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Rosemount™ CX2100 In-Situ Oxygen Analyzer

ROSEMOUNT™

EMERSON™

Safety messages

⚠ WARNING

Follow installation guidelines

Failure to follow these installation guidelines could result in death or serious injury. If the equipment is used in a manner not specified by the manufacturer, the protection it provides against hazards may be impaired.

- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Ensure only qualified personnel perform the installation, operation, and maintenance of the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Follow appropriate local and national codes.
- If you do not understand any of the instructions, contact your local Emerson representative for clarification.

⚠ WARNING

Explosions

Do not open when an explosive atmosphere may be present.

⚠ WARNING

Electrical shock

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

- Do not open the junction box cover or display cover while energized.
- Install all protective covers, clamps, and ground leads after installation.
- Ensure that power terminals are covered by a plastic door and HART® terminals are accessible.

⚠ WARNING

Connect all devices to the proper electrical and pressure sources.

⚠ WARNING

Physical access

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

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

⚠ CAUTION

For Rosemount CX2100TR Remote Electronics Transmitter, only use cables and certified cable glands rated ≥ 185 °F (85 °C).

⚠ CAUTION

Tampering or unauthorized substitution of parts and procedures can affect the performance and cause unsafe operation of your process

Use only factory documented components for repair.

NOTICE

Handheld communication devices must be upgraded to System Software 2.0 with graphic license for operation with the analyzer. The AMS software must be upgraded to AMS 8.0 or above.

Contents

1 Introduction

1.1 Overview

The Rosemount CX2100 In-Situ Oxygen Analyzer is intended for measuring flue gases resulting from any combustion process.

This product uses an in-situ sensor (meaning the sensor is placed at the end of the probe and the probe extends directly into the flue gas duct or stack at a given length). The sensor generates its own millivolt signal based on the difference between a reference gas (ambient or instrument air - always 20.95 percent O_2) and the flue gases being measured.

You can configure the probe as a stand-alone analyzer, using integral local operator interface (LOI) or HART® communication as a method of accessing the electronics for setup, operation, and diagnostics. The CX2100 is available as an integral electronics probe or as a remote configuration consisting of a junction box probe and a set of remote electronics connected to the probe via a 7-conductor remote cable. See Electrical installation for wiring diagrams for these configurations.

1.2 System description

Emerson has designed the Rosemount CX2100 In-Situ Oxygen Analyzer to measure excess oxygen concentrations in flue gas temperatures up to +2100 °F (+1427 °C) with optional accessories. You can make electrical, power, and communication connections through either the ½-inch NPT or M20 ports in the electronics transmitter or junction box enclosure, depending on the analyzer configuration. You can order fittings and cables as part of the CX2100 model. Depending on product approval codes, follow National Electrical Code (NEC), International Electrotechnical Commission (IEC), and/or other applicable national or local codes.

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

EMF = KT log10 (P1/P2) + C

Where:

1. *P2* is the partial pressure of the oxygen in the measured gas on one side of the cell.
2. *P1* is the partial pressure of the oxygen in the reference air on the opposite side of the cell.
3. T is the cell temperature.
4. C is the cell constant.
5. K is an arithmetic constant.

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

When the cell is at operating temperature and there are unequal oxygen concentrations across the cell, oxygen ions will travel from the high oxygen partial pressure side to the low oxygen partial pressure side of the cell.

For a new cell, the resulting logarithmic output voltage is approximately 50 mV per decade.

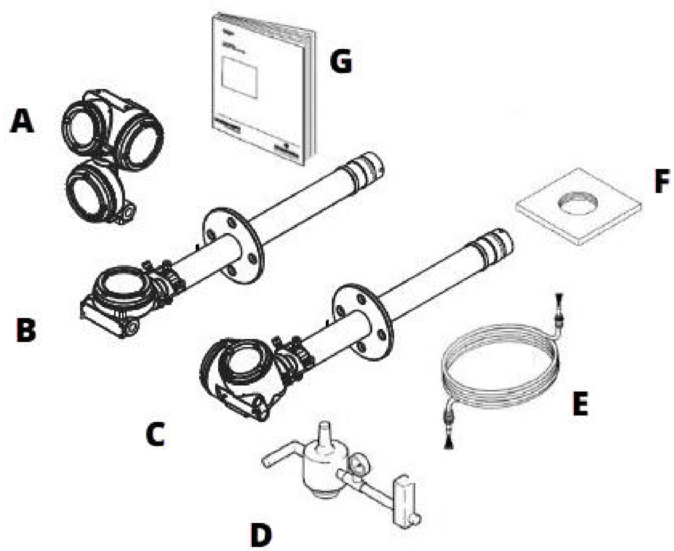
The output is proportional to the inverse logarithm of the oxygen concentration. Therefore, the output signal increases as the oxygen concentration of the sample gas decreases. This characteristic enables the analyzer to provide exceptional sensitivity at low oxygen concentrations.

The oxygen analyzer measures net or excess oxygen concentration in the presence of all the products of combustion, including water vapor. Therefore, it may be considered analysis on a "wet" basis. In comparison with other methods, such as the portable apparatus, which provides an analysis on a "dry" gas basis, the "wet" analysis will, in general, indicate a lower percentage of oxygen. The difference will be proportional to the water content of the sample gas.

1.3 Component checklist

A typical Rosemount CX2100 contains the items shown in Figure 1-1. A complete oxygen analyzer system includes some or all of the equipment shown.

Figure 1-1: Typical System Package



A. *CX2100 Remote Electronics (TR)*
B. *CX2100 Direct Replacement (DR) Probe*
C. *CX2100 Integral Electronics (PI) Probe*
D. *Optional reference and calibration gas accessories*
E. *Traditional architecture remote mounting cable*
F. *Optional mounting or adapter plate*
G. *Quick Start Guide*

1.4 System configurations

1.4.1 Rosemount CX2100 Integral Electronics (PI) Probe

The CX2100 Integral Electronics Probe has a quick connect electronics transmitter integral to the probe. The blue electronics housing controls the heater temperature and converts the raw O_2 millivolt signal to a linear 4-20 mA output.

You can run the 4-20 mA signal lines directly to the control room from the analyzer electronics. The blue electronics housing also contains a local operator interface (LOI) that you can use to configure the analyzer and run various tools. As with most other Rosemount analyzers, you can use HART® communications to measure oxygen with a handheld communicator or AMS.

1.4.2 Rosemount CX2100 Direct Replacement (DR) Probe with CX2100 Remote Electronics (TR) Transmitter

In a CX2100 DR Probe, there are no electronics inside the probe head, so the raw sensor signals for the heater thermocouple and zirconium oxide O_2 sensor are sent to a CX2100 TR Remote Electronics Transmitter.

The CX2100 TR Remote Electronics will also directly apply power to the probe heater to maintain the correct sensor temperature. This arrangement calls for a 7-conductor cable to carry this power and the sensor signals. Maximum length for the cable is 300 ft. (91.4 m). The CX2100 DR Probe will also operate with legacy Rosemount 6888 Xi and OXT electronics.

1.4.3 Rosemount 6888 or Oxymitter (OXT) Direct Replacement (DR) Probe with CX2100 Remote Electronics (TR) Transmitter

You can use the CX2100 TR Remote Electronics with legacy 6888 and OXT DR Probes.

Like the CX2100 DR Probe, legacy probes do not have electronics inside the probe housing. The raw sensor signals for the heater thermocouple and zirconium oxide O_2 sensors are sent to the CX2100 TR Remote Electronics. The CX2100 TR also directly applies power to the probe heater to maintain the correct sensor temperature. This arrangement calls for a 7-conductor cable to carry this power and the sensor signals. Maximum length for the cable is 300 ft. (91.4 m).

1.5 Communication options

1.5.1 Data communications

You can configure and diagnostically troubleshoot the Rosemount CX2100 in one of two ways:

1. Using the CX2100 local operator interface (LOI) display allows local communication with the electronics. The CX2100 also offers the following optional features:
    - Fully automatic calibration with the Rosemount SPS4001B accessory.
    - Flame safety interlock.
    - Advanced Features Suite provides the following capabilities:

- — Extended temperature operation [above 700 °C (1292 °F) standard temperature].
- — Stoichiometer feature provides the ability to indicate O_2 deficiency when the combustion process goes into reducing conditions (0 percent O_2).
- — Plugged diffuser diagnostic to detect fouled diffuser.

2. Using the HART® interface, the CX2100'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:
   - Communication device: The communication device requires device driver (DD) software specific to the CX2100.
   - Personal computer (PC): The use of a PC requires AMS software available from Emerson.
   - DeltaV™ and Ovation™ Distributed Control System (DCS) with AMS-inside capability.
3. The CX2100 can also transmit HART information wirelessly via a wireless Emerson THUM™ Adapter. The THUM Adapter threads into the CX2100 conduit port and converts the 4-20 mA 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 the Emerson Wireless THUM Adapter Product Data Sheet.

Note
The AMS software must be upgraded to AMS 8.0 or above.

1.6 Probe options

1.6.1 Diffusion elements

The Rosemount CX2100 is available with one of three diffusion elements fitted to the process end. The basic diffusers provide for a constant outer probe tube diameter the full length of the probe.

When the CX2100 is used with an abrasive shield, the diffuser body has a dust seal, which has a larger diameter with grooves to accept packing material to seal out fly ash.

1.6.2 Snubber diffusion assembly

The standard snubber diffusion assembly (Figure 1-2) is satisfactory for most applications; however, do not use the snubber diffuser in flue gas temperatures above 752 °F (400 °C).

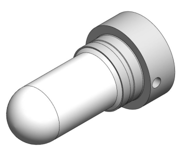
Figure 1-2: Snubber Diffusion Assembly

1.6.3 Ceramic diffusion assembly

The ceramic diffusion assembly (Figure 1-3) is the traditional design for the probe.

Used for over 25 years, the ceramic diffusion assembly provides a greater filter surface area and reduced thermal conductivity which makes the ceramic diffuser preferable for highest temperature applications.

Figure 1-3: Ceramic Diffusion Assembly

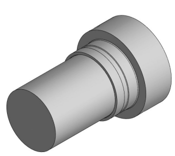


1.6.4 Alloy C-276 diffusion assembly

The alloy C-276 diffusion assembly (Figure 1-4) is typically used in high temperature applications where frequent diffusion element plugging is a problem.

The cup-type diffusion assembly is available with a 40 micron, sintered, alloy C-276 element.

Figure 1-4: Alloy C-276 Cup-Type Diffusion Assembly



2 Installation

2.1 Product safety

⚠ WARNING

Safety instructions

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

⚠ WARNING

Electrical shock

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

Install all protective equipment covers and ground leads after installation.

2.2 System considerations

NOTICE

Plug all unused ports on the Rosemount CX2100 Probe with suitable fittings.

Figure 2-1: Typical System Installation with Remote Electronics

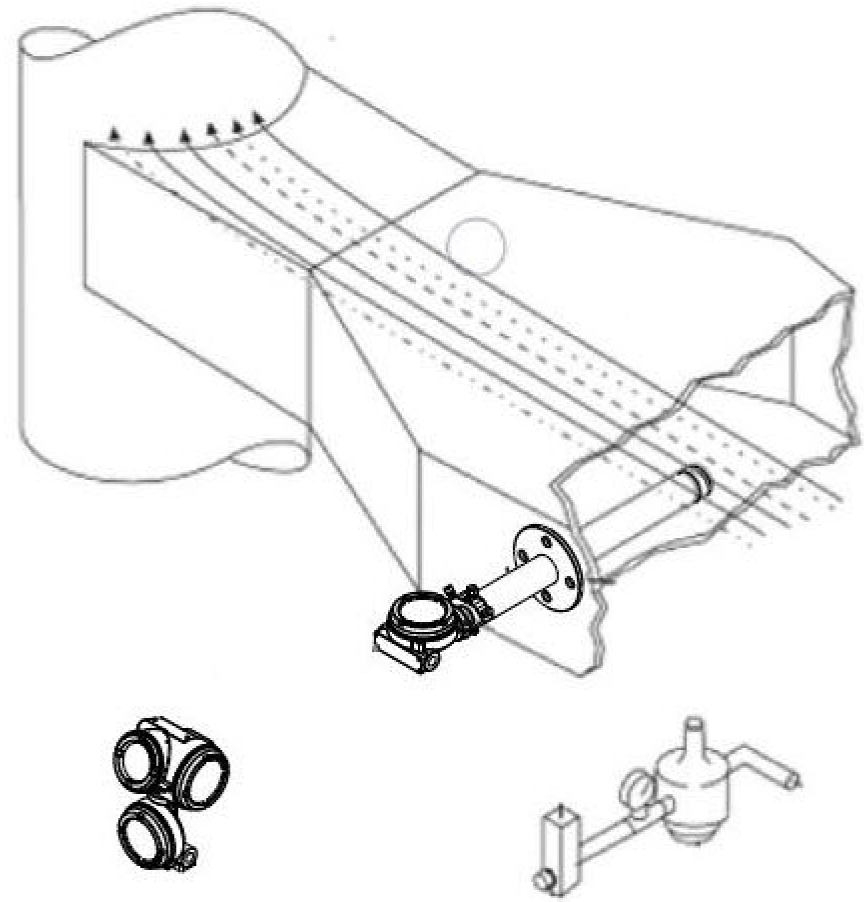
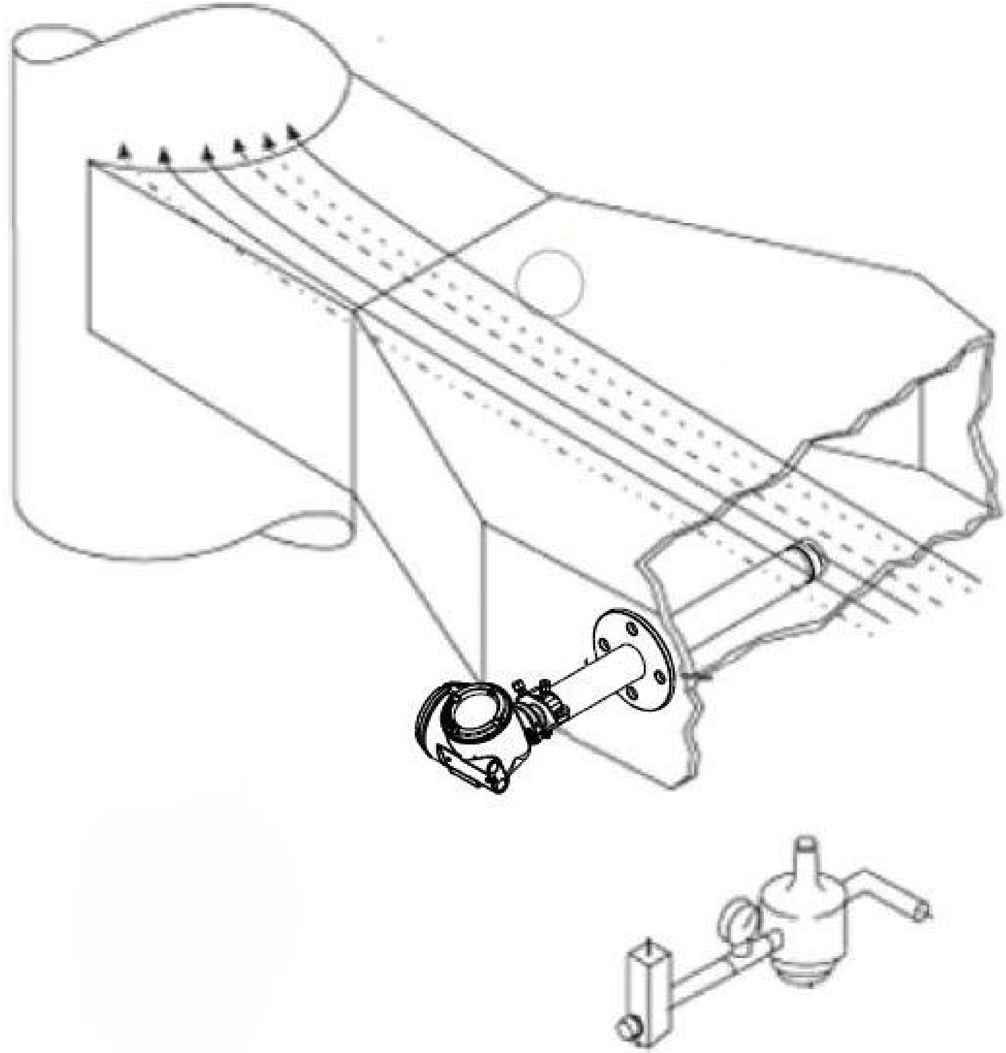


Figure 2-2: Typical System Installation with Integral Electronics



2.3 Mechanical installation

Most combustion processes run only slightly negative or positive in pressure, so that the probe flange is for mechanical mounting only.

The probe is not rated for high pressures. If this is a new installation, Emerson can supply a weld plate for welding to the flat flue gas duct surfaces.

2.3.1 Install Rosemount CX2100-PI Integral Probe or CX2100-DR Direct Replacement Probe

Prerequisites

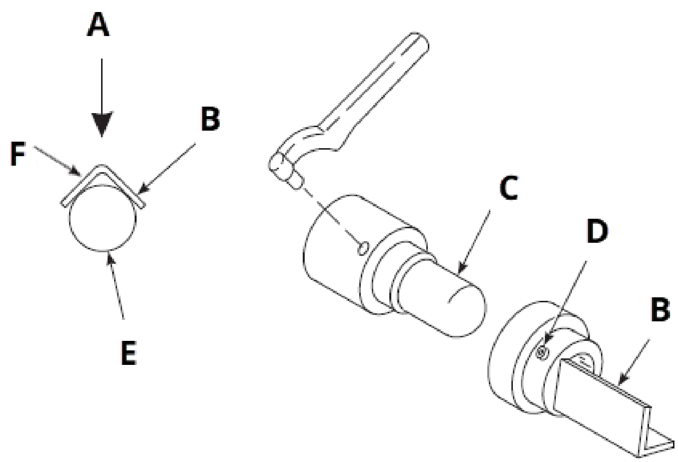
Ensure all components are available to install the probe.

Procedure

1. If using a diffusion element with a vee-deflector, the vee-deflector must be correctly oriented. Before inserting the probe, check the direction of the gas flow in the duct. Orient the vee-deflector so the apex points upstream towards the flow.

   See Figure 2-3.

Figure 2-3: Orienting Optional Vee Deflector



A. Gas flow direction
B. Vee deflector
C. Diffusion element
D. Set screw
E. Filter
F. Apex

   a) Loosen the set screws.

