SGX SENSORTECH

An Amphenol Company

INIR2-ME100

Safety **Industrial Health** **Mining**

Methane sensor
Datasheet

The **INIR2-ME100** is a user-friendly digital Gas Sensor, which is designed to use the latest SGX Sensortech's non-dispersive infrared technology. It has been primarily designed for the purpose of gas leakage detection in both industrial and residential environments. Developed with the latest generation of power efficient CORTEX microcontrollers allows for high flexibility and functionality. It incorporates the latest electronics and offers a linear output proportional to the gas concentration applied. Temperature compensation, good accuracy, low voltage DC power supply and simple implementation into end-user system make this sensor a perfect solution for gas leakage detection.

Quality, Safety, Responsibility

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Functional specifications

Power Supply	Min	Typical	Max
Supply Voltage	3.2 VDC	3.3 VDC	5.25 VDC
Average Current Consumption	30mA	32mA	35mA*
	*Inrush Current can be up to 60mA		
Logic Outputs Level	LOW Voltage Level (V_{OL}): 0.6V Maximum HIGH Voltage Level (V_{OH}): 2.0V Minimum 1.6mA source current maximum		
Logic Inputs Level	LOW Voltage Level (V_{IL}): 0.4V Maximum HIGH Voltage Level (V_{IH}): 2.0V Minimum		

Humidity			
Operating Humidity	0%	50%	99%
Storage Humidity	0%	50%	90%
Condensation (>100% Humidity)	Sensor's Detection Limit, Stability & Linearity would be affected, algorithms are implemented to minimize as the effect.		

Temperature			
Operating Temp.	-40°C to 75°C		
Storage Temp.	-20°C to 55°C		
Temp. Cycle Limits		0.8°C/min	1.3°C/min

Pressure (Compensation will be required, see also note on page 2)			
Operating Pressure	80kPa - 120kPa		
Storage Pressure	80kPa - 120kPa		

Output Signal			
Analogue Output	Resolution: 12-Bit at 0.0-2.5 Volts DC Max		
UART — Signal format	8 data bits, 2 stop bit, no parity		
UART — Baud rate	38400 as default, 115200, 19200, 9600		

Technical specifications			
Body Material	Stainless Steel		
Weight	20 g	23 g	25 g

| Gas Sensor Sockets	
S1	5-Pin , Polygon Topology

Features

- **Triple Range** with linear approximation in each case:
    - 0-5%vol.; 5-40%vol.; 40-100%vol.
- Gas Sensor with **Automatic Switchover** between ranges,
- **High Resolution** up to 10ppm,
- **Detectivity Level** at 100ppm,
- **Analog Output of gas concentration,**
- Serial port communication (**UART**),
- Full **Faults Diagnostics** & **Error Generation**
- Cyclic Redundancy Check (**CRC**)
- **Typical Low power** consumption < 100mW (Average)
- **Factory calibrated** for up to 5% Methane
- **Evaluation Kit** available including **PC software** for easy testing and production calibration functions
- Design for use in Hazardous Areas
- **Certified** for use in Explosive Atmospheres (EX)

Key applications

- Agriculture
- Automation & Control
- Indoor Air Quality
- Industrial Health & Safety
- Waste Management
- Mining
- Industrial Health & Safety

Pin Configuration

(Dimensions in mm)
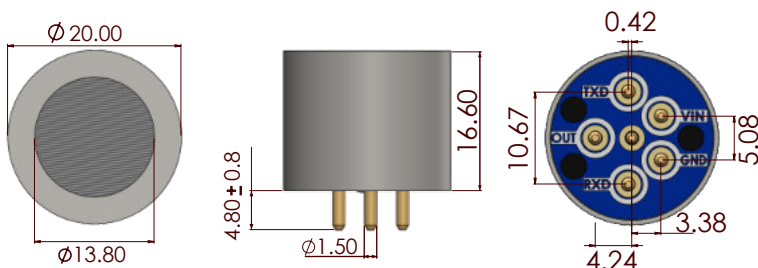
Pin	Name	Description
1	TXD	Data transmitted from the Integrated IR.
2	VIN	3.2 Volts – 5.25 Volts DC input to Integrated IR
3	GND	GND Plane, 0 Volts reference for Integrated IR
4	RXD	Data received by the Integrated IR.
5	OUT	Analog Output. Scalable range, see Application Note 1 Integrated IR Protocol & Calibration for details.
Pad	Pad	Bootloader Pad. Not used by the customer.

Note 1: All Dimensions in mm. All tolerances Linear +/- 0.1mm and Angular 0.5° unless otherwise stated.

