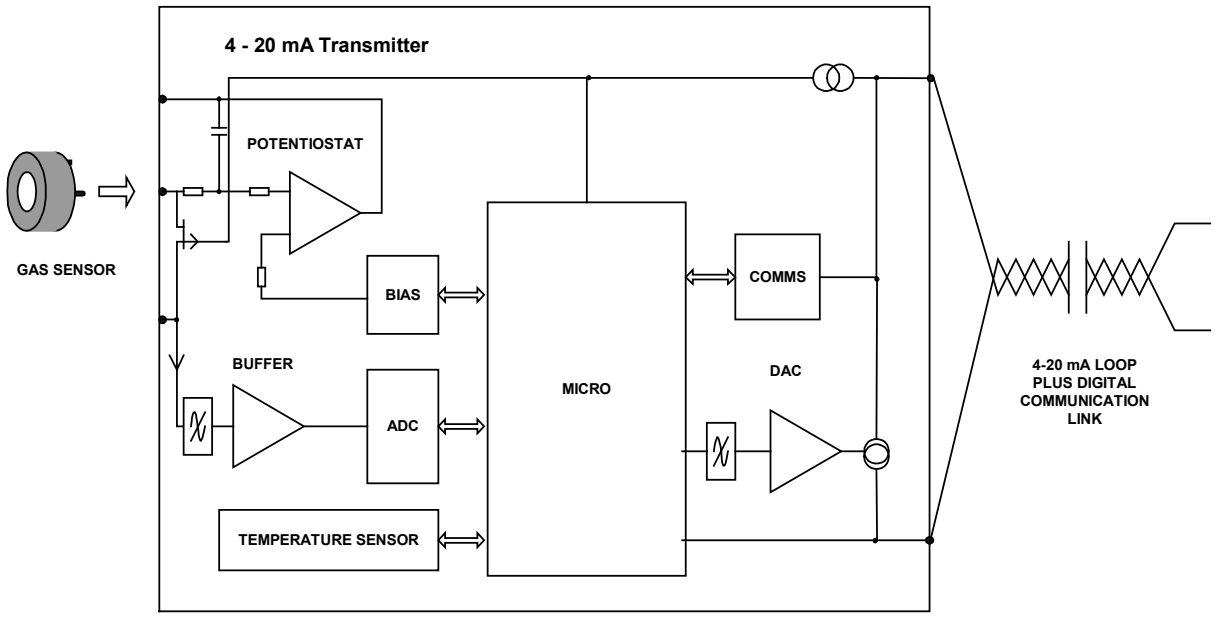
1 INTRODUCTION

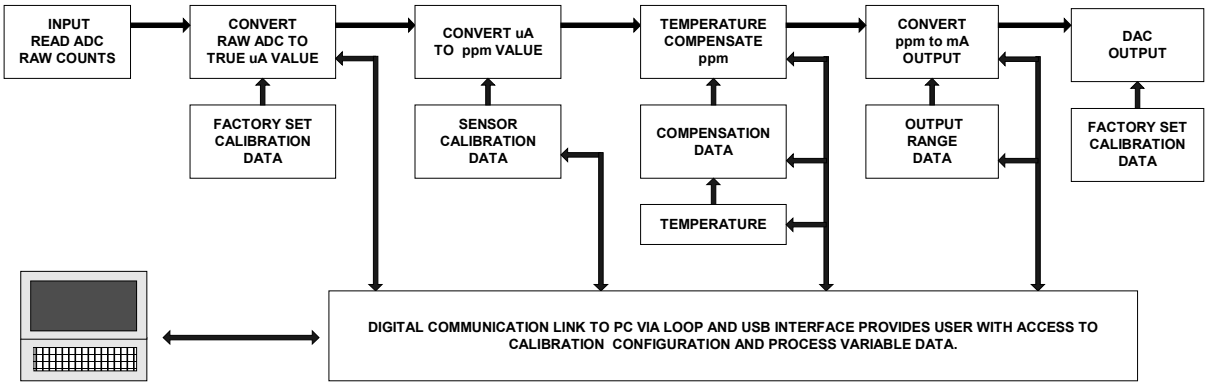
Figure 1 - Block Diagram



The Transmitter PCB includes circuitry for a 3-electrode toxic sensor to convert the µA output signal from the sensor to a 2-wire 4-20mA signal. The Circuitry is based around a low power Micro-controller, which provides digital communication to a PC via the 4-20 mA loop. This communication link allows the user to monitor process variables, perform active calibration of the sensor, and configure the transmitter parameters.