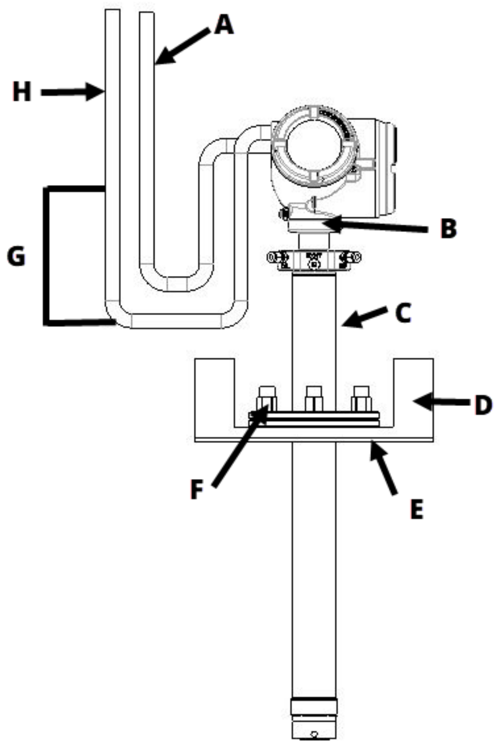
   b) Rotate the vee-deflector to the desired position.

   c) Retighten the set screws.

2. In vertical installations, ensure the system cable drops vertically from the analyzer and the conduit is routed below the level of the analyzer or junction box housing.

   This drip loop, shown in Figure 2-4, minimizes the possibility that moisture will damage the electronics.

Figure 2-4: Drip Loop and Insulation Removal



A. Logic input/output, 4-20 mA signal
B. Clamp screw
C. ***Note***
Replace insulation after installing analyzer.
D. Insulation
E. Stack or duct metal wall
F. Adapter plate
G. Drip loop
H. Line voltage

Note
CX2100PI Integral Analyzer is shown. You may orient the probe in any direction. Emerson does not recommend vertical up orientation due to the possibility of particulate settling on the cell.

3. If using the standard square weld plate, weld or bolt the plate onto the duct.

   The through hole diameter in the stack or duct wall and refractory material must be at least 2.5 in. (63.5 mm).

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

NOTICE

Emerson recommends an abrasive shield for abrasive particulates in the flue gas stream and for longer probes to provide support.

NOTICE

If process temperatures will exceed +392 °F (+200 °C), use anti-seize compound on the stud threads to ease future removal of the analyzer. Refer to the conditions for safe use in the Product certifications section of the *Quick Start Guide* for maximum flange temperature.

5. Insert the probe with a new gasket installed through the opening in the mounting flange and bolt the unit to the flange.

   Take care when inserting a probe with a dust seal. Push probe straight so as to not deform the seal between the O_2 cell and probe.

6. If installing a CX2100 PI Integral Probe, ensure the analyzer is properly earthed by way of both internal and external points.

NOTICE

Uninsulated stacks or ducts may cause ambient temperatures around the electronics to rise, which may cause overheating damage to the electronics.

If you removed duct work insulation for analyzer mounting, replace the insulation afterwards. Ensure the probe installation does not obscure the warnings on the housing covers.

7. If installing a CX2100PI Integral Electronics Probe, position the transmitter to the correct orientation for your process by loosening the clamp and clamp screw. Once the transmitter has been positioned in the correct orientation, tighten the clamp and clamp screw back onto the probe.

⚠ WARNING

The quick connect clamp is part of the enclosures.

To maintain the integrity of the enclosures for hazardous and ordinary locations approvals, the clamp must be installed with the clamp screw at the correct torque per Table 2-1.

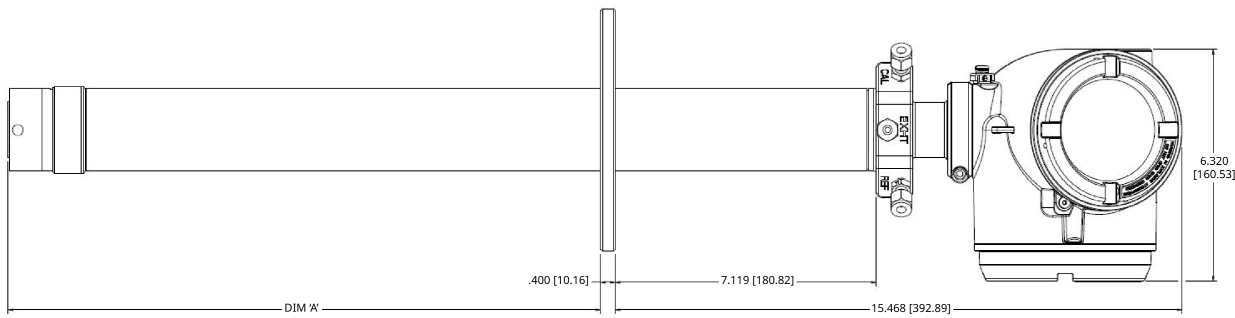
NOTICE

Do not twist the transmitter more than 180 degrees to protect cable assembly.

Table 2-1: Quick Connect Clamp Screw Specifications

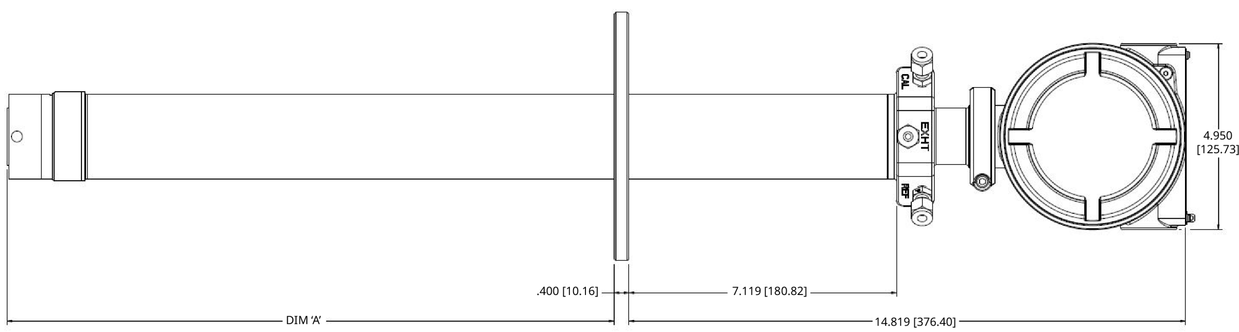
Screw material	Torque	Property class	Screw thread
Stainless steel	31 ± 1 in-lb	A4-70 SHCS	M5 x 0.8

Figure 2-5: CX2100-PI Integral Analyzer with Ordinary Locations Approved Snubber Diffuser



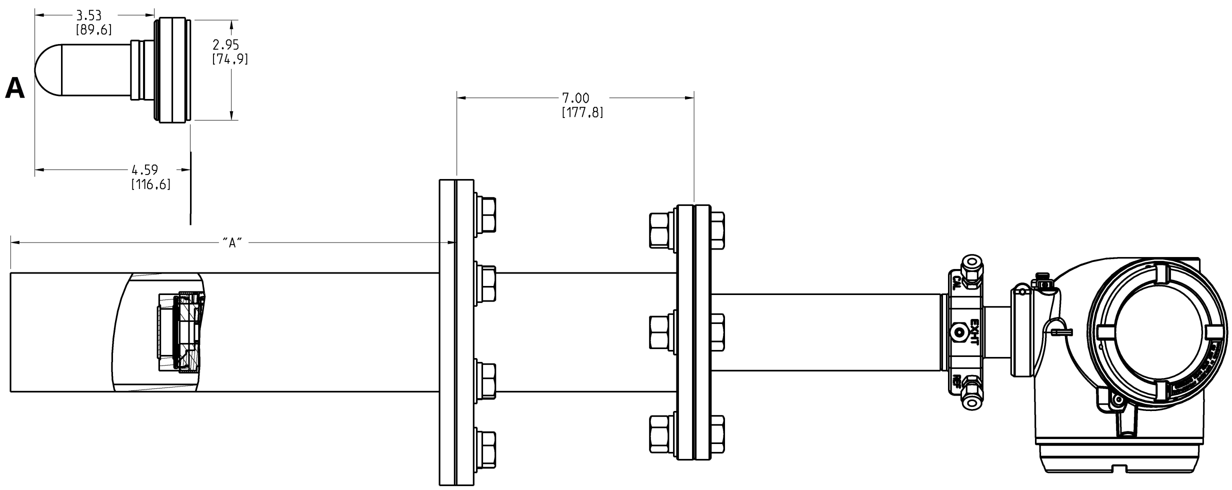
An integral probe consists of a transmitter directly attached to a probe body.

Figure 2-6: CX2100 DR Direct Replacement Probe with Ordinary Locations Approved Snubber Diffuser



A direct replacement (DR) probe consists of a junction box directly attached to a probe body via a quick connect clamp.

Figure 2-7: CX2100-PI Integral Analyzer with Ordinary Locations and Abrasive Shield



Dimensions are in inches [millimeters].

A. *Ceramic dust seal diffuser*

Table 2-2: Dimensions for CX2100-PI Integral Analyzer with Ordinary Locations and Abrasive Shield

ANSI	Insertion depth with abrasive shield
18 in. (457 mm)	13.1 in. (333 mm)
3 ft. (0.91 m)	31.1 in. (790 mm)
6 ft. (1.83 m)	67.1 in. (1704 mm)
9 ft. (2.74 m)	103.1 in. (2619 mm)
12 ft. (3.66 m)	139.1 in. (3533 mm)

Table 2-3: Removal/Installation Dimensions for Probes with Snubber Diffusers

Dimension A in Figure 2-5 and Figure 2-6

Probe length	No hazardous locations certifications	
	Insertion depth with snubber diffuser	Insertion depth with abrasive shield
18 in. (0.457 m)	15.826 in. (0.402 m)	13.1 in. (0.333 m)
3 ft. (0.91 m)	33.826 in. (0.859 m)	31.1 in. (0.79 m)
6 ft. (1.83 m)	69.826 in. (1.774 m)	67.1 in. (1.704 m)

Table 2-4: Removal/Installation Dimensions for Probes with Alloy C-276 Diffusers

Probe length	No hazardous locations certifications	
	Insertion depth with Alloy C-276 diffuser	Insertion depth with Alloy C-276 diffuser and vee-deflector
18 in. (457 mm)	18.71 in. (475 mm)	19.82 in. (503 mm)
3 ft. (0.91 m)	36.71 in. (932 mm)	37.82 in. (961 mm)

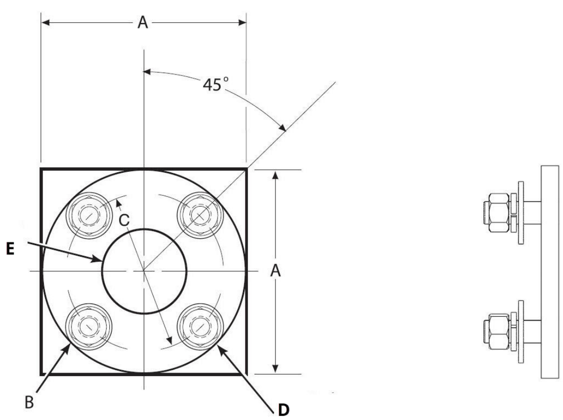
Table 2-4: Removal/Installation Dimensions for Probes with Alloy C-276 Diffusers *(continued)*

Probe length	No hazardous locations certifications	
	Insertion depth with Alloy C-276 diffuser	Insertion depth with Alloy C-276 diffuser and vee-deflector
6 ft. (1.83 m)	72.71 in. (1847 mm)	73.82 in. (1875 mm)

Table 2-5: Removal/installation dimensions for probes with ceramic diffusers

Probe length	No hazardous locations certifications	
	Insertion depth with ceramic diffuser	Insertion depth with ceramic diffuser and vee-deflector
18 in. (157 mm)	19.57 in. (497 mm)	19.82 in. (503.4 mm)
3 ft. (0.91 m)	37.57 in. (954.3 mm)	37.82 in. (960.6 mm)
6 ft. (1.83 m)	73.57 in. (1868.7 mm)	73.82 in. (1875 mm)

Figure 2-8: Probe installation square weld plates



A. Square weld plate length (see Table 2-6)
B. Thread size (see Table 2-6)
C. Bolt circle diameter (see Table 2-6)
D. Four studs, lockwashers, and nuts equally spaced on C, diameter BC
E. Inner dimension (see Table 2-6)

Table 2-6: Installation square weld plate dimensions

	ANSI 2-inch Class 150	ANSI 3-inch Class 150	DIN65 PN10	DIN100 PN06
A (square weld plate length)	6 in. (152 mm)	7.75 in. (197 mm)	7.5 in. (191 mm)	8.46 in. (215 mm)
B (thread size)	⅝-11 unified national thread (UNC) - 2B	⅝-11 UNC	M16 x 2.0	M16 x 2.0 - 6H
C (bolt hole diameter)	4.75 in. (121 mm)	6 in. (152 mm)	5.71 in. (145 mm)	6.69 in. (170 mm)
E (inner dimension)	2.5 in. (64 mm)	3.25 in. (83 mm)	2.5 in. (64 mm)	3.25 in. (83 mm)

Table 2-7: Mounting flange dimensions

	ANSI 2-inch Class 150	ANSI 3-inch Class 150	DIN65 PN10	DIN100 PN06
Outer diameter	6.6 in. (168 mm)	7.5 in. (191 mm)	7.28 in. (185 mm)	8.3 in. (211 mm)
Bolt circle diameter	4.75 in. (121 mm)	6 in. (152 mm)	5.71 in. (145 mm)	6.7 in. (170 mm)
Bolt hole diameter	0.75 in. (19 mm)	0.75 in. (19 mm)	0.71 in. (18 mm)	0.71 in. (18 mm)

2.3.2 Install 6888 Direct Replacement Probe

Prerequisites

Ensure all components are available to install the probe.

Procedure

1. If using the optional ceramic diffusion element, the vee-deflector must be correctly oriented. Before inserting the probe, check the direction of gas flow in the duct. Orient the vee-deflector so the apex points upstream towards the flow.

   See Figure 2-3.

   a) Loosen the set screws.

   b) Rotate the vee-deflector to the desired position.

   c) Retighten the set screws.

2. If using the standard square weld plate or an optional flange mounting plate, weld or bolt the plate onto the duct.

   The through hole diameter in the stack or duct wall and refractory material must be at least 2.5 in. (64 mm)

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

NOTICE

Emerson recommends an abrasive shield for high velocity particulates in the flue stream (such as those in coal-fired boilers, kilns, and recovery boilers) and for probes 9 ft. (2.7 m) or greater in length to provide mechanical support.

NOTICE

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

Refer to the conditions for safe use in the Product certifications section of the *Quick Start Guide* for maximum flange temperature.

4. Insert probe with new gasket through the opening in the mounting flange and bolt the analyzer to the flange.

⚠ WARNING

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

NOTICE

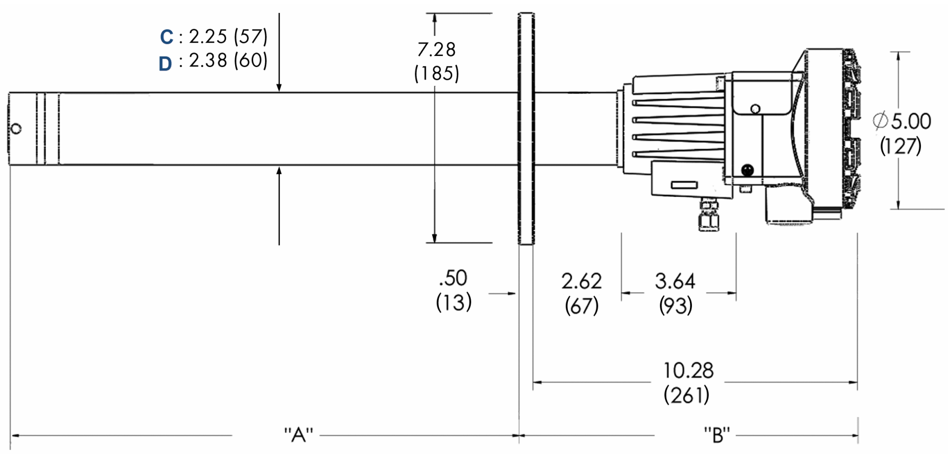
If washing the ducts down during an outage, make sure to first power down the probes and remove them from the wash area.

NOTICE

Uninsulated stacks or ducts may cause ambient temperatures around the electronics to rise, which may cause overheating damage to the electronics.

If you removed duct work insulation for analyzer mounting, replace the insulation afterwards. Ensure the probe installation does not obscure the warnings on the housing covers.

Figure 2-9: 6888A Direct Replacement Probe with Standard Terminations and Electronics Housing



All dimensions are in inches with millimeters in parentheses.

- *A. Dimension (see Table 2-8)*
- *B. Dimension (see Table 2-8)*
- *C. Standard tube*
- *D. Abrasion-resistant tube*

Table 2-8: Removal/installation dimensions for 6888A Direct Replacement Probe

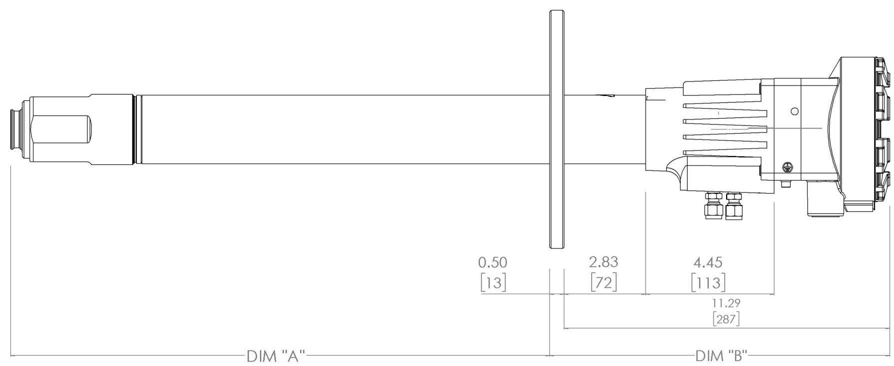
Probe length[1]	Dimension A insertion depth	Dimension B removal envelope standard housing
18 in. (0.457 m) probe	16.1 in. (0.409 m)	15.77 in. (0.401 m)
3 ft. (0.91 m) probe	33.52 in. (0.851 m)	46.6 in. (1.184 m)
6 ft. (1.83 m) probe	68.52 in. (1.74 m)	82.6 in. (2.098 m)
9 ft. (2.74 m) probe	104.52 in. (2.655 m)	118.6 in. (3.012 m)

Table 2-8: Removal/installation dimensions for 6888A Direct Replacement Probe *(continued)*

Probe length(1)	Dimension A insertion depth	Dimension B removal envelope standard housing
12 ft. (3.66 m) probe	140.52 in. (3.569 m)	154.6 in. (3.927 m)

(1) Add 3.8 in. (97 mm) to Dimension A and Dimension B for probe with ceramic or Alloy C-276 diffuser.

