

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**

Dynamant 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:

$$[\text{concentration}] = (-\ln(1 - (1 - \text{Ratio}/\text{zero})/\text{span})) / a)^{1/b}$$

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<sub>2</sub>.

**a** = 0.84096, **b** = 0.66972 and the typical **span** = 0.3 for a range of 0-5% volume CO<sub>2</sub>.

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 Dynamant application notes on the Dynamant web site or by contacting Dynamant directly.

**Dynamant Limited**

Hermitage Lane Industrial Estate · Kings Mill Way · Mansfield · Nottinghamshire · NG18 5ER · UK.

Tel: 44 (0)1623 663636 · Fax: 44 (0)1623 421063

email: [sales@dynamant.com](mailto:sales@dynamant.com) · [www.dynamant.com](http://www.dynamant.com)

## SPECIFICATION

<b>Maximum lamp Power Requirements:</b>	5V d.c. 60mA max. (50% duty cycle source drive)
<b>Minimum operating voltage:</b>	3.0V d.c. (50% duty cycle source drive)
<b>Source drive frequency:</b>	2.0Hz minimum, 3.0 Hz typical, 4.0 Hz maximum
<b>Active mV pk-pk output in N<sub>2</sub>:</b>	5.2mV typical @ 3Hz, 50% duty cycle
<b>Reference mV pk-pk output in N<sub>2</sub>:</b>	4.0mV typical @ 3Hz, 50% duty cycle
<b>Sensitivity (reduction in active signal) at 20°C, 3Hz, 50% duty cycle:</b>	14% typical @ 5000ppm CO <sub>2</sub> 30% typical @ 2.0% volume CO <sub>2</sub>
<b>Measuring range:</b>	0 -1000ppm up to 0 - 5% volume CO <sub>2</sub>
<b>Resolution:</b>	1% of measuring range
<b>Warm up time:</b>	To final zero ± 100ppm : <20s @20°C (68°F) ambient To specification: < 30 minutes @20°C (68°F) ambient
<b>Response Time T<sub>90</sub>:</b>	<30s @20°C (68°F) ambient
<b>Zero Repeatability:</b>	± 50ppm @20°C (68°F) ambient
<b>Span Repeatability:</b>	± 50ppm @20°C (68°F) ambient
<b>Long term zero drift:</b>	± 50ppm per month @20°C (68°F) ambient
<b>Operating temperature range:</b>	-20°C to +50°C (-4°F to 122°F)
<b>Storage temperature range:</b>	-20°C to +50°C (-4°F to 122°F)
<b>Humidity range:</b>	0 to 95% RH non-condensing.
<b>MTBF:</b>	> 5 years
<b>Temperature signal:</b>	Integral thermistor for temperature monitoring
<b>Weight:</b>	17 grams

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

**MECHANICAL DETAIL**

Dimensions shown: 5, 5, 4.8, 16.6, 2, 20, Dia 1.5mm ± 0.05, Dia 15mm, Dia 20mm, 6.4, 4, 4.

**NOTES**

- DIMENSIONS WITHOUT TOLERANCES ARE NOMINAL
- RECOMMENDED PCB SOCKET: WEARNES CAMBION LTD CODE: 450-3326-01-06-00
- WEIGHT: 15g
- USE ANTI-STATIC PRECAUTIONS WHEN HANDLING
- DO NOT CUT PINS
- DO NOT SOLDER DIRECTLY TO PINS

**PIN OUT**

- LAMP RETURN
- LAMP +5V
- +5V PYRO SUPPLY
- DETECTOR OUTPUT
- REFERENCE OUTPUT
- THERMISTOR OUTPUT
- 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 – CO<sub>2</sub> / F / I**

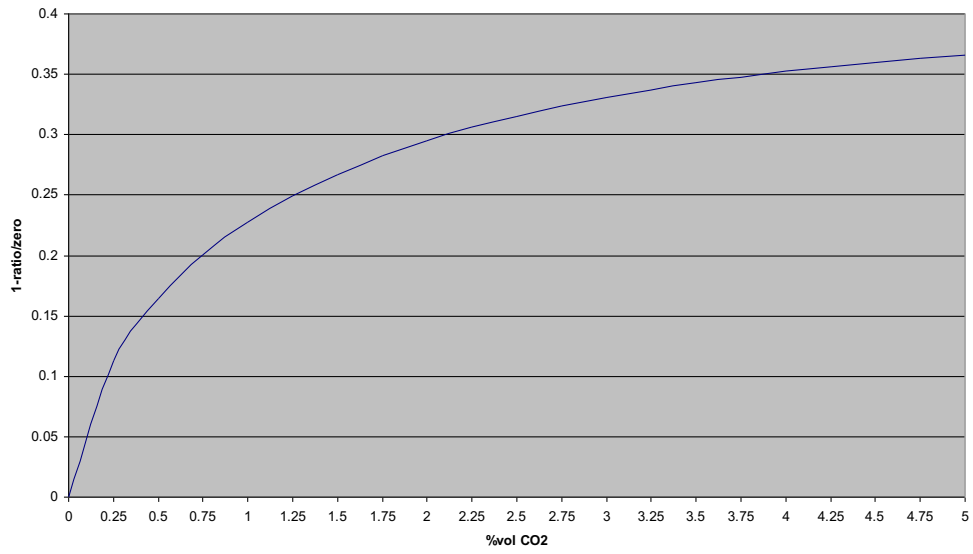
**OPTIONS:**

**ISOLATION :** BLANK = STANDARD  
I = ISOLATED CASE

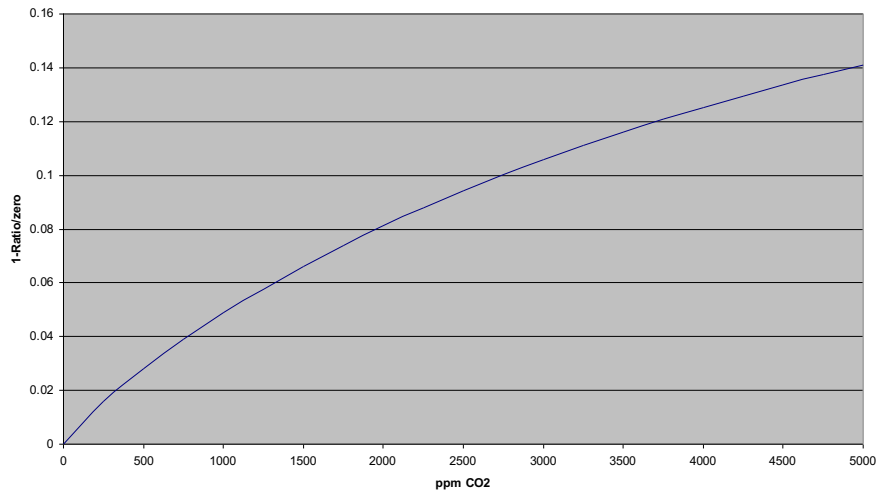
**FILTER :** BLANK = OMITTED  
F = FITTED

GAS TYPE : CO<sub>2</sub> = Carbon dioxide

Typical response to 0-5.0% volume CO2



Typical response to 0-5000ppm CO2



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

## Warranty information

All Dynament Standard sensors carry a two-year warranty against defects in materials and workmanship. The warranty is invalidated if the sensors are used under conditions other than those specified in this data sheet.

Attention should be paid to the following criteria:

- **Observe the correct supply polarity**
- **Do not exceed the maximum rated lamp supply voltage of 5V**
- **Do not solder directly to the sensor pins**
- **Do not expose the sensor to corrosive gases**
- **Do not allow liquids to enter the sensor**