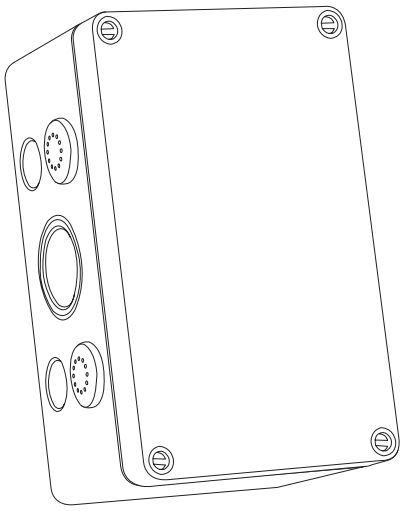


## INTRODUCTION

The $CO_2$ transmitter uses Infrared Technology to monitor $CO_2$ levels and outputs a linear 4-20 mA or 0-5/0-10 Vdc signal. Features include a back-lit LCD with user menu for easy installation and optional control relay with user selectable temperature sensor outputs.

## BEFORE INSTALLATION

Read these instructions carefully before installing and commissioning the $CO_2$ transmitter. Failure to follow these instructions may result in product damage. **Do not use in an explosive or hazardous environment, with combustible or flammable gases, or as a safety or emergency stop device or in any other application where failure of the product could result in personal injury.** Take electrostatic discharge precautions during installation and do not exceed the device specifications. Use 22 AWG shielded wiring for all connections and do not locate the device wires in the same conduit with wiring used to supply inductive loads such as motors. Make all connections in accordance with national and local codes.

## MOUNTING

Select a suitable mounting spot on an exterior wall where the $CO_2$ sensor is best protected from direct exposure to sunlight, wind, etc. preferably on a north facing wall. Do not mount the sensor near opening windows, supply/exhaust air louvres or other known air disturbances. Avoid areas where the sensor is exposed to vibrations or rapid temperature changes. It is recommended that the enclosure be mounted so conduit or cable-gland connections be made on the bottom of the enclosure. See Figure 1.

Remove the cover by using a standard or flat screwdriver to loosen the four screws as shown in Figure 2. As the screws are captive type, complete removal of the screw from the cover is not required.

On the bottom of the enclosure, remove conduit/cable gland entry knockout (s) as required. See Figure 3. Install a conduit fitting or cable gland as shown in Figure 4. It is recommended that weatherproof conduit or cable gland fittings be used.

Mount the sensor directly on an exterior wall using the four integrated mounting holes that are provided on the enclosure. See figure 5. Select the best mounting technique based on the exterior wall material. The 4 mounting holes will facilitate a #10 size screw (not supplied).

After the base is securely fastened to the exterior wall, connect conduit to conduit connector or feed cable through the cable gland and tighten.

Make wire connections as per the "Wiring" illustrations on Page 2. Once wiring and set up are complete and re-install cover and secure by tightening the four screws using a flat screwdriver.

Figure 1

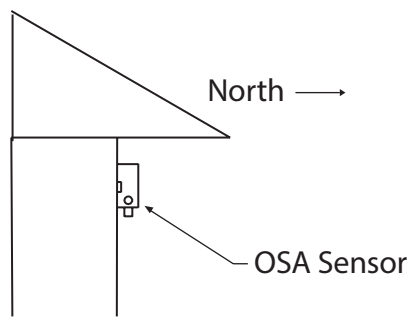



Figure 2

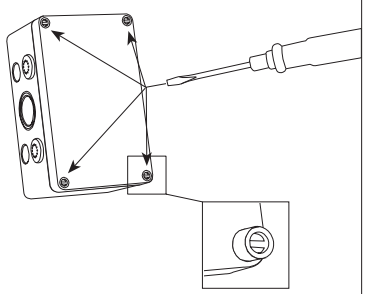


Figure 3

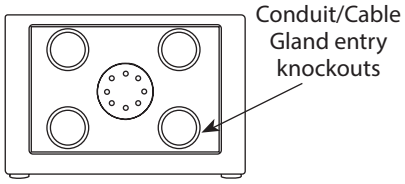



Figure 4

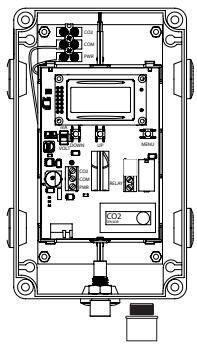
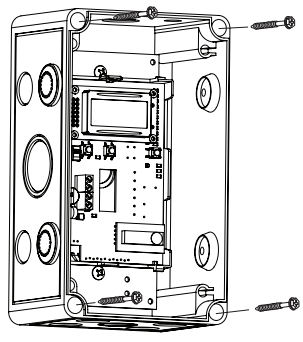


