

Room CO Transmitter - MODBUS RTU - Optional LCD

Product Overview

The AX-GS-CM-M-S is an optimal solution for detecting carbon monoxide presence for indoor environment of residential & commercial buildings. It employs an electrochemical sensor to monitor carbon monoxide (CO) concentration levels ranging from 0 to 300 parts per million (ppm). The device transmits data over the RS-485 network using the Modbus RTU protocol. By continuously monitoring CO levels, the ventilation system can be adjusted accordingly to maintain air quality within safe limits.



Products Features

- Monitors CO levels over a range of 0 to 300ppm
- Electrochemical sensing element
- Isolated RS-485 Output
- Rising Clamp Terminals
- Easy maintenance and 3 year exchange sensor option
- Sensor is UL recognised component UL2034, UL2075, E240671
- 3 Year Warranty

Product Specifications

Sensor Type:	CO : Electrochemical 3-electrode Temperature: 10K3A1 NTC Thermistor
Power Supply:	24Vac $\pm 10\%$, 100mA maximum or 24Vdc $\pm 10\%$, 60mA maximum
Output:	Isolated RS-485 Modbus RTU (Maximum 32 devices in a network without repeater) Supported baud rates: 9600,19200,38400,57600,115200bps. More info in installation.
Output Accuracy:	CO : $\pm 5\text{ppm}$ or $\pm 5\%$ of reading (whichever is greater) between 0-50°C Temperature : $\pm 0.3^\circ\text{C}$ Typical
Output Stability:	<5% signal drift per year
Display (option):	4 digit 9mm high character LCD
Relay (option):	Normally open contacts. Contact rating: 8A resistive, 250Vac
Sounder (option):	85dB @ 10cm .Alarm levels set in Modbus register
Typical Coverage Area:	700m ² or 15m radius
Settling Time:	3 minutes after power up
Response Time(t_{90}):	<35 Seconds
Life Expectancy:	>3 years dependant on environment
Ambient Range:	0-50°C, 15-90% RH non-condensing
Housing:	Cool white. ABS UL94-5VA compliant
Dimensions & Weight:	87 x 82 x 27mm, 75g, IP20
Terminals:	Rising clamp for 0.5-1.5mm ²
Country of origin	UK

Product Order Codes

Order Code	Description
AX-GS-CM-M-S	Room Carbon Monoxide Transmitter, 0-300PPM Modbus
AX-GS-CM-M-SD	Room Carbon Monoxide Transmitter, 0-300PPM Modbus, LCD
	Add -R for relay and/or -SND for sounder

Room CO Transmitter - MODBUS RTU - Optional LCD

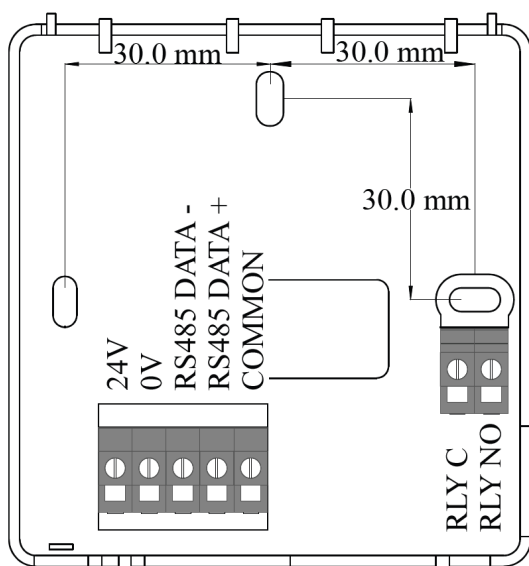
Installation

The AX-GS-CM-M-S should be installed by a suitably qualified technician in accordance with any guidelines for the device and the equipment which is to be connected to. Field wiring should be installed to satisfy the requirements set out by the manufacturer of the equipment that the unit is being connected to using screened cable where necessary.