Figure 2-10: 6888C Direct Replacement Probe with standard terminations and electronics housing

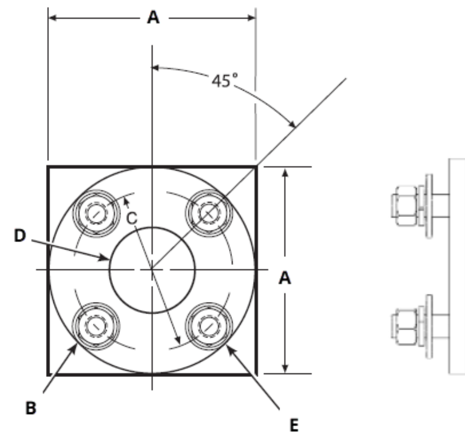


All dimensions are in inches with millimeters in brackets.

Table 2-9: Removal/installation dimensions for 6888C Direct Replacement Probe

Probe length	Dimension A insertion depth	Dimension B removal envelope standard housing
18 in. (0.457 m)	16.1 in (0.409 m)	15.77 in. (0.401 m)
3 ft. (0.9 m)	32.52 in. (0.826 m)	46.6 in. (1.184 m)
6 ft. (2 m)	68.52 in. (1.74 m)	82.6 in. (2.098 m)

Figure 2-11: Installation square weld plates for 6888 Direct Replacement Probe



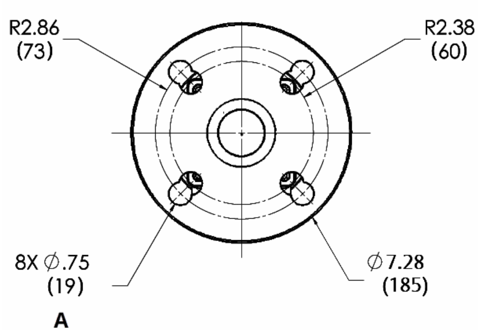
All dimensions are in inches with millimeters in parentheses.

A. Dimension (see Table 2-10)
B. Thread dimension (see Table 2-10)
C. Bolt circle diameter (see Table 2-10)
D. Four studs, lockwashers, and nuts equally spaced on C, diameter B C

Table 2-10: Weld plate dimensions for 6888 Direct Replacement Probe

Dimension	6888A ANSI	6888A DIN	6888C ANSI	6888C DIN
A	6 in. (152.4 mm)	7.5 in. (190.5 mm)	7.75 in. (197 mm)	8.5 in. (216 mm)
B thread	⅝-11 UNC	M16x2	⅝-11 UNC	M16x2
C diameter	4.75 in. (120.7 mm)	5.71 in. (145 mm)	6 in. (152 mm)	6.7 in. (170 mm)
D	2.5 in. (64 mm)		3.25 in. (83 mm)	

Figure 2-12: Mounting Flange for 6888 Direct Replacement Probe



A. Equally spaced

Table 2-11: Mounting flange dimensions for 6888 Direct Replacement Probe

	6888A ANSI	6888A DIN	6888C ANSI	6888C DIN
Flange diameter	7.28 in. (184.9 mm)		8.25 in. (210 mm)	
Hole diameter	0.75 in. (19 mm)			
4 holes equally spaced on BC	4.75 in. (121 mm)	5.71 in. (145 mm)	6 in. (152 mm)	6.7 in. (170 mm)

2.3.3 Install Rosemount Oxymitter 4000 Direct Replacement Probe

Procedure

1. If using the optional ceramic diffusion element, the vee-deflector must be correctly oriented. Before inserting the probe, check the direction of the gas flow in the duct. Orient the vee-deflector so the apex points upstream towards the flow.

   See Figure 2-3.

   a) Loosen the set screws.

   b) Rotate the vee-deflector so that the apex points upstream.

   c) Retighten the set screws.

2. If using the standard square weld plate or an optional flange mounting plate, weld or bolt the plate onto the duct.

   The through hole diameter in the stack or duct wall and refractory material must be at least 2.5 in. (64 mm) for OXT4A or 3.25 in. (83 mm) for OXT4C.

3. Insert the probe through the opening in the mounting flange and bolt the transmitter to the flange.
4. If the system has an abrasive shield with a dust seal, check the dust seal gaskets. Make sure the joints in the two gaskets are staggered 180 degrees and that the gaskets are in the hub grooves as the transmitter slides into the 15-degree forcing cone in the abrasive shield.

NOTICE

Emerson recommends an abrasive shield for high velocity particulates in the flue stream (such as those in coal-fired boilers, kilns, and recover boilers) and for probes 9 ft. (2.7 m) in length to provide mechanical support.

NOTICE

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

5. Insert probe through the opening in the mounting flange and bolt the transmitter to the flange.
6. If installing an integral probe with a transmitter, ensure the transmitter is properly earthed by way of both internal and external points.

NOTICE

Uninsulated stacks or ducts may cause ambient temperatures around the electronics to rise, which may cause overheating damage to the electronics.

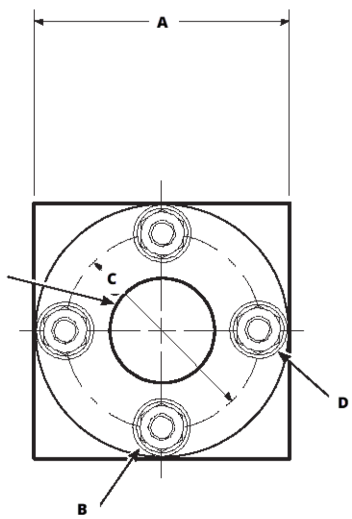
If you remove duct work insulation for transmitter mounting, replace the insulation afterwards. Ensure the probe installation does not obscure the warnings on the housing covers.

7. If installing an integral probe with a transmitter, position the transmitter to the correct orientation for your process by loosening the clamp and clamp screw. Once the transmitter has been positioned in the correct orientation, tighten the clamp and clamp screw back onto the probe.

Table 2-12: Removal/installation dimensions for Oxymitter Direct Replacement Probe

Probe	Dimension A	Dimension B, removal envelope
18 in. (0.457 m)	15.3 in. (0.387 m)	35.9 in. (0.912 m)
3 ft. (0.914 m)	33.2 in. (0.842 m)	53.8 in. (1.367 m)
6 ft. (1.829 m)	69.4 in. (1.762 m)	90 in. (2.287 m)

Figure 2-13: Mounting Plate for Oxymitter 4000 Direct Replacement Probe



Dimensions are in millimeters with inches in parentheses.

A. *Dimension A*
B. *Dimension B (stud size)*
C. *Dimension C (diameter BC)*
D. *Four studs, lockwashers, and nuts equally spaced on C, diameter BC.*

Table 2-13: Mounting plate dimensions for Oxymitter 4000 Direct Replacement Probe

Dimensions	ANSI	DIN
A	7.5 in. (190 mm)	8.25 in. (210 mm)

Table 2-13: Mounting plate dimensions for Oxymitter 4000 Direct Replacement Probe *(continued)*

Dimensions	ANSI	DIN
B (stud size)	0.625-11	M16 x 2
C (diameter BC)	6 in. (152 mm)	6.69 in. (170 mm)

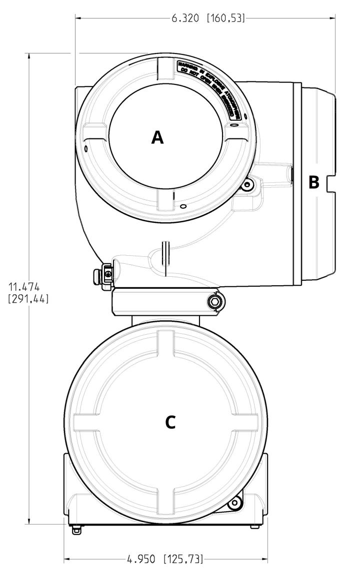
Table 2-14: Adapter plate dimensions for Oxymitter 4000 Direct Replacement Probe

Part numbers for adapter plates include attaching hardware

Dimensions	ANSI (PN 4512C35G01)	DIN (PN 4512C36G01)	JIS (PN 451235G01)
A	6 in. (153 mm)	7.5 in. (191 mm)	5.5 in. (165 mm)
B (thread)	0.625-11	(M-16 x 2)	(M-12 x 1.75)
C (diameter)	4.75 in. (121 mm)	5.708 in. (145 mm)	4.118 in. (130 mm)

2.3.4 Install Rosemount CX2100 TR Remote Electronics

Figure 2-14: Remote Electronics Transmitter



A. Local operator interface (LOI) cover
B. Terminal transmitter cover
C. Blind junction box cover

Figure 2-15: CX2100 Remote Electronics Mounted on Pole

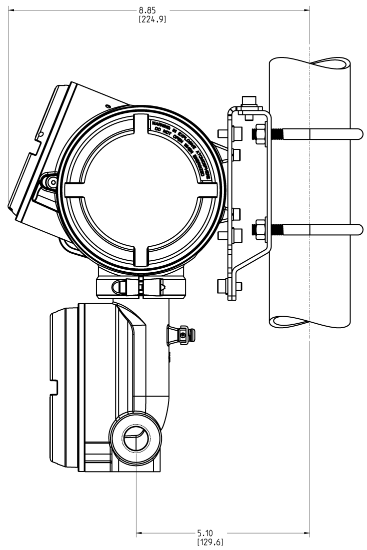
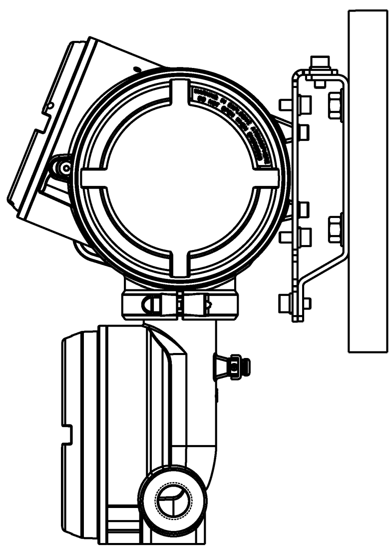


Figure 2-16: Remote electronics transmitter mounted on wall



Procedure

1. For a Rosemount CX2100 configuration with the remote electronics option, install the probe according to Install Rosemount CX2100-PI Integral Probe or CX2100-DR Direct Replacement Probe
2. Install the remote electronics unit using the mounting bracket kit on a wall, standpipe, or similar structure.

NOTICE

Use only bolts supplied with the electronics analyzer.

2.4 Electrical installation

All wiring must conform to local and national codes.

This section shows multiple wiring diagrams. Always refer to the diagrams that apply to your configuration and disregard all other wiring diagrams.

⚠ WARNING

Electrical shock

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

Disconnect and lock out power before wiring the AC terminals.

Install all protective covers and ground leads after installation.

To meet the safety requirements of CSA/IEC/UL 61010-1 and ensure safe operation of the equipment, connect the main electrical power supply through a circuit breaker (minimum 10 A) which will disconnect all current-carrying conductors during a fault situation. This circuit breaker should also include a mechanically operated isolating switch. If it does not, keep another external means of disconnecting the power supply from the equipment close by. Circuit breakers or switches must comply with a recognized standard, such as IEC 947.

To maintain proper earth grounding, ensure a positive connection exists between the analyzer housing and earth. The connecting ground wire must be 14 AWG minimum.

⚠ WARNING

To maintain Explosion-proof protection for hazardous area installations, all cable entry devices and conduit plugs for unused apertures must be certified Flameproof and suitable for the conditions of use. Make sure they are properly installed.

All unused conduit entries must be closed by a suitable conduit plug as to meet the requirements of the applicable codes and standards. Do not use a conduit plug with a thread adapter.

Install any threaded rigid metal conduit or cable glands per applicable codes and standards.

Figure 2-17 shows conduit entries. If conduit entries are not marked as M20, the entries are ½-in. NPT.

NOTICE

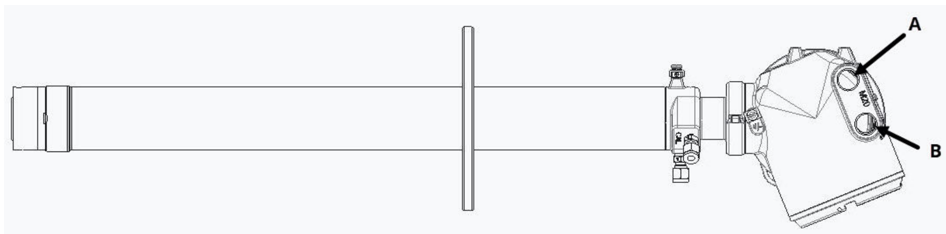
To maintain CE compliance, ensure a good connection exists between the mounting flange bolt and earth.

2.4.1 Wire Rosemount CX2100 Transmitter for integral or remote configuration

Procedure

1. Remove the terminal transmitter cover from the transmitter.
2. Use the conduit entries shown in Figure 2-17 to route the line power and Channel `A`/`B`/`C` cables into the analyzer housing.

Figure 2-17: Conduit Entries for CX2100 Integral Probe

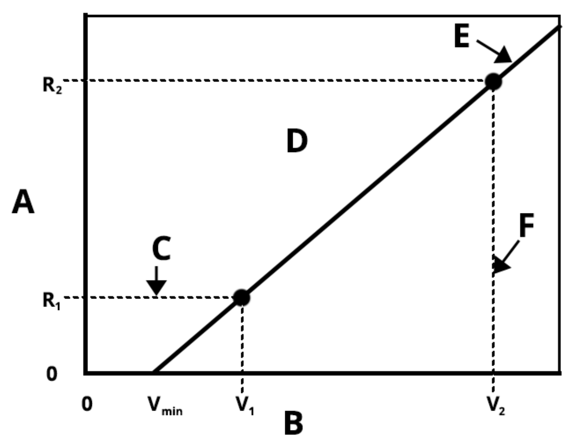


A. To channel A, B, and C signal lines
B. To power

3. Connect the line power (`L1` wire) to the `L1 Line Power` terminal, the neutral (`L2` wire) to the `L2/N` terminal, and the ground wire to the ground lug.

   The analyzer accepts line voltage between 85 and 250 Vac. No setup is required. See Figure 2-19.

Figure 2-18: CX2100 Loop Resistance and Supply Voltage



A. Loop resistance (Ω)
B. Supply voltage (V)
C. Minimum load for communication
D. Operating region
E. Load limit line
F. Maximum voltage

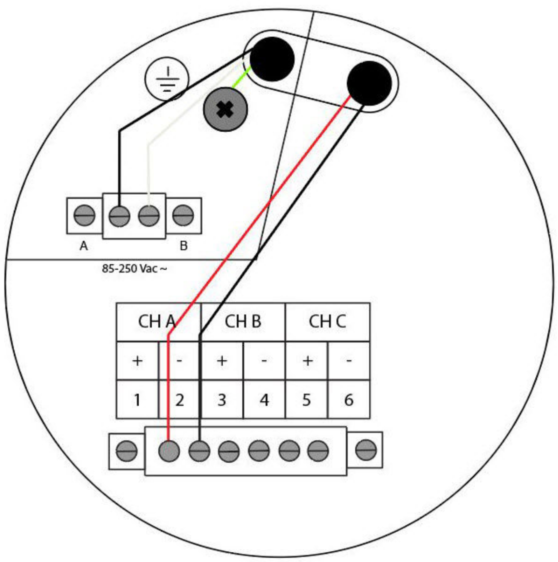
Table 2-15: Load Resistance and Voltage Supply Limits for Externally Powered Analyzer

$R_1(\Omega)$	250
$R_2(\Omega)$	1061
V_{min} (V)	4.25
$V_1(V)$	9.88
$V_2(V)$	30

Table 2-16: Load Resistance for Internally Powered Analyzers

$R_{max}(\Omega)$	820
$V_{nom}(V)$	24

Figure 2-19: Wiring for CX2100 Transmitter - Power and Channel A 4-20 mA



A. `L1`*: Line power*

B. `L2`*: Neutral power*

Table 2-17: Available Channels

Signal	Channel A		Channel B		Channel C	
Wiring terminal	1	2	3	4	5	6
Inputs/ output	mA output (HART®)		Relay or Autocalibration		Relay or Flame Safety Interlock	

Table 2-18: CX2100 Power Requirements and Consumption

Analyzer input voltage and frequency	85-250 Vac, 50/60 Hz
Analyzer heater maximum output power	250 W

Table 2-18: CX2100 Power Requirements and Consumption *(continued)*

Remote probe input maximum voltage	250 Vac
Remote probe input power	200 Watts at 115 V

Table 2-19: Conductor Sizing and Wire Gauge for CX2100 Transmitter

	Conductor sizing	Wire gauge
Line/Neutral/Earth	1.5 - 2.5 mm^2	16-12 AWG
Channel A/Channel B/ Channel C	0.25 - 2.5 mm^2	24-12 AWG

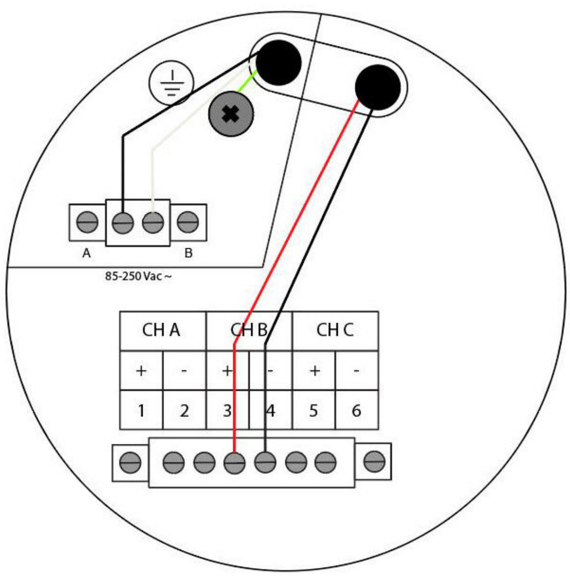
4. Connect the analog output wires at the **Channel A** terminals according to Figure 2-19.

   The transmitter electronics analog output can be either active or passive (meaning an internal or external power supply).

   4-20 mA signal The 4-20 mA signal represents the O_2 value. Superimposed on the 4-20 mA signal is HART® information that is accessible through a communication device or AMS software.

