

## MF010 Series Low Temperature and MF020 Series High Temperature Oxygen Sensors

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### DESCRIPTION

The MF010 Series Low Temperature Oxygen Sensors is designed to determine the oxygen concentration in air or inert gas mixtures with temperatures of  $-100\text{ }^{\circ}\text{C}$  to  $250\text{ }^{\circ}\text{C}$  [ $-148\text{ }^{\circ}\text{F}$  to  $482\text{ }^{\circ}\text{F}$ ] max. The MF020 Series High Temperature Oxygen Sensors is designed to determine the oxygen concentration in air or inert gas mixtures with temperatures of  $-100\text{ }^{\circ}\text{C}$  to  $400\text{ }^{\circ}\text{C}$  [ $-148\text{ }^{\circ}\text{F}$  to  $752\text{ }^{\circ}\text{F}$ ] max.

These products are particularly suitable for measuring oxygen in areas that are not easily accessible, or in closed systems. The MF010 and MF020 Series may both be supplied with a measuring range of  $0.1\text{ vol}\%O_2$  to  $25\text{ vol}\%O_2$  and  $0.1\text{ vol}\%O_2$  to  $100\text{ vol}\%O_2$ . The entire measurement range is linear for both series.

The sensor detects the gas mixture's oxygen partial pressure (absolute oxygen content) by using a dynamic process that occurs on two zirconium dioxide discs which form a hermetically sealed chamber. Because no chemical substances are used, the sensor exhibits significantly longer service life than an electrochemical sensor.

The actual oxygen sensor is mounted in the tip of the bar probe and is protected by a stainless-steel sintered disk which serves as a flame back-flash stop. The water-proof plastic housing accommodates the electronics and is mechanically connected to the bar probe.

### FEATURES

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- No moving parts
- Low power consumption
- No need for temperature stabilization
- Functional testing and calibration in ambient air
- Long life

Sensor electronics include:

1. Signal amplifier
2. Control for the ionic pump with an analog component
3. Test component
4. Internal monitoring logic component
5. Power supply for the sensor heating element and the analog and digital components
6. Reset
7. Voltage monitor
8. Analog output
9. Bi-directional digital output
10. Internal potentiometer

The sensor outputs the measured values via an analog channel ( $4\text{ mA}$  to  $20\text{ mA}$  or  $0\text{ V}$  to  $10\text{ V}$ ) and a digital channel (also provides any error signals) which are evaluated and further processed in a user-specified external mounting device such as a fuel controller, display, measuring instrument, programmable logic controller or ventilation system.

Both series may be calibrated manually or self-calibrated using atmospheric air instead of a reference gas. The sensor can also conduct external operational self-tests.

Both series may also operate in a fault-proof mode. The sensor self-monitors during operation and provides error signal output. A second oxygen sensor is not necessary.

### POTENTIAL APPLICATIONS

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- Boiler combustion controls
- Aircraft oxygen generation systems

# MF010 Series and MF020 Series

**Table 1. MF010 Series Specifications and Order Information**

Characteristic	Catalog Listing			
	MF010-0-LC1 MF010-1-LC1 MF010-2-LC1	MF010-0-LC2 MF010-1-LC2 MF010-2-LC2	MF010-0-LC3 MF010-1-LC3 MF010-2-LC3	MF010-0-LC4 MF010-1-LC4 MF010-2-LC4
Temperature range at probe tip	-100 °C to 250 °C [-148 °F to 482 °F]			
Output	0 Vdc to 10 Vdc		4 mA to 20 mA	
O <sub>2</sub> range (O <sub>2</sub> partial pressure) with equivalent O <sub>2</sub> output	1 mbar to 250 mbar 0.1 vol%O <sub>2</sub> to 25 vol%O <sub>2</sub>	1 mbar to 1000 mbar 0.1 vol%O <sub>2</sub> to 100 vol%O <sub>2</sub>	1 mbar to 250 mbar 0.1 vol%O <sub>2</sub> to 25 vol%O <sub>2</sub>	1 mbar to 1000 mbar 0.1 vol%O <sub>2</sub> to 100 vol%O <sub>2</sub>
Probe length:				
-0-LXX	220 mm [8.7 in]			
-1-LXX	400 mm [15.7 in]			
-2-LXX	600 mm [23.6 in]			

**Table 2. MF020 Series Specifications and Order Information**

Characteristic	Catalog Listing			
	MF020-0-LC1 MF020-1-LC1 MF020-2-LC1	MF020-0-LC2 MF020-1-LC2 MF020-2-LC2	MF020-0-LC3 MF020-1-LC3 MF020-2-LC3	MF020-0-LC4 MF020-1-LC4 MF020-2-LC4
Temperature range at probe tip	-100 °C to 400 °C [-148 °F to 752 °F]			
Output	0 Vdc to 10 Vdc		4 mA to 20 mA	
O <sub>2</sub> range (O <sub>2</sub> partial pressure) with equivalent O <sub>2</sub> output	1 mbar to 250 mbar 0.1 vol%O <sub>2</sub> to 25 vol%O <sub>2</sub>	1 mbar to 1000 mbar 0.1 vol%O <sub>2</sub> to 100 vol%O <sub>2</sub>	1 mbar to 250 mbar 0.1 vol%O <sub>2</sub> to 25 vol%O <sub>2</sub>	1 mbar to 1000 mbar 0.1 vol%O <sub>2</sub> to 100 vol%O <sub>2</sub>
Probe length:				
-0-LXX	220 mm [8.7 in]			
-1-LXX	400 mm [15.7 in]			
-2-LXX	600 mm [23.6 in]			

**Table 3. MF010 and MF020 Series General Specifications**

Characteristic	Parameter
Supply voltage	24 Vdc ±5%
Supply current	500 mA
Ambient temperature (includes solar radiation)	-10° C to 50° C [14 °F to 122 °F]
Resolution	12 bit
Heat-up time	approx. 10 min
Accuracy	±2% FS (Full Scale)
Reproducibility	±1% FS (Full Scale)
Gas flow rate	0 m/s to 10 m/s
Reaction time	approx. 3 s
Incidental permissible acceleration	30 g
Repetitive permissible acceleration	5 g
Bar probe material	stainless steel 1.4301
Housing material	Makrolon 8030 (30% GV), UL94 V-1
Housing sealing	IP65
Connector sealing	IP67
Weight (without bar probe)	150 g [5.3 oz]
Termination (female connector)	99-4226-14-07 (Binder 693 series)
Certification	complies with EMC directives EN 50082-2 and EN 50081-1 and directives 89/336/EWG and 92/31/EWG

# Oxygen Sensors

**Figure 1. Dimensional Drawing and Pinout (For reference only: mm/in.)**



**Figure 2. System Block Diagram**



**Figure 3. Sensor Mounting**



**Order Guide**

Catalog Listing	Description
MF010 Series	Low temperature oxygen sensor (See Table 1 for specifics.)
MF020 Series	High temperature oxygen sensor (See Table 2 for specifics.)

**⚠ WARNING**

**PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

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000670-3-EN IL50 GLO Printed in USA  
July 2011  
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