### **⚠ WARNING**

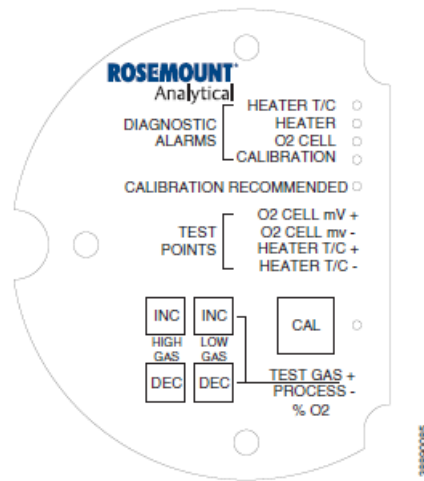
Installing the Rosemount™ IMPS 4000 or SPS 4001B in a potentially explosive environment could cause serious injury or death as well as equipment damage.

Do not install a Rosemount IMPS 4000 or SPS 4001B within a hazardous area.  
Ensure the sequencer is installed in a safe area.

#### **Note**

You can abort a calibration any time during the process. Press the **CAL** key (see [Figure 9-1](#)) on the transmitter keypad three times within three seconds or abort via the LOI, HART/AMS, or a Rosemount IMPS 4000. An aborted calibration retains the values of a the previous good calibration.

Figure 9-1: Membrane Keypad



## Calibrate automatically

Automatic calibration requires no operation action. However, the operator must set up the transmitter so that calibration gases are permanently piped to it. In addition, the operator must install a Rosemount™ IMPS 4000 or SPS 4001B to sequence the gases and set the logic I/O to mode 8 via HART®/AMS so the sequencer and transmitter can communicate.

Depending on your system setup, one of the following methods will initiate an automatic calibration:

- The transmitter will calibrate every time the `CALIBRATION RECOMMENDED` alarm signals that a calibration is required.
- Use the HART/AMS or the LOI to enter a time since last calibration (`CAL INTRVL`) parameter that will initiate an automatic calibration at a scheduled time interval (in hours). To configure the `CAL INTRVL` parameter, refer to [Automatically calibrate with HART®](#) or [Setup at the LOI](#).
- If using a Rosemount IMPS 4000, enter a time interval via the Rosemount IMPS 4000 keypad that will initiate an automatic calibration at a scheduled time interval (in hours).

Once an automatic calibration is initiated, by any of the above three methods, the transmitter's `CALIBRATION RECOMMENDED` alarm signals a Rosemount IMPS 4000 or SPS 4001B to initiate a calibration. The sequencer sends an `in cal` signal to the control room so that any automatic control loops can be placed in manual mode. Then, the sequencer begins to sequence the calibration gases.

## Calibrate semi-automatically

Semi-automatic calibration requires no operator action other than initiation. However, the operator must set up the system so that the calibration gases are permanently piped to the transmitter. In addition, the operator must install a Rosemount™ SPS 4001B or IMPS 4000 to sequence the gases and set the logic I/O mode to mode 8 or 9 via HART®/AMS to allow the sequencer and the transmitter to communicate.



Depending on your system setup, you can initiate a semi-automatic calibration with one of the following methods.

- Membrane keypad: Press the **CAL** key on the keypad.
- LOI: Select `Start Calib` from the CALIBRATION menu.
- Rosemount IMPS 4000: Use the keypad to change the `InitCalX` parameter of the CHANGE PRESETS display mode from `0000` to `0001`.
- HART: Use the HART Communicator to access the O<sub>2</sub> CALIBRATE menu and perform the O<sub>2</sub> Cal method. Refer to [Calibrate O<sub>2</sub> with HART®](#) for the complete calibration procedure.
- AMS: Refer to AMS documentation for more information.
- Remote contact: Initiate a calibration from a remote location via the remote contact input connection provided by a Rosemount IMPS 4000 or SPS 4001B. Refer to the documentation available for the control system in use for more information.

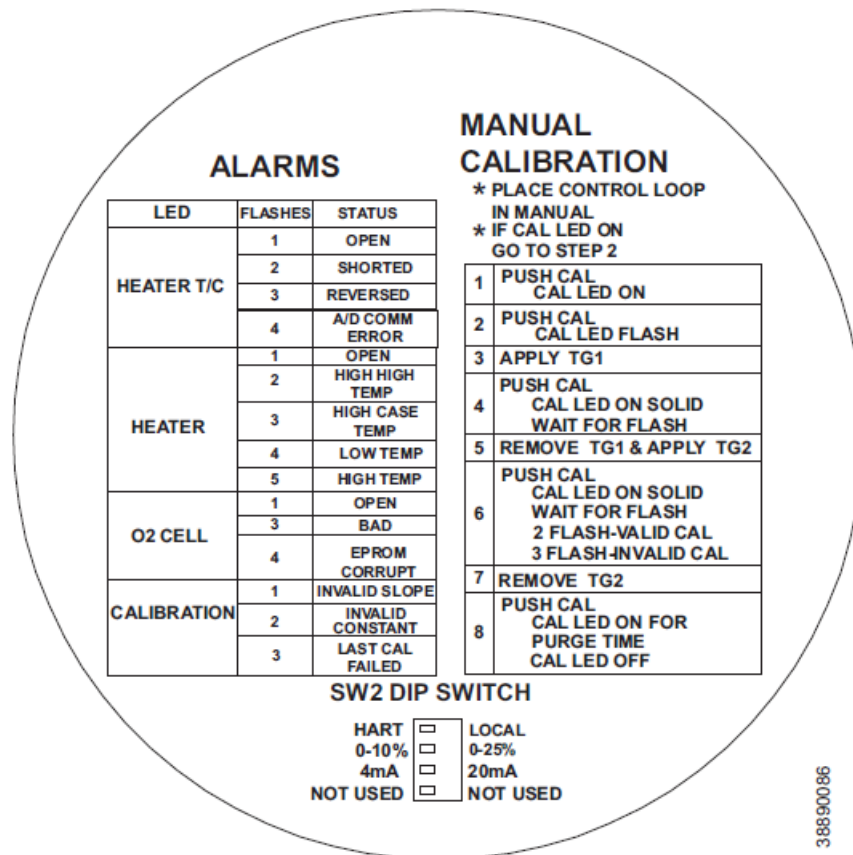
Once you have initiated a semi-automatic calibration by any of the above methods, the transmitter's `CALIBRATION RECOMMENDED` alarm signals a Rosemount IMPS 400 or SPS 4001B to initiate a calibration. The sequencer sends an in cal signal to the control room so that any automatic control loops can be placed in manual mode. Then the sequencer begins to sequence the calibration gases.

## Calibrate manually with membrane keypad

To calibrate manually, the operator must perform the calibration at the transmitter and complete each step in the process.

The inside right cover of the transmitter displays manual calibration instructions in condensed form.

Figure 9-2: Transmitter Inside Right Cover



### Procedure

1. Place control loop in manual.
2. Verify the calibration gas parameters are correct per [Calibrate with keypad](#). If calibrating manually with the CALIBRATION LED off and the CAL LED off, start at [Step 3](#). If calibrating manually with the CALIBRATION RECOMMENDED LED on and the CAL LED on, start at [Step 4](#).
3. Press the CAL key.  
The CALIBRATION RECOMMENDED LED turns on, and the CAL LED is on solid. If a multimeter is attached across TP5 and TP6, the reading displays the percentage of oxygen the cell sees.
4. Press the CAL key.  
The CALIBRATION RECOMMENDED LED turns off, and the CAL LED flashed continuously. You can configure the transmitter so that the 4-20 mA signal holds the last value. The default condition is for the output to track. A flashing LED indicates that the transmitter is ready to accept the first calibration gas.
5. Apply the first calibration gas.  
Electronics will abort the calibration if you do not complete this step within 30 minutes.

6. Press the **CAL** key.  
The **CAL** LED turns solid. A timer is activated to allow the calibration gas adequate time to flow (default time of five minutes). When the timer times out, the transmitter has finished taking the readings using the first calibration gas. The **CAL** LED starts to flash continuously. The flashing indicates that the transmitter is ready to take readings using the second calibration gas.
7. Remove the first calibration gas and apply the second calibration gas.  
Electronics will abort the calibration if you do not complete this step within 30 minutes.
8. Press the **CAL** key.  
The **CAL** LED turns solid. The timer is activated for the second calibration gas flow. When the timer times out, the **CAL** LED flashes a two pattern flash or a three pattern flash. (A two pattern flash indicates a valid calibration, and a three pattern flash indicates an invalid calibration). If the slope or the constant is out of specification, a diagnostic alarm LED starts flashing. The diagnostic alarm remains active until the purge cycle is over. If the three pattern flash occurs without the diagnostic alarm, the calibration gases could be the same or the calibration gas could not be turned on.  
  
A flashing **CAL** LED indicates the calibration is done. See [Troubleshoot](#) for an explanation of the two pattern and three pattern flashes.
9. Remove the second calibration gas and cap off the calibration gas port.
10. Press the **CAL** key.  
The **CAL** LED turns solid as the unit purges. (The default purge time is three minutes.) When the purge is complete, the **CAL** LED turns off, and the transmitter unlocks from its held value and begins to read the process O<sub>2</sub>.  
  
