

Instruction Bulletin Addendum For Pressure-Balanced In Situ Oxygen Probes

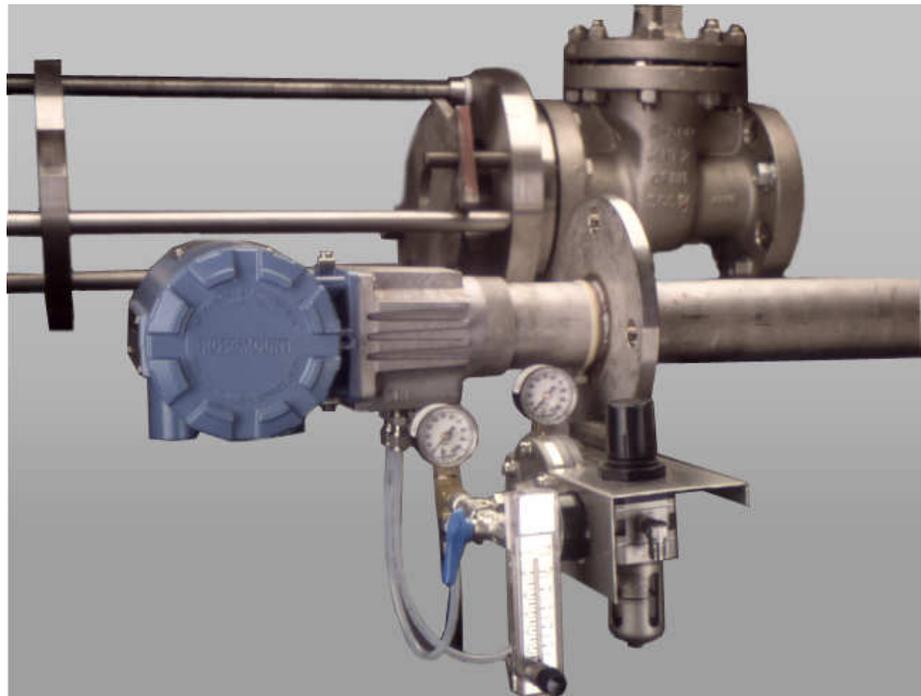
Instruction Bulletin Addendum IB – PB1000

Oxymitter 4000

Part no. _____

Serial no. _____

Order no. _____



Applicability:

Used with pressure-balancing option, p/n 3D39811 (50 psig maximum process pressure). This product option may be utilized with Rosemount Analytical's Oxymitter 4000/5000 O₂ analyzer or with Rosemount Analytical's CENELEC World Class O₂ Analyzer. This may also be used with 3081/4081FG high temperature systems (remote mounted only) and may be used in conjunction with optional Isolation Valving System Oxy-Iso 1000

General

Rosemount Analytical's line of in situ oxygen analyzers utilize zirconium oxide sensing technology, which is sensitive to pressure variations in the process. The ZrO₂ sensing cell develops an EMF O₂ relative to content based upon the Nernst Equation:

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

where:

