SENSORTECH

IR31SC, IR31SE
Single Channel Miniature Infrared Gas Sensors for CO_2 Monitoring in Non-Hazardous Areas

FEATURES

- Configured for carbon dioxide 0 – 3000ppm, 0 – 2% and 0 – 5% vol. concentration
- Single channel IR detector for short-term gas monitoring
- Diffused gas sampling
- Low power
- Fast response
- Special gold plated optical/gas cavity for stable signal levels
- Operational in varying ambients of temperature, pressure and humidity
- Self-compensating for transient temperature changes
- Rugged stainless steel construction
- Resistance to corrosion
- No moving parts
- Reliable operation
- Low maintenance
- IR31SC - Suitable for use under gas flow caps, gas diffusion membranes, particulate filters, flame arrestors or explosion-proof housings
- IR31SE - Incorporates a stainless steel mesh for gas diffusion and particle filtering

DESCRIPTION

The IR31SC and IR31SE use the proven non-dispersive infrared (NDIR) principle to detect and monitor the presence of carbon dioxide. The sensors are built with an IR source and a single-channel detector specifically filtered for carbon dioxide, inside a compact optical/gas cavity. This economical design does not include a reference channel as featured in the IR3xxx series, so it is more suited for monitoring in short-term intermittent applications (up to 24 hours) where instrumentation readings are regularly re-zeroed.

The IR31SC is open-fronted (see photograph) and must be installed in an enclosure under a suitable gas diffusion membrane, e.g. stainless steel sintered disc or mesh. As well as preventing entry of dust and contamination, the membrane also acts as a partial reflector for infrared. This will cause a slight increase in the pyroelectric detector output voltage (see Performance). It is important that the gas diffusion membrane be securely attached and rigid enough not to cause flexing and spurious signal instability during ambient temperature and pressure changes.

The IR31SE option has a mesh diffusion membrane built into the sensor.

(Photograph shows device approximately 3 x actual size)

OPERATION

To operate as NDIR gas sensors, the IR31SC and IR31SE 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 using algorithms in the system software. This is necessary for sensors to meet their full performance specification. A temperature sensor must be included in the electronics and be positioned close to the gas sensor.

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

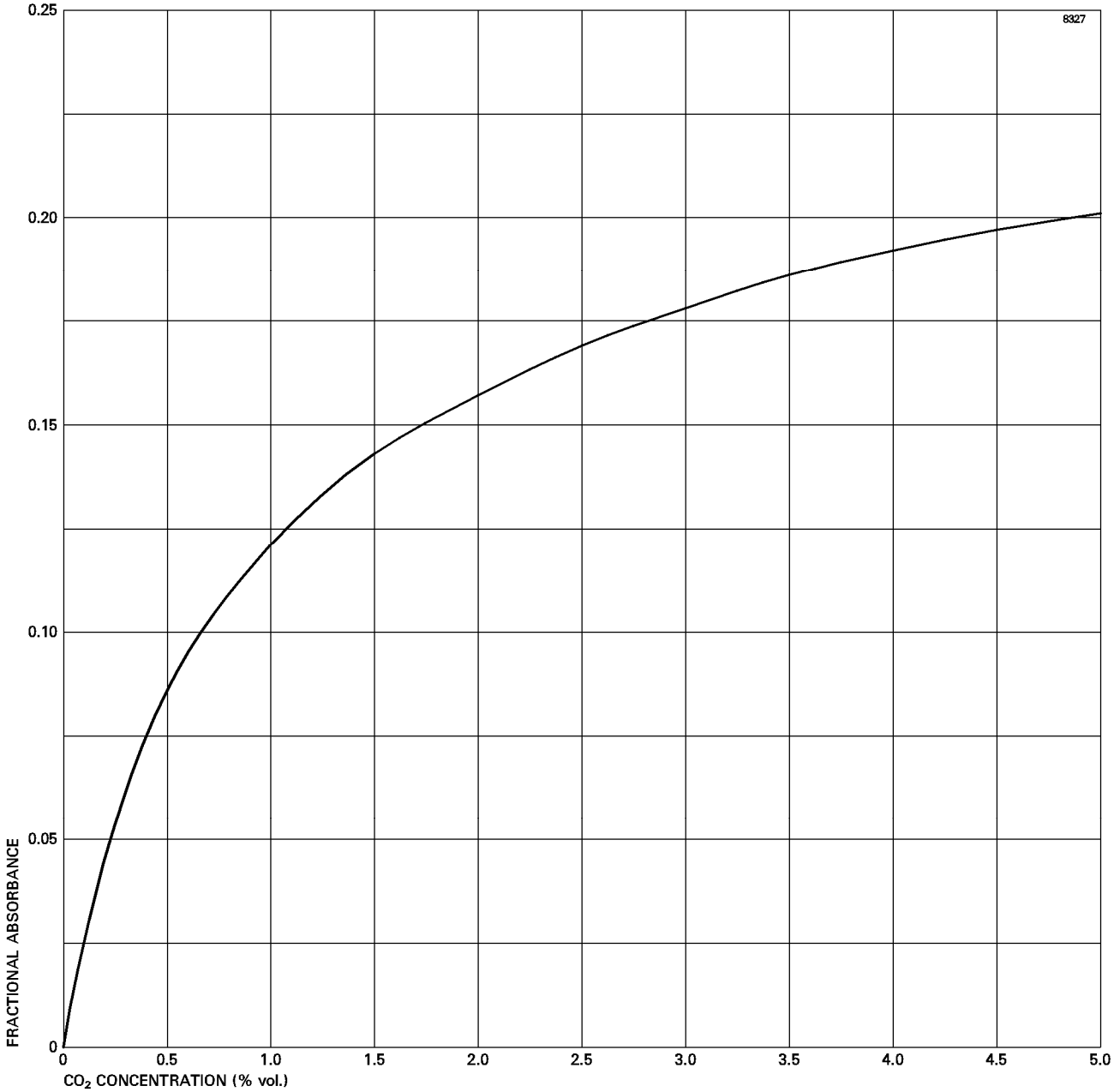
Infrared Sensor Application Note 4: Electronics Design