If the calibration was valid, the **DIAGNOSTIC ALARMS** LEDs will indicate normal operation. If either new calibration value (slope or constant) is not within parameters, the **DIAGNOSTIC ALARMS** LED indicates an alarm. See [Troubleshoot](#) for alarm codes. If the calibration was invalid, the transmitter will return to normal operation, as it was before the calibration, and the parameters will not be updated.
11. Place control loop in automatic.

## 9.2.3 Calibrate with LOI

Refer to [LOI menu tree](#) for a view of the LOI menu tree.

### Procedure

1. Go to **CALIBRATION** → **Start Calibration**.  
To abort the calibration at any time, select **Abort Calib**. This exits the calibration. After you remove the calibration gases and the purge times out, the transmitter goes back to normal operational mode.  
The LOI instructs you through the entire procedure.  
The LOI displays the following:

Apply Gas 1

Hit E when ready

The transmitter is ready to accept the first calibration gas.

2. Apply the first calibration gas.  
Electronics will abort this calibration if this step is not done within 30 minutes.
3. Press **ENTER** to start the Gas 1 flow.  
The transmitter activates a timer to allow the calibration gas adequate time to flow (default time of five minutes). The LOI displays:

Flow Gas 1 xxxxs

Read Gas 1 xxxxs

Done Gas 1

The display counts down the seconds remaining to flow Gas 1 and then the time remaining for sensing the O<sub>2</sub> concentration of Gas 1. Done Gas 1 indicates completion.

4. Remove the first calibration gas and apply the second calibration gas.  
Electronics will abort the calibration if this step is not done within 30 minutes.  
The LOI displays:

Apply Gas 2

Hit E when ready

5. Press **ENTER** to start the Gas 2 flow.  
The transmitter activates the timer. The LOI displays:

Flow Gas 2 xxxxs

Read Gas 2 xxxxs

Done Gas 2 xxxxs

Stop Gas

Hit E when ready

6. Remove the second calibration gas and cap off the calibration gas port.
7. Press **ENTER** to indicate completion.  
The transmitter activates the timer. The LOI displays:

Purge xxxxs

The default purge time is three minutes. When the gas purge timer times out, the transmitter begins to read the process O<sub>2</sub>.

### Cal constants - Results of the calibration

<b>Current Calibration</b>	If the calibration passed, the transmitter updates these values. Log these levels into the calibration record ( <a href="#">Calibration record</a> ). If the process has high levels of particulate, the transmitter removes the response back to the process after cal gas.
<b>Previous Calibration</b>	Values from the prior good calibration.
<b>Failed Calibration</b>	The transmitter does not load bad calibration values into the electronics.

### Cal constants status

<b>Calibration Step</b>	The current step in an active calibration procedure.
<b>Calibration Time</b>	Time until the next scheduled calibration.
<b>Next O2 Cal</b>	Time until the next O <sub>2</sub> calibration, if different than the next scheduled calibration.

## 9.3 Repair

Each of the following procedures details how to remove and replace a specific component of the transmitter.

### ⚠ WARNING

The transmitter is hot and may cause severe burns.

Remove the transmitter from the stack for all service activities. Allow the transmitter to cool and take it to a clean work area.

### ⚠ WARNING

#### Electrical shock

Disconnect and lock out power before working on any electrical components. There is voltage up to 115 Vac.

### 9.3.1 Remove probe

Refer to [Figure 2-14](#) if you are using integral electronics or [Figure 2-18](#) if you are using remote electronics. The numbers indicated in the steps below correspond to the numbers of the items in those figures.

#### Procedure

1. Turn off power to the system.
2. Shut off the calibration gases at the cylinders and instrument air.

3. Disconnect the calibration gas and instrument air lines from the transmitter.
4. While facing the transmitter and looking at the Rosemount™ label, remove screw (18), cover lock (19), and captive washer (20) that secures the cover (17) on the left side of the housing (11). Remove the cover to expose the terminal block (15).
5. Remove all signal and power wiring to the probe.
6. Remove insulation to access the mounting bolts.
7. Unbolt the transmitter from the stack and take it to a clean work area.
8. Allow the unit to cool to a comfortable working temperature.

### 9.3.2 Replace probe

Refer to [Figure 2-14](#) if you are using integral electronics or [Figure 2-18](#) if you are using remote electronics. The numbers in the steps below correspond to the numbers of the items in those figures.

#### Procedure

1. Bolt the transmitter to the stack and install the insulation.
2. Connect all signal and power leads at the probe.  
Refer to [Installation](#) for detailed wiring instructions.
3. Install left side cover (17) and ensure it is tight. Secure the cover using captive washer (20), cover lock (19), and screw (18).
4. Connect the calibration gas and instrument air lines to the probe.
5. Turn on the calibration gases at the cylinders and turn on instrument air.
6. Restore power to the system.  
Refer to [Start up and operate transmitter with membrane keypad](#) or [Start up and operate transmitter with LOI](#)
7. When the probe has reached operating temperature, calibrate it per [Calibrate with keypad](#) or [Calibrate with LOI](#).

---

#### Note

Recalibrate whenever you replace electronic cards or the sensing cell.

---

### 9.3.3 Replace entire electronics (with housing)

#### **⚠ WARNING**

Opening the electronics housing will cause the loss of all hazardous permits. Opening the electronics housing in hazardous areas may cause an explosion resulting in loss of property, severe personal injury, or death.

You may need to get a hot work permit from your company safety officer before opening the electronics housing.

---

Refer to [Figure 2-14](#). The numbers in the following steps correspond to the numbers of the items in that figure.

### Prerequisites

Follow the instructions in [Remove probe](#) to remove the transmitter from the stack or duct.

### ⚠ CAUTION

Damage to the aluminum probe housing can occur.

Do not force the probe housing when installing or removing it from the integral electrical barrier/feed-through.

### Procedure

1. Remove four screws (22) and washers (21) from the probe tube assembly (23). Remove the probe tube assembly from the housing (11).
2. Disconnect the heater and signal wire connectors from the mating connectors on the heater strut assembly (32).

#### Note

The integral electrical barrier/feed-through is thread-locked into the electrical housing and cannot be removed.

3. Make sure the O-ring (31) is in good condition. Replace the O-ring if damaged.
4. Make sure that the conduit port of the electronic housing is on the same side as the CAL and REF gas ports. Install four washers (21) and screws (22). Tighten screws.
5. Follow the instructions in [Replace probe](#) to replace the probe in the stack or duct.

## 9.3.4 Replace electronic assembly

### ⚠ WARNING

Opening the electronics housing will cause the loss of all hazardous permits. Opening the electronics housing in hazardous areas may cause an explosion resulting in loss of property, severe personal injury, or death.

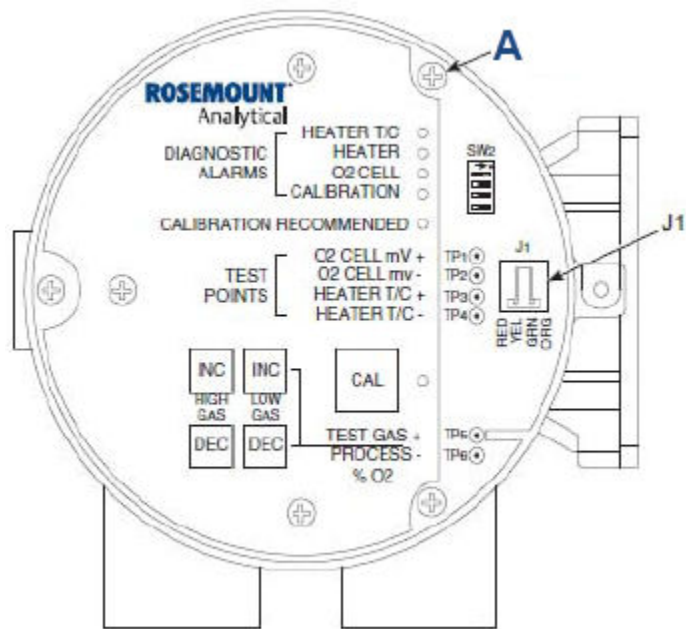
You may need to get a hot work permit from your company safety officer before opening the electronics housing.

Refer to [Figure 2-14](#) if you are using integral electronics or [Figure 2-18](#) if you are using remote electronics. The numbers in the following steps correspond to the numbers of the items in those figures.

### Procedure

1. Remove screw (18), cover lock (19), and captive washer (20), securing cover (1). Remove the cover.
2. Depress and remove the J1 (cell and thermocouple) connector from the J1 socket. See [Figure 9-3](#).

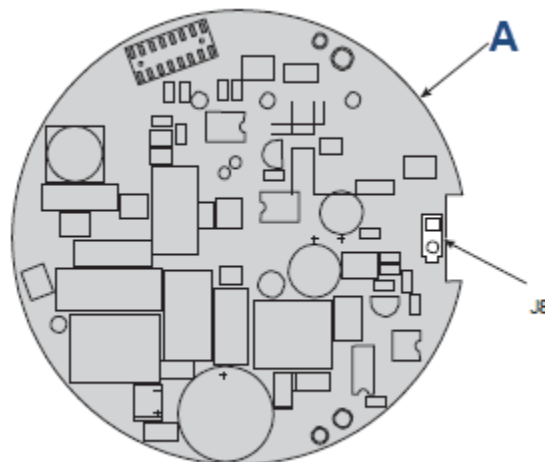
Figure 9-3: Electronic Assembly



A. Mounting screw

3. Loosen the three captive screws (9). Slide electronic assembly (2) partially out of housing (11).
  4. Squeeze the sides of the J8 connector and carefully remove the J8 connector (heater leads) from the power supply board.
- See [Figure 9-4](#).

