Technical data sheet TDS0003

PATENT NUMBER: GB 2372099B; US 6,753,967 B2

CARBON DIOXIDE INFRARED SENSOR TEMPERATURE COMPENSATED CERTIFIED VERSION TYPE MSH-CO2

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FEATURES

- High sensitivity to carbon dioxide
- Standard sensor size
- Fast Response
- Internal temperature signal
- Gas diffusion sampling
- Temperature compensated detector elements
- Wide operating temperature range
- Low power

DESCRIPTION

Dynament infrared sensors operate by using the NDIR principle to monitor the presence of target gas. The sensor contains a long life tungsten filament infrared light source, an optical cavity into which gas diffuses, a dual temperature compensated pyroelectric infrared detector and an integral thermistor to monitor the internal temperature. The infrared source should be driven externally with a constant voltage supply switched at a fixed frequency with a 50% duty cycle. The dual pyroelectric detector produces two output signals in response to pulsed incident radiation from the source:

- An active signal which decreases in the presence of target gas
- A reference signal which is used to monitor the intensity of the source

Both signals are composed of a DC offset voltage (typically 0.7V – 1.0V) with a small superimposed response signal alternating in sympathy with the source drive voltage. The alternating signal must be extracted and amplified in order to obtain a measure of the peak to peak value for both the active and reference. The ratio of active to reference peak to peak signals is essentially independent of variations in source intensity over time and this ratio reduces in the presence of target gas. It is the reduction in this ratio that is used to determine the target gas concentration. The reduction in ratio is non-linear and the gas concentration can be extracted using the expression:

[concentration] = (-(ln (1 – (1 – Ratio/**zero**)/**span**)) / **a**) ^ (1/**b**)

Where **zero** is the ratio in the absence of target gas, **span** is determined during calibration and

a = 0.00059896, **b** = 0.87404 and the typical **span** = 0.22 for a range of 0-5000ppm CO_2.
a = 0.84096, **b** = 0.66972 and the typical **span** = 0.3 for a range of 0-5% volume CO_2.

The internal temperature signal is used to measure the temperature inside the sensor. This temperature measurement is used to correct for the ideal gas law and to correct for any optical filter effects on zero and span as a function of temperature. The internal temperature is typically 10°C higher than ambient at 20°C due to the heat generated from the infrared source. This internal heating beneficially reduces the probability of water condensing within the optical cavity.

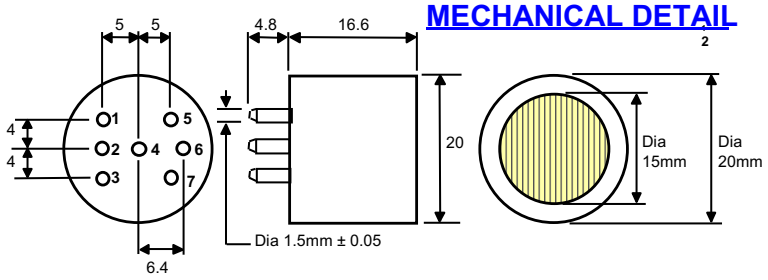
Further details on the sensor, interfacing circuitry, signal extraction and relative responses to other hydrocarbons can be found in the Dynament application notes on the Dynament web site or by contacting Dynament directly.

SPECIFICATION

Maximum lamp Power Requirements:	5V d.c. 60mA max. (50% duty cycle source drive)
Minimum operating voltage:	3.0V d.c. (50% duty cycle source drive)
Source drive frequency:	2.0Hz minimum, 3.0 Hz typical, 4.0 Hz maximum
Active mV pk-pk output in N_2:	5.2mV typical @ 3Hz, 50% duty cycle
Reference mV pk-pk output in N_2:	4.0mV typical @ 3Hz, 50% duty cycle
Sensitivity (reduction in active signal) at 20°C, 3Hz, 50% duty cycle:	14% typical @ 5000ppm CO_2 30% typical @ 2.0% volume CO_2
Measuring range:	0 -1000ppm up to 0 - 5% volume CO_2
Resolution:	1% of measuring range
Warm up time:	To final zero ± 100ppm : <20s @20°C (68°F) ambient To specification: < 30 minutes @20°C (68°F) ambient
Response Time T_{90}:	<30s @20°C (68°F) ambient
Zero Repeatability:	± 50ppm @20°C (68°F) ambient
Span Repeatability:	± 50ppm @20°C (68°F) ambient
Long term zero drift:	± 50ppm per month @20°C (68°F) ambient
Operating temperature range:	-20°C to +50°C (-4°F to 122°F)
Storage temperature range:	-20°C to +50°C (-4°F to 122°F)
Humidity range:	0 to 95% RH non-condensing.
MTBF:	> 5 years
Temperature signal:	Integral thermistor for temperature monitoring
Weight:	17 grams

Refer to Technical Data Sheet TDS0022 – General Description for further information

MECHANICAL DETAIL



NOTES

1 DIMENSIONS W ITHOUT TOLERANCES ARE NOMINAL
2 RECOMMENDED PCB SOCKET: WEARNES CAMBION LTD CODE: 450-3326-01-06-00
3 WEIGHT: 15g
4 USE ANTI-STATIC PRECAUTIONS WHEN HANDLING
5 DO NOT CUT PINS
6 DO NOT SOLDER DIRECTLY TO PINS

PIN OUT

1 LAMP RETURN
2 LAMP +5V
3 +5V PYRO SUPPLY
4 DETECTOR OUTPUT
5 REFERENCE OUTPUT
6 THERMISTOR OUTPUT
7 0V PYRO SUPPLY AND CASE CONNECTION

