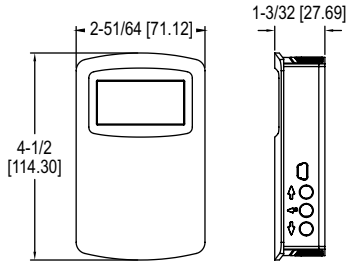
Series CDTA and CDTC Communicating Carbon Dioxide Detector

Specifications - Installation and Operating Instructions



The **Series CDTA and CDTC Communicating Carbon Dioxide Detector** combines the function of several room sensors into a single, compact housing. Both the Series CDTA and the CDTC's parameters include carbon dioxide, temperature, and temperature set point with override while the CDTA also includes a humidity sensor. By having field selectable Modbus® and BACnet Communications, only four wires are needed for power and the communication signal. The communicating detectors can be daisy chained together to further reduce installation cost. In order to reduce the set up time, the RS-485 MAC address is set up using on-board DIP switches. A second set of DIP switches are used to select whether output is Modbus® RTU or BACnet MS/TP communication protocols and to limit access to the set up menu.

The barometric pressure can be programmed to correct for altitude. The humidity parameter in the Series CDTA uses a capacitive polymer sensor and the temperature is measured using a 10KΩ thermistor sensor.

Optional integral display is available to display any of the parameters. For applications in which the building occupants aren't familiar with CO_2 concentrations, the LCD can be programmed to display temperature, humidity (only for Series CDTA), or temperature set point instead. For environments occupied 24 hours per day it is recommended to periodically expose the CO_2 sensor to outside ambient air.

The Series CDTA and CDTC CO_2 transmitters are maintenance free instruments with the ability to adjust the CO_2 calibration by using the on-board Automatic Background Calibration (ABC) logic for intermittently occupied spaces. The ABC algorithm accounts for long term drift by making small adjustments to it's zero calibration point based on the lowest CO_2 readings it measures eight day cycles.

INSTALLATION

⚠ WARNING Disconnect power supply before installation to prevent electrical shock and equipment damage. Make sure all connections are in accordance with the job wiring diagram and in accordance with national and local electrical codes. Use copper conductors only.

NOTICE Avoid locations where severe shock or vibration, excessive moisture or corrosive fumes are present.

NOTICE Do not exceed ratings of this device, permanent damage not covered by warranty may result.

MOUNTING

1. Push tab on top and bottom of cover and lift cover from back plate (See Figure 1).
2. Select the mounting location, away from diffusers, lights or any external influences.
3. Mount transmitter on a vertical surface to a standard electrical box using the two #6 M2C type screws provided.
4. Pull wires through sub base hole and make necessary connections.
5. Reattach cover to base plate.

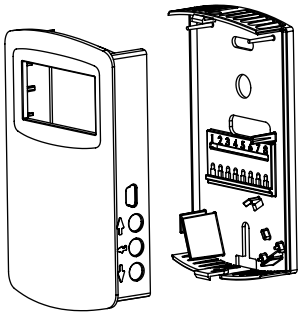


Figure 1: Removal of cover from back plate

SPECIFICATIONS	
Sensor: CO_2: NDIR 15 year life expectancy; Humidity*: Capacitive polymer; Temperature: 10KΩ thermistor. **Range:** CO_2: 0 to 2000 or 5000 PPM CO_2 (depending on model); Humidity*: 0 to 100% RH; Temperature: 32 to 122 °F (0 to 50 °C). **Accuracy**:** CO_2: ±40 PPM ±3% of reading 2000 PPM; ±50 PPM + 5% of reading 5000 PPM; RH*: ±2% (10 to 90% RH); Temperature: ±1°C @ 25°C. **Response Time (CO_2):** 2 min for 90% step change.	**Temperature Limits:** 32 to 122°F (0 to 50°C). **Humidity Limits:** 0 to 85% (non-condensing). **Power Requirements:** 10-42 VDC/ 10-30 VAC. **Device Load:** 1/8 unit load. **Output:** 2-wire RS-485, Modbus® RTU or BACnet MS/TP communication protocol. **Weight:** 4.4 oz (125 g). **Compliance:** BTL, CE.
*Only the Series CDTA has humidity sensing capabilities. **The specified CO2 accuracy is only guaranteed after three weeks of continuous operation in environments which are intermittently occupied.	