A special interface is required for communication; the interface connects directly into the USB port of a PC. During configuration, the transmitter is powered direct from the interface.

Figure 2 - Function of Micro-controller



The transmitter board includes four mounting pillars and hardware that may be used if required

Alphasense 4-20 mA transmitters offer convenience and easy maintenance for toxic sensors:

- Transmitters are shipped pre-calibrated for immediate use.
- Small circuit board size allows smaller sensor housing.
- Conformally coated circuit board gives environmental protection of circuit.
- Low power circuitry with excellent performance means no degradation of sensor performance due to electronics.
- Close PCB tracking of sensor transducer reduces noise pick-up and RFI/EMI susceptibility.
- Temperature compensation is provided together with switched bias.
- Configurable range allows user to select any range within the sensors operating range.

Besides periodic sensor re-calibration, the transmitter electronics require no maintenance throughout the lifetime of the sensor.

The sensor can be replaced at the end of the sensor working life. Re-calibration is required when the sensor is changed.

Please read these instructions to ensure correct installation, use and calibration of your gas sensor/ transmitter.

2 Transmitter Specification @ 20 °C

Input

Type:	3-wire gas sensor Series A or Series B (4 or 7 Series)
Range:	-50 uA to +100 uA
Minimum Span:	± 3 uA
Sample Rate:	500 ms per sample
Thermal Drift:	0.05 uA / °C
Protection:	Power off shorting FET
Resolution:	4 nA resolution.
Bias:	Selectable off, 200 mV, +300 mV (± 10 mV tolerance)
Temperature Compensation:	On-board temperature sensor range –30 °C to +60 °C ± 0.5 °C used for selectable Software correction @ zero and span.
Connection:	Plug in sockets.

Output

Output:	(4 to 20) mA 2-wire loop powered
Maximum Output Range:	(3.8 to 21) mA
Operating Voltage:	(10 to 30) VDC
Accuracy:	± 5 uA
Sensor out of range:	Up Scale > 21 mA
Supply sensitivity:	< 0.03% (10 to 30) VDC
Loop ripple effect:	± 2 uA measure @1 volt RMS 50 Hz supply ripple
Thermal drift:	± 0.2 uA / °C
Loop resistance:	700R @ 24 VDC
Resolution:	0.75 uA
Protection:	Reverse connection protected and over voltage
Connection:	2-Pin MOLEX plug (Ref. 22-27-2021)

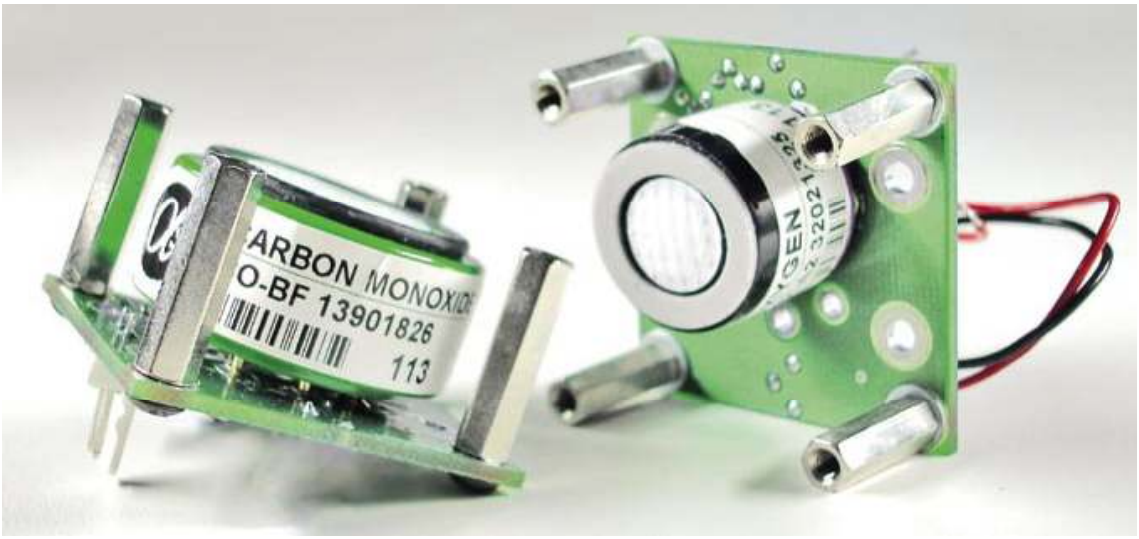
General

Warm up Time:	2-Minutes to full accuracy.

