

### INTRODUCTION

The CO<sub>2</sub>/RH/T Transmitter incorporates three sensors in one attractive wall mount enclosure for the most efficient environmental monitoring and control system. It uses Infrared Technology to monitor CO<sub>2</sub> levels within a range of 0 to 2000 ppm or 20,000 ppm, a field-proven RH sensor to monitor relative humidity from 0-100 %RH and a curve-matched thermistor to measure temperature over common field-selectable ranges. All three measurements are continuously available on separate outputs as linear 4-20 mA or 0-5/0-10 Vdc signals. The device includes an LCD for configuration and operating parameters are programmed using a keypad for specific applications. Options include a control relay, override switch and slide pot set-point control.

### BEFORE INSTALLATION

Read these instructions carefully before installing and commissioning the device. Failure to follow these instructions may result in product damage. Do not use 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. Take electrostatic discharge precautions during installation. **Do not exceed device ratings.**

### MOUNTING

The transmitter installs directly on a standard electrical box and should be mounted five feet from the floor of the area to be controlled. Do not mount the sensor near doors, opening windows, supply air diffusers or other known disturbances. Avoid areas where the detector is exposed to vibrations or rapid temperature changes.

The cover is hooked to the base at the top edge and must be removed from the bottom edge first. Use a small Phillips screwdriver to loosen the security screw as shown in Figure 1. Complete removal of the screw is not required. Use the screwdriver to carefully pry each bottom corner if necessary. Tip the cover away from the base and sit it aside as shown in Figure 2.

Sit the PCB aside until the base is mounted on the wall. For added protection, place the PCB in the supplied anti-static bag.

Mount the base by screwing to an electrical box or directly to the wall as shown in Figure 4. The mounting hole locations are shown on page 7.

After the base is screwed to an electrical box or directly to the wall using the appropriate holes, remove the PCB from the anti-static bag, feed connection wires through the center hole and place the top of the PCB into the PCB holders on the backplate and snap the bottom of the PCB into place as shown in Figure 4.

Making wiring connections as per the Wiring illustrations on page 2 and install the decorative cover by placing the top of the cover into the cover holder on the top of the backplate and snapping the bottom into place as shown in Figure 4. Tighten the security screw with a Phillips screwdriver.

Figure 1

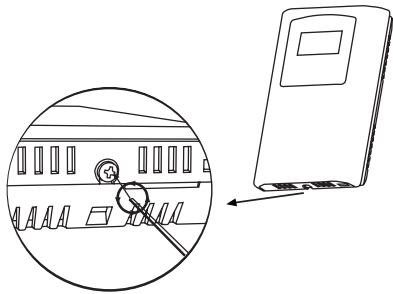


Figure 2

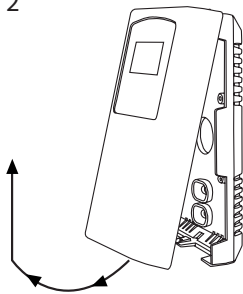


Figure 3

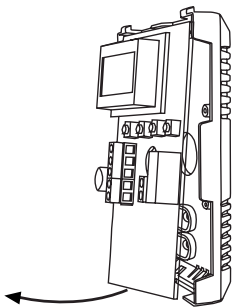
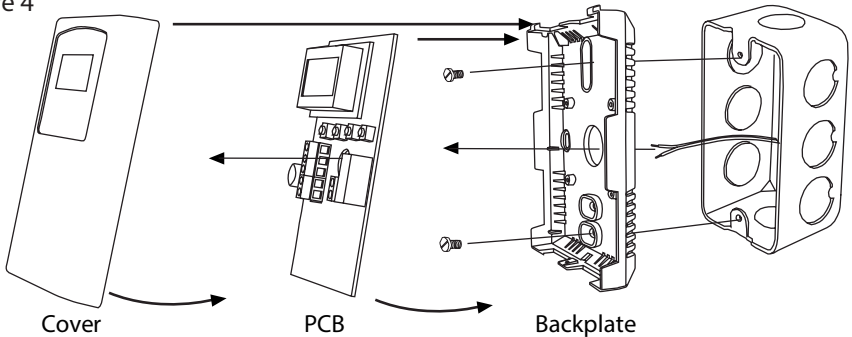