WIRING

NOTICE Wiring should comply with Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems, TIA/ EIA-485-A-1998, Telecommunications Industry Association, 1998.

NOTICE Use electrostatic discharge precautions (e.g., use of wrist straps) during installation and wiring to prevent equipment damage.

When using a common power supply, wire the CDTA and CDTC as shown in Figure 2, using two twisted pair conductors. One pair is to be used for B[+] and A[-]. The other pair is to be used for power and common. This configuration is not suitable for AC supplies. Use a DC supply only. Care should be taken that there are not too many devices powered from the same supply as voltage drops will occur in the wiring. If you have many devices, or have long cable runs, the local supply configuration may be a better choice.

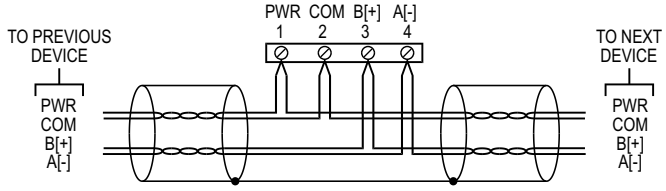


Figure 2: Common power supply wiring

When using a dedicated local power supply, wire the CDTA and CDTC as shown in Figure 3, using a twisted pair and a single conductor. The pair is to be used for B[+] and A[-]. The single conductor is to be used for common. Both AC and DC supplies are suitable for this configuration.

In either configuration, the B[+] and A[-] lines must be terminated at both ends with a 120 Ω resistor. If the CDTA is an end device it has an on-board resistor that may be used. See DIP SWITCH SETTINGS to enable it.

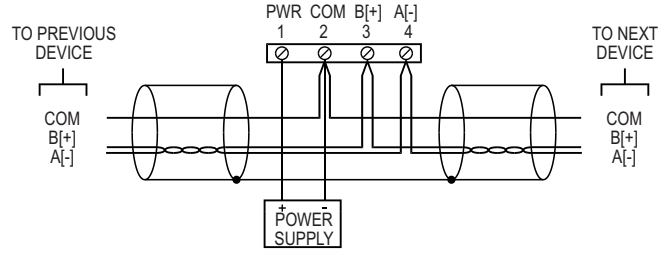


Figure 3: Local power supply wiring

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SETUP AND DIP SWITCH CONFIGURATION

Use DIP Switch SW2 to configure the RS-485 MAC address of the device. The address assignment is determined by adding the values for each of the switches that are in the ON position Table 1 below.

Switch Position	1	2	3	4	5	6	7	8
Address Value	128	64	32	16	8	4	2	1

Table 1: Address value for each switch position

The CDTA and CDTC comes from the factory with all of the DIP switches, except position 1, in the ON position as shown in Figure 4 below. The address of the transmitter would be 127 as it would be 64+32+16+8+4+2+1 = 127. Another example would be if the address desired was 008, the only DIP switch position in the ON position would be position 5.

A valid address depends on the protocol selected. Valid BACnet addresses range from 0 to 127. Valid Modbus® addresses range from 1 to 247. A valid and unused address should be set before connecting to an existing network. The device will not function properly if an invalid address is set. During the power up sequence, the LCD (if present) will display the RS-485 address as the primary value with “ADR” as the primary text and either “BAC” to indicate BACnet or “MOD” to indicate Modbus® as the secondary text. If the RS-485 MAC address is invalid, the invalid value is shown as the primary value with “ERR” as the primary text.