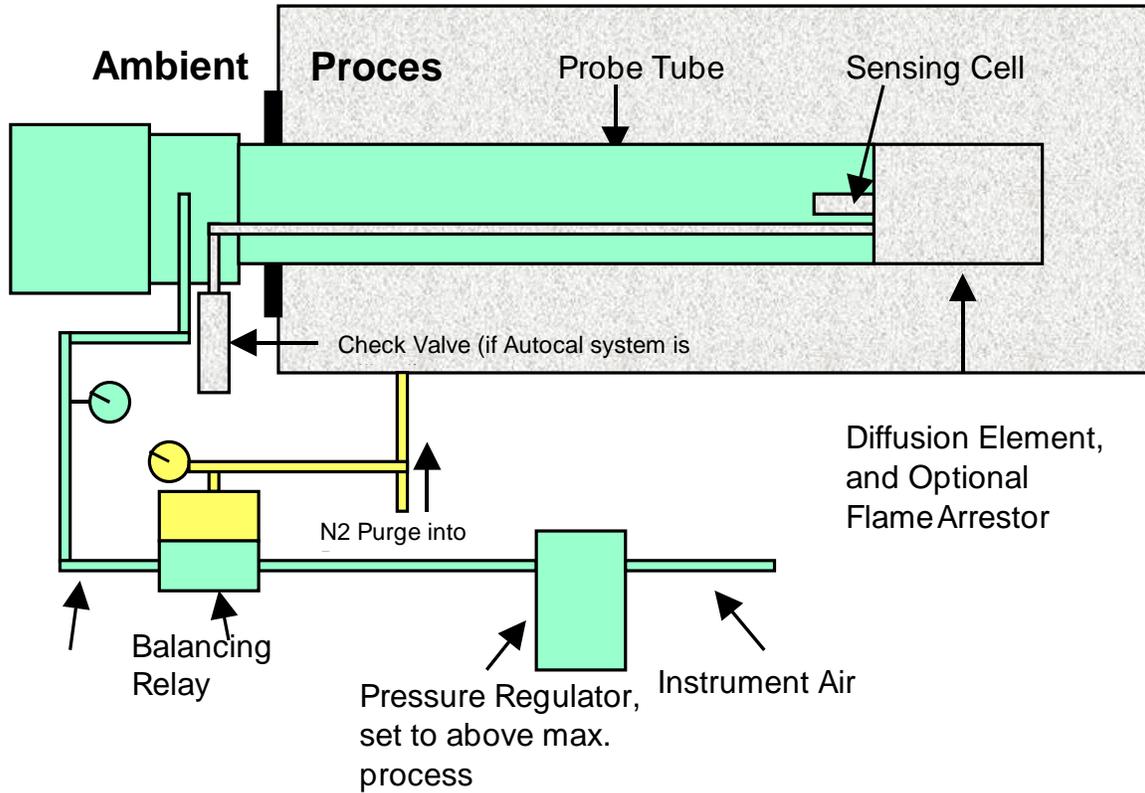
P2 is the partial pressure of oxygen on the flue gas side
P1 is the partial pressure of oxygen on the reference side
T is the absolute temperature
K is a constant
C is the cell constant.

Rosemount Analytical's Oxymitter and World Class probes place the sensing cell at the end of an in situ probe that inserts directly into the process gas stream. This arrangement provides for fast response and is also very resistant to pluggage from particulate material, or the acids that frequently condense out of normal flue gas.

The ZrO₂ sensing technology is sensitive to pressure changes of the process, and one can expect an output change of approximately 1% of reading (not 1 % FS, or 1% O₂) for every 4 inches of H₂O pressure or vacuum in the process. The pressure errors of a few psi can be calibrated by calibrating the probe in the installed, pressurized condition. However, pressure fluctuations from the calibrated state will induce errors. A better accommodation for pressurized processes is to balance the process pressure with reference air (common instrument air) inside of the oxygen probe (see following page). The sensing cell will have the same pressure on both sides, eliminating any pressure-induced error. Pressure fluctuations in the process will be balanced, maintaining the most accurate O₂ reading throughout normal operating conditions.

Rosemount Analytical's Oxymitter 4000/5000 probes (both hazardous area and general purpose styles) and the CENELEC World Class probes are suitable for pressure balancing. Process pressure is routed to a "balancing relay" via a nitrogen purge system or via the probe's internal calibration gas line. The balancing relay duplicates the process pressure with instrument air and this is routed to the reference side of the probe (inside of the probe). This pressure balancing system is integrally mounted to the probe and gauges are provided to confirm proper balancing operation.

Preferred Arrangement Utilizing N₂ Purge into the Process and Representing Process Pressure



Installation notes for N₂ Purge Arrangement

Install T for N₂ tap as close to process as possible.

