Carbon Monoxide/Nitrogen Dioxide Transmitter

SAE-111x - Installation Instructions

INTRODUCTION

The Carbon Monoxide/Nitrogen Dioxide series of sensors monitor CO gas levels and offers an optional local or remote NO_2 sensor.

Features include an LCD for configuration and monitoring, various output signal types, optional temperature sensor, optional relays for alarm indication, optional high intensity strobe and buzzer for alarms and field replaceable calibrated sensors.

BEFORE INSTALLATION

Read these instructions carefully before installing and commissioning the gas sensor. Failure to follow these instructions may result in product damage. Do not use this device in an explosive or hazardous environment, with combustible or flammable gases, as a safety or emergency stop device or in any other application where failure of the product could result in personal injury. **Follow electronic discharge precautions during installation and do not exceed the device ratings.**
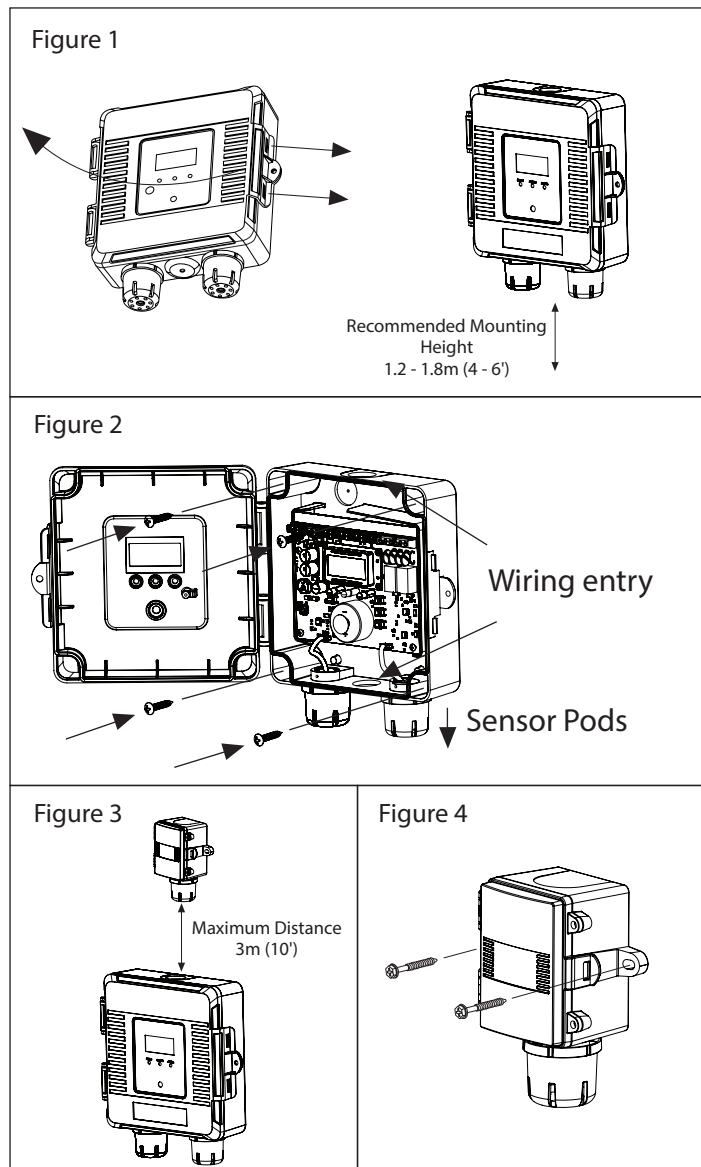
MOUNTING

For wall mounting, select a suitable mounting area away from opening windows or doors and avoid areas subject to high vibrations or excessive moisture. The recommended mounting height is 1.2 - 1.8 m (4' - 6') above the floor. The enclosure has a hinged cover with a latch. Open the cover by pulling slightly on the latch on the right side of the enclosure as shown in Figure 1. Mount the device directly to the flat surface using the four integrated mounting holes that are provided on each corner of the enclosure using screws (not provided). Ensure the sensor pods are pointing downwards as shown in Figure 1.

The enclosure offers two entry points for wiring one on top and one on bottom, see Figure 2 for locations. The enclosure includes one rubber grommet installed in the bottom wiring hole. Depending on the installation wiring can be routed through top or bottom hole and the grommet can be placed in the unused hole. The hole provided is for conduit or cable gland mounting. The hole size is 21.38mm (0.86") diameter.

Make wiring connections as per the "Wiring" illustrations as shown in Figure 6. Once the wiring and device setup are complete, close and latch the cover. The enclosure includes a hole to allow the use of anti-tamper device.

REMOTE NO_2 MOUNTING

The recommended mounting height for the remote NO2 sensor is 0.6 m (2') below the ceiling and must be mounted within 3m (10') of the main enclosure as shown in Figure 3. Secure the enclosure to the selected section of wall above the main enclosure with (2) #10 x 25 mm (1") self-tapping screws (not provided) and tighten screws until the enclosure is tight against the wall as shown in Figure 4. Ensure there is no movement of the enclosure.

Figure 1

Recommended Mounting Height
1.2 - 1.8m (4 - 6')

Figure 2

Wiring entry

Sensor Pods

Figure 3

Maximum Distance
3m (10')

Figure 4

The enclosure has a hinged cover with a latch. Open the cover by pulling slightly on the latch on the right side of the enclosure. At the same time pulling on the cover.

Make wiring connections as per the "Wiring" illustrations. See Figure 9.

Swing door closed until securely latched. For added security, 2 screws are provided that may be installed in the integrated screw tabs. See Figure 5.

Figure 5
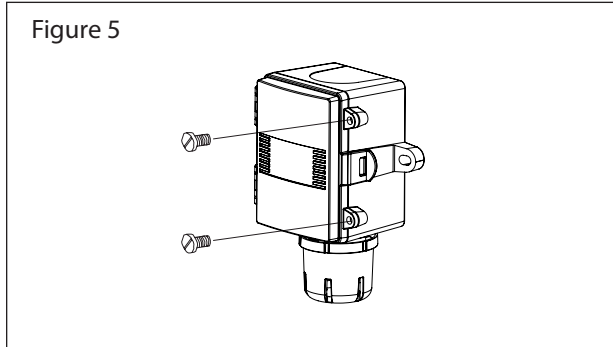
WIRING

Deactivate the 24 Vac/dc power supply until all connections are made to the device to prevent electrical shock or equipment damage. Follow proper electrostatic discharge (ESD) handling procedures when installing the device or equipment damage may occur. Use 14-22 AWG shielded wire for all connections and do not locate the device wires in the same conduit with wiring used to supply inductive loads such as motors. Pull enough wire into the enclosure to reach the terminal blocks and complete the wiring connection according to the wiring diagram. Make all connections in accordance with national and local codes.

Connect the plus DC or the AC voltage hot side to the PWR terminal and the power supply common is connected to the COM terminal. The device is reverse voltage protected and will not operate if connected backwards. It has a half-wave power supply so the supply common is the same as the signal common. Use caution when wiring multiple devices or when grounding the secondary of a transformer to ensure that the circuit ground point is the same on all devices and the controller.

The sensor can be ordered with four output options. Analog options include 4-20 mA active output or voltage output configurable as 0-5 Vdc or 0-10 Vdc. Network options include BACnet® or Modbus.

