

Calibration gas generating systems have two critical control systems that must be monitored to ensure accurate and reliable output concentrations. The first is the rate at which the unit generates the desired gas. The second is the volume of background air that the gas is being blended with. These two factors combine to produce the concentration of the output gas in Parts Per Million or PPM. ACD product allow for control and monitoring of both to provide an exceptionally wide range of flexibility for our customers.

CELL FAILURE (No purge mode)

When the ACD product is first turned on the unit must identify the generating cell being used to determine the gas type, efficiency and other information. If there is no generating cell present in the unit when it is first turned on, this information is not available and so the unit simply generates a “CELL FAILURE” and immediately turns off. It is possible to produce this failure with a generating cell in the system if the interface connections between the cell and the instrument are not mated correctly. If an instrument generates this failure at startup and immediately shuts off, check to ensure that the connection between the cell and the instrument is properly connected and that there is no corrosion on either the cell or the mating connector on the instrument. This connector provides an identification interface to the generating cell as well as the path for the cell energy to be delivered, for these reasons this is a critical connection.

CELL FAILURE (purge mode)

The rate at which the unit generates the desired gas is controlled by the energy put into the generating cell and cell efficiency. Faraday’s law states that the amount of chemical change during electrolysis is proportional to the charge passed. ACD products tightly control this energy to the generating cell and constantly monitor that it is correct. If at any time the expected energy to the cell cannot be obtained, the instrument will produce a “CELL FAILURE” error and will turn itself off after purging rather than continue to operate at what may be an incorrect concentration. The difference between a communication error to the cell and an error in providing the correct energy to the cell can be seen in whether the instrument goes to “PURGING” mode prior to shutting off.

If a “CELL FAILURE” results in the unit going to “PURGING”, the unit has failed due to an inability to provide proper energy to the generating cell. The most likely cause for such a failure is a low electrolyte level in the generating cell itself. To check this level, remove the generating cell and observe the liquid in the chamber. The liquid level should be to approx. $\frac{3}{4}$ to the top of each side of the ‘U’ shaped chamber. If the level is low, the caps on top of the cell can be carefully removed and de-ionized water can be added to bring the level into compliance. This should be done with a pipette being careful not to spill any of the cell contents. (Note: the electrolyte is corrosive and if spilled, could damage the system electronics.) When finished, replace the cell caps (make sure O-rings remain in place) and reinsert the cell. The unit should operate normally.

There are other, less likely causes for this form of “CELL FAILURE”. If the above does not appear to be the problem, it could be that the current path to the cell through the interface connector is questionable. Check the connector on the cell and the mate to ensure proper alignment and also check for corrosion. Clean as necessary. It is also possible that due to back pressure or cell age the electrolyte may not be capable of passing sufficient energy at the higher levels. These type problems can typically occur at maximum flow and highest concentration levels (i.e. 25 PPM @ 1.0 LPM). To test for this type condition, simply turn down the flow rate or concentration or both. If the unit runs normally at the lower required energy, this may be your problem. If this is the problem you are seeing, disconnect the outlet hose and attempt to run the unit with nothing connected at your original desired flow and concentration. If the unit still fails it will likely need to be serviced.

If, however, it runs normally with nothing connected, the problem may be excessive back pressure produced by the outlet hose or cal cup. This can also be caused by a unit being connected to a sample draw instrument resulting in the two pumps ‘fighting’ one another. (Sample draw instruments should be calibrated with the generator in the sample draw mode or using an in line ‘T’ fitting. See manual.) Check to locate the source of the pressure (i.e. kinked hose, blocked fitting etc.) and remove it. The unit should run normally when corrected.

FLOW TOO LOW failure

ACD generators utilize an internal rotary vein pump in combination with feedback from a mass flow sensor to provide accurate and adjustable flow rates. If for any reason, the selected flow cannot be achieved the instrument will indicate with a “FLOW TOO LOW” error and will go into “PURGING” mode and turn itself off rather than continue to operate at what may be an incorrect concentration. There are essentially 4 possibilities for such a failure.

- There is a restriction preventing airflow that exists outside of the ACD instrument (i.e. downstream)
- There is a restriction inside the ACD instrument.
- The pump cannot produce the desired flow due to aging or failure.
- The mass flow sensor has failed.

The most common of these for possibilities is that there is a restriction downstream. Usually caused by a ‘calibration cup’ or connection to a flow resistive system this is easily detected by simply disconnecting the hose outlet from the ACD generator and observing that the unit runs normally with nothing connected to it. To correct the condition, simply remove the restriction and provide for a flow path that is without restriction and the unit will calibrate normally.

If there appears to be no downstream restriction, attempt to run the instrument at a lower flow rate. If there is no restriction and the unit will run at lower flow rates and fails at the 1.0 LPM rate the problem may be that the rotary vein pump has become inefficient over time and needs to be replaced. A new pump can be ordered and replaced in the field if this is the case. (The replacement pump does not affect calibration of the instrument.) Calibrate at lower flow rates until the replacement is received. The unit

will still produce accurate calibration gas just at the reduced flow. (Note: anytime the unit is running without a failure indication, the concentration is correct.)

If the ACD instrument still fails even at lower rates in this way with no outlet hose connected, it is possible that the source of the problem is a kinked hose inside the instrument itself. The test for this is quite simple. Remove the charcoal filter and again attempt to run the instrument at the 1.0LPM flow rate with no hose connected and no charcoal filter installed. (leave the plug and the filter itself out of the unit for this test) If at this point the unit runs normally, the problem is likely a kinked hose inside the unit. If it is determined that the problem is likely a kinked hose, the problem can be corrected by the end user if they are interested.

- a. Remove the bottom cover of the unit.
- b. Remove the four screws holding the case together.
- c. Remove the charcoal filter and outlet fitting.
- d. Take the guts of the unit out of the case
- e. Remove the three screws holding the battery holder assembly in and remove the battery case and power board assembly by pulling straight up after removing screws. (note there is an 8-pin connector that interfaces to the main board.)
- f. The hose connecting the back of the filter housing to the flow manifold is now visible. If the hose is not kinked, this is not your problem. If it is ...
 - i. Carefully remove the hose from the fitting on the end of the filter housing and if necessary, slightly shorten the hose by cutting a small amount (possibly $\frac{1}{4}$ ") to allow it to be reconnected without kinking.
- g. If the hose now is connected with no kinks replace the battery housing being careful that the 8-pin connector is securely inserted.
- h. Replace the housing screws and place the unit back in its case. Replace the cover and the screws securing it. Replace the filter and the outlet fitting and retest.

If the system appears to have no restrictions either downstream or internal to the unit, if the pump appears to be functioning normally and there in fact appears to be excessive flow coming out of the instrument and it still fails for "FLOW TOO LOW" (or "FLOW TOO HIGH") it is possible that the mass flow sensor itself has failed. This is extremely uncommon and can only be repaired by ACD personnel. The unit would need to be returned to ACD for service.