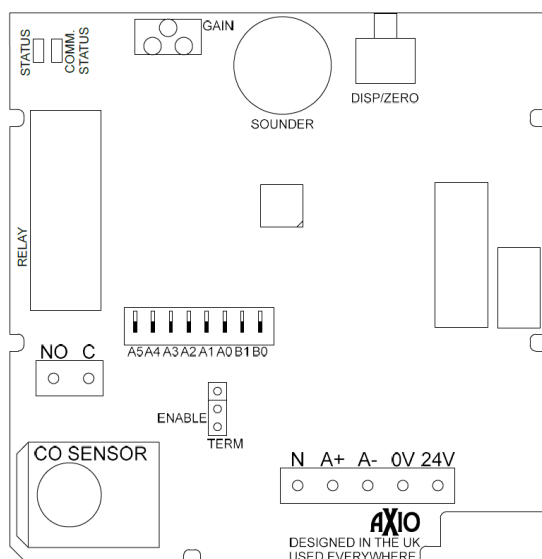
Location

The unit should be mounted at a height of 1 to 1.5 metres from the floor of the area to be monitored in an area of good airflow. For best operation do not mount the sensor near doors, opening windows, supply air diffusers or other known air disturbances. Avoid areas where the transmitter would be exposed to vibrations or rapid temperature changes.

Connections



PCB



LCD Display (If fitted)

The display can be configured to show the CO level in ppm, the temperature in °C, both in sequence. Refer to *Modbus registers* information for more details.

The DISP/ZERO switch can be used change the display

Sounder (If fitted)

The unit can be configured to generate an audible alarm when the CO level exceeds the values defined in the Modbus registers. By default, the alarm levels follow the EN 50291 standard for alarm thresholds and response times:

30 ppm	→	120 minutes
50 ppm	→	60 minutes
100 ppm	→	10 minutes
300 ppm	→	1 minute

Once activated, the sounder may be muted by pressing the DISP/ZERO button or via Modbus command.

Relay (If fitted)

By default, the relay follows the alarm conditions of the sounder. It can be decoupled from the sounder and configured to use a separate activation value. Refer to the *Modbus registers* for details.

Status LED

This flashes 4 times every 6 seconds. A brighter flash in the sequence indicates a fault, ordered as:

- 1 - EEPROM
- 2 - CO Sensor
- 3 - Ext. Temperature sensor
- 4 - CO Gain Error

Communication status LED

OFF - No valid communication

Short flash - Valid packets received. NOT for this unit.

Long flash - Valid packets received. Replied to the request.

Termination Impedance

If the slave device is at the end of the network, enable 120Ohms termination resistor by placing TERM in ENABLE Position. This ensures the proper termination of signals travelling in both directions on the bus. Do NOT use more than two termination impedances in a network.

Usage

Suitable for monitoring and ventilation applications. Do NOT use in safety critical or hazardous applications.

Datasheet Contents

Every effort has been taken in the production of this data sheet to ensure accuracy. Annicom do not accept responsibility for any damage, expense, injury, loss or consequential loss resulting from any errors or omissions. Annicom has a policy of continuous improvement and reserves the right to change this specification without notice.

Installation and Operation

The purpose of this document is to provide information on installing and setting up AX-GS-CM-M-S range of carbon monoxide transmitters. The details of the variants of the transmitters are provided in the relevant datasheet. Please download the latest datasheets from our website www.annicom.com. This manual is applicable for the following models.

CO transmitters : AX-GS-CM-M-S, AX-GS-CM-M-SD

General

Read this manual carefully before installing and commissioning the transmitter. It is imperative that the installation be carried out by qualified personnel familiar with relevant standards and safety procedures. Failing to do so may result in personal injury and product damage.

Prior to installation ensure that all power sources are disconnected and locked out and remain locked out during Installation and set-up. Follow electrostatic discharge (ESD) precautions while installation to prevent equipment damage.



Do NOT use the product in explosive or hazardous environments, with combustible or flammable gases, or in safety critical systems where the failure of the product could result in loss of life, significant property damage, or damage to the environment.

Gas detection principle

AX-GS-CM-M-S range of transmitters use 3-electrode electrochemical sensors to detect carbon monoxide gas. They exhibit good linearity, are highly selective, and respond quickly to the target gas. Inside an electrochemical cell, three electrodes (sensing, reference, and counter electrodes) are immersed in an electrolyte. The material selected for the electrode determines the target gas. In this case, it is carbon monoxide. When CO gas comes into contact with the electrodes through diffusion, it undergoes a series of reactions that result in an electrical current flowing between the electrodes. The magnitude of the current is proportional to the concentration of CO gas present.

The ambient temperature has a small yet significant effect on the electrochemical cells. A built-in temperature sensor mitigates this effect. Data from the electrochemical cell and temperature sensor are digitally processed using a microcontroller. The processed data is then transmitted over RS-485 lines using the Modbus RTU protocol.