Figure 9-4: J8 Connector



A. Power supply board



5. Remove the electronic assembly (2) from the housing (11).
6. Slide the new electronic assembly (2) partially into the housing.
7. Reconnect the J8 connector to the power supply board. Make sure the connector is secure.
8. Holding the J1 connector leads, slide the electronic assembly the rest of the way into the housing. Seat the electronic assembly on the mating connector pins.
9. Gently try to rotate the electronic assembly to check for full seating. If the electronic assembly rotates, remove the assembly and repeat [Step 8](#).
10. Reconnect the J1 connector to the microprocessor board ([Figure 9-3](#)). Ensure the connector is secure.
11. Tighten the three captive screws (9) in the top of the microprocessor board.
12. Install and tighten cover (1); make sure it is tight. Secure the cover using captive washer (20), cover lock (19), and screw (18).

### 9.3.5 Replace terminal block

#### **⚠ WARNING**

Opening the electronics housing will cause the loss of all hazardous permits. Opening the electronics housing in hazardous areas may cause an explosion resulting in loss of property, severe personal injury, or death.

You may need to get a hot work permit from your company safety officer before opening the electronics housing.

Refer to [Figure 2-14](#) if you are using integral electronics or [Figure 2-18](#) if you are using remote electronics. The numbers in the following steps correspond to the numbers of the items in those figures.

#### **Procedure**

1. Remove the left side cover (17) from the housing (11).
2. Loosen the three captive screws (16) in the terminal block (15). Carefully lift the terminal block out of the housing.
3. Carefully align the new terminal block on the pins so that it sits flat in the housing. The round end of the terminal block should be on the opposite side of the housing conduit ports and should not be able to rotate.
4. Tighten the three mounting screws and ensure the terminal block is secure in the housing.

## 9.3.6 Replace fuse

### **⚠ WARNING**

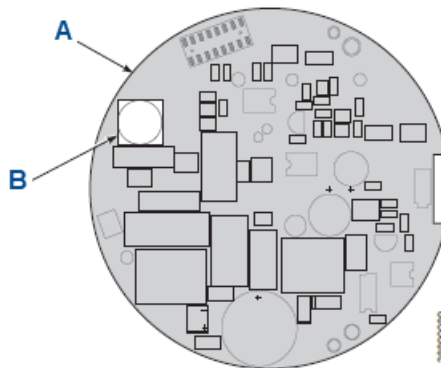
The transmitter, probe tube, and flame arrestor hub can be hot (up to 572 °F [300 °C]) in the region of the probe heater. This can cause severe burns.

Wear heat resistant gloves and clothing when removing probe.

Do not attempt to work on the probe until it has cooled to room temperature.

Refer to [Figure 2-14](#) if you are using integral electronics or [Figure 2-18](#) if you are using remote electronics. The numbers in the following steps correspond to the numbers of the items in those figures. Also see [Figure 9-5](#).

**Figure 9-5: Fuse Location**



- A. Power supply board
- B. Fuse

### **Procedure**

1. Remove screw (18), cover lock (19), and captive washer (20) securing cover (1). Remove the cover.
2. Depress and remove the J1 (cell and T/C) connector from the J1 socket. See [Figure 9-3](#).
3. Loosen the three captive screws (10). Slide electronic assembly (2) partially out of housing (11).
4. Squeeze the sides of the J8 connector and carefully remove the J8 connector (heater leads) from the power supply board. See [Figure 9-4](#).
5. Remove the electronic assembly (2) from the housing (11).
6. Turn the electronic assembly over so that you are looking at the bottom of the power supply board ([Figure 9-5](#)).
7. Gently depress the two white posts one at a time. Carefully separate the power supply board from the analog board.
8. Remove the fuse and replace it with a new slow blow fuse rated 250 Vac, 5 A.

9. Align the white posts with the post holes on the power supply board and the pin connector on the power supply board with the connector port on the back of the analog board. Gently push the boards together until the white posts snap in place. Ensure the assembly is secure by gently trying to separate the boards.
10. Holding the J1 connector leads, slide the electronic assembly the rest of the way into the housing. Seat the electronic assembly on the mating connector pins.
11. Gently try to rotate the electronic assembly to check for full seating. If the electronic assembly rotates, remove the assembly and repeat [Step 10](#).
12. Reconnect the J1 connector to the microprocessor board ([Replace electronic assembly](#)).
13. Tighten the three captive screws (10) in the top of the microprocessor board (5).
14. Replace the right housing cover (1); make sure it is tight. Secure the housing cover using captive washer (20), cover lock (19), and screw (18).
15. Install and tighten cover (1). Make sure it is tight. Secure the cover using captive washer (20), cover lock (19), and screw (18).

### 9.3.7 Replace entire probe

Do not attempt to replace the probe until you have eliminated all other possibilities for poor performance.

#### **⚠ WARNING**

The transmitter, probe tube, and flame arrestor hub can be hot (up to 572 °F [300 °C]) in the region of the probe heater. This can cause severe burns.

Wear heat resistant gloves and clothing when removing probe.

Do not attempt to work on the probe until it has cooled to room temperature.

If you need to replace the probe, see [Replacement parts](#) for part numbers.

#### **Procedure**

1. Follow the instructions in [Remove probe](#) to remove the transmitter from the stack or duct.
2. Separate the probe and the electronics housing per [Step 1](#) in [Replace entire electronics \(with housing\)](#).
3. Reinstall electronics on the new probe per [Step 3](#) and [Step 4](#) in [Replace entire electronics \(with housing\)](#).
4. Follow the instructions in [Replace probe](#) to install the transmitter into the stack or duct.

## 9.3.8 Replace heater strut

Do not attempt to replace the heater strut until you have eliminated all other possibilities for poor performance.

### **⚠ WARNING**

The transmitter, probe tube, and flame arrestor hub can be hot (up to 572 °F [300 °C]) in the region of the probe heater. This can cause severe burns.

Wear heat resistant gloves and clothing when removing probe.

Do not attempt to work on the probe until it has cooled to room temperature.

If you need to replace the heater strut, order a replacement heater strut. See [Table 10-2](#).

### **Procedure**

1. Follow the instructions in [Remove probe](#) to remove the transmitter from the stack or duct.
2. Remove oxygen sensing cell per [Replace cell](#).

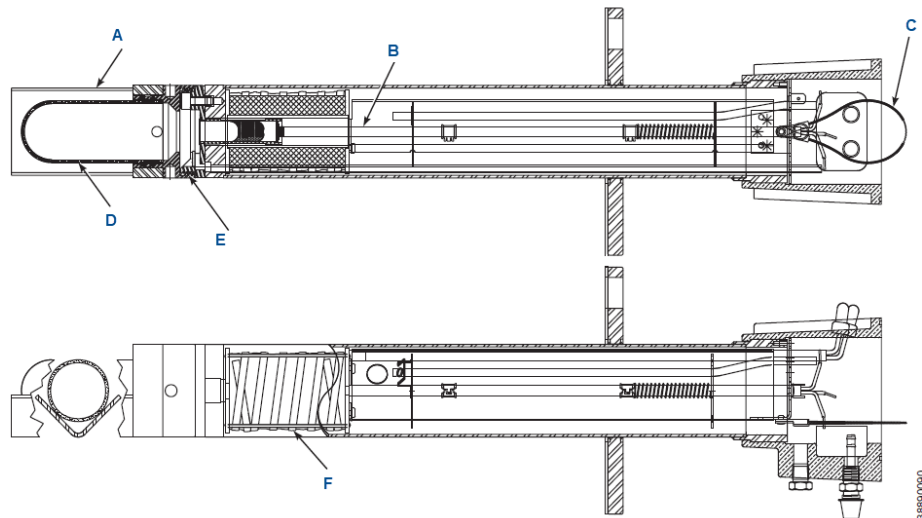
### **⚠ CAUTION**

Damage to the aluminum housing can occur.

Do not force the probe housing when installing or removing it from the integral electrical barrier/feed-through ([Figure 2-14](#)).

3. Remove four screws (22, [Figure 2-14](#)) and washers (21) from the probe tube assembly (23). Remove the probe tube assembly from the housing (11). Once you have separated the probe and housing, spring tension releases, and the heater strut assembly (32) moves up.
4. Remove strut pressure clamp (35).
5. Disconnect the heater and signal wire connectors from the mating connectors on the heater strut assembly (32).
6. Remove tube clamps (33). Carefully pull the CAL and REF gas silicone tubes (34) from the CAL and REF gas ports.
7. Remove gas port fittings (29) from the CAL, REF, and VENT ports.
8. Grasp the wire loop and carefully slide the heater strut assembly (32) out of the probe tube.  
See [Figure 9-6](#).

