



# Oxygen Probe Troubleshooting Guide

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## NOTE

All of the following tests assume that the oxygen sensor is operating above 1100°F and the process that is being read is stable.

### Sensor Oxygen Reading is too High

Check	You Find	It Means
Increase the furnace pressure for 1 - 2 min	Reading drops	The sensor is being affected by air leakage through the wall or through the sensor, or by a blanket of dead air close to the wall. There are 4 possible solutions: 1. Seal the furnace better 2. Seal the sensor better 3. Insert the sensor past the dead air (if the temperature is not too high) 4. Install the sensor in a better location
	Reading stays approx the same	Continue to next check
Check sensor cell resistance (see App)	Resistance is low <50K ohms	Sensor is okay - go to next check
	Resistance is high >50K ohms	Electrode is dead – Replace sensor
Use a portable device to take a sample close to the hot tip of the MSI sensor (see App)	Readings agree within an acceptable range	Sensor is correct, but is not exposed to typical gas. Check other locations with a portable analyzer to determine the best location
	Readings disagree outside of an acceptable range	If the portable analyzer is known to be correct, (calibrated) then the MSI sensor is suspect - Replace or contact MSI agent for assistance

### Reference Air Check

Check	You Find	It Means
Remove the ref air connection to the head - feel for air flow	No air flow through the tubing	This is the problem - reference air flow must be 0.5 to 1.5 SCFH
Reattach the air line to the sensor. Increase the ref air (but not higher than 2 SCFH)	Air is flowing reading increases	Cell is broken - if ref air is cut off, reading will drop to correct reading for a while - Replace the sensor
	Reading	There was not enough reference air. Leave the

	decreases to correct reading	reference air at the higher flow rate. Sensor should be correct now.
Turn off air flow	Reading decreases more than acceptable	Normal - return reference air to higher level
Remove end cap of sensor only with permission from MSI technician. Examine ref air tube	Tube is missing or destroyed, or is disconnected at either end.	Replace or reconnect the tube - see sensor manual for instructions on where tube is to be reconnected
	Tube is intact	This is not the problem - go to the next section
Check the temperature display at the monitor	Temp is stable and seems to be realistic for this location	This is not the problem - go to the next section
	Temperature is varying more than 50° up/down	There is either a short circuit (possibly inside the sensor) or the wrong wires are attached to the T/C terminals at the monitor. Check at the sensor to see if the T/C voltage is stable or varying. If stable, check for correct connections between the sensor and the monitor. If the temp is varying, then the T/C is shorted in the sensor and must be replaced.

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## Temperature Checks

Check	You Find	It Means
	Temp reads off-line or higher than seems realistic	T/C is open or broken. Sensor must be removed
	Temp reads 0° F	T/C is shorted and must be replaced. Sensor must be removed before new T/C is replaced (to prevent sensor thermal shock)

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### Wiring - two part check

**Note: the following checks must be done with furnace at temperature >1400° and atmosphere present.**

Check	You Find	It Means
Measure the sensor millivolt output at the monitor - leave the wires attached to the monitor during the check	Negative signal	Signal leads are reversed at monitor, switch sensor leads
	Positive millivolt signal	Compare readings to chart, if low continue to step 2.
Disconnect the wires at the head - measure the sensor millivolt output at the head terminals	Significantly higher output in 2) than 1)	There is a short: check for melted wire insulation between monitor and sensor, dust buildup on sensor, dust buildup on terminals, wires touching inside sensor head, loose connector.
Visually inspect wiring between sensor terminal block (inside head) and monitor	Melting of insulation	Intermittent short - replace wiring
Remove cap of sensor (only with permission from a MSI technician) Examine ref air tube	Tube is missing or destroyed, or is disconnected at end	Replace or reconnect the ref air tubing
	Tube is intact	This is not a problem. Go to next check.
Remove the sensor (this should be done if other checks do not resolve the problem) Ref air tube	Slag , glossy or carbon buildup at the end of the sensor	Furnace gases are not getting into the cell. You can try cleaning off, but it is usually necessary to replace the sensor.
	Ref air tube T/C shows signs of Combustion – Greatly dis-colored or a buildup	There may be oil or other combustibles in the ref air – check air and filters. Dirty air will destroy the inner electrode of the sensor

### Erratic O2 Reading

Check	You Find	It Means
Take combustibles reading at the sensor location with a portable combustible analyzer	High or varying combustible amounts	Poor combustion or mixing, or sensor is located too close to the flame. Either fix the burners, or move the sensor further away from the burners.
	Low or no combustibles	Go to next check

<b>Check</b>	<b>You Find</b>	<b>It Means</b>
Shut off Reference air	Readings drop or stabilize	Cell is probably broken - Replace sensor. Go to next step for confirmation
	No change	Go to next step
Increase reference air (<2.0) SCFH	Reading goes higher	Cell is broken - Replace sensor
	Reading stays same	Go to next step
	Reading stabilizes	There wasn't enough reference air - leave at higher level
Increase furnace pressure	Reading goes down	Pressure is not quite high enough at sensor location – either increase pressure or move sensor to better location

## **O2 Readings Appear Too Low**

<b>Check</b>	<b>You Find</b>	<b>It Means</b>
Check for combustibles with analyzer	High combustibles	Sensor is correct
	No combustibles	Go to next check.
Check O2 with portable analyzer	Same reading as MSI sensor	Sensor is correct.
	Higher O2 reading	Go to next check
Check probe temperature reading at monitor	Temperature is correct for furnace	Go to next check
	Temperature is significantly different than furnace	Either T/C is bad, too much ref air is cooling the T/C, or the wrong thermocouple type is selected in the monitor for the T/C type in the probe.
Check sensor millivolt reading at monitor. Remove wires at sensor and check millivolt reading at sensor	Millivolt reading at monitor is significantly more than the sensor.	The wiring is not well shielded and is picking up stray voltage or the monitor is out of calibration
	Readings are the same.	This is not the problem.