Figure 4



# 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 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.

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

Figure 5

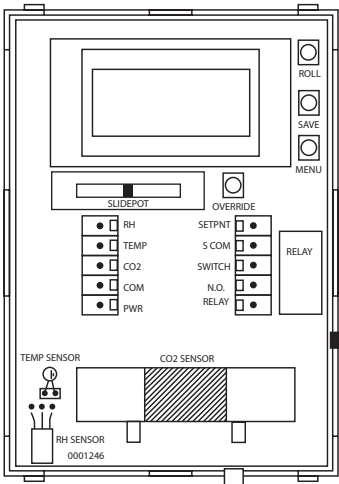


Figure 6

Typical 4-20 mA wiring with 24 Vdc

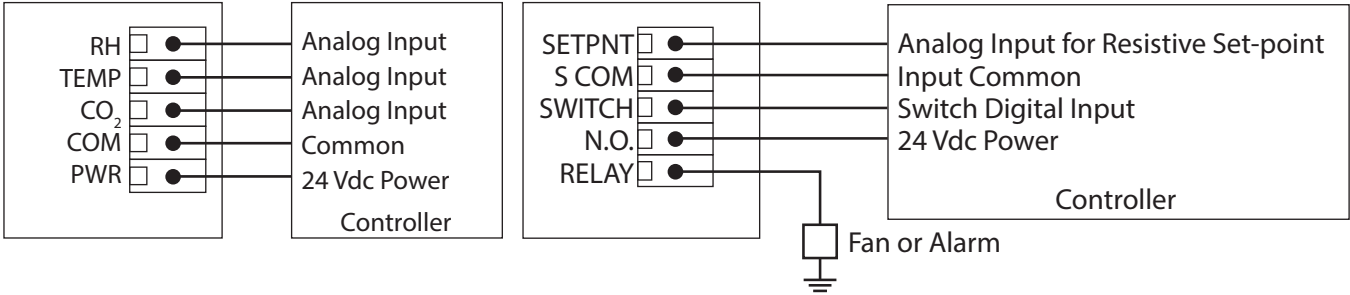
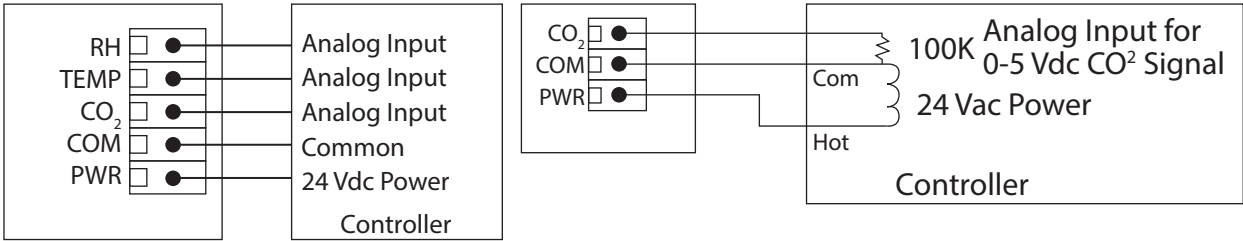


Figure 7

Typical 0-5 Vdc wiring with 24 Vac



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.

The analog outputs are available on the CO<sub>2</sub>, RH and TEMP terminals. The signal type can 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 output operates in the active mode and does not require a loop power supply. This means that the signal current is generated by the transmitter and must not be connected to a powered input or device damage will result. Check the controller Analog Input to determine the proper connection before applying power. Both current and voltage signals are referenced to the COMMON terminal. The analog output signals are typically connected directly to the Building Automation System (B.A.S.) and used as control parameters.

An optional signal is the relay output available on the N.O. RELAY terminals. 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.