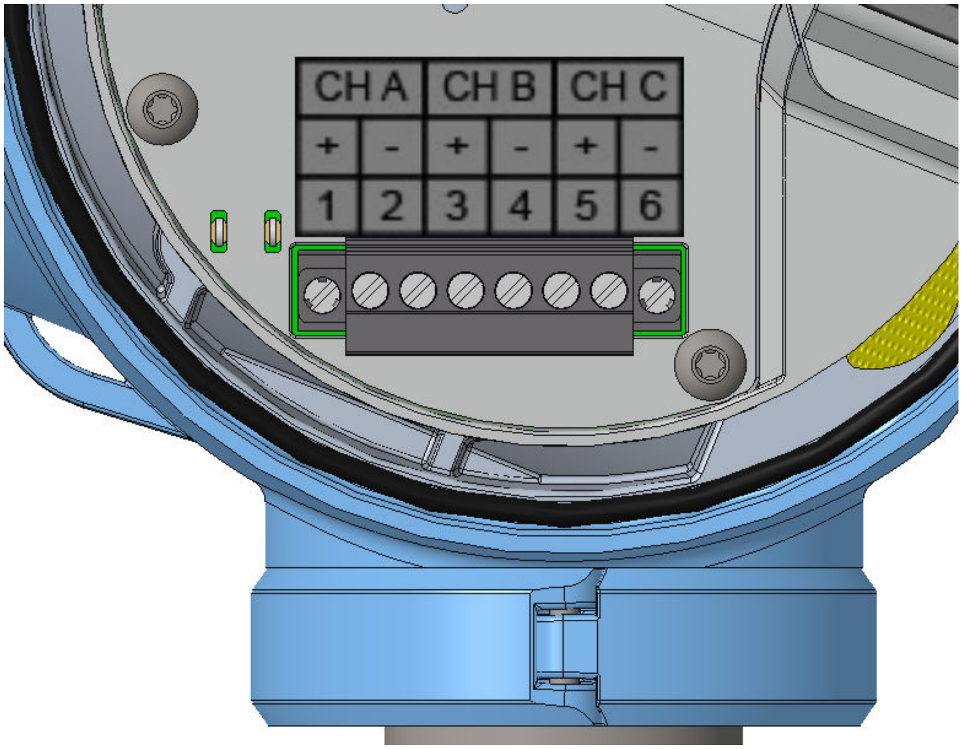
5. Connect optional `Autocalibration` or `Relay Output` leads to **Channel B** as shown in Figure 2-20.

Figure 2-20: Wiring for CX2100 Transmitter - Channel B Rosemount SPS 4001B or Relay



A. `L1`: *Line power*
B. `L2`: *Neutral power*

Figure 2-21: Channels on the CX2100 Transmitter Terminal



If **Channel B** is configured to `Relay`, you can use the output signal to trigger an alarm.

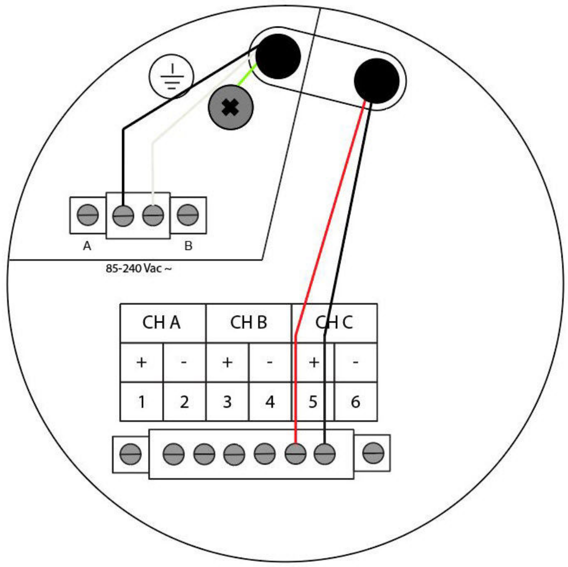
The **Channel B** output signal can provide a calibration handshake signal to a Rosemount SPS 4001B Autocalibration System. Refer to the Rosemount SPS 4001B Manual for maintaining SPS wiring details.

⚠ WARNING

If using an SPS 4001B, install it in a non-hazardous, explosive-free environment.

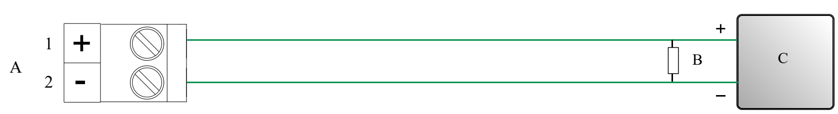
6. Connect optional `Flame Safety Interlock` or `Relay Output` leads to **Channel C** as shown in Figure 2-22.

Figure 2-22: Wiring for CX2100 Transmitter - Channel C Flame Safety Interlock or Relay



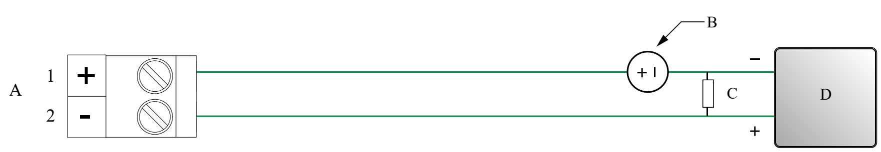
A. *`L1`: Line power*
B. *`L2`: Neutral power*

Figure 2-23: mA/HART Output Wiring (Internally Powered)



A. *mA/HART output*
B. *250 - 600 Ω resistance*
C. *HART device*

Figure 2-24: mA/HART Output Wiring (Externally Powered)



A. *mA/HART output*
B. *5-30 Vdc (maximum)*
C. *250 - 600 Ω resistance*
D. *HART device*

If **Channel C** is configured to `Relay`, you can use the output signal to trigger an alarm.

If **Channel C** is configured to `Flame Safety Interlock`, **Channel C** will accept a discrete input from a dry contact relay.

7. Reinstall cover on transmitter.

Note
For NEMA® 4X, IP66, and IP88 requirements, use thread sealing PTFE tape or paste on male threads of conduit to provide a water and dust tight seal. Always ensure a proper seal by installing the electronics housing cover(s) so that metal contacts metal. Use Rosemount O-rings.

8. Plug and seal unused conduit connections on the transmitter housing to avoid moisture accumulation on the terminal side.

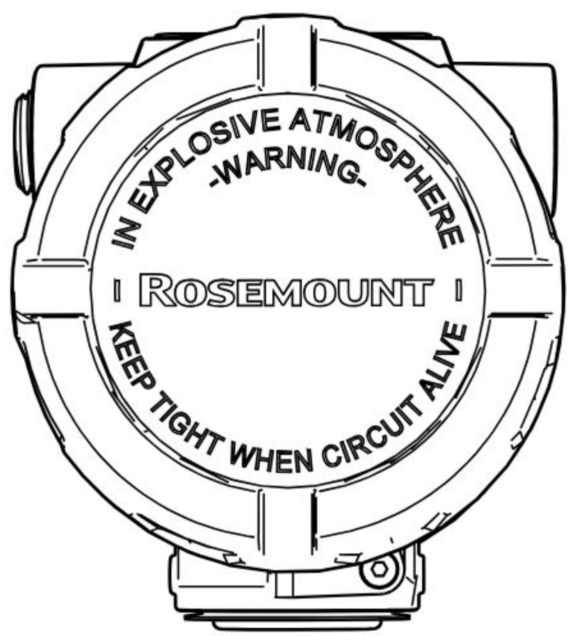
2.4.2 Install cover jam screw

For transmitter housings shipped with a cover jam screw, install the screw after wiring and powering up the transmitter.

Proper installation and use of the cover jam screw is required to maintain hazardous location approvals.

The cover jam screw is intended to prevent removing the transmitter cover in flameproof environments without using tools.

Figure 2-25: Cover Jam Screw



Procedure

1. Verify the cover jam screw is completely threaded into the housing.

2. Install the transmitter housing cover and verify that the cover is tight against the housing.
3. Using an M4 hex wrench, loosen the jam screw until it contacts the transmitter cover.
4. Turn the jam screw an additional ½ turn counterclockwise to secure the cover.

NOTICE

Applying excessive torque may strip the threads.

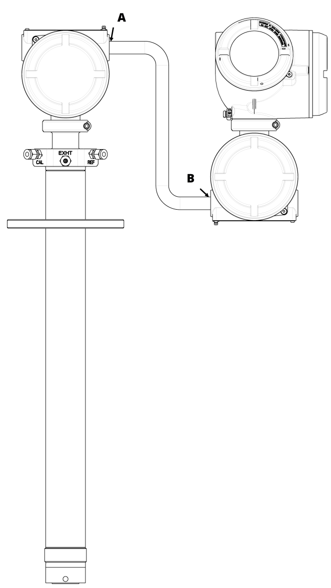
5. Verify the cover cannot be removed.

2.4.3 Wire Rosemount CX2100 junction boxes for remote configuration

The remote electronics junction box is located on the CX2100TR Remote Electronics Transmitter.

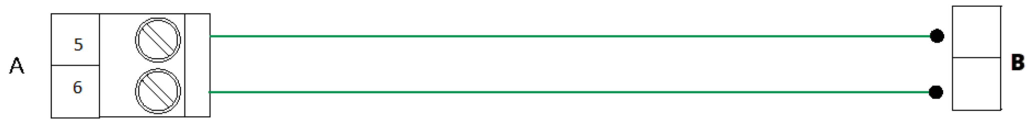
When installing a CX2100 remote configuration consisting of a CX2100 Direct Replacement (DR) Probe and CX2100TR Remote Electronics Transmitter, a multi-conductor power/signal cable connects the probe to the remote electronics transmitter as shown in Figure 2-26.

Figure 2-26: CX2100 Remote Electronics Configuration



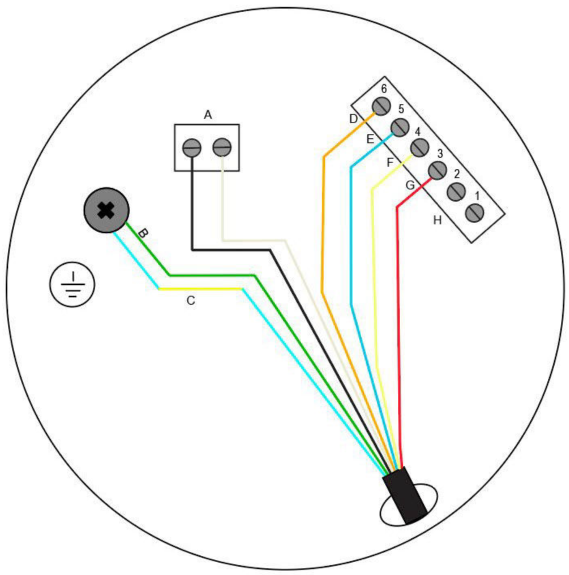
A. DR probe junction box conduit entries
B. Remote electronics junction box conduit entry

Figure 2-27: Channel B Rosemount SPS 4001B Output Wiring



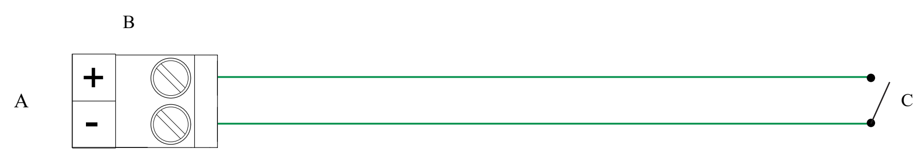
A. *SPS 4001B output*
B. *Handshake*

Figure 2-28: Junction Box Wiring



A. *Heater (HTR)*
B. *Safety ground*
C. *Shields (transmitter wiring only)*
D. *Oxygen (O_2+)*
E. *O_2-*
F. *Thermocouple (TC+)*
G. *TC−*
H. *RTD*

Figure 2-29: Discrete Input Wiring (Internally Powered)



A. *Discrete input*
B. *Channel C*
C. *Flame Safety Interlock relay*

Procedure

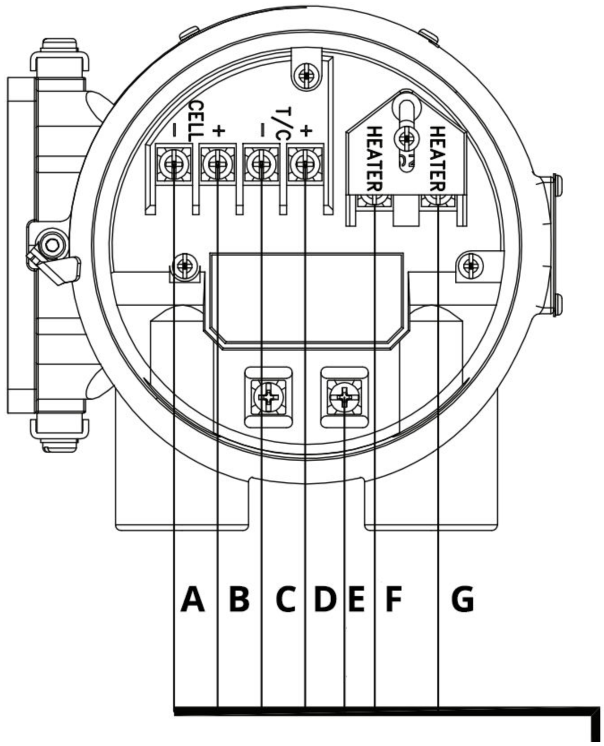
1. Remove the cover from the junction box.
2. You can use either of the two conduit entries to route the cable into the junction box housing.
3. Connect the heater power lines to the two `HTR` terminals.
4. Connect the O_2 signal lines to the `O2−` and `O2+` terminals.
5. Connect the thermocouple (TC) lines to the `TC−` and `TC+` terminals.
6. Connect the safety ground wire to the ground lug.
7. If wiring the transmitter junction box, terminate the shield at the transmitter junction box housing.
8. Reinstall cover on junction box.
9. For NEMA® 4X, IP66, and IP68 requirements, use thread sealing PTFE tape or paste on male threads of conduit to provide a water and dust tight seal. Always ensure a proper seal by installing the electronics housing cover(s) so that metal contacts metal. Use Rosemount O-rings.
10. Plug and seal unused conduit connections on the transmitter housing to avoid moisture accumulation on the terminal side.

2.4.4 Wire Rosemount 6888 or Oxymitter Direct Replacement (DR) Probe with CX2100 Remote Electronics Transmitter

Procedure

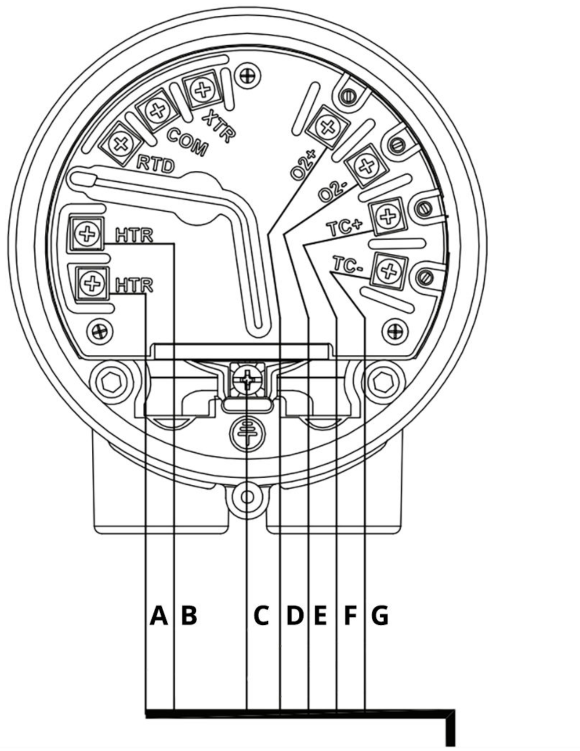
1. Remove cover from probe.
2. Feed all DR probe wiring through the probe's line power conduit.
3. Connect DR probe heater power leads to DR probe connectors as shown in Figure 2-30 or Figure 2-31.

Figure 2-30: Oxymitter DR Probe



A. Blue (oxygen [O2]-)
B. Orange (O2+)
C. Red (thermocouple [TC]-)
D. Yellow (TC+)
E. Green (ground [GND])
F. White (heater [HTR])
G. Black (HTR)

Figure 2-31: 6888 DR Probe



A. White (HTR)
B. Black (HTR)
C. Green (GND)
D. Orange (O2+)
E. Blue (O2-)
F. Yellow (TC+)
G. Red (TC-)

4. Connect O_2 signal and thermocouple wires to DR probe connectors.
5. Run the seven-conductor cable from the probe installation site to the remote electronics transmitter installation site.
    a) Install the seven-conductor cable at the remote electronics junction box.
    b) Connect the heater power lines to the two `HTR` terminals shown in Figure 2-28.
    c) Connect the oxygen signal lines to the `O2−` and `O2+` terminals shown in Figure 2-28.
    d) Connect the thermocouple lines to the `TC−` and `TC+` terminals shown in Figure 2-28.
    e) Connect the safety ground wire to the ground lug as shown in Figure 2-28.
    f) Terminate the shield at the transmitter junction box housing.
    g) Reinstall cover on junction box.

2.4.5 Wiring Rosemount CX2100DR to Rosemount 6888 Xi

Refer to *Rosemount 6888 Xi Manual* for installation instructions.

2.5 Pneumatic installation

2.5.1 Calibration gas

Emerson recommends the following calibration gas concentrations for typical applications operating below 10 percent O_2:

- Low gas (0.4 percent O_2, balance N_2)
- High gas (8.0 percent O_2, balance N_2)

For higher O_2 applications, like winbox O_2, Emerson recommends:

- Low gas (0.4 percent to 2 percent O_2, balance N_2)

  Note
  Emerson recommends using a low gas value that spans the application's range of measurement and that has a minimum delta of 4 percent O_2 from the high gas value.

- High gas (21 percent O_2, balance N_2 or dry bottle air)

Refer to the *Rosemount CX2100 Product Data Sheet* for calibration gas performance specifications.

NOTICE

Failure to use proper gases will result in erroneous readings.

Do not use 100 percent nitrogen as a low gas (zero gas). Emerson recommends using between 0.4 percent and 2.0 percent O_2 for the zero gas. Do not use gases with hydrocarbon concentrations of more than 40 parts per million.

NOTICE

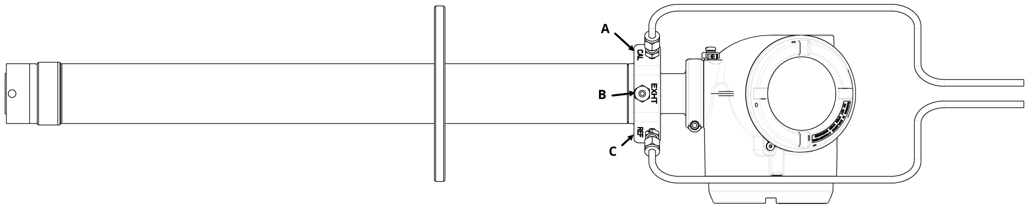
Before washing down the ducts, verify that the analyzers have been powered down and removed from the wash areas.

NOTICE

Damage can result from having a cold analyzer exposed to process gases.

Upon completing installation, ensure that the analyzer is turned on and operating before firing up the combustion process.
During outages, if possible, leave all analyzers running to prevent condensation and premature aging from thermal cycling.

