

IR15TT, IR15TT-M, IR25TT, IR25TT-M Miniature Infrared Twin-Gas Sensors for Hazardous Areas and Intrinsic Safety in Mining

FEATURES

- Two active gas channels for simultaneous detection of carbon dioxide, methane and hydrocarbons
- IR15TT and IR25TT sensing ranges: CO₂ for 0 – 2% vol. conc. (optional 0 – 5% vol.) and hydrocarbons to LFL levels (optional 0 – 100% vol.)
- IR15TT-M and IR25TT-M sensing ranges: CO₂ for 0 – 2% vol. conc. (optional 0 – 5% vol.) and methane to LFL levels (optional 0 – 100% vol.)
- Diffused gas sampling
- Low power
- Reference channel for self-compensation
- Special gold plated optical/gas cavity for stable signal levels
- Embedded thermistor temperature sensor
- Operational in varying ambients of temperature, pressure and humidity
- Fast response
- Rugged stainless steel construction
- No moving parts
- Resistance to corrosion
- Immunity from 'poisoning'
- Reliable fail-safe operation
- Low maintenance
- Suitable for fixed or portable instrumentation
- Series expandable to other gases or vapours
- ATEX certified  II 2G Ex d IIC Gb (IR15T Series)
(T_a = –20 to +55 °C)
- ATEX certified  I M1 Ex ia I Ma (IR25T Series)
(T_a = –20 to +60 °C)
- IECEx certified Ex d IIC Gb (IR15T Series)
(T_a = –20 to +55 °C)
- IECEx certified Ex ia I Ma (IR25T Series)
(T_a = –20 to +60 °C)
- CSA certified - File 107498 (IR15T Series)
- UL recognised - File E186043 (IR15T Series)

DESCRIPTION

The IR15T and IR25T Series of sensors use the proven non-dispersive infrared (NDIR) principle to detect and monitor the presence of gases. With an infrared source and specific filtering on the pyroelectric detectors mounted inside the optical/gas cavity, individual gases or types of gas can be identified and their concentrations determined.



(Photograph shows device approximately 2½ x actual size)

The IR15T Series are suitable for reliable monitoring of gas levels in general industrial safety applications where the infrared sensor size is restricted and requires flameproof/explosion-proof certification. The IR15TT is filtered to sense a broad range of hydrocarbons, and carbon dioxide, but has a slight cross-sensitivity to water vapour when the RH is high. The IR15TT-M is filtered to a narrower waveband, more specific to methane, but will also sense a lesser range of hydrocarbons. It has very low cross-sensitivity to the water vapour levels typically found in mining applications.

The IR25T Series share the same build standard, performance and cross-sensitivity as the IR15T Series, but are labelled as being intrinsically safe for methane monitoring in mining applications.

A shock-resistant lamp version is available for enhanced reliability in portable applications - IR15TT-M_1 (contact SGX Sensortech for availability of other sensor versions).

OPERATION

To operate as NDIR gas sensors, the IR15T and IR25T Series must be interfaced to a suitable transmitter for power supply and for amplifying and processing signals. Sensor outputs require linearisation and compensation for ambient temperature variation (facilitated by the inbuilt thermistor) by algorithms in the system software. This is necessary for sensors to meet their full performance specification.

Compensation for pressure changes can also be made in an algorithm, provided there is a suitable input from a pressure sensor.

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

Infrared Sensor Application Note 1: Background to NDIR Gas Sensing

Infrared Sensor Application Note 2: Signal Processing

Infrared Sensor Application Note 3: Software Design

Infrared Sensor Application Note 4: Electronics Design

Infrared Sensor Application Note 5: Determining Coefficients for Linearisation and Temperature Compensation

Infrared Sensor Application Note 6: Advice for Using Infrared Gas Sensors in Mining Applications

CERTIFICATIONS

IR15T Series

SIRA Certification Services, EU Notified Body No. 0518, have certified the IR15T Series 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 IR15T Series 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 IR15T Series 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.

