



Technical Support Note

Title: Calibrating a Model 900131 on either Low Ox (TriGas) or Hi-Ox gas mixes.

TSN Number: 24

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Calibration Overview

Checking accuracy and calibrating a Model 900131 requires a strict attention to detail in order to achieve the best results. This TSN establishes a method of operation that ensures the best results for this process using certified test gas and a P/N 001246 MAP Analyzer Calibration Stand.

NOTE: The gas analyzer should have been powered up and running in continuous measurement mode for at least 15 minutes before it is connected to the calibration stand. If you are going to check an analyzer as part of this process, it is wise to power it up and let it thermally stabilize while the setup steps below are done.

Setting up the Certified Gas Cylinder and Regulator

1. **Fit the Regulator to the Certified Gas Cylinder and ensure that there is a gas tight seal:**

Check the input end of the regulator fitting for contamination and damage – and likewise inspect the mating cylinder valve fitting. These mating surfaces should be clean and free of deformation to insure a good seal.

Tightly Install the gas regulator on the certified gas cylinder. Make sure that the calibration regulator is very tightly installed on the cylinder – and that there is no leak between the cylinder and the regulator. A small leak here is on the high-pressure side of the regulator and can significantly reduce calibration gas tank longevity.

Once the regulator is tightly installed, verify that the regulator has a gas-tight seal to the cylinder by first turning the regulator fully off (counterclockwise) and then turning the cylinder valve on. You should see the cylinder-side regulator gage read the cylinder pressure – about 2000psi for a freshly charged cylinder. Then turn the cylinder valve fully off – and observe the leak-down rate on the high pressure gage. Since the regulator and cylinder valve are off, the pressure reduction shows how fast the gas is leaking from the cylinder valve/regulator interface. If the gage holds pressure, then the system is leak-tight. If the pressure leaks down, there is a gas leak between the cylinder and regulator, which should be located and corrected. The gage should show undetectable pressure reduction in a minute of observation.

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2. **Plumb the Regulator Output to the Calibration Stand Input:**

Install the plastic 1/4NPTM / 1/8th Barb adapter provided into the output of the regulator. Use Teflon tape or the equivalent to ensure gas tightness.

Install the length of the yellow 3/32 inch feed line on the barb fitting. Connect the other end of the tubing by its quick-release Luer connector to the calibration stand input fitting. Be careful that the connections between the regulator and the calibration stand are gas-tight. There will ultimately be 20 psi pressure on these connections, and a gas leak here will greatly increase gas consumption during the calibration process.

Also be sure the gas line is small in diameter (Bridge provides 3/32 inch ID tubing for this purpose) and only long enough to facilitate placement of the calibration stand near the cylinder.

3. **Set the Regulator to 20 PSI and confirm 500 ml/min flow can be achieved:**

Turn the calibration stand flowmeter valve clockwise until it is off. (Do not over-tighten this needle valve – just tighten it until it is fully seated.) Make sure that the output T-Fitting and interconnect tubing are connected to the calibration stand output –no gas analyzer should be connected at this time.

Open the feed valve at the regulator output, if it has one. Turn the main cylinder valve on, and set the output pressure of the regulator to about 20 psi. This is the line pressure that feeds gas to the calibration stand.

Slowly turn the cal stand flowmeter valve counterclockwise until flow is seen on the gage, and confirm that flow can be adjusted to a full 500 ml/min (the gage may be marked in 'cc/min' which is the same as 'ml/min'). Once 500 ml/min flow is achieved, observe the regulator output pressure gage and readjust it to 20 PSI at this flow if necessary.

Turn the flowmeter valve off to stop gas flow through the calibration stand.

Prepare the Analyzer for Calibration

NOTE: The gas analyzer should have been powered up and running in continuous measurement mode for at least 15 minutes before it is connected to the calibration stand.

4. **Make sure the analyzer has reached thermal stability, and Zero the Analyzer:**

The analyzer should have been measuring room air for some time, as above, and its readings should be fairly stable. Because the analyzer prompts for a Zero every half hour

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from the previous Zero, it is wise to Zero the analyzer before attaching it to the calibration stand to ensure the working time.

Once the analyzer is recovered from the Zero process (about 1 minute), proceed to the next step.

5. **Connect the gas analyzer to the Cal Stand Output:**

Insert the analyzer sample needle into the end of the yellow tubing, being sure that there is a tight seal between the tubing and the base of the needle. The analyzer should be on and in the continuous measurement mode. It will continue to draw ambient air in through the T-Fitting even though there is no gas flow from the cal stand.

6. **Setting the Calibration Gas Flow to the Analyzer:**

Confirm that the calibration gas cylinder main valve is on and the regulator output pressure is set to about 20 psi. Slowly turn the flowmeter valve counterclockwise until flow is seen, and set the flow rate to a low level – about 150 ml/min. The analyzer should begin to measure the test gas, although the readings will be off due to air dilution. (The analyzer is still drawing room air in through the tee.)