Figure 2-32: Calibration Gas Connections



A. `CAL` *is calibration gas in*
B. `EXHT` *is reference air vent*
C. `REF` *is reference air in*

Reference air components are included in the optional manual calibration panel and the Rosemount SPS 4001B Single Probe Autocalibration Sequencer.

NOTICE

The optional SPS 4001B Sequencer can be used with the CX2100, 6888, and Oxymitter oxygen analyzers. Ensure the analyzers are configured for autocalibration when using the SPS 4001 B Sequencer.

See the Rosemount SPS 4001B Reference Manual for wiring and pneumatic connections.

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

3 Configuration, start-up, and operation

⚠ WARNING

Electrical shock

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

Install all protective covers and ground leads after installation.

3.1 Powering up Rosemount CX2100 Analyzer

3.1.1 Power up Rosemount CX2100 TR Remote Electronics or CX2100 PI Integral Electronics Probe

Prerequisites

Verify that the cables are connected to the analyzer as described in Figure 2-19.

Verify that all analyzer covers and seals are closed.

Maximum power of analyzer: 270 VA

Procedure

1. Apply AC line power to the analyzer.
2. Using either the distributed control system (DCS) or a communication device, verify communication to the analyzer.

The probe takes approximately 25 minutes to warm up to the +1357 °F (+736 °C) heater set point. The 4-20 mA signal remains at a default alarm level, and the O_2 reading displays `NaN` during the warm-up period. After warm-up, the probe begins reading oxygen, and the 4-20 mA output is based on the default range of 0 to 10 percent O_2.

If there is an error condition at start-up, the analyzer displays an alarm message.

Postrequisites

Emerson recommends waiting at least two hours after powering up the CX2100 before calibrating.

3.1.2 Powering Rosemount CX2100DR with other electronics

Refer to the electronics manual for start-up procedure.

3.2 Device revision information

Release date	NAMUR software revision	NAMUR hardware revision	HART® universal revision	Device revision	Manual document number	Change description
Sep 2025	01.01.00	01.00.00	7	1	MS-00809-0100 -9740	Initial release

3.3 *Guided Setup*

When you first power up the analyzer, a ***Guided Setup*** program will guide you through the basic setup procedure.

Once configured, the analyzer retains the set parameters. At the end of the ***Guided Setup*** program, the analyzer prompts you to choose if ***Guided Setup*** will repeat at each start-up.

Procedure

1. When the analyzer turns on, the ***Guided Setup*** screen appears. The first screen reads `Do you want Help configuring this device?`
   - Select **Yes** to continue with ***Guided Setup***.
   - Select **No** to exit ***Guided Setup***.

   The ***Guided Setup*** program guides you through several screens that allow you to configure a range of instrument settings.
2. Follow ***Guided Setup*** screens to configure analyzer settings.

   You can access ***Guided Setup*** at any time from the ***Configuration*** menu.

   The ***Guided Setup Complete*** screen reads: `Guided setup is complete. Do you want this device to prompt guided setup at each start-up?`
3. Select **Yes** or **No**.

Once the Guided Setup is complete, the display returns to the main screen.

Related information

Install Rosemount CX2100-PI Integral Probe or CX2100-DR Direct Replacement Probe

3.4 Input/output configuration

The Rosemount CX2100 Analyzer has three channels with configurable inputs and outputs.

Channel A is always configured as the 4-20 mA output signal. **Channels B** and **C** can be configured to output a status via **Relay** output or can be configured to the optional **Autocalibration** feature using the Rosemount SPS 4001B accessory or the optional **Flame Safety Interlock** feature.

Channel	Input/output options
A	mA Output
B	Relay or Autocalibration (choose one)

Channel	Input/output options
C	Relay or Flame Safety Interlock (choose one)

3.5 Rosemount CX2100 In Situ Oxygen Analyzer with flame safety interlock

A flame safety interlock by Emerson is available for heater power disconnect whenever there is a loss of the process flame or a heater runaway condition (heater over-temperature) in the O_2 probe.

This input is internally powered by the CX2100 electronics, either an Integral Electronics Probe (PI) or Remote Electronics (TR) and is actuated via a dry contact output from your flame scanner. A closed contact indicates a flame is present. An open contact indicates a loss of flame.

3.6 Automatic calibration

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

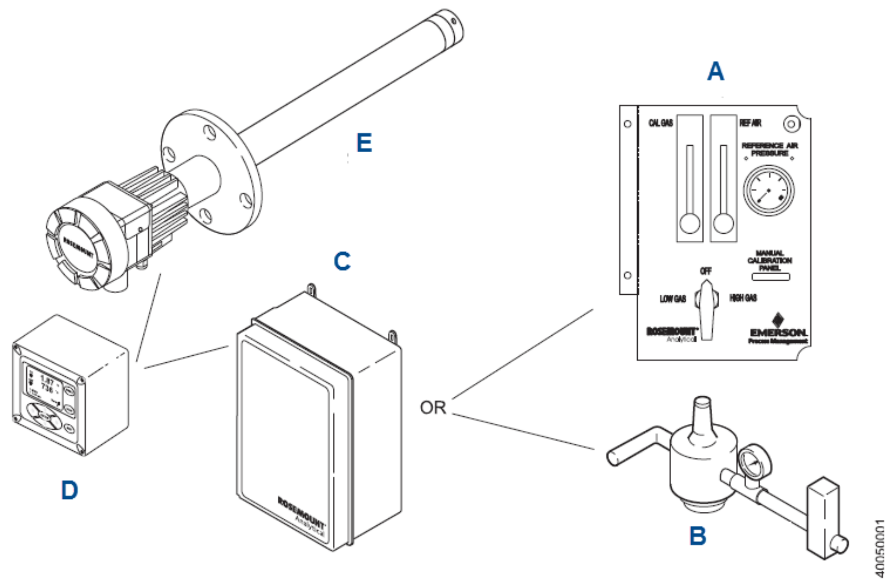
NOTICE

Failure to use proper gases will result in erroneous readings.

Do not use 100 percent nitrogen as a low gas (zero gas). Emerson recommends using between 0.4 percent and 2 percent with O_2 for the zero gas. Do not use gases with hydrocarbon concentrations of more than 40 parts per million.

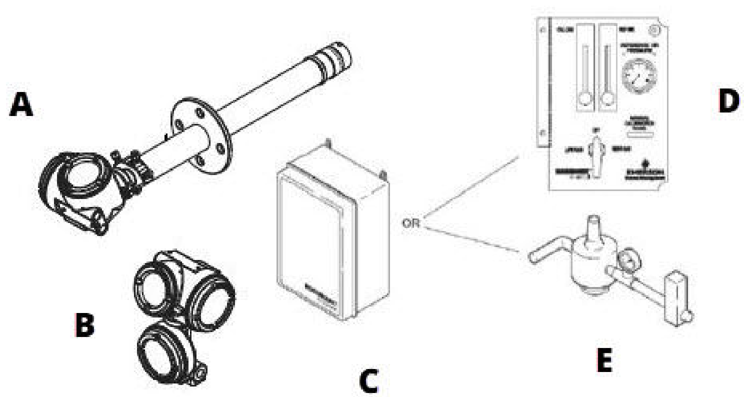
Flow meters (for calibration gases) and regulators and flow meters (for reference air) are available as loose components, mounted into an optional manual calibration switching panel or a fully automatic calibration system (Figure 3-1) where calibration solenoids are switched from the CX2100 Integral Electronics Probe (PI) or Remote Electronics (TR). See the Rosemount SPS 4001B Single Probe Autocalibration Sequencer Manual for additional details.

Figure 3-1: Rosemount 6888A with Rosemount 6888 Xi Advanced Electronics and Autocalibration Sequencer



A. Manual calibration switching panel
B. Reference air set
C. Rosemount SPS 4001B
D. CX2100TR Remote Transmitter
E. CX2100PI Integral Probe
F. CX2100DR Direct Replacement Probe

Figure 3-2: CX2100 with Autocalibration Sequencer



A. CX2100 Integral Electronics (PI) Probe
B. CX2100 Remote Electronics (TR)
C. SPS 4001B
D. Manual calibration switching panel
E. Reference air set

3.7 Display Security and Write Protection

The transmitter has several features that can help to protect it against intentional or unintentional access and configuration changes.

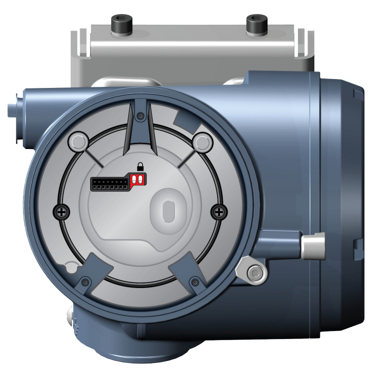
- When enabled, the software setting **Write Protection** prevents any configuration changes. When enabled, a lock icon displays at the top of the home screen of the display.
- When enabled, the display option **Display Security** prevents any configuration changes being made from the display unless the display passcode is entered. **Display Security** does not prevent configuration changes from other interfaces.
- If the universal service port (USP) is disabled, the port (USB-A) cannot be used by any service tool to communicate with or make changes to the transmitter.

3.7.1 Enable or disable software **Write Protection**

When enabled, **Write Protection** prevents changes to the transmitter configuration. You can perform all other functions, and you can view the transmitter configuration parameters.

To enable **Write Protection**, toggle the physical **Write Protect** (dip) switch (identified by a lock icon) located behind the display module.

Figure 3-3: Write Protect (Dip) Switch behind the Display Module



3.7.2 Configure security for the display

- Display: **Menu** → **Configuration** → **Security** → **Display Security**
- ProLink™ III: **Device Tools** → **Configuration** → **Transmitter Display** → **Display Security**
- Field Communicator: **Device Settings** → **Display** → **Display Menus**

When using the display, you can require users to enter a pass code to do any of the following tasks:

- Enter the ***Main*** menu.
- Change a parameter.
- Access alert data through the display.
- Start, stop, or reset totalizers or inventories via the context menu.

You can use ProLink III, HART®, or Bluetooth® communication to enable security on the local display. You can also change the local display pass code at the same time.

The display pass code can be the same or different from the totalizer/inventory context menu control password. If it is different, use the display pass code to reset, start, and stop totalizers or inventories by going to **Menu** → **Operations** → **Totalizers**.

3.7.3 Restore the factory configuration

A file containing the factory configuration is always saved in the transmitter's internal memory and is available for use.

- Display: **Menu** → **Configuration** → **Save/Restore Config** → **Restore Config from Memory** → **FactoryConfig**
- ProLink™ III: **Device Tools** → **Configuration Transfer** → **Restore Factory Configuration**
- Field communicator: **Device Settings** → **Restore/Restart** → **Restore Factory Configuration**

This action is typically used for error recovery or for repurposing a transmitter.

If you restore the factory configuration, the real-time clock, the audit trail, the historian, and other logs are not reset.

4 Calibration

4.1 Calibrate manually

A technician can calibrate the Rosemount CX2100 Probe using the CX2100local operator interface (LOI) or using HART® communication to a communication device or AMS console.

Prerequisites

Before beginning calibration, ensure that the analyzer is configured to the desired calibration settings. On the LOI, go to **Configuration** → **Calibration**. For best results, calibrate the analyzer at least two hours after it has reached its 1357 °F (+736 °C) operating temperature and while the process is running.

Procedure

1. On the LOI, navigate to **Service Tools** → **Calibration** → **Run Manual Calibration**.
2. When ready to begin manual calibration, select **Start Calibration**. Follow the directions on LOI screens.
3. Apply Gas 1. Turn nozzle on Manual Calibration to Low Gas or High Gas (depending on how Gas 1 or Gas 2 is configured). Set gas flow rate to 5 scfh (2.5 L/min.). Press **Continue**.

   Do not adjust the flow rate on subsequent calibrations even if the flow rate decreases. Only make flow rate adjustments when a new diffuser is installed.

   The ***Gas 1 Stabilizing*** menu will appear. The transmitter will automatically detect stabilization of calibration gas (0.15 mV/min). This step can take up to 600 seconds. When the calibration gas is successfully collected, the ***Gas 1 Collected*** menu will appear.
4. Press **Continue**.
5. Repeat Step 3 and Step 4 for Gas 2.
   At this point, the calibration should be complete. A ***Calibration Passed*** or ***Calibration Failed*** screen will appear.
6. Acknowledge the ***Calibration Passed*** or ***Calibration Failed*** screen.
   The ***Remove Calibration*** screen will appear.
7. Press **Continue**.
8. Remove calibration gas by closing the nozzle.

   The calibration port must be sealed during normal operation.

   The ***Gas Purging*** screen will appear.
9. Once the gas has been purged, press **Continue**.

The electronics determine if the calibration was successful and calculate new calibration values. The analyzer does not automatically load new calibration values into the electronics after a successful calibration. You can accept or reject the new calibration values.

A significant calibration change may cause a bump in the O_2 readings at the distributed control system (DCS) console, causing operator concern. If you are using the electronics, the calibration log stores calibration data for the past 20 successful calibrations.

NOTICE

A loose or missing cap can permit fresh air to bias the O_2 readings high in processes that run at negative pressure.

Make sure the calibration gas port is capped tightly between calibrations.

Need help?
See Manual for product alerts if calibration fails.

Postrequisites

The analyzer can hold the 4-20 mA signal representing O2 or permit the signal to vary with the bottled gases. If the signal varies, you can trend a calibration record to the DCS. To trend a calibration record, go to **Detailed Setup** → **Calibration Setup** in the DCS.

4.2 Autocalibrate

Autocalibration requires a separate single probe sequencer (Rosemount SPS 4001B), which is a solenoid box for switching calibration gases.

Refer to the Rosemount SPS 4001B Manual for installation and start-up procedures.

Prerequisites

If using the O_2 measurement for automatic control, always place the O_2 control loop into **Manual** prior to calibrating. Always inform the operator prior to calibrating.

⚠ CAUTION

Calibration gas bottles are piped and under pressure at all times. Be sure to leak-check all fittings, tubes, and connections.
Always use dual-stage pressure regulators.

Ensure Channel B is configured for autocalibration.

Note
Before beginning calibration, ensure the analyzer is configured for the desired calibration settings. For best results, calibrate the analyzer at least two hours after it has reached its +1357 °F (+736 °C) operating temperature and while the process is running.

Procedure

Initiate automatic calibration in one of the following ways:

- On the local operator interface (LOI), go to **Service Tools** → **Calibration** → **Run Autocalibration**.
- Use HART® communication with a communication device or AMS.
- Use external contact closure on the SPS 4000.
- Set **Autocalibration interval**.
- Set **Start Time**.

The sequencer provides an `IN CAL` contact closure and a `CAL INITIATE` contact. The analyzer sequences the calibration gases into the sensing cell. The analyzer runs a gas stability check for both calibration gases. During the gas stability check, the analyzer runs a 300 second purge cycle, which lets the probe signal come back to the normal flue gas readings.

Postrequisites

The analyzer can hold the 4-20 mA signal representing O_2 or permit the signal to vary with the bottled gases. If the signal varies, you can trend a calibration record at the distributed control system (DCS). To trend a calibration record, go to **Configuration** → **Calibration Settings** → **Purge/Hold** → **mA Output** in the DCS.

4.3 Other calibration features

4.3.1 Calibration check

You can use the O_2 drift check feature to validate that the current calibration is still valid or if you need to recalibrate.

When using this feature, a target gas of a known O_2 value is applied to the probe and measured over a timespan. Once the target gas has been measured, the analyzer calculates the differential between the measured O_2 and the known target gas O_2.

The calibration check threshold is set to a default of 0.2 percent of the target gas. This means that if the measured value drifts more than 0.2 percent of the target gas concentration, the calibration check will fail, and the analyzer will recommend a calibration.

You can also configure the O_2 drift value to your desired threshold.

Manual calibration check

Prerequisites

Before beginning calibration check procedures, ensure that the analyzer is configured to the desired calibration settings. On the local operator interface (LOI), navigate to **Configuration** → **Calibration Settings** → **Purge/Hold**.

Procedure

1. On the LOI, navigate to **Service Tools** → **Calibration** → **Run Manual Check**.
2. When ready to begin the manual calibration check, select **Start Check**. Follow directions on LOI screens.
3. Apply Gas 1/Target Gas. Turn nozzle on Manual Calibration to Low Gas or High Gas (depending on how Gas 1/Target Gas is configured). Set gas flow rate to 5 scfh (2.5 L/min). Press **Continue**.
   The ***Gas Stabilizing*** screen will appear. The transmitter will automatically detect stabilization of calibration gas (0.15 mV/min). This step can take up to 600 seconds. The ***Gas Collected*** screen will appear when the calibration gas is successfully collected.
4. Press **Next**.
   The calibration check should be complete at this point. A ***Cal Check Passed***, ***Cal Recommended*** or ***Cal Check Failed*** screen will appear.
5. Acknowledge ***Cal Check Passed***, ***Cal Recommended***, or ***Cal Check Failed***. Press **OK**..
   The ***Remove Cal Gas*** screen will appear.
6. Press **Continue**.
7. Remove gas by closing the nozzle.

   The calibration port must be sealed during normal operation.

   The ***Gas Purging*** screen will appear.

8. Once the gas has been purged, the screen will return to the main screen.

Automatic calibration check

The automatic calibration check runs the same program as the manual calibration check, but it is run automatically using the Rosemount SPS 4001B.

You can initiate an automatic calibration check through HART® communication or from **Service Tools** → **Calibration** → **Run Autocal Check** → **Start Check**. Automatic calibration check can also be configured to run a new calibration automatically when a calibration check fails.

4.3.2 Plugged Diffuser diagnostic

The **Plugged Diffuser** diagnostic feature measures the return to process rate after calibration gases are removed and initiates an alarm when this time exceeds 75 percent of the purge time configured.

A `Purge Time Too Short` alarm is an indication that the diagnostic could not work because of a short purge time and could also indicate that the diffuser is plugged. In this case, increase purge time. Another feature that comes with the plugged diffuser diagnostic is automatic gas switching. This feature switches calibration gases and ends the purge sequence when the readings settle instead of waiting for a configured flow time. This saves time and gas.

4.3.3 View current calibration constants

You can view current calibration constants, including slope, cell constant, cell impedance, and calibration gas values at any time via the Rosemount CX2100 local operator interface (LOI) or a handheld device.

To view current calibration constants:

Procedure

Go to **Main Menu** → **Service Tools** → **Calibration** → **Calibration Menu** → **Cal Constants** → **View Current Constants**.

4.3.4 Load custom calibration constants

If needed, you can load custom calibration constants via the Rosemount CX2100 local operator interface (LOI) or a handheld device.

These constants include the slope and cell constant values. To load custom calibration constants:

Procedure

Go to **Main Menu** → **Service Tools** → **Calibration** → **Calibration Menu** → **Cal Constants** → **Load Custom Constants**.

4.4 System parameter descriptions

Among the parameters available through the handheld communicator menus are a number of system parameters, which define variables that configure a specific probe in the analyzer system. System parameters are described in the following table.