IR25T Series

SIRA Certification Services, EU Notified Body No. 0518, have certified the IR25T Series under the ATEX Directive, 94/9/EC, and the IECEx Scheme. Certificate number SIRA 02ATEX2015U certifies it as an intrinsically safe component for mining applications, category M1, to EN60079-0:2006 (including amendments A1 and A2), EN60079-11:2007 and EN50303:2000. **Instructions specific to hazardous area installations apply.** See page 4. Certificate number IECEx SIR 03.0003U certifies it as a flameproof component to IEC60079-0 Ed. 5 and IEC60079-11 Ed. 5.

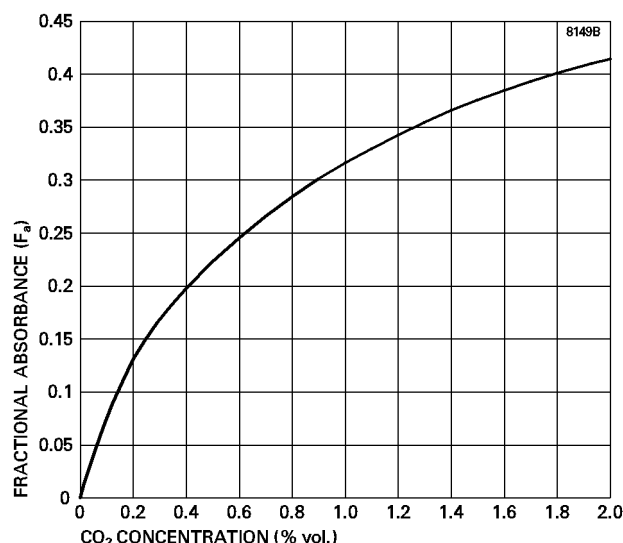
HANDLING PRECAUTIONS

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.

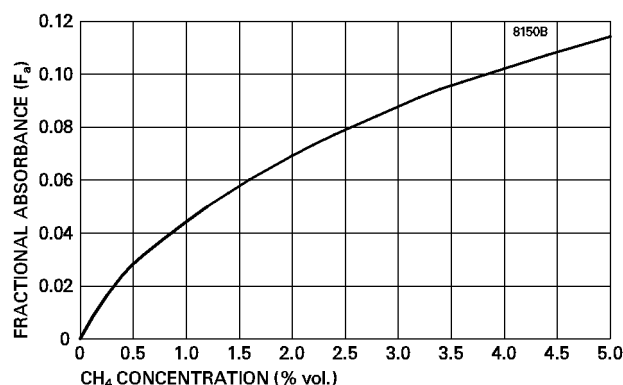
FRACTIONAL ABSORBANCE CURVES

These show the sensitivity versus concentration before linearisation for the range of gases. For further explanation, refer to the Infrared Sensor Application Notes.

Typical Sensitivity to 0 to 2% vol. Carbon Dioxide



Typical Sensitivity to 0 to 5% vol. Methane (≡ 100% LFL)



Note: Other Fractional Absorbance curves are available from Gas Sensor Engineering at SGX Sensortech.

TECHNICAL SPECIFICATION

Mechanical

Dimensions	see outline, page 4
Body material	stainless steel
Weight	27 g

Environmental

Ambient temperature range: for operation for storage	-20 to +55 °C -25 to +85 °C
Operational pressure range	700 to 1300 hPa
Humidity range for operation and storage	0 to 95% non-condensing
Vibration	complies with EN61779-1
Ingress protection	requires extra protection depending on application

Electrical

DC supply to detectors	+3 to +15 V; +5 V recommended
Maximum power supply	180 mW
Lamp supply	3 to 5 V (60 mA), modulation 4 Hz, 50% duty cycle recommended Note: Applying >5 V will reduce the lamp lifetime
Warm-up time	<20 s to operate, <30 min. to full specification at 20 °C

PERFORMANCE

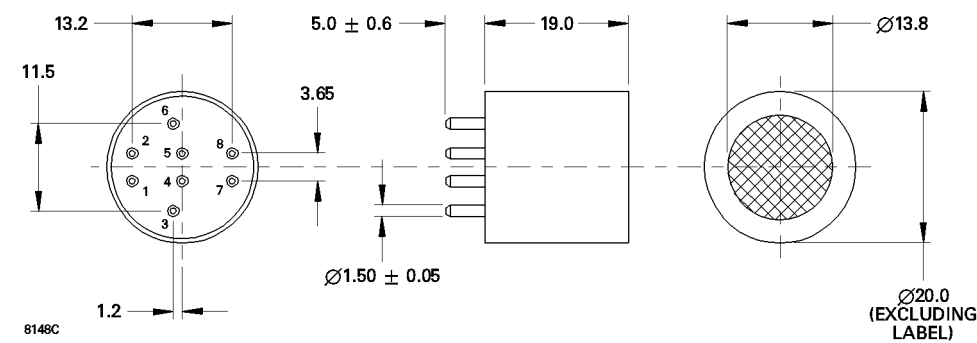
All measurement data taken using:

