

IR11BR Miniature Infrared Gas Sensor for Monitoring Carbon Dioxide up to 100% Vol.

FEATURES

- Carbon dioxide gas sensor
- 0 to 100% vol.
- Long life
- Low power
- Fast response
- Reference channel for self-compensation
- Special gold-plated optical/gas cavity for stable signal levels
- Rugged stainless steel construction
- 20 mm body height
- Immune from "poisoning"
- Resistance to corrosion
- Reliable fail-safe operation
- No moving parts
- Low maintenance
- Suitable for fixed and portable instrumentation
- ATEX Certified  II 2G Ex d IIC Gb
(T_a = -20 to +55 °C)
- IECEx Certified Ex d IIC Gb (T_a = -20 to +55 °C)
- CSA Certified – File 107498
- UL Recognised – File E186043

DESCRIPTION

The IR11BR sensor uses the proven non-dispersive (NDIR) principle to detect and monitor the presence of carbon dioxide gas up to 100% volume. With an infrared source and specific filtering on the pyroelectric detectors mounted inside the optical/gas cavity, the carbon dioxide gas concentration can be determined.

OPERATION

To operate as an NDIR gas sensor, the IR11BR must be interfaced to a suitable electronics, for power, lamp pulsing, amplifying and signal processing. Signal processing, in its simplest terms, involves the linearisation and temperature compensation using algorithms in the system software.

The IR11BR does not contain a temperature sensor, so a means of measuring the temperature will need to be added to electronics to allow temperature compensation to be performed. In certain applications where relatively large changes in ambient pressures are found, a pressure sensor may be required for compensation.

A set of Application Notes is available from SGX Sensortech to explain more about NDIR gas sensing and provide advice for the end-user on interfacing the sensors and the signal processing.



HANDLING PRECAUTIONS

1. Do not allow sensors to fall on the floor. This could cause lamp filament breakage, damage to the pins and the gas entrance aperture.
2. Do not apply mechanical force against the gas entrance aperture.
3. Do not immerse sensors in water or other fluids.
4. Protect the gas entrance aperture against dust ingress and sprayed materials.
5. Anti-static handling precautions must be taken.
6. Under no circumstances should the sensor pins be soldered directly to a pcb or wires. Excessive heat could cause irreparable damage to the pyroelectric detectors.

CERTIFICATIONS

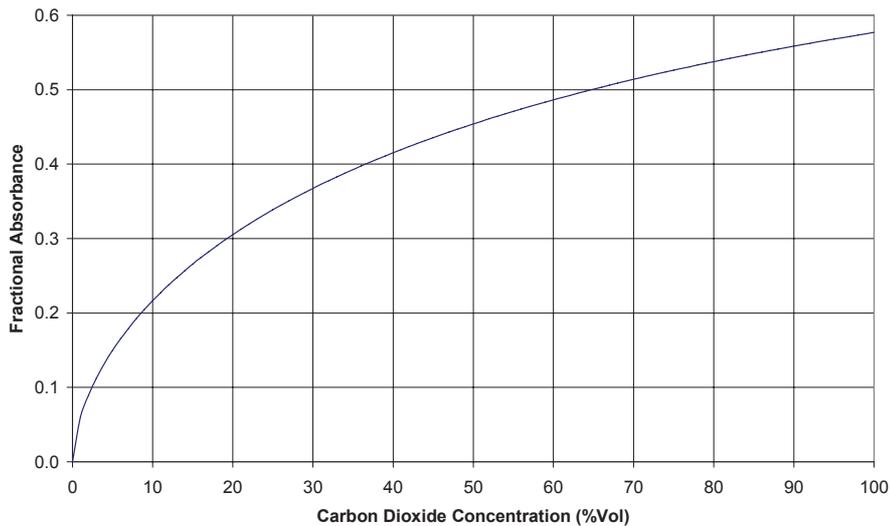
SIRA Certification Services, EU Notified Body No. 0518, have certified the IR11BR under the ATEX Directive, 94/9/EC, and the IECEx Scheme. Certificate number SIRA 99ATEX1121U certifies it as a flameproof component to EN60079-0:2006 (including amendments A1 and A2) and EN60079-1:2007. **Instructions specific to hazardous area installations apply** (see page 4). Certificate number IECEx SIR 04.0031U certifies it as a flameproof component to IEC60079-0 Ed. 5 and IEC60079-1 Ed. 6.