Table 4-1: System Parameters

Parameter name	Unit	Description
O_2	%	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.
O_2 Temp	°C	Current O_2 sensor temperature.
CJC Temp	°C	Current cold junction temperature.
O_2 Cell	mV	Raw mV value for O_2 sensor.
Cell Imp	ohm	Cell impedance/sensor resistance measured.
Heater Power	kW	Heater power
O_2AO	mA	Analog output value represents the O_2 concentration measurement.
O_2 Temp Max	°C	This is the highest O_2 sensor temperature reached since last reset.
O_2 Temp Max Time	Days ago	Time stamp of the highest O_2 sensor temperature reached since last reset.
OP Mode	--	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)
Active alarms	--	Current alarms
Device	--	Alarm state
Failed	--	Alarm state: On/Off `NV Memory Fail`, `Board Temp High`, `Factory Mode`, `Heater Ramp Rate`
Maintenance 1	--	Alarm state: On/Off O_2 Sensor Open, O_2 T/C Open, O_2 Temp Low, O_2 Temp High, O_2 T/C Shorted, O_2 T/C Reversed, `Heater Failure`, `Burner Flameout`
Maintenance 2	--	Alarm state: On/Off `Xmtr Disconnect`, `Cal Recommended`, `Cal Failed`, `Cell Imp High`, `Probe Mismatch`
Advisory	--	Alarm state: `Xmtr Disconnect`, `Cal Recommended`, `Cal Failed`, `Cell Imp High`, `Probe Mismatch`
Duty Cycle	--	O_2 heater duty cycle. Value between 0 and 1.
O_2 Temp SP	°C	PID temperature set point.

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

Parameter name	Unit	Description
Heater Ramp Rate	°C/sec	Heater ramp rate calculated in °C per second.
Operating Status	--	Device configuration: On/Off `Factory Mode`, `Flame Status` (IO Board DIP Switch setting), `Auto Cal Device`, `Relay 1 Device`, `Relay 2 Device`, `AO Device`
Xmtr EE Val	--	Analyzer board nonvolatile memory diagnostic.
Xmtr Restart	--	Software restart count for the analyzer.
HART | Device Rev	--	HART device revision number.
Analyzer | Version	--	Software version number for the analyzer.
Tag	--	Device tag: Up to 8 characters long.
Serial Number	--	Probe serial number.
Device ID	--	Unique device ID number. (HART)
PV	--	Primary variable assignment: O_2 (HART).
SV	--	Secondary variable assignment: Cell imp (HART).
TV	--	Third variable assignment: Cell imp (HART).
4V	--	Fourth variable assignment: O_2 cell (HART).
Xmtr Address	--	Analyzer board polling address.
O_2 LRV	%	Primary variable (O_2%) lower range value.
O_2 URV	%	Primary variable (O_2%) upper range value.

4.5 Parameter setup

4.5.1 Set test gas values

Use the local operator interface (LOI) or handheld communicator to set test gas values for calibration. Emerson ships the Rosemount CX2100 from the factory with the low test gas value set to 0.4 percent and the high test gas value set to 8 percent. Perform the following procedure each time you replace an analyzer board.

Procedure

1. Go to **Main Menu** → **Configuration** → **Calibration Settings**.
2. In the ***Calibration Settings*** menu, set values for **Gas 1** and **Gas 2**.

4.5.2 Set test gas times

Use the local operator interface (LOI) or Field Communicator to set test gas **Gas Time** and **Purge Time** for calibration.

Emerson ships the Rosemount CX2100 from the factory with the**Gas Time** set to Auto and the **Purge Time** set to 300 seconds. When set to `Auto`, the analyzer monitors for millivolt stability from test or calibration gas. Complete the following procedure each time you replace an analyzer board.

Procedure

1. From the main screen, go to **Main Menu** → **Configuration** → **Calibration Settings**.
2. In the ***Calibration Settings*** menu, select the **Gas Time** as `Auto`, `5 minutes`, or `10 minutes`.
3. In the ***Calibration Settings*** menu, select **Purge/Hold**. Change **Purge Time** in the ***Purge/Hold*** menu.

4.5.3 Configure **Analog Output (AO) Hold**

You can configure the analog output signal from the Rosemount CX2100 for the 4-20 mA range and fault condition.

The default condition for **AO Hold** is to hold the last AO value during calibration. Emerson ships the Rosemount CX2100 from the factory with the analog outputs set to a `3.5 mA` alarm level. You can also configure the alarm to Rosemount standard levels, NE43 levels, or custom levels. Complete this process each time you replace an analyzer board.

Procedure

1. From the main screen, go to **Main Menu** → **Configuration** → **Calibration Settings**.
2. In the ***Calibration*** menu, select either Hold or `Active` for the **Purge/Hold** setting.

4.6 *Calibration* Log

The Rosemount CX2100 stores the current and previous 10 calibrations. The stored data includes the slope, constant, cell impedance, and time (in days) since that calibration. The log can be accessed as follows:

Using the local operator interface (LOI): **Service Tools** → **Service Data** → **Calibration Logs**.

When first entering the log, the screen displays `Calibration 1`. This is the most recent previous calibration, not the current calibration. `Calibration 0` displays the current calibration. Use the keypad or communicator keys to navigate through the logs. The factory default for log entries is a slope of 50.00 mV/Dec and a constant of 0.00 mV. Any log entries with these values means there have not been at least 10 calibrations performed to fill the entire log.

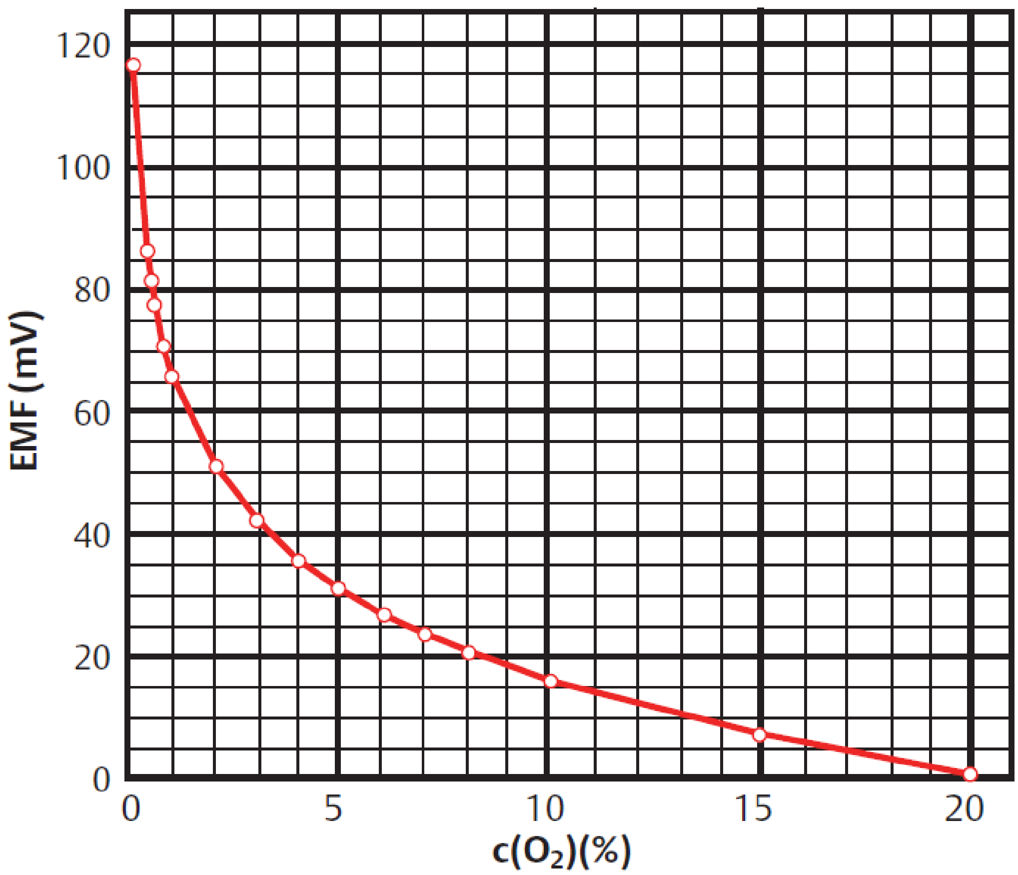
5 Troubleshooting

5.1 Overview

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 percentage and the reference O_2 percentage inside the probe (20.95 percent O_2 instrument or ambient 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. Percent O_2 at +1357 °F (+736 °C) (Reference Air, 20.95 Percent O_2)



O_2%	EMF (mV)
100	-34
20	1.0
15	7.25
10	16.1
9	18.4
8	21.1
7	23.8
6	27.2
5	31.2
4	36.0
3	42.3
2	51.1
1	66.1
0.8	71.0

O_2%	EMF (mV)
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 Electrical issues

⚠ WARNING

Electric shock

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

Install all protective covers and ground leads after troubleshooting.

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

5.2.1 Grounding

It is essential that you take adequate grounding precaution when installing the system.

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

5.2.2 Electrical noise

Emerson designed the analyzer to operate in an 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

NOTICE

Electrostatic discharge can damage ICs in the electronics.

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

5.3 Alarm indications

The operators running the process are usually the first to recognize a problem at the O_2 measuring system. 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:

Alarm levels default to NE43 standards.

4-20 mA signal alarm level	Analyzer condition
0 mA	Analyzer power is off or completely failed
3.5 mA	Critical alarm - analyzer 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 - analyzer 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, make sure that the distributed control system (DCS) is configured to interpret signal levels correctly.

Once an alarm condition is identified, the Rosemount CX2100 offers several diagnostics to interpret the specific alarm.

Alarm indications are available via the local operator interface (LOI) or the Field Communicator and Rosemount AMS 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.

Note
The CX2100 has a measurable O_2 range of 0 to 50 percent. In addition to checking the distributed control system (DCS), ensure that the analyzer is configured so the analog output (AO) range matches a typical O_2 range for the process.

5.3.1 `Flame Safety Interlock On`

Category	Failure
Analog output status	`Alarm`

The flame safety interlock has tripped, indicating that conditions are not safe for the heater to be on.

Recommended action

Check process conditions to resolve why the interlock tripped.

5.3.2 `Heater Ramp Rate Fault`

Category	Failure

Analog output status	`Alarm`

Heater ramp rate is outside the defined warm-up ramp rate, or warm-up has timed out.

Recommended actions

1. Check the wiring between probe and electronics.
2. Cycle power on the electronics.
3. Replace the probe electronics if the alarm does not clear.

5.3.3 `Board NV Memory Corruption`

Category	Failure
Analog Output Status	Alarm

An error was detected in the configuration memory when the device was turned on.

Recommended actions

1. Restart the device.
2. If alert persists, perform a factory reset.

5.3.4 `Analog Output Readback Failure`

Category	Failure
Analog output status	Alarm

Readback of analog output is out of tolerance since the last trim.

Recommended actions

1. Check the integrity of the loop.
2. Reset the device.
3. Perform an analog output trim.
4. Replace electronics if failure exists.

5.3.5 `Cell Temp Low`

Category	Failure
Analog output status	Alarm

The cell temperature is below the low temperature threshold while not in sensor warm-up mode.

Recommended actions

1. Check the wiring between probe and electronics.
2. Check process for instability.

5.3.6 `Cell Temp High`

Category	Failure

Analog output status	Alarm

The cell temperature is above the high temperature threshold. If the extended temperature range feature is enabled, the cell temperature is above this threshold.

Recommended actions

1. Check the wiring between probe and electronics.
2. High process temperatures can damage the cell. Ensure process temperatures are below the high temperature threshold.

5.3.7 Thermocouple `(TC) Shorted`

Category	Failure
Analog output status	Alarm

This diagnostic is only intended to detect a copper short of the thermocouple connections at the electronics connector. The cell heater thermocouple voltage is reading close to zero, indicating the thermocouple may be shorted.

Recommended action

Check the wiring between probe and electronics for short circuits.

5.3.8 Thermocouple `(TC) Open`

Category	Failure
Analog output status	Alarm

The resistance between the thermocouple terminals is more than a threshold, indicating the thermocouple wires may be disconnected or thermocouple junction may be open.

Recommended actions

1. Check the wiring between probe and electronics.
2. Ensure board connectors and feed-thru cable harnesses are installed correctly.
3. Ensure feed-thru is mating with connectors correctly.
4. Ensure low resistance between TC+ and TC- throughout the probe to the electronics.

   Resistance reading should be less than 10 ohms.

5.3.9 Thermocouple `(TC) Reversed`

Category	Failure
Analog output status	Alarm

The thermocouple voltage is reading a negative voltage, indicating the thermocouple wire connections may be reversed.

Recommended actions

1. Check the wiring between probe and electronics.
2. Ensure the conductor polarity matches the thermocouple extension wire color.

5.3.10 O2 Sensor Open

Category	Failure
Analog output status	Alarm

The cell impedance is indicating the sensor wires may be disconnected or the sensor junction may be open.

Recommended actions

1. Check the wiring between probe and electronics.
2. Check cell integrity and replace the cell if issue persists.

5.3.11 Board Electronics Failure

Category	Failure
Analog output status	Alarm

A failure has occurred on the board electronics.

Recommended actions

1. Cycle power on the electronics.
2. Replace electronics if failure persists.

5.3.12 Loop Current Fixed

Category	Maintenance
Analog output status	Fixed Current

The analog output is fixed and does not represent the process measurement. This may be because the device is in **Fixed Current** mode or the device is in a calibration.

Recommended action

Verify that it was intended for the transmitter to be operating in **Fixed Current** mode.

If **Calibration Hold** is enabled, loop current will be fixed until purge sequence is complete.

5.3.13 Board Temp High

Category	Advisory
Analog output status	Normal

The electronics board temperature reading is above the recommended operating threshold.

Recommended action

Relocate transmitter to a lower temperature location.

5.3.14 RTC Time Not Set

Category	**Advisory**
Analog output status	**Normal**

The real-time clock has not been set.

Recommended action

Set the transmitter date and time.

5.3.15 RTC Time Stuck

Category	**Advisory**
Analog output status	**Normal**

The real-time clock is not incrementing. Measurement will not be affected, but log timestamps will not be accurate.

Recommended actions

1. Set the transmitter date and time.
2. Replace electronics if failure persists.

5.3.16 Display Disconnected

Alert

Category	**Advisory**
Analog output status	**Normal**

Communication with a display board cannot be established.

Recommended action

Check display board alignment.

5.3.17 Heater Short/Open

Category	**Advisory**
Analog output status	**Normal**

An issue has been detected with the heater.

Recommended actions

1. Check the wiring between probe and electronics.
2. Cycle power on the electronics.
3. Disconnect probe and check integrity of heater terminals.
4. Replace the probe if heater is shorted or open.

5.3.18 Button Stuck

Category	**Advisory**
Analog output status	**Normal**

A stuck button was detected.

Recommended actions

1. Ensure screen is clear of moisture and debris.
2. Ensure glass cover is fully seated.
3. Cycle power on the electronics.

5.3.19 Stochiometer Diagnostic

Category	**Advisory**
Analog output status	**Normal**

Potential cause

The probe is detecting an oxygen deficiency.

5.3.20 Diffuser Warning

Category	**Advisory**
Analog output status	**Normal**

Recommended actions

1. Make sure calibration gas bottles are not empty and calibration gas is turned on.
2. Check the calibration line for obstructions.
3. Remove the diffuser from the probe and examine the diffuser.
4. Clean or replace the diffuser.
5. Calibrate or cycle power to clear.

5.3.21 Line Voltage Low

Category	**Advisory**
Analog output status	**Normal**

The supply voltage for the transmitter is below a minimum threshold. Heater capacity could be limited.

Recommended action

Check the power supply.

5.3.22 Line Voltage High

Category	**Advisory**

Analog output status	Normal

The supply voltage for the transmitter is above the maximum threshold.

Recommended action

Check the power supply.

5.3.23 Cell Impedance High

Category	Advisory
Analog output status	Normal

The cell impedance is high, indicating that the cell may be reaching end of life.

Recommended actions

1. Check the wiring between probe and electronics.
2. Check cell integrity and replace the cell if issue persists.

5.3.24 Calibration Recommended

Category	Advisory
Analog output status	Normal

Calibration is recommended. Either the cell impedance has shifted enough since the last calibration to indicate accuracy may be compromised, or a calibration check detected a shift in O_2 accuracy.

Recommended action

Calibrate the device.

5.3.25 Calibration Failed

Category	Advisory
Analog output status	Normal

An error occurred during the last calibration.

Recommended actions

1. Check calibration log for details.
2. Make sure calibration gas bottles are not empty and calibration gas is turned on.
3. Check the calibration line for obstructions.
4. Ensure cell is installed correctly and sealed tightly.
5. Replace cell if issue persists.
6. Recalibrate or cycle power to clear.

5.3.26 SPS Communication Failed

Category	Advisory

Analog output status	Alarm

During SPS calibration, communication was lost or could not be established.

Recommended actions

1. Ensure SPS is powered.
2. Check wiring between electronics and SPS.
3. Power cycle the SPS and electronics together.

5.3.27 Sensor Warmup

Category	Advisory
Analog output status	Alarm

The sensor is currently warming up.

Recommended action

Wait for completion of warmup cycle before measurement.

5.3.28 Low O2 Alarm

Category	Advisory
Analog output status	Normal

Recommended action

The O_2 reading is below the user-defined alarm setpoint.

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. Cycle AC power to the transmitter to clear a non-recoverable alarm.

Alarm messages are displayed on the Rosemount CX2100 local operator interface (LOI) or the handheld communicator.

A listing of the alarm/fault messages and the related fault status descriptions are shown in Table 5-1.

