

Calibration Basics for Gas Density Applications

Choosing Calibration Gasses

Whether you use Yokogawa's GD system to measure gas density, specific gravity, or % concentration, at its core it is always measuring DENSITY. Below are a few tips for choosing calibration gasses for these applications:

- Remember that the system is only measuring density. Choose calibration gasses (Zero and Span) whose densities bracket your normal measuring density.
- Calibrating with two gasses (Zero Gas and Span Gas) is the preferred method and results in the most accurate measurements.
- If the density of your application does not vary widely, it is acceptable to calibrate with one gas that has a density similar to your normal process value.
- The GD system provides excellent measurement linearity. Because of this, you can choose inexpensive, safe calibration gasses. For example, the density of Acetylene may be exactly what you need in a calibration gas for your application, but do you really want to store that flammable of a gas? If not, you can choose a safer gas like Helium, whose density may not be as desirable, but will still provide accurate measurements because of the GD's linearity.
- Locate the calibration gas bottles close to the GD40 detector. This will decrease calibration time and reduce calibration gas consumption.
- Only use "Calibration Grade" gasses with certified purity. Do NOT use bulk gasses as they will introduce measurement error. Custom blended gasses are not required.

*See the appendix for common gasses and their densities.

Setting up the GD for your Calibration Gasses

To set calibration data, press the **【*】** key in the measurement mode, (when password is selected, enter the password (XXX)) and select the parameter 『*CAL.DT』

Zero-point density 『*Z_DNS』 : **Enter the density of your zero cal gas.**

Configurable range = 0.0000 to 6.0000 (kg/m³) or 0.00000 to 0.40000 (lb/ft³)

Span-point density 『*S_DNS』 : **Enter the density of you span cal gas.**

Configurable range = 0.0000 to 6.0000 (kg/m³) or 0.00000 to 0.40000 (lb/ft³)

Output during calibration 『*C_HLD』 : **Do you want the analog output to be held during calibration?**

- Disable: 0
- Enable: 1
- Enable (preset value): 2

Performing a Calibration

The majority of applications will require a manual calibration.

The steps for completing the calibration are as follows:

- 1) Press the "MODE" key.
- 2) Press "NO" when DISP is displayed.
- 3) Press "NO" when SEM CAL is displayed.
- 4) Press "YES" when MAN CAL is displayed.
- 5) Press "YES" when ZERO is displayed.
- 6) Confirm that the correct density is displayed for your zero calibration gas.
- 7) Flow your zero calibration gas at a rate of 0.6 LPM to the GD40 detector. This should be similar to your process gas flow rate.
- 8) Press the "Enter" key.
- 9) Allow the density reading to stabilize. Once stable, press the "Enter" key.
- 10) Press "YES" when SPAN is displayed.
- 11) Confirm that the correct density is displayed for your span calibration gas.
- 12) Flow your span calibration gas at a rate of 0.6 LPM to the GD40 detector.
- 13) Press the "Enter" key.
- 14) Allow the density reading to stabilize. Once stable, press the "Enter" key.
- 15) Return the process gas flow back to the detector.

Appendix

Table 1 Pure Gas Specific Gravities, Gross Calorific Values, Densities and Net Calorific Values (0 °C, 1 atm)

No.	Gas	Chemical formula	Specific gravity (Air=1.0000)	Gross Calorific value (kJ/m ³)	Gas Density (*) (kg/m ³)	Net Calorific Values (KJ/m ³)
1	Carbon monoxide	CO	0.967	12610	1.2504	12610
2	Hydrogen	H ₂	0.0696	12780	0.08988	10830
3	Methane	CH ₄	0.554	39940	0.7175	36020
4	Ethane	C ₂ H ₆	1.038	70470	1.3552	64550
5	Ethylene	C ₂ H ₄	0.968	63560	1.2612	59620
6	Propane	C ₃ H ₈	1.522	101400	2.0102	93390
7	Propylene	C ₃ H ₆	1.452	93730	1.9122	87760
8	n-Butane	n-C ₄ H ₁₀	2.006	134300	2.7024	124100
9	i-Butane	i-C ₄ H ₁₀	2.006	133100	2.6897	122900
10	1-Butene	1-C ₄ H ₈	1.936	126300	2.5956	118100
11	cis-2 Butene	cis-2-C ₄ H ₈	1.936	126600	2.6042	118400
12	trans-2 Butene	tr-2-C ₄ H ₈	1.936	126300	2.6042	118100
13	i-Butene	i-C ₄ H ₈	1.936	125500	2.5953	117400
14	n-Pentane	n-C ₅ H ₁₂	2.490	171400	3.4542	158700
15	i-Pentane	i-C ₅ H ₁₂	2.490	169300	3.4266	156800
16	n-Hexane	n-C ₆ H ₁₄	2.974	215700	4.3205	199900
17	Benzene	C ₆ H ₆	2.695	163300	3.8343	156800
18	Toluene	C ₆ H ₅ CH ₃	3.179	227700	4.8495	217600
19	Carbon dioxide	CO ₂	1.519	—	1.9771	—
20	Oxygen	O ₂	1.104	—	1.4289	—
21	Nitrogen	N ₂	0.967	—	1.2504	—

Source : JIS K2301-1992

Table for SEC10.eps

(*) Gas density is only reference data.