The analog outputs are available on the CO, TEMP and NO$_2$ terminals. The signal type may be ordered as either voltage or 4-20 mA active outputs. The voltage model is selectable for either 0-5 or 0-10 Vdc via the menu (the factory default is 0-5 Vdc). The current outputs operate in the active mode and do not require a loop power supply. This means that the signal current is generated by the sensor and the outputs must not be connected to a powered input or device damage will result. Check the controller Analog Inputs (AI) to determine proper connection before applying power. Both current and voltage output signals are referenced to the COM terminal. The analog output signals are typically connected directly to the Building Automation System (BAS) and used as control parameters. See Figure 6.
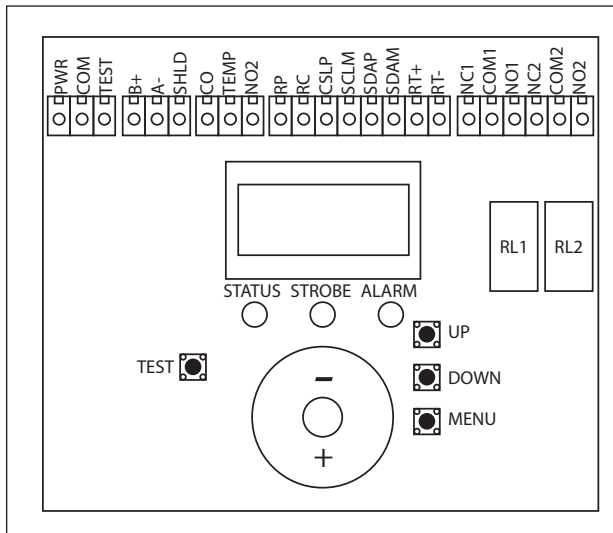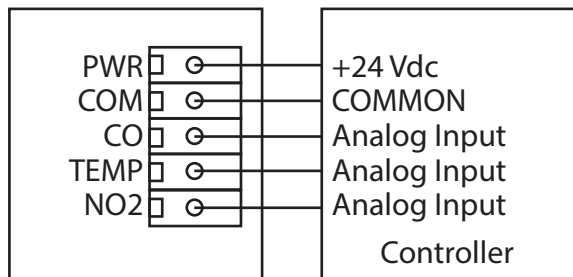
Figure 6

Typical wiring for 24 Vdc power from controller

PWR ———— +24 Vdc
COM ———— COMMON
CO ———— Analog Input
TEMP ———— Analog Input
NO2 ———— Analog Input
Controller

Typical wiring for 24 Vac power from controller

24 Vac Transformer

24 Vac
COMMON

PWR
COM
CO
TEMP
NO2

COMMON

Analog Input
Analog Input
Analog Input
Controller

Figure 7

Device 01 / Device 02 / Device 03

Building Controller 24 Vac / dc — PWR
Common — COM
Shield — SHLD
B+ — B+
A- — A-
BACnet® Master

Connect Shield One End Only

Set EOL Jumper

External 24 Vdc Power Supply or 24 Vac Transformer

Device 01 / Device 02 / Device 03

Building Controller 24 Vac / dc — PWR
Common — COM
Shield — SHLD
B+ — B+
A- — A-
BACnet® Master

Connect Shield One End Only
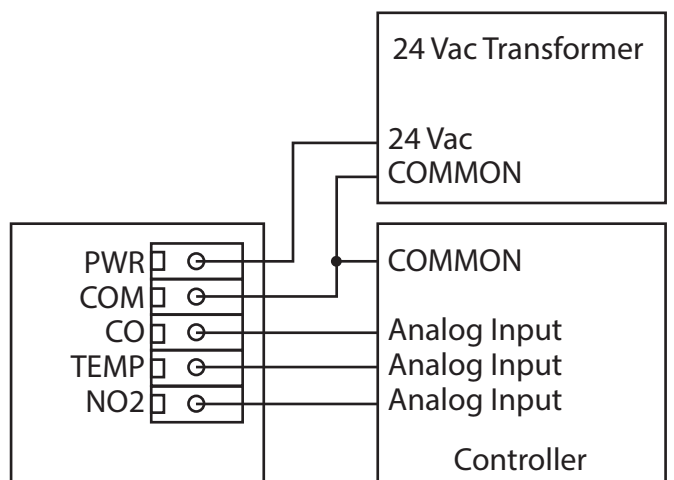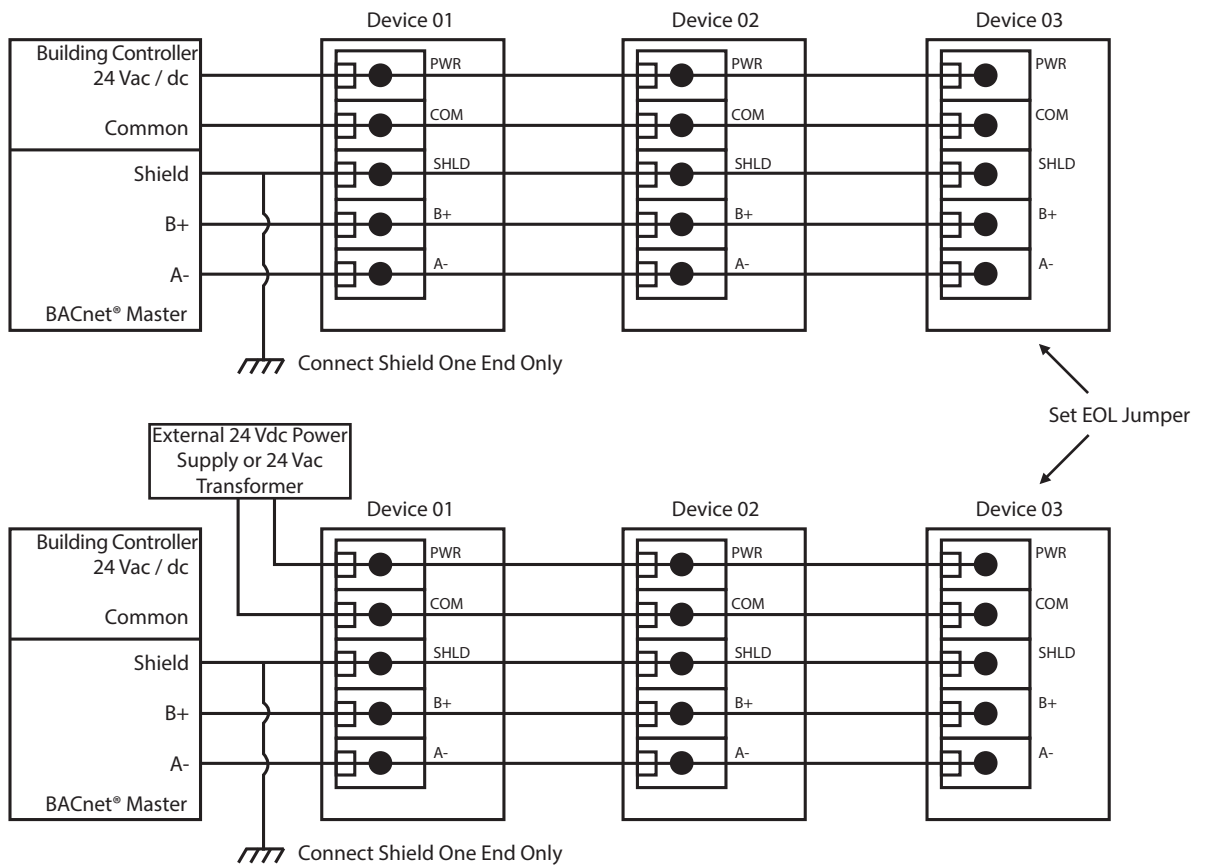
If the device includes the optional network connection, use twisted shielded pair to connect to the terminals marked A-, B+ and SHLD (SHIELD). The positive wire connects to B+, the negative to A- and the cable shield must be connected to the SHLD terminal on each device. The shield wire should be connected to earth ground at one end of the network only. See Figure 7. If the device is installed at either end of an RS-485 network, an end-of-line (EOL) termination resistor (121 ohms) should be installed in parallel with the A- and B+ terminals. This device includes a network termination resistor and jumper that can be used to connect the EOL resistor on the PCB. Simply move the jumper to the EOL position and no external resistor is required. See Figure 8.

