# AX-GS-CM-NO2-M

## Nitrogen Dioxide and Carbon Monoxide Transmitter, Modbus RTU

## Product overview

The AX-GS-CM-NO2-M is an ideal solution for detecting harmful emissions in parking garages, loading docks, warehouses etc. It offers detection of carbon monoxide and nitrogen dioxide gases in the same enclosure . Sensor readings are transmitted over RS-485 Modbus RTU protocol. By monitoring the levels of CO and NO2 in the air, the ventilation system can be adjusted to ensure that the air quality is within safe limits.


## Products Features

- Detection range - CO: 0 to 300 ppm ,NO2: 0 to 10ppm
- Electrochemical sensing elements
- Easy installation with plug-in connections
- Isolated RS485 output
- Zero and sensitivity adjustments for field calibration
- UL listed sensors: File no. E240671

## Product Specifications

| | |
|---|---|
| Power Supply: | 24Vac ±10%, 100mA maximum or 24Vdc ± 10%, 60mA maximum |
| Sensor Type (CO and NO2): | Electrochemical 3-electrode |
| Output Range: | CO: 0-300ppm, NO2:0-10ppm |
| Output Accuracy: | CO : ±5ppm or ±5% of reading, NO2:±0.2ppm or ±5% of reading (whichever is greater) |
| Response time($t_{90}$): | < 35 seconds |
| Long term sensitivity drift: | CO : <5% signal drift per year, NO2:<12% signal drift per year |
| Typical Coverage Area: | 700m² or 15m radius |
| Settling Time: | 3 minutes after power up |
| Life Expectancy: | NO2: 2 years dependant on environment, CO:5 Years |
| Ambient Temperature & Humidity: | 0-50˚C, 15-90% RH non-condensing |
| Housing: | Flame retardant ABS, IP65 White ( optional Black-see order codes) |
| Dimensions & Weight: | 92mm diameter x 52mm, 180gms |
| Terminals: | Rising clamp for 0.5-1.5mm² , 2 Part Pluggable |
| Communication | |
| Protocol: | Modbus RTU protocol over RS485 |
| Address range: | 1-63 (settable using dipswitch), 1-247 (settable using configuration register) |
| Baud rates supported: | 9600bps,19200bps,38400bps,57600bps,115200bps |
| Parity: | None (default), Odd, Even (odd, even selectable via configuration register) |
| Number of stop bits: | 1(default),2 (2 is selectable via configuration register) |
| Isolation: | 1500VDC (60sec, <1mA leakage current) between Power and Output |
| 120Ohms termination : | Available on board. Enabled using jumper |
| Recommended cable: | 24AWG twisted pair shielded cable (1 pair for data and 1 conductor for common) |
| Maximum devices on a network: | 32 |
| Warranty: | 5 years for the product. (NO2 sensor: 2 years , CO sensor:3 years) |
| Country of origin: | UK |

## Product Order codes

| Order code | Description |
|---|---|
| AX-GS-CM-NO2-M | CO 0-300ppm , NO2 0-10ppm transmitter, RS485 Modbus |