Figure 9-6: Heater Strut Assembly



- A. V-deflector
- B. Ceramic support rod
- C. Wire loop
- D. Cell flange
- E. Ceramic diffuser assembly
- F. Heater

9. When replacing the strut, orient the probe so that the small calibration gas tube lays at the 6 o'clock position of the probe tube. Align the slot on the heater plate with the calibration gas line in the probe tube. Slide the strut into the probe tube. The strut turns to align the hole on the back plate of the strut with the calibration gas line. When the hole and calibration gas line are aligned correctly, the strut will slide in the rest of the way.
10. Install the guide rod into the calibration gas tube to assist in guiding the calibration gas tube through the hole in the end of the strut.
11. Push down on the back plate of the strut to make sure you have spring tension and then install the strut pressure clamp (34) on the back plate.
12. Install gas port fittings (29) in the CAL, REF, and VENT ports.
13. Replace the CAL and REF gas silicone tubes (34) and tube clamps (33).
14. Install the entire electronics per [Step 3](#) and [Step 4](#) in [Replace entire electronics \(with housing\)](#).
15. Follow the instructions in [Install probe](#) to install the transmitter into the stack or duct.

## 9.3.9 Replace cell

Do not attempt to replace cell until you have eliminated all other possibilities for poor performance.

### ⚠ WARNING

The transmitter, probe tube, and flame arrestor hub can be hot (up to 572 °F [300 °C]) in the region of the probe heater. This can cause severe burns.

Wear heat resistant gloves and clothing when removing probe.

Do not attempt to work on the probe until it has cooled to room temperature.

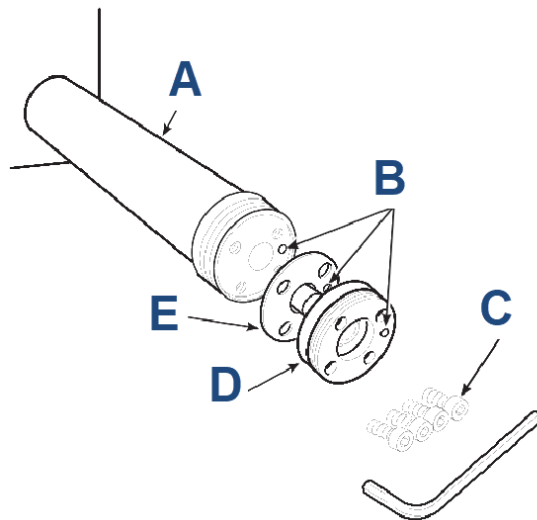
### ⚠ CAUTION

Removing the cell may damage the cell and platinum pad.

Do not remove the cell unless it needs to be replaced. Go through the complete troubleshooting procedure to eliminate other possible causes before removing the cell.

If you need to replace the cell, order the cell replacement kit. See [Replacement parts](#). The cell replacement kit ([Figure 9-7](#)) contains a cell and flange assembly, corrugated seal, setscrews, socket head cap screws, and anti-seize compound. Emerson carefully packages the items to preserve precise surface finishes. Do not remove items from the packaging until you are ready to use them. A special tools kit contains spanner and hex wrenches.

**Figure 9-7: Cell Replacement Kit**



- A. Probe tube (not included in kit)
- B. Calibration gas passage
- C. Socket head cap screws
- D. Cell and flange assembly
- E. Corrugated seal

### Procedure

1. Follow the instructions in [Remove probe](#) to remove the probe from the stack or duct.
2. If the probe uses a snubber diffuser, use a spanner wrench to remove the flame arrestor/snubber diffuser assembly.
3. Remove the locking set screw from the flame arrestor. Use spanner wrenches from the probe disassembly kit ([Table 10-4](#)) to turn the flame arrestor hub free from the probe flange. If equipped with the flame arrestor with ceramic diffuser, remove and discard the setscrews and remove the vee deflector ([Figure 9-8](#)). Inspect the ceramic diffuser. If damaged, replace using the element.

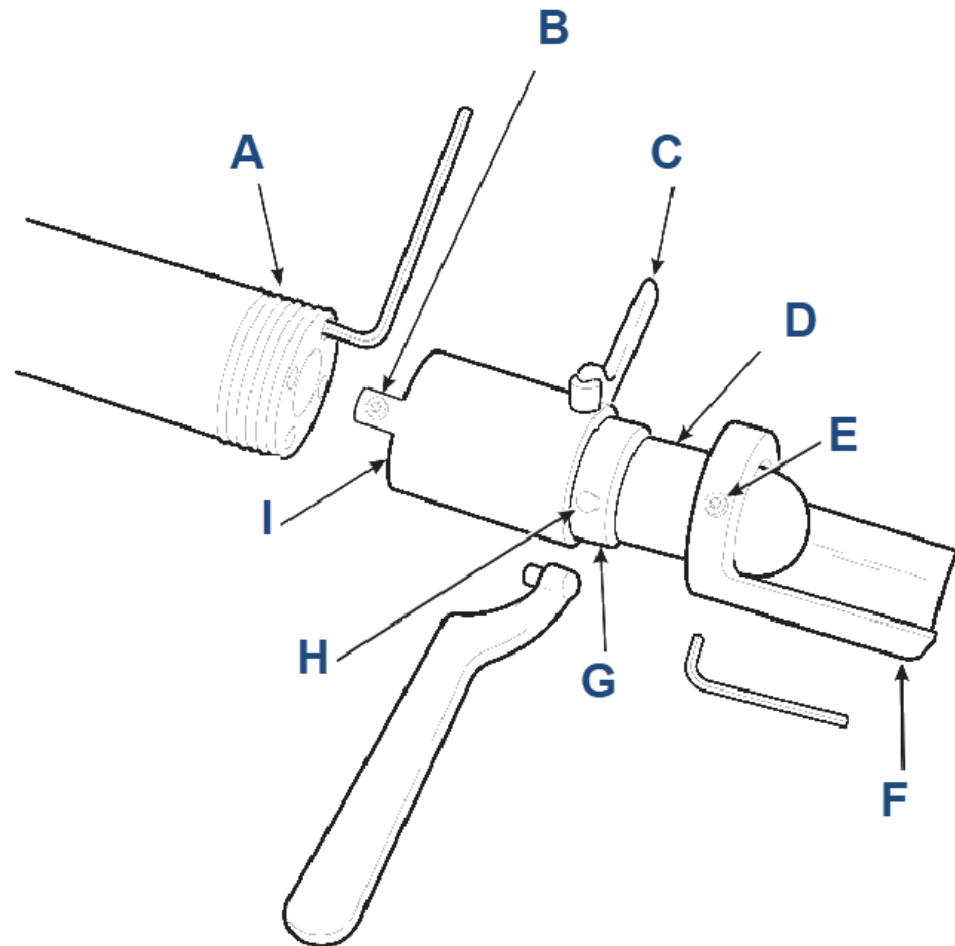
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### Note

The flame arrestor and flame arrestor hub are among the critical components of this type of protection. See *Safety Data Sheet 1A99078*.

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**Figure 9-8: Ceramic Diffuser Element Replacement**



- A. Threaded probe flange
- B. M5-0.8 x 5 mm locking set screw (use 2.5 mm hex key)
- C. Spanner wrench
- D. Ceramic diffusion element
- E. M5-1 x 6 mm setscrew (use 3 mm hex key)
- F. Vee deflector
- G. Cement fillet
- H. Cement port
- I. Flame arrestor hub

4. If equipped with the optional ceramic diffusion assembly, remove and discard the setscrews and remove the vee deflector. Use spanner wrenches from the probe disassembly kit (Table 10-4) to turn the hub free from the retainer. Inspect the diffusion element. If damaged, replace the element.
5. Loosen the four socket head cap screws from the cell and flange assembly.
6. Remove the assembly and the corrugated cell.



The cell flange has a notch that you can use to gently pry the flange away from the probe. The contact pad inside the probe will sometimes fuse to the oxygen sensing cell.

7. If the cell is fused to the contact pad, push the cell assembly back into the probe (against spring pressure) and quickly twist the cell assembly. The cell and contact pad should separate. If the contact pad stays fused to the cell, you need to install a new contact/thermocouple assembly.
8. Disconnect the orange cell wire at the probe electronics end of the strut by cutting the wire.
9. Withdraw the cell with the wire still attached.
10. Remove entire electronics per [Step 1](#) and [Step 2](#) in [Replace entire electronics \(with housing\)](#)
11. If the contact and thermocouple assembly is damaged, replace the assembly or the contact pad.  
Refer to [Replace contact and thermocouple assembly](#) to replace the contact and thermocouple assembly. The cell replacement kit includes instructions for replacing the contact pad.
12. Remove and discard the corrugated seal.
13. Clean the mating faces of the probe tube and cell.
14. Remove burrs and raised surfaces with a block of wood and a crocus cloth.
15. Clean the threads on the probe flange and flame arrestor hub.
16. Apply a light coating of anti-seize compound to both sides of the new corrugated seal.
17. Assemble the cell and flange assembly and corrugated seal to the probe tube. Make sure the calibration tube lines up with the calibration gas passage in each component. Apply a small amount of anti-seize compound to the screw threads and use the screws to secure the assembly. Torque to 35 in.-lb. (4 N-m).
18. Apply anti-seize compound to the probe threads, flame arrestor hub, and setscrews.
19. Reinstall the flame arrestor on the probe.
20. Using pin spanner wrenches, torque to 10 ft.-lb. (14 N-m).
21. Secure the flame arrestor with the locking setscrew. Torque to 25 in.-lb. (2.8 N-m).
22. If applicable, reinstall the vee deflector, orienting apex toward gas flow. Secure with the setscrew and anti-seize compound. Torque to 25 in.-lb. (2.8 N-m).
23. On systems equipped with an abrasive shield, install the dust seal gaskets with joints 180° apart.
24. If previously removed, install the entire electronics per [Step 3](#) and [Step 4](#) in [Replace entire electronics \(with housing\)](#).
25. Follow the instructions in [Install probe](#). Install the transmitter into the stack or duct. If there is an abrasive shield in the stack, make sure the dust seal gaskets are in place as they enter the 15° reducing cone.