A network segment is a single shielded wire loop run between several devices (nodes) in a daisy chain configuration. The total segment length should be less than 1220 meters (4000 feet) and the maximum number of nodes on one segment length is 128. Nodes are any device connected to the loop and include controllers but do not include the EOL terminators. To install more than 128 devices, or to increase network length, repeaters will be required for proper communication. The maximum daisy chain length (segment) depends on transmission speed (baud rate), wire size and number of nodes. If communication is slow or unreliable, it may be necessary to wire two daisy chains to the controller with a repeater for each segment.

The toxic gas sensor may have one or two optional relays installed. The relays are Form C type with both a normally open (NO) and a normally closed (NC) contact. The relay contacts may be connected to controller Digital Inputs (DI) for status monitoring or used to directly control an alarm or ventilation fan. Do not exceed the device contact ratings. In some cases, a separate control relay may be used between the sensor relay and a large fan for example.
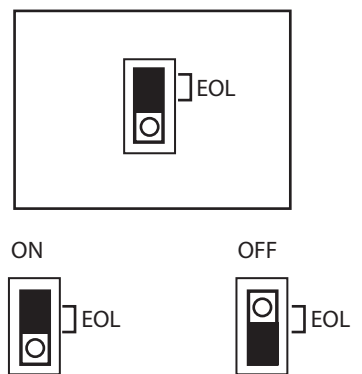
Figure 8

EOL

ON — EOL

OFF — EOL

Figure 9

Remote NO₂ Wiring

Main Unit	Remote NO₂
RP	12V
RC	COM
SCLP	CLP
SCLM	CLM
SDAP	DAP
SDAM	DAM

Figure 10
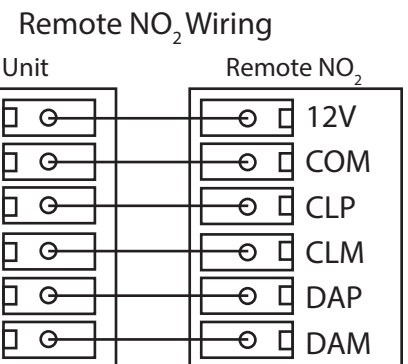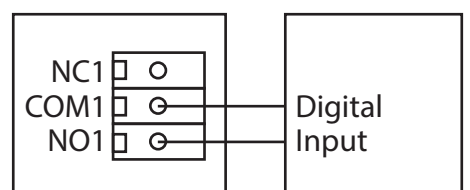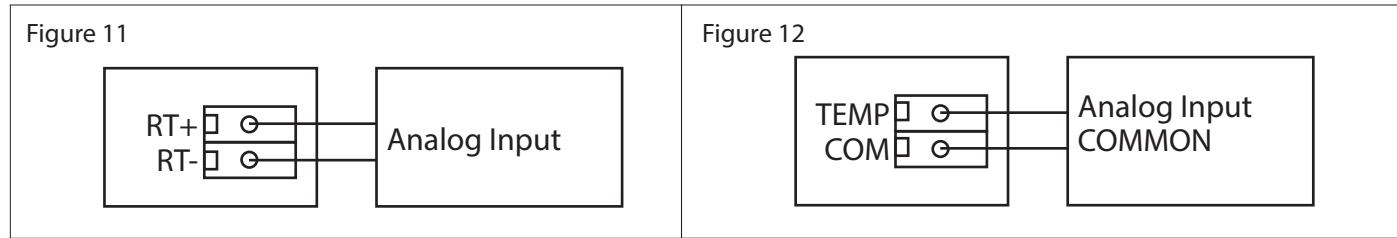
NC1	
COM1	Digital Input
NO1	

Relay terminals are designated NO, COM and NC. Each relay output is independent and isolated from the other and the relays COMs are not connected to the device COM. See Figure 10.

Figure 11	Figure 12
RT+ ⊡ ⊙ / RT- ⊡ ⊙ → Analog Input	TEMP ⊡ ⊙ / COM ⊡ ⊙ → Analog Input COMMON

An optional temperature sensor is available either as a feed through with different sensor types, see Figure 11, or as a transmitter with an analog output available on TEMP & COM terminals. See Figure 12. Terminals are not present unless option is ordered.

OPERATION - START-UP

Upon applying power to the device, it will enter the start-up mode. The LCD backlight will be on during the start-up mode. The LCD will display the current operating settings for 2 seconds each:

Software Version Number	*Version* / *1.00*
Analog output type (if applicable) (0-5 Vdc, 0-10Vdc, or 4-20 mA)	*0-5 Vdc Output* *0-10 Vdc Output* *4-20 mA Output*
Network protocol type (if applicable) (BACnet® or Modbus)	*Modbus Network* *BACnet Network*
Baud rate setting (if applicable) (9600, 19200, 38400, 57600, 76800, or 115200)	*BaudRate 9600*
Network Address (if applicable) (0-255)	*Address 1*
CO sensor range (if applicable) (0-100, 0-150, 0-300, 0-400 or 0-500)	*CO Range 0-300ppm*
NO_2 sensor range (if applicable)	*NO2Range 0-10ppm*
Temperature sensor range (if applicable) (-20 to 50°C, 0 to 50°C, -4 to 122°F, 32 to 122°F)	*T Range -20-50°C*

After the above display, the alarm buzzer will beep twice (if applicable)

The start-up mode will continue with a one minute countdown	*Warm Up 60 Sec*

During the warm-up mode the alarms will be set to off, the Status LED will flash green, all communications are disabled, the key pad is disabled and any analog output will be set to minimum value.

Immediately after the start-up mode, the device will enter normal mode.

OPERATION - NORMAL

During normal operation, the installed sensor measurements are read and displayed on the LCD. The analog outputs are updated with the appropriate values and alarm conditions are monitored.

In normal operation the sensor(s) will measure the gas concentration level in the surrounding air and output a proportional value on the analog output which is scaled to the default range of 0-300 ppm CO or 0-10 ppm NO_2.

The temperature sensor can be ordered as a feed through with different sensor options, or as a transmitter. When configured as a transmitter output signal is scaled 4-20 mA or 0-5/0-10 Vdc or network variable depending on the device model. The temperature range may be changed to -20-50 °C (-4-122°F) or to 0-50°C (32-122°F) via the Setup Menu.

