Introduction

The CO2/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 CO2 levels within a range of 0 – 2000 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 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 setpoint control. This product is also available with 4-20 mA current output signals instead of voltage.

Before Installation

Read these instructions carefully before installing and commissioning the CO2/RH/T 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, 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 ratings.

Mounting

The room type sensor 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 air 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 screwdriver to carefully pry each bottom corner if necessary. If a security screw is installed on the bottom edge, then it may have to be loosened or removed also. Tip the cover away from the base and sit it aside.

The pcb must be removed from the base to access the mounting holes. Follow usual anti-static procedures when handling the pcb and be careful not to touch the sensors. The pcb is removed by pressing the enclosure base to unsnap the latch near the bottom edge, then the pcb can be lifted out of the base. Sit the pcb aside until the base is mounted on the wall.

After the base is screwed to an electrical box or the wall using the appropriate holes, pull the wires through the wiring hole in the center of the pcb and then reinstall it in the enclosure base. Ensure the pcb is snapped into the base securely and correctly.

The mounting hole locations are shown in the following drawing.

Remove cover from base   Un-snap pcb

Typical wiring with 24 Vdc
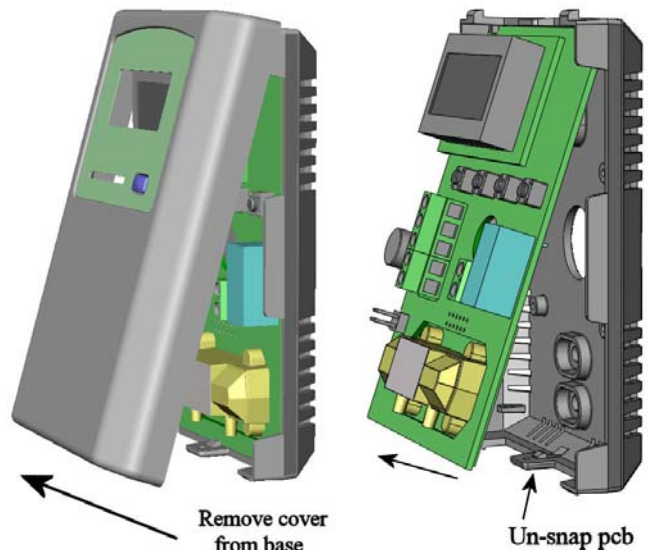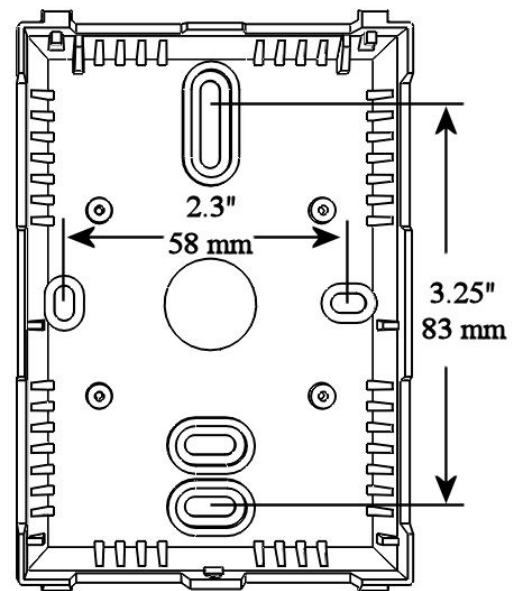
Wiring
Deactivate the 24 Vac/dc power supply until all connections are made to the device to prevent electrical shock or equipment damage. Follow proper electrostatic discharge (ESD) handling procedures when installing the device or equipment damage may occur.

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 voltage output 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.

The analog outputs are available on the **CO2**, **RH**, and **TEMP** terminals. These outputs are selectable for either 0-5 Vdc or 0-10 Vdc signals. Check the controller Analog Input to determine the proper connection before applying power. All output signals are referenced to the **COM** terminal. The analog output signals are typically connected directly to the Building Automation System and used as control parameters or for logging purposes.