Table 5-1: Diagnostic/Unit Alarm Fault Definitions

Message	Status	Alert	Self clearing	Set critical alarm
NV Memory Fail	A checksum error was detected in the nonvolatile memory configuration data when the device was turned on. Default values have been loaded. Check to see that your configurations have not been changed. Cycle the power to clear alarm.	Failed	No	Yes
Board Temp High	The electronics board reading is above the threshold. The board may not function correctly. The predefined temperature threshold is +187 °F (+86 ° C) for input/output (IO) board or +259 °F (+126 °C) for transmitter board.	Failed	No	Yes
O2 Sensor Open	The cell impedance is reading less than -1.0 Vdc, indicating the O_2 sensor wires may be disconnected or the O_2 sensor junction may be open. Check wiring.	Maint	Yes	Yes
O2 TC Open	The O_2 sensor heater thermocouple voltage is reading more than 0.065 volt, indicating the thermocouple wires may be disconnected or the thermocouple junction may be open. Check wiring.	Maint	Yes	Yes
O2 Temp Low	The sensor heater temperature is below the low temperature threshold. If extended temperature feature is not enabled, the pre-defined low temperature threshold is +1339 °F (+726 °C). If extended temperature feature is enabled, the pre-defined low temperature threshold is +1339 °F (+726 °C) if the **Heater Set Point (SP)** is set to **Normal** or +1030 °F (+540 °C) if the **Heater SP** is set to **Low**.	Maint	Yes	Yes
O2 Temp High	The heater temperature is above the defined temperature threshold. If extended temperature feature is not enabled, the pre-defined high temperature threshold is +1382 °F (+750 °C). If extended temperature feature is enabled, the high temperature threshold is defined by the **High Temperature Alarm Set Point (Temp Alrm SP)** parameter.	Maint	Yes	Yes
O2 T/C Shorted	This diagnostic is only intended to detect a copper short of the thermocouple connections at the electronic connector. The cell heater T/C voltage is reading close to zero, indicating the thermocouple wires may be shorted.	Maint	Yes	Yes

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

Message	Status	Alert	Self clearing	Set critical alarm
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. Check wiring.	Maint	Yes	Yes
Cal Failed	A calibration error occurred during the last calibration. Check the calibration result for more details. Acknowledge calibration failed or recalibrate to clear alarm.	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
Xi Disconnect	It indicates using transmitter's analog output (AO) when connected to Rosemount 6888Xi and Rosemount 6888Xi is disconnected.	Maint	Yes	Yes
Htr Voltage Low	The heater voltage for the O_2 heater is below 30 volts. Check heater power.	Adv	Yes	No

5.4.1 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 a new diffuser is installed.

Potential cause

External reference air leak.

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

Recommended action

Verify that the calibration gas is capped tightly between calibrations.

If using an abrasive shield, a small leak at the probe flange can migrate down the annular space between the probe outer dimension (OD) and shield inner dimension (ID) to the sensing cell, causing a false high O_2 reading.

Figure 5-2: Probe Leakage Paths

A. Calibration gas ¼-inch tube
B. Reference air ¼-inch tube
C. Vent

Potential cause

Internal reference air leak.

There may be a leak inside the O_2 probe itself, permitting the reference air (20.95 percent 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. You may also need to seal the conduit ports where the signal and power wires pass. The O_2 reading should decrease slightly. If the O2 reading increases during this test, there is a leak inside the probe.

Recommended actions

1. Acid condensation inside the probe can degrade the hose that carries the calibration gas to the cell. Inspect this hose.

   Dislodging or improper installation of the calibration 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.

Potential cause

Bad reference side cell electrode.

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.

5.4.2 Probe passes calibration, O_2 still reads low

Potential cause

A bad reference side cell electrode can cause an elevated O_2 reading. This fault is usually indicated by a frequent `Calibration Recommended` alarm and increasing cell impedance readings.

Recommended action

A high cell impedance can be calibrated out, but if the impedance continues to increase rapidly, replace the sensing cell.

NOTICE

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

5.4.3 How do I detect a plugged diffuser?

When the diffuser is plugged:

- 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 read lower. Never readjust this flow upwards to correct for a plugged diffuser.

NOTICE

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 calibration gas is removed. As the diffuser plugs, this recovery time will increase. Use a calibration record to record and track calibration response times.

The Rosemount 6888Xi Advanced Electronics is available with an enhanced software feature to automatically characterize the rate of diffuser plugging during a calibration cycle.

Related information

Calibration

5.4.4 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 percent, and the first calibration gas is 8 percent. Adjust the flow of calibration gas downward until the reading begins to migrate from 8 percent to lower values, indicating that the process gases are now mixing with the calibration gases.

Adjust the flow rate back up until the gases stop mixing. Calibrate at this flow rate. Replace the diffuser as soon as possible.

⚠ WARNING

Electric shock

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

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

6 Maintenance and service

6.1 Maintenance intervals

The required maintenance interval depends on the ambient and process conditions the analyzer is exposed to.

The zirconium oxide sensing cell is non-depleting and has no specific shelf life or a defined life in flue gas operation. The sensitivity of a sensing cell that is mounted inside a boiler that is burning natural gas may shift slightly 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 percent O_2).

The manual calibration check or SPS calibration check will notify the operator if a calibration is recommended.

Combustion processes with a high level of ash or other particulate content will cause the diffusion element on the end of the probe to plug. A significantly 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. In addition, a significantly plugged diffuser can introduce error during a calibration and negatively affect accuracy.

When performing a calibration check or actual calibration, the calibration flow meter may read lower if the diffuser is significantly plugged. Never increase the flow rate, 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. Diffuser plugging can be tracked through the calibration record.

Visually inspect the probe during plant outages, paying particular attention to condensed components. Condensation can be reduced or eliminated by insulating the probe installation, including the probe mount, flange, and blue housing.

6.2 Repair

Each of the following procedures details how to remove and replace a specific component of the Rosemount CX2100.

⚠ WARNING

Burns

Failure to comply may cause severe burns.

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

⚠ WARNING

Electric shock

Disconnect and lock out power before working on any electrical components. There is voltage up to 240 Vac.

6.2.1 Remove and replace probe

Remove probe

To remove the probe from the stack:

Procedure

1. Turn off power to the system.
2. Shut off the calibration gases at the cylinder and the instrument air.
3. Disconnect the calibration gas and instrument air lines from the transmitter.
4. Remove housing cover.
5. Remove all signal and power wiring to the probe.
6. Remove insulation to access the mounting probe.
7. Unbolt the transmitter from the stack and take it to a clean work area.
8. Allow the device to cool to a comfortable working temperature.

Replace probe

To replace the probe in the stack:

Procedure

1. Bolt the transmitter to the stack and install the insulation.
2. Connect all signal and power leads at the probe.
3. Connect the calibration gas and instrument air lines to the probe.
4. Install the housing cover.
5. Turn on instrument air.
6. Restore power to the system.

NOTICE

Recalibration is required whenever the electronic cards or sensing cell is replaced.

Related information

Installation

6.2.2 Replace oxygen sensing cell

If you need a cell replacement, order the cell replacement kit.

The cell replacement kit (Figure 6-1) contains a cell and flange assembly, corrugated seal, setscrews, socket head cap screws, and anti-seize compound. The items are carefully packaged to preserve precise surface finishes. Do not remove items from the packaging until they are ready to be used. Spanner wrenches and hex wrenches needed for this procedure are part of an available special tools kit (Table 1).

⚠ WARNING

Burns

Probe components can be as hot as 572 °F (300 °C). This can cause severe burns.

Use heat-resistant gloves and clothing when removing the probe.
Do not attempt to work on these components until they have cooled to room temperature.
Disconnect and lock out power before working on any electrical components. There is voltage up to 240 Vac.

⚠ CAUTION

Equipment damage

Do not remove the cell unless you are certain it needs to be replaced.
Follow the complete troubleshooting procedure to make sure the cell needs to be replaced before removing it.

Figure 6-1: Cell Replacement Kit

Procedure

1. Follow the instructions in Remove and replace probe to remove the transmitter from the stack or duct.

2. If the probe uses the standard diffusion element, use a wrench to remove the diffuser assembly.
3. Use spanner wrenches from the probe disassembly kit (Table 1) to turn the hub free from the retainer.
4. Inspect the diffusion element. If it is damaged, replace the element.
5. Loosen the four socket head cap screws from the cell and flange assembly.
6. Remove the assembly and the corrugated seal.

NOTICE

The cell flange has a notch that may be used to gently pry the flange away from the probe. The contact pad inside of the probe sometimes fuses to the oxygen sensing cell. If the cell is fused to the contact pad, push the cell assembly back into the probe (against spring pressure) and quickly twist the cell assembly.

7. Remove and discard the corrugated seal.
8. Clean the mating faces of the probe tube and retainer.
9. Remove burrs and raised surfaces with a block of wood and crocus cloth.
10. Clean the threads on the retainer and hub.
11. Rub a small amount of anti-seize compound on both sides of the new corrugated seal.
12. Assemble the cell and flange assembly, corrugated seal, and probe tube.
13. Make sure the calibration tube lines up with the calibration gas passage in each component.
14. Apply a small amount of anti-seize compound to the screw threads and use the screws to secure assembly.
15. Torque to 60 in-lb (6.8 N-m).
16. Follow the instructions in Remove and replace probe to install the transmitter to the stack or duct.
17. Turn on power and monitor thermocouple output.

    It should stabilize at 29.3 ±0.2 mV.
18. Set reference air flow at 2 scfh (1 L/min).
19. After the transmitter stabilizes, calibrate the probe.
20. If new components have been installed, repeat calibration after 24 hours of operation.

6.2.3 Replace diffusion element

The diffusion element protects the cell from particles in process gases.

In severe environments, the diffusion elements may be plugged, broken, or subject to excessive erosion.

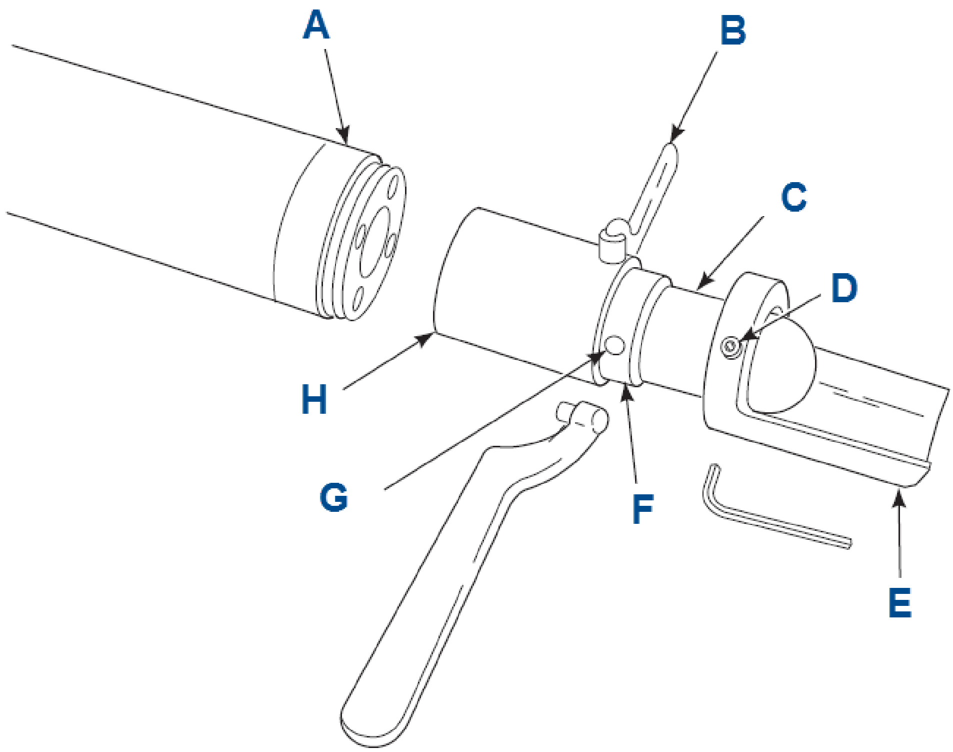
Examine the element whenever removing the probe for any purpose. Replace if damaged.

Damage to the diffusion element may become apparent during calibration. Compare probe response with previous response.

A slow response to process gas after calibration may indicate diffuser plugging.

A broken diffusion element will cause an inadequate response to calibration gas. Hex wrenches needed to remove setscrews and socket head screws in the following procedure are available as part of a probe disassembly kit, Table 1.

Figure 6-2: Ceramic Diffuser Element Replacement



A. Retainer
B. Spanner wrench
C. Optional ceramic diffusion element
D. Set screw
E. Vee deflector
F. Cement fillet
G. Cement port
H. Hub

Procedure

1. Follow the instructions in Remove and replace probe to remove the probe from the stack or duct.
2. Loosen set screws (D) using the hex wrench from the probe disassembly kit and remove the vee deflector (E). Inspect sets crews. If damaged, replace with stainless sets crews coated with anti-seize compound.
3. Follow the instructions in Remove and replace probe to install the probe into the stack or duct.

6.2.4 Replacing electronics module

The electronics module is not repairable and must be replaced if any component fails.

The electronics module is available as a spare parts kit.

⚠ WARNING

Electric shock

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

NOTICE

Measurement errors

Failure to resynchronize the calibration parameters with a Rosemount CX2100 after replacing the transmitter board or recalibrating the device may cause an inaccurate O_2 measurement. When the transmitter board is replaced and the calibration parameters are not synchronized with the CX2100, the parameters in the CX2100 will be used as default to calculate the O_2 measurement.

Remove electronics

Prerequisites

An additional 3 mm hex driver is required.

Procedure

1. Remove existing display.
2. Loosen the 3 mm hex screws until released from housing.
3. Disconnect wiring harness connector from electronics.
4. Pull out electronics module.

Reinstall electronics

Procedure

1. Insert electronics module.
2. Reconnect wiring harness connector to electronics.
3. Tighten the 3 mm hex screws.
4. Replace display.

6.2.5 Battery replacement

The transmitter contains a battery that is used to power the clock when the transmitter is not powered up.

Check the transmitter clock. During the reboot, the transmitter clock is powered by the battery; therefore, the transmitter clock and all timestamps should be accurate. If the transmitter clock is not correct, the battery may need to be replaced.

Operators cannot service or replace the battery. If the battery needs to be replaced, contact customer support.

If the battery is non-functional and the transmitter is powered down, then powered up, the clock will restart from the time of the power-down. All timestamps will be affected. You can correct the issue by resetting the transmitter clock.

For a permanent resolution, the battery must be replaced.

6.3 Replacement parts

Part number	Description
6A00453G01	Kit: snubber diffusion assembly (compatible with O_2 cell)
6A00453G02	Kit: snubber with dust seal (compatible with O_2 cell)
3534B48G01	Kit: vee deflector assembly
6A00453G03	Kit: ceramic diffuser with vee-deflector (compatible with O_2 cell)
6A00453G05	Kit: alloy C-276 diffuser with vee deflector (compatible with O_2 cell)
6A00453G06	Kit: alloy C-276 diffuser with dust seal (compatible with O_2 cell)
02101-8030-0001	20-ft. (6.1 m) 7-conductor shielded remote cable for Rosemount CX2100
02101-8030-0002	60-ft. (18.3 m) 7-conductor shielded remote cable for CX2100
02101-8030-0003	100-ft. (30.5 m) 7-conductor shielded remote cable for CX2100
02101-8030-0004	200-ft. (61 m) 7-conductor shielded remote cable for CX2100
02101-8030-0005	300-ft. (90.4 m) 7-conductor shielded remote cable for CX2100
02101-8031-0001	½-inch NPT cable glands
02101-8031-0002	M20 cable glands
02101-8030-0006	1000-foot (304.8 m) cable spool
02101-8060-0001	Spare glassed header
02101-8061-0001	Spare quick connect clamp kit (purchased as a kit)
02101-8050-0010	Standard replacement kit, ANSI
02101-8050-0011	Standard cell replacement kit, DIN
02101-8050-0020	High sulfur cell replacement kit, ANSI
02101-8050-0021	High sulfur cell replacement kit, DIN
6A00456G03	DIN 2 in., 5 piece gasket
6A00456G01	ANSI 2 in., 5 piece gasket
6A00456G02	ANSI 3 in., 5 piece gasket
6A00456G04	DIN 3 in., 5 piece gasket
02101-8070-0001	Local operator interface (LOI) display assembly
02101-8071-0001	LOI window cover
02101-8072-0001	Advanced features board stack - transmitter
02101-8072-0002	Standard board stack - transmitter
02101-8074-0001	Terminal analog input (AI) cover
02101-8075-0001	Phoenix connector kit (1 terminal, 2 junction boxes)
02101-8073-0001	Transmitter internal cable assembly

Part number	Description
02101-8073-0002	Junction box internal cable assembly
02101-8077-0001	Wall mount kit (for remote transmitter)
02101-8076-0001	Junction box board
4512C34G01	ANSI 2-inch Class 150 new weld plate
4851B11G01	ANSI 3-inch Class 150 new weld plate
4512C36G01	DN65 PN10 new weld plate
1M03235G01	DN 100 PN06 new weld plate
3535B30G04	ANSI 2-inch Class 150 to existing 3-inch 150 adapter plate
3535B30G01	ANSI 2-inch Class 150 to existing 4-inch 150 adapter plate
3535B30G05	ANSI 2-inch Class 150 to existing 6-inch 150 adapter plate
3535B30G10	ANSI 2-inch Class 150 to existing 3-inch 300 adapter plate
4851B78G21	ANSI 2-inch Class 150 to existing 4-inch 300 adapter plate
4851B24G10	ANSI 2-inch Class 150 to existing 4-inch 150 adapter plate
4851B24G23	ANSI 3-inch Class 150 to existing 4-inch 150 adapter plate
4851B24G23	ANSI 3-inch Class 150 to existing 6-inch 150 adapter plate
4851B78G25	ANSI 3-inch Class 150 to existing 4-inch 300 adapter plate
3D39004G01	3-inch ANSI bypass and mounting hardware package for use with 18-inch ANSI General Purpose
3D39004G02	6-inch ANSI bypass and mounting hardware package for use with 18-inch ANSI General Purpose
3D39004G07	3-inch DIN bypass and mounting hardware package for use with 18-inch DIN General Purpose
3D39004G08	3-inch DIN bypass and mounting hardware package for use with 18-inch DIN General Purpose
3D39004G11	Bypass assembly, 18 in. ANSI
3D39005G01	90 ° bypass elbow probe housing - 4-inch 150# ANSI bolt circle for ANSI general purpose probe
3D39005G03	90 ° bypass elbow probe housing - 4-inch 150# ANSI bolt circle for DIN general purpose probe
4507C26G01	Bypass pickup assembly 3 ft. long, for general purpose ANSI probe
4507C26G02	Bypass pickup assembly 6 ft. long, for general purpose ANSI probe
4507C26G07	Bypass pickup assembly 3 ft. long, for general purpose DIN probe
4507C26G08	Bypass pickup assembly 6 ft. long, for general purpose DIN probe
3D39003G01	Abrasive shield ANSI 2 in., 3 ft.
3D39003G02	Abrasive shield ANSI 2 in., 6 ft.
3D39003G05	Abrasive shield DIN 65, 3 ft.
3D39003G06	Abrasive shield DIN 65, 6 ft.
3D39003G13	Abrasive shield ANSI 2 in., 18 in.
3D39003G15	Abrasive shield DIN 65, 18 in.
3D39003G31	Abrasive shield, ANSI 2 in., 18 in.
3D39003G32	Abrasive shield, ANSI 3 in., 3 ft.
3D39003G33	Abrasive shield DIN 100, 3 ft.
3D39003G34	Abrasive shield DIN 100, 6 ft.

