



Technical data sheet TDS0004

CARBON DIOXIDE INFRARED SENSOR TEMPERATURE COMPENSATED NON-CERTIFIED VERSION TYPE MSH-P-CO2/NC/TC



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

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 CO₂.

a = 0.84096, **b** = 0.66972 and the typical **span** = 0.3 for a range of 0-5% volume CO₂.

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 also 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 and signal extraction can be found in the Dynamant application notes, on the Dynamant website or by contacting Dynamant directly.



Dynamant Limited

Premier House · The Village · South Normanton · Derbyshire · DE55 2DS · UK.

Tel: 44 (0)1773 864580 · Fax: 44 (0)1773 864599

email: sales@dynamant.com · www.dynamant.com

SPECIFICATION

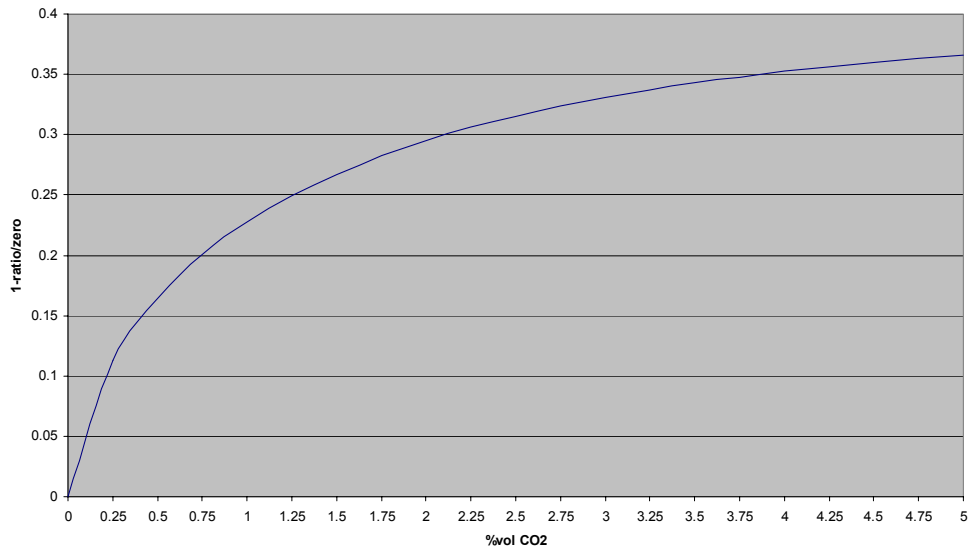
Maximum lamp Power Requirements:	5V d.c. 60mA max. (50% duty cycle source drive)
Minimum operating voltage:	3.0V d.c. (50% duty cycle source drive)
Source drive frequency :	2.0Hz minimum, 3.0 Hz typical, 4.0 Hz maximum
Active mV pk-pk output in N₂:	5.2mV typical @ 3Hz, 50% duty cycle
Reference mV pk-pk output in N₂:	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 T₉₀:	<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:	7 grams

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

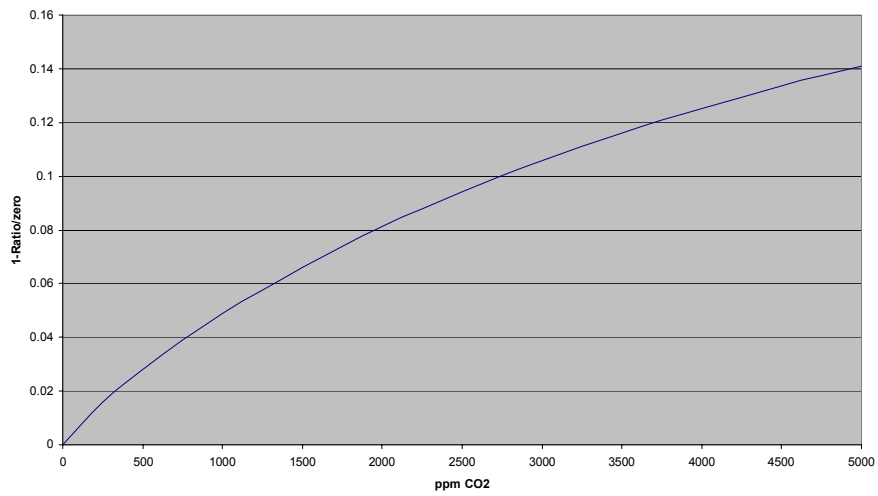
<p style="text-align: center;">MECHANICAL DETAIL</p>	<p style="text-align: center;">NOTES</p> <ol style="list-style-type: none"> 1 DIMENSIONS WITHOUT TOLERANCES ARE NOMINAL 2 RECOMMENDED PCB SOCKET: WEARNES CAMBION LTD CODE: 450-3326-01-06-00 3 WEIGHT: 15g 4 USE ANTI-STATIC PRECAUTIONS WHEN HANDLING 5 DO NOT CUT PINS 6 DO NOT SOLDER DIRECTLY TO PINS 	<p style="text-align: center;">PIN OUT</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">1 LAMP RETURN</td> <td style="width: 50%;">2 LAMP +5V</td> </tr> <tr> <td>3 +5V PYRO SUPPLY</td> <td>4 DETECTOR OUTPUT</td> </tr> <tr> <td>5 REFERENCE OUTPUT</td> <td>6 THERMISTOR OUTPUT</td> </tr> <tr> <td>7 0V PYRO SUPPLY AND CASE CONNECTION</td> <td></td> </tr> </table>	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	
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<p>Available sensor options:</p> <p>P = Removable 45 micron plastic insert dust filter</p> <p>F = Replaceable, self adhesive, microporous PTFE filter</p> <p>I = Case isolated from 0V pin</p>	<p style="text-align: center;">EXAMPLE OF ORDER CODES</p> <p style="text-align: center;">MSH – CO₂ / NC / TC / P / F / I</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 5px; margin-left: 20px;"> <p style="text-align: center; margin: 0;">OPTIONS:</p> <p>ISOLATION: BLANK = STANDARD I = ISOLATED CASE</p> <p>FILTER: BLANK = OMITTED F = FITTED</p> <p>PLASTIC INSERT: BLANK = OMITTED P = FITTED</p> <p>TC = TEMPERATURE COMPENSATED DETECTOR ELEMENTS</p> <p>NC = NON-CERTIFIED</p> <p>GAS TYPE : CO₂ = Carbon Dioxide</p> </div> </div>
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Typical response to 0-5.0% volume CO2



Typical response to 0-5000ppm CO2



Warranty information

All Dynament Premier 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.

Particular 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**