9 Troubleshooting and Calibration

9.1 Return Material Authorization Number

If an analyzer has to be returned to the factory, the shipper will have to obtain a Return Material Authorization number from Delta F by calling the Service Line at (781) 935-5808 or sending a written request via the Service Fax Line at (781) 932-0053. See the Shipping Section on page 97 for more details.

9.2 Maintenance

The analyzer maintenance recommendations made in this manual apply to all Analyzers being operated under Normal Operating Conditions and in clean gas applications.

A clean gas application is one in which certain process conditions are met. The sample background gas must contain less than 10% of the acid gas limits shown in Table 1 page 29, on a continuous basis. Solvents or other gases that are listed as "very soluble" to "infinitely soluble" in water must make up less than 0.1% of the background gas composition. Sample condensation must be avoided. For a hydrocarbon background gas, the sample must be kept at a temperature of at least 40°F over the sample dewpoint. A wet sample (high water dewpoint) must be kept at a temperature of at least 10° F over the dewpoint. The particulate density must be below the limit of 0.03 mg/L (weight of particulate matter / volume of sample at atmospheric pressure).

Some examples of clean gas applications include monitoring of high purity gas pipelines, compressed cylinder gases, cryogenic air separation plants, polyolefin feedstocks, glove boxes, and semiconductor process tools.

9.2.1 Calibration

All Delta F Platinum Series Process Oxygen Analyzers are calibrated with NIST (National Institute For Standards And Technology) traceable certified gas standards at the factory prior to shipment. No initial calibration is required upon receipt from the factory.

For Analyzers used in clean gas applications (as described above) and operated under Normal Operating Condition**s**, Delta F recommends verifying the span calibration every 12 months of continuous use. This can be accomplished by using the Analyzer to read a gas sample with a known concentration, such as a certified cylinder gas mixture of O_2 in N_2 background, available from any specialty gas supplier. For process applications containing more significant quantities of acid gases or particulate, or where liquids may be encountered, contact Delta F for a recommendation on calibration verification for your specific case.

For Analyzers used in clean gas applications, and operated under ***Normal Operating Conditions*** there is no need for zero calibration checks in the field.

NOTE

If the analyzer is used in a portable mode, the optional isolation valves should be used during transport to preserve the stability of the zero calibration.

9.2.2 Storage Conditions

If the analyzer is to be stored for extended periods of time, be sure that the temperature of storage location does not exceed 50° C (122° F). Storage in direct sunlight can cause temperatures to exceed the recommended limits even though ambient temperatures may be below the maximum temperature.
Store the analyzer with the electrolyte removed from the sensor.

9.2.3 Sensor Maintenance

The analyzer does not require routine maintenance other than water addition. Exposure to dry gas for an extended time gradually extracts water from the sensor. The water needs to be replenished occasionally.

CAUTION

If the electrolyte level is low, only distilled or deionized water needs to be added to the sensor. **Do not add electrolyte solution to restore the electrolyte level.** Do not overfill.

The Sensor Assembly consists of two connected chambers. The operation of the sensor is satisfactory as long as the level of electrolyte is above the minimum indicator line on the reservoir label.
One bottle of electrolyte, contains 100 cc. This quantity is sufficient for satisfactory operation. It is not necessary to add additional water.
Typically, bone dry sample gas can extract approximately 10 to 20 cc of water per month. The electrolyte level should be checked every 1 to 2 months. If water is needed, add water to bring the electrolyte level between the minimum and maximum indicator lines on the reservoir label. Operation with sample gases with very low dew points increases the frequency of replenishing water.
The Oxygen Analyzer is equipped with an Electrolyte Condition alarm to indicate that the electrolyte level is low. The operation of this alarm is described in the *Alarms* section.

9.2.4 Procedure for Adding Water to the Sensor

1) Open the front door.
2) Unscrew and remove the sensor cover. Remember, the electrolyte is caustic; be careful of drips of electrolyte from the cover.
3) Add distilled or de-ionized water to the electrolyte solution using the supplied squeeze bottle.
4) Fill to the max level indicator line on the reservoir label. Be careful not to spill water on the electronics or on the outside of the sensor. **Do not overfill**.
5) Replace the cover securely and close the front door.

CAUTION

If the electrolyte level is low, only distilled or de-ionized water needs to be added to the sensor. **Do not add electrolyte solution to restore the electrolyte level.** Do not overfill.

9.3 Replaceable Spare Parts List

When ordering spare parts, be sure to include the analyzer serial and model numbers.

