

# CARBON SENSOR TROUBLESHOOTING

by Stephen Thompson

## Technical Data

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There are several key components in all atmosphere control systems. When a difficulty arises, it is important to identify the cause with a minimum of effort and expended time. The procedure that follows is designed to aid in that process.

### INTRODUCTION

The starting point for any troubleshooting procedure is to properly identify the symptom that necessitates it. The cause of the symptom can often be elicited by answering some preliminary questions.

Is this a startup problem, or has the system been operating under control? If this is a startup problem, it is necessary to establish that all system components have been properly connected and configured for the application.

If the system has been operating properly and there has been either a gradual or sudden change in the control performance, it may conceivably be a problem with the probe. In order to establish the correct performance of the carbon sensor, **resist the temptation to remove the sensor from the furnace.** All of the tests outlined here must be done while the sensor is located in the furnace, at temperature, and exposed to a reducing atmosphere. This procedure can be performed on the SSi Gold Probe and on most other manufacturer's sensors. We strongly recommend that you call us at 800-666-4330 before you remove the probe.

**NOTE: IF YOU HAVE ALREADY REPLACED THE PROBE AND THE PROBLEM PERSISTS.....THE PROBE MAY NOT BE THE PROBLEM!**

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### PROCEDURE

Does a shim stock analysis, a 3-gas analysis (SSi PGA3000) or a dew point analysis (SSi DP2000) verify the indicated value from the probe? If the values are close to the same, the problem is not likely the Gold Probe. If the values are not similar, continue with the following steps:

1. Verify that both mV and t/c cables between the sensor and the controller are clean and connected firmly to the Gold Probe and controller terminals. Verify polarity.
2. Verify that the reference air supply is connected to the reference air fitting. This will be the fitting closest to you when you face the probe. It has been found that on occasion the reference air has been connected in error to the burnoff fitting, causing low readings.
3. Check that the reference air is flowing. Disconnect the air supply at the probe and submerge it in a cup of water. Bubbles verify the flow.
4. Verify that no air is flowing into the burnoff fitting by submerging the burnoff tubing in a cup of water. (Flow can occur if the burnoff air pump is subject to external vibration.)
5. Leak test- this test can detect a cracked or broken substrate in your Gold Probe. Verify that reference air is flowing at 0.5 to 2.0 cfh. Turn off the reference air for one minute and read the Gold Probe output millivolts. Turn the reference air back on and note the change in mV. It should not display more than a 5 mV increase.
6. Is the controller COF set to the proper value? This factor is referred to by other descriptions such as Process Factor, Furnace Factor, CO Factor, Circulation Factor, Calibration Factor, etc. The factor may require adjustment to eliminate any offset or discrepancy between the indicated carbon potential and the actual achieved result in the work pieces or shim stock.

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7. Do the sensor temperature and MV output as measured by an independent digital calibrator agree with the indicated values on the controller with one sensor and one t/c lead disconnected? If not, there is most likely a controller calibration problem or a cable problem.
8. Does the Gold Probe mV signal return to within 1mV of it's original value in 1 minute as measured by a digital VOM after it has been shorted for 5 seconds? If it does not, go to step 10.
9. Probe impedance (resistance) test- this is one of several electrical tests that determine the electrical integrity and reliability of the Gold Probe. Some contemporary controllers can perform it. If yours does not, conduct this simple test: at process temperature, disconnect the controller cable at the Gold Probe mV output and measure the mV value with a VOM. Then shunt the signal with a 100 kilohm resistor. After 10 seconds, read the new mV value, divide the original value by the new value, subtract 1 from the result and multiply by the value of the shunt resistor (=100K). The calculated value is the sensor resistance in kilohms, which should be less than 25 kilohms.
10. If the problem is not corrected by probe and/or furnace burnout as described in the Gold Probe Manual and your system manual, and the problem is a faulty probe, contact SSi at (800)666-4330 and describe your problem to our technician. You may then request a Returned Material Authorization for repair or replacement of your Gold Probe.
11. **WARNING-** even though you suspect a faulty sensor, **do not** remove your Gold Probe from a hot furnace at a rate faster than 2 inches per minute. Cool the sensor on an insulating medium to avoid thermal shock. This will prevent damage that is expensive to repair.

Our technical support staff is available Monday – Friday, 7:00 a.m.to 6:00 p.m. EST to assist you and answer your atmosphere control problems.

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