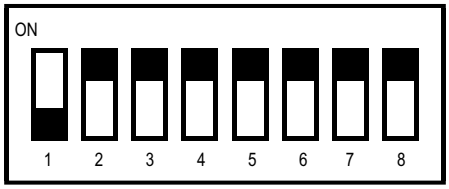

Figure 4: DIP switch SW2 (center-left)

Use DIP Switch SW1 (see Figure 5) to configure other hardware and software options per Table 2 below.

Switch	On	Off
1 – Menu Enable	Access to the setup menu is enabled	Access to the setup menu is disabled
2 – Protocol	Modbus®	BACnet
3 – Reserved		
4 – Terminating Resister	120Ω between A[-] and B[+]	Open

Table 2: DIP switch menu options

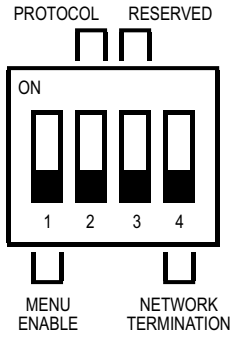

Figure 5: DIP switch SW1 (bottom-center)

Figure 6: Internal view of transmitter

AUTO SERIAL CONFIGURATION

Auto serial configuration enables the device to determine the baud rate, parity and stop bits directly from the serial traffic. This allows a device to be quickly and easily deployed after a valid RS-485 MAC address is chosen. Note that the auto configuration procedure assumes a serial configuration appropriate to the selected protocol as follows:

SUPPORTED SERIAL CONFIGURATIONS				
Protocol	**Supported Baud Rates**	**Data Size**	**Parity**	**Stop Bits**
BACnet	9600 19200 38400 57600 76800 115200	8	None	1
Modbus® – RTU			Even Odd	1
			None	2

Table 3: Supported serial configurations

If this is not the case, then the serial communication must be configured manually in the setup menu.

To activate auto serial configuration, set a valid RS-485 MAC address using DIP switch SW2, connect the serial bus and power wires, and apply power. The device will power up and begin examining the serial bus for communication.

When Modbus® is selected, and the device is setup offline or away from the main network, it is necessary to generate traffic in order to configure the serial communication. Attempting to read input registers is a good method to generate traffic. Note that while serial configuration is in progress, the device may not respond to requests. The device may require multiple read requests to complete the serial configuration process.

The auto serial configuration process will complete once a message addressed to the device is received and processed successfully. The serial configuration parameters are then saved to non-volatile storage and loaded by default each time the device starts. If the serial configuration of the bus changes, a power cycle of the device is required to restart the Auto Serial Configuration process.

USER INTERFACE

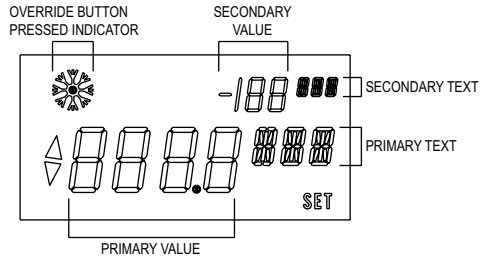

Figure 7: Display layout

Home Screen

For models with the LDC display option, or when using the A-449A remote display tool, the home (idle) screen displays up to two measured values and is the steady state of the device. The information displayed on the home screen can be changed by the “DSP” value in the setup menu.

Set Point

When idle, a single press of either the UP or DOWN button will display the current set point value with the selected units displayed as the primary text. Additional presses of the UP or DOWN buttons will increase or decrease the set point value by 1 degree. A press and hold of the UP or DOWN button will initiate continuous changing of the set point value. The set point display will timeout and return to the home screen after 5 seconds of inactivity. At this point the new set point value is stored in non-volatile memory. The range of the set point value can be configured with “SOH” and “SOL” values in the setup menu. A display is not required to change the set point value.

Override

When on the home screen or when changing the set point, the override button (middle button) can be pressed. When the override button is pressed in these states, a snow flake symbol is displayed momentarily to indicate the button was pressed.