If the model also includes a NO_2 sensor, then the output signal is scaled 0-10 ppm = 4-20 mA or 0-5/0-10 Vdc or as a network variable.

The sensor readings are also displayed on the LCD depending on the device model and can also be configured with the Setup Menu. There are several configurations on how information is displayed, see the Menu section for full details. Example displays are shown below.

| CO xxx ppm | NO2 xx.x ppm | CO xxx NO2 xx.x | CO Detector | NO2 Detector | CO / NO2 Detector |

| Temp 24.5 °C | CO xxx 24.5 °C | NO2 xx.x 76.1 °F |

OPERATION - ALARMS

	Start Up	Normal	TEST MODE	Comm failure with CO Sensor POD	Comm failure with NO_2 Sensor POD	CO ppm > Buzzer Setpoint	NO_2 ppm > Buzzer Setpoint	ppm > Strobe Setpoint	ppm > Alarm 1 Setpoint
Status LED	Flashing GREEN	GREEN	Flashing RED	Flash RED every 10 minutes	Flash RED every 10 minutes	Flashing RED	Flashing RED	Flashing RED	Flashing RED
Strobe LED	OFF	OFF	Flashing	-	-	-	-	Flashing	-
Alarm LED	OFF	OFF	RED	-	-	-	-	-	RED
Buzzer	OFF	OFF	Beep Every 15 seconds	Short every 10 minutes	Short every 10 minutes	ON-Short	ON-Long	-	-

NOTE:
• The sensor readings are compared to pre-set setpoints for alarms and if they are exceeded the device enters Alarm Mode
• The 2 alarms are always present with network devices
• The alarms are only present on analog devices if the relays are also included
• There is no alarm associated with the temperature value
• Alarm1 is always tied to Relay1 (if present) and Alarm2 is always tied to Relay2 (if present)
• Alarm1 and Alarm2 may be freely assigned to CO or NO_2
• The alarm resets back to Normal Mode which can be configured via the menu as either Automatic reset or Manual Reset
• When an alarm condition occurs, the alarm status will be displayed alternately with the normal display. If more than one alarm occurs, then they will alternate every 2 seconds with the normal display. This includes all active alarm conditions

| CO xxx ppm | Alarm1 CO xxx | Alarm2 NO2 xx.x | CO xxx ppm |

• When a buzzer alarm condition occurs, the buzzer alarm status will be displayed alternately with the normal display. If more than one alarm occurs, then they will alternate every 2 seconds with the normal display. This includes all active alarm conditions.

| CO xxx ppm | Buzzer CO xxx | Buzzer NO2 xx.x | CO xxx ppm |

• For a CO buzzer alarm, the sound is a short beep
• For an NO_2 buzzer alarm, the sound is a long beep

- The LCD will display an alarm if a sensor POD is not communicating and the buzzer will beep once every ten minutes. The buzzer can be silenced by pressing the TEST switch.

NO2 Sens Error	CO Sens Error

- The Automatic Alarm Reset operates as described below:

AUTOMATIC ALARM RESET (DEFAULT)

The trip point, hysteresis and delay time of each alarm can be programmed via the menu. For example, Alarm1 defaults to a 50 ppm CO trip point, 10 ppm hysteresis and 2 minute delay time. Alarm2 defaults to a 150 ppm CO trip point, 20 ppm hysteresis and 2 minute delay time All of these values can be changed via the menu. In the example for Alarm1, a timer is started when the CO level exceeds 50 ppm (the trip level). If the level drops below 50 ppm before 2 minutes (the delay time) has expired, then the alarm is not activated. If the CO level exceeds 50 ppm for 2 minutes then the alarm is activated. The alarm will remain activated until the CO level drops below 40 ppm (trip level – hysteresis). This alarm can be used to signal a "low alarm". Alarm2 operates in the same manner and has independently programmable trip point, hysteresis and delay time. This alarm can be used to signal a "high alarm". The LCD will indicate the Alarm mode details and the LED will flash red. If the device has the optional relays, then Relay1 is tied to Alarm1 and Relay2 is tied to Alarm2.

The buzzer alarm defaults to a 150 ppm CO trip point and 5 minute delay time and can be programmed similarly to Alarm1 and Alarm2. When the trip point is exceeded for a time longer than the delay time, then the buzzer will sound until the CO level falls below the trip point. The buzzer operates independently of Alarm1 and Alarm2 and can be disabled via the menu. If enabled, and the device is in Alarm mode, pressing the TEST switch will "silence" the buzzer only. Buzzer silence will only hold until the buzzer alarm condition is cleared so the next buzzer setpoint alarm will activate the buzzer again. The TEST switch will not change status of LEDs, only silence the Buzzer.

The Strobe alarm defaults to a 150 ppm CO trip point and 5-minute delay time and can be programmed similarly to buzzer alarm. When the trip point is exceeded for a time longer than the delay time, then the Strobe LED will flash until the CO level falls below the trip point. The Strobe LED operates independently of Alarm1 and Alarm2 and can be disabled via the menu. If enabled, and the device is in Alarm mode, pressing the TEST switch will have no impact on Strobe.

MANUAL ALARM RESET

In this case, the alarms will activate the same way as described above but will not automatically reset to Normal Mode when the CO level drops below the trip level - hysteresis value. In order to reset the alarms to Normal Mode the user must also press the TEST switch on the front cover (or activate the remote TEST input). If the CO level is below the alarm level AND the TEST switch is pressed, then the alarms will return to the Normal Mode.

The Manual Reset also applies to the buzzer alarm. If the buzzer alarm is active, pressing the TEST switch will "silence" the buzzer. If the buzzer alarm was active but the CO level has been reduced below the trip point, then the TEST switch must be pressed to reset the buzzer alarm to the Normal Mode.

OPERATION - TEST MODE

The Test mode function is disabled by default, it must be enabled via the menu to operate. To initiate the Test function during normal operation, either press and hold the TEST switch, located on front cover for 1 second or activate it remotely by shorting the TEST + to COM. This will cause the Status LED to blink red, all analog outputs to go to 100% and both alarms to activate. The buzzer will also beep once every 15 seconds if enabled and the LCD will indicate the Test mode and the remaining time. The Test function will continue for 5 minutes (default) and then the device will reset to normal operation. The Test function can be canceled by pressing the TEST switch a second time. Test mode cannot be activated if the device is in Fault, Alarm or Re-Cal modes of operation, only in Normal mode. The Test function is useful to verify the output and alarm relay operation and the Test time can be programmed via the menu. The Test Mode display will show even if the LCD mode is set to off.

TestMode 300 Sec	TestMode 299 Sec

OPERATION - FAULT MODE

The Fault mode function is disabled by default, it must be enabled via the menu to operate. The Fault function will monitor the CO and NO_2 sensor lifetime and indicate when either sensor should be replaced. If the device determines that the sensor has reached the end of its useful life and that replacement is necessary, it will enter Fault mode. This will cause the Status LED to blink red and the buzzer to beep once every 10 minutes. The LCD will periodically show "Sensor Fault". The Fault mode can be disabled via the menu or enabled at any time. If enabled, and the device is in Fault mode, pressing the TEST switch will "silence" the buzzer due to the Fault alarm only. Buzzer silence due to the Fault alarm will hold until the fault condition is reset via the menu. The buzzer may still activate due to a setpoint alarm if enabled. The Fault Mode display will show even if the LCD mode is set to off.