Note 2: Pins height 4.8 (+/- 0.8mm)

Note 3: DO NOT SOLDER PINS. Use sockets to push-fit the sensor in the instrument. Please refer to our handling precautions on page 4.

Note 4: SGX Sensortech recommends the Wearns Cambion type 450-1813-01-03-00 single-pole solder mount socket with through hole, or a suitable equivalent.

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Design Considerations & Applications

Warm-Up Time

The Warm-Up Time for the INIR2ia sensor is 45 seconds after each power "ON" or every time when we are changing from Configuration to Normal/Engineering Mode. During this time data are not valid. Please read Fault codes in Application Note 1, "Integrated IR Protocol & Calibration".
The Warm-Up time is not including the period that the sensor needs to reach the ambient temperature. The sensor though is capable of producing readings during the Warm-Up but with a much higher error than specifications.

Calibration

For calibration process please read the appropriate Application Note 1, "Integrated IR Protocol & Calibration".
For optimum performance please use following cylinders:

INIR2-ME100 (Methane)
5.0% CH4 for Span Cal.

Always do Zero Calibration first followed by High Span.

Gas Flow Rate

For valid evaluation and to keep tests consistent it is recommended to use 450 – 500 cc/min. flow rate to minimize any effects due to pressure variations in the INIR2ia.

Digital Interface/Communication

To read-out the digital output from the sensor, a Microcontroller (MCU) or Personal Computer (PC) is required. The software with our Evaluation kit is compatible with Windows Operating System only and at the moment is not possible to read the Analogue output by using the Evaluation Software.

Analogue Output

The Analogue Output is updated once per second. Analogue voltage is directly related with measurement range and current concentration.

Faults Monitoring/Error States

The Error monitoring and Fault generation happens every second transmitted by the UART. Regularly check all the Faults generated from the INIR2ia to ensure errorless communication and rise appropriate alarms depending on the Fault code. For further information on the different Faults and how to translate them, please read the Application Note 1, "Integrated IR Protocol & Calibration".

Condensation, Compensation, Dust & Extreme Conditions

Using the INIR2iaia in extreme environmental conditions may affect its performance. Typically, the module has a high corrosion resistance and temperature compensated linearized output. The INIR2ia implements a Condensation Compensation Algorithm to minimize the effect especially after power "ON", eliminating the problem with false alarm. The Sensor can withstand multiple thermal shocks that don't exceed 1.3°C/min temperature slopes. In applications like mining where dust or other particles are present is recommended to use a dust filter firmly attached to the inlet of the INIR2ia Gas Sensor. The filter tends to increase response times T90, T10 and T50 therefore ensure correct installation and evaluation to comply with regulations in your country. If your device is intended to be used in a hazardous environment, please seek advice from a certification body.

Pressure Compensation

The INIR2ia will need pressure compensation irrelevant if the pressure is within the operating pressure range. Re-Zero the INIR2ia Gas Sensor under operating conditions is recommended; this will minimize the pressure effects, temperature differential effects but will not eliminate the weather effects like extreme wind velocity, rain or lighting.

Three Ranges/Automatic Switchover

The INIR2ia implements an automatic switchover between three ranges, LOW(0.0%vol.–4.0%vol.), MID(4.0%vol.–40%vol.), High(40%vol. & above). When needed individual coefficients are used for each range improving precision, resolution and linearity based on default factory calibration.

Certifications Details

	ATEX	IECEx
	OBAC 22 ATEX 0196U	IECEx OBAC 20.0006U
Standards	EN 60079-0, IEC 60079-1	IEC 60079-0, IEC 60079-1
Product Marking	⟨Ex⟩ 1461 I M2 Ex db I Mb II 2G Ex db IIC Gb	Ex db I Mb Ex db IIC Gb
Special Conditions for Safe Use	**Power Input:** 1.5W Maximum **Ambient temperature range:** -40°C to +75°C **Condition 1:** The thermal resistance of the Gas Sensing Heads do not exceed 25K/W. This shall be taken into account when considering its surface temperature and the temperature classification of the equiment into which it is to be incorporated. Tests indicated that an internal ignition increases the temperature of the mesh by further 4.2K (including a 1.2 safety factor). **Condition 2:** The Gas Sensing Heads shall be protected from impact in service. The Gas Sensing Head shall be mounted in a protective enclosure such that an impact of 7 J in accordance with IEC 60079-0:2007 clause 26.4.2 from any direrction shall not cause the impact head to make contact with the Sensing Head. **Condition 3:** The Gas Sensing Heads are dust-proof (IP5X) but offers no protection against the ingress of water. Where protection in excess of IP50 is required, then the apparatus into which the Gas Sensing Head is installed shall provide the necessary ingress protection (for example by fitting an external semi-permeable membrane).	
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Typical performance characteristics