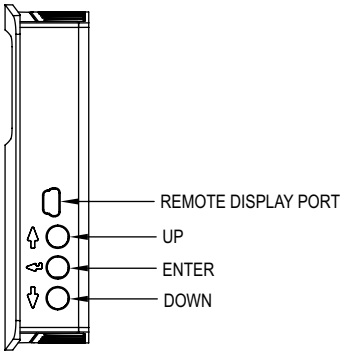

Figure 8: Side view of transmitter

Setup Menu
The setup menu provides a means to configure the device locally. The setup menu can only be entered if the Menu Enable switch is in the on position and a display is present (local or remote). To enter the setup menu, press and hold the UP and DOWN buttons for at least 3 seconds or until the display changes.

The setup menu contains a scrollable list of values that can be changed. Use the UP and DOWN buttons to scroll through the available values. The scrollable list is circular to allow continuous scrolling in either direction.

A value can be modified by first scrolling to the desired value, then press and hold the UP and DOWN buttons for at least 0.5 seconds, or until to word SET is displayed. The value can now be changed with the UP and DOWN buttons. Numerical values are displayed in the primary value area of the display with the current units in the primary text area. Some settings are text based and only show values in the primary text area. When the desired value is reached, press and hold the UP and DOWN buttons for 0.5 seconds to store the value in non-volatile memory and return to the setup menu.

The setup menu will timeout and return to the home screen after 30 seconds of inactivity. The setup menu can also be exited manually by a press and hold of the DOWN button for 0.5 seconds.

SETUP MENU VALUES			
Value	**Description**	**Value**	**Description**
MAX	Maximum CO_2 Value	BAR	Typical barometric pressure
DSP	Home screen configuration	ABC	Automated background calibration
UNI	Units selection	OFH*	Relative humidity offset
SOL	Set point low limit temperature	OFT	Temperature offset
SOH	Set point high limit temperature	OFC	CO_2 offset
LON	CO2 warning indicator limit (Model dependent)	AUT	Auto serial configuration
		BAU	Baud rate selection
LOF	CO2 warning indicator off level (Model dependent)	PAR	Parity selection
		STP	Stop bits selection
		RST	Reset to factory defaults
*Only the Series CDTA has humidity sensing capabilities.			

Table 4: Setup values

Home Screen Configuration (DSP)
This value controls what information is displayed on the home screen.

DSP				
Setting Value	**Primary Value**	**Primary Text**	**Secondary Value**	**Secondary Text**
“CH”*	CO_2 concentration	“PPM”	Relative humidity	“%”
“CT”	CO_2 concentration	“PPM”	Temperature	“°C” or “°F”
“HT”*	Relative humidity	“%”	Temperature	“°C” or “°F”
“TS”	Temperature	“°C” or “°F”	Set point	“°C” or “°F”
“S”	Set point	“°C” or “°F”		
“T”	Temperature	“°C” or “°F”		
“H”*	Relative humidity	“%”		
“C”	CO_2 concentration	“PPM”		
*Only the Series CDTA has humidity sensing capabilities.				

Table 5: Display values

Maximum CO2 Value (MAX)
Displays the highest CO_2 concentration value observed by the sensor since the last power cycle or reset. Reset the MAX CO_2 concentration by pressing and holding the UP and DOWN buttons for 1 second.

Units Selection (UNI)
This value controls the units that data is displayed in.

UNI	
Setting Value	**Description**
“US”	US customary units (°F, in Hg)
“SI”	International system units (°C, hPa)

Table 6: Unit values

Set Point Low Limit Temperature (SOL)
This value sets a lower limit on the current set point value. The set point low limit value is a numerical setting that supports continuous change (increment/decrement) by press and holding of either UP or DOWN button. If the new set point low limit temperature is higher than the current set point temperature, then the set point temperature will be set to the new set point low limit temperature.