Calibration Gas Fitting- capped tight between calibrations

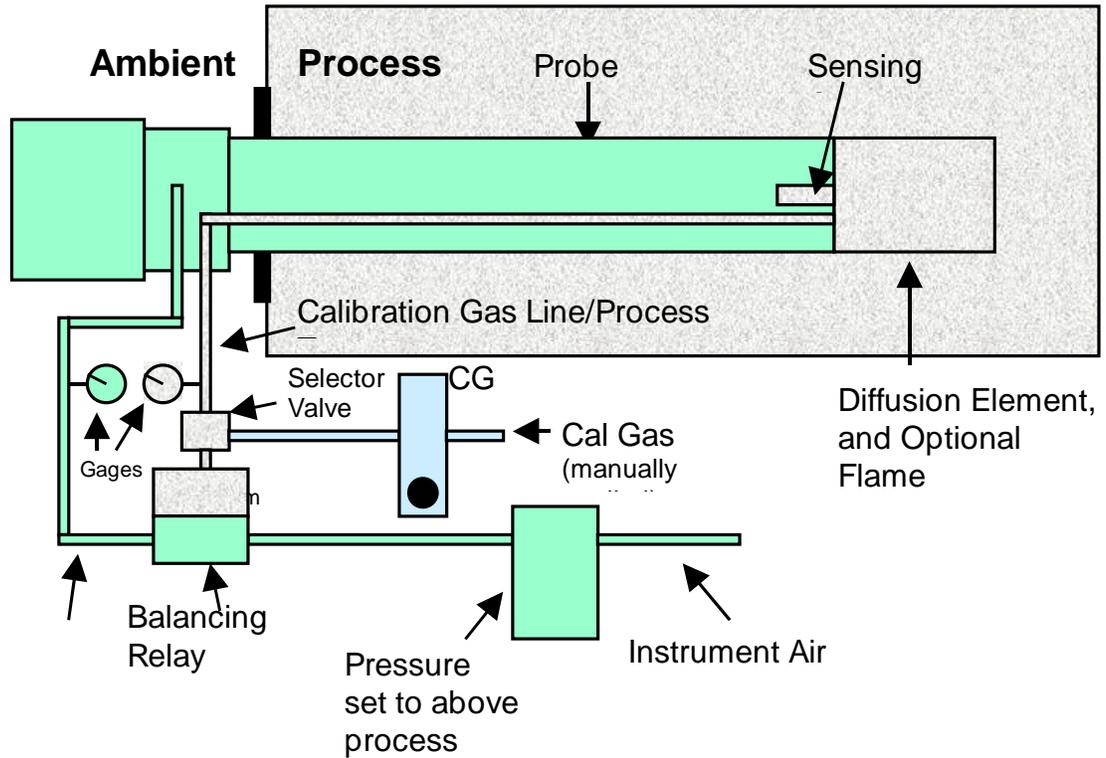
If autocal system is utilized, or if cal gas lines are permanently installed, use check valve kit, p/n 7307A56G02