Environment

Ambient Temperature:	-30 °C to +60 °C
Ambient Storage:	-40 °C to +70 °C
Ambient Humidity:	0% to 95% Continuous - (Non Condensing)
Coating:	Conformally spray coated

CE approval : **BS EN 61326 (Industrial)**



3 Range / Options

Sensor and transmitter boards are shipped from Alphasense pre-calibrated. Standard available ranges are listed below:

Table 1 Transmitter ranges

Sensor	Full-Scale Gas Concentration (ppm)	PCB Gain
CO-AF	1000	Low
CO-AF	100	High
H2S-AE	1000	Low
H2S-A1	200	Low
H2S-A1	25	High
SO2-AF	100	Low
SO2-AF	20	High
NO2-A1	50	High
NO2-A1	10	High
CL2-A1	10	High
CO-BF	1000	Low
CO-BF	100	High
H2S-BE	1000	Low
H2S-B1	200	Low
H2S-B1	25	High
SO2-BF	100	Low
SO2-BF	20	High
NO2-B1	50	High
NO2-B1	10	High
CL2-B1	10	High

Although the sensor and transmitter are pre-calibrated and the ranges are preset, it is possible to change range by using the communication link to re - configuring the output range.

Both Low (4 ma) and High (20mA) range can be set anywhere within the sensors working range, this makes it possible for example to have a (20 to 4) mA output for say a (0 to 100) ppm input.

Different sensors can be fitted to a transmitter board, the communications link allows the operator to select the correct sensor type and then perform active sensor calibration.

4 Set-up

4.1 Mechanical Mounting

Transmitters should be mounted to your housing using the pillars provided.

These pillars should first be attached to the PCB using the supplied screws and washers.

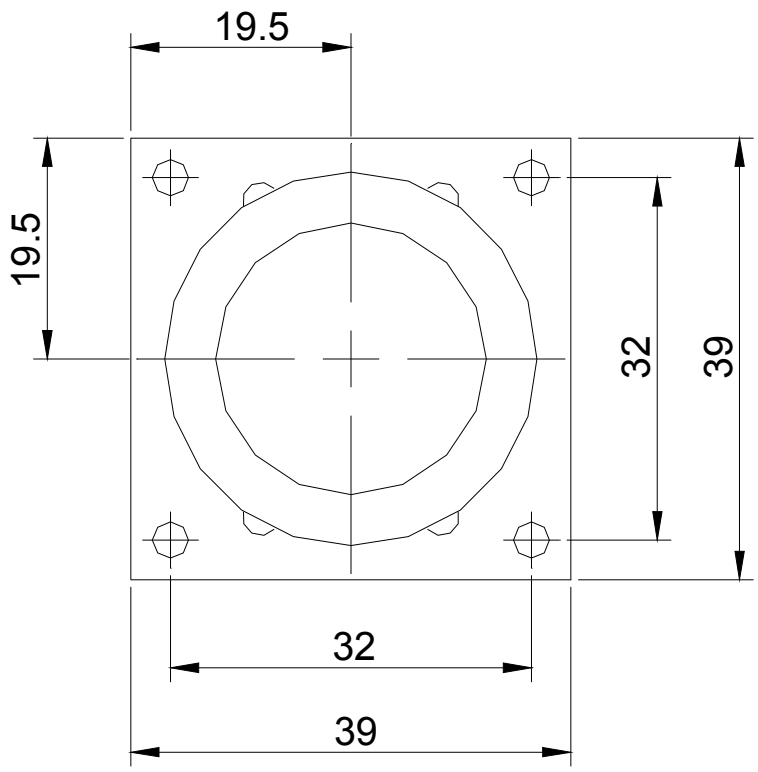
(**Important note:** Ensure that a washer is fitted on **BOTH** sides of the PCB: see Figure 3).