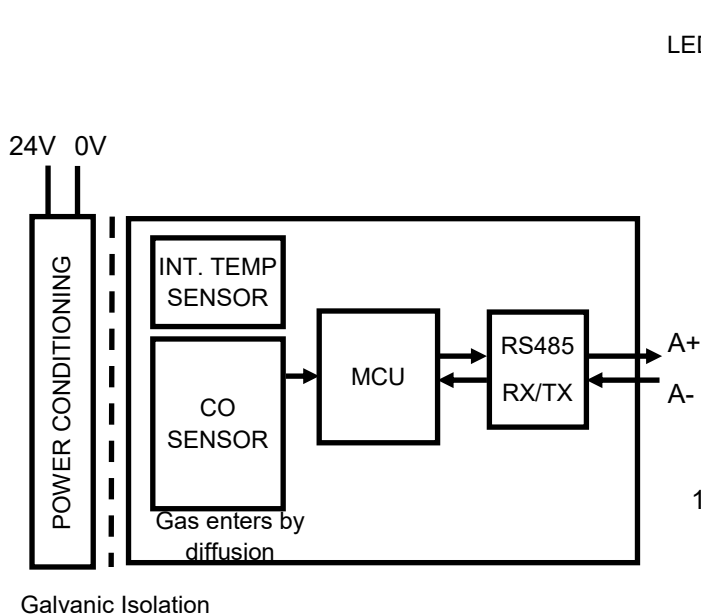


Figure 1

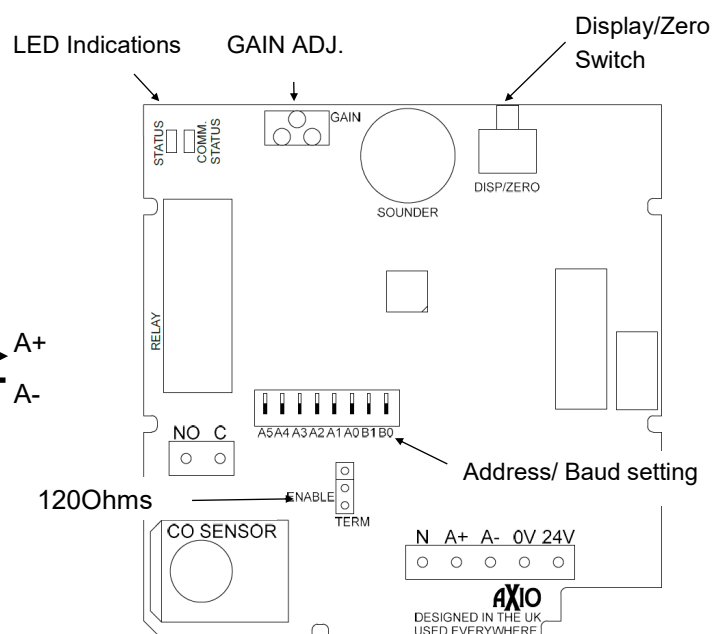


Figure 2 - PCB

Siting gas detectors

- Choose a location with good air circulation and representative of the monitored area.
- Mount the transmitter on a flat surface 1 to 1.5 metres from the floor of the area to be monitored.
- For best operation do not mount the sensor near doors, opening windows, supply air diffusers or other known air disturbances .
- Avoid areas where the transmitter would be exposed to vibrations or rapid temperature changes.

Dimensions and mounting

- Place the backplate on the surface where you want to mount the device and mark the locations of the holes. Choose at least two from the three mounting holes.
- Drill the holes and secure the enclosure with supplied screws.
- Strip the insulation on wires (approx. 6mm) .Insert the conductor fully and tighten screws to 0.5Nm torque. (Use ferrules for fine strands)

1.	24V	3.	RS485 Data -	6.	Relay Common
2.	0V	4.	RS485 Data +	7.	Relay NO
		5.	RS485 Common		

- Ensure that no copper is exposed.
- Verify the connection with a pull test.



