Rosemount™ Xi

Advanced Electronics for Zirconium Oxide Flue Gas O$_2$ Probes

ROSEMOUNT™

EMERSON™

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 VOID YOUR WARRANTY. Look-alike substitutions may result in fire, electrical hazards, or improper operation.

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

Preface

The purpose of this manual is to provide information concerning the components, functions, installation, and maintenance of the Rosemount Xi Electronics.

Some sections may describe equipment not used in your configuration. You should become thoroughly familiar with the operation of this module before operating it. Read this instruction manual completely.

Definitions

The following definitions apply to warnings, cautions, and notes found throughout this publication.

⚠ WARNING

Highlights an operation or maintenance procedure, condition, statement, etc. that 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. that 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

$\perp$: Earth (ground) terminal

⏚ : Protective conduit or terminal

⚠ : Risk of electrical shock

⚠ : Warning: Refer to Instruction Manual

NOTICE

The number in the lower right corner of each illustration in this publication is a manual illustration number. It is not a part number and is not related to the illustration in any technical manner.

Overview

The Rosemount Xi is specifically designed to control a zirconium oxide probe for measuring oxygen, usually the O_2 remaining from a combustion process. Call Emerson's Rosemount Customer Central to get recommendations for other oxygen probes: 800 999 9307 (US and Canada).

The Rosemount Xi electronics has several main functions:

1. Heater Control: The electronics receives a type K thermocouple input from an O_2 probe and switches power on and off to the probe's heater in order to maintain a temperature setpoint of 1357 °F (736 °C).

2. Signal Conditioning: The electronics receives the raw millivolt signal from the O_2 sensing cell and then linearizes and amplifies the signal to provide a linear 4-20 mA output signal used for recording or as in input into a DCS system for control purposes.

3. Calibration: A bottled calibration gas of known value is typically flowed into the probe's sensor to verify that it is reading correctly. If the signal is out of calibration, the calibration gas is used to adjust the 4-20 mA output signal. During calibration, the Rosemount Xi prompts the technician to flow two calibration gases into the probe and, with the calibration gases flowing, automatically adjusts the O_2 signal. With the addition of a Single Probe Sequencer (SPS), the Rosemount Xi electronics can also switch the calibration gases on and off.

4. Diagnostics: Multiple alarms are available for display. The alarm displays are intended to assist a technician in locating where an instrument problem may reside.

The electronics has been verified to operate the following probes:

- Westinghouse 218 and World Class
- Rosemount Oxymitter
- Yokogawa

Technical support hotline

For assistance with technical problems, call the North American Response Center. The Response Center is staffed 24 hours a day, 7 days a week.

Phone: 1-800-654-RSMT (1-800-654-7768)

Emerson may also be reached via the Internet through email and the following websites:

Email: GAS.CSC@emerson.com

Websites:

- Emerson.com/RosemountCombustionAnalysis
- Emerson.com/Rosemount-Gas-Analysis
- Emerson.com/Rosemount
- Emerson.com

Warranty

Emerson 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, Emerson 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 Emerson 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 OR FITNESS FOR PURPOSE).

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

Emerson 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 Emerson but not manufactured by it will be subject to the same warranty as is extended to Emerson 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, the sensor being supplied with ac power and reference air will not be subjected to component deterioration.

Contents

1   Description and specifications

1.1   Component checklist

A typical Rosemount O_2 Combustion Flue Gas Transmitter should contain all the items shown in Figure 1-1. A complete Oxygen Analyzer system will include some or all of the equipment shown. However, this manual describes item *H* only.

Use the product matrix (Table 1-1) at the end of this section to compare your order number against your unit. The first part of the matrix defines the model. The last part defines your options and features. Ensure the features and options specified by your order number are on or included with the unit.

Figure 1-1: Typical system package
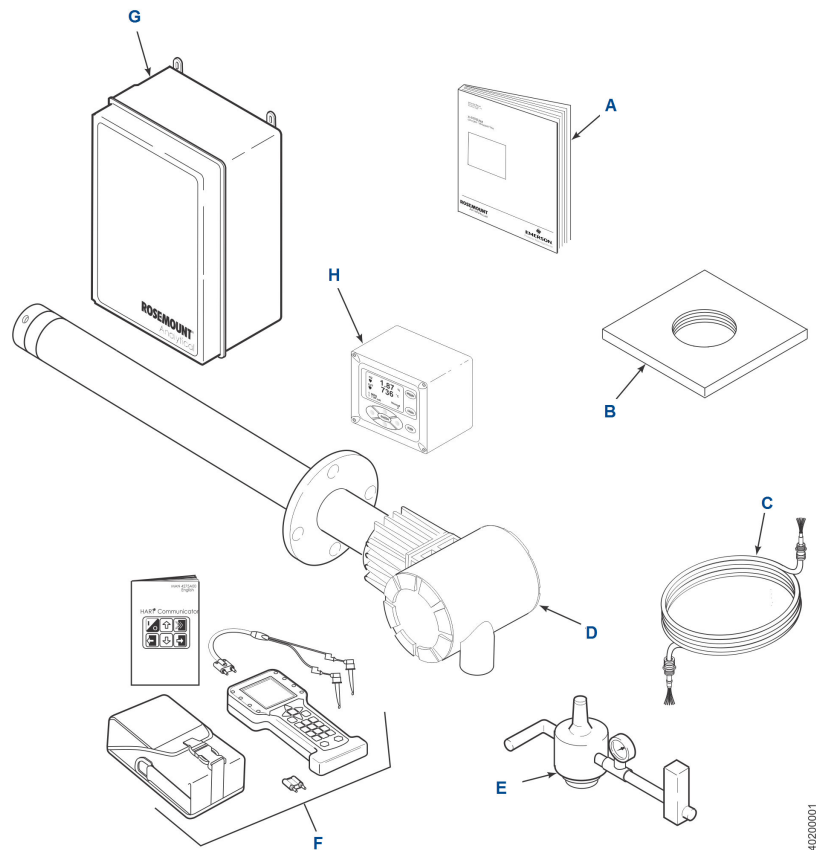
A. Quick Start Guide
B. Weld plate
C. Traditional architecture cable
D. O_2 probe
E. Reference Air Set (not used if SPS 4001B is used)
F. Field Communicator package (optional)
G. Optional SPS 400 1B Single Probe Autocalibration Sequencer
H. Rosemount Xi Advanced Electronics

1.2 System overview

1.2.1 Scope

This Reference Manual supplies details needed to install, start up, operate, and maintain the Rosemount .

Signal conditioning electronics output a 4-20 mA signal representing the O_2 value. This information, plus additional details, can be accessed with the Field Communicator or Asset Management Solutions (AMS) software.

1.2.2   System configurations

Traditional architecture, HART ,and Rosemount Xi communications

Some customers prefer not to mount electronics onto the probe, so a traditional architecture version is offered. This probe sends raw millivolt signals via a 7-conductor cable to the Rosemount Xi electronics, Figure 1-2, which does all heater control and signal conditioning in addition to its display/keypad functions. The Rosemount Xi Advanced Electronics is offered to support direct replacement probes with either 120 volt or 44 volt heaters.

Figure 1-2: Direct replacement probe with traditional architecture electronics

Figure 1-3: O_2 probe with Rosemount Xi Electronics and autocalibration sequencer

1.2.3   Automatic calibration

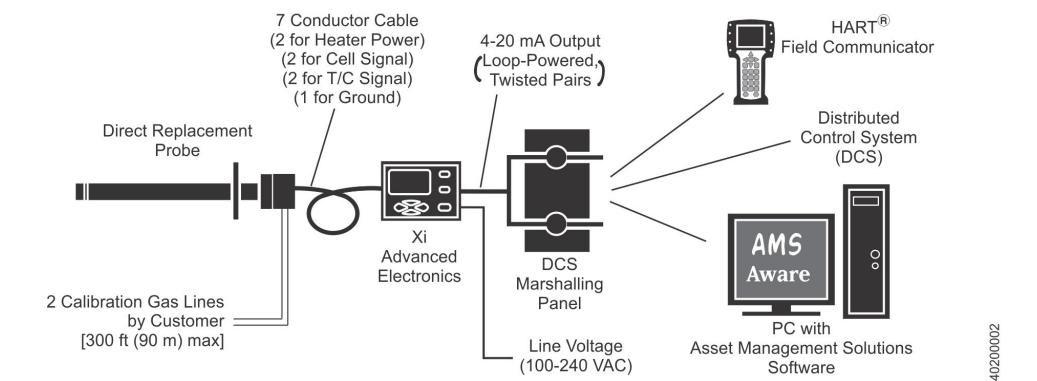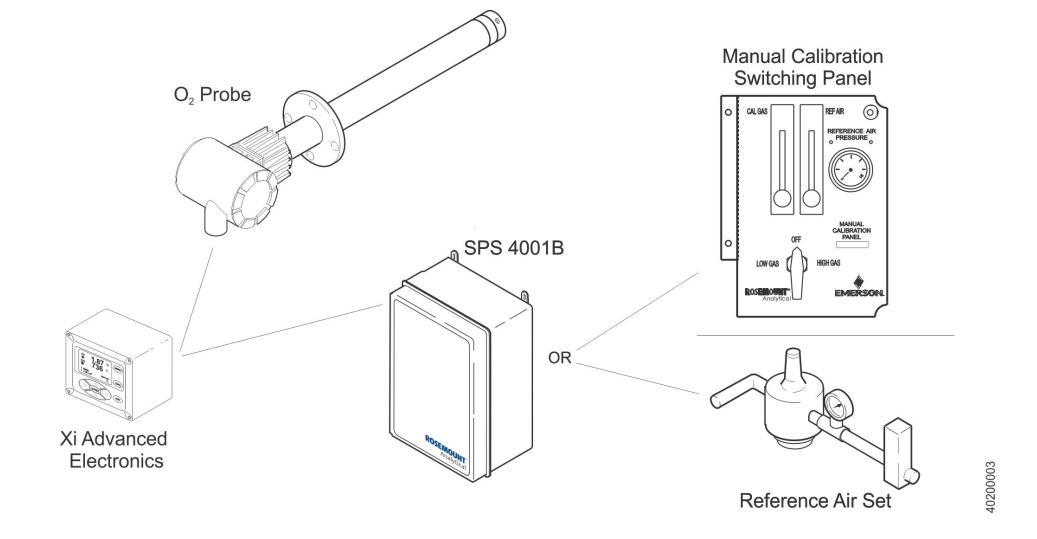Calibrations consist of introducing bottled gases of known value into the probe so the electronics can make automatic adjustments to the O_2 readings to match the bottled gas

value. 0.4% O_2 and 8% O_2 (balance nitrogen) gases are recommended. Never use nitrogen or instrument air as calibration gases.

Flowmeters (for calibration gases) and regulators and flowmeters (for reference air) are available as loose components, mounted into an optional manual calibration switching panel or as a fully automated calibration system, Figure 1-3, where calibration solenoids are switched from the Rosemount Xi Electronics. See IM-106-340AC, SPS 4000B Single Probe Autocalibration Sequencer for additional details.

1.2.4   Communication options

Data communications

An operator can configure and troubleshoot the O_2 probe system in one of two ways:

1. Using the Rosemount Xi Advanced Electronics; the Rosemount Xi carries the following optional advanced features:
   - Fully automatic calibration

   - Flame safety interface

   - High temperature operation [above 1292 °F (700 °C) standard temperature]

   - Stoichiometer feature provides the ability to indicate O_2 efficiency when the combustion process goes into reducing conditions (0% O_2).

   - Programming reference provides advanced accuracy when measuring at or near O_2 level (20.95% O_2).

2. Using the HART interface, the Rosemount Xi'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 line. This information can be accessed through the following:
   - Rosemount Field Communicator - The handheld communicator requires Device Description (DD) software specific to the Rosemount Xi. The DD software will be supplied with many Field Communicator units, but can also be programmed into existing units at most Emerson service offices. See Startup and operation for additional information.

   - Personal computer (PC) - The use of a personal computer requires AMS software available from Emerson.

   - Delta V and Ovation Distributed Control System (DCS) with AMS-inside capability.

3. The Rosemount Xi can also transmit HART information wirelessly via a wireless THUM Adapter, Figure 1-4. The THUM Adapter threads into the Rosemount Xi conduit ports and converts the 4-20 mA O_2 signal to a wireless protocol. All other HART information is also transmitted.
   In addition to the wireless THUM Adapter, a hard-wire connection of the 4-20 mA signal to the DCS may be used at the same time. More detailed information regarding the application of the THUM Adapter is available in Product Data Sheet 00813-0100-4075. Note that the THUM Adapter may also be used with the Oxymitter, mounted integral to the probe, or to the Oxymitter remote electronics.

Figure 1-4: Wireless THUM Adapter
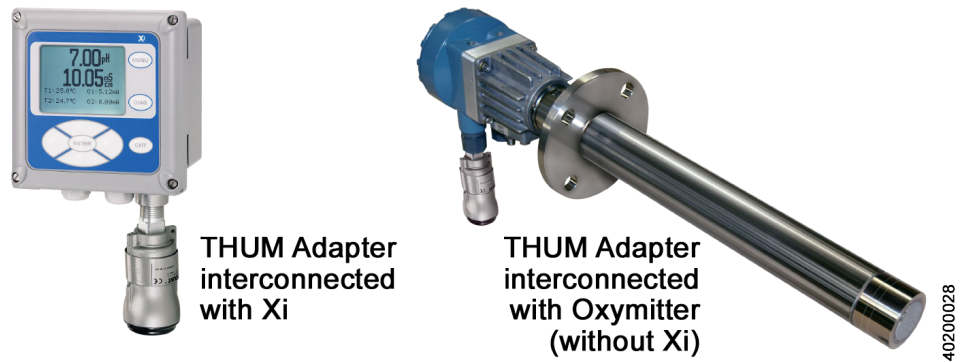
THUM Adapter
interconnected
with Xi

THUM Adapter
interconnected
with Oxymitter
(without Xi)

40200028

Optional OxyBalance display and averaging system

Receives up to eight 4-20 mA signals from individual Rosemount Xi units. Trends individual outputs and calculates four programmable averages as additional 4-20 mA outputs. OxyBalance graphic displays are shown in Figure 1-5. See IM-106-4050, OxyBalance Oxygen Display and Averaging System, for additional details.

Figure 1-5: OxyBalance displays

38890063
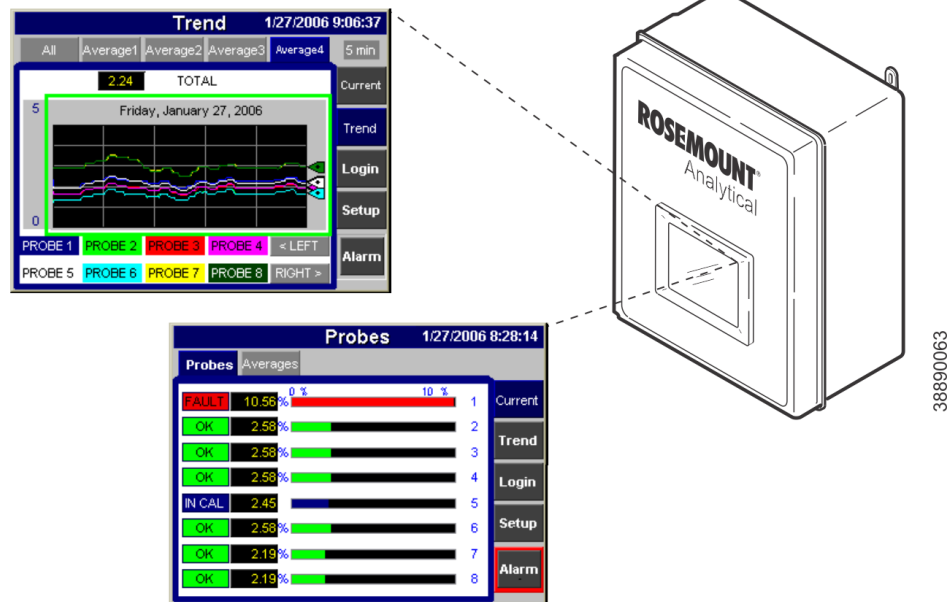
1.3 Specifications

Table 1-1: Specifications

Measurement specifications	
Net O_2 range	0 to 50% O_2 user scalable -2 to 50% O_2 user scalable with stoichiometer
Lowest detectable limit	0.01% O_2
Signal stability	±0.03% O_2
Accuracy in reducing conditions	±10% of reading or 0.1% O_2
Ambient temperature effect on Rosemount Xi 4-20 mA signal	Less than 0.0025% O_2 per degree Celsius
Environmental specifications	
Rosemount Xi Advanced Electronics	Type 4X/IP66 polycarbonate material
Ambient temperature limits	-4 to 122 °F (-20 to 50 °C) -4 to 158 °F (-20 to 70 °C) as measured by electronics
Rosemount Xi LCD display: ambient temperature limits	-4 to 131 °F (-20 to 55 °C)
General purpose certifications	CE CSA
Installation specifications	
Mounting	Panel, wall, or pipe
Reference air	0.5 scfh (0.25 l/min), clean, dry, instrument-quality air (20.95% O_2), regulated to 5 psi (34 kPa)
Calibration	Semi-automatic or automatic
Cal gases	0.4% O_2 and 8% O_2, balance N_2
Traditional architecture cable	200 ft (61 m) maximum length
Transmitter electrical power	12 - 24 Vdc (loop-powered from control room or Rosemount Xi)
Electrical power for Rosemount Xi	100 - 240 Vac ±10%, 50/60 Hz
Power consumption of Rosemount Xi	12 VA maximum or 776 VA maximum with traditional archtecture, 120 V probes 450 VA maximum with traditional architecture, 44 V probes
Alarm relay outputs	Two provided - 2 Amperes, 30 Vdc, Form-C
Optional loss of flame input	Internally powered input to remove heater power actuated via dry contact output from user's flame scanner
CE	Emerson has satisfied all obligations from the European legislation to harmonize the product requirements in Europe. All static performance characteristics are with operating variables constant. Specifications subject to change without notice.