Reference Gas Inlet- Piped to pressure/balancing system

Reference Gas Exhaust- Capped, ½ turn open from tight

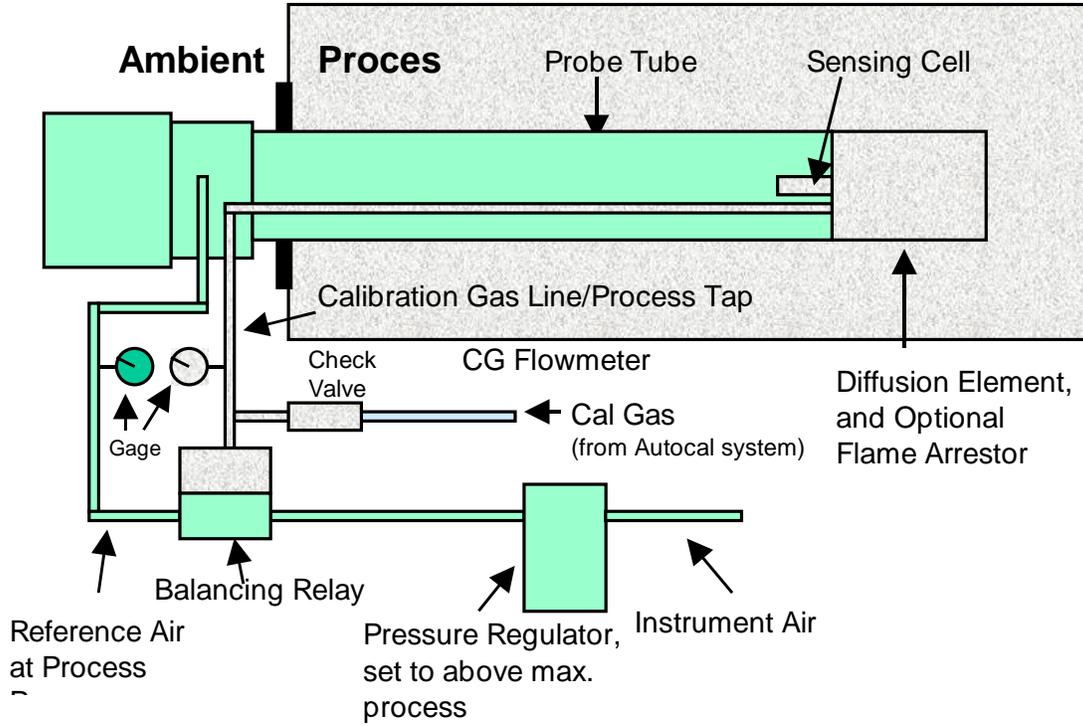
Operation Note- Set N₂ pressure regulator to 10 PSI above maximum process pressure

Integral Pressure Balancing Arrangement- Manual Calibration



If N₂ purge is unavailable, the probe's calibration gas line may be utilized as the process pressure tap for the Balancing Relay. Ensure that all parts wetted by process gases are well insulated to prevent condensation.

Integral Pressure Balancing Arrangement- Auto



An optional “isolation valving system” facilitates the insertion and withdrawal of the probe for service while the process is under pressure. This valving system is recommended if the process cannot be shut down for probe maintenance.

Unpacking

Probe will be shipped with the pressure-balancing valving option mounted and tested.

Installation of Pressure Balancing System

Reference Air

Follow standard instructions in the instruction bulletin for the mechanical installation of the probe system. Instrument air is required and must be piped into the pressure regulator provided on the pressure balancing assembly. Set this pressure regulator to 50 psi. Reference air exhaust port should be capped loosely, ½ turn open from tight.

Calibration Gases

If the probe system will be manually calibrated, ensure that the blocking valve is shut except during calibration. When calibrating, connect bottles to the bottom part of the calibration gas flowmeter and set bottle pressure regulators to 50 psi. If an automatic calibration system will be used, mount the SPS, IMPS or MPS per standard instruction bulletin and pipe calibration gas outlet line to the check valve provided on the probe (per page 3 of the appendix).

If an automatic calibration system will be used, again set the pressure regulator on the calibration gas bottles to 50 psi. Any time the calibration gases will be permanently connected, ensure that a check valve is provided to prevent the migration of process flue gases back down the calibration gas line. To prevent corrosion from condensation of process gases insulate all process wetted parts; including the probe flange, the calibration gas/process line and balancing relay. If this is an outdoor installation where rain and snow will be present, cover the entire probe electronics (Oxymitter) or probe junction box (CENELEC World Class) to inhibit the cooling effect of precipitation.