CO	CO	NO2
xxx ppm	Fault	Fault

OPERATION - RE-CAL MODE

The Re-Cal mode function is enabled by default, it must be disabled via the menu if it is not required. The Re-Cal function will monitor the device and indicate when the CO or NO_2 sensors should be re-calibrated. If the device determines that the sensor requires re-calibration it will enter Re-Cal mode. This will cause the Status LED to blink red and the buzzer to beep once every 10 minutes. The LCD will periodically show " CO Cal Required" or "NO_2 Cal Required" as applicable. If enabled, and the device is in Re-Cal mode, pressing the TEST switch will "silence" the buzzer due to the Re-Cal alarm only. Buzzer silence due to the Re-Cal alarm will hold until the Re-Cal condition is reset via the menu. The buzzer may still activate due to a setpoint alarm if enabled. The Re-Cal Mode display will show even if the LCD mode is set to off.

CO	CO Cal	NO2 Cal	CO
xxx ppm	Required	Required	xxx ppm

OPERATION - SETUP MENU

The device has several parameters that can be configured locally via the Setup menu using the keypad and LCD. All parameters default to typical values but the installer may want to change some values. In some cases, such as the device network address, the installer MUST change the settings before operation. Any changes made are saved in non-volatile memory and are restored in case of a power loss. Only the menu items relevant to the device model will be shown. The menu can be accessed at any time after the warm-up mode and if there is 5 minutes of inactivity the menu will close, and normal operation will continue. Note that the TEST switch has no affect when the Setup menu is in use.

The menu has several items as shown below. To enter the menu, press and release the <MENU> key. This will enter the Setup Menu step 1, pressing the <MENU> key a second time saves the setting and advances to step 2. Each press of the <MENU> key saves the current setting and advances the menu item. The <UP> and <DOWN> keys are used to make changes to program variables by scrolling through the available options. Holding the <UP> or <DOWN> key will scroll through some options at a faster rate. To access the keys open the cover, keys are located on PCB and are marked. When a value is changed, use <MENU> to save it to memory and advance to the next menu item. The first column below shows what will be displayed on the LCD, including the default value.

| <Menu> | Press and release the <Menu> key to enter the Setup Menu |

Only if **CO is sensor is installed** & the output type is **Voltage or mA**

| **1. CO RANGE** | CO Range 0-300ppm | Press the <UP> or <DOWN> keys to scroll through the available options. The CO sensing range and output scale can be changed to 0-100ppm, 0-150ppm, 0-300pm, 0-400ppm, or 0-500ppm. The factory default CO range is 0-300ppm. |

| <MENU> | Press to advance to next menu item |

2. TEMP RANGE

T Range -20-50°C

Press the <UP> or <DOWN> keys to scroll through the available options. The temperature sensing range and output scale can be changed to -20 to 50°C, 0 to 50°C, -4 to 122°F, 32 to 122°F if necessary. The factory default temperature range is -20 to 50°C.

<MENU>   Press to advance to next menu item

3. BUZZER

Buzzer Enable

Use <UP> or <DOWN> to enable or disable the buzzer alarm. When disabled, the buzzer will not sound if the buzzer trip point is exceeded. The buzzer will still beep on startup and will still beep for a fault alarm (if enabled) and Re-Cal alarm (if enabled). The factory default is Enable.

<MENU>   Press to advance to next menu item

Only if the **buzzer** & **CO sensor** is installed

4. CO BUZZER TRIP POINT

CO Buzz Trip 150

Press the <UP> or <DOWN> keys to scroll through the available options. The buzzer alarm trip point for CO may be set to OFF or from 20 to 500 ppm in 10 ppm increments. The default if 150 ppm. The buzzer may operate as a CO alarm, an NO_2 alarm or both depending on the trip point settings. If set to OFF, then the buzzer will not operate as a CO alarm.

<MENU>   Press to advance to next menu item

5. CO BUZZER DELAY

CO Buzz Dly 5Min

Press the <UP> or <DOWN> keys to scroll through the available options. The CO buzzer delay may be set from 0 to 10 minutes in 1-minutes increments. Is only available if the CO Buzzer Trip is enabled not set to OFF. The default is 5 minutes.

<MENU>   Press to advance to next menu item

Only if the **buzzer** & **NO_2 sensor** is installed

6. NO_2 BUZZER TRIP POINT

NO2 Buzz Trip 2

Press the <UP> or <DOWN> keys to scroll through the available options. The buzzer alarm trip point for NO_2 may be set to OFF or from 1 to 10 ppm in 1 ppm increments. The default is 2 ppm. The buzzer may operate as a CO alarm, an NO_2 alarm or both depending on the trip point settings. If set to OFF, then the buzzer will not operate as an NO_2 alarm.

<MENU>   Press to advance to next menu item

7. NO_2 BUZZER DELAY

NO2 Buzz Dly 5Min

Press the <UP> or <DOWN> keys to scroll through the available options. The NO_2 buzzer delay may be set from 0 to 10 minutes in 1-minute increments. The default is 5 minutes.

<MENU>   Press to advance to next menu item

Only if the **buzzer** is enabled

8. BUZZER

Buzzer Test OFF

Press the <UP> or <DOWN> to toggle the buzzer ON or OFF.

<MENU>   Press to advance to next menu item

9. STROBE

Strobe Enable	Use <UP> or <DOWN> to enable or disable the Strobe LED. When disabled, the Strobe will not flash if the strobe trip point is exceeded. The strobe will still flash on startup and will still flash for a fault alarm (if enabled). The factory default is Enable.

<MENU> Press to advance to next menu item

--- Only if the **strobe** is enabled and the **CO sensor** is installed ---

10. CO STROBE TRIP	*CO Strb Trip 150*	Use <UP> or <DOWN> to scroll through the available options. The strobe alarm trip point for CO may be set to OFF or from 20 to 500 ppm in 10 ppm increments. The default is 150 ppm. The strobe may operate as a CO alarm, a NO_2 alarm or both depending on the trip point settings. If set to OFF, then the strobe will not operate as a CO alarm.

<MENU> Press to advance to next menu item

--- Only if the **strobe** is enabled, the **CO sensor** is installed and the **CO Strb Trip** is not set to **OFF** ---

11. CO STROBE DELAY	*CO Strb Dly 5Min*	Use <UP> or <DOWN> to scroll through the available options. The CO strobe delay may be set from 0 to 10 minutes in 1 minute increments. The default is 5 minutes.

<MENU> Press to advance to next menu item

--- Only if the **strobe** is enabled, the **NO_2 sensor** is installed ---

12. NO_2 STROBE TRIP	*NO2 Strb Trip 2*	Use <UP> or <DOWN> to scroll through the available options. The strobe alarm trip point for NO_2 may be set to OFF or from 1 to 10 ppm in 1 ppm increments. The default is 2 ppm. The strobe may operate as a CO alarm, a NO_2 alarm or both depending on the trip point settings. If set to OFF, then the strobe will not operate as a NO2 alarm.

