

SERIES AP

AP3 Probe



In-Situ Oxygen Probe For Atmospheres up to 3000°F

- Medium reduction, neutral or oxidizing atmospheres
- Ideal for kilns, furnaces and boilers
- Energy cost savings
- Designed for high temperature applications
- High accuracy and repeatability
- High efficiency, low maintenance
- Rapid response
- Compatible with all O₂ controllers
- Reference air supply

In-Situ Probe

The AP3 In-situ Oxygen probe, one of the Series AP probes, offers direct and continuous measurement of oxygen in various process applications. When coupled with the proper O₂ controller, it can safely and consistently maintain the desired level of oxygen in the process. It is designed to operate above 1400°F (760°C) with a choice of K, R, S or B thermocouples and can go up to a maximum of 3000°F with a “B” type internal thermocouple installed. Above 1400°F a voltage is generated from the migration of oxygen ions through the solid zirconium electrolyte when there is a difference in oxygen concentration on each side of the sensor. The sensor reacts instantaneously to changes in oxygen level and becomes increasingly more sensitive as the oxygen in the process decreases. The probe will measure very low partial pressures with extreme accuracy and repeatability. The probe does not require frequent maintenance or cleaning. The output of the probe consists of two millivolt level signals, temperature and oxygen, which can be connected to an O₂ controller or transmitter.

The probe is installed directly into the process atmosphere. No extractive sampling or cooling is required. Response time to changes in the process is less than one second. Measurement accuracy of

1% of mV output over the range of the sensor is maintained during operation.

Typical industries that use this probe include glass, ceramics, power, and steel. Specific applications include controlling material characteristics in ceramic kilns, color management in brick kilns, combustion efficiency in gas fired furnaces and NOx emission from exhaust stacks.

Operation

The AP3 probe is suitable for high temperature medium reduction, neutral or oxidizing atmospheres.

Zirconia is a solid state electrolyte, which conducts oxygen ions at temperatures above 1400°F. The ion conduction results in a voltage between the two electrodes. Two connections to the zirconia cell conduct the voltage to the four pin connector.

$$\text{probe Vdc} = 0.0215 \times T \times \ln(O_1/O_2)$$

probe Vdc = sensor output in mV;
T = sensor temperature in degrees Kelvin (°K);
O₁ = oxygen concentration on inside surface of the sensor – ambient air which is 20.9% oxygen;
O₂ = sample oxygen concentration on outside surface of the sensor – furnace atmosphere.
ln = natural logarithm

Reference Air Supply

The reference air enclosure is a self-contained CE compatible unit that provides reference air to the AP3 oxygen probe. Reference air of approximately 20% oxygen must be supplied for the probe to perform properly. The reference air enclosure may be supplied with a single flowmeter and output for one probe operation or a dual flowmeter and output for dual probe operation.



Dual output supply shown

AP3 OXYGEN PROBE TECHNICAL SPECIFICATIONS

Output	Up to 500mV over the operating range
Readout	% oxygen probe should be used with controlling, recording, and indicating instruments that have input impedance of 10 MegOhms or higher.
Accuracy	±0.02 PPM oxygen at 1 PPM oxygen. ± 1 % of full scale mV output
Response Time	Less than 1.0 second
Operating Temperature	1400°F (760°C) to 3000°F (1649°C)
Protection Tube Alumina	Resistant to corrosion and oxidation up 3000°F (1649°C)
Weight/Length	Weight—3lb 5oz. Length—21" (other lengths available up to 41"). Shipping wt—5lb 8oz.
Thermal properties	Withstands temp. up to 3100°F. Will withstand thermal gradients, but is more sensitive to thermal shock.
Mechanical Shock	Resists mild mechanical shock.
Immersion Depth	3" minimum
Reference Air	Uncontaminated air at recommended max. rate of 236cc/min, 0.5 cu ft/hr

AP3 ACCESSORIES

Cable Assemblies

A- 10727-200-0-06	Type K/flexible armor
A- 10727-300-0-06	Type R/S/flexible armor
A- 10727-400-0-06	Type B/flexible armor
A- 12237-200-0-06	Type K/no flexible armor
A- 12237-300-0-06	Type R/S/no flexible armor
A- 12237-400-0-06	Type B/no flexible armor

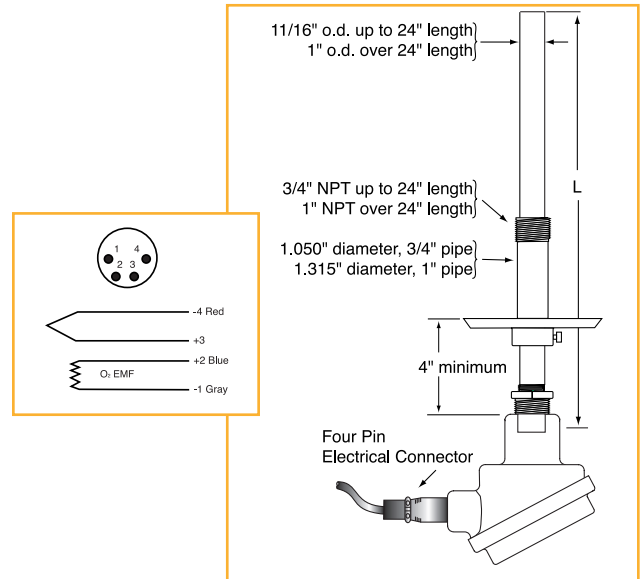
Reference Air Supplies, Single Output

A- 13893-000-0-00	120 Vac, 50/60 Hz., panelmount
A- 13893-000-1-00	120 Vac, 50/60 Hz., with housing
A- 13893-000-0-01	240 Vac, 50/60 Hz., panelmount
A- 13893-000-1-01	240 Vac, 50/60 Hz., with housing

Reference Air Supplies, Dual Output (2 probes)

A- 13893-100-0-00	120 Vac, 50/60 Hz., panelmount
A- 13893-100-1-00	120 Vac, 50/60 Hz., with housing
A- 13893-100-0-01	240 Vac, 50/60 Hz., panelmount
A- 13893-100-1-01	240 Vac, 50/60 Hz., with housing

AP3 OXYGEN PROBE DIAGRAM



ORDERING CODE

Base Model	T-couple Type	Reserved	Length (Dim "L")	Reserved	Cable	Reserved	Reserved	Label	Reserved
AP3		001		2		0	0		0

Base Model	Thermocouple	Length (Dimension L)	Cable	Label
AP3 Carbon probe	1 Type K 2 Type R 3 Type S 4 Type B	21 21" probe, Type K, Type R, Type S or Type B LL Length in whole inches (22" min. to 41" max.)	0 Six feet, no armor 1 Six feet, with armor 9 Other than 6 feet (specify length when ordering)	0 Barber-Colman E Eurotherm

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