SWITCHING - SENSING - TECHNOLOGY

Installation and User Instruction for
O2A Series Standard and High Temp Oxygen Sensors

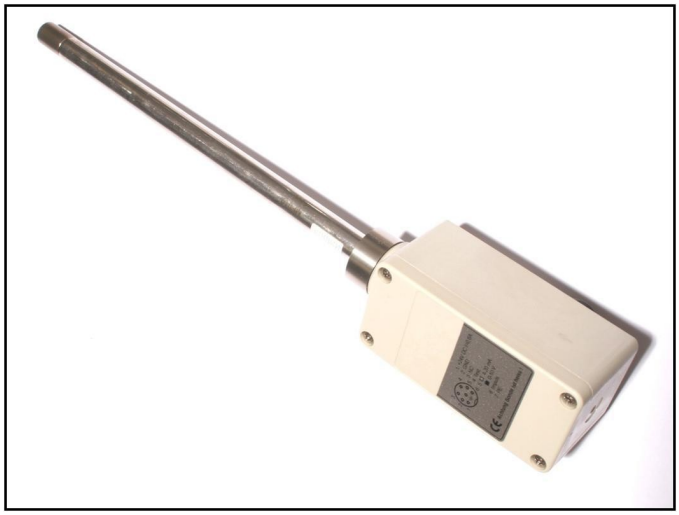
1 General Information

The 02A Series Oxygen Sensor is designed to measure the oxygen pressure in air or other gas mixtures with temperatures from -100°C to 250°C max and -100°C to 400°C.

Standard measuring ranges are:

- 0.1 to 25 vol. % O2
- 0.1 to 100 vol. % O2

The entire measurement range is linear.



1.1 Product description

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 sensor bar probe.

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 as well as for the analogue and digital component
6. Reset
7. Voltage Monitor
8. Analog output
9. Bi-directional digital output
10. Internal potentiometer

1.2 Operation overview

Measurement is based on a dynamic process that occurs on two zirconium dioxide discs which form a hermetically sealed chamber.

The sensor outputs measured values via an anolog channel (4 to 20mA or 0 to 10V) 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 a ventilation system.

The O2A Series may be calibrated manually or self-calibrated using atmospheric air instead of a reference gas. The sensor can also conduct external operation self-tests.

The O2A Series can 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.

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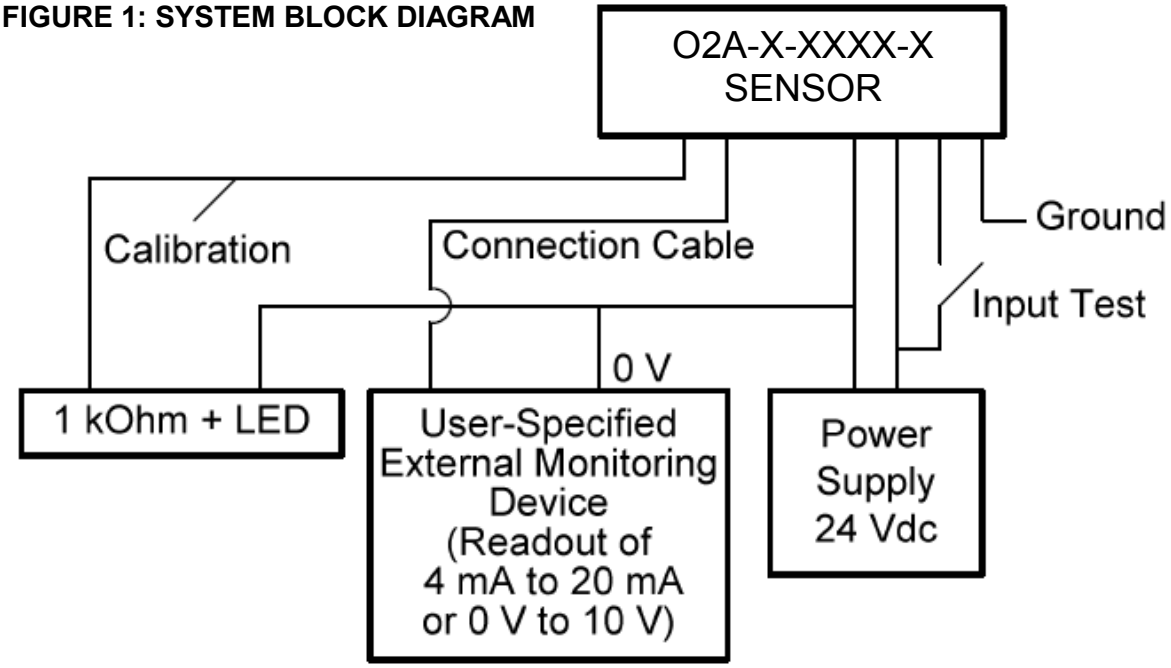
FIGURE 1: SYSTEM BLOCK DIAGRAM