Table 1-2: Product matrix, Rosemount Xi advanced electronics

Xi	Rosemount Xi Advanced Electronics
Code	**Remote type**
01	Single channel[1]
03	Dual channel[1]
04	Single channel traditional architecture for 120 V probes
05	Single channel traditional architecture for 44 V probes
Code	**Mounting**
00	No hardware
01	Panel mount kit with gasket
02	2 in. pipe/wall mount kit
Code	**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 (60 m) cable
Code	**Stoichiometer function**
00	None
01	Single channel
02	Dual channel
Code	**Programmable reference function**
00	None
01	Single channel
02	Dual channel
Code	**800 deg C process function**
00	None
01	Single channel
02	Dual channel

1. Requires XPS transmitter, P/N 6A00358G03

Note

All static performance characteristics are with operating variables constant. Specifications subject to change without notice.

2   Install

> **⚠ WARNING**

Failure to follow the safety instructions could result in serious injury or death.

> **⚠ WARNING**

ELECTRICAL HAZARD

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

Install all protective covers and safety ground leads after installation.

> **⚠ WARNING**

HAZARDOUS AREAS

The Rosemount can be installed in general purpose areas only.
Do not install the Rosemount in hazardous areas or in the vicinity of flammable liquids.

> **⚠ WARNING**

ELECTRICAL HAZARD

If external loop power is used, the power supply must be a safety extra low voltage (SELV) type.

Note
Plug all unused ports on the probe housing and enclosure with a suitable filling.

2.1 System considerations

A typical system installation for a Rosemount Xi or O_2 probe is shown in Figure 2-1.

Figure 2-1: Typical system installation
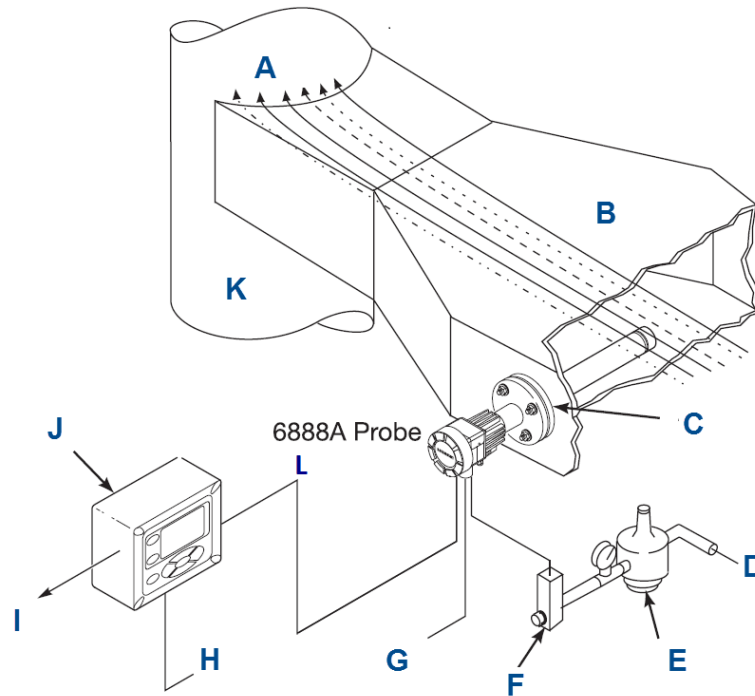
A. Gases
B. Duct
C. Adapter plate and flange
D. Instrument air supply (reference air)
E. Pressure regulator
F. Flow meter
G. Calibration gas
H. Line voltage
I. 4 to 20 mA signal
J. Rosemount Xi Advanced Electronics (optional)
K. Stack
L. Traditional architecture cable

2.2 Mechanical installation

2.2.1   Mount

The Rosemount Xi Advanced Electronics is available in a panel mounting, wall mounting, or pipe mounting configuration.

Refer to Figure 2-2 or Figure 2-3 for the panel, wall, or pipe mounting details.

1. Ensure all components are available to install the Rosemount Xi.

2. Select a mounting location near or removed from the O_2 probe.

   Consider the temperature limitations of the Rosemount Xi (see Specifications) when selecting the mounting location.

3. Mount the Rosemount Xi at a height convenient for viewing and operating the interface.

   Approximately 5 ft (1.5 m) is recommended.

4. The keypad window on the Rosemount Xi may have interior and exterior protective membranes. Remove the protective membranes prior to use of the Rosemount Xi enclosure.

   NOTICE
   Failure to remove the protective membranes may cause the display to appear distorted. The membrane may be difficult or impossible to remove after extended use at elevated temperatures.

Figure 2-2: Rosemount Xi Advanced Electronics - panel mounting details – front and side view
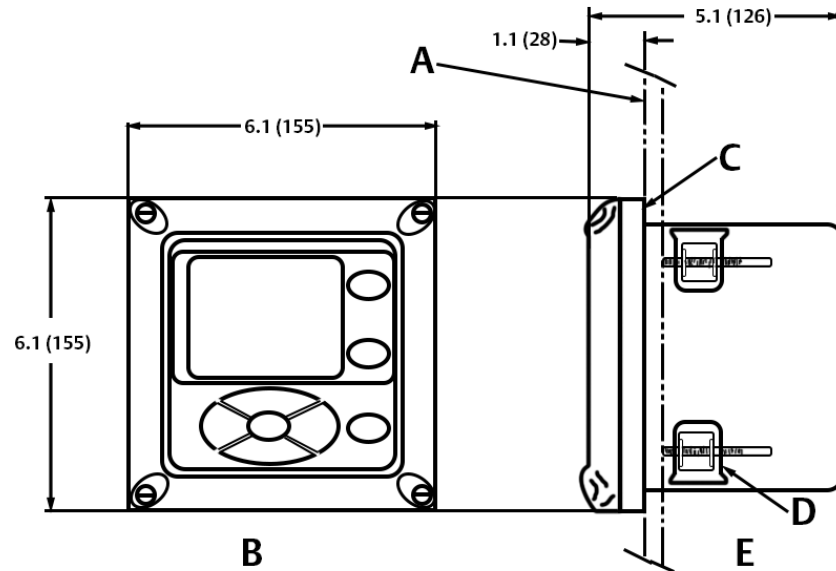
A. Maximum Panel Thickness 0.375 (9.75)
B. Front View
C. Panel Mount Gasket
D. 4x Mounting Brackets and Screws provided
E. Side View

Figure 2-3: Rosemount Xi Advanced Electronics - panel mounting details – bottom view
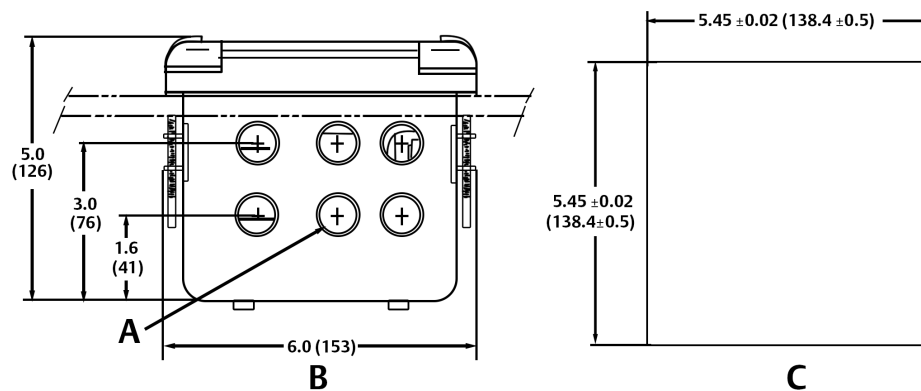
A. 6X ½ in NPT conduit openings
B. Bottom View
C. Panel Cut-Out

Note
Dimensions are in inches with millimeters in parentheses.

Note
The front panel is hinged at the bottom. The panel swings down for easy access to the wiring locations.

Figure 2-4: Rosemount Xi Advanced Electronics - wall/surface mounting – front and side view
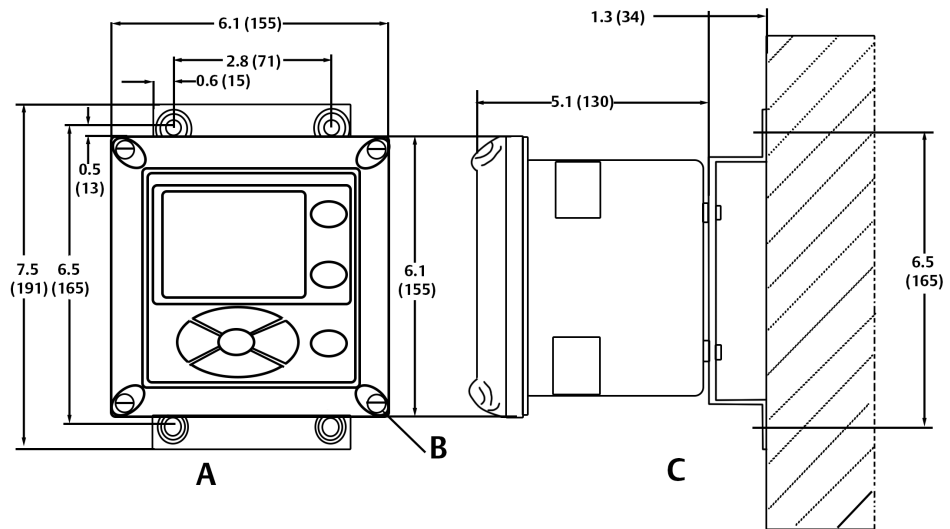
A. *Front View*

B. *4K Cover Screw*

C. *Side View*

Figure 2-5: Rosemunt Xi Advanced Electronics - pipe mounting – bottom view
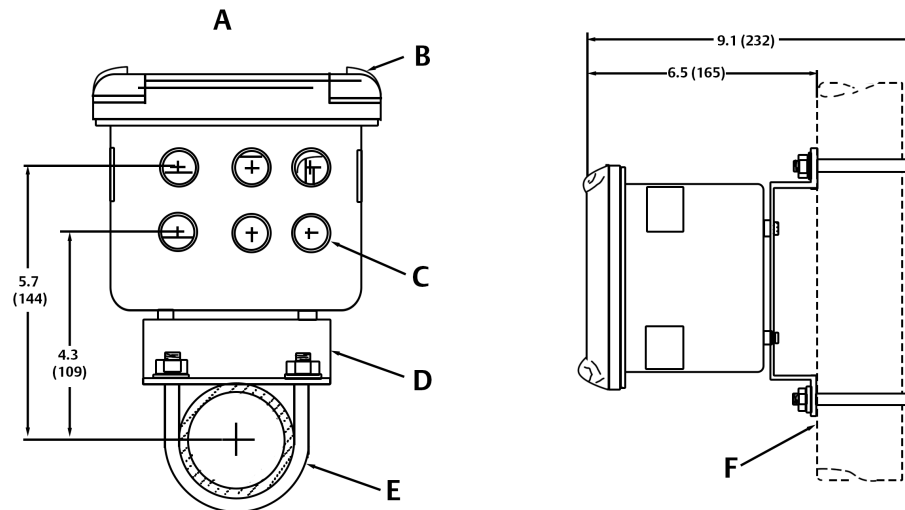
A. *6X ½ in NPT conduit openings*
B. *Front View*
C. *6X ½ in NPT Conduit Openings*
D. *Mounting Bracket*
E. *U-Bolts*
F. *2 in Pipe Supplied by Customer*

Note
Dimensions are in inches with millimeters in parentheses.

2.3   Electrical installation

All wiring must conform to local and national codes. Multiple wiring diagrams are shown in this section. Always refer to the diagrams that apply to your transmitter configuration and disregard all other wiring diagrams.

⚠️ **WARNING**
ELECTRIC SHOCK
Disconnect and lock out power before connecting the power supply. Failure to lock out power could result in serious injury or death.

⚠️ **WARNING**
ELECTRIC SHOCK
Install all protective covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

⚠ WARNING

ELECTRIC SHOCK

To meet the safety requirements of EN 61010 (EU requirement) and ensure safe operation of this equipment, connection to the main electrical power supply must be made through a circuit breaker (min 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 it does not, locate another external means of disconnecting the power supply close by. Circuit breakers or switches must comply with a recognized standard such as IEC 947.

Note
Line, voltage, signal, and relay wiring must be rated for at least 221 °F (105 °C).

NOTICE
If a metal conduit is used with the Rosemount Xi, the conduit should be reliably bonded to protective earth. The grounding plate inside the Rosemount Xi is not bounded to PE and does not provide adequate grounding.

1. Remove cover screws from the front cover of the Rosemount Xi. Swing down the front cover of the interface box.

2. Pull out the I/O board on the right-hand side of the card rack inside the Rosemount Xi. If your system is configured to operate two transmitter probes, there are two I/O interface boards.

3. See Figure 2-6. Connect the 4-20 mA signal wires at J4 of the I/O board. Attach the supplied ferrite clamp over the 4-20 mA OUT wires that extend past the shield.

   NOTICE
   Installation of the ferrite clamp over the 4-20 mA OUT wires is required for compliance with the European EMC directive.

Figure 2-6: Signal connections at I/O board: outer box
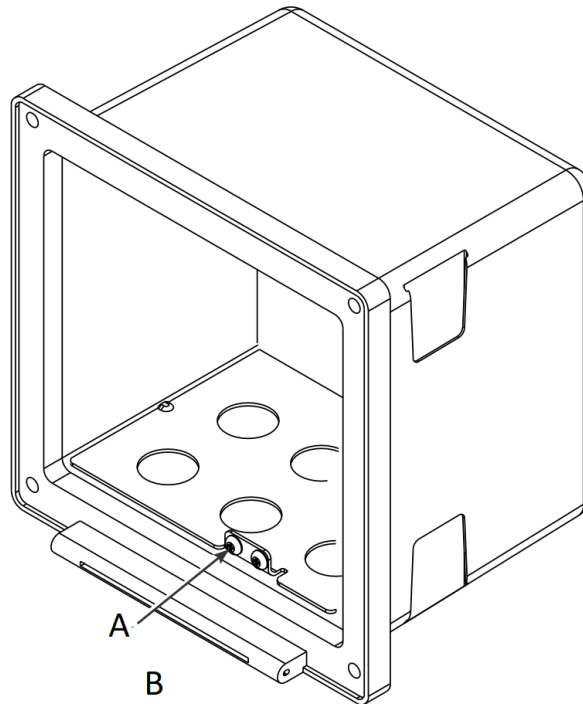
A. Shield Termination
B. Rosemount Xi Enclosure

Figure 2-7: Signal connections at I/O board: Internal Settings
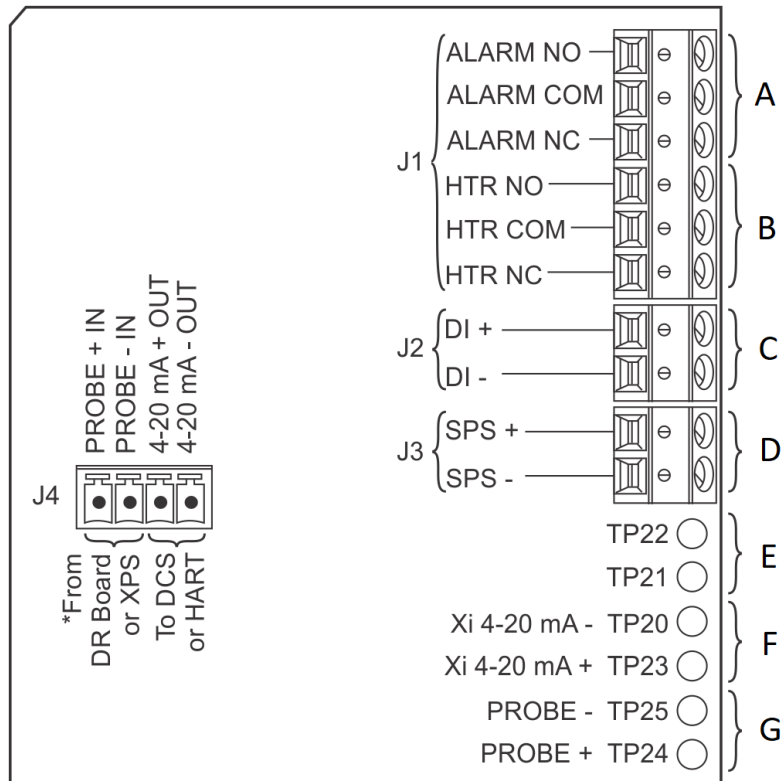
A. To Alarm 1 Indicator
B. To Heater Relay or Alarm 2 Indicator
C. Flame Status input
D. To SPS
E. To Filed Communicator
F. Rosemount Xi Output to Ammeter (4-20mA Check
G. Probe Output to Voltmeter (24 VDC Loop)

Figure 2-8: Alarm indicator relay terminals
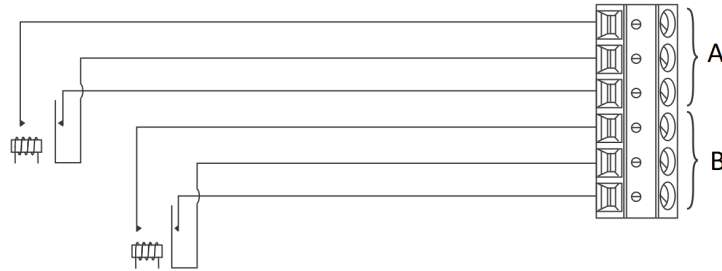
A. *To Alarm 1 Indicator*
B. *To Heater Relay or Alarm 2 Indicator*

4. Terminate the shield of the 4-20 mA signal wires at the designated ground terminal of the Rosemount Xi. Do not allow bare shield wires to contact the circuit boards. Insulate the shield wires prior to termination.