Add –R to the part number for rear cable entry , Add –B for Black Enclosure


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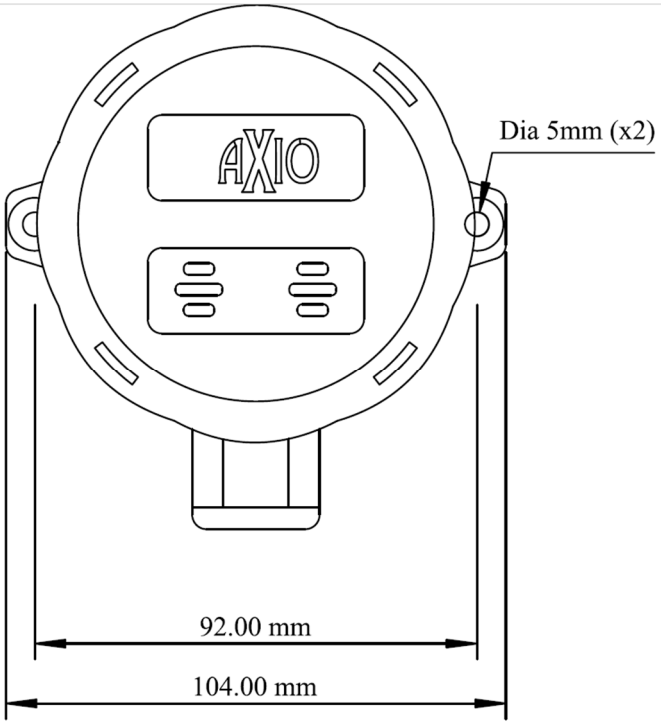
# AX-GS-CM-NO2-M

## Nitrogen Dioxide and Carbon Monoxide Transmitter, Modbus RTU

## Fixing and dimensions




## Installation

The unit should be installed by suitably qualified technician in conjunction with any guidelines for the equipment it is to be connected to and any local regulations. Field wiring should be installed to satisfy the requirements set out by the manufacturer of the equipment that the sensor is being connected to. Anti-static precautions must be observed when handling. The PCB contains circuitry that can be damaged by static discharge.

Do not route the conductors near power lines, power circuits with a high di/dt, switch-mode converters, power-regulation control devices.

## Location

The enclosure 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.

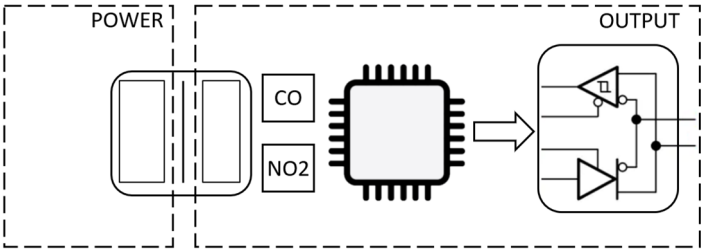
## Alternate Cable Entry

The AX-GS-CM-NO2-M provides a side-entry M20 cable gland as standard, whilst the-R version offers the option of rear cable entry allowing the unit to be mounted to a wall with its cable hidden from view. The –R version is supplied with a M20 gland plug and gasket that can be repositioned to the side or the rear.

## Usage

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

## Isolation scheme




## Sensor replacement

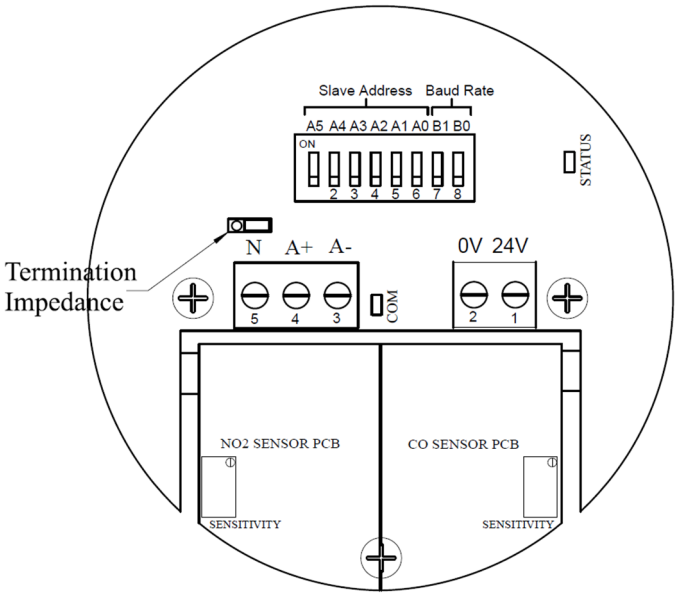
The expected life time for NO2 sensor is 2 years and CO sensor is 5years in standard working conditions. Sensor PCBs with factory set sensitivity can be ordered to replace the existing sensors.