## 9.3.10 Replace ceramic diffusion element

The diffusion element protects the O<sub>2</sub> cell from particles in process gases. The element does not normally need to be replaced, because the vee deflector protects it from particulate erosion. In severe environments, the filter may be broken or subject to excessive erosion. Examine the ceramic diffusion element whenever removing the probe for any purpose and replace it if damaged.

---

### Note

This procedure applies to the ceramic diffusion element only.

---

Damage to the diffusion element may become apparent during calibration. Compare probe response with previous response. A broken diffusion element will cause a slower response to calibration gas.

### Prerequisites

To remove set-screws and socket head screws, you will need hex wrenches. These wrenches are part of a probe assembly kit ([Replacement parts](#)).

### Procedure

1. Follow the instructions given in [Remove probe](#) to remove the transmitter from the stack or duct.
2. Loosen set screws using the hex wrench from the probe assembly kit and remove vee deflector. Inspect set-screws. If damaged, replace with stainless steel set-screws coated with anti-seize compound.
3. On systems equipped with abrasive shield, remove dual dust seal gaskets.
4. Use spanner wrenches from the probe disassembly kit ([Table 10-4](#)) to turn hub free from retainer.
5. Put hub in vise. Break out old ceramic diffusion element with chisel along cement line and  $\frac{3}{8}$ -in. (9.5 mm) pin punch through cement port.
6. Break out remaining ceramic diffusion element by tapping lightly around hub with hammer. Clean grooves with pointed tool if necessary.
7. Replace ceramic diffusion element using the ceramic diffusion element replacement kit in [Replacement parts](#).  
This consists of a diffusion element, cement, set-screws, anti-seize compound, and instructions.
8. Test fit replacement ceramic diffusion element to be sure seat is clean.
9. Thoroughly mix cement and insert tip of squeeze bottle into cement port. Tilt bottle and squeeze while simultaneously turning ceramic diffusion element into seat.

### CAUTION

Any cement on ceramic diffusion element blocks airflow through the element. Wiping wet cement off of the ceramic element only forces cement into pores.

Do not get any cement on ceramic diffusion element except where it touches the hub. Also do not get any cement onto the flame arrestor element.

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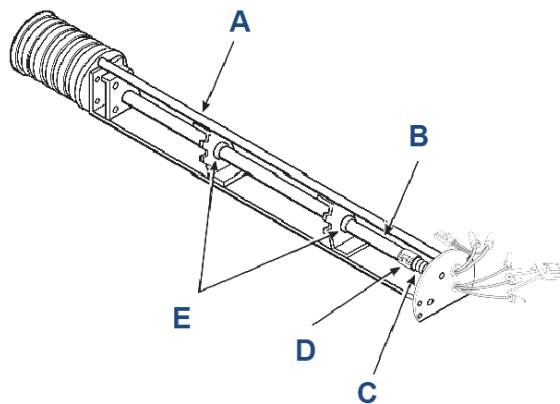
Do not get any cement on upper part of ceramic diffusion element. Ensure complete penetration of cement around three grooves in hub. Cement should extrude from opposite hole.

10. Wipe excess material back into holes and wipe top fillet of cement to form a uniform fillet.  
A cotton swab is useful for this.
11. Clean any excess cement from hub with water.
12. Allow filter to dry at room temperature overnight or one to two hours at 200 °F (93 °C).
13. Wipe a heavy layer of anti-seize compound onto the threads and mating surfaces of the flame arrestor, diffusion hub, and probe tube.
14. On systems equipped with abrasive shield, install dust seal gaskets with joints 180 ° apart.
15. Reinstall vee deflector, orienting apex towards gas flow.
16. Apply anti-seize compound to set-screws and tighten with hex wrench.
17. Reinstall probe on stack flange.

### 9.3.11 Replace contact and thermocouple assembly

See [Figure 9-9](#).

**Figure 9-9: Contact and Thermocouple Assembly Replacement**



- A. Strut
- B. Contact and thermocouple assembly
- C. Spring
- D. Spring clip
- E. Tube support

#### Procedure

1. Remove the cell per [Replace cell](#), steps [Step 1](#) through [Step 10](#).
2. Remove the heater strut assembly, per [Replace heater strut](#), steps [Step 3](#) through [Step 8](#).

3. Use a pencil to mark locations of the spring clips on the ceramic rod of the contact and thermocouple assembly.
4. Squeeze the tabs on the spring clips and pull the contact and thermocouple assembly out of the heater strut. Retain the spring clips and spring. Replace if damaged.
5. While very carefully handling the new contact and thermocouple assembly, lay the old assembly next to the new one. Transfer the pencil marks to the new rod. Throw away the old contact and thermocouple assembly.
6. Carefully guide the new contact and thermocouple assembly through the spring, spring clips (held open by squeezing the tabs), tube supports, and heater support of the heater strut assembly until the spring clip reaches the pencil mark.
7. Install the cell per the instructions in [Replace cell](#), steps [Step 12](#) through [Step 25](#).
8. Slide the heater strut assembly into the probe per the instructions in [Replace heater strut](#), steps [Step 9](#) through [Step 14](#).
9. On systems equipped with an abrasive shield, install the dust seal gaskets, with joints 180° apart.
10. Follow instructions in [Install probe](#) to install the transmitter into the stack or duct. If there is an abrasive shield in the stack, make sure the dust seal gaskets are in place as they enter the 15° reducing cone.

# 10 Replacement parts

## 10.1 Probe replacement parts

**Table 10-1: Diffusers**

Figure and index number	Part number	Description
Figure 2-18, 33	1U05677G01	Ceramic flame arrestor diffuser
Figure 2-18, 33	1U05677G03	Snubber flame arrestor diffuser

**Table 10-2: Heater Strut Assemblies**

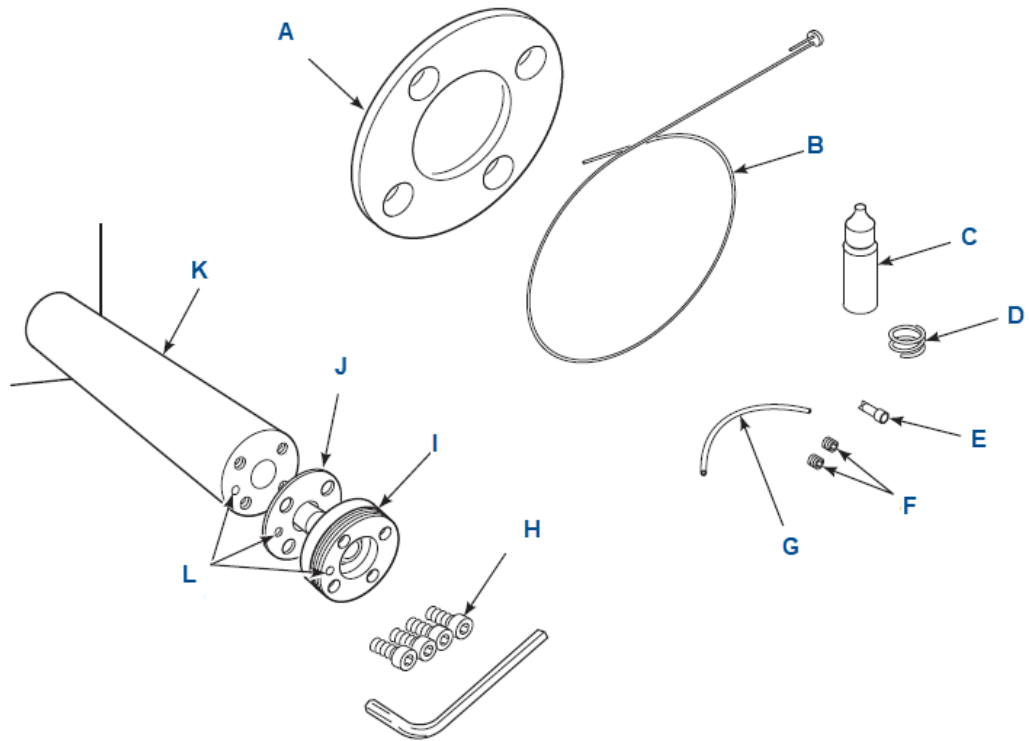
Figure and index number	Part number	Description
Figure 2-14, 32	3D39744G01	18-in. (457.2 mm) heater strut assembly
Figure 2-14, 32	3D39744G02	3-ft. (0.9 m) heater strut assembly
Figure 2-14, 32	3D39744G03	6-ft. (1.8 m) heater strut assembly

**Table 10-3: Cell Replacement Kits**

Figure	Part number	Description
Figure 10-1	4847B61G25	DIN 18-in. (457.2 mm) cell replacement kit <sup>(1)</sup>
Figure 10-1	4847B61G20	DIN 3-ft. (0.9 m) cell replacement kit <sup>(1)</sup>
Figure 10-1	4847B61G21	DIN 6-ft. (1.8 m) cell replacement kit <sup>(1)</sup>
Figure 10-1	4847B61G27	ANSI 18-in. (457.2 mm) cell replacement kit <sup>(1)</sup>
Figure 10-1	4847B61G28	ANSI 3-ft. (0.9 m) cell replacement kit <sup>(1)</sup>
Figure 10-1	4847B61G29	ANSI 6-ft. (1.8 m) cell replacement kit <sup>(1)</sup>

(1) Includes pad and wire.