The Canadian Standards Association has issued a component certification for the IR11BR for use as part of an intrinsically safe portable combustible gas detector or housed in a remote sensor housing. It has satisfied the requirements of CSA standard C22.2 No. 30-M 1986. File No. 107498.

Underwriters Laboratories Inc. recognise the IR11BR as components in intrinsically safe single- or multi-gas detectors for use in Class 1, Division 1, Groups A, B, C and D hazardous locations. It has satisfied the requirements of UL913, fifth edition. File E186043.

ABSORBANCE CURVE

This graph shows the sensitivity versus concentration before linearisation. For further explanation, refer to the Infrared Sensor Application Notes.



TECHNICAL SPECIFICATION

General

Gas type	carbon dioxide (CO ₂)
Concentration range	0 to 100% vol.

Mechanical

Dimensions	see outline
Body material	stainless steel
Weight	27 g

Environmental

Ambient temperature range: for operation for storage	-20 °C to +55 °C -25 °C to +85 °C
Ambient pressure range: for operation for storage	80 kPa to 120 kPa 80 kPa to 120 kPa
Ambient humidity range: for operation for storage	0 to 99% (non-condensing) 0 to 99% (non-condensing)
Ingress protection	requires extra protection depending upon application

Electrical

DC supply to detectors: minimum recommended maximum	+3 V +5 V +15 V
Maximum sensor power with lamp max: @3 V @5 V	100 mW 180 mW
Lamp supply: "On" voltage "On" current frequency duty cycle pulse	3 V to 5 V 60 mA (@5 V) 4 Hz 50% square wave
Warm-up time (@20 °C): to operate to specification	<20 seconds <30 minutes
MTBF	>5 years

PERFORMANCE SPECIFICATION

All measurement data taken using:

- SGX electronics and hardware
- SGX linearisation and temperature compensation algorithms (see Infrared Gas Sensor Application Notes).
- Lamp modulation 0.4 V to 5.0 V, square wave at 4 Hz and 50% duty cycle.
- Ambient temperature (except for temperature tests) and pressure (except for pressure tests)
- All gases diluted with dry nitrogen.
- All sensors purged with dry nitrogen throughout tests, except for periodic exposures to carbon dioxide.

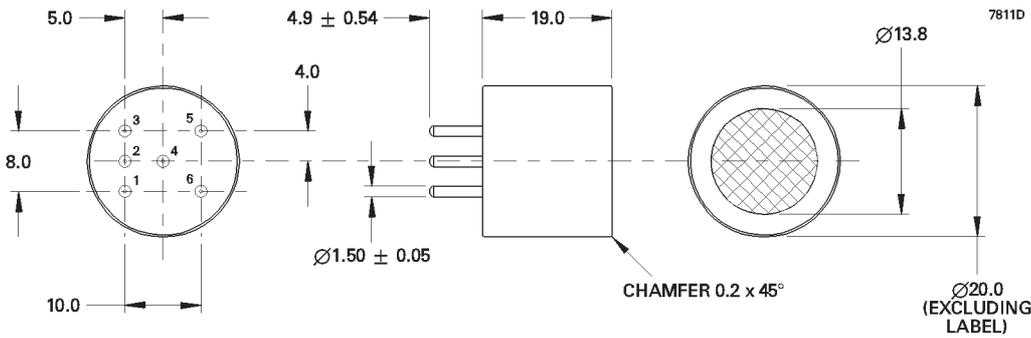
Note: Any variation from these conditions may affect the sensor performance.