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

FRACTIONAL ABSORBANCE CURVES

This shows the sensitivity of the sensors versus CO_2 concentration. For further explanation, refer to the Infrared Sensor Application Notes.



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

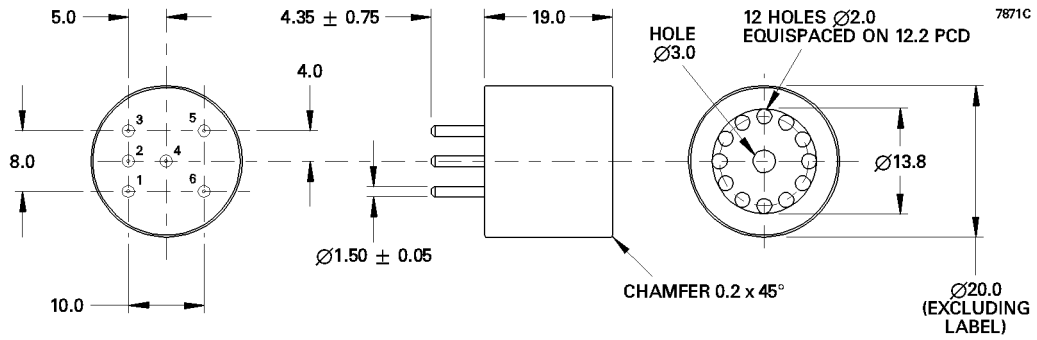
All measurement data taken using:
- SGX Sensortech linearisation and temperature compensation algorithms; see Infrared Sensor Application Notes.
- Lamp modulation 0.4 - 5.0 V, square wave, at 4 Hz and 50% duty cycle.
- Ambient temperature (20 °C) and pressure (1010 hPa).
- All gases diluted in nitrogen.
Note: Any variation from these conditions may affect sensor performance.

Sensor type	**IR31SC**	**IR31SE**
Gas/sensing range	Carbon Dioxide, 0 – 3000 ppm, 0 – 2% vol., 0 – 5.0% vol.	
Maximum response time (T90)	<20 s	
Limits of detector output voltage in nitrogen (x165 pre-amplifier gain)	1.0 to 4.0 V	2.0 to 5.0 V
Sensitivity to gas over three concentration ranges (before linearisation)	See Fractional Absorbance Curve	
Maximum variation of zero from –20 to +55 °C	±10 ppm/°C	
Resolution (dependent on electronics)	100 ppm	
Maximum short-tem zero drift/hour at 20 °C	TBD	
MTBF (lamp dependent only)	>10 years for 5 V operation, >20 years for 3 V operation	

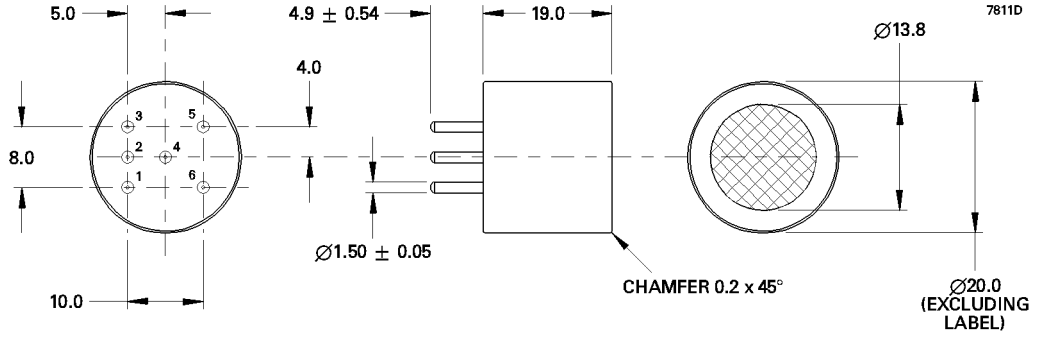
HANDLING PRECAUTIONS

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 irrepairable damage to the pyroelectric detectors.

OUTLINE OF IR31SC (All dimensions in millimetres; see note 1)



OUTLINE OF IR31SE (All dimensions in millimetres; see note 1)



Connection (both outlines)

Pin	Connection
1	+ V DC detector input
2	Lamp
3	Lamp return
4	Not connected
5	Active detector output
6	0 V input (connected internally to sensor body

Outline Notes

1. Body dimensional tolerances ±0.1 mm. Pin dimensional tolerances as indicated.
2. IR31SC and IR31SE 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. SGX Sensortech recommend the Wearns Cambion type 450-1813-01-03-00 single-pole solder mount socket with through hole, or a suitable equivalent.