Press and hold DISP/ZERO switch for 10seconds to zero the sensors in clean air environment after replacing sensor(s).

## Termination Impedance

If the slave device is at the end of the network, enable 120 Ohms 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.

## Connections




## Status LED

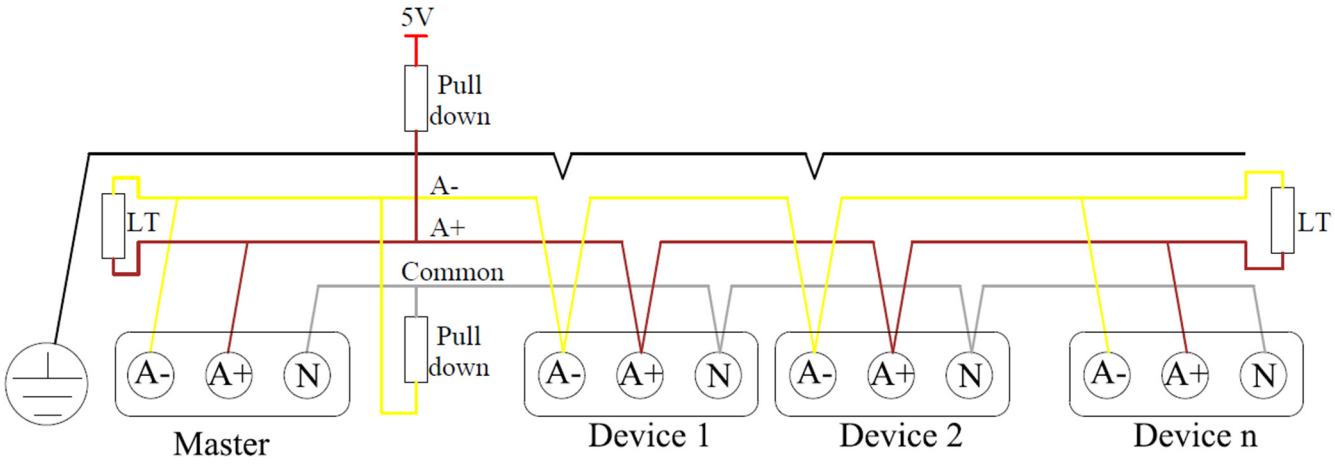
This flashes 6 times every 8 seconds. A brighter flash in the sequence indicates a fault, ordered as:

| | |
|---|---|
| 1 - Program memory | 2 - Internal |
| 3 - Calibration | 4 - Sensor selection |
| 5 - CO sensor | 6 - NO2 sensor |

## Communication status LED:

Flashes once per second if unit sees network activity, 1 second burst when unit accessed/transmits.

**RS-485 output wiring**




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, AX-GS-CM-NO2-M 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 None, and the Number of Stop bits will be 1 in this mode. If changes are made after powering up, new values will not be updated until either the unit is re-powered or a software reset is executed.

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.

It is of great importance to ensure at the time of the procedure of devices addressing, that there is not two devices with the same address. In such a case, an abnormal behaviour of the whole serial bus can occur, the Master being unable impossibility to communicate with any slave on the bus.

