

To drain the electrolyte (which is a solution of KOH), remove the sensor from the cabinet as described in Section 2.2. Remove the cap and invert the sensor over a suitable receptacle. Flush the sensor twice with deionized water. Dispose of the electrolyte and rinse water in accordance with Federal, State and Local regulations.

Refill the sensor with electrolyte as instructed in Section 2.2. If the alarm is observed after returning the Analyzer to operation, contact the factory.

Note: Once the sensor has been charged with electrolyte, no further addition of electrolyte solution is required. The dissolved components in the electrolyte are neither consumed nor converted during operation, so only periodic replenishment with distilled or deionized water is necessary.

#### **8.1.4 Replacing The Filter**

The in-line gas filter should be replaced on a periodic basis. The lifetime of the filter element is dependent on the nature of the gas that is being analyzed, thus a general statement about the frequency of filter replacement cannot be provided.

For Analyzers in clean gas applications, if a filter is present, the filter should be inspected on a yearly basis. For other applications Delta F suggests that the filter be inspected on a weekly basis until the operator gains an understanding about the effect of the sample gas on the filter.

Replacement filters can be obtained from Delta F. Two grades are available:

Fine grade (BQ) (< 1 micron)	P/N 64005012
Course grade (DQ) (> 1 micron)	P/N 64005011

### **8.2 Troubleshooting**

#### **8.2.1 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 the reading 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.

### 8.2.2 Basic Troubleshooting

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

<b>PROBLEMS</b>	<b>POSSIBLE SOLUTIONS</b>
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
13) Display normal but other outputs (0-10VDC, 4-20mA, etc.) read zero	S Z

- 14) Battery will not hold a charge (Analyzer will not operate on battery power, or BAT LOW message is always on) T U 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 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 (+) =  $1.30 \pm 0.03$  VDC  
Secondary Electrodes:   wht/blu (-) to wht/red (+) =  $6.0 \pm 1.0$  VDC

Note: For 25% instruments the above Primary Electrodes voltage should be  $1.40 \pm 0.03$  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 DF-E05 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 DF-E05 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 Section 6.4.5.1 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 Section 6.3.4.
- N) Enter the Diagnostics menu and verify that the temperature is between 0 and 45 degrees 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) Check power supply fuse (on Power Control Panel, see Figure 1-2) and operating voltage.
- P) Add deionized 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<sub>2</sub> 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.
- S) Check the 100 mA, fast acting, output protection fuses on the analog output board.
- T) The battery pack has an integral  $45 \pm 5^{\circ}\text{C}$  thermal cutout in the charging lead. If the Analyzer is operated in a warm environment this cutout may open and remain open because the reset temperature is approximately  $20^{\circ}\text{C}$ . Turn off the Analyzer, disconnect the battery pack, and place it into a refrigerator for an hour. Then reinstall the pack, charge for 15 hours, and attempt to run on battery power.
- U) Battery pack life is extremely dependent upon the number of charge/discharge cycles, how often the battery is discharged, how deeply it is discharged, and how long it remains discharged before being charged. It is nearly impossible to predict battery life, but as a general rule if the battery is more than two years old it may be suspected if the Analyzer will not run on battery power. If item T has not been successful, it is suggested that the battery pack be replaced.
- Z) Contact the Delta F Customer Support Services Department. The phone number is 781-935-5808. The fax phone number is 781-932-0053. For faster service, have the instrument serial number and model number in hand before calling. Always be certain to drain the sensor of electrolyte before returning it to the factory for repair.