5. Connect the signal wires from the SPS (if used) to the applicable terminals of J3. Refer to the SPS instruction manual for wiring details.

6. Connect the signal wires for the flame status input (if used) to the applicable terminals of J2. The flame status sensing device is supplied by the customer. Refer to the applicable OEM documents for signal wiring details.

7. Connect the customer's alarm indicator devices to the alarm indicator relay terminals. See Figure 2-8 for the alarm indicator relay terminals.

8. Reinstall the I/O board in the card rack of the Rosemount Xi.

Figure 2-9: Power connections - Rosemount Xi Advanced Electronics
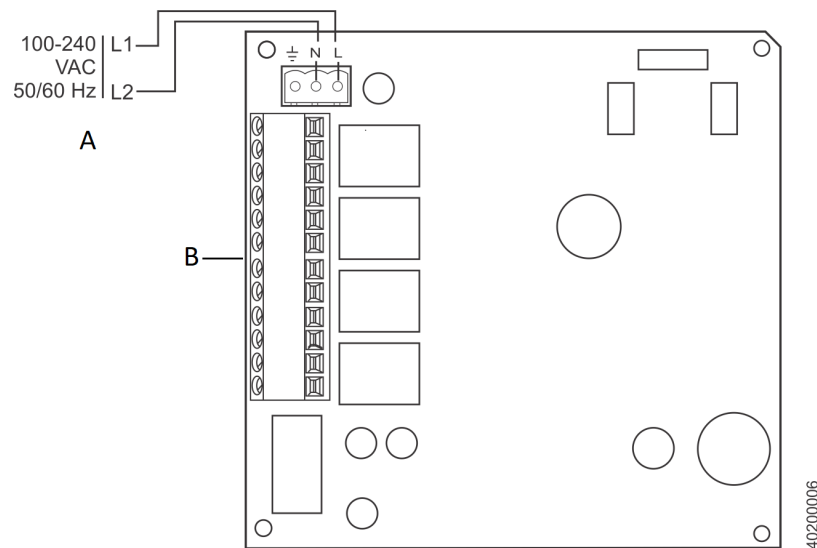
A. From DR board for Traditional Architecture configurations
B. Power Supply Board

9. If your system is configured for two channel operation, repeat steps 2 through 7 to connect the other signal wires.

10. Remove the connector from the power supply board located on the left-hand side of the card rack inside the Rosemount Xi.

11. See Figure 2-9. Connect the line, or L1, wire to the L1 terminal and the neutral, or L2, wire to the N terminal.

12. Reinstall the power supply connector in the power supply board.

13. Close and fasten the Rosemount 736 °C Roseount Xi cover.

2.3.1 Wire the traditional architecture cable connections

A traditional architecture configuration is used to provide for remote location of the transmitter electronics. All electronics are housed inside the Rosemount Xi. A multi-conductor power/signal cable connects between the probe and the Rosemount Xi. Use the following procedure to connect the traditional architecture probe to the Rosemount Xi.

NOTICE
The traditional architecture cable is provided at the specified length and is ready for installation. The cable glands must be properly terminated to maintain EMC/EMI noise protection.

1. Run the 7-conductor cable between the traditional architecture probe and the installation site for the Rosemount Xi. Use new cable conduit or trough as needed.

2. Install the cable and lead wires to the probe per manufacturer's instructions.

3. Install the cable at the probe housing and at the Rosemount Xi enclosure according to the following procedure:

   a) Unscrew the locking nut from the gland assembly and slide the locking nut back along the cable.

   b) Pull the gland body away from the plastic insert.

      Use care not to damage the cable shield braid.

   c) Insert the cable wires into the proper entry port in either the probe housing or the Rosemount Xi enclosure.

   d) At the probe housing, apply polytetrafluoroethylene (PTFE) tape or similar sealing compound to the tapered pipe threads. Thread the gland body into the probe housing until properly seated.

   e) At the Rosemount Xi enclosure, insert the gland body into the left front cable port from the inside of the enclosure. Use the rubber O-ring provided to seal the cable port.

   f) Ensure the cable shield braid is evenly formed over the gray insert.

      When properly formed, the braid should be evenly spaced around the circumference of the insert and not extend beyond the narrow diameter portion.

   g) Carefully press the gray insert into the gland body. The grooves on the insert should align with similar grooves inside the gland body. Press the insert in until it bottoms out in the gland body.

   h) Slide the locking nut up and thread it onto the gland body. Tighten the locking nut so the rubber grommet inside the plastic insert compresses against the cable wall to provide an environmental seal.

4. At the Rosemount Xi, connect the cable leads to the connectors on the transmitter I/O board.

3 Configure

3.1 Verify installation

> ⚠️ **WARNING**
> ELECTRIC SHOCK
> Install all protective equipment covers and safety ground leads before equipment startup. Failure to install covers and ground leads could result in serious injury or death.

> ⚠️ **WARNING**
> ELECTRIC SHOCK
> If external loop power is used, the power supply must be a safety extra low voltage (SELV) type.

3.1.1 Rosemount Xi configuration

Refer to Figure 3-1 and Table 3-1 for the configuration of jumpers JP1 through JP8. The jumper configuration for your I/O board depends on the system design and system components used in your installation.

The setting of switch SW4 and the configuration of jumpers JP1 through JP8 must be verified on the I/O board in the Rosemount Xi. All four dip switches on switch SW4 must be set to the *Off* position, as shown.

Figure 3-1: I/O board jumper configuration
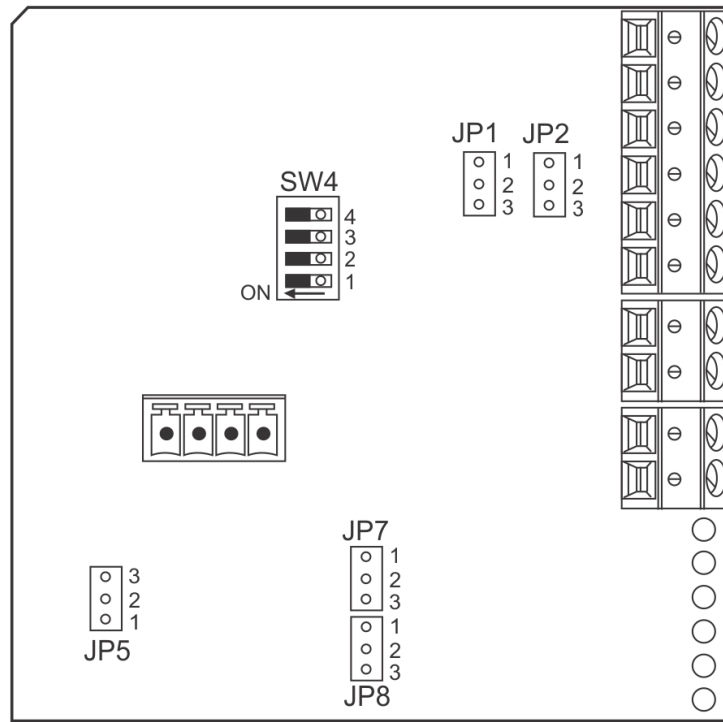
Table 3-1: Configuring Jumpers JP1 through JP8

Configuration	Selection	Jumper	Jumper setting
Flame safety function or Extra alarm output	Flame safety function	JP1 and JP2 (Both must be set the same.)	Pins 1 and 2
	Extra alarm output		Pins 2 and 3
Loop power for 4-20 mA/HART Signal from the Rosemount Xi to Probe	Powered from the Rosemount Xi (most common method)	JP5	Pins 1 and 2
	Powered from external DC supply		Pins 2 and 3
Loop power for 4-20 mA/HART Signal from the Rosemount Xi to DCS	Powered from the Rosemount Xi.	JP7 and JP8 (Both must be set the same.)	Pins 1 and 2
	Powered from DCS.		Pins 2 and 3

Sw4 switch settings (Default = OFF):

1. Reserved; must remain OFF.

2. Not used.

3. Not used.

4. Flame safety function enable.

3.2 Set test gas values

Use a Field Communicator or the Rosemount Xi to set test gas values for calibration.

A Rosemount Xi shipped from the factory has test gas values for low and high set to 0.4% and 8% respectively. This same process must be performed any time a replacement transmitter board, I/O board, or DR board is installed.

Setting test gas values using the Rosemont Xi display/keypad

1. Press the *MENU* button once.
2. From the main menu, select *PROBE 1*.
3. From *PROBE 1*, select *DETAILED SETUP*.
4. From the *DETAILED SETUP* menu, select *CAL SETUP*.
5. From *CAL SETUP*, select *Cal Gas 1*. Enter the percent O_2 used for the low O_2 test gas.
6. From *CAL SETUP*, select *Cal Gas 2*. Enter the percent O_2 used for the high O_2 test gas.
7. Press the *Left* arrow key several times to return to the main menu.
8. Repeat steps 2 through 6 for PROBE 2 if configured for dual channel.

3.2.1 Setting test gas values using Field Communicator

1. Use the Field Communicator software to access the HART menu.
2. From the *DEVICE SETUP* menu, select *DETAILED SETUP*.
3. From the *DETAILED SETUP* menu, select *CAL SETUP*.
4. From *CAL SETUP*, select *Cal Gas 1*. Enter the percent O_2 used for the low O_2 test gas.
5. From *CAL SETUP*, select *Cal Gas 2*. Enter the percent O_2 used for the high O_2 test gas.

3.3 Alarm relay output configuration

The Rosemount Xi has two dry contact Form-C alarm relay output signals that can be configured in eight different modes through the Rosemount Xi keypad display or the Field Communicator. A list of possible configurations is shown in Table 3-1. Each alarm relay can be configured separately.

Table 3-2: Alarm relay output configurations

Mode	Configuration
No alarm[1]	The output is not configured for any alarm condition.
Unit alarm	The output is configured for a unit alarm.
Low O_2 alarm	The output is configured for a low O_2 alarm.
Low O_2/unit alm	The output is configured for a unit alarm and a low O_2 alarm.
Cal recommended	The output is configured for a calibration recommended display.
Cal rec/unit alm[2]	The output is configured for a unit alarm and a calibration recommended display.

Table 3-2: Alarm relay output configurations *(continued)*

Mode	Configuration
Low O_2/cal rec	The output is configured for a low O_2 alarm and a calibration recommended display.
Low O_2/unit/cal rec	The output is configured for a low O_2 alarm, a unit alarm, and a calibration recommended display.

(1)   The default configuration for Alarm 2.
(2)   The default configuration for Alarm 1.

3.3.1   Configuring alarm relays with the Rosemount Xi keypad/display

1. Press the *MENU* button once.
2. From the main menu, select *PROBE 1*.
3. From *PROBE 1*, select *DETAILED SETUP*.
4. From the *DETAILED SETUP* menu, select *ALARM RELAY*.
5. From *ALARM RELAY*, select as follows:

    •   **Alm Relay1** - Alarm 1 mode

    •   **Alm Relay2** - Alarm 2 mode

    •   **Low O2 Alm SP** - Low O_2 alarm setpoint

    •   **High Temp Alm SP** - High temperature alarm setpoint

6. Press the *Left* arrow key several times to return to the main menu.
7. Repeat steps 2 through 6 for *PROBE 2* if configured for dual channel.

3.3.2   Configuring autocalibration with the Field Communicator

1. Use the Field Communicator software to access the HART menu.
2. From the *DEVICE SETUP* menu, select *DETAILED SETUP*.
3. From the *DETAILED SETUP* menu, select *CAL SETUP*.
4. From *CAL SETUP*, select *Auto Cal*.
5. Press the *Right* arrow key to change the state from *NO* to *YES*.

3.4   Autocalibration setup

If autocalibration is desired, the Rosemount Xi must be used with an SPS 4001B. The Rosemount Xi must be properly configured before autocalibration can take place. Refer to the applicable SPS 4001B instruction manual for details on performing autocalibration. Refer to Startup and operation for details on manual calibration procedures.

A Rosemount Xi is shipped from the factory without autocalibration configured. This same process must be performed any time a replacement I/O board is installed.

3.5 Optional advanced features inside the Rosemount Xi

Advanced features available inside the Rosemount Xi are typically ordered as part of the initial package. However, these advanced features are also available for field retrofit.

A Rosemount Xi is shipped from the factory with the optional enhanced software features enabled based on the configuration.

⚠ WARNING

The I/O board is shipped from the factory without any of the enhanced software features activated. These features must be activated once the new board has been installed and before the remote interface is put into service.

⚠ WARNING

If the existing I/O board has been operated with the stoichiometric enhanced software feature, this feature must be activated in the new board before the remote interface is put back into service. Failure to do so will cause a false analog output signal to the DCS.

NOTICE

For enhanced software feature option upgrades or to enable the feature to duplicate the existing configuration, contact Emerson at 1-800-433-6076. Reference the following:

- 6A00269G01: Enhanced software option upgrade, stoichiometric function

- 6A00269G02: Enhanced software option upgrade, programmable reference function

- 6A00269G03: Enhanced software option upgrade, 800 °C process function

3.5.1 Extended process temperature range to 1472 °F (800 °C)

The Oxygen Analyzer employs a heater and thermacouple to maintain a temperature setpoint at 1357 °F (736 °C). Temperature control is maintained within ±1 °C to process temperatures of about 1300 °F (705 °C). This is satisfactory for most applications, but excursions to higher temperatures can occur in some processes. In these instances, the heater is turned off and the process temperature is used to heat the sensing cell.

The oxygen reading is adjusted immediately to compensate for the varying process temperatures. Cell life will be reduced by continuous operation at temperatures above 1300 °F (705 °C). If process temperatures are expected to be continuously above 1300 °F (705 °C), Emerson recommends the use of an optional bypass or probe mounting jacket accessory. The extended temperature range feature is selected in the Rosemount Xi product matrix, but may not be purchased as a field retrofit.

3.5.2 Stoichiometer

Process upsets can sometimes cause a combustion process to go into sub-stoichiometric or reducing conditions. The oxygen readings from one or more probes may decline all the

way to zero. The stoichiometer cell will measure the amount of oxygen deficiency during these reducing conditions. The trends in your DCS can be set up for a lower range limit of -1 or -2% oxygen to depict the level of oxygen deficiency.

You can see if your control recovery actions are having the desired effect. These types of events do not occur frequently, but knowing the parameters of the situation prevents over-correcting while coming out of the reducing condition. The stoichiometer feature requires purchasing the acid resistant stoichiometer cell and the stoichiometer feature inside the Rosemount Xi.

NOTICE

Make sure the DCS is configured for the same range as the Rosemount Xi. For instance: -1% O_2 to 10% O_2.

3.5.3   Programmable reference

The zirconium oxide sensing technology has historically measured process oxygen by using ambient or instrument air as a reference (20.95% oxygen). The sensor develops most of its signal at the low oxygen levels typically found in combustion flue gases (2 to 4% oxygen) and is most accurate at these levels. When measuring near 20.95% O_2, the sensor develops only a few millivolts of signal, and accuracy degrades.

The programmable reference feature permits you to use a bottled reference gas of low oxygen value (0.4% oxygen recommended). When measuring at or near 21% oxygen, a strong negative oxygen signal results with much improved accuracy. A bottle of reference gas typically lasts about a month at the low flows required. Typical applications would be:

- **Flue gas recirculation** - controlling the mixing of flue gases into the burner windbox ahead of the burner to reduce NO_x emissions.

- **Moisture monitoring** - measuring the amount of moisture coming off of industrial dryers by noting that the dilution effect water vapor has on the normal 20.95% ambient drying air (non-combusion drying processes only).

- **Enriched oxygen concentration** - pure oxygen is sometimes mixed in with the combustion air to increase heat at the flame. This is used in steel and other metals reduction processes and in some catalyst regenerators.

4 Startup and operation

4.1 Overview

Interface to the Rosemount Xi for setup, calibration, and diagnostics can be via a Field Communicator or Asset Management System.

Setup, calibration, and diagnostic operations differ depending on the selected interface for communications with the transmitter.

4.2 Startup

The O_2 probe takes approximately 45 minutes to warm up to the 1357 °F (736 °C) heater setpoint. The 4-20 mA signal remains at a default value of 3.5 mA through this warmup period. Once warm, the O_2 reads oxygen, and the 4-20 mA signal's reading is based on the default range of 0-10% O_2.

NOTICE
The Rosemount Xi offers optional advanced features, such as elevated process temperature capability to 1472 °F (800 °C), autocalibration via an SPS solenoid vox, a stoichiometer feature for indicating the level of oxygen defiency in reducing conditions, and programmable reference to enhance accuracy at near ambient levels of O_2.

Figure 4-1: Rosemount Xi display (typical)
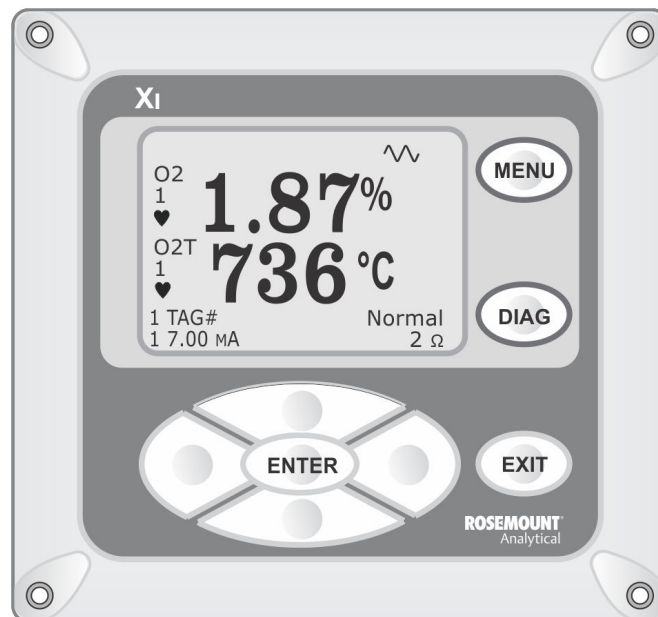
Note
The display can be customized through the Rosemount Xi menu. Use the **SYSTEM** → **CONFIGURE** → **MAIN DISPLAY** path (Figure 4-2).