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 labelled **S. COM** and this is not connected to the power supply **COM**.
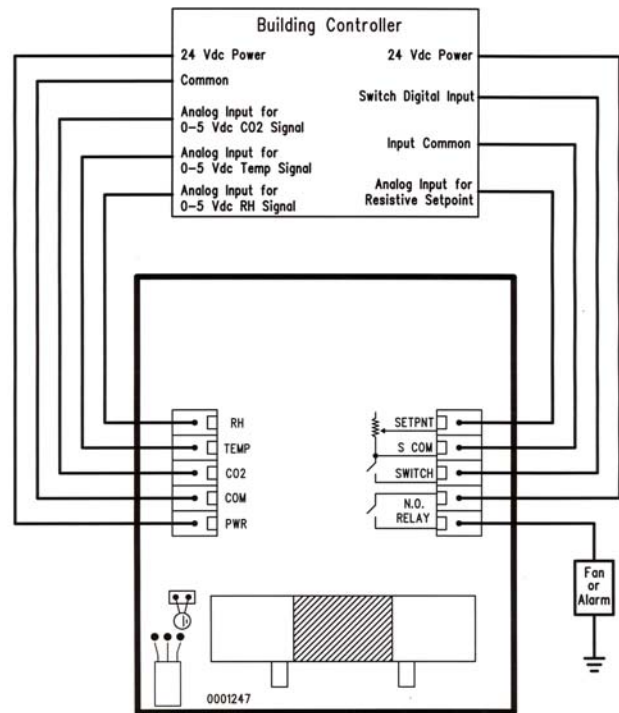
Typical wiring with 24 Vac
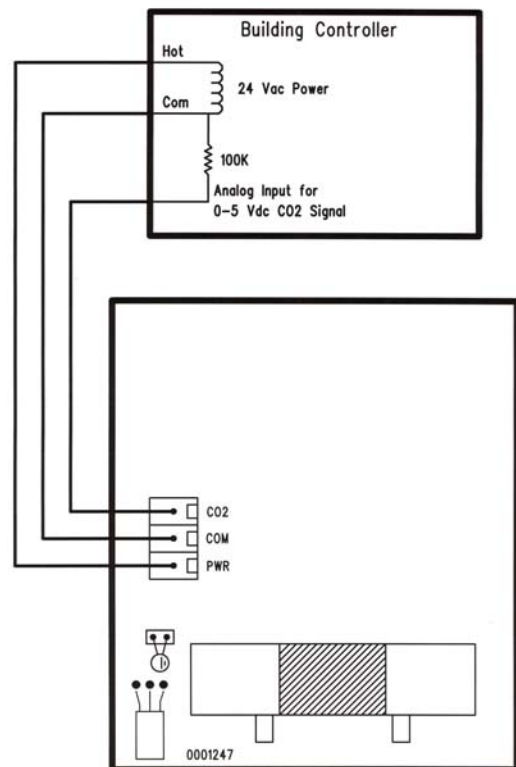
Start-up
Verify the transmitter is properly wired and connections are tight. Apply power and note that the CO2 sensor chamber light flashes on and off. The LCD will indicate the software version number, the relay setpoint (if installed), the CO2 measurement range, the temperature range and then the device 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 CO2 output is scaled so that 0-5 or 0-10 Vdc equals 0 to Out_High as set in the Setup menu. The default is 0-2000 ppm. Out_High can be changed from 1000 to 7500 ppm and the output voltage signal is scaled accordingly.

The RH output is scaled such that 0-5 or 0-10 Vdc equals 0-100 %RH and is temperature compensated over the full 0-50 °C temperature range. The temperature output is scaled so that 0-5 or 0-10 Vdc equals either 0-35 °C, 32-95 °F, 0-50 °C or 32-122 °F depending on which range is selected in the menu. The default range is 32-95 °F.

Operation
The CO2 analog signal is always available on the **CO2** terminal and is connected to the B.A.S. analog input. The B.A.S. reads the CO2 voltage signal and calculates the actual CO2 ppm value using correct scaling for the CO2 range and signal type. This CO2 value can be used to control output ventilation devices or initiate alarms. The CO2 value is also displayed locally on the LCD.

Similarly, the RH and temperature analog signals are available on the **RH** and **TEMP** terminals and are connected to the B.A.S. analog inputs. These values are also displayed on the LCD.

The display is factory set to display all three measurement values. The CO2 level will be displayed as 0-2000 ppm (default), the %RH will be displayed as 0-99H and the temperature will be displayed as 32-95°F. The Setup menu can be used to modify the displayed information. The installer can select to only display CO2, or to display CO2 and RH, or alternately CO2 and temperature. The device supports four temperature ranges that may also be selected in the menu. The default is 32-95°F but this may be changed to 0-35°C and the output signal will stay the same. Also, the temperature range may be changed to 32-122°F or 0-50°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 B.A.S. The switch status is not indicated on the LCD.

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

Calibration
Calibration with gas requires a field calibration kit consisting of an LCD, a bottle of 1000 ppm CO2 gas, a tank pressure regulator with flow restrictor and the necessary tubing to connect to the device.

Note that because of the Automatic Calibration Mode and other technology incorporated into the CDD series, only a single point 1000 ppm calibration is required to meet specified accuracy.

Turn the regulator on/off knob fully off and attach it to the 1000 ppm CO2 gas bottle and firmly tighten it by hand. Remove 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 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. Slowly turn the valve knob on the regulator to let the gas begin flowing.

The regulator will restrict the flow rate to the specified 100 ml/min. After a brief period the gas will flow into the chamber and the CO2 reading on the LCD will begin to approach 1000 ppm. Wait 1 to 2 minutes until the CO2 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 process of reprogramming the internal calibration setting is taking place.

This calibration process takes about 5 minutes and the LCD will count down the minutes. Do not disturb the unit or the gas flow during this period. When calibration is complete the unit will display **Calibrat Done**. Press the <SAVE> key to return to normal operation and then the gas can be shut off.

Disconnect the tubing and replace the cap on the sensor chamber as calibration is complete.

