CDD

Carbon Dioxide Transmitter

Installation and Operating Instructions

NOTE: **Always confirm, prior to installation of the device(s), that the applications and configurations are as they were intended and suitable for. The PC boards are static sensitive, always ground yourself prior to handling the board.**

Jan. 6, 2004

Part Number Designation

CDD - 1A - X - XX - X

			Other Options
			0 – No Options
			1 – LCD
			2 – RS-485 communication
		Relay Option	
		00 – No relay	
		10 – Form C relay (5A 250Vac 30Vdc)	
	Enclosure		
	1 – Decorative wall mount		
	6 – ABS duct mount		
CO2 NDIR Series			

Introduction

The CDD Carbon Dioxide Transmitter uses Infrared Technology to monitor CO2 levels within the range of 0 – 2000 ppm and outputs a linear signal as either 4-20 mA or 0-5 Vdc. Options include an LCD to display current CO2 ppm levels, a control relay and 0-10 Vdc output. Operating parameters are easily programmed by an on-board keypad to configure the transmitter to a specific application. Note that the output scale can be programmed using the Out_Lo and Out_High variables. This is useful to obtain a 4-20 mA signal to represent (for example) 800 – 1000 ppm if desired.

Mounting Instruction

The Decorative type room sensor has mounting provisions to install directly on a standard electrical box and should be mounted at a height about five feet from the floor of the area to be controlled. For best operation, do not mount the sensor near doors, opening windows, supply air diffusers or other known air disturbances.

The duct sensor should be mounted on the outside of a return air duct with the air sampling tube inserted into the duct. A foam plug is provided for use in the wiring conduit to prevent air from entering the enclosure through the conduit and giving a incorrect reading. Mount the sensor in an easily accessible location in a straight section of duct at least five feet from corners and other items that may cause disturbances in the air flow. Avoid areas where the transmitter would be exposed to vibrations or rapid temperature changes.

Wiring Instruction

The transmitter has standard screw block connectors and easy wire access to facilitate wiring. It is recommended that shielded twisted pair wiring at least 22 AWG be used for all connections and that the device wires not be run in the same conduit with wiring used to supply inductive loads such as motors.

The device power (20-30 Vac/dc) is connected to the terminal marked **POWER**. This terminal is used for the positive dc voltage or the hot side of the ac voltage. The device is reverse voltage protected and as such will not operate if connected backwards.

The common of the power supply is connected to the terminal marked **COMMON**. Note that this device has a half-wave type power supply which means the power supply common is the same as the output signal common. Therefore, several devices may be connected to one power supply and the output signals all share the same
signal common. Use caution when grounding the secondary of an ac transformer or when wiring multiple devices to ensure that the circuit ground point is the same on all devices and the controller.

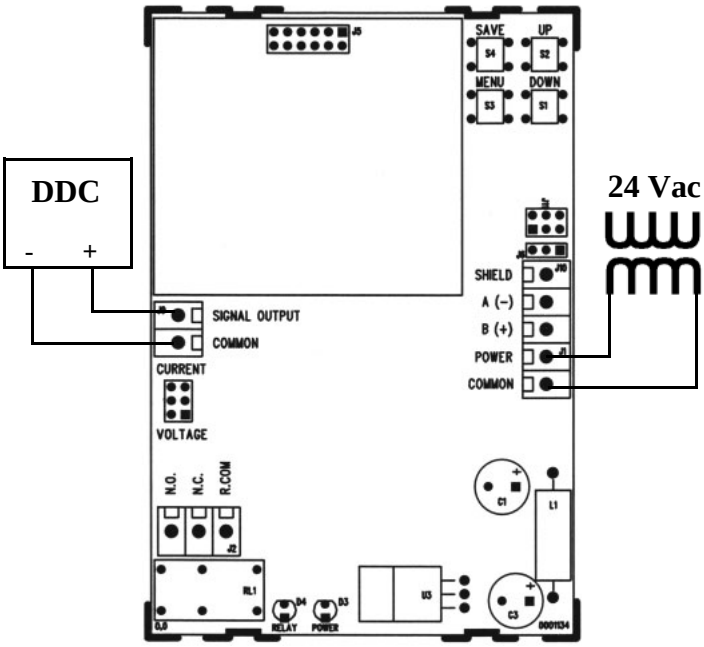
The analog output signal is available on the **SIGNAL OUTPUT** terminal. This signal is jumper selectable for either a voltage output or a standard 4-20 mA active output signal type. When voltage mode is selected, the output is 0-5 Vdc or 0-10 Vdc. These options are clearly indicated on the device circuit board. The 4-20 mA current output signal operates in the Active mode and does not require a loop power supply. This means that **the signal current is generated by the Carbon Dioxide 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 the current and voltage signals are referenced to the **COMMON** terminal. The analog output signal is typically connected directly to the Building Automation System (B.A.S.) and used as a control parameter or for logging purposes.