<MENU> Press to advance to next menu item

--- Only if the **strobe** is enabled, the **NO_2 sensor** is installed and the **NO_2 Strb Trip** is not set to **OFF** ---

13. NO_2 STROBE DELAY	*NO2 Strb Dly 5Min*	Use <UP> or <DOWN> to scroll through the available options. The NO2 strobe delay may be set from 0 to 10 minutes in 1 minute increments. The default is 5 minutes.

<MENU> Press to advance to next menu item

--- Only if the **strobe** is enabled ---

14. STROBE TEST	*Strobe Test OFF*	Use <UP> or <DOWN> to toggle the strobe ON or OFF. Press <MENU> to reset to OFF and advance.

<MENU> Press to advance to next menu item

--- Only if **Relay1** installed & only if **2 sensors** are installed ---

15. ALARM 1	*Alarm 1 CO*	Press the <UP> or <DOWN> to scroll through the available options. The available options are CO or NO_2. Alarm1 may be assigned to either sensor. The default is CO.

<MENU> Press to advance to next menu item

16. ALARM 1 SETPOINT

Alarm 1 Trip 50
Alarm 1 Trip 2

Press the <UP> or <DOWN> to change the Alarm1 Setpoint within the limits. If Alarm1 is assigned to CO the range is 20 to 500 ppm in 10 ppm increments and default is 50 ppm. If Alarm1 is assigned to NO2 the range is 1 to 10 ppm in 1 ppm increments and default is 2 ppm.

<MENU>   Press to advance to next menu item

17. ALARM 1 HYSTERESIS

Alarm 1 Hyst 10
Alarm 1 Hyst 0.5

Press the <UP> or <DOWN> to change the Alarm1 Hysteresis within the limits. If the Alarm1 is assigned to CO the range is 10 to 100 ppm in 5 ppm increments and default is 10 ppm. If Alarm1 is assigned to NO_2 the range is 0.5 to 2.0 ppm in 0.5 ppm increments. The default is 0.5 ppm.

<MENU>   Press to advance to next menu item

18. ALARM 1 DELAY

Alarm 1 Dly 2Min

Press the <UP> or <DOWN> to change the Alarm1 Delay time within the limits. The delay time may be set from 0 to 10 minutes in 1-minute increments. The default is 2 minutes.

<MENU>   Press to advance to next menu item

19. RELAY OPERATION

Relay 1 Direct

Press the <UP> or <DOWN> to toggle the available options. Relay 1 operation may be set to Direct or Reverse. Direct operation means the relay is normally not energized and will energize on an alarm condition (the NO/NC PCB designations are correct). Reverse operation means the relay is normally energized and will de-energize on an alarm condition (the NO/NC PCB designations are reversed). Reverse operation can be used for 'Fail Safe' operation as the relay will change state on power loss. The default is Direct.

<MENU>   Press to advance to next menu item

20. RELAY TEST

Relay 1 Test OFF

Press the <UP> or <DOWN> to toggle Relay1 ON or OFF to test the relay operation.

<MENU>   Press to advance to next menu item

— Only if **Relay2 & 2 sensors** are installed —

21. ALARM 2

Alarm 2 CO

Press the <UP> or <DOWN> to scroll through the available options. The available options are CO or NO_2. Alarm 2 may be assigned to either sensor. The default is CO.

<MENU>   Press to advance to next menu item

22. ALARM 2 TRIP POINT

Alarm 2 Trip 150
Alarm 2 Trip 4

Press the <UP> or <DOWN> to change the Alarm2 setpoint within the limits. If Alarm2 is assigned to CO the range is 20 to 500 ppm in 10 ppm increments and default is 150 ppm. If Alarm2 is assigned to NO_2 the range is 1 to 10 ppm in 1 ppm increments. Default is 4 ppm.

<MENU>   Press to advance to next menu item

23. ALARM 2 HYSTERESIS

Alarm 2 Hyst 20

Alarm 2 Hyst 0.5

Press the <UP> or <DOWN> to change the Alarm2 Hysteresis within the limits. If Alarm2 is assigned to CO the range is 10 to 100 ppm in 5 ppm increments. The default is 20 ppm. If Alarm2 is assigned to NO_2 the range is 0.5 to 2.0 ppm in 0.5 ppm increments. The default is 0.5 ppm.

<MENU> Press to advance to next menu item

24. ALARM 2 DELAY

Alarm 2 Dly 2Min

Use <UP> or <DOWN> to change the Alarm 2 Delay time within the limits. The delay time may be set from 0 to 10 minutes in 1-minute increments. The default is 2 minutes.

<MENU> Press to advance to next menu item

25. RELAY 2 DIRECT/ REVERSE

Relay 2 Direct

Use <UP> or <DOWN> to toggle the available options. Relay 2 operation may be set to Direct or Reverse. Direct operation means the relay is normally not energized and will energize on an alarm condition (the NO/NC PCB designations are correct). Reverse operation means the relay is normally energized and will de-energize on an alarm condition (the NO/NC PCB designations are reversed). Reverse operation can be used for 'Fail Safe' operation as the relay will change state on power loss. The default is Direct.

<MENU> Press to advance to next menu item

26. RELAY 2 TEST

Relay 2 Test OFF

Use <UP> or <DOWN> to toggle relay2 ON or OFF to test the relay operation. Press <MENU> to reset to OFF.

<MENU> Press to advance to next menu item

27. RELAY 2 TEST MODE

TestMode Disable

Use <UP> or <DOWN> to disable or enable the test mode. The default is Disable. When disabled, the front panel TEST switch or TEST input will not initiate the test function. When enabled, pressing the TEST switch will initiate the test function. Note that the test mode will only function is the device is operating in the Normal mode, the test function cannot be initiated if any alarm is present.

<MENU> Press to advance to next menu item

28. RELAY 2 TEST MODE TIME

TestMode Time 5

Use <UP> or <DOWN> to change the test mode time within the limits. The test mode operating time may be set from 1 to 15 minutes in 1-minute increments. The default is 5 minutes. This item sets how long the test mode will operate when the TEST switch is pressed.

<MENU> Press to advance to next menu item

29. CO FAULT MODE TIMER

CO Fault Disable

Use <UP> or <DOWN> to set the CO fault mode timer to Disable, 3, 4, 5, 6 years or Reset. The factory default is Disable. When disabled, the device will not sound the buzzer or provide LCD and status LED indication when the CO sensor life is exceeded. When set to 3, 4, 5 or 6 years, the fault alarm will activate to indicate that the CO sensor life is exceeded. If set to Reset and <MENU> is pressed, then the fault condition for the CO sensor is cleared, the CO life-time timer is reset, and CO fault mode remains at the previous setting. The timer is automatically reset if the CO sensor is replaced. If the desired time has already been exceeded, then it cannot be selected.

<MENU>   Press to advance to next menu item

Only if **NO$_2$ Sensor** is installed

30. NO$_2$ FAULT MODE TIMER

NO2 Fault Disable

Use <UP> or <DOWN> to set the NO$_2$ fault mode timer to Disable, 1, 2, 3, 4 years or Reset. The factory default is Disable. When disabled, the device will not sound the buzzer or provide LCD and status LED indication when the NO$_2$ sensor life is exceeded. When set to 1, 2, 3 or 4 years, the fault alarm will activate to indicate that the NO$_2$ sensor life is exceeded. If set to Reset and <MENU> is pressed, then the fault condition for the NO$_2$ sensor is cleared, the NO$_2$ life-time timer is reset and NO$_2$ fault mode remains at the previous setting. The timer is automatically reset if the NO$_2$ sensor is replaced. If the desired time has already been exceeded, then it cannot be selected.

