Mini IR Sensor

OEM User Datasheet

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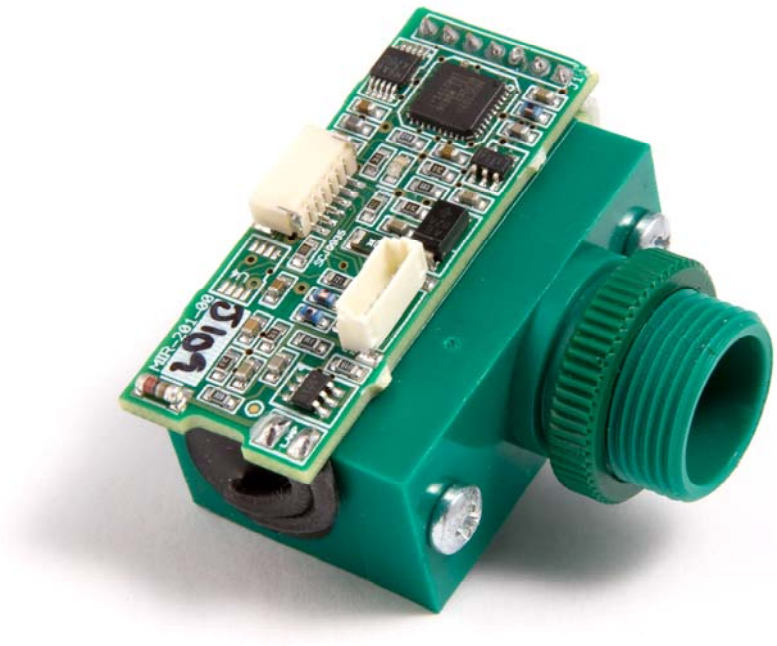
1 Overview

The MIR sensor from Analox is a miniaturised dual channel IR sensor optimised for the measurement of CO_2. The latest micro-controller technology and dual channel IR detectors make excellent performance possible in a small package with low power consumption and long operational life.

All sensors are characterised and tested across their specified temperature range before despatch.

Values and drawings in this datasheet refer to the 5% (or 50mbar) range part. 5000ppm, 1%, 10%, 20%, and 100% range parts are also available on request.



2 Absolute maximum ratings

Parameter	Comments	Min	Typ	Max	Units
Supply voltage		-6.0		6.0	V
TTL terminal voltage	With respect to 0V	-0.3V		5.3V	V
RS485 terminal voltage	With respect to 0V	-9		+14	V
RS485 ESD tolerance			15		kV

3 Specifications

Parameter	Comments	Min	Typ	Max	Units
POWER REQUIREMENTS					
Voltage (for TTL versions)		3.0		5.5	V
Voltage (for RS485 versions)		4.5		5.5	V
Power supply ripple				100	mV
Averaged current	Peaks at 120mA		32	40	mA
SIGNALS					
RS485 transmitted signal levels			5.0		V
RS485 inputs		-9		14	V
RS485 ESD tolerance			±16		kV
TTL transmitted signal level			2.8		V
TTL receiver input		-0.3		5.3	V
ENVIRONMENTAL					
Operational temperature range		-5		55	°C
Storage temperature range		-20		70	°C
Humidity	Non condensing	0		99	%RH
Pressure range[1,3]	Reading is not pressure compensated	500	1000	1500	mbar
IP rating	Gas port only		IP65		
GAS PERFORMANCE[2,3]	5% RANGE				
Zero error	10mbar = 1% = 10,000ppm			500	ppm
Span error	Percent of reading			1	%
Tempco	Deviation from calibration temperature			50	ppm/°C
Response time	To 90% of final value	30			s
Warmup time	After power on	30			s
Gas flow rate		0.05		1	litre/min