1.3 Connection cable (connects sensor to user-specified external monitoring device)

Ensure the connection cable meets the following requirements:

- Permanent, six core and shielded, with a diameter of 9mm to 11mm . (0.35 in to 0.43 in).
- Capable of withstanding expected mechanical, chemical and thermal conditions.

1.4 User-specified external monitoring device

A user- specified external monitoring device is needed to evaluate the measured signals as well as to manage and monitor the periodic self-tests. This device also manages error signal response.

Ensure the user-specified external monitoring device meets the following requirements:

- The device must be fault proof, i.e. The processes described below must be carried out without any errors, the input signals must be read-in without errors and the output signals must output without errors.
- Channel 1 & Channel 2 measured values must be compared permanently within the fault tolerance time permissible for the application.
- Channel 2 output signal timing must be checked constantly. In this respect, static signals are to be considered internal errors.
- A self-test must be initiated periodically and its effects on the measured signal must be determined and evaluated. The time interval between two test cycles must not exceed a certain value.

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2 Mount Sensor

Mount the sensor using standard available 12 mm (0.47in) pipe fittings so that the probe projects through the partition directly into the gas mixture to be measured (e.g. gas pipe, chimney, container). Ensure the housing remains on the same side of the partition as the atmospheric air (see Figures 2 and 3).

FIGURE 2: SENSOR INSTALLATION

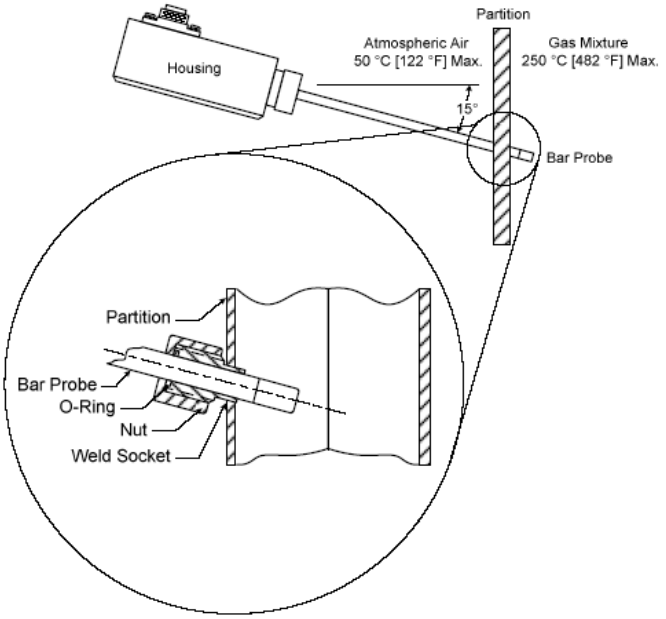
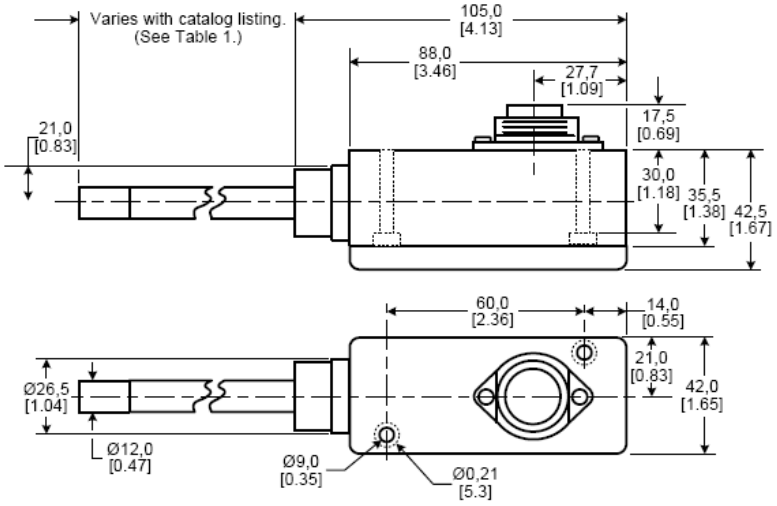