(All Data are related to a calibrated sensor and conditions: Temperature 20°C, Relative Humidity 10%RH, Pressure 101kPa, 500 to 1000 ml/min Gas Flow, Averaging of 20 values, unless otherwise stated.)
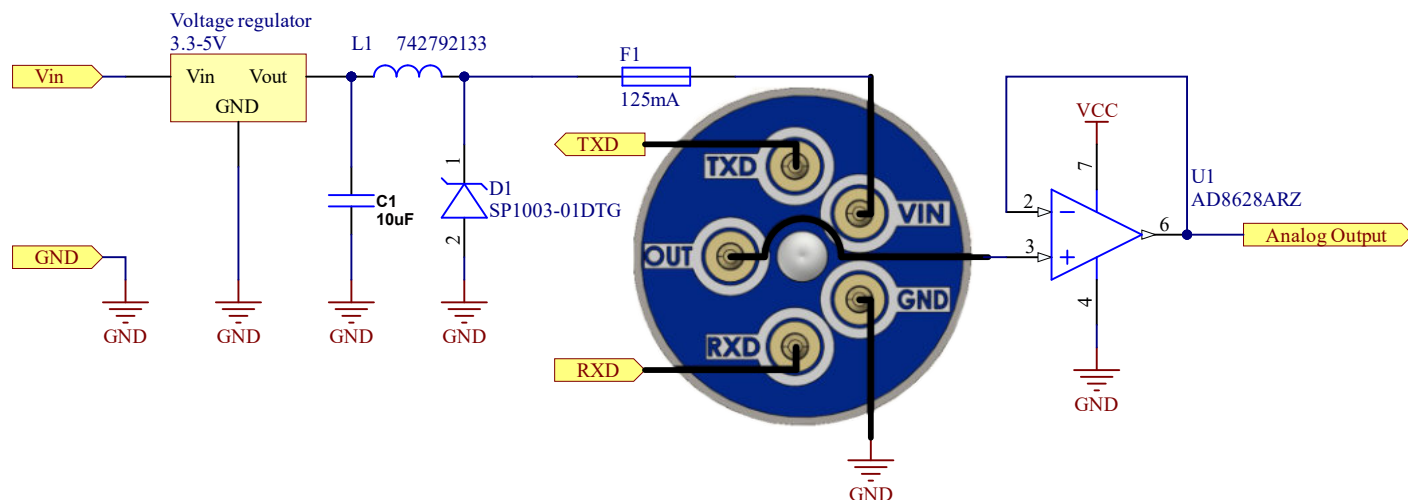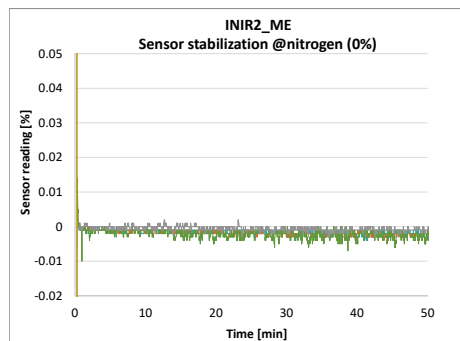

Fig.1 Example schematic for Interfacing Integrated IR (INIR2-ME100)

Test	INIR2-ME100
Stabilisation or Warm-up Time (EN)*¹	0%vol. ±0.1%vol. in 45 seconds
Calibration Curve (EN) or Basic Error (AQ)	0 to 100%vol. ±0.06%vol. or ±6% of Reading whichever is greater
Short Term Stability (EN) of the Displayed Value(AQ)	0%vol. ±0.005%vol. 5%vol. ±0.1%vol. 100%vol. ±1%vol.
Minimum Resolution (AQ)	From 0 to 5% vol. ±0.002%vol. From 5 to 100% vol. ±0.1%vol.
Long Term Stability (EN) or Working Stability (AQ)	0%vol. ±0.01%vol. / Month 5%vol. ±0.1%vol. / Month 100%vol. ±1.5%vol. / Month
Temperature Error (with Compensation) (-40°C to +75°C, relative to 20°C)	0%vol. to 5%vol. ±0.05%vol. 5%vol. to 20%vol. ±0.2%vol. 20%vol. to 100%vol. ±2%vol.
Humidity Error (10%RH to 90%RH, relative to 45%RH)	0%vol. ±0.05%vol. 5%vol. ±0.1%vol. 100%vol. ±1.5%vol.
Response Time*² (without dust filter)	Typ. T_{90} ≈ 19 sec, Average 10 Max T_{90} ≈ 30 sec, Average 20
Power Supply Variations (at ±5% of Nominal Voltage)	The Performance of the INIR2ia is not affected by power supply variations as long as the power supply provides DC Regulated voltage according to specifications.
Power Supply Rejection Ration (PSRR) (at ±5% of Nominal Voltage)	at 1 MHz -> 50 dB, at 100 kHz -> 68 dB, at 10 kHz -> 88 dB
Temperature Cycling or Ramping Drift (Maximum at 1.3°C/min.)	0%vol. ±0.05%vol. 5%vol. ±0.2%vol. 100%vol. ±3%vol.
Thermal Shock Drift	0%vol. ±0.05%vol. (max)
Uncertainty Error of Calibration	±0.15% Error of the Actual Reading