Watch the O₂ reading, and slowly increase the cal stand flow until the readings no longer change with increased flow. This is the point where the cal stand gas flow matches the analyzer sample gas extraction rate, and should occur at a flow rate between 250 ml/min and 400 ml/min.

7. **Confirming the Calibration Gas Flow to the Analyzer:**

To confirm this flow, slowly reduce the gas flow by turning the flowmeter valve in the clockwise direction.

For Low-Ox gas: At some point, you should begin to see the O₂ reading of the analyzer increase, along with a concomitant reduction of the CO and CO₂ readings, indicating that ambient oxygen from the room air is being drawn into the gas analyzer through the tee. This is the point at which the gas flow from the cal stand is not quite enough supply the analyzer, and it is drawing room air in from the ‘Tee’ on the Cal Stand output line.

Turn the gas flow a small amount (50 ml/min or so) higher than this point to make sure there is adequate gas flow to ensure that no room air is diluting the calibration gas.

For High-Ox gas: At some point, you should begin to see the O₂ and CO₂ readings of the analyzer decrease indicating that ambient oxygen from the room air is being drawn into the gas analyzer through the tee. This is the point at which the gas flow from the cal stand is not quite enough supply the analyzer, and it is drawing room air in from the ‘Tee’ on the Cal Stand output line.

Turn the gas flow a small amount (50 ml/min or so) higher than this point to make sure there is adequate gas flow to ensure that no room air is diluting the calibration gas.

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Calibrating the Gas Analyzer on Low Ox (TriGas):

NOTE: Gas calibration of the gas analyzer is a serious function, as the analyzer will be permanently changed. It should be performed in a careful and rigorous manner by a fully qualified technician.

8. **Calibrating the Analyzer on Low Oxygen (Trigas) Gas:**

With the analyzer measuring calibration gas as in step 7 above, observe if the gas readings are stable. Pay particular attention to the O₂ reading, as this is the slowest to respond. When you are satisfied that the readings are stable, Zero the analyzer and wait for 1 minute from completion of the zero for the readings to stabilize.

Once the readings have stabilized, enter the 'Calibration Mode' by pressing down the **CAL** and **ZERO** buttons and holding them for 1 Second. The analyzer displays will change to show numbers only on the gas that can be calibrated, with 'CAL' being shown on the other gas displays. Pressing the **CAL** button moves from one gas to another, allowing the selection of each gas in order.

9. **Adjust CO₂ Calibration:**

Press the **CAL** button until the CO₂ display is active ('CAL' appears on the CO and O₂ displays).

Compare the CO₂ value displayed to the 'Tag' value of the certified gas cylinder. Adjust the CO₂ gas reading on the analyzer to match the 'Tag' value using the **UP** and **DOWN** arrows. (A single button push moves the calibration one least significant digit up or down. Holding the button down puts the analyzer into the 'scroll' calibration mode, where the gas readings change at the maximum rate.)

When the readings match, change to the High O₂ (Span) calibration mode by pressing the **CAL** button.

10. **Move to High O₂ Calibration – inactive at this time:**

The High O₂ calibration mode indicators will flash, indicating that the High O₂ calibration mode is inactive because the O₂ reading is too low (less than 2.00%) for O₂ Span Calibration.

11. **Adjust Low O₂ Calibration:**

Press the **CAL** button again to enter the Low O₂ Calibration (Offset) Mode.

The Low O₂ reading may be adjusted to match the value in the certified gas cylinder by using the **UP** and **DOWN** buttons, as described above. NOTE: It may take some time for the O₂ sensor to stabilize close to zero after the analyzer has been exposed to room air during the Zero process – which provides high oxygen for working span calibration of the O₂ sensor. Make sure low O₂ readings are stable before correcting them.

12. **Adjust CO Calibration:**

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Press the **CAL** button again to enter the CO Calibration Mode.

Similar to the CO₂ readings, compare the displayed values to the certified gas cylinder 'Tag' value and adjust the readings accordingly.

Check and Confirm Gas Calibrations:

Press the **CAL** button and cycle through all of the gases to confirm that they are all adjusted correctly. Note: Adjusting the CO₂ level will affect the CO level somewhat – so if you adjust CO₂ calibration, always recheck the CO level when you are done.

When you are satisfied that the gas readings match the calibration tank certified gas levels, the calibration can be saved by pressing **CAL** and **ZERO** buttons together for one second.

This completes the calibration of the analyzer, and the corrected calibration values are stored permanently in the analyzer for later use.

13. Confirm reading accuracy in the Test Measurement Mode:

Press the **TEST** button to put the analyzer in the Test Measurement Mode. The display should flash once per second until the end of the sample period, at which time the pump should turn off, and the readings are frozen on the displays. The readings should match the calibration values.