Electrical

Follow the probe electrical installation instructions in the Instruction Manual. Note that electrical penetrations into the CENELEC World Class probe will be under pressure, and must be sealed. The normal procedures for installing probes into hazardous areas are usually sufficient to maintain pressure inside a probe.

The Oxymitter utilizes an internal bulkhead which isolates the terminations side of the probe from the pressure balancing system. The termination side cover can be removed and the wires disconnected while the system is under pressure. Do not remove the electronics side cover while the process is under pressure, and the pressure balancing system is active.

Note: The pressure balancing system must be connected and operational at all times. If an optional isolation valving system is utilized for inserting or withdrawing the probe while the process is under pressure, the pressure balancing system must be active at all times until the gate valve is closed. This may require an installation whereby the reference instrument air lines and electrical cables can ride back and forth with the probe. See Instruction Bulletin Addendum for Isolation Valving System, IB ISO1000 for more information. Calibration gas lines may be removed for probe installation or removal.

Start-up and Operation

Pressure Balancing system works automatically, and requires no adjustment. Two pressure gages are provided with the system, and should always read very close to the same pressure. Reference gas side gage may read 1-2 PSI lower than the process side gage. Consult the troubleshooting table whenever these gages do not read the same. For most accurate operation, calibrate the probe after the process is up, and at operating temperature and pressure.

Caution: The inside of the probe is pressurized. If using the CENELEC World Class product do not unscrew the junction box cover or the electrical penetrations until reference gas pressure is bled off.

If using the Oxymitter, do not unscrew the electronics side cover while pressurized. Oxymitter terminations side cover may be opened while pressurized.

Operational Note: Some catalyst regeneration applications (notably the UOP CCR process) use nitrogen in the process. During shutdown, the O₂ is completely displaced with N₂ for some period of time. Residual CO and other combustible components can build up on the diffuser and cell of the probe. When coming back on line, the probe will read zero percent O₂ until these components are burned completely off the heated probe.

We recommend that nitrogen be bled down the probe's calibration gas line at 5 SCFH during any periods where the probe's O₂ reading approaches zero. This flow may be removed and the cal gas line capped tightly when the unit comes back on line. This will insure that the O₂ reading will respond normally as air is reintroduced into the process.