1.0 to 1.5 meters

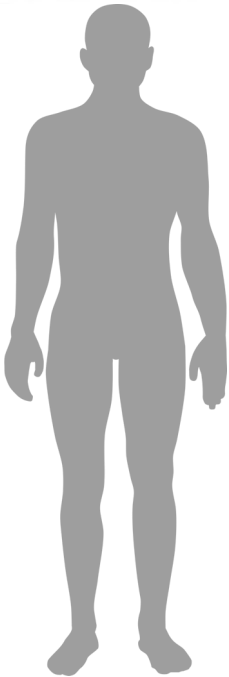


Figure 3

- Configure address and baud rate using the dipswitch on the PCB. See *Network Configuration*.
- Enable termination if the device is the last one in the network.
- Place the enclosure with the pin headers aligning with the connector and gently push to lock the enclosure to the base.
- All other configurations can be done through modbus registers
- Finally, use the supplied locking screw to secure cover to the base plate for tamper resistance.

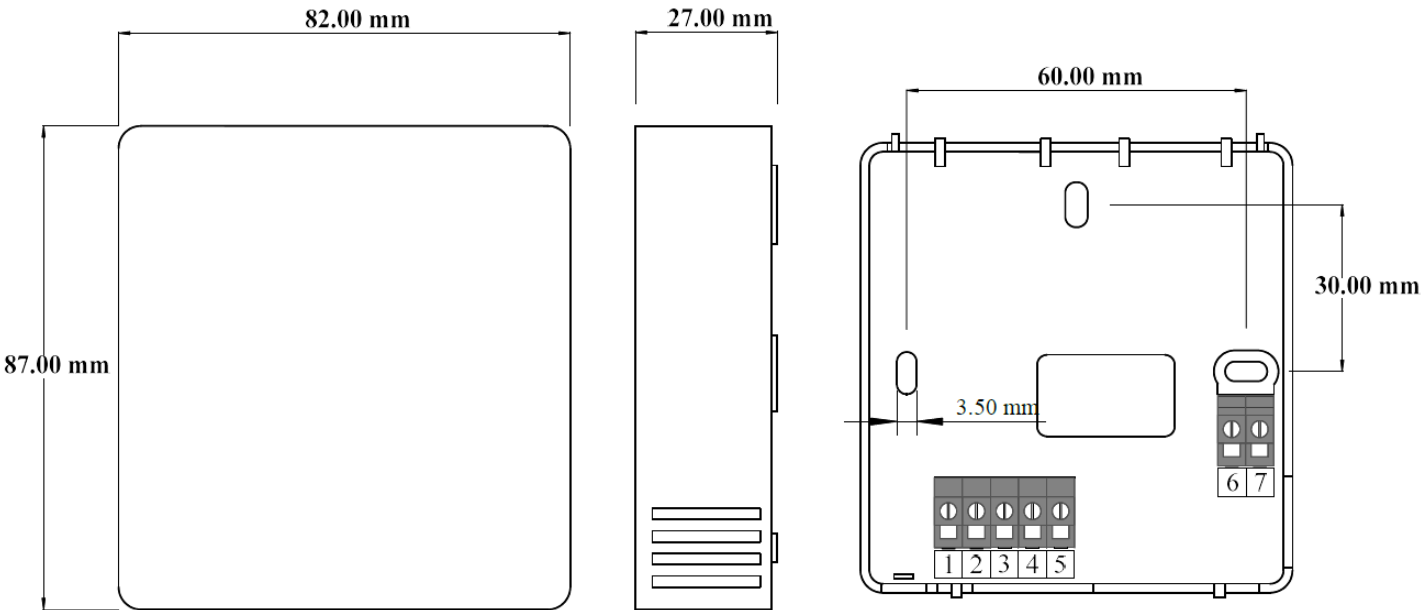


Figure 4

RS-485 output wiring

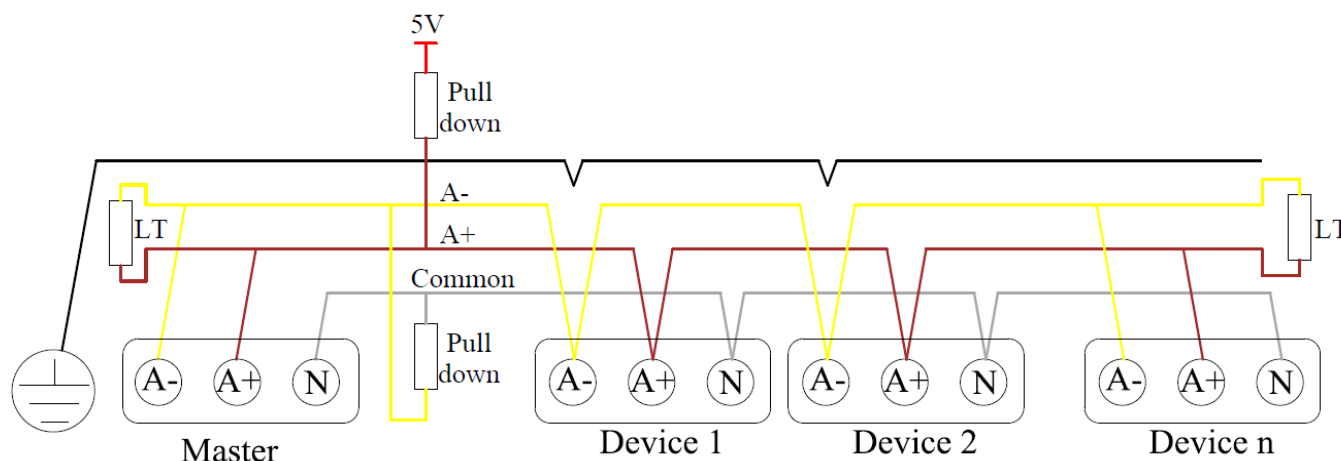


Figure 5

Use twisted pair shielded cables with a characteristic impedance of approximately 120 ohms. A balanced pair must be used for data lines (A+,A-) and a third conductor for the net common (N). The shield should be connected to the earth at one end only, preferably at the master control panel.

The RS485 standard suggests a daisy chain topology. A long trunk with short derivation cables is also acceptable.

A maximum of 32 devices may be connected to the network without using a repeater. This is subject to changes depending on the Unit Load used by other devices on the network and line polarization.

Either end of the network should be terminated with 120 Ohms to avoid signal reflections. Do not use line termination on a derivation cable. For convenience, unit has the Line Termination (LT) built-in, which may be enabled using the jumper.

Line polarisation might be needed in applications involving noisy environments. A pull-up is connected to a 5V source on A+ circuit. A pull-down resistor to the common is connected on A- circuit. The value of the resistors is chosen between 450 ohms and 650 ohms. Line polarisation will reduce the maximum number of devices that may be connected to a network.