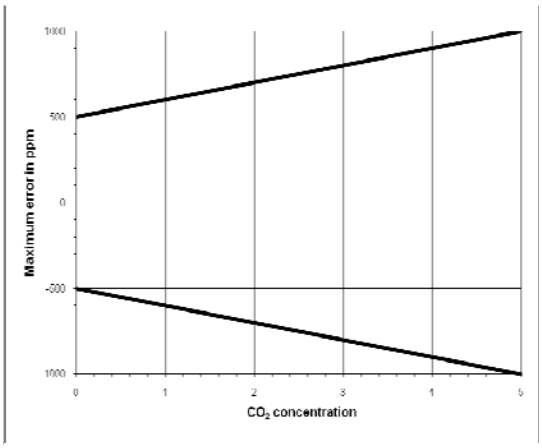
Notes

1) The sensor will not be damaged by use over the pressure range 500 – 1500mbar. See the section on the effect of pressure below.

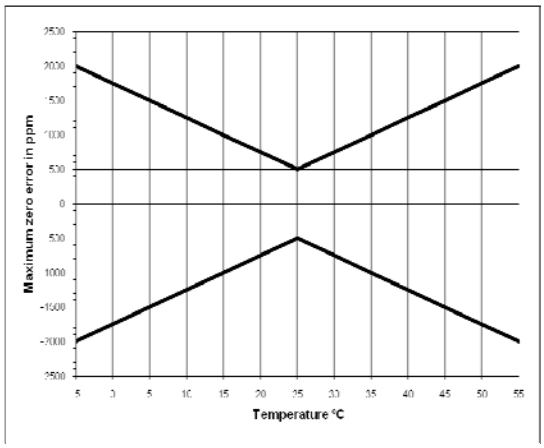
2) The total sensor error is the sum of the zero error, span error and tempco. So for example for a 5% range sensor reading 2% (20,000ppm) at 10°C following calibration at 25°C, the maximum error would be: 500ppm + 200ppm + (50ppm x 15) = 1450ppm (0.145%).

3) All specifications assume the ambient pressure is 1000mbar. The sensor actually measures partial pressure of CO_2, not percentage concentration. Please see section 6.8.