4.2.1 Operation via Rosemount Xi

The following procedures describe operations using the Rosemount Xi to set up and calibrate the system. Additional operating instructions are included in the *SPS 4001B* instruction manual, if applicable to your system.

4.2.2 Error conditions

If there is an error condition at startup, an alarm message is displayed. Refer to Troubleshoot to determine the cause of the error. Clear the error and cycle power. The %O$_2$ and temperature display should return without the alarm message.

4.2.3 Rosemount Xi Controls

The Rosemount Xi can be used to change the software and alarm settings, to adjust the high and low gas settings, and to initiate the calibration sequence. Refer to the following control descriptions. Use the control keys on the front panel of the Rosemount Xi (Figure 4-1) to navigate and edit the Rosemount Xi menu (refer to the Figure 4-2).

- *MENU* toggles between three main menu options: *System*, *Probe1*, and *Probe2* (if available). The top level of the selected main menu is displayed.

- *DIAG* toggles between the *Alarms* list of the three main menus. All faults and warnings related to the selected main menu device are displayed.

- *ENTER* saves newly entered data and returns you to the previous menu level.

- *EXIT* returns you to the previous menu level without saving newly entered data. When navigating the menu tree, pressing *EXIT* returns you to the main menu.

- *Up/Down* keys scroll up and down through menu items. During data entry, the *Up/ Down* keys increment and decrement the data values.

- *Left* arrow key returns you to the previous menu level. During data entry, the *Left* arrow key moves the cursor one digit to the left.

- *Right* arrow key advances you to the next menu level and, when a menu item is highlighted, selects the item from a list of menu options. During data entry, the *Right* arrow key moves the cursor one digit to the right.

Figure 4-2: Xi menu

PROBE 1
or
PROBE 2

PROCESS
VARIABLES

OP Mode
PROCESS
VARS

- O2
- O2 Temp
- CJC Temp
- Elec Temp

RAW VALUES

- O2 Cell
- TC Volt
- Cell Imp
- Htr Volt
- CPU Volt

ANALOG
OUTPUT

- O2 AO
- O2 AO%
- O2 LRV
- O2 URV
- AO Range

DIAGNOSTICS

ALARMS
STATUS

FAILED

- NV Memory Fail
- Board Temp High
- Factory Mode
- O2 Htr Ramp Rate

MAINTENANCE1

- O2 Sensor Open
- O2 T/C Open
- O2 Temp Low
- O2 Temp High
- O2 T/C Shorted
- O2 T/C Reversed
- O2 Htr Failure
- No Flame

MAINTENANCE2

- Xmt Disconnect
- Cal Recommend
- Cal Failed
- Cell Imp High

ADVISORY

- CPU Volt Low
- CPU Volt High
- O2 Htr Volt Low
- O2 Htr Volt High
- Low O2

OPERATING

- Factory Mode
- DIP Switch 2
- DIP Switch 3
- Flame Status
- AutoCal Device
- Relay Device
- Cal Hold
- Heater On

PROBE

VAR MAX

- O2 Temp Max
- CJC Temp Max
- Elect Temp Max
- Htr Volt Max
- Reset Max Temp

HEATER
CONTROL

- Duty Cycle
- PID SP
- O2 Temp
- Htr Ramp Rate

I/O STATES

- Flame Status In
- Alm Relay1 Out
- Alm Relay2 Out
- SPS/IMPS In
- SPS/IMPS Out

EE STATUS

- T EE Val
- I/O EE Val

SOFTWARE

TRANSDUCER — Version

I/O BOARD — Version

SERVICES

- T Restart Cntr
- IO Restart Cntr
- Reset Restart Cntr
- Reset Device

40050004

(CONTINUED FROM
SHEET 2)

```
BASIC SETUP ─┬─ IDENTIFICATION ─── Tag
             │                      Device ID
             │
             ├─ VARIABLE ─────────── PV is
             │  MAPPING              SV is
             │                       TV is
             │                       Qv is
```

DETAILED
SETUP

```
├─ SENSOR ──────────── T90 Filter
│                       O2 Cell Ref
│                       O2 Temp SP
│                       Features
│
├─ ANALOG ──────────── O2 LRV
│  OUTPUT               O2 URV
│                       AO Range
│                       Signal Alarm Level
│
├─ ALARM ───────────── Alm Relay1
│  RELAY                Alm Relay2
│                       Low O2 AlmSP
│                       Hi Temp Alm SP
│
├─ CAL SETUP ───────── AO Tracks
│                       Auto Cal
│                       Start On CalRec
│                       Cal Gas 1
│                       Cal Gas 2
│                       Gas Time
│                       Purge Time
│                       Cal Intv
│                       Next Cal Time
```

Signal Alarm Level options:
No Alarm
Unit Alarm
Low O2 Alarm
Low O2/Unit Alm
Cal Recommended
Cal Rec/Unit Alm
Low O2/Cal Rec
Low O2/Unit/Cal Rec

Alarm Relay options:
No Alarm
Unit Alarm
Low O2 Alarm
Low O2/Unit Alm
Cal Recommended
Cal Rec/Unit Alm
Low O2/Cal Rec
Low O2/Unit/Cal Rec
Heater Relay

CALIBRATION

```
├─ O2 CALIBRATION ──── Start Cal
│                       Abort Cal
│                       Display Cal
│                       CAL STATUS ──── Cal Result
│                                        Reset Cal Rsult
│                                        Delta Imp
│                                        Next Cal Time
│
├─ CAL CONSTS ──────── CURRENT CAL ──── Cal Slope
│                                        Cal Const
│                                        Cal Imp
│                                        Reset Cal
│
│                       DISPLAY
│                       CAL LOGS
│
│                       FAILED CAL ──── Failed Slope
│                                        Failed Const
│
└─ 4-20 MA SIGNAL ──── D/A Trim
```

39640008

4.2.4 Password protection

Beginning with Rosemount Xi system software version 1.05 or higher, the main display and diagnostic screens of the Rosemount Xi can be viewed at any time, but further access and unauthorized configuration changes can be prevented by enabling a password protection feature. However, the Rosemount Xi is shipped with password protection disabled.

Password protection can be enabled by selecting **System Main Menu > Configure > LCD > Enable Password** (see Figure 4-2).

The factory default upon enabling the password protection is *ROSE*, but the password can consist of any 4 alpha/numeric characters.

If you forget the password, do one of the following:

- In North America, call Emerson's Rosemount Customer Central at 1-800-999-9307.

- For everywhere else, contact your nearest Emerson representative or go to Emerson.com.

A *Lock* icon is displayed at the top right corner of the main display when password protection is in effect.

The password protection relocks itself after a certain number of seconds with no button pushes (defined as *revert time* in the same *LCD setup* menu). You can also force the front panel to be locked by selecting **System Main Menu > Log Off**. The *Log Off* selection performs on function if the password feature is disabled.

The Rosemount Xi has a *Reset* function that reestablishes all factory default conditions, including the password protection feature, i.e., the password protection falls back to a disabled condition after a reset.

4.3 System parameter descriptions

Among the parameters available through the Rosemount Xi and Field Communicator menus are a number of *system parameters*. The system parameters define variables that configure the Rosemount Xi in the transmitter system. System parameters are described in the following table.

Table 4-1: System parameters

CPU	Parameter name	Units	Parameter description
Y	Version	---	Software version number for the CPU board
Y	Build Num	---	Software build number for the CPU board
Y	Comm Status	---	Communication status between the CPU and I/O boards
Y	Restart Cntr	---	Software restarts counter for the CPU board
N	Pol Addr	---	Polling address - address used to identify a field device; changeable by user
N	Serial Number	---	I/O board serial number
N	Features	---	Available advanced software features for the I/O board. ON: feature supported. OFF: feature not supported.

Table 4-1: System parameters *(continued)*

CPU	Parameter name	Units	Parameter description
N	EE Erase Count	---	This is for nonvolatile memory diagnostic only.
Y	Num Probe	---	Number of probes configuration: If set to 1, use One Probe configuration for the main display. If set to 2, use Two Probes configuration for the main display.
Y	Probe Sel	---	This parameter is applicable only if the Num Probe configuration is set to 2. It defines which probe is to be displayed.
Y	Probe 1 Enable	---	Probe 1 state. If enabled, the probe menu will be displayed; otherwise it will not be displayed. (No, Yes)
Y	Probe 2 Enable	---	Probe 2 state. If enabled, the probe menu will be displayed; otherwise it will not be displayed (No,Yes)
Y	LineX Probe	---	Probe number for line x. (1, 2)
Y	Line 1 Data	---	Main display, line 1 data; 0 displays PV (O_2), 1 displays SV (O_2 temp)
Y	Line 2 Data	---	Main display, line 1 data; 0 displays PV (O_2), 1 displays SV (O_2 temp)
Y	Line 3 DataL	---	Main display, line 3 left hand side data: 0 displays PV (O_2) 1 displays SV (O_2 temp) 2 displays TV (cell imp) 3 displays 4 V (cell mV) 4 displays CJC temp 5 displays AO 6 displays OP mode 7 displays Tag
Y	Line 3 DataR	---	Main display, line 3 right hand side data 0 displays PV (O_2) 1 displays SV (O_2 temp) 2 displays TV (cell imp) 3 displays 4 V (cell mV) 4 displays CJC temp 5 displays AO 6 displays OP mode 7 displays Tag

Table 4-1: System parameters *(continued)*

CPU	Parameter name	Units	Parameter description
Y	Line 4 DataL	---	Main display, line 4 left hand side data 0 displays PV (O_2) 1 displays SV (O_2 temp) 2 displays TV (cell imp) 3 displays 4 V (cell mV) 4 displays CJC temp 5 displays AO 6 displays OP mode 7 displays Tag
Y	Line 4 DataR	---	Main display, line 4 right hand side data 0 displays PV (O_2) 1 displays SV (O_2 temp) 2 displays TV (cell imp) 3 displays 4 V (cell mV) 4 displays CJC temp 5 displays AO 6 displays OP mode 7 displays Tag
Y	Revert time	min	Rosemount Xi display reverts to main display time. Also locks screen if password protection is enabled.
Y	Language	---	0 displays English 1 displays Spanish 2 displays German
Y	Contrast	---	Display contrast (120 to 200)
Y	Alarms	---	See Troubleshoot
Y	Password	---	Security password
Y	Enable password	---	Enables/disables security password protection

4.4 Probe parameter descriptions

Among the parameters available through the Rosemount and Field Communicator menus are a number of probe parameters. The probe parameters define variables that configure a specific probe in the transmitter system. Probe parameters are described in the following table:

Table 4-2: Probe parameters

TX	I/O	Parameter name	Units	Parameter description
Yes	Yes	O2	%	Current oxygen concentration value (O_2%). The value should reflect the last good O_2 value if it is in the Lock state during calibration.
Yes	Yes	O2 Temp	°C	Current O_2 sensor temperature.
Yes	Yes	CJC Temp	°C	Current cold junction temperature.
No	Yes	Elec Temp	°C	Current electronic temperature measured at the I/O board.
Yes	Yes	O2 Cell	mV	Raw mV value for ZrO_2 sensor.
No	Yes	TC Volt	mV	O_2 T/C voltage.
Yes	Yes	Cell Imp	Ohm	Cell impedance/sensor resistance measured.
Yes	Yes	Htr Volt	Volt	Heater voltage.
Yes	Yes	CPU Volt	Volt	Transmitter CPU voltage.
Yes	Yes	O2 AO	mA	Analog output value represents the O_2 concentration measurement.
No	Yes	O2 AO%	%	O_2 analog output percentage for O_2 AO.
Yes	Yes	O2 Temp Max	°C	This is the highest O_2 sensor temperature reached since last reset.
Yes	Yes	CJC Temp Max	°C	This is the highest temperature reached at the cold junction since last reset.
No	Yes	Elec Temp Max	°C	This is the highest temperature reached at the I/O board since last reset.
Yes	Yes	Htr Volt Max	°C	This is the highest heater voltage reached since last reset.
Yes	Yes	Htr Duty Cycle	---	O_2 heater duty cycle. Value between 0 and 1.
Yes	Yes	PID SP	°C	PID temperature set point.
Yes	Yes	Htr Ramp Rate	°C/s	Heater ramp rate calculated in degree C per second.
No	Yes	Flame Stat In	N/A	Flame input state. (OFF/ON)
No	Yes	SPS In	N/A	SPS input state. (OFF/ON)
No	Yes	SPS Out	N/A	SPS output state. (OFF/ON)
No	Yes	Alarm Relay 1 Out	N/A	Alarm Relay 1 output state.
No	Yes	Alarm Relay 2 Out	N/A	Alarm Relay 2 output state. (OFF/ON)

Table 4-2: Probe parameters *(continued)*

TX	I/O	Parameter name	Units	Parameter description
Yes	Yes	OP Mode	N/A	Device operating mode: PO = Power up; WU = Warm up (analog output is railed); NM = Normal operation; CA = Calibrating (analog output can be tracking or locked at last good value based on AO Tracks configuration; AL = Alarm detected (recoverable); SF=Alarm detected (non-recoverable)
Yes	Yes	Tag	N/A	Device tag.
Yes	Yes	Device ID	N/A	Unique device ID number (HART).
Yes	Yes	PV	N/A	Primary variable assignment (HART).
Yes	Yes	SV	N/A	Secondary variable assignment (HART).
Yes	Yes	TV	N/A	Third variable assignment (HART).
Yes	Yes	QV	N/A	Fourth variable assignment (HART).
Yes	Yes	Xmtr Address	N/A	Transmitter board polling address.
Yes	Yes	Cal Slope	mV/Dec	Current calibration slope. This is the slope value that was calculated as a result of the last successful calibration.
Yes	Yes	Cal Const	mV	Current calibration constant. This is the constant value that was calculated as a result of the last successful calibration.
Yes	Yes	Cal Imp	Ohm	Cell impedance. This is the sensor resistance that was calculated as a result of the last successful calibration.
No	Yes	Prev Slope	mv/Dec	Previous calibration slope. There are ten calibration results. 1 is the most recent, and 10 is the least recent calibration slope.
No	Yes	Prev Const	mV	Previous calibration constant. There are ten calibration results. 1 is the most recent, and 10 is the least recent calibration constant.
No	Yes	Prev Cal Imp	Ohm	Previous cell impedance. This is the sensor resistance that was calculated as a result of the previous successful calibration. There are ten calibration results. Index 1 is the most recent, and Index 10 is the least recent sensor resistance measured.
No	Yes	Failed Slope	mV/Dec	Failed calibration slope.
No	Yes	Failed Const	mV	Failed calibration constant.
Yes	Yes	Cal Result	mV	Calibration result.
No	Yes	Delta Imp	N/A	Delta impedance since last calibration.
No	Yes	Cal Step	N/A	This represents the step the calibration cycle is in.
No	Yes	Time remain	seconds	Time remaining in the present calibration cycle state.

Table 4-2: Probe parameters *(continued)*

TX	I/O	Parameter name	Units	Parameter description
Yes	Yes	O2 Slope	mV/Dec	O_2 slope. This is the slope value that will be used to calculate O_2.
Yes	Yes	O2 Const	mV	O_2 constant. This is the constant value that will be used to calculate O_2.
No	Yes	T90 filter	sec	Analog output T90 time. It represents the time to take a step change in oxygen to reach 90% of the final value at the filter output.
No	Yes	O2 Cell Ref	%	O_2 sensor reference gas percentage. It allows a sensor reference gas other than air.
No	Yes	O2 Temp SP	deg C	O_2 sensor set point. It allows measurement of oxygen with an elevated sensor temperature. 0 = 1357 °F (736 °C) set point; 1 = 1533 °F (834 °C) set point
No	Yes	Features	---	Advanced software features • 0 = Stoichiometer • 1 = Programmable Reference • 2 = Elevated Temperature
Yes	Yes	O2 URV	%	Primary variable (O_2%) upper range value
Yes	Yes	O2 LRV	%	Primary variable (O_2% lower range value)
No	Yes	O2 AO Range	N/A	Analog output polarity. (0 = 4-20 mA; 1 = 20-4 mA)
Yes	Yes	O2 Alarm Level	N/A	O_2 alarm level. (0 = 3.5 mA; 1 = 21.1 mA)
No	Yes	Alarm Relay 1	N/A	Alarm Relay 1 mode. (no alarm; unit alarm; low O_2 alarm; low O_2/unit alarm; Cal recommended; Cal recommended/unit alarm; low O_2/Cal recommended, low O_2/unit alarm/Cal recommended.)
No	Yes	Alarm Relay 2	N/A	Alarm Relay 2 mode. (no alarm; unit alarm; low O_2 alarm; low O_2/unit alarm; Cal recommended; Cal recommended/unit alarm; low O_2/Cal recommended, low O_2/unit alarm/Cal recommended; Heater relay)
No	Yes	Low O_2 Alm	%	Low O_2 alarm threshold.
No	Yes	Hi Temp Alm	%	High temperature alarm threshold.
No	Yes	AO Track	N/A	Analog output track O_2 sensor measurement during a calibration. (No, Yes)
No	Yes	Auto Cal	N/A	Enable/disable automatic calibration. No = Set to manual calibration mode. Yes = Set to automatic calibration mode.
Yes	Yes	Cal Gas 1	%	Test gas 1 value. This is the actual value of the gas being applied during the test gas 1 phase of a calibration.