Modbus RTU is a serial protocol. As the number of devices in a network increases, there will be potential delays in updating data from each device. The system designer determines the number of devices connected in a network depending on the required data refresh interval.

Network Configuration

The communication parameters can be set using the Dipswitches or can be programmed over the network.

If any switches are ON, switches A5 to A0 sets the device address and B1 and B0 sets the baud rate. The Parity will be Even, and the Number of Stop bits will be 1 in this mode.

If the dipswitches A5 to A0 are set to OFF, the communication parameters will be loaded from the internal configuration registers. When these registers are modified, the updated values will not be stored until a Non Volatile Memory Update command has been executed and will not be used until either a Force Reset command or a re-power of the unit.

A unique address for each device is essential for the proper operation of the serial bus. If two devices have the same address, the Master will not be able to communicate with any slave on the bus, causing a malfunction. The address assignment must be checked carefully before the procedure.

Dipswitch configuration

A5	A4	A3	A2	A1	A0	
OFF	OFF	OFF	OFF	OFF	OFF	Comms. set by Modbus registers
						Address
OFF	OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	OFF	ON	OFF	2
↓	↓	↓	↓	↓	↓	↓
ON	ON	ON	ON	ON	ON	63
B1	B0	Baud Rate	Parity		No of Stop Bits	
OFF	OFF	9600	Even		One	
OFF	ON	19200				
ON	OFF	38400				
ON	ON	57600				

Supported Function Codes

03	READ HOLDING REGISTERS (4XXXXX BANK)
04	READ INPUT REGISTERS (3XXXXX BANK)
06	WRITE SINGLE REGISTER(4XXXXX BANK)
16	WRITE MULTIPLE REGISTERS(4XXXXX BANK)