If installed, the override switch output is a two-wire dry contact normally open switch contact. The slide pot output is a two-wire resistive signal that can vary from 0-10K ohms (for example) with left-to-right slide pot action. Other resistive values are available on request and the slide pot may be configured as normal or reverse acting.

The override switch and slide pot share a single common labeled S. COM and this is not connected to the power supply COM.

## START-UP

Verify the transmitter is properly wired and connections are tight. Apply power and note that the CO<sub>2</sub> sensor chamber light flashes on and off. The LCD will indicate the software version number, the relay set-point (if installed), the CO<sub>2</sub> measurement range, the temperature range and then the device will begin reading the sensor values and display them on the LCD. The sensor will update the output and display every 4 seconds

## OUTPUTS

The CO<sub>2</sub> output is scaled so that 4-20 mA (or 0-5/0-10 Vdc) equals 0 to Out High as set in the Setup Menu. Depending on the model ordered, the factory default is either 0-2000 ppm or 0-20,000 ppm. The OUT\_HIGH can be changed in the Setup Menu and the output signal is scaled accordingly.

The RH and temperature outputs operate similar to the CO<sub>2</sub> output. RH is scaled 0-100 %RH and temperature defaults to 32 to 95°F but can be changed to 0 to 35°C, 0 to 50°C or 32 to 122°F using the Setup Menu.

For voltage output models, the factory default is 0-5 Vdc and can be changed to 0-10 Vdc in the Setup Menu.

## OPERATION

The CO<sub>2</sub>, RH, and Temperature signals are connected to the Building Automation System (BAS) analog inputs. The BAS reads the voltage or current signals and calculates actual values using correct scaling for the ranges and signal type. These values can be used to control ventilation devices or initiate alarms. All values are displayed locally on the LCD. The Setup Menu can be used to modify the displayed information.

This display is factory set to display all three measurement values. The CO<sub>2</sub> level will be displayed as 0-2000 ppm or 0-20,000 ppm depending on the model, the %RH will be displayed as 0-99H and the temperature will be displayed as 32 to 95°F. The Setup Menu can be used to modify the displayed information. The installer can select to only display CO<sub>2</sub>, or to display CO<sub>2</sub> and RH, or alternately CO<sub>2</sub> and temperature. The device supports four temperature ranges that may also be selected in the menu. The default is 32 to 95°F but this may be changed to 0 to 35°C and the output signal will stay the same. Also, the temperature range may be changed to 32 to 122°F or 0 to 50°C and the output scaling will change to match the display.

If the optional relay is installed it can directly control a small fan or alarm by setting the trip value and hysteresis to appropriate values. The relay status is not indicated on the device LCD.

The optional override switch provides a dry contact closure to a digital input of the BAS. The switch status is not indicated on the LCD.

The optional slide pot can be connected to an analog input of the BAC and will provide a linear resistance signal such as 0-10 KΩ (for example) to be used as a set-point control. The set-point value is not shown on the LCD.

## CALIBRATION

The RH and temperature measurements typically do not need any calibration for the life of the product. Both values may have user offsets assigned in the Setup Menu.

CO<sub>2</sub> calibration with gas requires a field calibration kit with pressure regulator, necessary tubing and appropriate bottles of CO<sub>2</sub> gas. Note that the procedure depends on the device model. The standard model requires only a single point 1000 ppm calibration to meet specified accuracy due to the Automatic Calibration Mode and other technology incorporated into the A/B series.

The C/D series dual-channel sensor with extended range requires a 3 point calibration with 0, 1000 and 20,000 ppm gas (in order).

## OPPM CALIBRATION (FOR C/D MODELS ONLY)

Turn the regulator knob off and attach it to the Nitrogen gas bottle and hand tighten. Open the cover of the unit to be calibrated to expose the gas sensor chamber. The tubing from the gas bottle can be connected to either port on the chamber after the protective plastic cap is removed. Gently remove one cap and connect the tubing, note that strong shock or vibration can affect calibration.