*1. Wait for 45 mins for the Sensor to warm up and reach the Ambient Temperature after power on.

*2. NOTE: All data and tests are relating to EN 60079-29-1 and AQ 6211, European and Chinese standards. For more information about Average please read the Application Note 1, "Integrated IR Protocol & Calibration".

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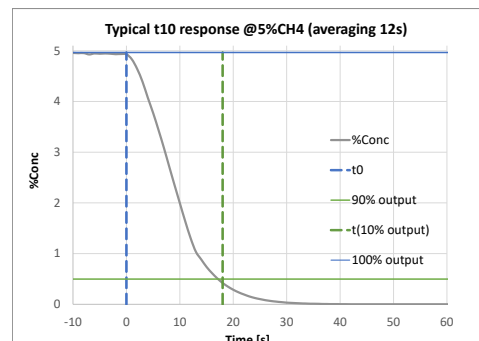Konduktorska 42 St.,
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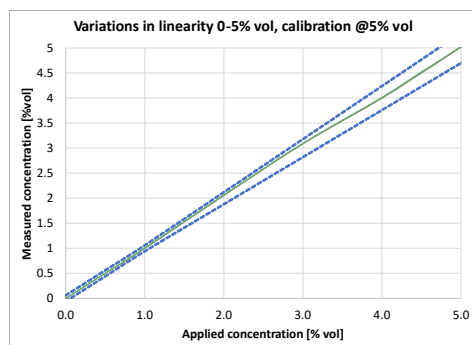
General performance

Warm Up, 20ºC

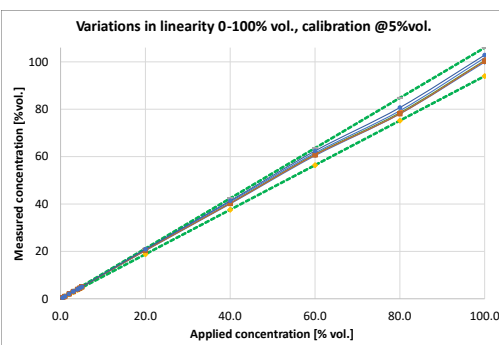## Typical T90 Response Time without Dust Filter
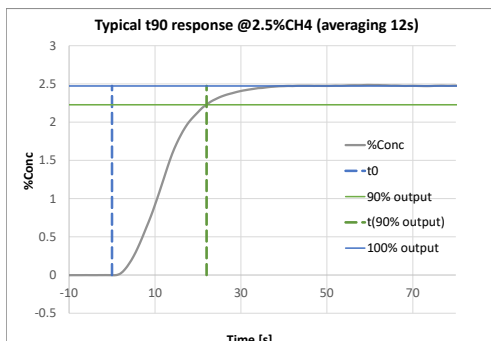
Typical recovery time (from 5% CH4)
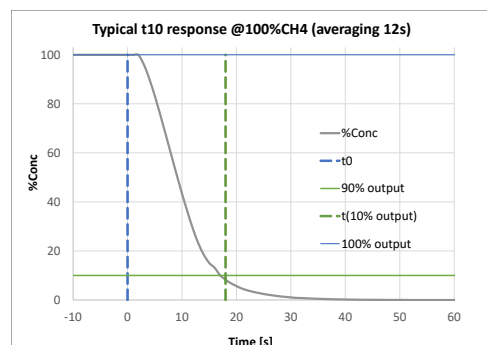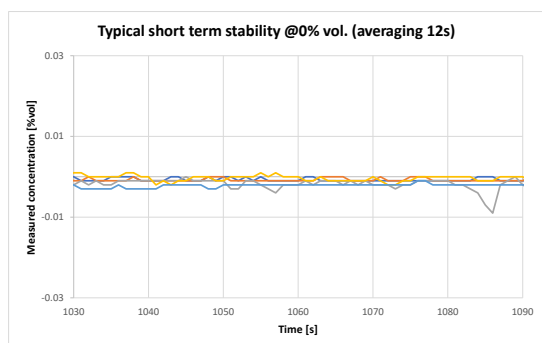