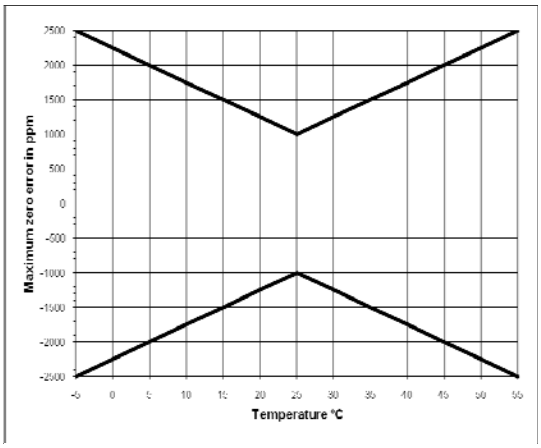
3.1 Specification graphs, 5% range



CO_2 error at constant temperature



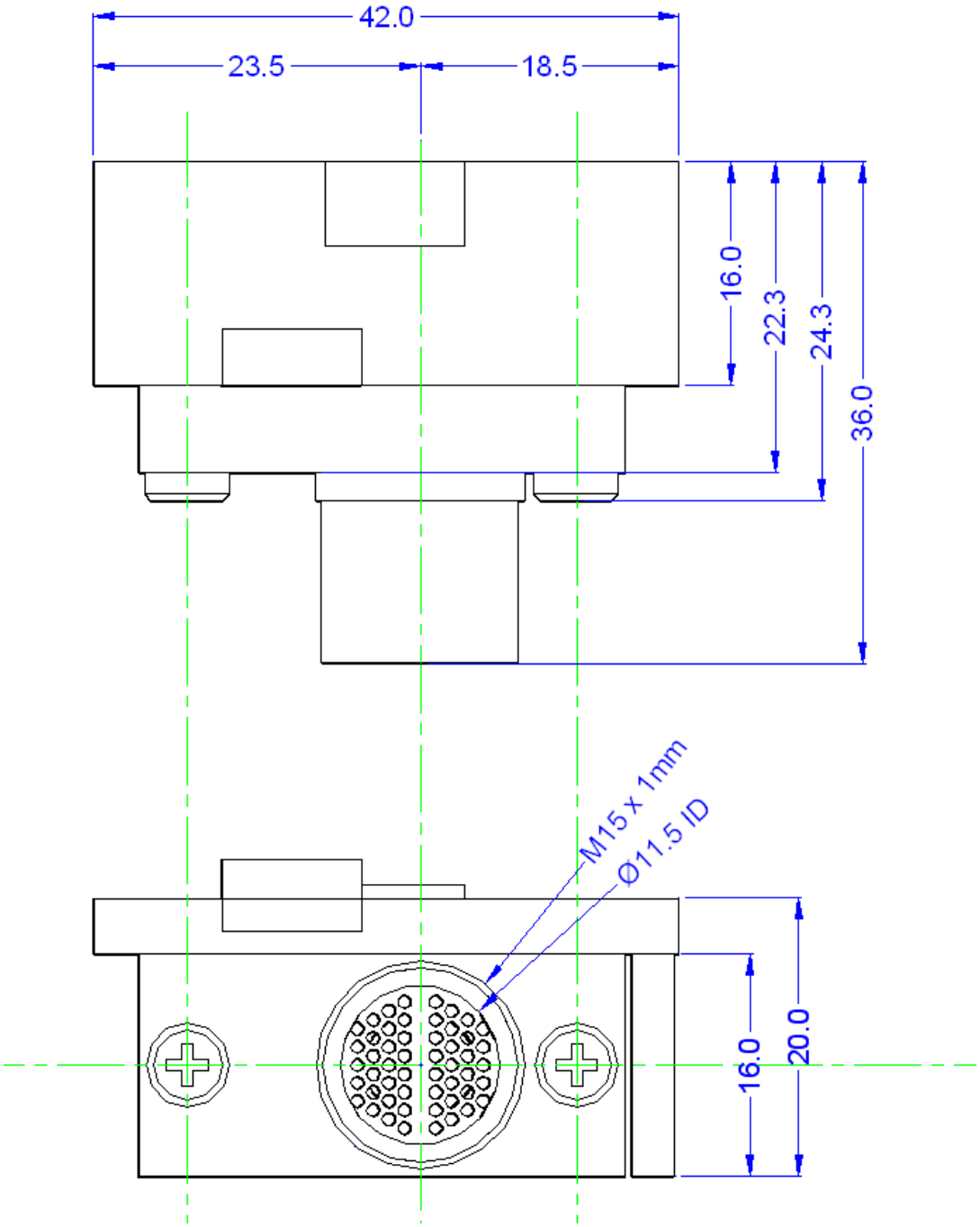
Zero error across temperature



CO_2 error across temperature

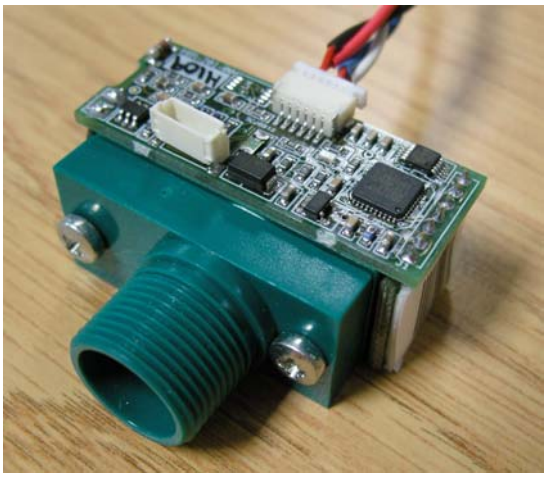
4 Dimensions

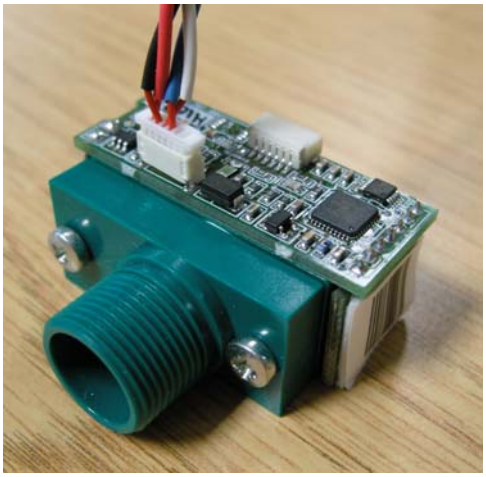
All dimensions are in millimetres



5 Electrical connections

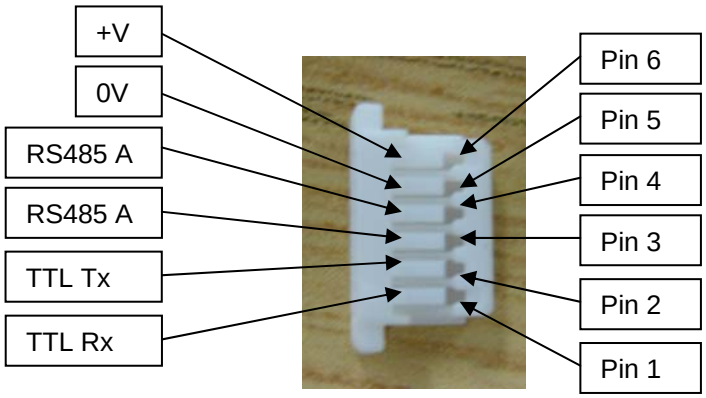
Two identical connectors are provided on the sensor to give maximum flexibility in mounting and packaging the sensor.





The connector is a 6 way Harwin 1mm pitch crimp receptacle. Pre-crimped leads are available in two lengths and two gauges. These items are also available from Analox as assemblies, see the accessories section.

The connector contains pins for power, TTL comms and RS485 comms. These are as follows:



5.1 Communication parameters

See the specifications section for the signal levels and tolerance to over-voltage.

The UART configuration should be 9600 baud with 1 start bit, 8 data bits, no parity and 2 stop bits (2 stop bits gives better tolerance of slightly mis-matched clock rates).

See Analox application note AN-001 for a full description of the OEM comms protocol.

5.2 Connector part numbers

Relevant part numbers for the parts are:

Part	Harwin PN	Farnell PN	RS PN	Mouser PN
Mating connector	M40-1100600	872-8895	681-3079	855-M40-1100600
150mm 28 AWG wire	M40-9000099	872-9166	681-3127	855-M40-9000099
150mm 32 AWG wire	M40-9010099	872-9174	681-3133	855-M40-9010099
300mm 28 AWG wire	M40-9020099	872-9182	681-3136	855-M40-9020099
300mm 32 AWG wire	M40-9030099	872-9190	681-3130	855-M40-9030099

6 Application information

6.1 Powering the sensor

The sensor should be powered from a clean supply conforming to the specifications detailed above. Ripple and noise of greater than 100mV can impair the sensor performance. Within a couple of seconds of power being applied you should see the yellow LED start flashing.

6.2 Status LED

The flash pattern of the status LED gives information about the sensor's status.

- Short single flashes are normal for the first 30s of operation. They indicate that the sensor is in warm-up.
- Long single flashes indicate that the sensor is warmed up and working correctly.
- Double flashes indicate that the sensor has detected an internal fault.
- Rapid flashing indicates that the sensor software has hit a fatal error.

6.3 Fault finding

If the sensor indicates a fault (double flashes of the status LED) it could be for several reasons. Ideally the serial communication should be used to extract further information about the nature of the fault, see the application note AN-001 detailing the command for this and the meanings of the various flags.