Table 4-2: Probe parameters *(continued)*

| TX	I/O	Parameter name	Units	Parameter description
Yes	Yes	Cal gas 2	%	Test gas 2 value. This is the actual value of the gas being applied during the test gas 2 phase of a calibration.
Yes	Yes	Gas Time	sec	Test gas application time. This is the length of time test gases are applied to the O_2 probe during low or high test gas phase of a calibration.
Yes	Yes	Purge Time	sec	Test gas purge time. This is the length of time before the output will be returned to the process reading after a calculation.
No	Yes	Cal Interval	hour	Automatic calibration interval. The number 9999 disables the automatic timed calibration.
No	Yes	Next Cal Time	hour	Automatic calibration interval. The number 9999 disables the automatic timed calibration.
Yes	Yes	T EE Val	N/A	Transmitter board nonvolatile memory diagnostic.
No	Yes	IO EE Val	N/O	I/O board nonvolatile memory diagnostic.
Yes	Yes	Transmitter - Version	N/A	Software version number for the transmitter.
No	Yes	I/O Board - Version	N/A	Software version number for the I/O board.
Yes	Yes	T Restart Cntr	N/A	Software restarts count for the transmitter.
No	Yes	IO Restart Cntr	N/A	Software restarts count for the I/O board.
Yes	Yes	Alarms	---	Current alarms. See Troubleshoot.

4.5 Operation via HART/AMS

The Field Communicator is a handheld communications interface device. It provides a common communications link to all microprocessor-based instruments that are HART compatible. The handheld communicator contains a liquid crystal display (LCD) and 21 keys. A pocket-sized manual, included with the Field Communicator, details the specific functions of all the keys.

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

4.5.1 Field communicator signal line connections

When working at the Rosemount Xi, the Field Communicator can be connected directly to test points TP21 and TP22 on the Rosemount Xi I/O board as shown in Figure 4-3. The AM+ and AM- test points are provided to monitor the 4-20 mA signal without breaking into the loop.

Figure 4-3: Field Communicator connection at the Rosemount Xi
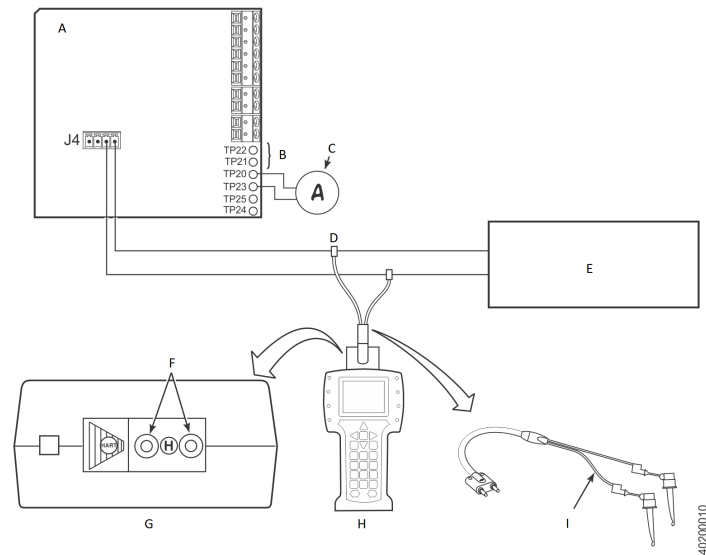
A. Rosemount Xi I/O Board
B. To Field Communicator
C. 4-20 mA Signal Monitor (Customer Supplied)
D. 4-20 mA Signal Line
E. Control Room/AMS or Data Acquisition System
F. Loop Connectors
G. Field Communicator Rear Panel
H. Field Communicator
I. Lead Set

4.6   Offline and online operations

The Field Communicator can be operated both offline and online.

Offline operations are those in which the communicator is not connected to the O_2 probe. Offline operations include interfacing the Field Communicator with a PC (refer to applicable HART documentation regarding HART/PC applications).

In the online mode, the Field Communicator is connected to the 4-20 mA analog output signal line. The communicator is connected in parallel to the O_2 probe or in parallel to the 250 ohm load resistor.

4.7 Calibration - general

New O_2 cells may operate for more than a year without requiring calibration, but older cells may require recalibration every few weeks as they near the end of their life.

A *CALIBRATION RECOMMENDED* alarm provides notice of when a calculation is required. This strategy ensures that the O_2 reading is always accurate and eliminates many unnecessary calibrations based on calendar days or weeks since previous calibration.

The O_2 probe(s) can be calibrated manually through the handheld Field Communicator or the Rosemount Xi. Fully automatic calibration can be performed automatically using the Rosemount Xi and the SPS 4001B Single Probe Autocalibration Sequencer.

4.8 O_2 calibration

This section covers manual calibration. For automatic calibration details, see the Instruction Manual for the SPS 4001B Single Probe Autocalibration Sequencer.

Calibration can be performed using three basic calibration methods. The methods available to you for use depend on the configuration of your system. The sections that follow describe how to perform a calibration for two basic system configurations shown in Figure 4-4.

Included in the calibration procedures are instructions for setting up the calibration parameters. Setup of the calibration parameters should be performed before the first O_2 calibration. Thereafter, perform calibration setup only as needed to change the calibration parameters or to reset the parameters following the replacement of primary system components.

Before calibrating, verify that the configuration gas parameters are correct. Refer to Configure.

Figure 4-4: Calibration methods, simplified
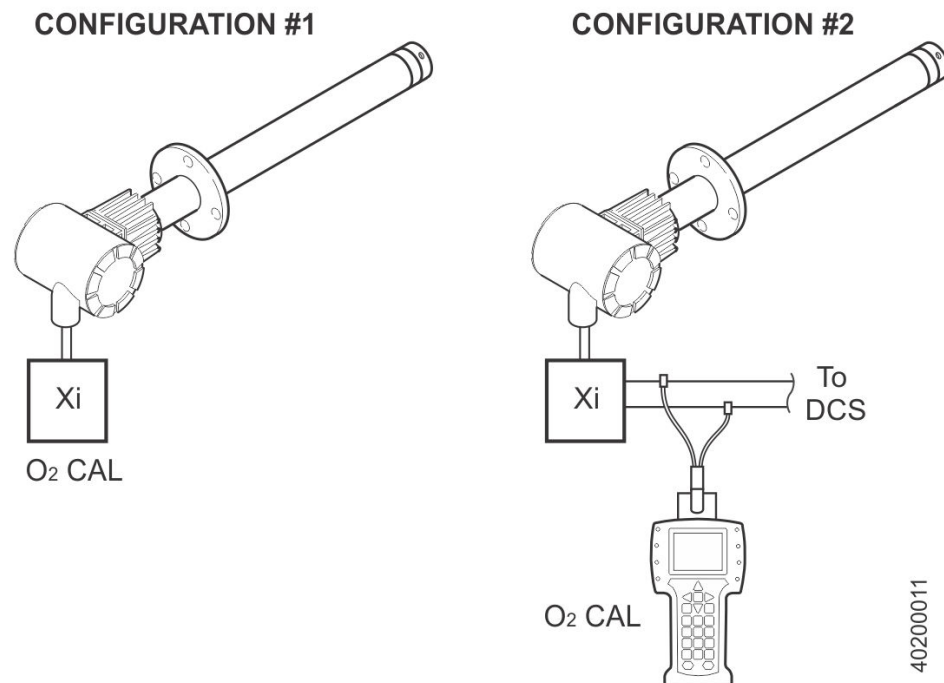
4.8.1 O_2 calibration with Rosemount Xi

For systems with configuration 1, shown in Figure 4-4, use the following procedure to perform a calibration using the Rosemount Xi. If necessary, use the Rosemount Xi menu tree in for reference.

NOTICE

To select a menu item, use the up and down arrow keys to scroll to the menu item and press the right arrow key to select the menu item. To return to a preceding menu, press the left arrow key.

---

1. From the Main Menu, select SYSTEM to access the Rosemount Xi System menu.
2. From the Rosemount Xi SYSTEM menu, scroll down and select DETAILED SETUP.
3. Select menu item 4, CAL SETUP, to input the cal gas and flow times.
4. Return to the SYSTEM menu and select the last menu item, CALIBRATION, to access the CALIBRATION menu.
5. From the O_2 CALIBRATION options, select Start Cal to start the O_2 calibration procedure.

⚠️ **WARNING**

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

In the first Start Cal screen, a "Loop should be removed from automatic control" warning appears.

6. Remove the Rosemount Xi from any automatic control loops to avoid a potentially dangerous operating condition and press OK.

7. Follow the Rosemount Xi display prompts to perform the O_2 cal procedure.

4.8.2 O_2 calibration with Rosemount Xi and Field Communicator

For systems with configuration 2, shown in Figure 4-4, use the following procedure to perform a calibration of the system using the Field Communicator. If necessary, use the menu tree in for reference.

NOTICE

To select a menu item, use the up and down arrow keys to scroll to the menu item and press the right arrow key to select the menu item. To return to a preceding menu, press the left arrow key.

---

1. Select DEVICE SETUP.

2. From the DEVICE SETUP screen, select menu item 4, DETAILED SETUP.

3. Select menu item 3, CAL SETUP, to input the cal gas and gas flow times.

4. Return to the DEVICE SETUP screen and select menu item 2, DIAG/SERVICE.

5. From the DIAG/SERVICE screen, select menu item 3, CALIBRATION, to access the O_2 CALIBRATION screen.

6. From the O_2 CALIBRATION screen, select menu item 1, O_2 CAL, to access the O_2 calibration procedure.

⚠ **WARNING**

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

In the first O_2 CAL screen, a "Loop should be removed from automatic control" warning appears.

7. Remove the Rosemount Xi from any automatic control loop to avoid a potentially dangerous operating condition and press OK.

8. Follow the handheld Field Communicator display prompts to perform the O_2 cal procedure.

4.9 D/A trim

The D/A trim procedure is used to calibrate the 4-20 mA output signal to a precision mA measurement device.

The procedure that follow describe how to perform a D/A trim for the basic system configuration shown in Figure 4-5. Only the signal to the DCS needs to be trimmed.

Figure 4-5: D/A trim methods, simplified
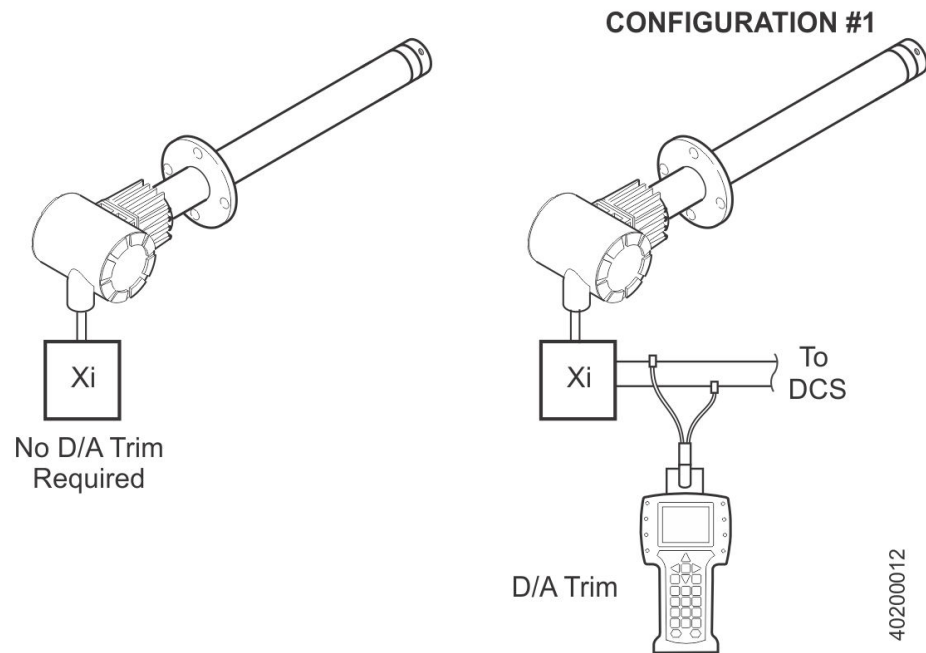
4.9.1   D/A trim with Rosemount Xi

For systems with configuration 1, shown in Figure 4-5, use the handheld Field Communicator to access the D/A trim procedure according to the instructions that follow. Refer to the Field Communicator Rosemount Xi menu tree in Figure 4-2.

1. From the DEVICE SETUP screen, select menu item 2, DIAG/SERVICE, to access the diagnostics and service menu options.
2. Select menu item 3, CALIBRATION, to access the calibration menu options.
3. Select menu item 3, 4-20 mA SIG, to access the 4-20 mA SIGNAL screen.
4. Select menu item 1, D/A TRIM, to start the trim procedure.

5 Troubleshoot

5.1 Overview of operating principles

When the Zirconium Oxide sensing cell is heated to its setpoint [1357 °F (736 °C)], the cell generates a voltage that represents the difference between the process O_2% and the reference O_2% inside the probe (20.95% O_2 instrument air).

When flowing calibration gases, the raw cell millivolt value should represent the levels on the chart in Figure 5-1. Note that the raw cell millivolt value increases logarithmically as the O_2 concentration decreases.

Figure 5-1: O_2 sensor mV reading vs %O_2 at 1357 °F (736 °C) (Reference air, 20.95% O_2)
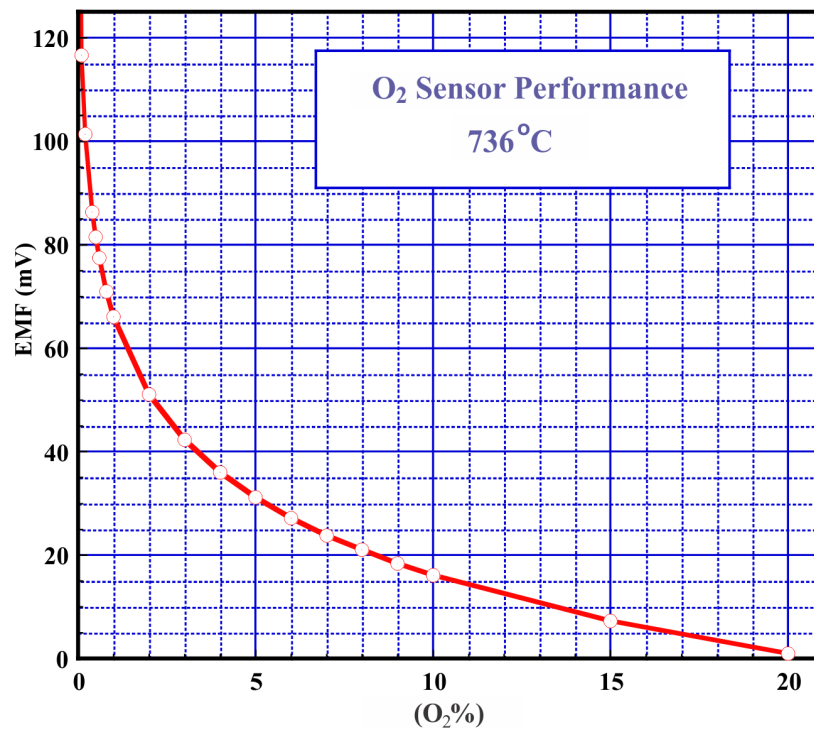
O_2%	EMF (mV)
100	-34
20	1.0
15	7.25
10	16.1
9	18.4
8	21.1

O$_2$%	EMF (mV)
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

5.2 General

⚠️ **WARNING**

ELECTRIC SHOCK

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

Consider the following equipment conditions, features, and requirements when troubleshooting a problem.

5.2.1 Grounding

It is essential that adequate grounding precautions are taken 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% effective grounding and the total elimination of ground loops.

5.2.2 Electrical noise

The Rosemount Xi has been designed 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.

5.2.3 Electrostatic discharge

Electrostatic discharge can damage the ICs used in the electronics. Before removing or handling the circuit boards, ensure you are at ground potential.

5.3 Alarm indications

The first indication of a problem at the O_2 measuring system usually comes from the operators running the process. Critical alarms that render the O_2 measurement unusable will force the 4-20 mA analog output signal representing O_2 to go to a default condition, as follows:

4-20 mA signal alarm level	Transmitter condition
0 mA	Transmitter unpowered or completely failed
3.5 mA	Critical alarm - transmitter reading unusable (factory default)
3.8 mA	Reading under range (Example - you set range to 2-10%. Current reading is 1.9%.)
4 to 20 mA	Normal operation
20.5 mA	Reading over range (Example - range is 0-10%. Current reading is 12%.)
>21 mA	Critical alarm - transmitter reading is unusable (you can choose this alarm level instead of the factory default level of 3.5 to 3.6 mA).

NOTICE

To ensure correct operation, you should make sure that the Digital Control System is configured to interpret these signal levels correctly.

Once an alarm condition is identified, the Rosemount Xi offers a number of diagnostics to interprest the specific alarm.

Alarm indications are available via the optional Rosemount 6888Xi or the Field 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.

5.4　Identifying and correcting fault indications

There are two types of alarms: recoverable and non-recoverable. If an existing alarm is recoverable, the alarm-active indication disappears when the alarm condition no longer exists. If an alarm is not recoverable, the alarm indication continues to be displayed after the cause of the alarm condition is corrected. AC power to the transmitter must be cycled to clear a non-recoverable alarm.

Alarm messages are displayed on the Rosemount 910Xi display window when the alarm status display is accessed via the Rosemount 910Xi menu. A listing of the alarm/fault messages and the related fault status descriptions are shown in Table 5-1.

Fault conditions that give no fault indication and that allow the probe to pass calibration are listed and discussed after Table 5-1.