Description	P/N
Cable – Display to Main Board	13230920
Cable – Sensor to Main Board	13231590
Connector - (10 pin)	50980743
Connector - (4 pin)	50980755
Display assembly with PCB	15330110
Electrolyte	DF-EO5
Electrolyte for Model 310-H0050 only	DF-EO6
Feet - Rubber	83950001
Filter Element - Coarse	64005011
Filter Element - Fine	64005012
Flow Meter	11220841
Flow Meter w/Valve	11220842
Fuse 24 VDC Operation - 1A	45002421
Fuse 100-240 VAC Operation - 2.5A	45002521
Handle Assembly	65000000
Manual	99000029
PCB – Main Interface	10429210
PCB - CPU	10429200
Power Cord	59017300
Power Supply (100-240VAC)	47500024
Pump – 24 VDC	63000310
Sensor	Call Delta F
Sensor Cap - Black	15015240
Sensor Cap - Green	17323100

Table 14: Replaceable Spare Parts

9.4 Troubleshooting

The following *Troubleshooting Guide* helps the user resolve many of the common operational situations that occur with the analyzer. Investigate possible remedies in the listed order.

9.4.1 Sample System Leak Test (Low Flow Sensitivity)

By far the most common reason for high Oxygen readings is a leak in the sample delivery system. Leaks are divided into two types: real leaks and virtual leaks. A real leak is a lack of integrity in the sample delivery system. A virtual leak is caused by Oxygen that is trapped in the upstream plumbing and components, such as regulators and filters. This Oxygen is slowly being purged out of the system. Virtual leaks are most common in new installations.
Determining the nature of the leak is not a difficult task. It is important to be consistent in the approach and technique. The steps listed below will be helpful toward resolving any leak related problems.

1) Determine if the high reading is due to a leak or is a real indication of Oxygen level. This can be easily done by performing a "Flow Sensitivity Test". If the Analyzer is equipped with a pump, it is recommended that it not be used during the Flow Sensitivity Test. This test requires a positive pressure sample delivery system. If it is not possible to provide positive sample pressure to the Analyzer, skip to Step 2. Perform the Flow Sensitivity Test as follows:

a) Establish a flow rate that is within the normal operating tolerances of the Analyzer. Generally a flow rate of around 1 LPM or 2 SCFH is ideal.

b) Give the Analyzer a couple of minutes to stabilize, and then carefully note the flow rate and the Oxygen level displayed.

c) Reduce the flow rate by 75%. In a system with good integrity, there should be little change in the front panel display. If a leak exists, however, the reading will rise noticeably. Allow it time to stabilize, and carefully note the flow rate and the Oxygen level displayed.

d) Re-establish a normal flow rate and allow the Analyzer to purge for ½ hour. Note again the flow rate and Oxygen level displayed.

e) Repeat step c. If the Oxygen level stabilizes at a level that is close to the prior value from step c, then the leak is real. If the reading shows a lower Oxygen level than the prior value from step c, the leak is probably a virtual leak and continued purging should rectify the problem.

2) Once it has been determined that there is a leak, the next logical step is to locate it. The easiest way to locate a leak is to close off the feed to the Analyzer from the sample delivery system, and to allow the system to pressurize. Apply Snoop® or another type of liquid leak detector to all of the fittings on the system. Any fitting that shows bubbles should be tightened

or replaced.

3) If it is not practical to remove the Analyzer from the sample delivery system, leaks can be located by monitoring Analyzer output while applying Snoop® or another liquid leak detector to one fitting at a time. Snoop® will not show bubbles at the low pressure required for proper Analyzer operation. However, Snoop® will temporarily block any leak, at the fitting being checked, and the Analyzer output will drop. It is important to give sufficient time for the Analyzer to respond before going on to the next fitting.
The more distance between the fitting and the Analyzer, the more time should be given for the Analyzer to respond.

9.4.2 Basic Troubleshooting

Solutions are listed in the order that they should be attempted.

	PROBLEMS	POSSIBLE SOLUTIONS
1)	Analyzer reads low	A B D E H I F J Z
2)	Analyzer reads high	A B C D E I J Z
3)	Analyzer output is noisy	A E I Z
4)	Analyzer reads high with pump on	C Z
5)	Analyzer reads 0.00 at all times	Q D Z
6)	Slow speed of response	G C D E F Z
7)	Electrolyte residue (white powdery build-up) visible on the sensor	Z
8)	Electrolyte Condition alarm “ON”	P D E Z
9)	Display is blank, or shows an unusual appearance	K O Z
10)	Display reads any of the following:	
	- Over Range or TEMP OVER RANGE	L M N Z
	- NOVRAM Failure	Z
	- Uncalibrated	Z
11)	Span reading is unacceptably high (>50% high)	R C J Z

12) Span reading is unacceptably low (>50% low) R J E Z

SOLUTIONS KEY

A) Check instrument performance using a gas standard of known Oxygen content (Span).