An optional signal is the relay output available on the **NO, R.COM** and **NC** terminals. Note that the Relay COM terminal is NOT connected to the signal or power supply COMMON terminal. The relay output is completely isolated and has both Normally Open (NO) and Normally Closed (NC) signals. This signal can be used to directly control an alarm, a ventilation fan or may be connected to a digital input of the B.A.S. for status monitoring.

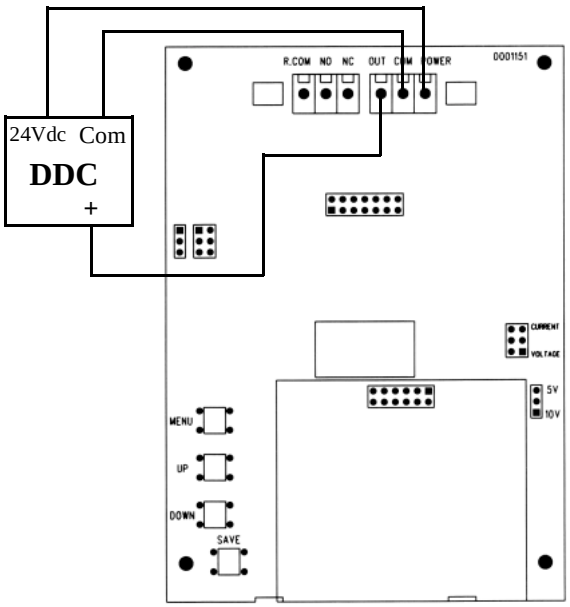
Power Up Instruction

Verify that the Carbon Dioxide Transmitter is properly wired and all connections are tight. Apply power to the device and note that the CO2 sensor chamber light will flash on and off . If an LCD is installed it will indicate the software version number (Version CO2 x.xx) and then begin a 120 second warm-up period. During this period the output is fixed at 4 mA or 0 Vdc and the relay is held off. After the warm-up period, the sensor will begin reading the CO2 levels, output the correct analog signal and also display the value on the LCD. The sensor operates on a 5 second interval and will update the output and display every 5 seconds.