Pressure Balancing System Troubleshooting

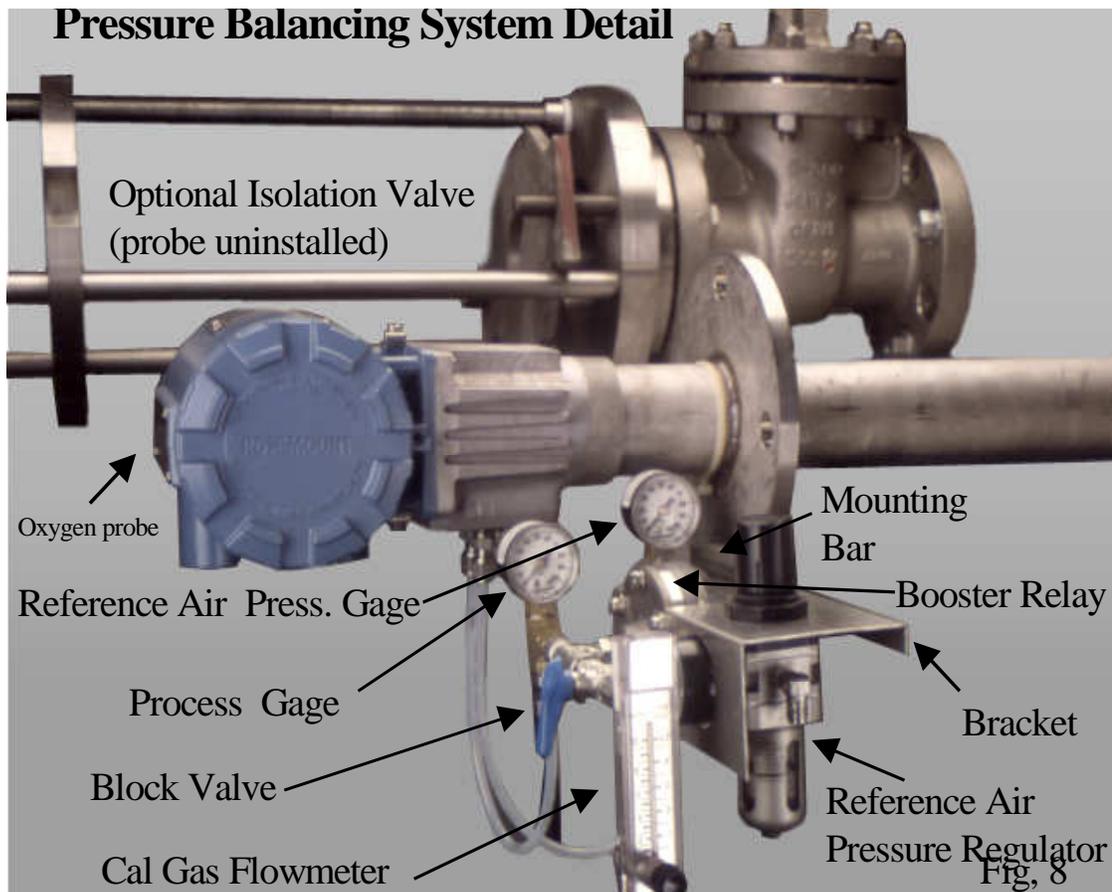
The pressure balancing system will operate without periodic adjustment. Whenever the probe is taken out of service, inspect the pressure balancing system for condensation or particulate pluggage in the lines. Most surfaces that are in contact with the process gases are stainless steel, but condensate can still corrode stainless steel. If condensation is found, insulate the process lines to keep them warm. Leaks are the most likely problems in the pressure-balancing system.

Symptom	Diagnosis	Cause	Correction
O ₂ oscillates up and down repeatedly and at a frequency greater than the normal process O ₂ changes, (up and down every few seconds).	Watch the two pressure gages on the pressure balancing system. If needles are not stable and do not follow each other, there is a hole in the balancing relay diaphragm or in the process tap/cal gas line feeding the balancing relay. Disassemble and bench test the balancing relay to isolate the leak.	Diaphragm on balancing relay or process tap has a hole in it.	Replace balancing relay or process tap.
O ₂ reading increases above normal readings.	Disassemble probe and look for leaks in the calibration gas line.	Process tap/calibration gas line has a hole in it or the elastomer tube has popped off. Process gas is mixing with reference air inside the probe.	

For disassembly of pressure balancing system, see page 9.

Spare Parts Lists

Balancing Relay	1A99408H01
Block Valve	3526B30H01
Check Valve	7307A56G02
Calibration Gas Flowmeter	771B635H01
Cal Gas/Process Dial Gage	1A99410H03
Reference Air Dial Gage	1A99410H01
Reference Air Pressure Regulator	1A99094H01
Mounting Bar	4851B62H01
Bracket	4851B61H01



Disassembly of Pressure Balancing System

- 1) Disconnect instrument air supply line at the pressure regulator.
- 2) Disconnect the instrument air reference line out of the balancing relay and into the probe.
- 3) Disconnect the calibration gas line into the flowmeter.
- 4) Disconnect the calibration gas line from probe into balancing relay.
- 5) Remove the entire pressure balancing assembly from the mounting bar that is welded to the probe flange.
- 6) Unscrew calibration gas assembly feeding into the balancing relay, including the CG flowmeter, valve (or check valve if an autocal system is utilized), and tee fitting.
- 7) Remove balancing relay from mounting bracket.
- 8) Unscrew reference gas assembly from balancing relay, including the instrument air reference gas pressure regulator, and gage.

Assembly procedure is reverse of disassembly procedure.