Otherwise please check that the power supply voltage is in specification, the temperature is not outside the range -5°C to 55°C and the sensor is not being exposed to a gas concentration of more than its specified range. If the fault is indicated following a calibration, then the calibration has been rejected, please repeat the calibration but check that the gas value is correct and that the other parameters of the calibration are correct.

6.4 Recommended mounting

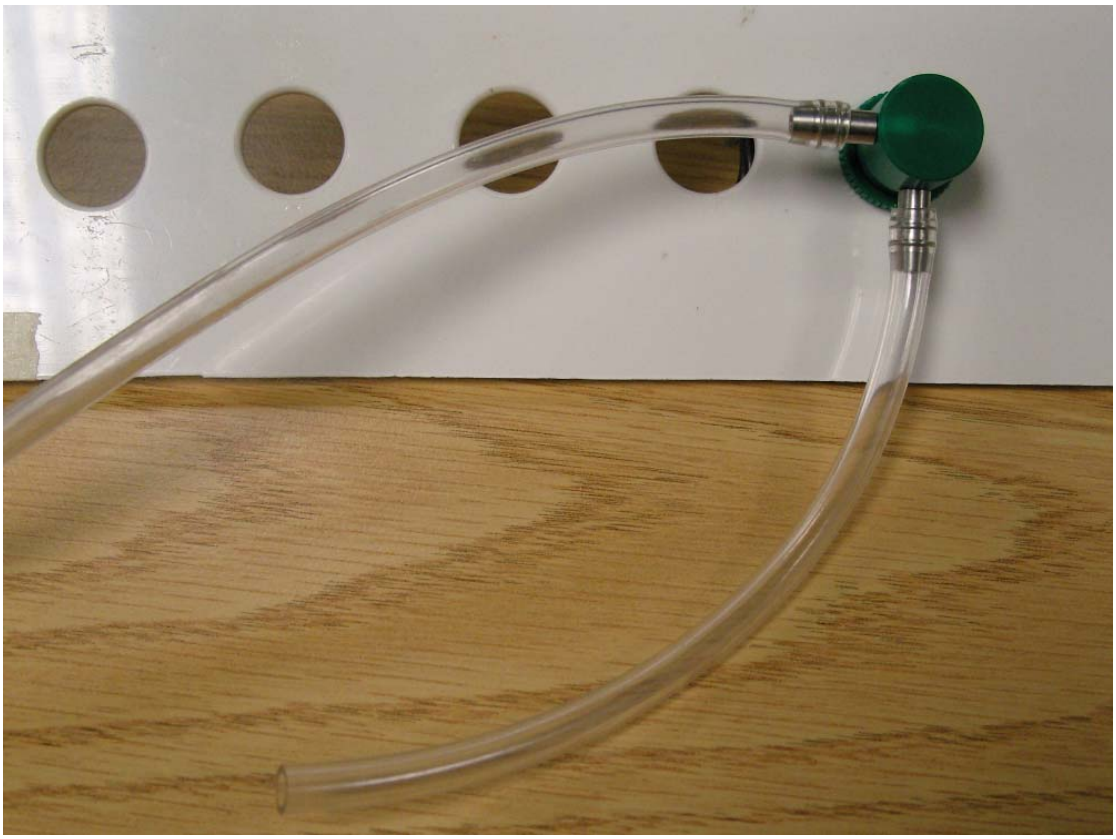
The sensor may be mounted by fitting through a Ø15 - Ø16mm hole. A Ø15 x 1.5mm O ring behind the panel will provide sealing to IP65.

6.5 Recommended gas configuration

It is recommended that the sample gas stream be discharged to atmosphere after it has passed the sensor. This avoids any possibility of the sensor being pressurised, which will cause elevated readings. The sample gas must leave the sensor through a tube at least 150mm long to avoid an possibility of the ambient air diffusing back up the exhaust

(remember that the individual gas molecules are moving at the speed of sound so they can easily travel upstream). To avoid pressurisation of the sensor, the exhaust tube should be no more than 1m long.