Wait for at least 1 minute for the analyzer to thermally stabilize to the pump-off state, leaving the sample needle inserted into the cal stand delivery tubing

At the end of this period, Zero the analyzer. At the end of the Zero process, the analyzer will conduct a gas test and turn the pump off. (This test will show high residual oxygen due to the oxygen in the ambient air Zero process – this is normal.

Test the calibration gas again and note that the oxygen readings reduce.

Repeat the test sequence until the readings stabilize and confirm that they are within the test tolerance in the Test Measurement Mode.

Ending the Calibration Process:

14. Turn off the Calibration Gas Cylinder:

Turn the main gas cylinder valve completely off (clockwise). Observe that the regulator input pressure begins to drop, then that the regulator output pressure and the sample gas flow will descend to zero.

NOTE: Always turn the certified test gas valve off after use. Failing to do so will rapidly empty the cylinder.

Remove the analyzer sample needle from the cal stand delivery system.

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Calibrating the Gas Analyzer on Hi-Ox:

NOTE: Gas calibration of the gas analyzer is a serious function, as the analyzer will be permanently changed. It should be performed in a careful and rigorous manner by a fully qualified technician.

1. **Calibrating the Analyzer on High Oxygen Gas:**

With the analyzer measuring calibration gas as in step 7 above, observe if the gas readings are stable. Pay particular attention to the O₂ reading, as this is the slowest to respond. When you are satisfied that the readings are stable, Zero the analyzer and wait for 1 minute from completion of the Zero for the readings to stabilize.

Once the readings have stabilized, enter the 'Calibration Mode' by pressing down the **CAL** and **ZERO** buttons and holding them for 1 Second. The analyzer displays will change to show numbers only on the gas that can be calibrated, with '**CAL**' being shown on the other gas displays. Pressing the **CAL** button moves from one gas to another, allowing the selection of each gas in order.

2. **Adjust CO₂ Calibration:**

Press the **CAL** button until the CO₂ display is active ('**CAL**' appears on the CO and O₂ displays).

Compare the CO₂ value displayed to the 'Tag' value of the certified gas cylinder. Adjust the CO₂ gas reading on the analyzer to match the 'Tag' value using the **UP** and **DOWN** arrows. (A single button push moves the calibration one least significant digit up or down. Holding the button down puts the analyzer into the 'scroll' calibration mode, where the gas readings change at the maximum rate.)

When the readings match, change to the High O₂ (Span) calibration mode by pressing the **CAL** button.

3. **Move to High O₂ (Span) Calibration:**

The High O₂ calibration mode indicators will be steady, indicating that the High O₂ calibration mode is active because the O₂ reading is above 2.00% - required for O₂ Span Calibration.

4. **Adjust High O₂ (Span) Calibration:**

The O₂ reading may be adjusted to match the value in the certified gas cylinder by using the **UP** and **DOWN** buttons, as described above. NOTE: It may take some time for the O₂ sensor to stabilize close to the correct value if the analyzer has been exposed to room air during the Zero process recently. Make sure that the O₂ readings are relatively stable when correcting them. If they continue to drift up, you may have to execute another Zero

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during this process to obtain a correct reading. When the O₂ readings are stable and correct, you may proceed to the following step.

5. **Check CO Measurement Function:**

Press the **CAL** button again to enter the CO Calibration Mode.

You should see that the CO readings are at or very close to Zero. No CO adjustment is necessary for this gas.

Check and Confirm Gas Calibrations:

Press the **CAL** button and cycle through all of the gases to confirm that they are all adjusted correctly.

When you are satisfied that the gas readings match the calibration tank certified gas levels, the calibration can be saved by pressing **CAL** and **ZERO** buttons together for one second.

This completes the calibration of the analyzer, and the corrected calibration values are stored permanently in the analyzer for later use.

6. **Confirm reading accuracy in the Test Measurement Mode:**

Remove the sample needle from the gas flow and expose it to room air. Press the **TEST** button to put the analyzer in the Test Measurement Mode. The display should flash once per second until the end of the sample period, at which time the pump should turn off, and the readings are frozen on the displays.

Wait for at least 1 minute for the analyzer to thermally stabilize to the pump-off state, leaving the sample needle exposed to room air.

At the end of this period, Zero the analyzer. At the end of the Zero process, the analyzer will conduct a gas test and turn the pump off.

Insert the sample needle into the calibration gas flow and Test the calibration gas.

Repeat the test sequence until the readings stabilize and confirm that they are within the test tolerance in the Test Measurement Mode.

Ending the Calibration Process:

7. **Ending the Calibration Process:**

Remove the sample needle from the cal stand delivery tubing.

Press the **TEST** button. The display should flash once per second until the end of the sample period, at which time the pump should turn off, and the readings are frozen on the displays. The readings should show the room air values.

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Turn the main gas cylinder valve completely off (clockwise). Observe that the regulator input pressure begins to drop, then the regulator output pressure and the sample gas flow will descend to zero.

NOTE: Always turn the certified test gas valve off after use. Failing to do so will rapidly empty the cylinder.

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