Table 5-1: Diagnostic/Unit Alarm Fault Definitions

Message	Status	Alert	Self clearing	Rail A out
NV Memory Fail	A checksum error was detected in the nonvolatile memory configuration data when the unit was turned on.	Failed	No	Yes
Factory Mode	On Rosemount Xi box I/O board, SW4, position 1 is set on *ON*. On transmitter electronics board, SW1, position 1 is set to *ON*. This setting should only be used in the factory.		No	
Board Temp High	The transmitter electronic board reading is above 259 °F (126 °C) or the Rosemount Xi unit I/O board temperature reading is above 187 °F (86 °C).	Failed	No	Yes
O2 Htr Ramp Rate	The O_2 sensor heater ramp rate is greater than the max allowed ramp rate, indicating a run away heater condition.		No	
O2 Sensor Open	The cell impedance voltage is reading less than -1.1 Vdc, indicating the O_2 sensor wires may be disconnected or the O_2 sensor junction may be open.	Maint	Yes	Yes
O2 TC Open	The O_2 cell heater thermocouple voltage is reading more than the hardware configured threshold voltage. This indicates the thermocouple wires may be disconnected of the thermocouple junction may be open.	Maint	Yes	Yes
O2 Temp Low	The heater temperature is below the minimum temperature. The predefined low temperature threshold is 1339 °F (726 °C).	Maint	Yes	Yes
O2 Temp High	The heater temperature is above the defined temperature threshold. The high temperature threshold is defined by the *High Alarm SP* parameter. The default value is 1382 °F (750 °C).	Maint	Yes	
O2 T/C Shorted	The O_2 sensor heater temperature thermocouple voltage is shorted.	Maint	Yes	Yes

Table 5-1: Diagnostic/Unit Alarm Fault Definitions *(continued)*

Message	Status	Alert	Self clearing	Rail A out
O2 T/C Reversed	The O_2 sensor heater temperature thermocouple voltage is reading a negative voltage, indicating the thermocouple wire connections may be reversed.	Maint	Yes	Yes
O2 Htr Failure	The O_2 sensor heater temperature is not responding to the controller and can't reach final temperature set by the device, indicating the O_2 heater may have failed.		Yes	
No Flame	The Flame Status Relay Input is set to the *OFF* state, indicating that it is not safe to operate the O_2 heater and the heater should be turned off.		Yes	
Xmtr Disconnect	Communication failures detected between transmitter and the I/O board, indicating the transmitter has been disconnected from the I/O board.		Yes	
Cal Recommended	Probe calibration is recommended. The cell impedance is above 100 ohms and has shifted 50 ohms since the last calibration; the accuracy of the O_2 reading may be compromised.		Yes	
Cal Failed	A calibration error occurred during the last calibration. The measured slope or constant is outside the acceptable range. (Slope: 34.5 to 57.5 mv/decade) (Constant ±20 mv)	Maint	Yes	No
Cell Imp High	The O_2 sensor impedance/cell resistance value measurement is greater than 2000 Ohms, indicating the cell may be beyond its useful life.	Maint	Yes	No
CPU Voltage Low	The CPU voltage is less than 2.7 V, indicating the CPU voltage is too low.		Yes	
CPU Voltage High	The CPU voltage is more than 3.3 V, indicating the CPU voltage is too high.		Yes	
Htr Voltage Low	The heater voltage for the O_2 cell heater is below 35 volts.	Adv	Yes	No
Htr Voltage High	The heater voltage for the O_2 cell heater is above 264 volts.		Yes	
Low O2	The O_2 reading is below the *Low O2 Alm SP*.		Yes	

5.5 Calibration passes, but still reads incorrectly

There are a few fault conditions where no alarm indication is present and the probe passes calibration, but the O_2 reading may still be incorrect.

An incorrect flow rate of calibration gases can cause a shifted calibration. If the flow rate of calibration gases is too low, process gases can mix in with the calibration gases, causing a mixture at the cell that is different from what is noted on the calibration gas bottles. Always set the calibration flow rate when a new diffuser is installed and never readjust this

flow rate until another new diffuser is installed. For applications with heavy particulate loading, see Probe passes calibration, O_2 still reads low.

If reference air is not supplied or is improperly supplied, the calibration may read incorrectly.

5.5.1   Probe passes calibration, O_2 still reads high

External reference air leak

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 drawn into the cell area, biasing the O_2 reading upward.

1. Make sure that the calibration gas is capped tightly between calibrations.
2. If autocal is used, make sure the check valve is sealing properly.

Figure 5-2: Probe Leakage Paths
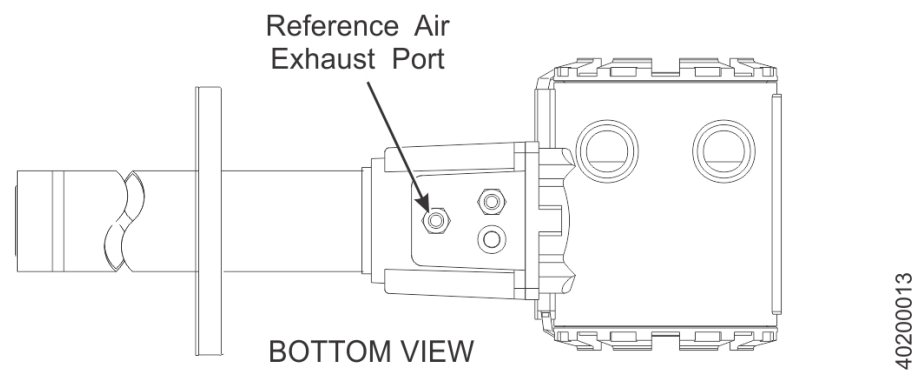
Internal reference air leak

See Figure 5-2. There may be a leak inside the O_2 probe itself, permitting the reference air (20.95% O_2) to mix with the process gases at the cell. To confirm this leak condition, pressurize the inside (reference side) of the probe by plugging the reference air exhaust port with your finger for one minute. (The conduit ports where the signal and power wires pass may also need to be sealed.) The O_2 reading should decrease slightly. If the O_2 reading increases during this test, there is a leak inside the probe.

1. Acid condensation inside the probe can degrade the hose that carries the cal gas to the cell. Inspect this hose. Dislodging or improper installation of the cal gas or reference air hose can cause a leakage path.
2. The sensing cell is fastened to the end of the probe tube and uses a corrugated washer to separate the process gases from the ambient reference air. The corrugated washer may be damaged by corrosion. Discard used washer.

NOTICE
Always install a new corrugated washer whenever you remove the sensing cell from the probe.

5.5.2 Probe passes calibration, O_2 still reads low

The diffusion element at the end of the probe is a passive filter. It plugs very slowly, because 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, recovery boilers, etc.) this diffusion element will eventually plug.

NOTICE
It is important not to pressurize the sensing cell during calibrations by flowing excessive cal gas against a plugged diffuser. Always use a two-stage regulator for setting calibration gas pressure. Calibration flow rates should be set only when a new diffuser is installed. As the diffuser plugs, do not adjust the flow rates upward.

5.5.3 How do I detect a plugged diffuser?

The O_2 cell's speed of response will degrade. The O_2 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 to correct for a plugged diffuser. 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 a calibration record to record and track calibration response times.

5.5.4 Can I 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 3%, and the first calibration gas is 8%. Adjust the flow of cal gas downward until the reading begins to migrate from 8% to lower values, indicating that the process gases are now mixing with the calibration gases.

Adjust the flow rate back up until this mixing is just eliminated. Calibrate at this flow rate. Replace the diffuser at the first opportunity.

⚠ **WARNING**
ELECTRIC SHOCK
Install all protective equipment covers and safety ground leads after troubleshooting. Failure to install covers and ground leads could result in serious injury or death.

6   Maintenance and service

6.1   Overview

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

⚠ WARNING

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

6.2   Maintenance intervals

The maintenance interval required is quite variable, depending on the type of service the analyzer is placed into. The zirconium oxide sensing cell is non-depleting and has no specific shelf life or a defined life in flue gas operation. The cell of a probe that is mounted inside a boiler that is burning natural gas may shift very little over several years. Acidic compounds are the main aggressors to the sensing cell, typically SO_2 resulting from sulfur contained in coal and heavy oil fuels and also HCl from the combustion of plastics in municipal incinerators and in industrial thermal oxidizers. Sensing cells may experience significant degradation and signal shift in this type of service, particularly if the operating levels of O_2 are very low (below 1% O_2).

A calibration check is generally recommended on a quarterly basis (every 3 months) by flowing bottled gas to the probe. (Make sure that the operations personnel are notified when doing this and also make sure that the O_2 control loop is placed in manual mode). If the probe readings vary significantly from the bottle values, then a formal calibration should be conducted as noted in Startup and operation.

The Rosemount Xi offers a *calibration recommended* diagnostic that indicates when the probe needs to be calibrated.

Combustion processes that have a high level of ash or other particulate content will cause the diffusion element on the end of the probe to plug off. A badly plugged diffuser causes a slower speed of response to changing O_2 levels in the process. This can usually be seen on the recorded trends in the control room.

When performing a calibration check or actual calibration, the calibration flow meter may read lower if the diffuser is badly plugged. (Never increase the flow rate back up, however, as this can cause a shifted calibration. Adjust the calibration flow rate only when a new diffuser is installed). Always record the response time back to the process after the calibration gases are removed.

During plant outages, conduct a visual inspection of the probe, paying particular attention to condensed components. To reduce or eliminate condensation, insulate the probe installation, including the probe mount, flange, and dual blue housings.

6.3   Calibration

The Rosemount Xi can calibrate an O_2 probe manually through the front panel display or via a handheldField Communicator or automatically through the SPS 4001B Single Probe Autocalibration Sequencer.

6.3.1   Automatic calibration

The Rosemount Xi can be used with the SPS 4001B in order to perform an auto/semi-automatic calibration. Refer to the SPS 4001B Instruction Manual for further details on how to configure and perform an automatic manual calibration.

6.3.2   Manual calibration

Refer to Calibration - general to perform a manual calibration.

6.4   Replacement parts

Refer to Replacement parts for individual replacement parts and part replacement kits. Part replacement kits are available for each of the components discussed in this section.

6.5   Rosemount Xi components replacement

Each of the following procedures details how to replace a specific component of the Rosemount Xi. Most of these procedures include component setup instructions that must be performed before returning the related O_2 probe to service. Refer to Figure 6-1 and Figure 6-2 for illustrations of the Rosemount Xi components.
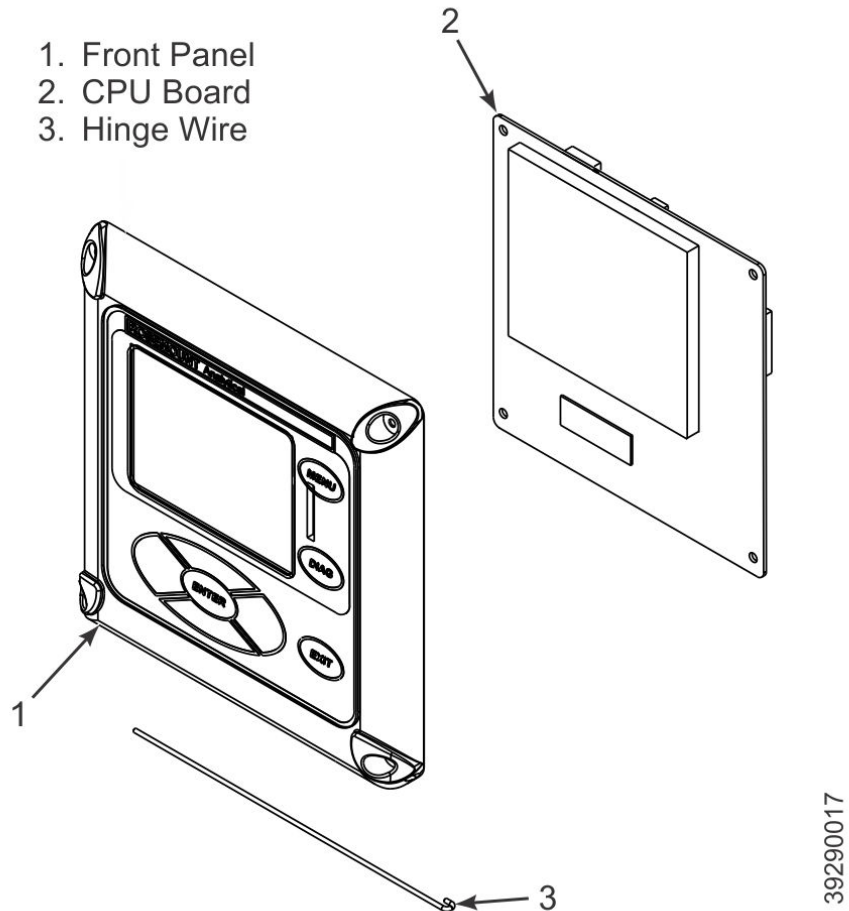
Component replacement kits are available for each of the components replaced in this repair section. Refer to Replacement parts for kit part numbers.

Figure 6-1: Rosemount Xi components

1. Enclosure
2. Gasket
3. I/O Board
4. Relay Board
5. Ribbon Cable, 10 Pin
6. Cover Assembly
7. Ribbon Cable, 14 Pin
8. Bumper, Front Cover
9. Bracket, Power Supply
10. Power Supply Board
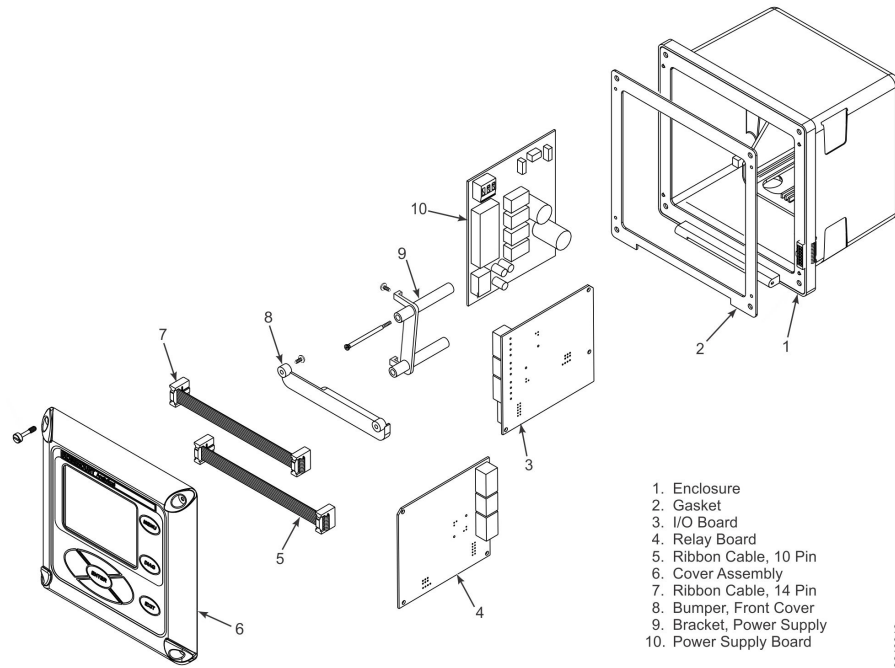
Figure 6-2: Xi front panel components

1. Front Panel
2. CPU Board
3. Hinge Wire

6.5.1   I/O board replacement

Use the procedure that follows to replace and set up the I/O board in the Rosemount Xi.

⚠ **WARNING**
ELECTRIC SHOCK
Disconnect and lock out power before working on any electrical components.

⚠ **CAUTION**
The I/O board is shipped from the factory without any of the enhanced software features activated. These features must be activated once the new board has been installed and before the Remote Interface is put into service.

⚠ **CAUTION**

If the existing I/O board has been operated with the Stoichiometric enhanced software feature, this feature must be activated in the new board before the Rosemount Xi Electronics is put back into service. Failure to do so will cause a false analog output signal to the DCS.

1. Loosen the four screws securing the Rosemount Xi cover.

   The screws are captive and do not need to be completely removed.

2. Swing the Rosemount Xi cover down to expose the inner components.

3. Disconnect the 110-pin ribbon cable from the I/O board.

   A new cable is supplied in the replacement kit and should be used if the old one is damaged.

4. Tag and disconnect wiring for Alarm Outputs, Flame Status Input, and/or SPS as applicable.

5. Slide the I/O board part way out of the Rosemount Xi enclosure.

6. Disconnect the 4-position plug for the transmitter probe and output wiring. Remove the I/O board completely from the Rosemount Xi enclosure.

7. See Figure 6-3. Set jumpers JP1, JP2, JP5, JP7, and JP8 to their proper positions using the old I/O board as a guide.

Figure 6-3: I/O board jumper configuration
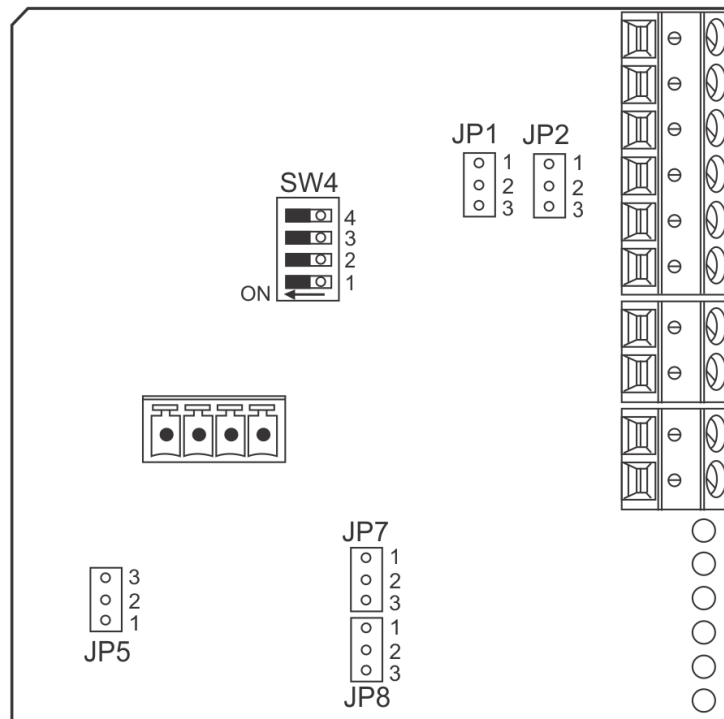
Table 6-1: Configuring Jumpers JP1 through JP8

Configuration	Selection	Jumper	Jumper setting
Flame safety function or Extra alarm output	Flame safety function	JP1 and JP2 (Both must be set the same.)	Pins 1 and 2
	Extra alarm output		Pins 2 and 3
Loop power for 4-20 mA/HART Signal from the Rosemount Xi to Probe	Powered from the Rosemount Xi (most common method)	JP5	Pins 1 and 2
	Powered from external DC supply		Pins 2 and 3
Loop power for 4-20 mA/HART Signal from the Rosemount Xi to DCS	Powered from the Rosemount Xi.	JP7 and JP8 (Both must be set the same.)	Pins 1 and 2
	Powered from DCS.		Pins 2 and 3

Sw4 switch settings (Default = OFF):

    a. Reserved; must remain OFF.

    b. Not used.

    c. Not used.

    d. Flame safety function enable.