FIGURE 3: DIMENSIONAL DRAWING AND PINOUT (for reference only: mm(in.))



3 Connect sensor and user-specific external monitoring device

User connector cable described in section 1.3.

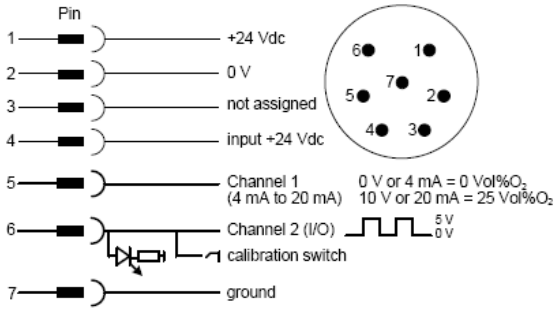
3.1 Connection for basic operation

- Connect sensor to the electric circuit via Pin 1, Pin 2, and Pin 7 (see Fig 3)
- Read off the measured data via pin 5 (4 to 20mA or 0 to 10V) from the user-specified external monitoring device.

3.2 Connection for fault-proof operation

- Connect sensor to the electric circuit via Pin1, Pin 2 and Pin 7 (see Fig 3)
- Read of the measured data via Pin 5 (4 to 20mA or 0 to 10V) from the user-specified external monitoring device.
- Connect Pin 4 (test channel) and Pin 6 (digital output)
- The user-specified external monitoring device evaluates and processes the measured signals. Sensor output signal is 4 to 20mA or 0 to 10V.

TABLE 1: PROBE LENGTH	
Part Number	Probe Length
O2A-0-XXXX-X	220mm [8.7 in]
O2A-1-XXXX-X	400mm [15.7 in]



Mating connector:
Part No.: 99 4218 00 07
By Binder Connectors & Assemblies

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4 Start-up

4.1.1 Ensure the following tasks are complete:

- Sensor is installed and connected
- Sensor housing is accessible and visible
- Ambient conditions have been taken into account
- Power supply is on

4.1.2 Conduct measured values test as follows:

- Thoroughly ventilate the bar probe surroundings (e.g. chimney, container) until fresh atmospheric air is present.
- Check the measured value on the user-specified external monitoring device. A value of is 20.7 vol. % O_2 ± 1% O_2 of FS (0.25%) indicates the sensor is ready for operation.

4.2 Output and error signals (see Fig 4 and Table 2)

The sensor outputs two measuring signals via two different channels. These signals must be read and processed by the user-specified external monitoring device.