Setup Menu

The menu has several items as shown below. To enter the menu, press and release the <MENU> key while in normal operation. This will enter the SETUP menu step 1, pressing the <MENU> key a second time advances to step 2. Each press of the <MENU> key advances the menu item. No values are saved or changed by using the <MENU> key. 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.

<MENU>	Press and release the <MENU> key to enter the SETUP menu

1. Out High
    2000 ppm

The default CO2 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. The factory default is 2000 ppm.

<MENU>

2. Altitude
    0 Ft

The default is 0 feet. Change by using the <ROLL> key from 0 to 5000 feet in 500 ft increments. Change for CO2 local altitude correction and press <SAVE> to save a change.

<MENU>

3. Auto Cal
    ON

Automatic Cal Mode default is ON to correct CO2 sensor drift to better than ± 10 ppm per year. Change with the <ROLL> key and save using <SAVE>. ON is recommended for applications where the CO2 level will be close to normal (400 ppm) at least once per day. If a building is occupied 24 hours and the CO2 level is fairly constant then this should be set to OFF.

<MENU>

4. Temp C/F
    °F

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

<MENU>

5. T Range
    32-95 °F

Two temperature ranges are available, 0-35 °C (32-95 °F) or 0-50 °C (32-122 °F). This can be changed using <ROLL> and saved with <SAVE>. The available range will depend on the C or F menu selection.

<MENU>

6. Display
    Mode 4

Select parameters normally displayed on the LCD. 1 = CO2 only, 2 = CO2 + RH , 3 = CO2 + T and 4 = CO2 + RH + T. The factory default is 4.

<MENU>

7. 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 F to the temperature. The range is –5 to +5 °F.

<MENU>

8. 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>

Items 9, 10 and 11 are only available if the Relay Option is installed, otherwise the menu skips directly to step 12.

9. Relay SP
    1000 ppm

The relay trip setpoint default is 1000 ppm. It can be changed from 500 to 5000 in 100 ppm increments. Save changes by using the <SAVE> key.

<MENU>

10. Relay Hy   The relay hysteresis default is 50 ppm. This can be changed from 25 to 200 in 25 ppm increments. Use
  50 ppm   the <SAVE> key to save any change.

<MENU>

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

<MENU>

12. Out Type   The factory default output type is 0-5 Vdc. Use the <ROLL> key to change the value to 0-10 Vdc if
  0-5 Vdc   necessary. Press the <SAVE> key to save.

<MENU>

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

<MENU>

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

<MENU>

Item 15 is only available if the cover is equipped with a viewable LCD, otherwise the menu skips directly to step 16.

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

<MENU>

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

<MENU>

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

General Specifications

Power Supply . . . . 20 – 28 Vac/dc (non-isolated half-wave rectified)
Consumption . . . . 85 mA max @ 24 Vdc, 150 mA max @ 24 Vac (with all options)
Output Signals . . . . 0-5 Vdc or 0-10 Vdc, field selectable via keypad
Output Drive Capability . . . . . 10 Kohm min
Output Resolution . . . . 10 bit PWM
Protection Circuitry . . . . Reverse voltage protected, overvoltage protected
Operating Conditions . . . . 0-50 °C (32-122 °F), 0-95 %RH non-condensing
Wiring Connections . . . . Screw terminal block (14 to 22 AWG)
Sensor Coverage Area . . . . . . 100 m^2 (1000 ft^2) typical
Enclosure . . . . Wall mount enclosure, 3.3"w x 4.7"h x 1.15"d (84 x 119 x 29 mm)

CO2 Signal

Measurement Type . . . . Non-Dispersive Infrared (NDIR), diffusion sampling
Measurement Range . . . . 0-2000 ppm standard, programmable up to 7500 ppm
Standard Accuracy . . . . ± 75 ppm @ 1000 ppm @ 22 °C (72 °F) compared to certified calibration gas
Temperature Dependence . . . . 0.2 %FS per °C
Stability . . . . < 2 %FS over life of sensor (15 year typical)
Pressure Dependence . . . . 0.13 % of reading per mm Hg
Altitude Correction . . . . Programmable from 0-5000 ft via keypad
Response Time . . . . < 2 minutes for 90 % step change typical
Warm-up Time . . . . < 2 minutes

Temperature Signal

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

RH Signal

Sensor . . . . Thermoset polymer based capacitive
Accuracy . . . . ± 2 %RH
Range . . . . 0-100 %RH, non-condensing
Hysteresis . . . . ± 3 %RH
Response Time . . . . 15 seconds typical
Stability . . . . ± 1.2 %RH typical @ 50 %RH in 5 years

LCD Display

Resolution . . . . 1 ppm CO2, 1 %RH, 1 °F (1 °C)
Size . . . . 1.4" w x 0.6" h (35 x 15 mm) alpha-numeric 2 line x 8 characters
Backlight . . . . Enable or disable via keypad

Optional Relay Output

Contact Ratings . . . . Form A contact (N.O.), 2 Amps @ 140 Vac, 2 Amps @ 30 Vdc
Relay Trip Point . . . . Programmable 500-5000 ppm via keypad
Relay Hysteresis . . . . Programmable 25-200 ppm via keypad

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