Figure 5



# WIRING

- Deactivate the power supply until all connections are made to the device to prevent electrical shock or equipment damage. Use 16-22 AWG shielded wire for all connections (only ground the shield at the controller end) and do not locate the device wires in the same conduit with wiring used to supply inductive loads such as motors. Pull at least six inches of wire into the enclosure and complete the wiring connection according to the wiring diagram.
- **NOTE:** The H (Heated) & N (Unheated) series have different connection terminals as shown on the diagrams.
- Select the desired signal output type by sliding the Output switch into desired position as shown in Figure 6. The factory default is "VOLT" and set to 0-5 Vdc. It may be changed to 0-10 Vdc during program set up. The "mA" setting provides a 4-20mA output.
- This is a 3-wire sourcing device. Connect the plus dc or the ac voltage hot side to the PWR terminal. The 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. Several devices may be connected to one power supply and the output signals all share the same common. Use caution when grounding the secondary of a transformer or when wiring multiple devices to ensure the ground point is the same on all devices and the controller. See Figure 7.
- The $CO_2$ analog output is available on the CO2 terminal. (see Figure 7) and connects to the controller analog input. Check the controller Analog Input to determine the proper connection before applying power. Both current and voltage signals are referenced to the COM terminal. The current output operates in the active mode and does not require a loop power supply (the signal current is generated by the transmitter and must not be connected to a powered input or device damage will result).