- SGX Sensortech linearisation and temperature compensation algorithms; see Infrared Sensor Application Notes.
- Lamp modulation 0.4 - 5.0 V, square wave, at 4 Hz and 50% duty cycle.
- Ambient temperature (20 °C) and pressure (1010 hPa).
- All gases diluted in nitrogen.

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

Sensor type	All	IR15TT, IR25TT	IR15TT-M, IR25TT-M
Gas	Carbon Dioxide	Methane	
Gas concentration range	0 – 2.0% vol.	0 – 5.0% vol.	
Maximum response time (T90)	<20 s		
Limits of detector output voltage in nitrogen (x165 pre-amplifier gain): active channel reference channel	1.7 to 4.0 V 3.0 to 6.0 V	4.0 to 8.0 V 3.0 to 6.0 V	2.0 to 6.5 V 3.0 to 6.0 V
Typical % fall in active detector voltage in maximum target gas (reference detector is unchanged)	42%	11%	10%
Sensitivity to gas over full concentration range (before linearisation)	see Fractional Absorbance Curves		
Maximum deviation from linearity	±0.1% vol.		
Typical variation of zero with temperature (–20 to +55 °C)	±10 ppm/°C	±20 ppm/°C	
Resolution (dependent on electronics)	100 ppm	500 ppm	
Maximum non-reproducibility of zero at 20 °C	±100 ppm	±500 ppm	
Maximum non-reproducibility of sensitivity at 20 °C	±100 ppm	±1000 ppm	
Long-term zero drift/month at 20 °C	±100 ppm	±500 ppm	
Response to 0 – 90% change in RH at 20 °C (in 2.5% vol. methane or 2% vol. carbon dioxide)	0% vol.	+0.3% vol.	+0.1% vol.
MTBF (lamp dependent only)	>10 years for 5 V operation, >20 years for 3 V operation		

OUTLINE (All dimensions in millimetres; see note 1)



Pin	Connection
1	Lamp
2	Reference detector output
3	Lamp return
4	Carbon dioxide detector output
5	+ V DC detector input
6	Hydrocarbon detector output
7	Thermistor
8	0 V input (connected internally to sensor body)

Outline Notes

1. Body dimensional tolerances ±0.1 mm. Pin dimensional tolerances as indicated.
2. IR15T and IR25T sensors are designed to press-fit into pcb sockets. 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 IR15T and IR25T Series Gas Sensing Heads are component-approved only and may not be used as stand-alone items in a hazardous area without further protection.
2. The IR15T and IR25T Series Gas Sensing Heads 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 IR15T and IR25T Series Gas Sensing Heads 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 IR15T and IR25T Series Gas Sensing Heads have 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 IR15T and IR25T Series Gas Sensing Heads 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 IR15T and IR25T Series Gas Sensing Heads may encounter. This is to ensure that the IR15T and IR25T Series Gas Sensing Heads are not subjected to conditions that may cause degradation of these materials.

7. The IR15T Series is only certified for use in ambient temperatures between -20 and +55 °C and should not be used outside this range.
8. The IR25T Series is only certified for use in ambient temperatures between -20 and +60 °C and should not be used outside this range.
9. The IR25T Series are galvanically isolating device with infallible separations between the lamp and detector circuits up to 10 V.

The IR25T Series have the following safety description:

Lamp Circuit..... Ui = 7.2 V
Detector Circuit Ui = 10 V
Lamp + Detector Circuits..... Pi = 2.71 W
Detector Circuit Pi = 1.2 W

10. The IR25T Series Gas Sensing Heads are dust-proof (IP5x) but offers no protection against the ingress of water. Where protection in excess of IP50 is required, the apparatus into which the IR Head is installed shall provide the necessary ingress protection.
11. The maximum input power shall not exceed 2.5 W.