

Gas Calibration Check for a Model 1231 Heated Oxygen Probe

Background

The sensor that is used in all Novatech probes is extremely predictable, stable and reliable. For this reason, the calibration of a Novatech oxygen system does not require the use of calibration gases.

However, all Novatech oxygen probes have a built in gas connection that does allow the accuracy of the probe to be checked. This technical note describes the way to do this, and gives some typical results.

Dust filter

The 1231 oxygen probe can be supplied with or without a sintered dust filters. The filter not only stops dust build up in the probe when the probe is used in dusty processes, but also provides a partial gas barrier when a gas calibration check is being performed. This allows the process gas to be more easily kept away from the oxygen sensor during the gas calibration checking procedure.

Equipment required

Certified gas supply bottle (generally between 2 and 8% oxygen in nitrogen)
Pressure regulator
Needle valve
Flow meter (0.5 to 5 l/m)

The procedure

Gas calibration check while the probe is in the process

Setting the probe offset

1. Make sure that the reference air supply is connected to the probe and is operating normally (≈ 50 cc/m)
2. Set the "Damping Factor" on the analyser to 0 or "No Damping"
3. Set the lower line display to be showing the probe EMF (mV) and probe Impedance in Set-up step 33
4. Note the mV reading on the analyser
5. Connect a supply of clean fresh air** to the "CAL" port of the probe from the regulator, needle valve and flow meter
6. Adjust the needle valve until about 0.5 l/m is flowing into the probe. If the connecting pipe is less than 5m, the mV reading should move towards 0mV within 5 seconds, and stabilise within 10 to 15 seconds. Note the mV reading.
7. As soon as the reading is stable and noted, change the flow rate to 1 l/m
8. Wait for a stable reading, and note the mV reading
9. Repeat this for flow rates of 2, 3, 4 and 5 l/m and then close the needle valve
10. Check the results, and pick the average mV reading, disregarding sudden variations at low and high flow levels

11. Enter this reading into the "Probe Offset" of the analyser

** If the air is from an instrument air supply or a gas bottle (compressed supply), add 0.4mV to the reading before entering it into "Probe Offset". This will compensate for the ambient humidity in the atmosphere.

If a diaphragm or aquarium pump is used to supply the CAL port, enter the mV reading as read from the lower line of the analyser. The analyser monitors and compensates for the ambient relative humidity.

Certified calibration gas check

12. Disconnect the air supply and connect the gas supply to the "CAL" port of the probe through the gas regulator, needle valve and the flow meter
13. Close the needle valve and set the gas regulator to about 50 kPa
14. Turn on the needle valve until about 0.5 l/m is flowing into the probe. The oxygen reading should move towards the certified oxygen concentration within <5 seconds, and stabilise within 10 to 15 seconds. Note the oxygen reading.
15. As soon as the reading is stable and noted, change the flow rate to 1 l/m
16. Wait for a stable reading, and note the oxygen reading
17. Repeat this for flow rates of 2, 3, 4 and 5 l/m and then close the needle valve

The oxygen readings should look like this –

Flow rate (l/m)	Analyser oxygen reading (%)
0	3.5
0.5	4.6
1	4.9
2	5.0
3	5.0
4	5.0
5	5.2

Note:

The next time a gas calibration check is done, it will not be necessary to vary the flow rate, but simply use a flow rate in the centre of the 'flat' area of the curve.

Oxygen probe: Model 1231, without filters
Process oxygen reading: 3.5%
Certified calibration gas: 5.0 +/- 0.05%

If the oxygen probe has filters fitted, the results will be very similar except that the readings at the lower flow rates will be closer to the calibration gas level.

Gas calibration check while the probe is out of the process

The procedure for checking a probe that is out of the process is the same as checking it when it is in the process except that a small muffle of a high temperature insulating cloth (or a high temperature glove) should be placed loosely around the end of the probe in high wind conditions.

The reference air must also be still operating during the test.

What to do if the oxygen reading does not match the certified gas %

Check the setting of the reference voltages in the analyser
Check that the calibration gas pipe work connections are not leaking
Confirm that the readings were taken within 1 minute, especially at high flow rates
Confirm the accuracy of the gas bottle

READING LOW

If the probe appears to be reading low this can be caused by a build up of hydrocarbons at the sensor running at 720°C and consuming the oxygen that should be measured due to combustion. A solution to this is to pump air into the calibration port to accelerate the burning process to consume and eliminate the hydrocarbons.

Having an excessive flow of reference air can also cause a low reading; this causes a cooling affect on the zirconia sensor. Reference airflow should be approximately 50cc/min.

READING HIGH

If the probe appears to be reading high then the reference air should be checked, remove the cap on the probe and pull the hypodermic from the four bore insulator, place the hypodermic in a glass of water to observe air flow.

If the process operates under a negative pressure then check that the 1/8-inch plug screwed into the calibration port on the probe is not leaking.

If the problem persists then replace or return the probe to Novatech.