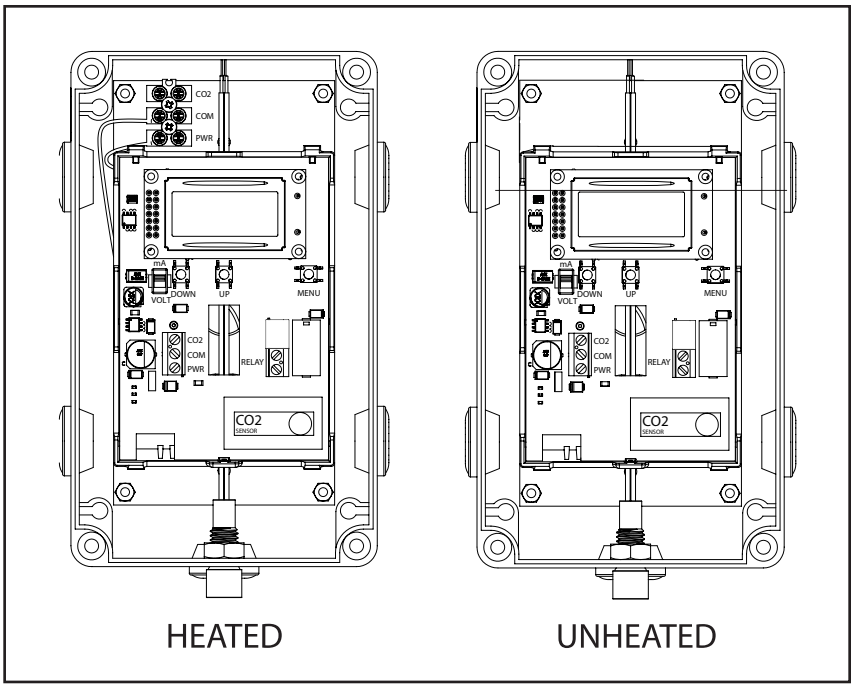



Figure 6

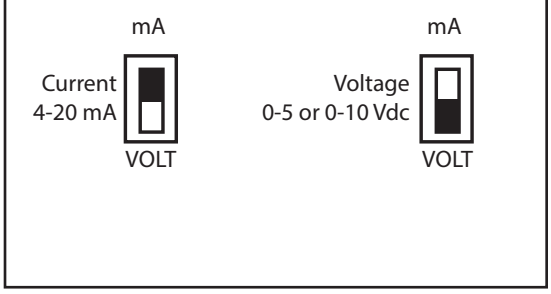
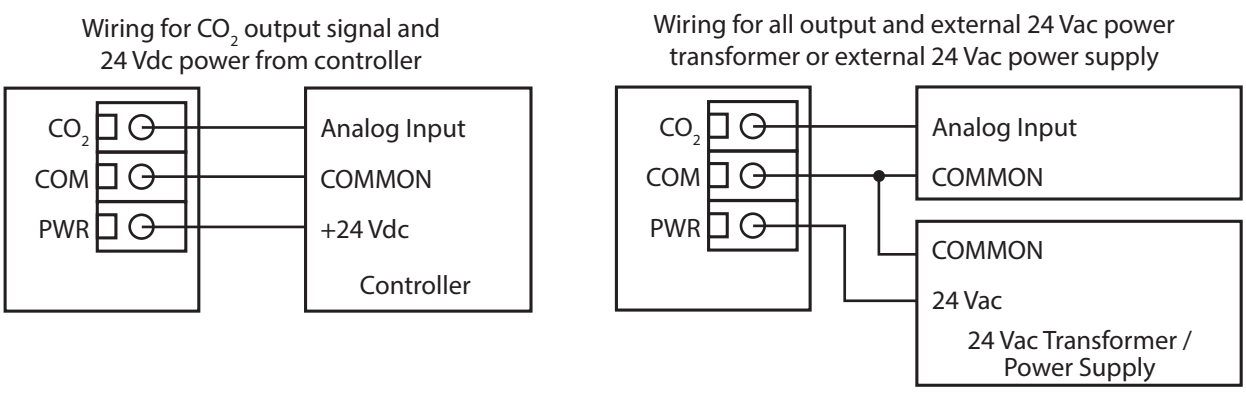



Figure 7



- The relay output is on the N.O. RELAY terminals as shown in Figure 8. The relay output is completely isolated and has a Normally Open (NO) signal. This signal can be used to directly control an alarm or ventilation fan. See specifications for switch rating.
- The optional two-wire temperature sensor output is available with various RTDs and thermistors to suit all control applications and is available as a twisted pair connection. All connections should be made using either butt-splices or soldering. The use of wire nuts is not recommended. See Figure 9

Figure 8

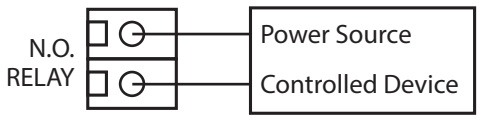
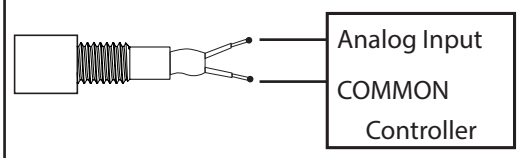



Figure 9




## START-UP

Verify the device is properly wired and connections are tight. Ensure the mA / VOLT switch is set for the correct signal type. Apply power and the LCD will indicate the software version number, the output signal type and then the sensor will begin a one minute warm-up countdown. When the warm-up time expires the device will enter normal mode.

## OUTPUT SCALING

The $CO_2$ output signal is scaled such that 4-20 mA (or 0-5 / 0-10 Vdc) equals 0-2000 ppm by default. The signal span may be changed via the Setup Menu from 1000 to 10,000 ppm in 500 ppm increments.

## OPERATION

The output signal is available on the $CO_2$ terminal and is connected to the BAS analog input which reads the signal and calculates the $CO_2$ ppm value using correct scaling for the range and signal type. The $CO_2$ value is used to control output ventilation devices or initiate alarms. The $CO_2$ value is also displayed locally on the LCD.

If the relay is installed it can control a small fan or alarm by setting the trip value and hysteresis to appropriate values.

If a temperature sensor is installed, it will be wired to an analog input of the BAS that is set for the specific resistance type. This could be a 10 KΩ thermistor, a 1000 Ω RTD or other sensor values. The BAS reads the resistance signal and converts it to a temperature value.