B) Check that the Analyzer zero setting matches the original factory setting. Consult the manual or the factory to verify these settings.

C) Check the sample delivery system for leaks.

D) Verify that the correct voltages are being supplied to the sensor. These voltages should be checked with the leads disconnected from the sensor. The voltages measured should be as follows:

Primary Electrodes:	wht/yel (-) to wht/blk/red (+) = 1.30 ± 0.03 VDC
Secondary Electrodes:	wht/blu (-) to wht/red (+) = 7.0 ± 0.5 VDC

Note: For 25% instruments the Primary Electrodes voltage should be 1.40 ± 0.03 VDC

Voltage levels between any other combination of wires should be less than 0.10 VDC. If there is any deviation from these values, contact the Delta F Customer Support Service Department at 781-935-5808.

E) Change the electrolyte. Use only electrolyte supplied by Delta F. Other types of electrolyte can damage the sensor and will void the warranty. Always rinse and drain the cell with distilled or de-ionized water at least three times before refilling the sensor with fresh electrolyte. Fill the sensor with exactly one full bottle of electrolyte (100 cc) and top off the sensor with distilled or deionized water to the MAX line. Allow the Analyzer to operate for several hours on Nitrogen or other inert gas. A calibration check is recommended if performance was poor prior to the electrolyte change.

F) Establish a flow of Nitrogen or other inert gas through the sensor. Reverse the positions of the two lower leads on the sensor. Turn the Analyzer on and allow it to operate in this fashion for at least 1 hour but not more than 3 hours. Immediately drain the sensor, flush three times with distilled or de-ionized water, and install fresh electrolyte. Return the sensor leads to their original positions and allow the Analyzer to operate on a purge gas for several hours and attempt to calibrate.

G) Remove and check the filter element. Replace if needed.

H) Check for contaminated plumbing. This is most easily done by examining the rotameter

(if so equipped) or Tygon tubing downstream from the sensor for evidence of oil, powder, or other material that may have made its way from the process to the Analyzer.

I) Remove any devices being driven by the Analyzer output, i.e., chart recorders, data acquisition systems, etc. Also, disconnect anything controlled by the Analyzer alarm relays. Attempt operation with these devices removed.

J) Ensure that the background gas is compatible with the Analyzers' current calibration. Otherwise, select the appropriate GSF value (if equipped with the GSF option), or offset the display readings externally by the appropriate Background Gas Correction Factor amount. See page 72 for more information.

K) Press the ↵ key once. If the display remains unchanged, power the Analyzer down momentarily, and then power it back up.

L) Ensure that the Analyzer has adequate sample flow.

M) Ensure that the sensor polarization voltage is turned on. See page 60.

N) Enter the Diagnostics menu and verify that the temperature is between 0° and 45°C. If temperature indicates erroneously high, check for good contact at the red and black wires on the sensor harness connector (for Analyzers having the sensor in the cabinet), or at all remote wiring connection point (starting at rear panel connector J11 pins 1 and 2) for remote sensors. Also, in remote sensor applications, verify that the temperature sensor wires are not reversed.

Note: The sensor temperature reading is only updated when entering the Diagnostics menu. After checking wiring connections leave the Diagnostics menu, wait one minute, and enter the menu again. The temperature value will be new, and should now be correct.

O) Confirm that the power supply is turned on, operating at the proper voltage and is connected properly to the analyzer.

P) Add de-ionized or distilled water if electrolyte level is near or below “MIN” mark.

Q) Check the sensor wiring. Make sure the nuts holding the wires to the sensor have not come loose. Trace the wires from the sensor back to the sensor connector. Make sure that the terminal pins are seated correctly in the connector plugs and are making good contact through the connector. Trace the wires further back to the backplane. Make sure the wires are soldered in and none have broken loose.

R) Check the accuracy and age of the calibration reference cylinder. Trace O_2 standards in steel cylinders decay over time due to oxidation of the cylinder walls. Standards below 100 ppm, in steel cylinders, should be re-analyzed or calibrated every three months. Ideally, standards below 100 ppm, and certainly standards below 10 ppm, should be prepared in aluminum cylinders.