Part number	Description
3D39003G39	Abrasive shield DIN 100, 18 in.
3D39003G40	Abrasive shield DIN 100, 18 in.
1A99119G01	O_2 calibration gas kit: contains 0.4% and 8.0% O_2 bottles, 550 L each (requires two CGA-590 regulators)
1A99119G02	O_2 calibration gas regulators kit: contains two CGA-590 regulators
6296A27G01	Portable test gas kit: contains 0.4% and 8.0% O_2 bottles, 103 L each, regulators, hoses, carrying case
1A99119H01	0.4% O_2, balance N_2 test gas bottle, 550 L
1A99119H02	8.0% O_2, balance N_2 test gas bottle, 550 L
1A99120H02	Regulator, pressure maximum inlet, CGA-590
3530B07G01	0.4% O_2, balance N_2 gas cylinder, 103 L (gray, no certifications available)
3530B07G02	8.0% O_2, balance N_2 gas cylinder, 103 L (gray, no certifications available)
6A00252G02	Manual calibration panel, including reference air regulator and flow meter, OXT
771B635H01	Flow meter 0 to 10 scfh
771B635H02	Flow meter, 0.2 to 2 scfh

7 Optional accessories

7.1 AMS

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.

7.2 Rosemount SPS 4001B Single Probe Autocalibration Sequencer

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

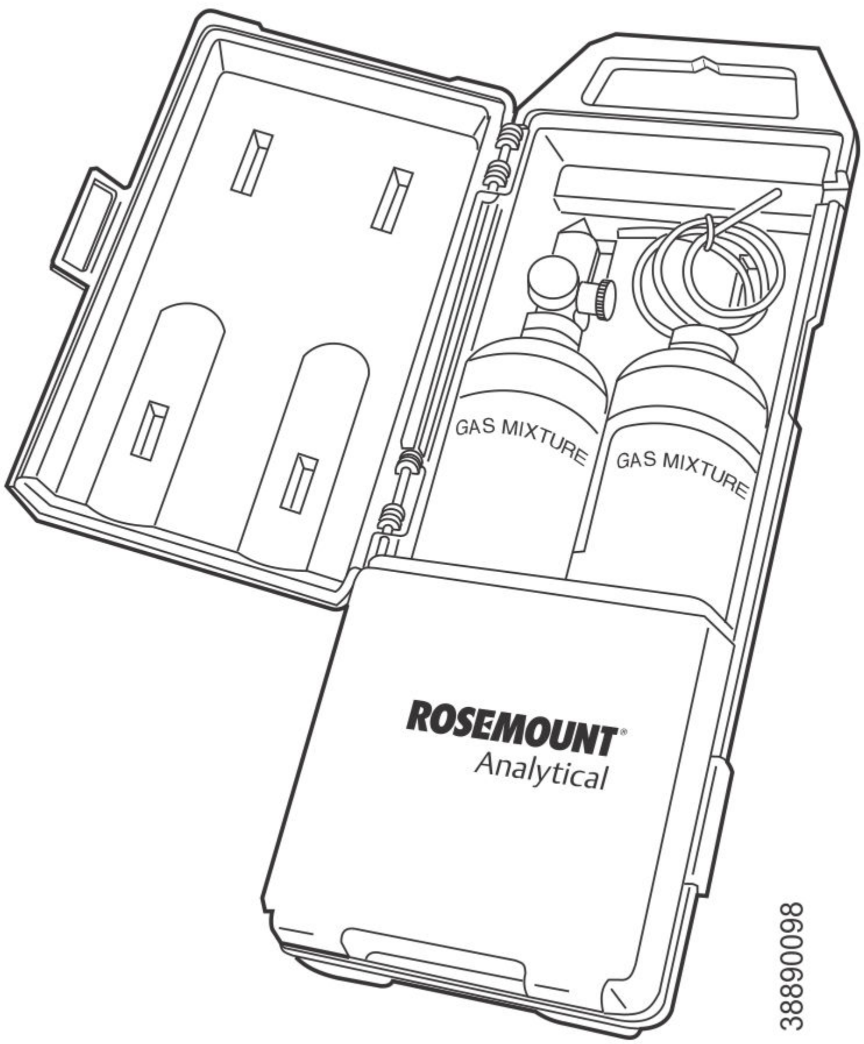
The SPS 4001B is fully enclosed in a NEMA® cabinet suitable for wall-mounting. This cabinet provides added protection against dust and minor impacts.

The SPS 4001B works in conjunction with the Rosemount CX2100, eliminating out-of-calibration occurrences and the need to send a technician to the installation site.

7.3 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 oxygen analyzers.

Figure 7-1: Calibration Gas Bottles



These lightweight, disposable gas cylinders eliminate the need to rent gas bottles.

A Menu trees

Figure A-1: *MAIN MENU*

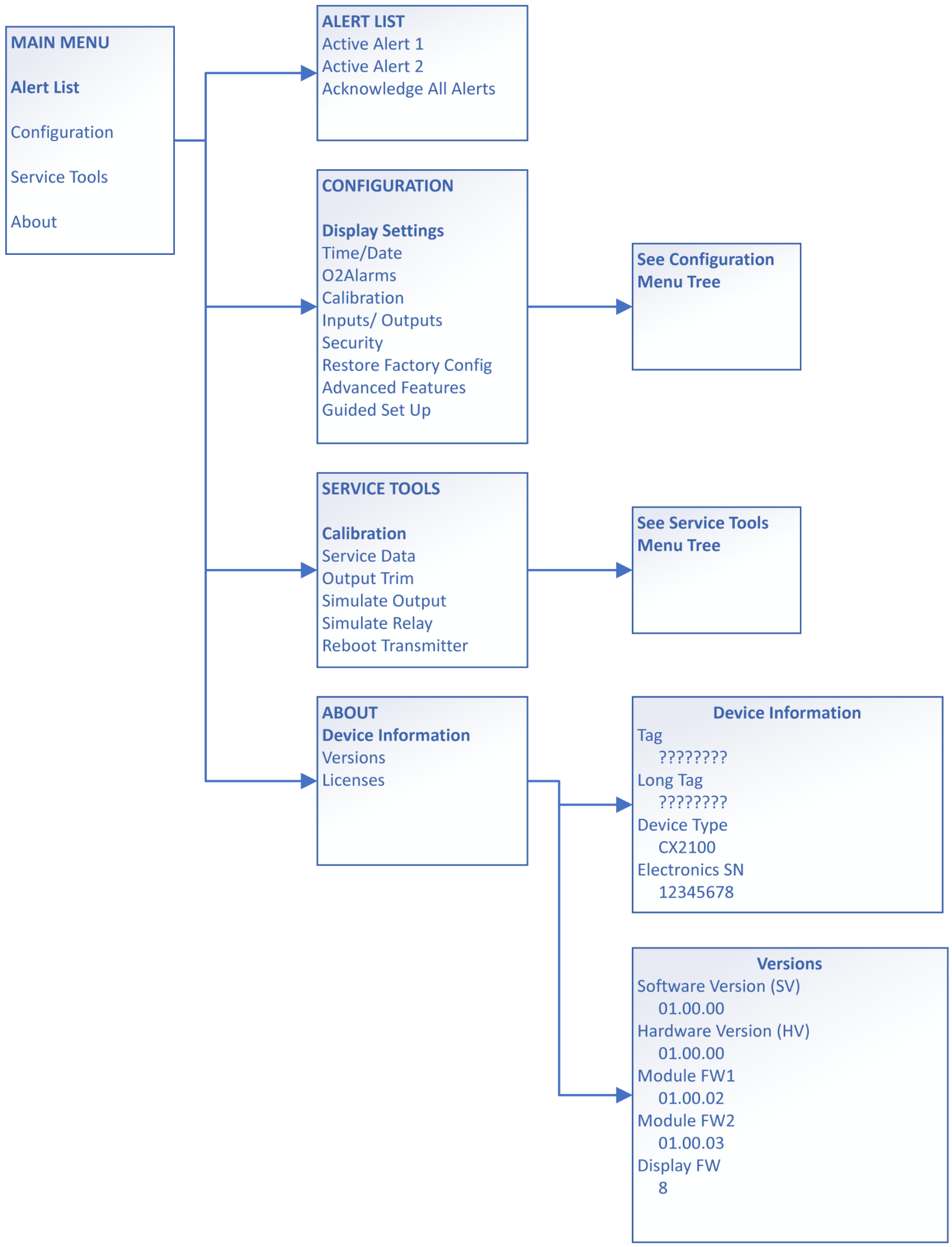


Figure A-2: *Configuration* menu - 1

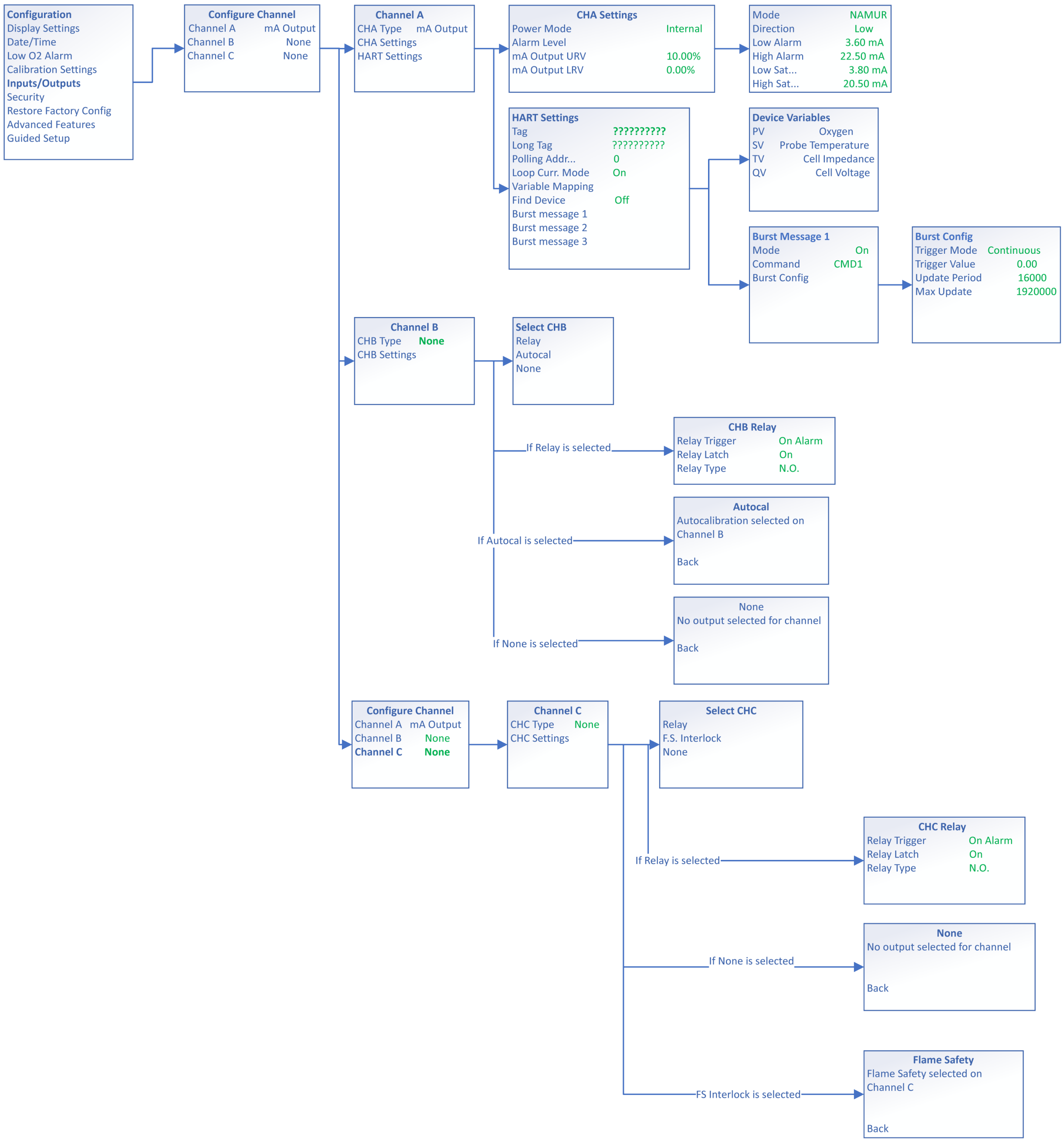


Figure A-3: *Configuration* menu - 2

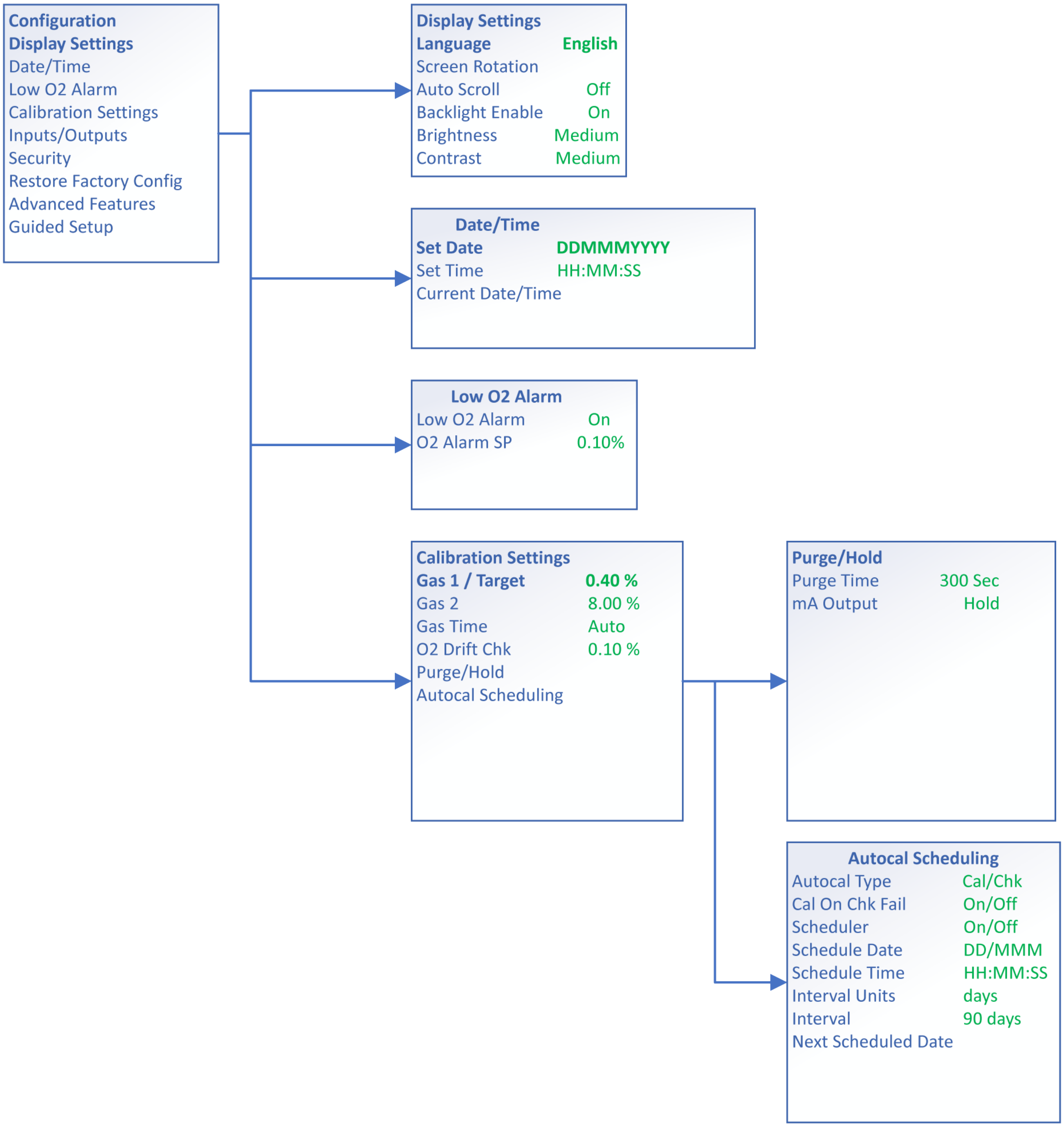
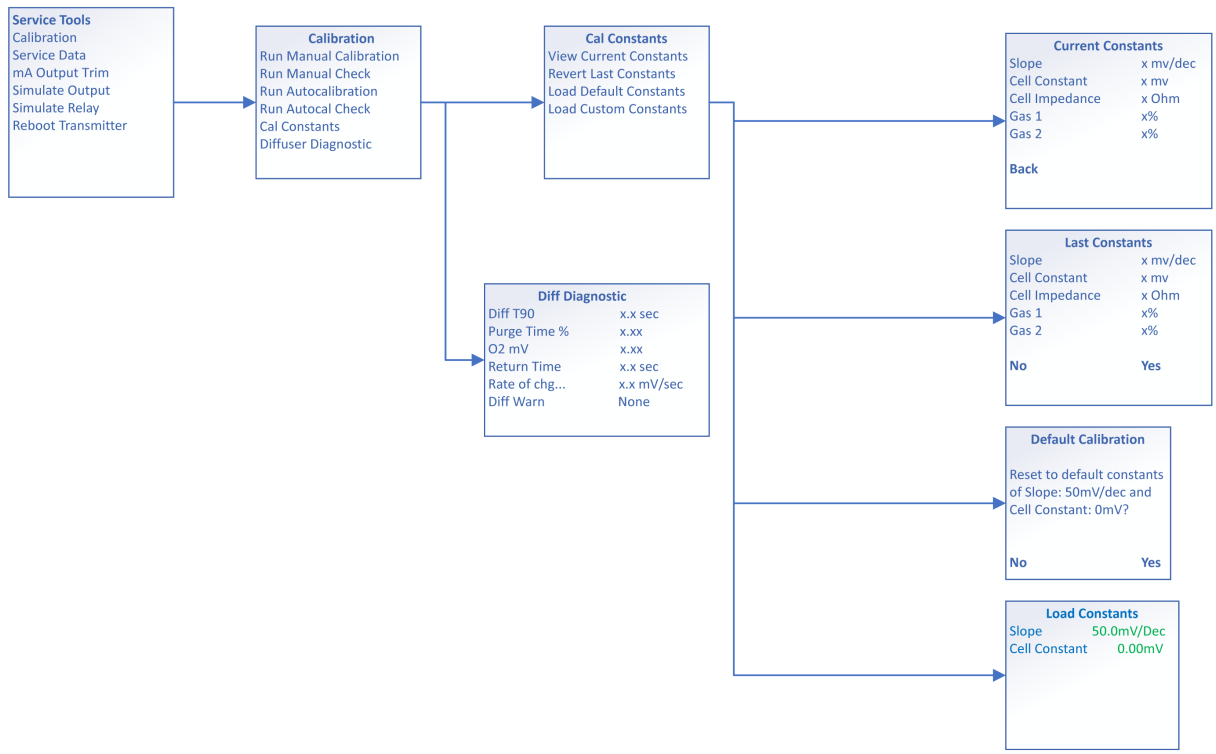


Figure A-4: *Service Tools* menu



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