Commonly the sensor is used in “diffusion mode” to monitor the atmosphere (eg. a chamber) in which it is immersed. This avoids the need for any pipework, except for calibration.



6.6 Calibration

Calibration is done through commands sent to the serial port. These are documented in Analox application note AN-001. Future developments will include a PC application to calibrate the sensor.

6.7 EMC

As a component part, the MIR sensor is not CE marked. We use it in products that have passed 10V/m immunity testing, but careful design is necessary. The power supply to the MIR should be quiet and should be through short or screened cables.

Radiated EMC emissions of the unshielded sensor are well below the limits of the light industrial standard.

6.8 Effect of pressure

The sensor actually measures partial pressure, not percentage concentration. As the ambient pressure varies there is simple relationship between partial pressure and concentration:

$$Partial\ \ pressure = \frac{Gas\ concentration\ in\ \%}{100} \times Atmospheric\ \ pressure$$

or:

$$Gas\ concentration\ in\ \% = \frac{Partial\ \ pressure}{Atmospheric\ \ pressure} \times 100$$

So for example, a concentration of 1% at a pressure of 1015 mbar means that the partial pressure of CO_2 is 10.15 mbar. Likewise a partial pressure of 2.4 mbar in a room where the atmospheric pressure is 960 mbar means that the concentration is 0.25%.

However there is a secondary effect at work, whereby increased pressure causes the sensor to *perceive* a greater CO_2 concentration. Our standard sensors do not implement compensation for this effect, please contact Analox if you need sensors for use in a pressurised environment.

For accurate results the pressure within the sensor must be the same as the surrounding ambient pressure. This is assured by using a flow rate within the specified range and ensuring that the exhaust is not obstructed.

7 Accessories

7.1 OEM RS485 6” cable

Analox part number MIR-641

7.2 OEM RS485 12” cable

Analox part number MIR-642

7.3 OEM TTL 12” cable

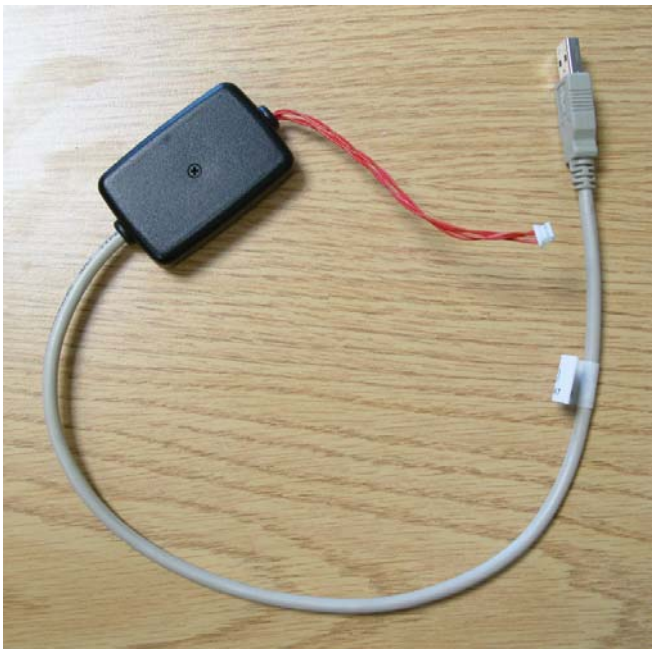
Analox part number MIR-643

7.4 USB RS485 cable

Analox part number MIR-662

7.5 USB TTL cable

Analox part number ITC-671



7.6 Flow adapter

Analox part number 8000-0069A

This is intended for use with tube of 3-4mm internal diameter. Gas can be piped into one port and will then circulate in close proximity to the sensor's hydrophobic membrane before flowing out of the other. Which port is used as inlet and which as outlet is not important.