SOL			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
20°C (68°F)	0°C (32°F)	Set point high limit	1°

Table 7: Set point for low temperature limit

Set Point High Limit Temperature (SOH)
This value sets an upper limit on the current set point value. The set point high limit value is a numerical setting that supports continuous change (increment/decrement) by press and holding of either UP or DOWN button. If the new set point high limit temperature is lower than the current set point temperature, then the set point temperature will be set to the new set point high limit temperature.

SOH			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
35°C (95°F)	Set point low limit	50°C (122°F)	1°

Table 8: Set point for high temperature limit

CO_2 Warning Indicator Limit (Model Dependent) (LON)
The CO_2 concentration that will turn on the warning LED

LON			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
1100 PPM	0 PPM	9999 PPM	1 PPM

Table 10: CO_2 warning indicator on limit

CO_2 Warning Indicator Off Level (Model Dependent) (LOF)
The CO_2 concentration that will turn off the warning LED

LOF			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
1050 PPM	0 PPM	9999 PPM	1 PPM

Table 11: CO_2 warning indicator off limit

Typical Barometric Pressure (BAR)
This value sets the typical barometric pressure for the location where the device is mounted. The factory setting is for standard pressure at sea level. Adjusting the barometric pressure gives a more accurate measurement, especially at higher elevations.

BAR			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
1013 hPa (29.9 inHg)	677 hPa (20.0 inHg)	1016 hPa (30.0 inHg)	1 hPa (0.1 inHg)

Table 12: Elevation/barometric pressure compensation

Automated Background Calibration (ABC)
Enables/disables the Automated Baseline Correction algorithm for disabling in locations that experience elevated levels of CO2 due to constant occupancy of the area. Select “ON” to enable ABC and select “OFF” to disable ABC. Factory Default is “ON.”

ABC	
Setting Value	**Description**
“ON”	Enables ABC algorithm
“OFF”	Disables the ABC algorithm

Table 13: Automated background calibration setting

Relative Humidity Offset (OFH)
This value, allows the relative humidity to be adjusted by a fixed amount to match another calibrated measurement. The display shows the current relative humidity value plus any previous offset value.

RHU			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
0%	-30%	30%	0.1%

Table 14: RH offset value

Temperature Offset (OFT)
This value allows the temperature to be adjusted by a fixed amount to match another calibrated measurement. The display shows the current temperature value plus any previous offset value.

OFT			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
0°	-30°	30°	0.1°

Table 15: Temperature offset value

CO_2 Offset (OFC)
This value allows the CO_2 Concentration to be adjusted by a fixed amount to match another calibrated measurement. The display shows the current CO_2 concentration value plus any previous offset value.

OFC			
Default Value	**Minimum Value**	**Maximum Value**	**Increment**
0 PPM	-500 PPM	500 PPM	1 PPM

Table 16: CO_2 offset value

Auto Serial Configuration (AUT)
This value enables or disables the automatic baud rate detection. If the device fails to communicate or the serial configuration is not one of the options in Table 3, then this value should be set to “OFF”. The serial can then be configured manually.

AUT	
Setting Value	**Description**
“ON”	Auto baud enabled
“OFF”	Auto baud disabled

Table 17: Automatic baud rate value

Baud Rate (BAU)
This value provides the selection of the desired serial baud rate. This value is only visible when the value of AUT is “OFF”.

BAU			
Setting Value	**Baud Rate**	**Setting Value**	**Baud Rate**
9.6 K	9,600	57.6 K	57,600
19.2 K	19,200	76.8 K	76,800
38.4 K	38,400	115.2 K	115,200

Table 18: Serial baud rate value

Parity Selection (PAR)
This value provides the selection of the desired serial parity. This value is only visible when the value of AUT is “OFF”.

PAR	
Setting Value	**Description**
“NON”	No parity
“EVE”	Even parity
“ODD”	Odd parity

Table 19: Serial parity value

Stop Bits Selection (STP)
This value provides the selection of the desired serial stop bits. This value is only visible when he value of AUT is “OFF”

STP	
Setting Value	**Description**
1	One stop bit
2	Two stop bits

Table 20: Serial stop bits value

Reset To Factory Defaults (RST)
This value, when set to “YES”, will reset all user settings to their default values and reset the device. This applies to all settings including BACnet writable settings.