Ensure the device has been operating normally for at least five minutes before applying gas. Turn the valve knob on the regulator to start the gas flow. The regulator will restrict the flow rate to the specified 100 ml/min. After a brief period the gas will flow into the chamber. Wait 1 to 2 minutes while the CO<sub>2</sub> reading stabilizes.

Enter the Setup menu and use the <MENU> key to advance to Calibrat 0 PPM. Press and hold the <SAVE> key for 2 seconds and the display will change to Waiting Calibrat then to Waiting 5 minute to indicate that the process of setting the internal calibration is taking place.

This takes about 5 minutes while the LCD counts down. Do not disturb the unit or the gas flow. When complete the unit will display Calibrat Done. Press the <SAVE> key to return to normal operation and shut the gas off.

### 1000 PPM CALIBRATION (FOR ALL MODELS)

Connect the 1000 ppm CO<sub>2</sub> gas bottle and apply the gas as described above. The CO<sub>2</sub> reading on the LCD will begin to approach 1000 ppm. Wait 1 to 2 minutes while the CO<sub>2</sub> reading stabilizes.

Enter the Setup menu and use the <MENU> key to advance to Calibrat 1000 PPM. Press and hold the <SAVE> key for 2 seconds and the display will change to Waiting Calibrat then to Waiting 5 minute to indicate that the device is calibrating. Again, this process takes about 5 minutes. When calibration is complete the unit will display Calibrat Done. Press the <SAVE> key to return to normal operation and shut the gas off.

### 20,000 PPM CALIBRATION (FOR C/D MODELS ONLY)

Connect the 20,000 ppm CO<sub>2</sub> and apply the gas as before. The LCD will begin to approach 20,000 ppm. Wait 1 to 2 minutes while the CO<sub>2</sub> reading stabilizes.

Enter the Setup menu and use the <MENU> key to advance to Calibrat 20,000 PPM. Press and hold the <SAVE> key for 2 seconds and the display will change to Waiting Calibrat then to Waiting 5 minute.

Again, wait 5 minute and when calibration is complete the unit will display Calibrat Done. Press the <SAVE> key to return to normal operation and shut the gas off. Disconnect the tubing and replace the cap on the sensor chamber as calibration is complete.

### SET-UP MENU

The menu has several items as shown below. Some items change depending on the hardware configuration and the CO<sub>2</sub> sensor. To enter the menu, press and release the <MENU> key while in normal operation. This enters the Set-up Menu, press the <MENU> key to advance to the next menu item. No values are saved or changed by using <MENU>. The <ROLL> key is used to make changes to program variables by scrolling through the available options. When a value is changed, use the <SAVE> key to save it to memory and advance to the next menu item.

Setup Menu operation is explained below, the factory default values are shown. Note that items that are not applicable to the hardware configuration are skipped on the device's setup.

Press and release the <MENU> key to enter the Setup Menu.

Only for **A/B** models

1. CO2 RANGE

Out High

2000 ppm

The default CO<sub>2</sub> range is 0-2000 ppm. The span can be changed from 1000 to 7500 ppm in increments of 500. Use the <ROLL> key to change the value and <SAVE> to save.

Only for **C/D** models

1. CO2 RANGE

Out High

20000 ppm

The default CO<sub>2</sub> range it 0-20,000 ppm. The span can be changed from 2000 to 20,000 ppm increments of 500. Use the <ROLL> key to change the value and <SAVE> to save.

<MENU> Press to advance to next menu item

### 2. LOCAL ALTITUDE

Altitude

0 Ft

The default is 0 feet. Change by using the <ROLL> key from 0 to 5000 ft increment. Change for CO<sub>2</sub> local altitude correction and press <SAVE> to save the change.

<MENU>

Press to advance to next menu item

Only for **A/B** models

3. CAL MODE

Auto Cal  
ON

Automatic Cal Mode default is ON to correct CO<sub>2</sub> sensor drift to better than ±10ppm per year. ON is recommended for application where the CO<sub>2</sub> level will be close to normal (400 ppm) at least once per day. If a building is occupied 24 hours and the CO<sub>2</sub> level is fairly constant then the dual beam sensor should be used.