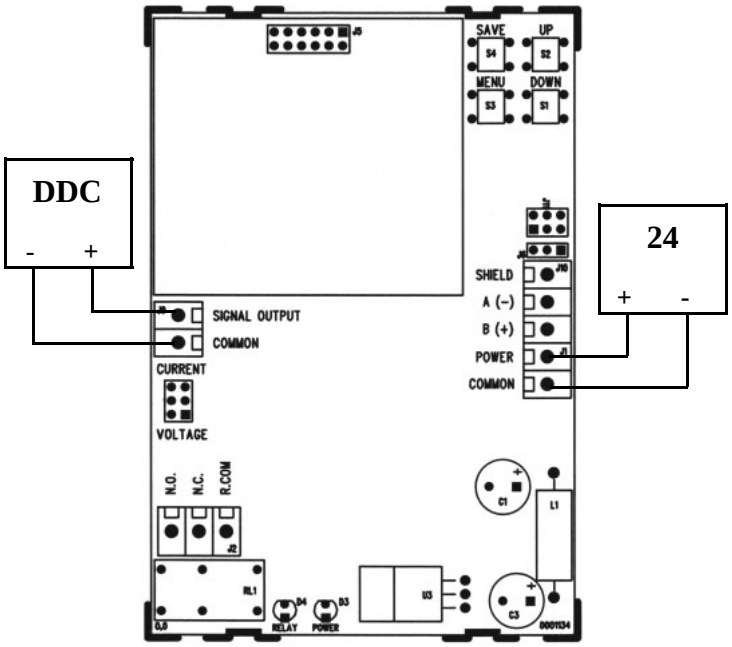
Wiring Diagrams



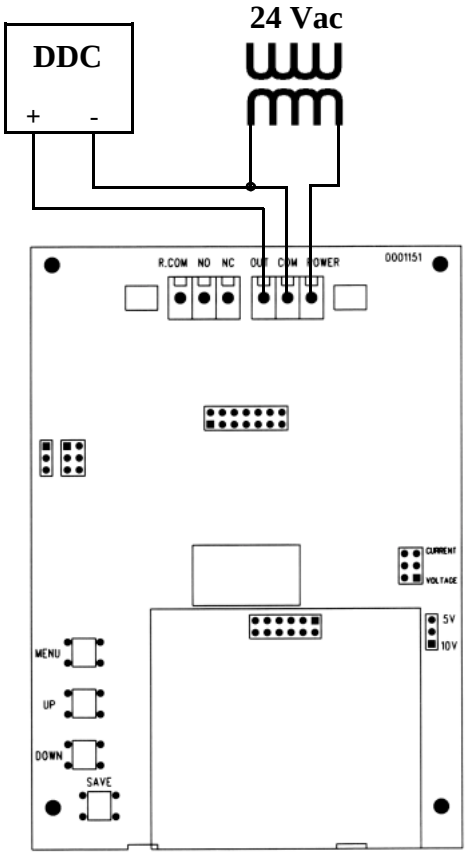
CO_2 Space Sensor, 24 Vac Supply, 4-20mA or Voltage Output, 4-wire



CO_2 Duct Sensor, 24 Vdc Supply, 4-20mA Output, 3-wire



CO_2 Space Sensor, 24 Vdc Supply, 4-20mA or Voltage Output, 4-wire



CO_2 Duct Sensor, 24 Vac Supply, 4-20mA Output, 3-wire

Menu Configuration

The configuration menu may be accessed any time after the initial warm-up period. The menu is controlled by using the four buttons on the circuit board labeled MENU, SAVE, UP and DOWN. The software menu is used for calibration and setup. *If a jumper is present on pins 2 & 3 of J6 it must be removed before accessing the menu.

The standard configuration menu has 13 items as shown below. Pressing the <MENU> switch once while in normal operation will set the operating mode to step 1, pressing the <MENU> switch a second time advances to step 2. Each press of the <MENU> switch advances the menu item. No values are saved or changed by using the <MENU> key.

The <SAVE> key saves the current setting to memory, exits the configuration menu system and returns the CO2 transmitter to normal operation. The <UP> and <DOWN> keys are used to make changes to program variables. Menu operation is explained below.

<MENU>	Press and release key to enter configuration menu
1. Restore Defaults	Press the <SAVE> key here to restore all factory defaults to their original settings. The device will return to the same calibration and setup values as when shipped from the factory.
<MENU>	
2. Out_Low 0 PPM	The factory default CO2 range is 0-2000 ppm. Both the zero and span points can be changed by using the <UP> or <DOWN> keys. This menu item is used to change the zero point from 0 ppm to 950 ppm in increments of 50 ppm. If a change is made, press the <SAVE> key to save the change to memory.
<MENU>	
3. Out_High 2000 PPM	The factory default CO2 range is 0-2000 ppm. Both the zero and span points can be changed by using the <UP> or <DOWN> keys. This menu item is used to change the span point from 1000 ppm up to 10,000 ppm in increments of 50 ppm below 1500 ppm or increments of 500 ppm above 1500 ppm. If a change is made, press the <SAVE> key to save the change to memory.
<MENU>	
4. Altitude 0ft	The factory default altitude is 0 feet. This can be changed by using the <UP> or <DOWN> keys from 0-5000 feet in 500 ft increments. Change this setting for local altitude correction and save the value by pressing the <SAVE> key.
<MENU>	
5. Auto_cal ON	The factory default for the Automatic Calibration Mode is ON. This software feature corrects sensor drift to better than ± 10 ppm per year. This can be changed using the <UP> and <DOWN> keys and then saved using the <SAVE> key. The recommended value is ON for applications where the CO2 level will be close to normal (350 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. **Please note:** unit may need to be powered up for 14 days to meet specified accuracy