**Figure 10-1: Cell Replacement Kit**

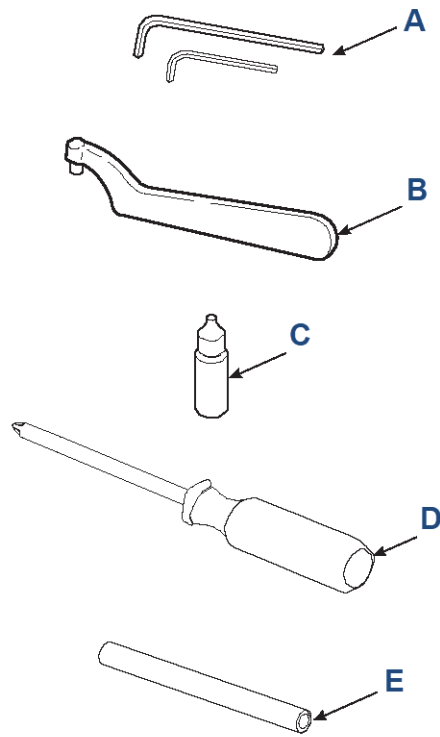


- A. ANSI gasket
- B. Wire and pad assembly
- C. Anti-seize compound
- D. 22 gauge wire
- E. Closed end connector
- F. Set-screws
- G. Teflon tubing
- H. M16-1 x 6 mm socket head cap screws
- I. Cell and flange assembly
- J. Corrugated seal
- K. Probe tube (not included in kit)
- L. Calibration gas passage

**Table 10-4: Tool Kits**

Figure	Part number	Description
Figure 10-2	3535B42G03	Probe disassembly kit

**Figure 10-2: Probe Disassembly Kit**



- A. Hex keys
- B. Spanner wrench
- C. Anti-seize compound
- D. Phillips screwdriver
- E. Tube insertion tube

## 10.2 Electronics replacement parts

**Table 10-5: Heater Strut Assemblies**

Figure and index number	Part number	Description
Figure 2-14, 1A	6A00170G01	Cover with window
Figure 2-14, 2	3D39861G01	Electronic board assembly (HART®)
Figure 2-14, 4 and Figure 2-18, 4	4849B72H01	Membrane keypad English
Figure 2-14, 4A and Figure 2-18, 4A	6A00115G01	Local operator interface (LOI) module
Figure 2-18, 31	6A00122G01	Cable assembly, 20 ft. (6 m)
Figure 2-18, 31	6A00122G02	Cable assembly, 40 ft. (12 m)
Figure 2-18, 31	6A00122G03	Cable assembly 60 ft. (18 m)
Figure 2-18, 31	6A00122G04	Cable assembly 80 ft. (24 m)

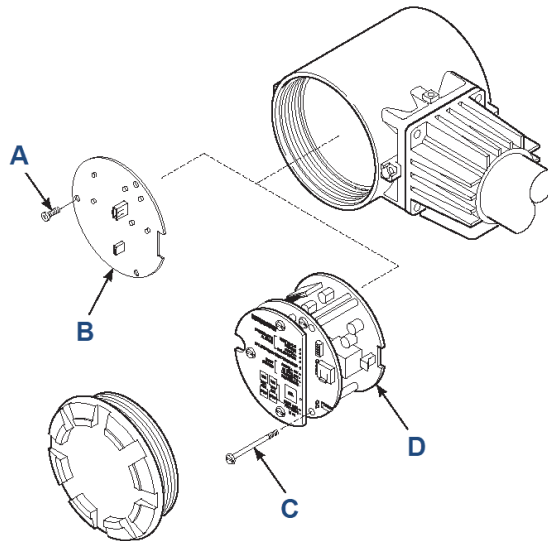
**Table 10-5: Heater Strut Assemblies (continued)**

<b>Figure and index number</b>	<b>Part number</b>	<b>Description</b>
Figure 2-18, 31	6A00122G05	Cable assembly 100 ft. (30 m)
Figure 2-18, 31	6A00122G06	Cable assembly 150 ft. (46 m)
Figure 2-18, 31	6A00122G07	Cable assembly 200 ft. (61 m)



# A Upgrade Rosemount™ Oxymitter DR to full Oxymitter

Figure A-1: Component Replacement



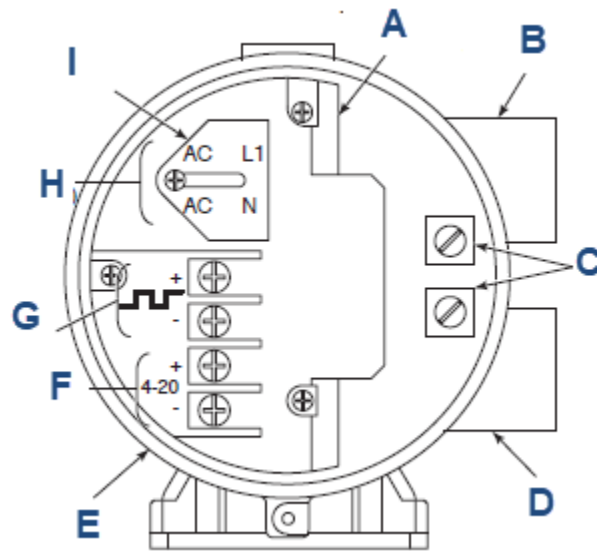
- A. Screws
- B. Rosemount OXT adapter board
- C. Screws
- D. Electronic assembly

## Procedure

1. Remove power from the Rosemount Oxymitter DR.
2. Remove the left and right covers from the Rosemount Oxymitter termination housing.
3. Remove and discard screws and Rosemount OXT adapter board (A and B, [Figure A-1](#)) located at the right side of the termination housing.
4. Place the new Rosemount Oxymitter electronic assembly (D) near the right side of the termination housing.
5. Plug the white connector with the two black wires into the white socket on the bottom power supply card.
6. Insert the electronics assembly into the termination housing. Ensure the black four-wire connector remains outside the housing and in the slot provided in the top card of the electronics assembly.  
The electronics assembly should seat on the bulkhead pins easily. Do not force the assembly into place.

7. Plug the black four-wire connector into the black socket on the microprocessor card.
8. Tighten three screws (D) securing the electronics assembly into the termination housing.
9. In the left side of the termination housing, place the new termination designation over the labels on the existing terminal block. After placing the new labels, the terminal block should appear as shown in [Figure A-2](#).

**Figure A-2: Terminal Block and Wiring**



- A. Terminal block
- B. AC line voltage port
- C. Ground lugs
- D. Signal port
- E. Left side of transmitter
- F. 4-20 mA signal
- G. Logic I/O or calibration handshake
- H. Line voltage (90 to 250 Vac)
- I. AC terminal cover

You can reuse the existing wires from the transmitter to the electronics. However, the wires will be carrying new signals as noted by the new labels.

10. Remove the 4-20 mA wires from the old electronics and re-terminate them to the wires carrying the 4-20 mA signal to the control room.
11. Convert the wires carrying the heater to power to carry AC power (80-250 Vac, 50/60 Hz) for the transmitter.  
The re-termination may be inside the old electronics housing, which will function as a simple junction box. Alternatively, you can remove the old electronics housing and replace it with a smaller junction box.

12. Place the round error blink code and calibration instructions label on the inside of the right housing cover.
13. Install both housing covers.

The HART® electronics offers the following additional features:

1. HART communications.
2. Automatic calibration (requires Rosemount SPS or IMPS autocalibration gas sequencers).
3. Calibration recommended diagnostic.

The new ambient temperature specification for the electronics is 185 °F (85 °C). You can read this temperature with HART communications.

To upgrade to FOUNDATION™ Fieldbus, you must change out the entire blue electronics housing with the Fieldbus version, PN 4850B10G11.