4.2.1 Output

- Channel 1 linear analog signal is 4 to 20mA or 0 to 10V:
  -17.25mA (8.28V) corresponds to 20.7 vol. % O_2
  - 20mA (10V) corresponds to 25 vol. % O_2
- Channel 2 digital signal is a pulse-width modulated alternating signal (high phase 5V, low phase 0V) The low phase duration is the oxygen measurement concentration and is indicated by the user-specified external monitoring device:
  - 0.09s corresponds to 0.1 vol. % O_2
  - 0.71s corresponds to 25 vol. % O_2

4.2.1 Error signals

- Digital signal (low + high) does not equal 0.2 to 4s (10% error tolerance), or is constant at 5V indicates the measured value is outside the measuring range.
- Digital signal is constant at 0V indicates the hardware is defective. Please notify the manufacturer and replace the device.

FIGURE 4: CHANNEL 2 OUTPUT SIGNALS

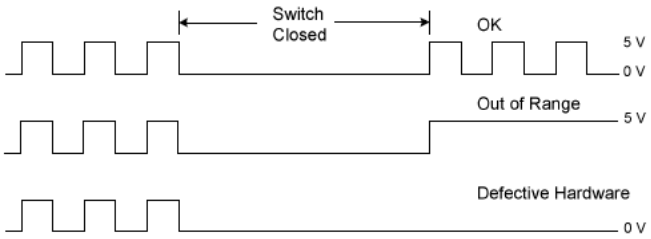

TABLE 2: SENSOR ERROR SIGNALS			
Sensor Ready for Operation			
State	Channel 1 Measured Signal (Analog)	Channel 1 Measured Signal (Digital)	Channel 1-2 Measured Signal Difference
Normal Operation (test switch open)	4 to 20mA or 0 to 10V	Low phase + high phase = 0.2 to 4s	4% max.
External Operation Test (switch closed, +24V)	> 20% decrease	> 20% decrease	4% max.
Sensor Out of Order			
State	Channel 1 Measured Signal	Channel 1 Measured Signal	Channel 1-2 Measured Signal Difference
Normal Operation (test switch open)	-	No signal Low phase + high phase < 0.2s or > 4s	> 4%
External Operation Test (switch closed, +24V)	< 20% decrease	< 20% decrease	> 4%

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5.0 CALIBRATION

The sensor measures the oxygen partial pressure. According to Dalton's Law, the oxygen partial pressure depends on the air pressure and relative humidity. Strong fluctuations of these parameters will affect calibration.

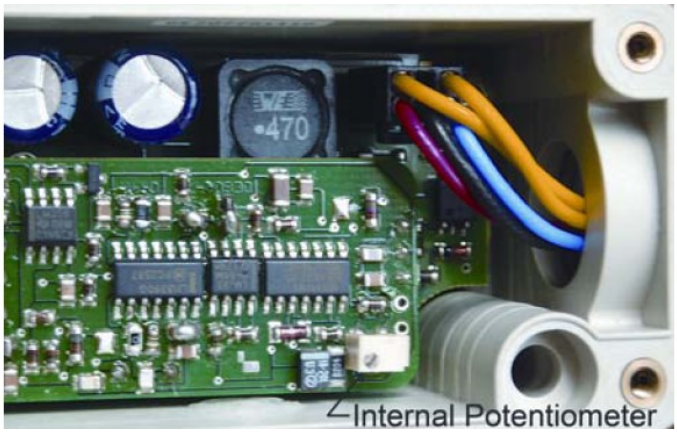
The sensor is designed so that no additional calibration is needed, even during long periods of operation. However, if necessary, a manual or a self calibration may be conducted.

5.1 Manual calibration

Manual calibration is conducted using an internal potentiometer (see Figure 5) located inside the sensor housing:

1. Thoroughly ventilate the bar probe surroundings (e.g. chimney, container) until fresh atmospheric air is present (20.7 vol. % O_2 ± 10%). The atmospheric air serves as reference gas.
2. Ensure the voltage supply is lower than 28V
3. Remove the sensor housing
4. Using a slot screwdriver, turn the Potentiometer screw until Channel 1 emits a current signal of 17.25mA or a voltage signal of 8.28V.
5. Replace the sensor housing.