<MENU>   Press to advance to next menu item

Only if **CO Sensor** is installed

31. CO RECAL MODE

CO ReCal 1 Year

Use <UP> or <DOWN> to set the CO recalibration mode timer to Disable, 1, 2, 3 years or Reset. The default is 1 Year. When disabled, the device will not sound the buzzer or provide LCD and status LED indication when the CO sensor requires recalibration. When set to 1, 2 or 3 years, the Re-Cal alarm will activate to indicate that the CO sensor requires recalibration. If set to Reset and <MENU> is pressed, then the Re-Cal condition for the CO sensor is cleared, the CO Re-Cal timer is reset and the CO Re-Cal mode remains at the previous setting. The timer is automatically reset if the CO sensor is replaced. If the desired time has already been exceeded, then it cannot be selected. If the CO sensor is calibrated with gas via the User Menu then the timer will be automatically reset.

| <MENU> | Press to advance to next menu item |

Only if NO$_2$ Sensor is installed

32. NO$_2$ RECAL MODE [2]

NO2ReCal 1 Year

Use <UP> or <DOWN> to set the NO2 recalibration mode timer to Disable, 1, 2, 3 years or Reset. The default is 1 Year. When disabled, the device will not sound the buzzer or provide LCD and status LED indication when the NO$_2$ sensor requires recalibration. When set to 1, 2 or 3 years, the Re-Cal alarm will activate to indicate that the NO$_2$ sensor requires recalibration. If set to Reset and <MENU> is pressed, then the Re-Cal condition for the NO$_2$ sensor is cleared, the NO$_2$ Re-Cal timer is reset and the NO$_2$ Re-Cal mode remains at the previous setting. The timer automatically resets if the NO$_2$ sensor is replaced. If the desired time has already been exceeded, then it cannot be selected. If the NO$_2$ sensor is calibrated with gas via the User Menu then the timer will be automatically reset.

| <MENU> | Press to advance to next menu item |

33. ALARM MODE

Alarm Md Auto

Use <UP> or <DOWN> to set the Alarm Mode to Auto or Manual. The default is Auto. This setting controls how Alarm1, Alarm2 and the buzzer alarm resets back to Normal mode. For the Auto setting, the device will reset the alarms automatically once the gas level drops below the set alarm thresholds. For the Manual setting, the gas level must be below the alarm thresholds AND the user must press the TEST switch on the device to reset the alarms.

| <MENU> | Press to advance to next menu item |

Only if CO Sensor is installed

34. CO ZERO FILTER

0 Filter CO ON

Use <UP> or <DOWN> to turn ON or OFF the CO zero filter. When ON, the device will filter low ppm readings such that 0-5 ppm CO will display and output 0 ppm. When OFF, 0-5 ppm will display and output actual 0-5 ppm. The factory default is ON. Note that the zero filter is automatically disabled when performing a CO gas calibration.

| <MENU> | Press to advance to next menu item |

Only if NO$_2$ Sensor is installed

35. NO$_2$ ZERO FILTER [2]

0 Filter NO2 ON

Use <UP> or <DOWN> to turn ON or OFF the NO$_2$ zero filter. When ON, the device will filter low ppm readings such that 0-0.5 ppm NO$_2$ will display and output 0 ppm. When OFF, 0-0.5 ppm will display and output actual 0-0.5 ppm. The factory default is ON. Note that the zero filter is automatically disabled when performing a NO$_2$ gas calibration.

<MENU>   Press to advance to next menu item

36. DISPLAY

*Display
CO ppm*

Use <UP> or <DOWN> to select either CO ppm, NO_2 ppm, CO + NO_2, Temp, CO + Temp, NO_2+Temp, Status or None.

When set to CO ppm, only the actual ppm value of the CO reading will be displayed on the LCD. When set to NO_2 ppm, only the NO_2 ppm reading will be displayed and CO + NO_2 will display both values. If set to Temp, only the temperature is displayed. If set to CO + Temp, then the CO and temperature values are displayed. If set to NO_2+Temp, then the NO_2 and temperature values are displayed. If set to Status, the ppm values will not be displayed only the device operating status. If set to None, there will not be any LCD display information in Normal mode (the LCD will still work for menu operation).

The default and available options depend on the installed sensors. For example, if the device only has a CO sensor, then CO ppm is the default and the only other options available will be Status and None. If both sensors are installed, then the default will be CO + NO_2. If the temperature sensor is not installed (or resistive) then no Temp display will be available. For Status, the normal display is CO Detector, NO_2 Detector or CO / NO_2 Detector as applicable. If set to None, then the backlight will be forced to Auto. If set to None, the test function still causes the LCD to display while in test mode.

<MENU>   Press to advance to next menu item

37. BACKLITE

*Backlite
Auto*

Use <UP> or <DOWN> to select the LCD backlight operation as Auto, Off or On. Auto means the backlight only operates when the menu is accessed, On means the backlight is always on and Off means it never lights. The default is Auto.

<MENU>   Press to advance to next menu item

─── Only if **Output is Voltage** is installed ───

38. OUTPUT   *Output
0-5 Vdc*   Use <UP> or <DOWN> to toggle the voltage output type to either 0-5 Vdc or 0-10 Vdc. The default is 0-5 Vdc.

<MENU>   Press to advance to next menu item

─── Only if **Modbus** model ───

39. ADDRESS   *ModBus
Addr 1*   Use <UP> or <DOWN> to select a unique slave address from 1-255. The default Modbus slave address is 1. Each device on the network must have a unique address.

<MENU>   Press to advance to next menu item

─── Only if **BACnet**® model ───

40. ADDRESS   *BACnet
MAC 3*   Use <UP> or <DOWN> to select a unique address from 0-127. The default BACnet address is 3. Each device on the network must have a unique address.

<MENU>   Press to advance to next menu item

41. BAUD RATE

BaudRate 9600

Use <UP> or <DOWN> to select a baud rate of 9600, 19200, 38400, 57600, 76800 or 115200 as required. The default baud rate is 9600.

<MENU>   Press to advance to next menu item

42. PARITY

ModBus Parity N

Use <UP> or <DOWN> to select a parity value of None, Odd or Even. The default ModBus parity is None.

<MENU>   Press to advance to next menu item

43. STOP BITS

ModBus Stop 1

Use <UP> or <DOWN> to toggle the stop bits between 1 and 2. The default ModBus stop bits is 1.

<MENU>   Press to advance to next menu item

44. CRC

ModBus CRC A001

Use <UP> or <DOWN> to set the CRC value to A001 (CRC-16 reverse), 1021 (CITT), 8005 (CRC-16), or 8408 (CITT reverse). The default CRC polynomial is OxA001.