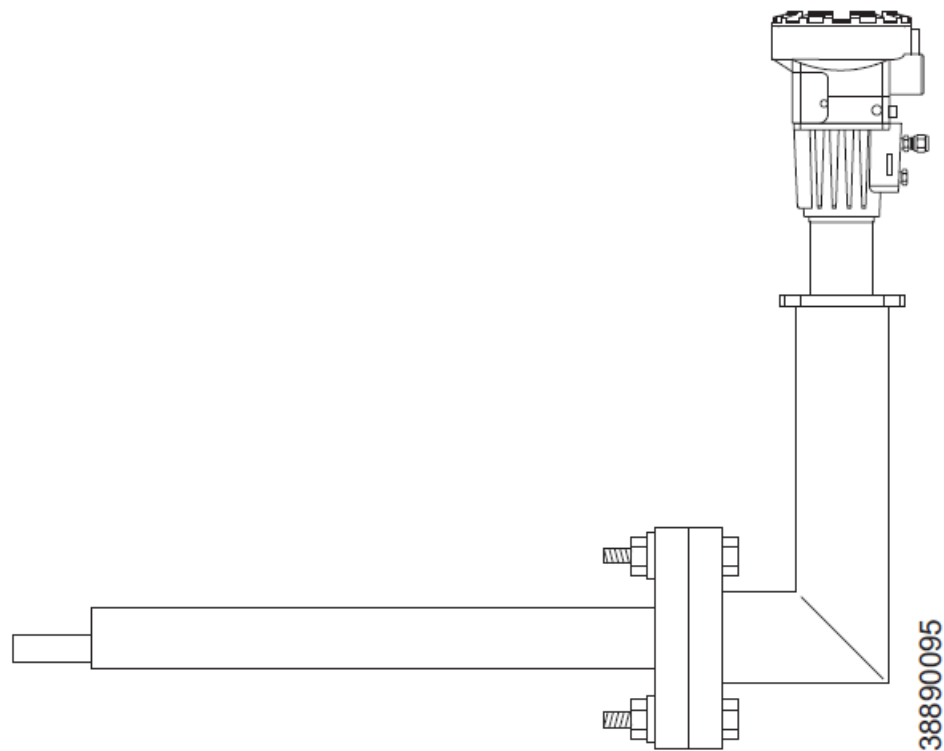
## B Optional accessories

### B.1 Rosemount™ By-Pass Package

The specially designed Rosemount By-Pass Package for oxygen transmitters has proven to withstand the high temperatures in process heaters while providing the same advantages offered by the in-situ sensor.

Alloy or protection steel tubes provide effective resistance to corrosion, and the package uses no moving parts, air pumps, or other components common to other sampling systems.

**Figure B-1: By-pass Package Mounting**

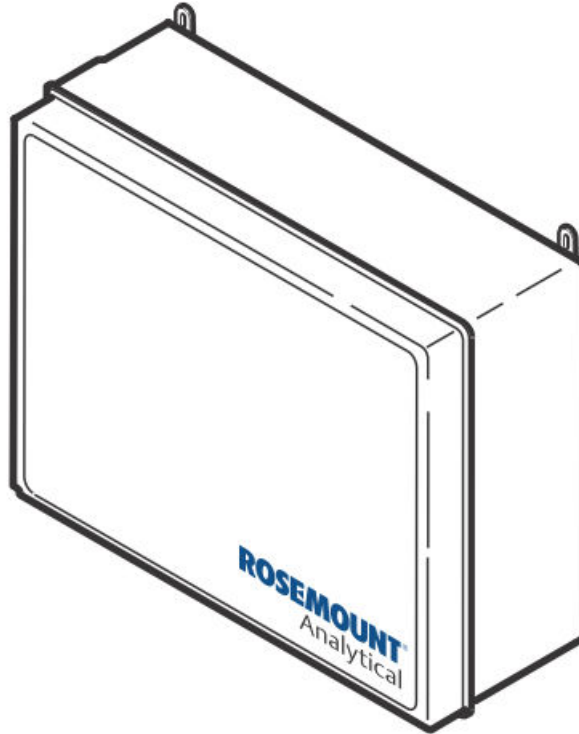


### B.2 Rosemount IMPS 4000 Intelligent Multiprobe Test Gas Sequencer

The Rosemount IMPS 4000 Intelligent Multiprobe Test Gas Sequencer is housed within an IP56 (Type 4X) enclosure and has the intelligence to provide calibration gas sequencing of

up to four Rosemount Oxymitter 4000s to accommodate automatic and semi-automatic calibration routines.

**Figure B-2: Rosemount IMPS 4000**



The sequencer works in conjunction with the CALIBRATION RECOMMENDED feature, eliminating out-of-calibration occurrences and the need to send a technician to the installation site. In addition, the Rosemount IMPS 4000 provides a remote contact input to initiate a calibration from a remote location and relay outputs to alert when a calibration is in progress, an O<sub>2</sub> probe is out of calibration, calibration gases are on, or calibration pressure is low.

### **B.3 Rosemount™ SPS 4001B Single Probe Autocalibration Sequencer**

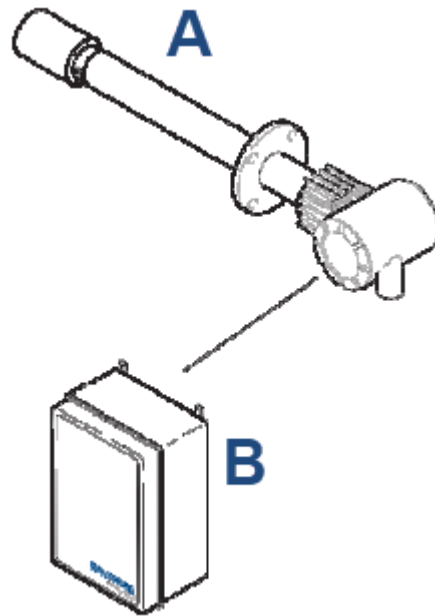
Emerson specifically designed the Rosemount SPS 4001B Single Probe Autocalibration Sequencer to perform automatic or on-demand calculations.

The Rosemount SPS 4001B system must be installed in a remote, safe area if the Rosemount Oxymitter 4000 is installed in a hazardous area.

The Rosemount SPS 4001B works in conjunction with the Rosemount Oxymitter 4000, eliminating out-of-calibration occurrences and the need to send a technician to the installation site.

In addition, the Rosemount SPS 4001B provides a remote contact input to initiate a calibration from a remote location and relay outputs to indicate when a calibration is in progress or the Rosemount Oxymitter 4000 is out of calibration.

**Figure B-3: Rosemount SPS 4001B**



- A. Rosemount Oxymitter 4000
- B. Rosemount SPS 4001B (in a safe area)





# C Safety data sheet for ceramic fiber products

July 1, 1996

## C.1 Identification

<b>Product name</b>	Ceramic fiber heaters, molded insulation modules, and ceramic fiber radiant heater panels
<b>Chemical family</b>	Vitreous aluminosilicate fibers with silicon dioxide
<b>Chemical name</b>	N/A
<b>Chemical formula</b>	N/A
<b>Manufacturer's name and address</b>	Watlow Columbia 2101 Pennsylvania Drive Columbia, MO 65202 Phone: 573-814-1300, ext. 5170 Fax: 573-474-9402

## C.2 Physical and chemical properties

<b>Appearance and odor</b>	Cream to white colored fiber shapes. With or without optional white to gray granular surface coating and/or optional black surface coating
<b>Specific weight</b>	12 - 25 lb./cubic foot
<b>Boiling point</b>	N/A
<b>Volatiles (percent by weight)</b>	N/A
<b>Water solubility</b>	N/A



# D Rosemount Oxymitter™ product certifications

Rev 2.9

## D.1 Directive information

A copy of the Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the Declaration of Conformity can be found at [Emerson.com/Rosemount](https://emerson.com/rosemount).

## D.2 Ordinary location certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

## D.3 Installing equipment in North America

The US National Electrical Code® (NEC) and the Canadian Electrical Code (CEC) permit the use of Division marked equipment in Zones and Zone marked equipment in Divisions. The markings must be suitable for the area classification, gas, and temperature class. This information is clearly defined in the respective codes.

## D.4 Rosemount OXT4A Oxymitter for general purpose locations and OXT4C general locations certification

Rosemount Oxymitter Oxygen Transmitters (Series 4000 & DR): OXT4A, OXT4ADR, OXT4C, OXT4CDR, OXT4CNF, and OXT4CDRNF and Rosemount Oxymitter 4000 series 6A00095G06 and 6A00094G08.

### D.4.1 USA/Canada

**CSA Certificate** 1238566

**Standards** CSA C22.2 No. 94.2-15, CAN/CSA-C22.2 No. 61010-1-12, UL 61010-1 (3rd ed.), UL 50E, 2nd ed.

**Markings** Type 4X

## D.5 Rosemount OXT4C Oxymitter for hazardous locations

### D.5.1 USA/Canada

<b>CSA Certificate</b>	1238566
<b>Standards</b>	CSA C22.2 No. 30-M1986 (R2016), CSA C22.2 No. 213-M1987 (R2013), CAN/CSA C22.2 No. 60079-0:19, CAN/CSA C22.2 No. 60079-1:16, CAN/CSA C22.2 No. 60079-7:16, UL Std No. 1203 Ed. 3, ANSI/ISA 12.12.01-2013, UL 60079-0 (7th Edition), UL 60079-1 (7th Edition), UL 60079-7 (5th Edition)

Oxymitter oxygen transmitters (integral & DR): OXT4C, OXT4CNF, OXT4CDR, and OXT4CDRNF ( $-40\text{ °C} \leq T_a \leq +70\text{ °C}$ )

Class I, Division 1, Groups B, C, and D

Ex db IIB+H2 T2 Gb

Class I, Zone 1, AEx db IIB+H2 T2 Gb

Oxymitter Oxygen Transmitters (split architecture, probe with remote electronics): OXT4C, OXT4CNF, 6A00094G ( $-40\text{ °C} \leq T_a \leq +70\text{ °C}$ )