FIGURE 5: INTERNAL POTENTIOMETER



5.2 Self-calibration (only possible in the 0.1 vol. % O_2 to 25 vol. % O_2 measuring range)

The sensor self calibrates in atmospheric air (20.7 vol. % O_2 ± 10%). In the event of a voltage cut-off, the newly – calibrated value will be saved.

1. Ensure Pin 6 is connected
2. Thoroughly ventilate the bar probe surroundings (e.g. chimney, container) until fresh atmospheric air is present (20.7 vol. % O_2 ± 10%). The atmospheric air serves as reference gas.
3. Use the user-specified external monitoring device to close switch S (Pin 6 or Channel 2) for at least 10s. The sensor will now self-calibrate:

- Alternating Channel 2 output signal indicates measured oxygen concentration is within 10% error tolerance.
- Constant 5V Channel 2 output signal indicates measured oxygen concentration is outside 10% error tolerance. Ensure sensor is exposed to enough atmospheric air and repeat calibration procedure. If constant 5V continues, notify the manufacturer and replace the sensor.

4. After successful calibration, the sensor corrects channel 1 to:

- 17.25mA = 20.7 vol. % O_2
- 20mA = 25 vol. % O_2

5.3 External operational self-test requirements

1. Ensure Pin 4 and Pin 6 are connected.
2. Apply +24V to Pin 4 to stimulate a lower oxygen concentration than actually exists at the bar probe. The measured signals at the digital and anolog outputs must drop equally by at least 20%. If this does not occur, then the bar probe is defective and must be replaced.
3. Disconnect the +24V after the test is complete.
4. Conduct this test periodically.

5.4 Fault-proof operation

5.4.1 Requirements

- Channel 1 analog signal corresponds to channel 2 digital signal (4% max. difference)
- Channel 2 signal low phase is 0.09s to 0.71s,which corresponds to an oxygen concentration of 0.1 vol. % O_2 or 25 vol. % O_2 (At a different measuring range the values change accordingly.)

5.4.2 Error signals

- Digital signal (low + high) does not equal 0.2s to 4s (10% error tolerance), or is constant at 5V, means the measured value is outside the measuring range.
- Digital signal is constant at 0V means the hardware is defective. Please notify the manufacturer and replace the device.

6 Maintenance

6.1 Maintenance checklist

Ensure the following:

- The sensor and connecting cable are checked by qualified personnel at least every six months and a servicing report is prepared.
- Periodic maintenance intervals are adapted to local safety requirements .
- Check the measured value after each operation interruption. If the measured value is 20.7 vol. % ± 1% of FS (0.25%), the device is ready for operation. If the measured value is outside this range, calibrate the sensor and conduct an external functional test.
  Inform the manufacturer or dealer or, if possible.
- Ensure the measured value is checked, the sensor calibrated and an external functional test is performed after every fault message.
- Ensure the sensor and its surroundings are always clean, accessible and visible.

6.2 Shutdown

Switch off the mains voltage. Refer to Section 6.4 for storage conditions.

6.3 Packaging & transport

The sensor contains sensitive electronic components. When returning the sensor, use appropriate packaging according to applicable regulations.

6.4 Storage

The sensor may be stored in a packed state in a dry environment between 10°C and 50°C (50ºF to 122°F). Protect the sensor against moisture, humidity, dust & dirt.

6.5 Disposal

Ensure inoperable sensors are rendered unusable immediately. Dispose of according to regulations.

WARNING	**CAUTION**
Personal Injury DO NOT USE these products as safety or Emergengy 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.**	Do not exceed maximum ratings and ensure sensor is operated in accordance with all requirements of AN0043 **Failure to comply with these instructions may result in product damage.** **It is the customer's responsibility to ensure that this product is suitable for use in their application. For techincal assistance or advice, please email us: info@sstsensing.com**