<MENU>

Press to advance to next menu item

4. TEMP SCALE

Temp C/F  
°F

The temperature scale defaults to Fahrenheit (°F). It can be changed to Celsius (°C) using the <ROLL> key. Save changes using the <SAVE> key.

<MENU>

Press to advance to next menu item

5. TEMP RANGE

T Range  
32-95°F

Two temperature ranges are available, 0 to 35°C (32 to 95°F) or 0 to 50°C (32 to 122°F). This can be changed using <ROLL> and saved with the <SAVE> key.

<MENU>

Press to advance to next menu item

6. DISPLAY MODE

Display  
Mode 4

Select parameters normally displayed on the LCD. 1 = CO<sub>2</sub> only, 2 = CO<sub>2</sub> + RH, 3 = CO<sub>2</sub> + T and 4 = CO<sub>2</sub> + RH + T.

<MENU>

Press to advance to next menu item

7. TEMPERATURE OFFSET

T Offset  
0°F

This item allows calibration of the temperature sensor. Use <ROLL> to add an offset to the temperature signal and display, then press <SAVE>. -1 subtracts 1 degree Fahrenheit from the temperature and +1 adds 1 degree Fahrenheit to the temperature. The range is -9 to +9°F

<MENU>

Press to advance to next menu item

8. HUMIDITY OFFSET

H Offset  
0 %RH

This item allows calibration of the RH sensor. Use <ROLL> to add an offset to the RH signal and display, then press <SAVE>. -1 subtracts 1 %RH and +1 adds 1 %RH. The range is -10 to +10.

<MENU>

Press to advance to next menu item

Only if **Relay** installed

9. RELAY CONTROL

The relay can be configured to use CO2 or Temperature for trip point.

For Temperature control of Relay: Relay As  
Temp

For CO<sub>2</sub> control of Relay: Relay As  
CO2

<MENU>

Press to advance to next menu item

10. SETPOINT

Relay SP  
1000 ppm

The relay can be set from 500 to 5000 in 100ppm increments for the 2000 ppm CO2 sensor. Or 500 to 15,000 for the 20,000 ppm sensor.

<MENU>

Press to advance to next menu item

11. HYSTERESIS

Relay Hy  
50 ppm

The hysteresis can be set from 25 to 200 in 25 ppm increments for the 2000 ppm CO<sub>2</sub> sensor to 25 to 500 ppm for the 20,000 ppm CO<sub>2</sub> sensor. Save changes by using the <SAVE> key.



<MENU>

Press to advance to next menu item

**12. TEST**

Relay  
Test OFF

Use the <ROLL> key to toggle the relay ON or OFF for testing purposes. Press either <SAVE> or <MENU> to turn the relay off and advance to the next item.

<MENU>

Press to advance to next menu item

**13. OUTPUT TYPE**

Out Type  
0-5 Vdc

Use the <ROLL> key to change the value to 0-10 Vdc if necessary. Press <SAVE> key to save changes.

<MENU>

Press to advance to next menu item

**14. OUTPUT**

Output  
Test OFF

Use the <ROLL> key to toggle outputs OFF (normal operation), MIN (minimum output) or MAX (maximum output) for testing purposes. Press either <SAVE> or <MENU> to set it back to OFF and advance to the next step.

<MENU>

Press to advance to next menu item

**CALIBRATION**

**15. CALIBRATION**

Calibrat  
0 PPM

This item is used for 0 ppm gas calibration and is explained in the *Calibration* section.

<MENU>

Press to advance to next menu item

**16. CALIBRATION**

Calibrat  
1000 PPM

This item is used for 1000 ppm gas calibration and is explained in the *Calibration* section.

<MENU>

Press to advance to next menu item

**CALIBRATION**

**17.**

Calibrat  
20000 PPM

This item is used for 20,000 ppm gas calibration and is explained in the *Calibration* section.

