Calibration Basics for Gas Density Applications

Technical Note

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 GC 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

No.	Gas	Chemical Formula	Specific Gravity (Air = 1.0000)	Gloss Calorific Value (kJ/m³)	Gas Density (*) (kg/m³)	Net Calorific Values Value (kJ/m³)
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_2H_6	1.038	70470	1.3552	64550
5	Ethylene	C_2H_4	0.968	63560	1.2612	59620
6	Propane	C_3H_8	1.522	101400	2.0102	93390
7	Propylene	C_3H_6	1.452	93730	1.9122	87760
8	n-Butane	n-C_4H_{10}	2.006	134300	2.7024	124100
9	i-Butane	i-C_4H_{10}	2.006	133100	2.6897	122900
10	1-Butene	1-C_4H_8	1.936	126300	2.5956	118100
11	cis-2-Butene	cis-2-C_4H_8	1.936	126600	2.6042	118400
12	trans-2-Butene	tr-2-C_4H_8	1.936	126300	2.6042	118100
13	i-Butene	i-C_4H_8	1.936	125500	2.5953	117400
14	n-Pentane	n-C_5H_{12}	2.490	171400	3.4542	158700
15	i-Pentane	i-C_5H_{12}	2.490	169300	3.4266	156800
16	i- Hexane	i-C_6H_{14}	2.974	215700	4.3205	199900
17	Benzene	C_6H_6	2.695	163300	3.8343	156800
18	Toluene	$C_6H_5CH_3$	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

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