Two sets of mounting holes are provided so that the assembly can be fixed to either the housing top, (using the locating holes in the corner of the PCB), or to the base of the housing, (using either set of locating holes.
Note: Long pillars will be required for this configuration, Alphasense Part No: 034-0005-00).

Figure 3 below shows mounting hole locations (dimensions are in mm).

Figure 3 diagrams the locating holes; normally the outer holes are used for mounting, while the inner holes are in the same location as the earlier issue of this PCB, allowing backward compatibility with the earlier PCB design.

Figure 3 Dimensions



The pillars are tapped to accept M3 screws. We recommend a screw length of at least 8mm to ensure rigid fixing. It is good practice to hold the pillar when screwing into the pillars to stop the pillar from rotating on the PCB. It may be easier to remove the sensor whilst screwing the circuit board pillars to your housing. If you remove the pillars, ensure that if mounting to the lid of your housing, that you include the washer between the pillar and PCB to ensure correct height of the pillar assembly. See Figures 4 and 6.

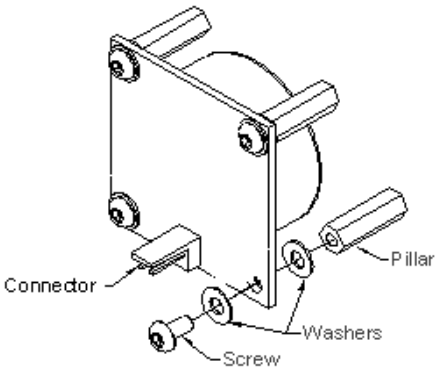


Figure 4. Mounting pillar configuration for attaching to the lid of an enclosure.

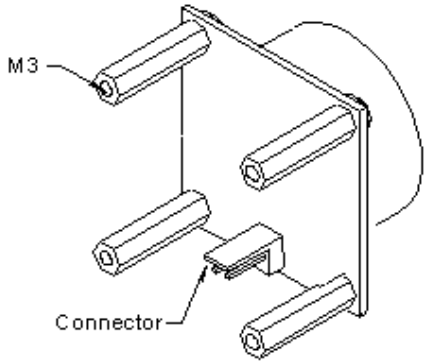


Figure 5. Mounting pillar configuration for attaching to the base of an enclosure.
(Long pillars required Part No: 034-0005-00)

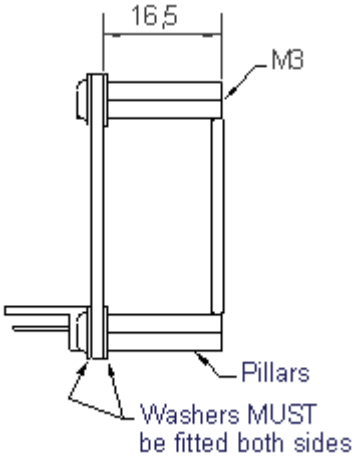


Figure 6. Side view of mounting to lid of an enclosure.

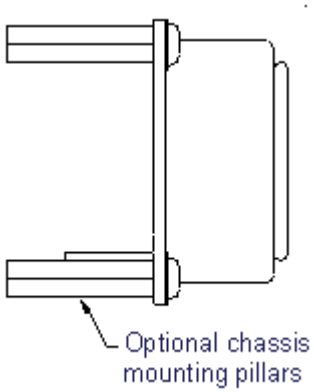


Figure 7. Side view of mounting to the base of an enclosure.

Allow 20 minutes after plugging the sensor back into the board for the output to stabilise.

Ensure that the sensor is sealed securely to the top face of your housing

The O-ring supplied with your transmitter sensor should be used to ensure an airtight seal, avoiding any access of toxic or corrosive gases to the circuit board and the housing interior.

4.2 Connection and Wiring

Power to the transmitter board is via a Molex 2-pin mini plug (Type: 22-27-2021: supplied with the transmitter). Connect using a screened, 2-core cable to the wires (black is ground, red is positive) by either soldering or using a screw terminal block. These leads can be shortened or extended as needed.