<MENU>

Press to advance to next menu item

**18. BACKLIGHT**

BackLite  
Enable

Use the <ROLL> key to enable or disable the LCD backlight. When enabled the backlight is always on, when disabled it never lights. Press the <SAVE> key to save the setting.

<MENU>

Press to advance to next menu item

**19. RESTORE DEFAULTS**

Restore  
Defaults

Press the <SAVE> key to restore all factory defaults and calibration to original factory settings.

<MENU>

Press to advance to next menu item

**20. EXIT**

Menu  
Exit

Press <SAVE> to exit the menu and return to normal operation, or <MENU> to repeat the menu.

SPECIFICATIONS

CO<sub>2</sub> SIGNAL

Measurement Type .....	Non-Dispersive Infrared (NDIR), diffusion sampling
Measurement Range .....	<b>A/B:</b> 0 to 2000 ppm, programmable span <b>C/D:</b> 0 to 20,000 ppm, programmable span
Standard Accuracy .....	<b>A/B (with Auto Cal):</b> +30 ppm +3% of reading <b>C/D (with dual channel sensor):</b> ±75 ppm or 10% of reading (whichever is greater)
Temperature Dependence .....	0.2 %FS per °C
Stability .....	<b>A/B:</b> <2 %FS over life of sensor (15 years typical) <b>C/D:</b> <5 %FS or <10% of reading annual
Pressure Dependence .....	0.135% of reading per mm Hg
Altitude Correction .....	Programmable from 0 to 5000 ft via keypad
Response Time .....	<2 minutes for 90% step change typical
Warm-up Time .....	<2 minutes

TEMPERATURE SENSOR

Sensing Element .....	10K thermistor, ±0.2°C (±0.4°F)
Range .....	0 to 35°C (32 to 95°F) or 0 to 50°C (32 to 122°F) selectable via keypad

HUMIDITY SENSOR

Sensor .....	Thermoset polymer based capacitive
Accuracy .....	±2 %RH
Range .....	0 to 100 %RH, non-condensing
Hysteresis .....	±3 %RH
Response Time .....	15 seconds typical
Stability .....	±1.2 %RH typical ±1.2 %RH in 5 years

OPTIONAL RELAY OUTPUT

Contact Ratings .....	Form A contact (N.O.) 2 Amps @ 140 Vac 2 Amps @ 30 Vdc
Relay Trip Point .....	Programmable via keypad
Relay Hysteresis .....	Programmable via keypad

LCD DISPLAY

Display Size .....	35mm W x 15 mm H (1.4" x 0.6")
Resolution .....	1 ppm CO <sub>2</sub>
Backlight .....	Enable or disable via menu

GENERAL

Power Supply .....	20 to 28 Vac/dc (non-isolated half-wave rectified)
Consumption .....	<b>Current:</b> 145 mA max @ 24 Vdc, 260 mA max @ 24 Vac <b>Voltage:</b> 85 mA max @ 24 Vdc, 150 mA max @ 24 Vac
Output Signals .....	4-20 mA active (sourcing) or 0-5 Vdc / 0-10 Vdc
Output Drive Capability .....	<b>Current:</b> 550 Ω maximum <b>Voltage:</b> 5 KΩ minimum
Output Resolution .....	10 bit PWM
Input Voltage Effect .....	Negligible over specified operating range
Protection Circuitry .....	Reverse voltage protected, overvoltage protected
Operating Conditions .....	0 to 50°C (32 to 122°F), 0 to 95 %RH non-condensing
Optional Override Switch .....	Front panel push-button available as two wire dry-contact output
Optional Slide Pot .....	Front panel pot available as two wire resistive output, 0-10 KΩ standard
Wiring Connections .....	Screw terminal block (14 to 22 AW)
Enclosure .....	White ABS, IP30 (NEMA 1) 84mm W x 117mm H x 29mm D (3.3" x 4.6" x 1.15")
Country of Origin .....	Canada

DIMENSIONS