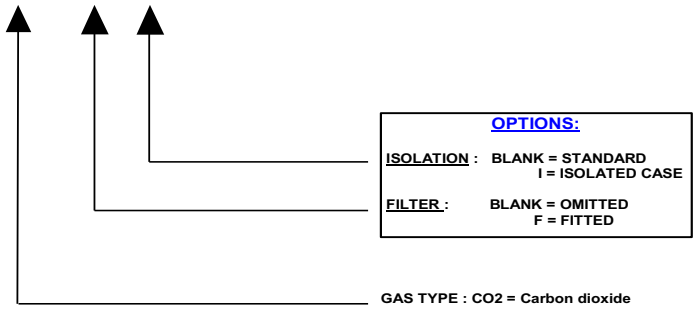
Available sensor options:

F = Replaceable, self adhesive, microporous PTFE filter

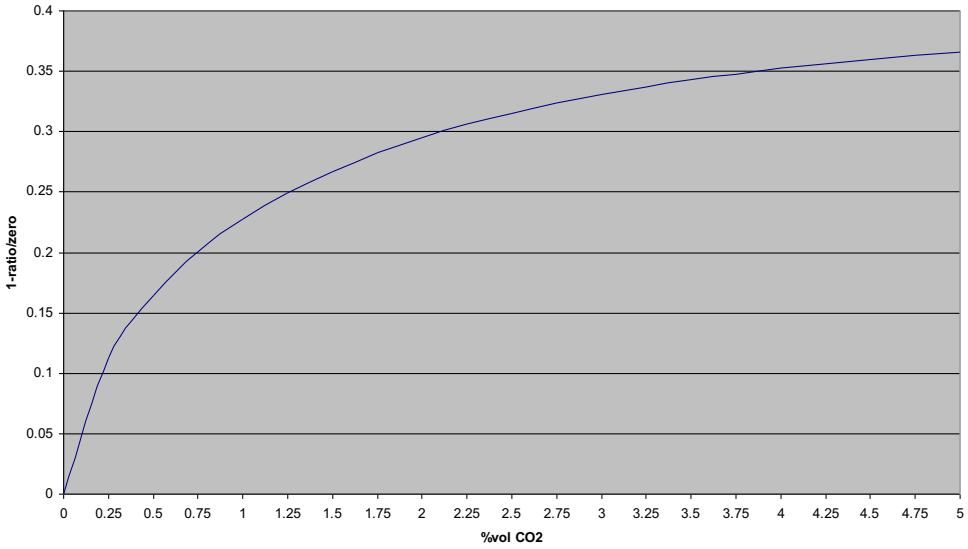
I = Case isolated from 0V pin

EXAMPLE OF ORDER CODES

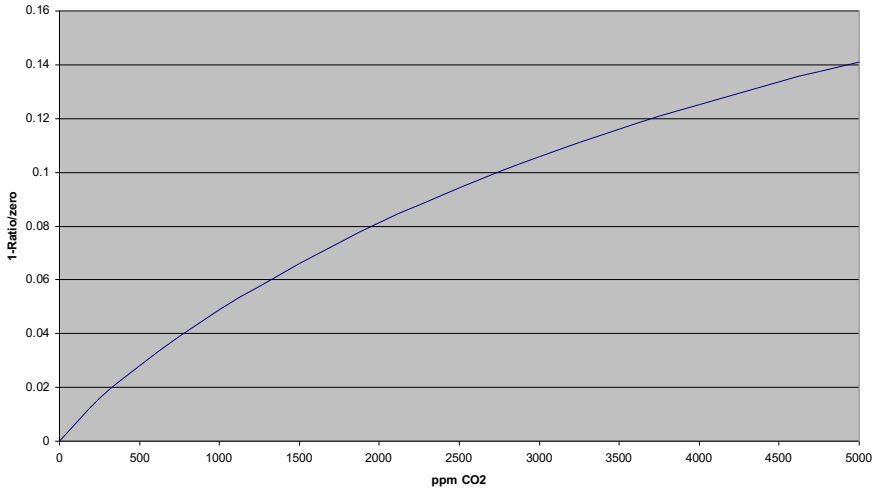
MSH – CO2 / F / I



Typical response to 0-5.0% volume CO2



Typical response to 0-5000ppm CO2



CERTIFICATION DETAILS	
European ATEX Certification	**Sensor type MSH *****
Approval body	**SIRA**
Certificate Number	**SIRA 04ATEX1357U**
Test Standards	**EN60079-0:2012+A11:2013, EN60079-1:2014, EN60079-11:2012, EN60079-26:2015**
Certification Codes	**I M2 Ex db I Mb** **II 2 G Ex db IIC Gb**
Input parameters	**0.8W max, 30V max.** **(See footnote)**
Operating temperature	**-20°C to +60°C (See footnote)**
International IECEx Certification	**Sensor type MSH *****
Approval body	**SIRA**
Certificate Number	**IECEx SIR 05.0053U**
Test Standards	**IEC 60079-0:2011** **IEC60079-1:2014** **IEC 60079-11:2011** **EN 60079-26:2014**
Certification Codes	**Ex db I and/or Ex db IIC**
Input parameters	**0.8W max, 30V max.**
Operating temperature	**-20°C to +60°C (See footnote)**
North American Certification	**Sensor type MSH *****
Approval body	**Underwriters Laboratory Inc.**
File Reference	**E336365**
Test Standards	**UL 60079 – 0, 4th Edition** **UL 60079 - 1, 6th Edition** **CAN/CSA-C22.2 No. 60079-0-1-7** **CAN/CSA-C22.2 No. 60079-1** **part 1, 1st Edition**
Hazardous Locations	**Class 1, Zone 1, AEx d IIC and Ex d IIC Hazardous Locations**
Input/Entity parameters	**0.8W max, 30V max.**
Input parameters are defined for certification purposes only, refer to the "Specification" table for the sensor operating voltage and temperature range.	