4.3 Power Supply

Your power supply must be between 10 and 30 VDC with less than 1 V RMS ripple.

Warning:
Do not supply Mains AC power to this unit: this will destroy the transmitter and void the warranty.

The transmitter is protected against incorrect polarity and over voltage, but will not function if you have reversed the power supply wires by connecting the Molex plug incorrectly to the transmitter board socket.

When selecting the power supply voltage, you must not exceed the maximum total loop resistance, which includes your measuring resistor used to change the 4-20 mA current into a measured voltage.

The transmitter requires a minimum of 10 volts to operate; therefore, the maximum potential drop allowed across your sensing resistor and cable is:

(Power supply voltage) - (10 V)

Assuming full-scale deflection at 20 mA, use Ohm's law to calculate the maximum loop (cable plus sensing resistor) allowed resistance.

To maintain CE requirements it is recommended that either twisted pair or screened cable are used for cable lengths greater than 30 metres. It is important to ensure the (4 TO 20) mA loop is grounded at one point, ideally at the power source.

5 Correct Usage and Maintenance

Ensure that there is a good gas seal between the sensor and the housing; also, if the sample is pumped, then ensure that the flow rate is sufficient. Alternatively, the sample gas can be allowed to diffuse to the front face of the sensor. The table below shows the recommended gas flow rate in **s**tandard **c**ubic **c**entimetres per **m**inute (**sccm**). Higher flow rates may be used, but beware that pulsing flow and higher-pressure drops may lead to erratic readings.

Table 2 Pumped gas recommended flow rates

Gas	Flow Rate (sccm)
CO	300 to 500
H_2S	400 to 700
SO_2	400 to 700
Cl_2, NO_2	400 to 700

The only required maintenance is changing of the O-ring if it has been exposed to extreme environments for long periods (this O-ring should last the lifetime of the sensor in normal conditions). In addition, if the top dust / oil filter has become badly contaminated, then contact Alphasense for replacement dust filter (Section 5).

6 Reordering Part Numbers

Replacement sensor O-rings and dust/oil filters can be ordered by quoting the part numbers below.

Table 3 Replacement Part Numbering

Part Number	Description
039-0002-00	Replacement O-ring
024-0011-00	Self-adhesive dust/oil filter
010-0178-00	Cable assembly (150 mm)
034-0005-00	20 mm long Pillar

7 Calibration

The 4-20 mA transmitter is shipped pre-calibrated to the range shown in Table 1. Periodic re-calibration is required for all gas sensors, especially in safety-critical applications.

To Calibrate:

- Connect communications link to PC USB port and run configuration software. Connect the **E**quipment **U**nder **T**est (**EUT**) to the communications link. Up Load all present sensor parameters.
- Ensure that a high quality zero gas source is available (e.g. cylinder of zero air or cleaned and scrubbed compressed air) and a bottle of calibration gas with validated accuracy (see Table 4 below).
- Apply zero gas for 10 minutes at the flow rate shown in Table 2. Read the sensor output current on the screen, ensure it is in the correct range. Click the Zero button in the sensor calibration frame. Follow instruction to enter gas sample in ppm. (Normally 0 ppm).
- Then press the CAL button. The transmitter is now calibrated against the sensor @ zero.
- Apply test gas for ten minutes; the recommended test gas concentration for calibration is shown below in Table 4. Read the sensor output current on the screen, ensure it is in the correct range. Click the Span button in the sensor calibration frame. Follow instruction to enter gas sample in ppm. Then press the CAL button. The transmitter is now calibrated against the sensor @ Span.
- Although it should not be necessary, it is good practice to recheck the zero after setting the span Check the gas ppm reading is within ±?? ppm in clean air ("zero gas"). Allow at least 10 minutes for full recovery to zero after the calibration gas has been removed.
- At this stage the transmitter is correctly re- calibrated. If required the output range can be re–configured by changing the output low and high range values (ppm).