Parameter	Min	Typical	Max	Units
Active detector output voltage in N ₂ (pk-pk)	15	25	35	mV
Reference detector output voltage in N ₂ (pk-pk)	6	11	18	mV
Absorbance to (100 % vol. CO ₂)	0.50	0.58	0.65	
Deviation from linearity (accuracy)	-3	0	3	% vol.
Response time	-	-	20	s
Short-term stability in 0% vol. CO ₂ (see note 1)	-1	0	1	% vol.
Short-term stability in 100% vol. CO ₂ (see note 1)	97	100	103	% vol.
Vibration (see note 2)	-3	0	3	% vol.
Temperature effects in 0% vol. CO ₂ (see note 3)	-0.1	0	0.1	% vol.
Temperature effects in 100% vol. CO ₂ (see note 3)	85	100	115	% vol.
Pressure effects in 100% vol. CO ₂ (see note 4)	95	100	105	% vol.
Humidity effects in 0% vol. CO ₂ (see note 5)	0	0	0.05	% vol.
Humidity effects in 100% vol. CO ₂ (see note 5)	100	100	100.5	% vol.
Long-term variation in 0% vol. (see note 6)	TBD	TBD	TBD	% vol. / month
Long-term variation in 100% vol. (see note 6)	TBD	TBD	TBD	% vol. / month
Resolution (see note 7)	0.5	-	-	% vol.

NOTES

1. Range of readings over an 8-hour period, allowing the sensor to stabilise for at least 30 minutes prior to testing.
2. The changes in output after vibration at the following conditions: 10 Hz to 30 Hz, 1.0 mm total excursion; 31 Hz to 150 Hz, 2g acceleration peak (rate of change = 10 Hz/min); 1 hour period in each of the three mutually perpendicular planes, in air.
3. Using SGX algorithms and average alpha and average beta temperature compensation coefficients. Sensor allowed to stabilise at each temperature prior to measurements being taken. Accuracy over temperature can be improved by testing each sensor individually.
4. With pressure compensation algorithm.
5. Humidity effects can only cause a positive increase in calculated concentration.
6. Average variation per month, tested over a minimum 3-month period.
7. Resolution will be at 100% vol. CO₂. The resolution will significantly improve as the concentration decreases. Resolution is calculated as twice the standard deviation of measurements taken at 100% vol. over a 1-hour period, allowing time for the sensor to stabilise before test commences.

OUTLINE (All dimensions in millimetres; see note 1)



Pin	Connection
1	+ V DC detector supply
2	Lamp
3	Lamp return
4	Active detector output
5	Reference detector output
6	0 V input

Outline Notes

1. Body dimensional tolerances ± 0.1 mm. Pin dimensional tolerances as indicated.
2. The IR11BR sensor is designed to press-fit into a pcb socket. The end-user should choose a socket to accommodate the full sensor pin length. This will ensure a stable mechanical location as well as good electrical contact. e2v technologies recommend the Wearn's Cambion type 450-1813-01-03-00 single-pole solder mount socket with through hole, or a suitable equivalent.

INSTRUCTIONS SPECIFIC TO HAZARDOUS AREA INSTALLATIONS (Ref. EU ATEX Directive 94/9/EC, Annex II, 1.0.6)

1. The IR11BR Gas Sensing Head is component-approved only and may not be used as stand-alone items in a hazardous area without further protection.
2. The IR11BR Gas Sensing Head shall be protected in service. The Sensing Head shall be mounted in a protective enclosure such that an impact of 7 J in accordance with EN60079-0:2006 clause 23.4.3.1 from any direction shall not cause the impact head to make contact with the Sensing Head.
3. The thermal resistance of the IR11BR Gas Sensing Head does not exceed 25 K/W; this shall be taken into account when considering its surface temperature and the temperature classification of the equipment into which it is to be incorporated.
4. The IR11BR Gas Sensing Head has not been assessed as a safety device (EHSR 1.5).
5. There are no user-serviceable parts in the component.
6. The end-user/installer shall be aware that the certification of the IR11BR Gas Sensing Head relies on the following materials used in its construction, which are suitable for most common applications:

Enclosure Stainless steel
 Mesh Stainless steel
 Bushing Epoxy resin

In accordance with the Note in EN60079-0:2006 clause 6.1(a), the end-user/installer shall inform the manufacturer of any adverse conditions that the IR11BR Gas Sensing Head may encounter. This is to ensure that the IR11BR Gas Sensing Head is not subjected to conditions that may cause degradation of these materials.

7. The IR11BR Gas Sensing Head is only certified for use in ambient temperatures between $-20\text{ }^{\circ}\text{C}$ and $+55\text{ }^{\circ}\text{C}$ and should not be used outside this range.
8. The maximum input power of the IR11BR Gas Sensing Head shall not exceed 2.5 W.