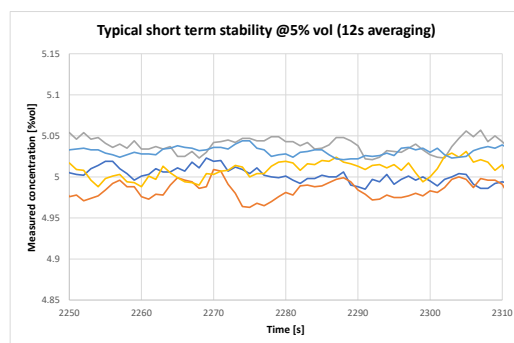## Typical Linearity 0-5% CH4

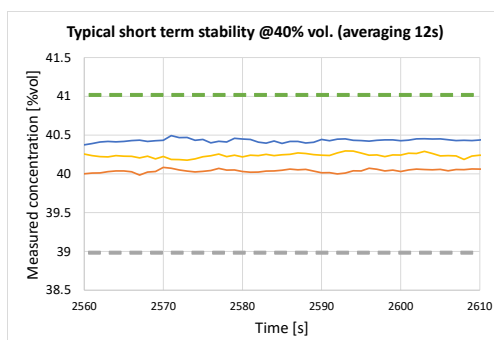## Typical Linearity 0-100% CH4

Typical recovery time (from 100% CH4)

Typical Short Term Precision/Stability @0%CH4

Typical Short Term Precision/Stability @5%CH4

Typical Short Term Precision/Stability @40%CH4

Intended use

This device has been designed to be used as component together with instruments to detect either flammable gas or carbon dioxide of certain concentrations. Please read recommended applications on page 1 for more details.

Handling precautions

A. Do not drop the Integrated IR on the floor as this could cause damage to the pins or internal components.
B. Avoid mechanical force against pins or sockets. Protect from dust and sprayed acidic particles .
C. Do not immerse in water or other fluids.
D. Do not solder the module directly onto a pcb or to wires. Excessive heat could cause damage.

ESD precaution

ESD (Electrostatic Discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary subjected circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

Warning! Plugging or Unplugging the Sensor while in operation may damage the device beyond repair. Always power down the instrument when performing maintenance.

ROHS compliance

Under the EU Directives, compliance testing is necessary for Pb, Cd, Hg, Cr (VI) and Br. The RoHS directive is effective since July 1, 2006. The regulations prohibit the use of these hazardous substances in new products sold after July 2003.

WEEE directive

WEEE (Waste from Electrical and Electronic Equipment) is a directive that controls how electric and electronic equipment is handled and recycled effective since August 13, 2005. INIR2 clustered as component and SGX do not need to have a recycling scheme in place, but manufacturers may need to ensure WEEE compliance for their systems.

ATEX/IECEx certifications

The ATEX directive consists of two EU directives describing what equipment is allowed in an environment with an explosive atmosphere. The Integrated IR is certified for ATEX and IECEx:

I M2 Ex db I Mb
II 2G Ex db IIC Gb
Ta -40°C to +75°C
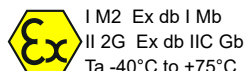
Warranty & Warning

The WARRANTY for all the INIR2 Gas Sensors is 2 years from the purchased date based on use according to this document and the INIR Application Note.

Warranty period or any extended warranties would be confirmed with the order confirmation.

The warranty is invalidated if the sensor is used under conditions other than those specified in this datasheet.

In addition, please pay attention to the following conditions as they will void immediately the WARRANTY:

1. Do not allow water condensing into the sensor or deep the sensor into water.
2. Do not vandalize the sensor.
3. Do not change label or cover it with other stickers.
4. Do not over voltage or overcurrent the sensor; always observe the correct polarity of the input.
5. Do not solder directly onto the pins, pads or the external body of the sensor.
6. Do not drop on the floor or hit it with tools.
7. Do not open, cut or break sensor apart.
8. Do not expose the sensor to high levels of dust.
9. Do not expose the sensor to corrosive gases or operate under corrosive environments.
10. Do not paint or mark the sensor externally.
11. Do not use in acid environment or operate under gases containing acid vapours or particles.
12. Do not custom modify the sensor.
13. Do not clean the sensor with acid.
14. Recalibrating the sensor will only void the calibration certificate not the warranty.

Order Information

	Part Number
Methane sensor	INIR2-ME100
Evaluation Kit	INIR-EK4