**NOTE: The outside enclosure slows the sensor response time to approximately 30 minutes for a 90% step change of $CO_2$ concentrations.**

## RELAY MODE

The optional relay can be used as an alarm signal to indicate that a setpoint has been exceeded. For the basic $CO_2$ product, the relay may be configured via the Setup Menu as a high or low alarm and the setpoint value, hysteresis and on-delay time may be set. The relay will activate and close the contacts if the $CO_2$ measurement goes above the setpoint (for a high alarm) or below the setpoint (for a low alarm). If required, this action can be delayed by a time period (relay delay time) to prevent false alarms. After the relay is activated, the measurement must fall below the setpoint - hysteresis value (for a high alarm) or go above the setpoint + hysteresis value (for a low alarm) to deactivate the relay and open the contacts. The high/low assignment, setpoint, delay time and hysteresis values may all be programmed via the Setup Menu as required.

## SETUP MENU

The device has several parameters that can be configured locally via the Setup menu using the keypad and LCD. Any changes made are saved in non-volatile memory and are restored in case of a power loss. The menu can be accessed at any time after the start-up mode and if there is 5 minutes of inactivity the menu will close and normal operation will continue.

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. 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

## 1. SPAN

| |
|---|
| *CO2 Span 2000 ppm* |

The $CO_2$ Span value controls the analog output scaling. $CO_2$ span can be changed from 1000 to 10,000 ppm in 500 ppm increments using <UP> or <DOWN>. If $CO_2$ Span = 2000 ppm, then the output signal is scaled 0-2000 ppm = 4-20 mA. Factory default is 2000 ppm.

<MENU> Press to advance to next menu item

## 2. SELF CALIBRATION

| |
|---|
| *Self-Cal ON* |

The Self-Cal feature <MENU> when enabled requires the sensor to be exposed to fresh air for at least one hour every twenty-four hours. When first installed the sensor requires a minimum of seven days of operation with fresh air exposer daily to allow the algorithm to adjust for self-calibration. Default for device is having this feature enabled "ON". If disabling this feature a manual calibration should be performed to ensure accuracy of the device.

<MENU> Press to advance to next menu item

## 3. ALTITUDE

| |
|---|
| *Altitude 0 m* |

The Altitude value allows $CO_2$ compensation for local atmospheric pressure and altitude and ensures the highest $CO_2$ accuracy. Altitude can be changed from 0 to 2550 meters in 50 meter steps using <UP> or <DOWN>. It will take a few moments to change the setting, then the menu will advance to the next step. Factory default is 0 m (sea level).

<MENU> Press to advance to next menu item

## 4. OUTPUT VOLTAGE SPAN

| |
|---|
| *V Output 0-5 Vdc* |

The V Output value controls the analog output voltage span if the PCB switch is set to VOLT. V Output can be set to either 0-5 Vdc or 0-10 Vdc using <UP> or <DOWN>. This setting has no effect if the PCB switch is set to mA. Factory default is 0-5 Vdc.

<MENU> Press to advance to next menu item

## 5. OUTPUT SIGNAL DIRECTION

| |
|---|
| *Output Direct* |

The Output value controls the analog output signal direction. Use <UP> or <DOWN> to change the setting from Direct (4-20 mA, 0-5 Vdc or 0-10 Vdc) to Reverse (20-4 mA, 5-0 Vdc or 10-0 Vdc) if reverse action is required. Factory default is Direct.

<MENU> Press to advance to next menu item

## 6. OUTPUT TEST

*Output Test OFF*

The Output Test value controls the analog output signal for testing purposes. Use <UP> or <DOWN> to toggle the output signal to OFF (normal operation), MIN (minimum output) or MAX (maximum output). The actual output signal will depend on the PCB switch position (mA or VOLT) and the V Output setting (for voltage operation). Press <MENU> to set it back to OFF and advance. Factory default is OFF.

<MENU> Press to advance to next menu item

## 7. DISPLAY

*Display CO2 ppm*

Display is used to control what information is displayed on the LCD. Use <UP> or <DOWN> to select either $CO_2$ ppm or None. Factory default is $CO_2$ ppm.