BACNET

NOTICE BACnet installations should comply with ANSI/ASHRAE Standard 135-2010 BACnet A Data Communication Protocol for Building Automation and Control Networks, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 2010

NOTICE Communications wiring must be in a daisy-chain fashion. Star connections and T connections are not permitted

BACnet Object Overview
The device supports the following objects:

SUPPORTED BACNET OBJECTS				
Object Type	**Dynamically Creatable**	**Dynamically Deletable**	**Object Identifier**	**Object Name**
Device	No	No	607xxx	CDTA IAQ
Analog Input	No	No	AI1	CO_2 concentration
Analog Input	No	No	AI2	Relative humidity*
Analog Input	No	No	AI3	Temperature
Binary Value	No	No	BV1	Override
Binary Value	No	No	BV2	Use SI units
Analog Value	No	No	AV1	Set point
Analog Value	No	No	AV2	Set point low limit
Analog Value	No	No	AV3	Set point high limit
Analog Value	No	No	AV4	Dew point
Analog Value	No	No	AV5	Wet bulb
Analog Value	No	No	AV6	Specific enthalpy
Analog Value	No	No	AV7	Display mode
Analog Value	No	No	AV8	CO_2 Offset
Analog Value	No	No	AV9	Barometric pressure
Analog Value	No	No	AV10	Relative humidity offset*
Analog Value	No	No	AV11	Temperature offset
*Only the Series CDTA has humidity sensing capabilities.				

The default object identifier is 607xxx, where **xxx** is replaced by the MS/TP MAC address set by DIP switch SW2. The object identifier value will change as the MS/TP MAC address changes. However, if a specific object identifier is written via BACnet, then that value is stored and changes to the MS/TP MAC address will no longer affect the object identifier. Similarly, the default object name includes 607xxx. The object name will reflect the current object identifier. If a specific object name is written via BACnet, then that value is stored and changes to the object identifier will no longer affect the object name.

APDU Timeout values are rounded to the nearest second (1000ms). Values less than 500 will be rounded to 0 and Number of APDU Retries will be set to 0.

BACnet Objects

Device Object

Property	Default Value	Property Data Type	Access
Object Identifier	607xxx	BACnetObjectIdentifier	Read/Write
Object Name	“CDTA IAQ 607xxx”	CharacterString(32)	Read/Write
Object Type	DEVICE(8)	BACnetObjectType	Read
System Status	Operational(0)	BACnetDeviceStatus	Read
Vendor Name	“Dwyer Instruments, Inc.”	CharacterString	Read
Vendor Identifier	607	Unsigned	Read
Model Name	“CDTA-???0-???”	CharacterString	Read
Firmware Revision	“?.?”	CharacterString	Read
Application Software Version	“?.?”	CharacterString	Read
Location		CharacterString(32)	Read/Write
Description	“All-in-One CO2/RH/Temp/SetPoint”	CharacterString(32)	Read/Write
Protocol Version	1	Unsigned	Read
Protocol Revision	12	Unsigned	Read
Protocol Services Supported	See PICS	BACnetServicesSupported	Read
Protocol Object Types Supported	See Table 2	BACnetObjectTypesSupported	Read
Object List	See Table 2	BACnetArray	Read
Active COV Subscriptions		List of BACnetCOVSubscription	Read
Maximum APDU Length Supported	480	Unsigned	Read
Segmentation Supported	NO_SEGMENTATION (3)	BACnetSegmentation	Read
APDU Timeout	6000	Unsigned	Read/Write
Number of APDU Retries	3	Unsigned	Read/Write
Max Master	127	Unsigned	Read/Write
Max Info Frames	1	Unsigned	Read/Write
Device Address Binding	Empty	BACnetAddressBinding	Read
Database Revision	1	Unsigned	Read
Serial Number (1000)		CharacterString	Read

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