8. Set switch SW4 to their proper positions using the old I/O board as a guide.

9. Partially slide the new I/O board into the Rosemount Xi enclosure. Ensure the board is correctly aligned within the slots in the enclosure.

10. Connect the 4-position plug for the transmitter probe and output wiring. Slide the I/O board completely into the Rosemount Xi enclosure.

11. Reinstall wiring for Alarm Outputs, Flame Status Input, and/or SPS as applicable.

See Figure 6-4 for wiring diagrams. See Figure 6-6 for I/O board positions in the Rosemount Xi enclosure.
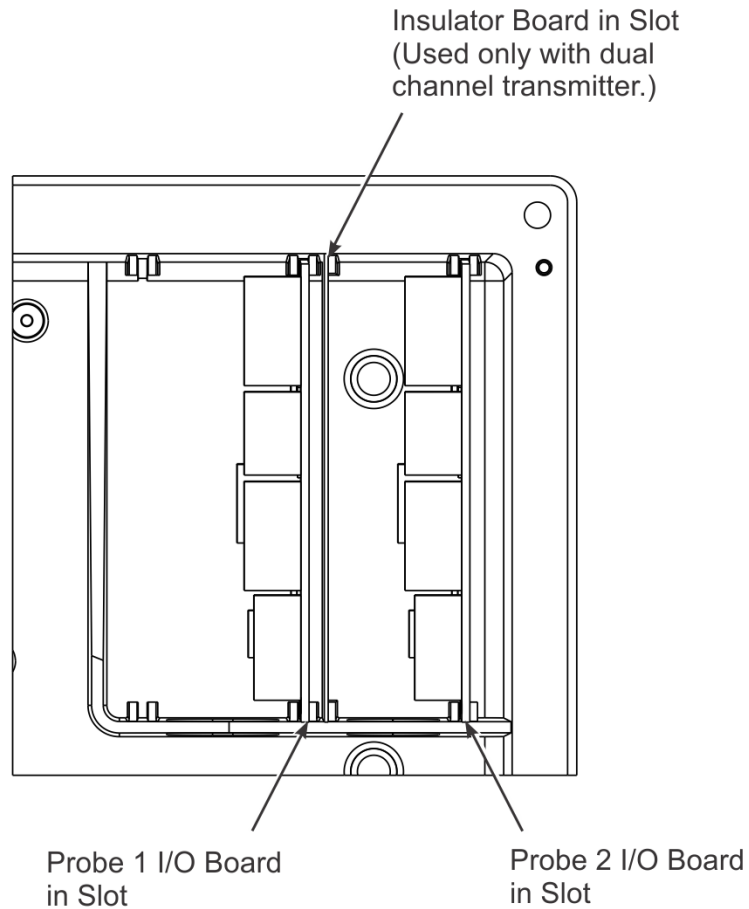
Figure 6-4: Signal connections at I/O board: outer box
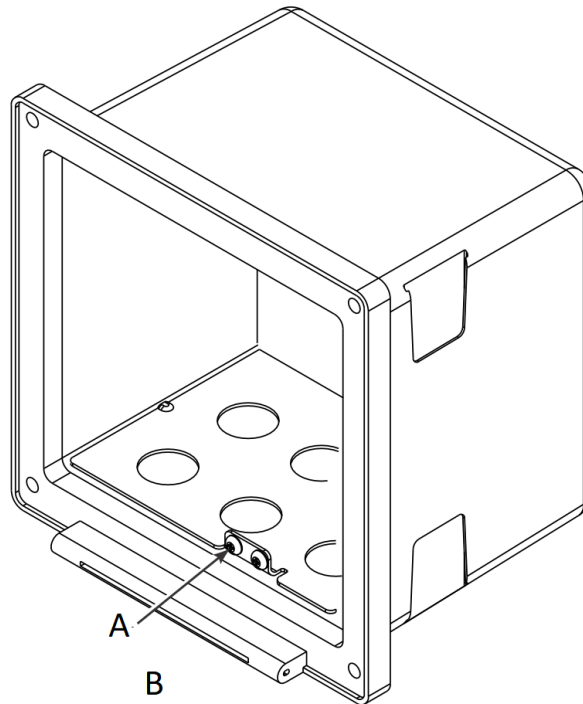
A. Shield Termination
B. Rosemount Xi Enclosure

Figure 6-5: Signal connections at I/O board: Internal Settings
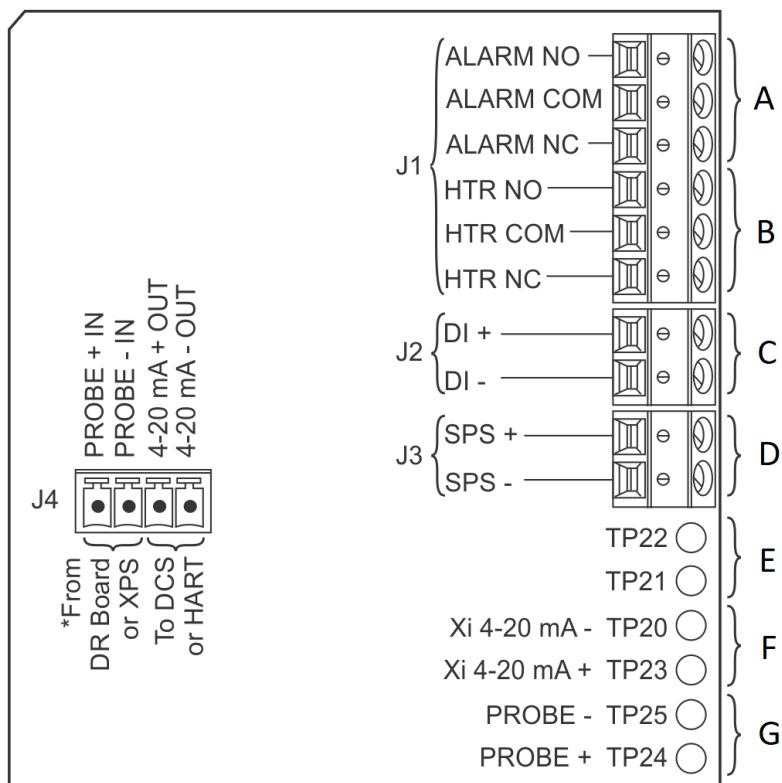
A. To Alarm 1 Indicator
B. To Heater Relay or Alarm 2 Indicator
C. Flame Status input
D. To SPS
E. To Filed Communicator
F. Rosemount Xi Output to Ammeter (4-20mA Check
G. Probe Output to Voltmeter (24 VDC Loop)

Figure 6-6: I/O board positions in the enclosure

Insulator Board in Slot
(Used only with dual
channel transmitter.)

Probe 1 I/O Board
in Slot

Probe 2 I/O Board
in Slot

39410035

12. Connect the ribbon cable to the I/O board.

   A new cable is supplied and should be used if the old one is damaged.

13. Swing the Rosemount Xi cover up in place and tighten the four screws.

14. Prior to operating the O_2 probe and the Rosemount Xi, all optional software enhancements (previously enabled or not) must be enabled.

   Notify Rosemount and reference the following part numbers to enable the software related options.

Part number	Software option
6A00269G01	Enhanced software option upgrade, stoichiometric function
6A00269G02	Enhanced software option upgrade, programmable reference function
6A00269G03	Enhanced software option upgrade, 850 °C process function

NOTICE

For enhanced software upgrades or to enable optional software features previously used in your Rosemount Xi configuration, contact Rosemount at 1-800-433-6076.

15. Recalibrate the O_2 probe according to the applicable calibration instructions in Startup and operation.

6.5.2   Power supply board replacement

Use the procedure that follows to replace the power supply board in the Rosemount Xi. Use this procedure to replace an original linear power supply board or the current configuration switching power supply board.

⚠ **WARNING**

ELECTRIC SHOCK

Disconnect and lock out power before working on any electrical components.

1. Loosen the four screws securing the Rosemount Xi cover.

   The screws are captive and do not need to be completely removed.

2. Swing the Rosemount Xi cover down to expose the inner components.

3. Refer to the wiring diagram in Figure 6-7. Unplug the AC input wiring plug from the power supply board.

   A new plug is supplied in the replacement kit and should be used if the existing plug is damaged.

Figure 6-7: Power supply board wiring
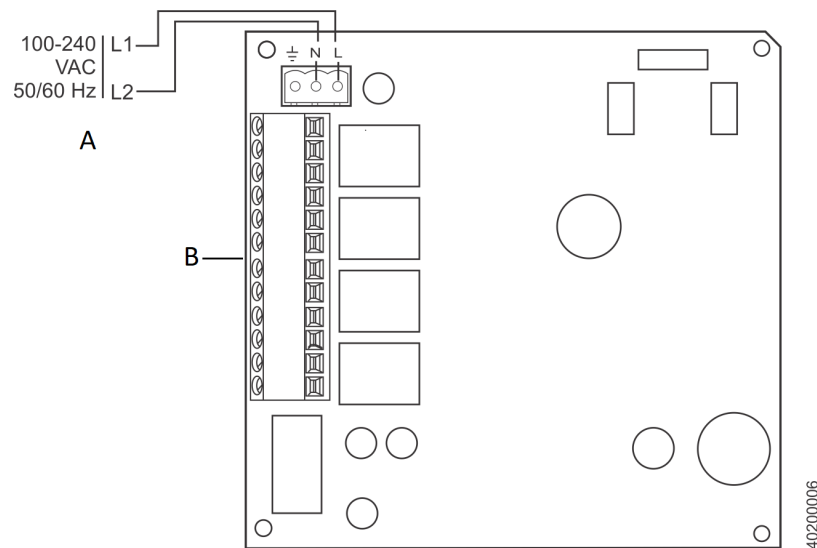
A. *From DR board for Traditional Architecture configurations*
B. *Power Supply Board*

4. Disconnect the 14-pin ribbon cable from the power supply board.

5. Remove the two long screws that secure the bracket (9, Figure 6-1) to the Rosemount Xi enclosure.

6. Hold the AC input wiring to the right and slide the power supply board out of the Rosemount Xi enclosure.

7. Install the new mounting bracket (9, Figure 6-1) on the new power supply board (10, Figure 6-1).

   A new bracket and mounting screws are provided in the replacement kit.

8. Slide the power supply board into the mating slots in the Rosemount Xi enclosure. Make sure the board is correctly aligned in the slots.

9. Install and tighten the bracket mounting screws.

   Two new screws are provided in the replacement kit and should be used if the existing screws are damaged.

10. Connect the ribbon cable to the power supply board.

    A new ribbon cable (7, Figure 6-1) is provided in the replacement kit and should be used if the existing cable is damaged.

11. Connect the AC power plug to the power supply board.

12. Swing the Rosemount Xi cover up and tighten the four mounting screws.

6.5.3 Rosemount Xi front panel replacement

Use the procedure that follows to replace the front panel on the Rosemount Xi. Replacement kits with and without the CPU board are available. Use the instructions that apply to the replacement kit you have.

⚠ WARNING
Disconnect and lock out power before working on any electrical components.

Replacing front panel assembly without CPU board

Complete the following steps to replace the front panel assembly without a CPU board.

1. Loosen the four screws securing the Rosemount Xi cover.

   The screws are captive and do not need to be completely removed.

2. Swing the Rosemount Xi cover down to expose the inner components.

3. Disconnect the 14-pin ribbon cable going to the power supply board.

   A new cable is supplied in the replacement kit and should be used if the old one was damaged.

4. Disconnect the 10-pin ribbon cable(s) going to the I/O board(s).

   One new cable is supplied in the replacement kit and should be used if either of the ribbon cables are damaged.

5. Remove the wire hinge from the right side of the Rosemount Xi cover.

   A paper clip or similar device can be inserted into the hole on the left side of the cover to push the hinge out of the cover. A new hinge pin is supplied in the replacement kit and should be used if the old one is damaged.

6. Position the new front panel assembly in place and reinstall the hinge pin. Ensure the hinge pin is fully seated into the Rosemount Xi cover.

   ### ⚠ CAUTION
   EQUIPMENT DAMAGE
   The new front panel assembly may be supplied with protective clear membranes over the interior and exterior of the window. Failure to remove the exterior protective membrane may cause the display to be distorted. The membrane may be difficult or impossible to remove after extended use at elevated temperatures.

7. The keypad window on the new front panel may be supplied with interior and exterior protective membranes. Remove the protective membranes prior to final assembly and use of the Rosemount Xi enclosure.

8. Reconnect the 10-pin ribbon cable from the I/O board.

9. Reconnect the 14-pin ribbon cable from the power supply board.

10. Swing the Rosemount Xi cover up in place and tighten the four screws.

11. If necessary, configure the appearance of the main display.

    Refer to Configure.

Replacing front panel assembly with CPU board

Complete the following steps to replace the front panel assembly with a CPU board.

1. Loosen the four screws securing the Rosemount Xi cover.

   The screws are captive and do not need to be completely removed.

2. Swing the Rosemount Xi cover down to expose the inner components.

3. Disconnect the 14-pin ribbon cable going to the power supply board.

   A new cable is supplied in the replacement kit and should be used if the old one was damaged.

4. Disconnect the 10-pin ribbon cable(s) going to the I/O board(s).

   One new cable is supplied in the replacement kit and should be used if either of the ribbon cables are damaged.

5. Remove the wire hinge from the right side of the Rosemount Xi cover.

   A paper clip or similar device can be inserted into the hole on the left side of the cover to push the hinge out of the cover. A new hinge pin is supplied in the replacement kit and should be used if the old one is damaged.

6. Place the front panel assembly on the bench. Remove the four screws securing the CPU board to the front cover.

   NOTICE

   Prior to disassembly, observe the position of the plastic bumper with rubber insert as it is installed over the CPU board. The two longer screws are used at the top edge of the CPU board passing through the bumper.

7. Lift the CPU board off of the front cover using care not to damage the board.

8. Disconnect the keypad overlay ribbon from the CPU board. Discard the used front cover with the keypad overlay attached.

   ⚠ **CAUTION**

   EQUIPMENT DAMAGE

   The new front panel assembly may be supplied with protective clear membranes over the interior and exterior of the window. Failure to remove the exterior protective membrane may cause the display to be distorted. The membrane may be difficult or impossible to remove after extended use at elevated temperatures.

9. The keypad window on the new front panel may be supplied with interior and exterior protective membranes. Remove the protective membranes prior to final assembly and use of the Rosemount Xi enclosure.

10. Clean the inside of the keypad overlay window and LCD display window to remove fingerprints and accumulated dust.

    Use only a soft cloth; do not use any detergents or chemicals.

11. Connect the keypad overlay ribbon cable on the new front panel assembly to the CPU board.

    Use care not to damage the board.

12. Position the CPU board in place in the front panel assembly.

13. Reinstall the bumper and 4 screws to secure the CPU board in place.

    The two longer screws are used with the plastic bumper on the top edge of the CPU board.

14. Position the front panel assembly and reinstall the hinge pin. Ensure the hinge pin is fully seated into the Rosemount Xi cover.

15. Reconnect the 10-pin ribbon cable from the I/O board.

16. Reconnect the 14-pin ribbon cable from the power supply board.

17. Swing the Rosemount Xi cover up in place and tighten the four screws.

18. If necessary, configure the appearance of the main display.

    Refer to Configure.

6.5.4 DR board replacement

Use the procedure that follows to replace the DR board in the Rosemount Xi that is connected to a direct replacement probe.

⚠️ **WARNING**

ELECTRIC SHOCK
Disconnect and lock out power before working on any electrical components.

1. Loosen the four screws securing the Rosemount Xi cover.

   The screws are captive and do not need to be completely removed.