$CO_2$ ppm Only the actual ppm value of the $CO_2$ reading will be displayed

*CO2 1235 ppm*

None No measurement information is displayed in normal mode the menu will still display in Setup Menu mode

<MENU> Press to advance to next menu item

## 8. BACKLIGHT

*BackLite Auto*

The BackLite setting is used to control how the LCD backlight functions. Use <UP> or <DOWN> to select either Auto, Off or On. Auto means the backlight only lights when a menu is accessed or when the setpoint is activated (ie: when a key is pressed), Off means the backlight is always off and On means it is always on. Factory default is Auto.

<MENU> Press to advance to next menu item

Only if **Relay** option Installed

## 9. RELAY

*Relay CO2*

The Relay setting allows the relay alarm to be assigned to either $CO_2$ High or $CO_2$ Low. Use <UP> or <DOWN> to select.
Factory default is $CO_2$ High.

<MENU> Press to advance to next menu item

## 10. RELAY SETPOINT

*Relay SP 1000 ppm*

The relay setpoint depends on the relay assignment set previously. Use <UP> or <DOWN> to change the setting within the limits as shown in the table. Note that only the one previous selection will be available. Note that a high alarm activates when the measurement exceeds the setpoint and a low alarm activates when the measurement goes below the setpoint. Use <MENU> to save and advance.

| **RELAY ASSIGNMENT** | **DEFAULT SETPOINT** | **SETPOINT RANGE** | ***RESOLUTION*** |
|---|---|---|---|
| $CO_2$ High | 1000 ppm | 500 to 9000 ppm | 100 ppm |
| $CO_2$ Low | 1000 ppm | 500 to 9000 ppm | 100 ppm |

<MENU> Press to advance to next menu item

Only if **Relay** option Installed

## 11. RELAY HYSTERESIS

The Relay Hysteresis Units will either be in ppm for $CO_2$ .

*Relay Hy 50 ppm*

Use <UP> or <DOWN> to change the Relay Hysteresis within the limits as shown in the table.

Note that a high alarm resets when the measurement goes below (setpoint - hysteresis) and a low alarm resets when the measurement goes above (setpoint + hysteresis). Note the value is somewhat dependent on the setpoint (ie: if the $CO_2$ setpoint is 500 ppm then the hysteresis cannot be 500 ppm).

| RELAY ASSIGNMENT | DEFAULT SETPOINT | SETPOINT RANGE | *RESOLUTION* |
|---|---|---|---|
| $CO_2$ High or Low | 50 ppm | 25 to 500 ppm | 25 ppm |

<MENU> Press to advance to next menu item

## 12. RELAY DELAY

*Relay Dly 0min*

Use <UP> or <DOWN> to change the Relay Delay time within the limits. The delay time may be set from 0 to 9 minutes in 1 minute increments to prevent false alarms. The default is 0 minutes (no delay).

<MENU> Press to advance to next menu item

## 13. RELAY TEST

*Relay Test OFF*

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

<MENU> Press to advance to next menu item

## 14. $CO_2$ REFERENCE

*Calibrat Ref 1000 ppm*

The calibration reference screen allows user to set the calibration gas level used for calibrating the sensor. Use <UP> and <DOWN> to adjust the ppm value of calibration gas. The minimum value is 400ppm, the maximum value is 2000ppm. Increment value is 50ppm for each step. Press <MENU> to save and advance. If no calibration gas is available exposing the sensor to fresh outside can be used and calibrate with 400PPM value. Another method is to determine the $CO_2$ ambient level using a calibrated unit as a reference and adjust calibration setting to desired value

<MENU> Press to exit the menu and return to normal mode

## 15. $CO_2$ CALIBRATION

*Calibrat 1000 ppm*

The calibration screen is used for performing calibration of the sensor. To perform calibration of the sensor place calibration hood over sensor housing and apply calibration gas. Wait for several minutes and then press and hold <UP> or down button for 5 seconds until display shows "Calibrat Done" or "Calibrat Fail". Refer to Calibration section in this document for more details.

<MENU> Press to exit the menu and return to normal mode

# CALIBRATION

Calibration with gas requires a field calibration kit (CDD1-CALKIT-GS) with pressure regulator, tubing, sensor adapter and bottle of $CO_2$ gas. The certified calibration gas is applied directly to the $CO_2$ sensor to perform a gas calibration.