**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 | None | One |
| OFF | ON | 19200 | | |
| ON | OFF | 38400 | | |
| ON | ON | 57600 | | |

## Modbus Registers

| ADDRESS | DESCRIPTION | DATA TYPE | DATA | ACCESS | NVM |
|---|---|---|---|---|---|
| 00001 | FORCE_RESET | BIT | 1:RESET | R/W | |
| 00002 | NON_VOLATILE_MEMORY_UPDATE | BIT | 1:UPDATE | R/W | |
| 00003 | FORCE_FACTORY_DEFAULTS | BIT | 1:FORCE DEFAULTS | R/W | |
| | | | | | |
| 10001 | SENSOR_STATUS_CO | BIT | 0: NO ERROR<br>1: ERROR | R | |
| 10002 | SENSOR_STATUS_NO2 | BIT | 0: NO ERROR<br>1: ERROR | R | |
| | | | | | |
| 30001 | CO_VALUE (0.0 - 300.0 PPM) | UINT16 | 0-3000 | R | |
| 30002 | NO2 _VALUE( 0.00 - 10.00 PPM) | UINT16 | 0-1000 | R | |
| 30003 | RESERVED | UINT16 | 0-65535 | R | |
| | | | | | |
| 40001 | DEVICE_ID | UINT16 | 0-65535 (DEFAULT:1) | R/W | * |
| 40002 | MODBUS ADDRESS (NETWORK) | UINT16 | 1-247(DEFAULT:1) | R/W | * |
| 40003 | BAUD RATE (NETWORK) | UINT16 | 0: 9600(DEFAULT)<br>1:19200<br>2:38400<br>3:57600<br>4:115200 | R/W | * |
| 40004 | PARITY (NETWORK) | UINT16 | 0:NONE(DEFAULT)<br>1:ODD<br>2:EVEN | R/W | * |
| 40005 | NO OF STOP BITS (NETWORK) | UINT16 | 0:1 STOP BIT (DEFAULT)<br>1:2 STOP BITS | R/W | * |

### Supported function codes

| | |
|---|---|
| 01 | READ MULTIPLE COILS ( 0XXXX BANK) |
| 02 | READ DISCRETE INPUTS ( 1XXXX BANK) |
| 03 | READ HOLDING REGISTERS (4XXXX BANK) |
| 04 | READ INPUT REGISTERS (3XXXX BANK) |
| 05 | WRITE SINGLE COIL( 0XXXX BANK) |
| 06 | WRITE SINGLE REGISTER(4XXXX BANK) |
| 15 | WRITE MULTIPLE COILS( 0XXXX BANK) |
| 16 | WRITE MULTIPLE REGISTERS(4XXXX BANK) |

### Common exceptions

- Exception code :01 - ILLEGAL FUNCTION

  Reason: Function code in the query is not supported by this device.

- Exception code : 02 ILLEGAL DATA ADDRESS

  Reason: Starting address or starting address+ number of registers is outside the acceptable range.

- Exception code : 03 ILLEGAL DATA VALUE

  Reason: The value in the request data field is not an authorized value for the slave.

### Register details

**FORCE_RESET [00001]**

Repowering the unit or a write(1) to the FORCE_RESET register will set the register values to their DEFAULT values except for the NON-VOLATILE MEMORIES(NVM).

**NON_VOLATILE_MEMORY_UPDATE[00002]**

The contents of the registers 40001 : 40005 will not be saved to the NVM until a write(1) to this register.

**FORCE_FACTORY_DEFAULTS[00003]**

Write(1) to this register resets the contents of all registers to DEFAULT including the NVMs.

**SENSOR_STATUS[10001-10004]**

Shows status of the on board sensors. '1' means Error

**CO_VALUE[300001]**

Unsigned integer register which stores the current CO level. Divide the register value by 10 to get the reading in ppm.

**NO2_VALUE[300002]**

Unsigned integer register which stores the current NO2 level. Divide the register value by 100 to get the reading in ppm.

**DEVICE_ID [40001]**

16-bit general-purpose register that may be used for identifying the device on the network. NVM update is required after modifying the contents of this register.

**COMMUNICATION_PARAMETERS [40002: 40005]**

If all the dipswitches are OFF, the communication parameters are set by these registers. After modifying the contents, write (1) to NON_VOLATILE_MEMORY_UPDATE to save the values to NVM. New values will come to effect after a FORCE_RESET or repowering of the unit.

## Datasheet Contents

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