<MENU>   Press to advance to next menu item

45. DELAY

ModBus Del MIN

Use <UP> or <DOWN> to change the value from Minimum to 50, 100, 150, 200, 250, 300 or 350mS. The factory default ModBus slave response delay is Minimum *(minimum delay means just more than 3.5 character time delays, 4ms for 9600 baud rate, for example).*

<MENU>   Press to advance to next menu item

46. ZERO CALIBRATION

CO Zero Cal GO

then

CO Zero Cal DONE

This item allows zero calibration of the CO sensor. Ensure the sensor is in clean air. Press and hold the <UP> key for 3 seconds to initiate the calibration process. When the calibration is complete, the display will indicate DONE. Then press <MENU> to advance to the next selection. A CO Zero Calibration Counter is incremented every time this step is performed. The CO ReCal timer is reset whenever this step is performed.

<MENU>   Press to advance to next menu item

47. SPAN CALIBRATION

CO 250 Cal GO

then

CO 250 Cal DONE

This item allows span calibration of the CO sensor. Apply 250 ppm CO gas to the sensor. Press and hold the <UP> key for 3 seconds to initiate the calibration process. When the calibration is complete, the display will indicate DONE. Then press <MENU> to advance to the next selection. A CO 250 Calibration Counter is incremented every time this step is performed. The CO Re-Cal timer is reset whenever this step is performed.

<MENU>   Press to advance to next menu item

48. ZERO CALIBRATION

NO2 Zero Cal GO
then
NO2 Zero Cal DONE

This item allows zero calibration of the NO$_2$ sensor. Ensure the sensor is in clean air. Press and hold the <UP> key for 3 seconds to initiate the calibration process. When the calibration is complete, the display will indicate DONE. Then press <MENU> to advance to the next selection. A NO$_2$ Zero Calibration Counter is incremented every time this step is performed. NO$_2$ Re-Cal timer is reset whenever this step is performed.

<MENU>   Press to advance to next menu item

49. SPAN CALIBRATION

NO2 10 Cal GO
then
NO2 10 Cal DONE

This item allows span calibration of the NO$_2$ sensor. Apply 10 ppm NO$_2$ gas to the sensor. Press and hold the <UP> key for 3 seconds to initiate the calibration process. When the calibration is complete, the display will indicate DONE. Then press <MENU> to advance to the next selection. A NO$_2$ 10 Calibration Counter is incremented every time this step is performed. The NO$_2$ Re-Cal timer is reset whenever this step is performed.

<MENU>   Press to advance to next menu item

50. TEMP OFFSET

T Offset 0.0 °C

This item allows offset calibration of the temperature sensor. Use <UP> or <DOWN> to add an offset to the temperature measurement. -1.0 subtracts 1.0° from the reading, +1.2 adds 1.2° to the reading. Units depend on the range selected, either °C or °F. The offset resets to 0.0 if the units are changed. The range is -5.0 to +5.0 for °C and -10.0 to +10.0 for °F. Resolution is 0.1°.

<MENU>   Press to exit the Setup Menu and return to normal mode

SPECIFICATIONS

Gas Type Detected	Carbon Monoxide (CO) and/or Nitrogen Dioxide (NO_2)
Sensor Type	Electrochemical, diffusion sampling
Ambient Sensor Accuracy	**CO:** ±5ppm, or ±5% of reading
	NO_2: ±0.2ppm or ±5% of reading
Measurement Range	**CO:** 0 - 500ppm, adjustable 100 - 500ppm
	NO_2: 0 - 10ppm
Response Time	<30 seconds typical
Warm-Up Time	1 minute
Sensor Coverage Area	700m^2 (7500ft^2) or 15m (50ft) radius
Sensor Life Span	**CO:** 5-7 years in air
	NO_2: 2 years
Sensor Reproducibility (same day)	±2%
Long Term Drift	**CO:** <5% per year
	NO_2: Zero, <±0.2ppm per year
	Span, <2% signal/month

GENERAL

Power Supply	24 Vdc ±20% or 24 Vac ±10% (non-isolated half-wave rectified)
Protection Circuitry	Reverse voltage protected and transient protected
Output Signal Type	4-20 mA (3-wire), 0-5 Vdc / 0-10 Vdc, BACnet® or Modbus
Network Interface	**Hardware:** 2 wire RS-485
	Software: Native BACnet® MS/TP or Modbus RTU
	Baud Rate: Locally set 9600, 19200, 38400, 57600, 76800, or 115200
	MAC Address Range: 0-255 (Factory default is 1)
	(128 devices max on one daisy chain)
Current Consumption	425 mA @ 24 Vac max, 220 mA @ 24 Vdc max (test mode)
Output Drive Capabilities	**Current:** 550Ω maximum
	Voltage: 10,000Ω minimum
Ambient Operating Range	-20 to 50°C (-4 to 122°F), 15 to 90 %RH non-condensing
Storage Temperature	-30 to 60°C (-22 to 140°F)
Display (LCD)	Viewable or concealed (with cover closed)
	Units: ppm for CO/NO_2, °C/°F for optional temperature
	Size: alpha-numeric 2-line x 8 characters
	35mm W x 15mm H (1.4" x 0.6")
	Backlight: Enable or disable via menu
User Interface	Silence / Test button, Bi-color status LED, Red LED Alarm indicator, White high intensity LED strobe (optional)

TEMPERATURE SIGNAL (OPTIONAL)

Type	Thermistor or RTD
Accuracy	**Thermistors:** ±0.2°C (±0.36°F) @ 25°C (77°F)
	Platinum RTD's: ±0.3°C (±0.54°F) @ 0°C (32°F)
	Nickel RTD's: ±0.4°C (±0.72°F) @ 0°C (32°F)
Output	2 Wire Resistive
Type	Analog, BACnet® or Modbus
Sensor Accuracy	±0.2°C (±0.36°F)
Range	-20 to 50°C (-4 to 122°F) or 0 to 50°C (32 to 122°F) (field selectable)
Output	**Analog:** 0-5/0-10 Vdc or 4-20mA (As per output selected)
	BACnet®/Modbus: Network Variable

RELAY OUTPUTS (OPTIONAL)

Contact Ratings	Form C (NO + NC), 5 Amps @ 140 Vac, 5 Amps @ 30 Vdc adjustable setpoints, delay and hysteresis, programmable via menu
Relay Time Delay	Programmable via menu

ALARM (OPTIONAL)

Audible Alarm (optional)	Buzzer, 93dB @ 30cm
Visual Alarm (optional)	High intensity white LED strobe
Enclosure Material	Grey Polycarbonate, UL94-V0
Enclosure Rating	IP65 (NEMA 4) with Security Screw installed
Main Enclosure Dimensions	**Inclu. Sensor Pod:** 202.3 x 184 x 54.5 mm (8 x 7.24 x 2.15")
Main Enclosure Weight	**Inclu. Sensor Pod:** 515 grams (1.14 lbs)
Remote NO_2 Dimensions	**Inclu. Sensor Pod:** 109.5 x 83.3 x 52 mm (4.31 x 3.28 x 2.05")
Remote Enclosure Weight	**Inclu. Sensor Pod:** 109 grams (0.24 lbs)
Wiring Connections	Screw terminal block (14 to 22 AWG)
	Top or bottom conduit entry 22.73 mm (0.875") hole
Approvals	CE
Country of Origin	Canada

DIMENSIONS

184.00 mm
7.24"

160.00 mm
6.29"

170.00 mm
6.69"

32.25 mm
1.26"

54.5 mm
2.15"

82.5 mm
3.25"

69.8 mm
2.75"

32.25 mm
1.26"

52.0 mm
2.05"

76.2 mm
3.00"