Class I, Zone 1, Ex db eb IIB+H2 T6 Gb (remote electronics) / T2 probe)

Class I, Zone 1, AEx db eb IIB+H2 T6 Gb (remote electronics) / (T2 probe)

Class 1, Division 1, Groups B, C, and D T2 (probe)

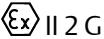
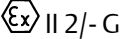
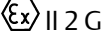
Class 1, Division 2, Groups B, C and D T6 (remote electronics)

#### Special Conditions for Safe Use

1. Non-flame arrestor probe "-NF" versions must have the probe tube installed in a non-classified area.
2. When the probe tube is mounted in a hazardous (classified) area (with flame arrestor end to complete assembly) calibration lines that travel in and out of the equipment bringing reference gas must not contain a pressure higher than 1.1 times the atmospheric pressure; these calibrating lines shall not contain pure oxygen, acetylene, or combustible gases other than the gases for which this Zones 1 classified application has been investigated for: Group IIB+H<sub>2</sub> gases.
3. Meets enclosure Type 4X rating when the reference air vent is routed to a dry area.
4. Contact the original manufacturer for information on the flame-proof joint dimensions.
5. Fasteners property class must be A2-70 for units intended for use in Zone 1 classified areas.
6. Any other electronics not covered by this report and used in conjunction with the Oxymitter probes or with the remote electronics must be installed in a non-classified area (ex. Xi Advanced Electronics).

## D.5.2 Europe

### ATEX/UKCA

<b>Certificate</b>	Sira 14ATEX1201X CSAE 21UKEX1214X
<b>Standards</b>	EN 60079-0: 2018 EN 60079-1: 2014 EN 60079-7: 2015+A1: 2018
<b>Markings</b>	Complete probe assemblies & DR probes:  II 2 G Ex db IIB+H2 T4 Gb -40 °C ≤ Ta ≤ +70 °C Probe assemblies without the flame arrestor end: "-NF"  II 2/- G Ex db IIB+H2 T4 Gb/- -40 °C ≤ Ta ≤ +70 °C Remote electronics: "Split architecture":  II 2 G Ex db eb IIB+H2 T5 Gb -40 °C ≤ Ta ≤ +70 °C

### Special Conditions for Safe Use (X):

1. Mounting flange temperature shall not exceed 239 °F (115 °C).
2. Non-flame arrestor probe versions "NF" must have the probe tube mounted in a safe area.
3. When the probe tube is mounted in explosive areas using flame arrestor end to complete the assembly, calibration lines that travel in and out of the equipment bringing reference gas must not contain a pressure higher than 1.1 times the atmospheric pressure; these calibration lines shall not contain pure oxygen, acetylene, or combustible gases other than the gases for which this application has been investigated for: Group IIB + H2 gases.
4. Meets enclosure Type 4X rating when the reference air vent is routed to a dry area.
5. Contact the original manufacturer for information on flameproof joint dimensions.
6. Fastener property class must be A2-70.

## D.6 Rosemount Xi, X-STREAM Xi Remote Interface, for general locations certification

### D.6.1 USA/Canada

#### CSA




**Certificate** 70130119

**Standards** CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1:2004 (2nd ed.), CAN/CSA-C22.2 No. 94-M91 (R2001), CAN/CSA C22.2 No. 60529:05, UL 50 (11th Ed.), IEC 60529 (Edition 2.1-2001-02)

**Markings** Type 4X

# E Declaration of Conformity

No: 1127 Rev. D

 **Declaration of Conformity**  

We,  
**Rosemount Inc.**  
6021 Innovation Blvd  
Shakopee, MN 55379  
USA


declare under our sole responsibility that the product,  
**Rosemount™ Oxygen Analyzers**  
**Oxymitter™ 4000, Models OXT4A, OXT4C, OXT4CNF, 6A00094G02, 6A00094G06**  
**Oxymitter™ DR, Models OXT4ADR, OXT4CDR & OXT4CDRNF**

Authorized Representative in Europe:  
Emerson S.R.L., company No. J12/88/2006, Emerson 4 street, Parcul Industrial Tetarom II, Cluj-Napoca 400638, Romania  
Regulatory Compliance Shared Services Department  
Email: [europaeproductcompliance@emerson.com](mailto:europaeproductcompliance@emerson.com) Phone: +40 374 132 035

For product compliance destination sales questions in Great Britain, contact Authorized Representative:  
Emerson Process Management Limited at [ukproductcompliance@emerson.com](mailto:ukproductcompliance@emerson.com) or +44 11 6282 23 64, Regulatory Compliance Department  
Emerson Process Management Limited, company No 00671801, Meridian East, Leicester LE19 1UX, United Kingdom

to which this declaration relates, is in conformity with:

- 1) the relevant statutory requirements of Great Britain, including the latest amendments, as shown in the attached schedule.
- 2) the provisions of the European Union Directives, including the latest amendments, as shown in the attached schedule.

 March 28, 2022  
(signature & date of issue)




Mark Lee | Vice President, Quality | Boulder, CO, USA  
(name) (function) (place of issue)

**ATEX Notified Body for EU Type Examination Certificate:**  
**CSA Group Netherlands B.V.** [Notified Body Number: 2813]  
Utrechtseweg 310  
6812 AR ARNHEM  
Netherlands

**UK Conformity Assessment Body for UK Type Examination Certificate:**  
**CSA Group Testing UK Ltd** [Notified Body Number: 0518]  
Unit 6 Hawarden Industrial Park, Hawarden, CH5 3US  
United Kingdom

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No: 1127 Rev. D	
	<h2 style="margin: 0;">Declaration of Conformity</h2>  
<p><b>EMC Directive (2014/30/EU)</b> Harmonized Standards: EN 61326-1:2013</p> <hr/> <p><b>Low Voltage Directive (2014/35/EU)</b> Harmonized Standards: EN 61010-1:2010</p> <hr/> <p><b>PED Directive (2014/68/EU)</b> Sound Engineering Practice</p> <hr/> <p><b>ATEX Directive (2014/34/EU)</b></p> <p>(Only valid for Models OXT4C, OXT4CNF, OXT4CDR, OXT4CDRNF, 6A00094G02 &amp; 6A00094G06) <b>Sira14ATEX1201X – Flameproof</b> Integral Assembly or Remote Probe Equipment Group II 2 G Ex db IIB+H2 T4 Gb (-40°C ≤ Ta ≤ +70°C)</p> <p>Integral Assembly or Remote Probe without flame arrestor Equipment Group II 2/- G Ex db IIB+H2 T4 Gb/- (-40°C ≤ Ta ≤ +70°C)</p> <p>Split Architecture Remote Electronics Equipment Group II 2 G Ex db eb IIB+H2 T5 Gb (-40°C ≤ Ta ≤ +70°C)</p> <p>Harmonized Standards: EN IEC 60079-0:2018 EN 60079-1:2014 EN 60079-7:2015+A1:2018</p>	<p><b>Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)</b> Designated Standards: EN 61326-1:2013</p> <hr/> <p><b>Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)</b> Designated Standards: EN 61010-1:2010</p> <hr/> <p><b>Pressure Equipment (Safety) Regulations 2016 (S.I. 2016/1105)</b> Sound Engineering Practice</p> <hr/> <p><b>Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107)</b></p> <p>(Only valid for Models OXT4C, OXT4CNF, OXT4CDR, OXT4CDRNF, 6A00094G02 &amp; 6A00094G06) <b>CSAE 21UKEX1214X – Flameproof</b> Integral Assembly or Remote Probe Equipment Group II 2 G Ex db IIB+H2 T4 Gb (-40°C ≤ Ta ≤ +70°C)</p> <p>Integral Assembly or Remote Probe without flame arrestor Equipment Group II 2/- G Ex db IIB+H2 T4 Gb/- (-40°C ≤ Ta ≤ +70°C)</p> <p>Split Architecture Remote Electronics Equipment Group II 2 G Ex db eb IIB+H2 T5 Gb (-40°C ≤ Ta ≤ +70°C)</p> <p>Harmonized Standards: EN IEC 60079-0:2018 EN 60079-1:2014 EN 60079-7:2015+A1:2018</p>



## F China RoHS table

表格 1: 含有 China RoHS 管控物质超过最大浓度限值的部件型号列  
Table 1: List of Model Parts with China RoHS Concentration above MCVs

部件名称 Part Name	有害物质 / Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr +6)	多溴联苯 Polybrominated biphenyls (PBB)	多溴联苯醚 Polybrominated diphenyl ethers (PBDE)
电子组件 Electronics Assembly	X	○	○	○	○	○
传感器组件 Sensor Assembly	X	○	○	○	○	○
壳体组件 Housing Assembly	X	○	○	X	○	○

本表格系依据 SJ/T11364 的规定而制作。

This table is proposed in accordance with the provision of SJ/T11364

○: 意为该部件的所有均质材料中该有害物质的含量均低于 GB/T 26572 所规定的限量要求。

O: Indicate that said hazardous substance in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: 意为在该部件所使用的的所有均质材料里, 至少有一类均质材料中该有害物质的含量高于 GB/T 26572 所规定的限量要求。

X: Indicate that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.

For more information: [Emerson.com](https://www.emerson.com)

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