<MENU>

6. Trip SET 1000 PPM — The relay trip point factory default is 1000 ppm. By using the <UP> and <DOWN> keys, this can be changed from 500-1500 ppm in 50 ppm increments and then from 1500-10,000 ppm in 250 ppm increments. Save any changes by using the <SAVE> key.

<MENU>

7. Hyst SET 50 PPM — The relay hysteresis factory default is 50 ppm. This can be changed from 25 - 200 ppm in 25 ppm increments by using the <UP> and <DOWN> keys. Use the <SAVE> key to save the value.

<MENU>

8. Calibrat 0PPM — This item is used for zero gas calibration and is explained later.

<MENU>

9. Calibrat 2000PPM — This item is used for span gas calibration and is explained later.

<MENU>

Note : Menu item 10 is only available if voltage output is selected via the jumper, otherwise the program skips directly to step 11.

10. Calibrat 5V x — This item allows calibration of the 5 Vdc output signal. Use the <UP> or <DOWN> keys to set the output to exactly 5.0 Vdc. The "x" value represents a calibration constant. Use the <SAVE> key to save any change.

<MENU>

Note : Menu items 11 and 12 are only available if current output is selected via the jumper, otherwise the program skips directly to step 13.

11. Calibrat 4mA x — This item allows calibration of the 4 mA output signal. Use the <UP> or <DOWN> keys to set the output to exactly 4.0 mA. Use the <SAVE> key to save any change.

<MENU>

12. Calibrat 20mA x — This item allows calibration of the 20 mA output signal. Use the <UP> or <DOWN> keys to set the output to exactly 20.0 mA. Use the <SAVE> key to save any change.

<MENU>

13. Menu Quit — Press the <SAVE> key to exit the menu and return to normal operation.

Test Menu

A special test menu is available by temporarily shorting pin 1 and 2 on J6 on the PCB. This menu can be used during setup. This menu is explained below.

Short 1-2 on J6	Enters test menu
1. Relay ON	If the Relay option is installed, the <UP> and <DOWN> key will set the relay ON or OFF. Use the <SAVE> key to activate the relay. Use the <SAVE> key again to return to the menu.
<MENU>	
2. TEST 4mA or TEST 0V	This item will test the analog output, either current or voltage depending on the jumper position. Use the <UP> or <DOWN> keys to select 4, 8, 12, 16 or 20 mA or 0, 1, 2, 3, 4 or 5 Vdc as applicable. Use the <SAVE> key to activate the output and again to return to the menu.
<MENU>	
3. Test Quit	Use the <SAVE> key to quit the test menu and return to normal operation.

Calibration

If necessary, the 4 mA, 20 mA and 5 Vdc outputs can be calibrated as described previously in the Menu Configuration section by using the keypad and a meter connected to the output.

Calibration with gas requires a field calibration kit consisting of an LCD, a bottle of zero gas (nitrogen), a bottle of span gas (2000 ppm CO2 in nitrogen), a tank pressure regulator with flow restrictor and the necessary tubing to connect to the device.

Note that because of the dual beam design and other technology incorporated into the CDD series, only a single point 0 ppm calibration is required to meet specified accuracy. The span gas calibration can also be done if required.

Disconnect the power to the device and install the LCD by plugging it into the on-board connector. Ensure that the pins of the connector are properly aligned and then restore the power. Verify that the device and LCD are operating correctly.