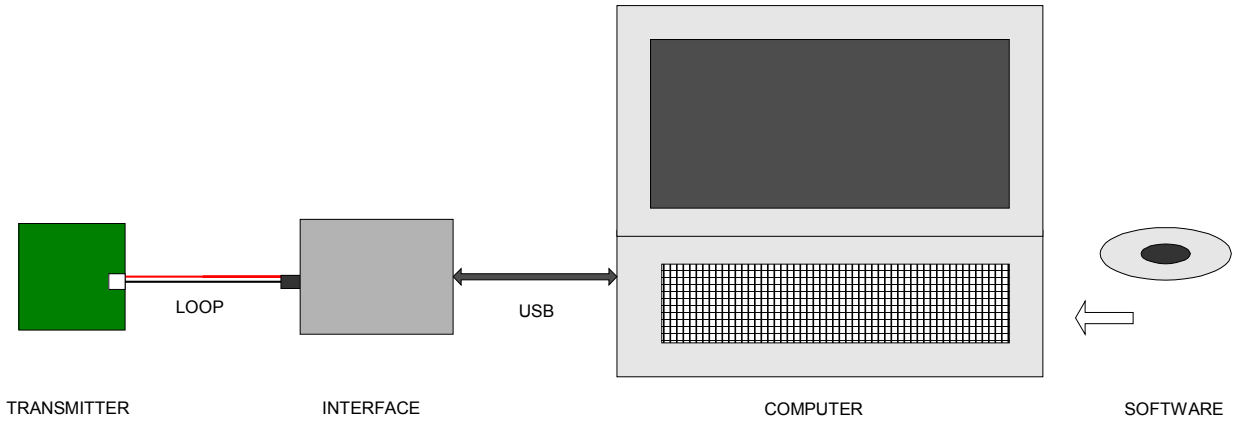
Table 4 4-20 mA Transmitter full span

Sensor	Full-Scale (ppm)	Calibration point (ppm)	Output at Calibration point (mA)
CO-AF	1000	400	10.40
CO-AF	100	100	20.00
H2S-AE	1000	400	10.40
H2S-A1	200	50	8.00
H2S-A1	25	20	16.80
SO2-AF	100	50	12.00
SO2-AF	20	10	12.00
NO2-A1	50	25	12.00
NO2-A1	10	5	12.00
CL2-A1	10	5	12.00
CO-BF	1000	400	10.40
CO-BF	100	100	20.00
H2S-BE	1000	400	10.40
H2S-B1	200	50	8.00
H2S-B1	25	20	16.80
SO2-BF	100	50	12.00
SO2-BF	20	10	12.00
NO2-B1	50	25	12.00
NO2-B1	10	5	12.00
CL2-B1	10	5	12.00

8 Communication Link

The communications link uses interface hardware connected to the USB port of a PC. The USB port is used to Provide power to the transmitter during configuration and calibration. Two way Digital communication is performed down the (4 to 20) mA loop, using current pulses. The communication rate is 1200 baud. To use the link connect interface/ transmitter to a PC as shown in Figure 8, then run the configuration software and follow instructions.

Figure 8 Communications Method



The communication link provides the user with access to the following list of process variables, configuration and calibration settings.

PROCESS VARIABLE		
Type	**Units**	**Description**
Sensor Current	**uA**	**True sensor current**
Raw Sensor output	**ppm**	**Value without temperature compensation**
Sensor output	**ppm**	**Temperature compensated value**
Ambient temperature	**°C**	**Sensor temperature used for compensation**
Output Current	**mA**	**The output current being transmitted**
CONFIGURATION		
Type	**Units**	**Description**
Sensor Type	**-**	**Sensor Part Number**
Bias	**mV**	**Select Bias " off , 200mV, 300mV"**
Ta Compensation	**-**	**Temperature compensation " off, on"**
Low Range	**ppm**	**Sensor ppm @ 4mA output**
High range	**ppm**	**Sensor ppm @ 20 mA output**
CALIBRATION		
Sensor Calibration zero	**ppm**	**Gas Sample (Normally 0ppm)**
	uA	**Sensor current @ zero gas sample**
Sensor Span Calibration	**ppm**	**Gas sample @ span**
	uA	**Sensor current @ span gas sample**

Additional data available with the communications link but intended for factory use only: -

- Temperature Compensation characteristics
- Current input calibration (Factory set)
- Current output calibration (Factory set).

9 Warranty

Transmitters are warranted for two years. Sensors are warranted separately. If you have any difficulties or problems then contact:

Customer Support

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