Modbus Registers

ADDRESS	DESCRIPTION	DATA TYPE	DATA	ACCESS	NVM
3XXXX REGISTER BANK					
30001	CO_CONCENTRATION (0.0-300.0) (ppm)	UINT16	0 - 3000	R	
30002	TEMPERATURE (0 to 50.0) (°C)	UINT16	0 - 500	R	
30003	FAULT (0: NO_FAULT, 1: FAULT)	UINT16	BITS 15-4: RESERVED BIT3: CO_GAIN BIT2: CO_SENSOR BIT1: TEMP_SENSOR BIT0: EEPROM	R	
30004	GAINx10(nA/ppm)	UNIT16	100-600	R	
30005:7	RESERVED	UINT16		R	
4XXXX REGISTER BANK					
40001	MODBUS ADDRESS (NETWORK)	UINT16	1-247(DEFAULT:1)	R/W	*
40002	BAUD RATE (NETWORK)	UINT16	0: 9600 1:19200(DEFAULT) 2:38400 3:57600 4:115200	R/W	*
40003	PARITY (NETWORK)	UINT16	0:NONE 1:ODD 2:EVEN(DEFAULT)	R/W	*
40004	NO OF STOP BITS (NETWORK)	UINT16	0:1 STOP BIT (DEFAULT) 1:2 STOP BITS	R/W	*
40005	DISPLAY	UINT16	1: CO (PPM) (DEFAULT) 2: TEMPERATURE(°C) 3: CO AND TEMPERATURE	R/W	*
40006	TEMP_OFFSET(-5.0°C to 5.0°C)	INT16	-50 - 50	R/W	*
40007	ALARM_LEVEL_1 (PPM)	UINT16	0 - 300 (DEFAULT:30) 0:OFF	R/W	*
40008	ALARM_LEVEL_1_DELAY (SEC)	UINT16	0 - 36000(DEFAULT:7200)	R/W	*
40009	ALARM_LEVEL_2 (PPM)	UINT16	0 - 300 (DEFAULT:50) 0:OFF	R/W	*
40010	ALARM_LEVEL_2_DELAY (SEC)	UINT16	0 - 36000(DEFAULT:3600)	R/W	*
40011	ALARM_LEVEL_3 (PPM)	UINT16	0 - 300 (DEFAULT:100) 0:OFF	R/W	*
40012	ALARM_LEVEL_3_DELAY (SEC)	UINT16	0 - 36000(DEFAULT:600)	R/W	*
40013	ALARM_LEVEL_4 (PPM)	UINT16	0 - 300 (DEFAULT:300) 0:OFF	R/W	*
40014	ALARM_LEVEL_4_DELAY (SEC)	UINT16	0 - 36000(DEFAULT:30)	R/W	*
40015	MUTE_SOUNDER	UINT16	1: MUTE (DEFAULT:0)	R/W	
40016	RELAY_ACTIVATION_LEVEL(PPM)	UNIT16	0-300 (DEFAULT:0) 0: USE ALARM_LEVEL_X LEVELS	R/W	*
40017	DISABLE_PCB_LED_INDICATIONS	UINT16	0: ENABLED, 1:DISABLED	R/W	*
40018	CALIBRATE_ZERO	UINT16	WRITE 0x5A TO ZERO	R/W	
40019	FORCE_RESET	UINT16	1:RESET	R/W	
40020	NON_VOLATILE_MEMORY_UPDATE	UINT16	1:UPDATE	R/W	
40021	FORCE_FACTORY_DEFAULTS	UINT16	1:FORCE DEFAULTS	R/W	

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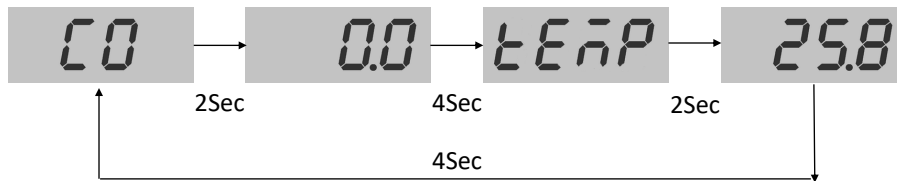
Common Exceptions

- Exception code :01 ILLEGAL FUNCTION Function code in the query is not supported by this device.
- Exception code :02 ILLEGAL DATA ADDRESS Starting address or starting address+ number of registers is outside range.
- Exception code :03 ILLEGAL DATA VALUE The value in the request data field is not an authorized value for the slave.