Turn the regulator on/off knob fully off and attach it to the 0 ppm nitrogen 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 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 and use the menu as described previously to verify that the elevation is correctly set. Then use the menu to access the item labeled **Calibrat 0PPM**. Press the <SAVE> key and the display will change to **Set 0 Test xxx**. This means that 0 ppm is the desired setting and the current CO2 reading is xxx.

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 xxx reading will begin to fall towards 0.

Wait a 1 to 2 minutes until the xxx reading stabilizes and then press the <SAVE> key. The display will change to **Waiting 5 minute** to indicate that the process of reprogramming the internal zero setting is taking place. This zero calibration process takes about 5 minutes. Do not disturb the unit or the gas flow during this period. When calibration is complete the unit will revert to normal operation and then the gas can be shut off. To abort the calibration for any reason while the display is Waiting 5 minute, simply remove power to the device and the calibration will remain unchanged.

Disconnect the tubing and replace the cap on the sensor chamber if calibration is complete or repeat the above process for the span 2000 ppm gas if required. For span calibration, access the menu item labeled **Calibrat 2000PPM**. Note that the <UP> and <DOWN> keys can be used to set the actual span gas value from 100-5000 ppm as required.

When the correct span calibration value is shown, press the <SAVE> key to display **Span2000 Test xxxx**. Start the 2000 ppm gas flow and wait for the xxxx reading to stabilize. Then press the <SAVE> key to display **Waiting 5 minute** while the unit recalibrates the internal span values. When finished, disconnect the gas and carefully reinstall the sensor cap. Calibration is complete.

Specifications

Measurement	Non-Dispersive Infrared (NDIR)
Sample Method	Diffusion or flow through, sample tube for duct
Measurement Range	Programmable from 0-1500 up to 0-10,000 ppm in 500 ppm increments, 0-2000 ppm standard
Standard Accuracy	± 75 ppm or 3% of reading (whichever is greater) 15-32 °C (59-90 °F) for 0-2000 ppm range ± 5% of reading for 2000-10,000 ppm
Extended Accuracy	± 150 ppm or 5% of reading (whichever is greater) 0-50 °C (32-122 °F) for 0-2000 ppm range ± 7% of reading for 2000-10,000 ppm
Repeatability	± 20 ppm
Stability	± 20 ppm typical, 5 year calibration interval
Pressure Dependence	0.13 % of reading per mm Hg
Altitude Correction	Programmable from 0-5000 ft in 500 ft increments
Response Time	< 60 seconds for 90 % step change
Warm-up Time	< 2 minutes
Operating Conditions	0-50 °C (32-122 °F), 0-95 %RH non-condensing

Power Supply	20 – 30 Vac/dc (non-isolated half-wave rectified)
Consumption	80 mA max @ 24 Vdc, 36 mA avg @ 24 Vdc
Input Voltage Effect	Negligible over specified operating range
Protection Circuitry	Reverse voltage protected and output limited
Output Signal	4-20 mA active (sourcing), 0-5 Vdc or 0-10 Vdc, jumper selectable
Output Drive Capability	550 ohm max for current output 10 Kohm min for voltage output
Output Resolution	10 bit PWM
Optional Relay Output	One Form C contact (N.O. and N.C.), status LED, 5 Amps @ 250 Vac, 5 Amps @ 30 Vdc, p.f. = 1
Relay Trip Point	Programmable 500-1500 ppm in 50 ppm increments
Relay Hysteresis	Programmable 25-200 ppm in 25 ppm increments
Optional LCD Display	1 ppm resolution, 1.1” w x 0.5” h (28 x 13 mm) alpha-numeric 2 line x 8 characters
Programming and Selection	Via internal push-buttons and jumper
Wiring Connections	Screw terminal block (14 to 22 AWG)
Enclosures	Decorative wall mount enclosure 3.6”w x 5”h x 1.7”d (91 x 127 x 43 mm) Duct mount enclosure with sampling tube 4.9”w x 7.2”h x 2.2”d (124 x 183 x 56 mm)