2. Swing the Rosemount Xi cover down to expose the inner components.

3. Slide the DR board part way out of the Rossemount Xi enclosure.

4. Unplug the wiring harness plug from the connector J8 located on the bottom, left-hand side of the board.
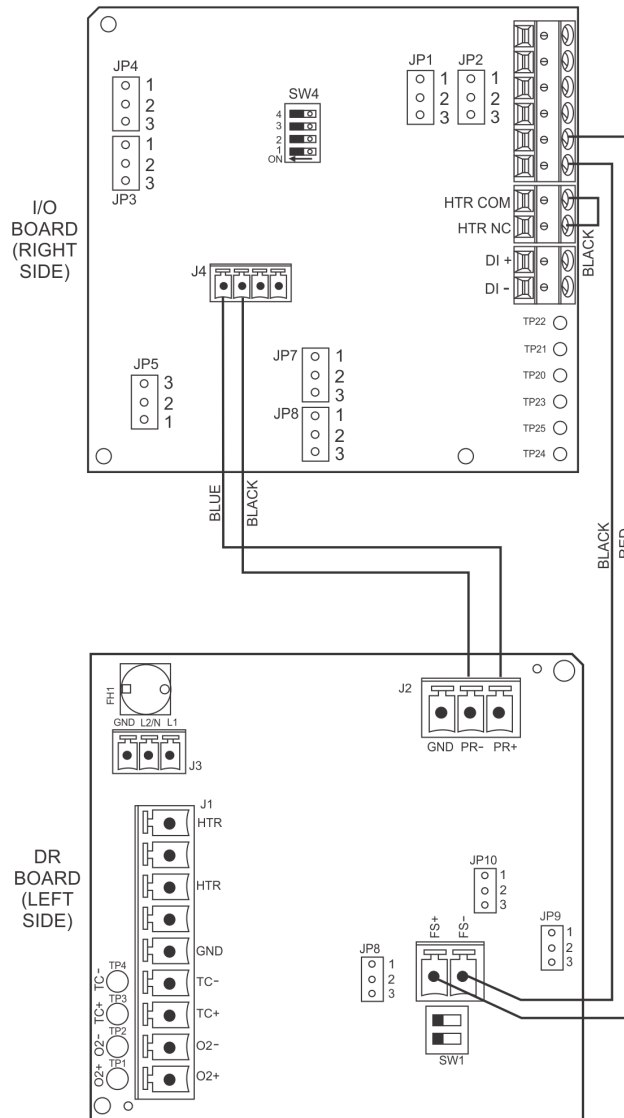
   Refer to Figure 6-8.

Figure 6-8: DR board wiring, right-hand side
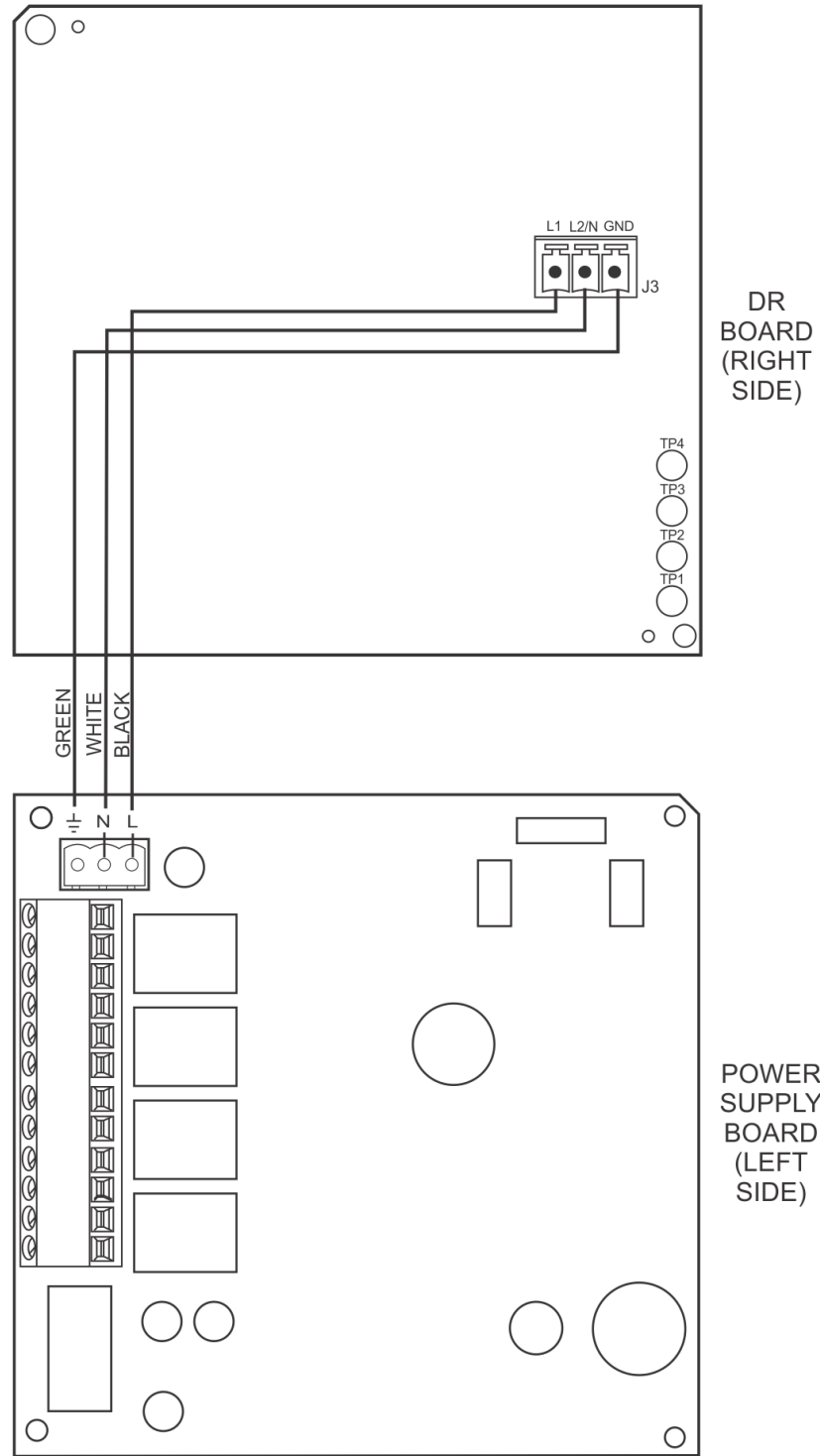
5. Unplug the wiring harness plugs from the connectors J1, J2, and J3 located on the top, right-hand side of the board. Refer to Figure 6-9.

Figure 6-9: DR board wiring, left-hand side

6. Tag and disconnect the wiring to connector J4.

7. Remove the DR board from the Rosemount Xi enclosure.

8. Partially slide the new DR board into the mating slots in the Rosemount Xi enclosure. Make sure the board is correctly aligned in the slots.

9. Refer to the wiring diagram in Figure 6-8. Reconnect the wiring to connector J4.

10. Connect the wiring harness plugs to connectors J1, J2, J3, and J8.

11. Slide the DR board completely into the Xi enclosure.

12. Swing the Rosemount Xi cover up and tighten the four mounting screws.

7 Replacement parts

7.1 Rosemount Xi electronics

Table 7-1: Replacement parts for Rosemount Xi

Part number	Description
6A00265G01	Kit, power supply board (obsolete - replaced by 6A00329G01)
6A00329G01	Kit, switching power supply board
6A00266G01	Kit, I/O board[1]
6A00267G01	Kit, AC relay board
6A00328G01	Kit, DR board
6A00268G01	Kit, front panel with overlay and CPU board
6A00268G02	Kit, front panel with overlay
6A00269G01	Enhanced software option upgrade, Stoichiometric function
6A00269G02	Enhanced software option upgrade, programmable reference function
6A00269G03	Enhanced software option upgrade, 800 °C process function
6A00237H24	Kit, pipe and wall mount
6A00237H33	Kit, panel mount
6A00243G01	Ribbon cable, 10 pin (CPU board to I/O board)
6A00242G01	Ribbon cable, 14 pin (CPU board to power supply board)
6A00291H01	Insulator
6A00381G01	Kit, hole plug and gland
6A00285H01	Gasket, panel
6A00287H01	Gasket, cover

(1) If the existing I/O board has been operated with the Stoichiometric enhanced software feature, this feature must be activated in the new board before the Rosemount Xi is put back into service. Failure to do so will cause a false analog output signal to the DCS.

7.2 Calibration components

**Table 7-2: Replacement parts for calibration components**

Part number	Description
1A99119G01	Calibration gas bottles -0.4% and 8% O_2, balance nitrogen - 550 liters each[1]
1A99119G02	Two flow regulators (for calibration gas bottles)
1A99119G03	Bottle rack

(1)   Calibration gas bottles cannot be shipped via airfreight.

8 Optional accessories

8.1 HART handheld Field Communicator

Figure 8-1: Field Communicator
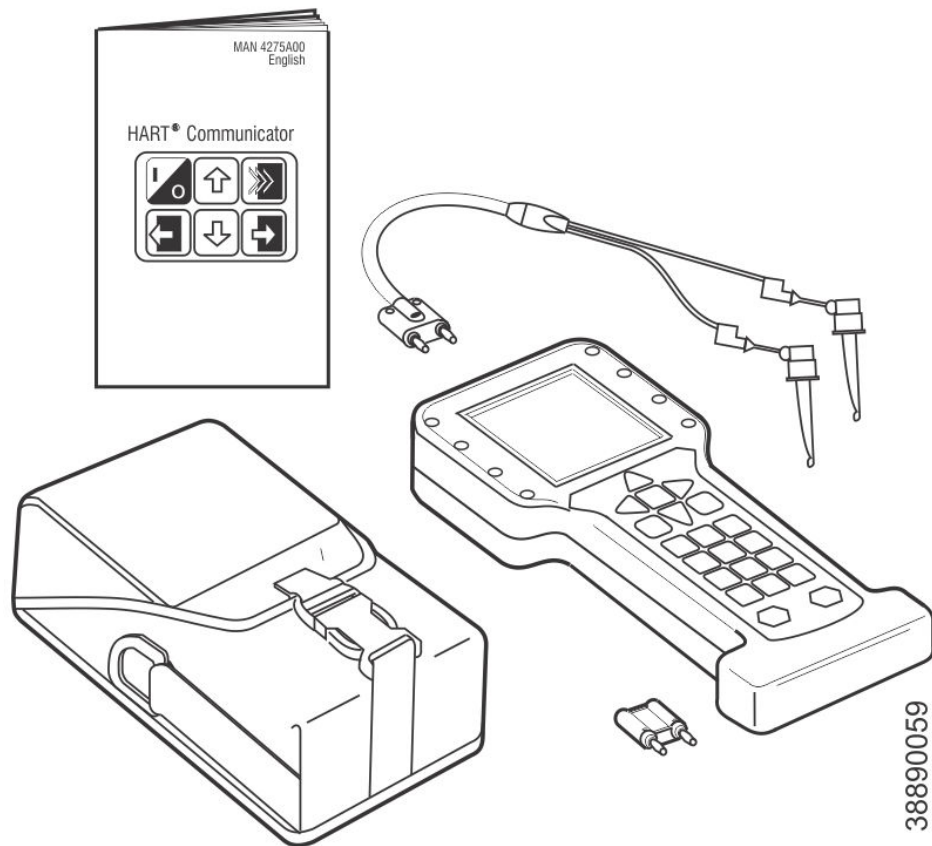
The Field Communicator is an interface device that provides a common communication link to HART-compatible instrument, such as the Rosemount Xi. HART communications protocol permits all the information available from the Rosemount Xi electronics to be transmitted over standard 4-20 mA signal wires. By attaching the Field Communicator at a termination point along the 4-20 mA signal line, you can diagnose problems and configure and calibrate the Rosemount Xi as if you were standing in front of the instrument.

For more information, call Rosemount at 1-800-999-9307.

8.2 Asset Management Solutions (AMS)

Asset Management Solutions (AMS) software works in conjunction with the HART® communication protocol and offers the capability to communicate with all HART plant devices from a single computer terminal.

For more information, call Rosemount at 1-800-999-9307.

8.3 By-Pass Packages

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.

Inconel steel tubes provide effective resistance to corrosion, and the package uses no moving parts, air pumps, or other components common to other sampling systems.

For more information, call Rosemount at 1-800-999-9307.

Figure 8-2: By-Pass Packages
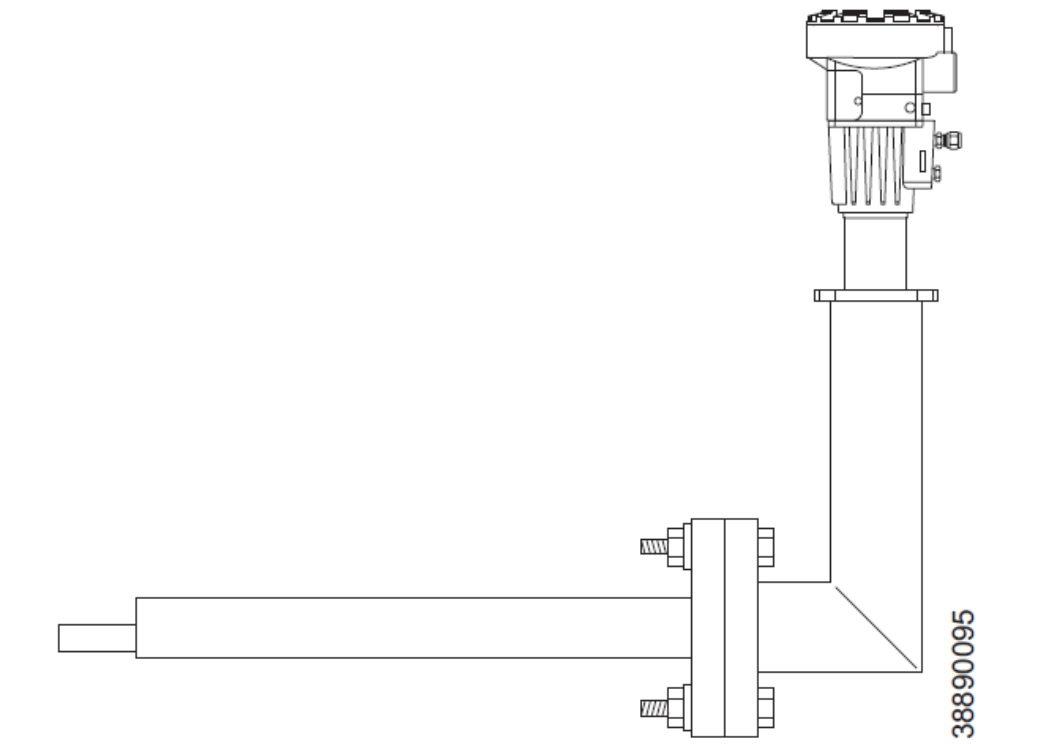
8.4 Rosemount™ SPS 4001B Single Probe Autocalibration Sequencer

Emerson specifically designed the Rosemount SPS 4001B Single Probe Autocalibration Sequencer to perform automatic or on-demand calculations.

The Rosemount SPS 4001B is fully enclosed in a NEMA cabinet suitable for wall-mounting. This cabinet provides added protection against dust and minor impacts.

The Rosemount SPS 4001B works in conjunction with the Rosemount , eliminating out-of-calibration occurrences and the need to send a technician to the installation site.

For more information, call Rosemount at 1-800-999-9307.

8.5   O$_2$ calibration gas

Emerson has carefully designed the O$_2$ calibration gas and service kits to provide a more convenient and fully portable means of testing, calibrating, and servicing Rosemount™'s oxygen analyzers.

Figure 8-3: Calibration Gas Bottles
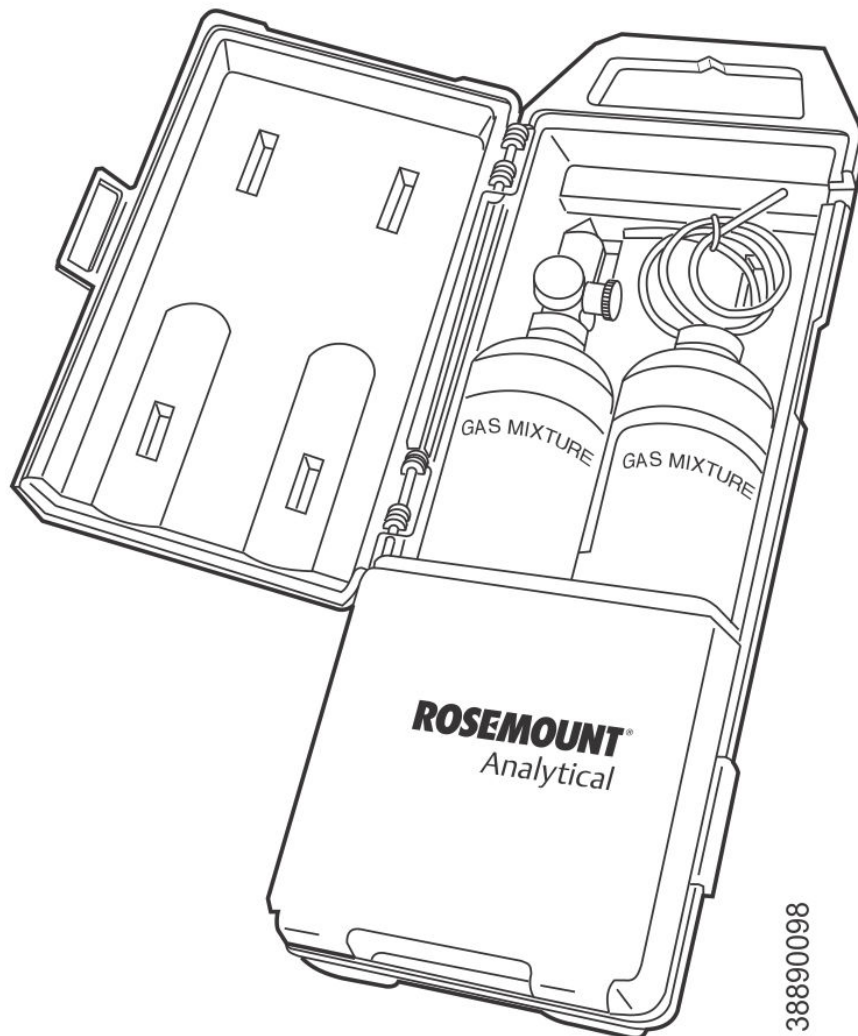
These lightweight, disposable gas cylinders eliminate the need to rent gas bottles.

For more information, call Rosemount at 1-800-999-9307.

A Service support

To expedite the return process outside of the United States, contact the nearest Rosemount™ representative.

Within the United States, call the Emerson™ Instrument and Valves Response Center using the 1-800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers and will provide a Return of Material Authorization (RMA) number. The center will also ask for the process material to which the product was last exposed.

For more information: **www.emerson.com**

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