GAS ANALYZER CALIBRATION PROTOCOL (CH₄)

User calibrations define linear regression coefficients based on a zero and span value. This protocol checks for zero and span drift.

Last eddit August 12, 2023



Protocol purpose:

The purpose of calibration is to establish a known relationship between the sensor's response and the actual concentration of the gas being measured. Over time, sensors can drift or degrade, leading to measurement inaccuracies. Calibration corrects for these deviations and ensures that the instrument provides consistent and accurate readings.

PREPARATION

- Turn off any HVAC systems to minimize temperature fluctuations. Ideal conditions would be a stable temperature between 20–30°C.
- Power on and allow the instrument to reach equilibrium temperature for several hours. Note that optics takes about 30 minutes to reach equilibrium before calibration.
- Clean mirrors on the top and bottom of the instrument. Record before/after signal strengths.
- Begin filling out the calibration spreadsheet's relevant sections (e.g., date/time/location, serial numbers, pre-cal coefficients, ambient temperature, signal strength). Pre-cal coefficients are buried under the Help menu About Factory Setup Watch LI-7700 Cal.
- Connect all plumbing for calibration. Insert the calibration sleeve over the instrument. To monitor flow rates, use an in-line 0-5 LPM flow meter. Use a pigtail (6 + inches) on the outlet of the calibration sleeve.

EQUIPMENT

LI-COR 7700 open path analyzer N_2 tank CH_4 tanks (span and check)

Paper tissues

CHEMICALS

 N_2 CH₄

DANGERS

Chemicals	$\bullet \bullet \bullet \bullet \bullet$
Physical	
Environmental	$\bullet \bullet \bullet \bullet \bullet$

PROTECTIVE GEAR

Safety glasses

LAB CALIBRATION

Step 1

Inspect zero for CH₄

- Use compressed nitrogen. Per manufacturer recommendation, start with a high ($\approx 5 \,\mathrm{LPM}$) initial flow rate for 5 minutes to flush calibration sleeve volume. After the initial flush, reduce the flow rate to $2\text{-}3 \,\mathrm{LPM}$.
- Using LI-COR software, plot the time series of CH₄ in both molar density $(mmol m^{-3})$ and mixing ratio $(\mu mol mol^{-1})$ on page 1. Plot signal strength, temperature, and pressure on page 2. Wait for stable readings. Stable values are changes of less than 10 ppb over 5 minutes. Once readings are stable, record average values. Auto-scale function on the software does not work well, and clearing the chart may be required. An acceptable range for CH₄ is $\pm 10 \text{ ppb}$. If out-of-spec, zero analyzer.

Step 2

Inspect CH₄ span

• Send span gas through the analyzer at a flow rate of $5\,{\rm LPM}$ for $5\,{\rm minutes}$, then reduce to $2\text{-}3\,{\rm LPM}$. Wait for stable readings using the above criteria (change of less than $10\,{\rm ppb}$ over $5\,{\rm minutes}$). Record stable reading. If the reading is $\pm10\,{\rm ppb}$ from the stated value, the analyzer will require a zero followed by a CH₄ span. If the instrument was previously zeroed, proceed directly to span the analyzer.

Step 3

Verify CH_4 calibration by running a 'check' gas through the instrument

• Verify calibration results by running a 'check' gas through the analyzer. Wait for stable readings (change of less than $10\,\mathrm{ppb}$ over $5\,$ minutes). Record average stable reading. If the reading is $\pm 10\,\mathrm{ppm}$ from the stated value, repeat the procedure from step 1.

Step 4

Record post-calibration coefficients on the calibration spreadsheet

SOURCES

References

• LI-7700 Open Path CH4 Analyzer Instruction Manual (2023). LI-COR Biosciences. URL: https://www.licor.com/documents/

18warrx05laaa1zo9s0pepmjk0cgiqm3.

NOTES

CONTACTS

You can contact the Tech Team at ameriflux-tech@lbl.gov