Ensure the regulator knob is turned off and then hand tighten the regulator to the 1000 ppm $CO_2$ gas bottle. A length of tubing should be connected between the regulator output and the sensor adapter hood.

Remove the cover of the device to be calibrated to expose the gas sensor. Carefully install the sensor adapter hood over the CO2 sensor on the PCB. The adapter should fit snuggly and securely over the sensor and remain in place during the entire calibration cycle. This will ensure a stable ppm CO2 environment during calibration. Turn the regulator knob on to allow gas to flow to the sensor. The CO2 reading on the LCD will begin to approach ppm level of calibration gas. Wait 3 to 5 minutes until the CO2 reading stabilizes.

Enter the Setup Menu and use the <MENU> key to advance to the "Calibrat" item. Press and hold either the <UP> or <DOWN> key for 5 seconds to start the gas calibration. The LCD will indicate "Calibrat / Done" if the process was successful. If "Calibrat / Fail" is displayed then the process may have to be repeated. Press the <MENU> key to return to normal operation, shut off the gas supply and remove the sensor adapter.

## SPECIFICATIONS

| | |
|---|---|
| Gas Type Detected | Carbon dioxide ($CO_2$) |
| Sensor Type | Dual Wavelength Non-Dispersive Infrared(NDIR) |
| Sensor Accuracy | ± (30 ppm + 3% of measured value) |
| Measurement Range | 0-2000 ppm (default), adjustable 1000-10,000 ppm |
| Temperature Dependency | ±2.5 ppm/°C |
| Response Time | Approx. 30 minutes |
| Warm-Up Time | 1 minute |
| Sensor Life Span | > 15 years |
| Transmitter Accuracy | ±0.25% of span<br>(including linearity, hysteresis and repeatability) |
| Power Supply | 24 Vdc ± 20% or 24 Vac ± 10%<br>(non-isolated half-wave rectified) |
| Protection Circuitry | Reverse voltage and transient protected |
| Input Voltage Effect | Negligible over specified operating range |
| Output Signal Type | 4-20 mA (3-wire), 0-5 or 0-10 Vdc (field selectable) |
| Current Consumption (4-20 mA output) | **Heated:** 1.0 A max @ 24 Vdc<br>1.1 A max @ 24 Vac<br>**Unheated:** 50 mA max @ 24 Vdc<br>100 mA max @ 24 Vac |
| Current Consumption (voltage output) | 50 mA @ 24 Vdc max, 100 mA @ 24 Vac max |
| Output Drive @ 24 Vdc | **Current:** 550Ω max<br>**Voltage:** 10,000Ω min |
| Operating Temperature | **Heated:** -40 to 50°C (-40 to 122°F)<br>**Unheated:** 0 to 50°C (32 to 122°F) |
| Storage Temperature | -40 - 70°C (-22 - 158°F) |
| Operating Humidity | 5 to 90 %RH non-condensing |
| Storage Humidity | 5 to 90 %RH non-condensing |

### CONCEALED LCD DISPLAY

| | |
|---|---|
| Units | ppm ($CO_2$) |
| Range | 0 - 10000 ppm |
| Size | 1.4" w x 0.6" h (35 mm x 15 mm)<br>Alpha-numeric 2 line x 8 character |

### OPTIONAL TEMPERATURE SENSOR

| | |
|---|---|
| Type | Various Thermistors and RTDs |
| Accuracy | **Thermistors:** +/-0.2°C (+/-0.36°F) @ 25°C (77°F)<br>**Platinum RTD's:** +/-0.3°C (+/-0.54°F) @ 0°C (32°F)<br>**Nickel RTD's:** +/-0.4°C (+/-0.72°F) @ 0°C (32°F) |
| Output | 2-wire resistive |
| Relay (optional 2-wire output) | Form A (N.O.), 2 Amps @ 140 Vac / 30 Vdc |
| Enclosure | 110mm W x 180mm H x 89mm D (4.3" x 7.125" x 3.5")<br>IP65 (NEMA 4X) |
| Process Connection | 1/2" NPT |
| Wiring | Screw terminal block (14 to 22 AWG) |
| Approvals | CE |
| Country of Origin | Canada |

# DIMENSIONS