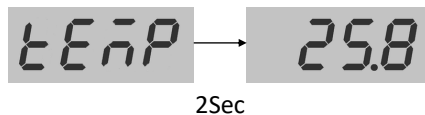
Display (if fitted)

The -SD version of the device features a segmented display for local readout. The switch on the PCB and register 40005 control the displayed parameter. By default, the display is programmed to show CO value

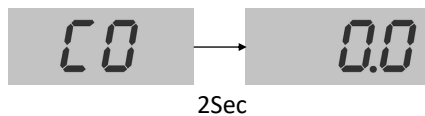
40005 Register value : 3



40005 Register value : 2



40005 Register value : 1



Sounder (if fitted)

The -SND versions features a sounder for audible alarms. The alarm levels and the delays is defined by the registers 40007 through 40014. Write 0 to registers 40007, 40009, 40011 to deactivate the alarm.

If the sensor reading rises above the thresholds defined in register ALARM_LEVEL_X for a duration defined in the corresponding ALARM_LEVEL_X_DELAY register, the sounder will be activated. Once activated, it can be muted either by pressing the DISP/ZERO switch once or by writing 1 to the MUTE_SOUNDER [40015] register. The sounder will not activate again until the alarm condition has cleared.

Relay (If fitted)

Relay contacts may be used to signal other devices or external alarms when the CO level reaches a defined threshold. The threshold is set by register 40016. Once activated, the relay will return to normal when the CO level falls below 90% of the set value.

RELAY ON: CO (ppm) ≥ RELAY_ACTIVATION_LEVEL [40016]

RELAY OFF: CO (ppm) < 90% of RELAY_ACTIVATION_LEVEL [40016]

Writing 0 to RELAY_ACTIVATION_LEVEL [40016] links the relay contacts directly to the alarm conditions defined by registers 40007–40011.

Testing CO Alarm

Use a thin flat screwdriver or a similar tool to operate the DISP/ZERO button from the top.

Press the button four times. The display will show “tESt”, with both the sounder and the relay activated.

Press the button again to stop the test.

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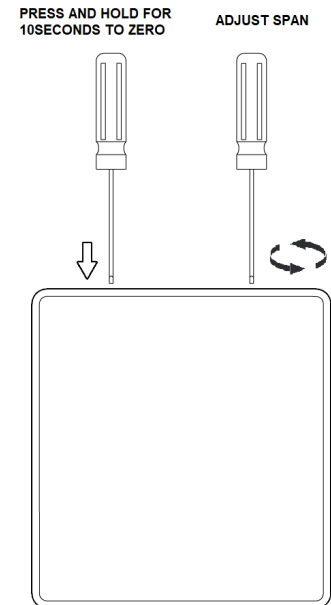
Calibration

The device comes with pre-calibrated sensors. The sensors have an expected lifetime of 7 years. It is recommended to verify the calibration once a year.

Use a calibrated gas source (not supplied) to verify the calibration. The transmitter must be turned on for at least 15 minutes before applying the calibrated gas. Allow a steady flow of gas (0.4 to 1 litre/min) through the enclosure vents using a regulator for a minimum of 2 minutes.

ZEROING – Place the device in clean air or apply nitrogen gas. Press and hold the ZERO switch for 10 seconds. The display (if fitted) will show ‘ZERO,’ save the value to the EEPROM, and reset after 5 seconds. The ZERO button can be accessed using a thin screwdriver through the vents on top of the enclosure.

SPAN ADJUSTMENT – Apply calibrated CO gas of a known concentration and observe the output. If the output is less than expected, reduce the gain by adjusting the GAIN trimpot counterclockwise. The switch can be accessed from the top side of the enclosure through the vents.



Bump testing

Before powering on, ensure all connections are secure. Ensure that 120-ohm termination is enabled only at the end of the line. Observe the status LED after powering on. The 1st, 2nd, and 4th flashes in the status LED sequence should be dim. If the BMS controller to which the device is connected is sending requests, the device will send messages back and the communication LED will have a bright flash to indicate that it has responded to the request. If the communication is valid but the request is not addressed to the device, the communication status LED will show a dim flash. If the communication is not valid (e.g., incorrect baud rate, parity, etc.) or the line is idle, the communication status LED will remain off.

Allow the transmitter to warm up and stabilise for at least 15 minutes.

To perform a bump test, you will need a gas source with a known concentration (not supplied). Allow a steady flow of gas (0.6 to 1 litres/min) using a regulator. The gas will diffuse into the sensor and change the output. The transmitter output will depend on the concentration of the target gas. Observe the output on the display (if fitted) or on the controller.