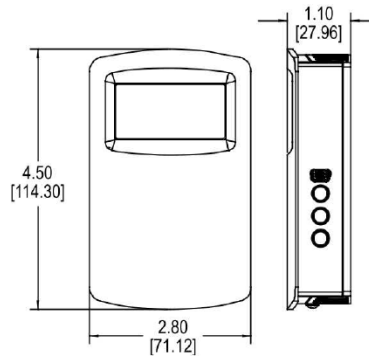

SUPPLEMENTAL INSTRUCTIONS

8403-096 Carbon Dioxide Transmitter



8403-096 wall mount carbon dioxide temperature transmitters accurately monitor the CO₂ concentration and temperature in schools, office buildings and other indoor environments to help achieve LEED® certification. For increased sensor life, a single-beam dual-wavelength non-dispersive infrared (NDIR) sensor is used to automatically correct the measurement in both occupied and unoccupied buildings against aging effects. The single-beam dual-wavelength sensor technology provides the highest level of accuracy compared to Automatic Baseline Correction methods, which can unintentionally shift the calibration based on CO₂ levels and barometric pressure conditions. In order to achieve a higher level of accuracy, the transmitter includes digital barometric pressure adjustment and the ability to field-calibrate the sensor.

Universal outputs allow users to select the transmitter output to be 4-20 mA, 0-5 VDC or 0-10 VDC to work with virtually any building management controller. An optional relay with user adjustable setpoints can be used to control exhaust fans, open actuated windows or dampers or signal a light or horn.

For applications that require visual indication, the transmitter is supplied with an integral LCD display. Push buttons are standard on all transmitters for access to the menu structure. To prevent tampering, the action of the buttons can be locked out using an internal dip switch selection. Menu items that can be accessed include: Engineering units, relay output setpoints, display configuration, transmitter output scaling, ambient barometric pressure and field calibration of the transmitter.

Single-beam dual-wavelength sensor advantages:

- Automatically corrects for aging effects in occupied and unoccupied buildings*
 - Perfect for hospitals and manufacturing plants that are occupied 24 hours per day
- Measures actual unfiltered light intensity directly
 - Eliminates error from incorrect assumptions of gas concentration in theoretical logic assumption methods

* For buildings occupied 24 hours per day, it is recommended that calibration be verified every 6 to 12 months depending on application.



Climate Control Solutions

Bard Manufacturing Company, Inc.
Bryan, Ohio 43506
www.bardhvac.com

Manual: 7960-902B
Supersedes: 7960-902A
Date: 5-12-22

SPECIFICATIONS

Sensor: Single beam, dual-wavelength NDIR.

Range: CO₂: 0 to 2000; Temperature: 32 to 122°F (0 to 50°C).

Accuracy: CO₂: ±40 PPM ±3% of reading; Temperature: ±1°C @ 25°C.

Temperature Dependence: ±8 PPM/°C at 1100 PPM.

Non-Linearity: 16 PPM.

Pressure Dependence: 0.13% of reading per mm of Hg.

Response Time: 2 min for 99% step change.

Temperature Limits: 32 to 122°F (0 to 50°C).

Humidity Limits: 10 to 95% RH (non-condensing).

Power Requirements: 16-35 VDC or 19-28 VAC.

Power Consumption: Average: 2 w; Peak: 3.75 w.

Output: Current: 4-20 mA (max. 500 Ω); Voltage: 0-5 VDC or 0-10 VDC (min. 500 Ω); Relay: SPST NO rated 2A@ 30 VDC; RTD or thermistor per r-t curves on page 6 (depending on model).

Weight: 4.4 oz (125 g).

Agency Approvals: CE.

INSTALLATION



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

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

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.

NOTICE

Upon powering the transmitter, the firmware version will flash on the display. A warm up period of 30 minutes is required for the transmitter to adjust to the current CO₂ concentration.

NOTICE

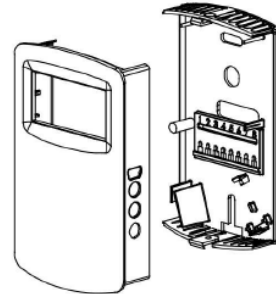
Self calibration feature of the transmitter requires exposure to normal outdoor equivalent carbon dioxide level once every 30 days.

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



WIRING

Use maximum 18 AWG wire for wiring to terminals. Refer to Figure 4 for wiring information.

DIP SWITCH SETTINGS

To access the DIP switch, remove the cover of the unit as shown in Figure 2. The DIP switch is located on the back of the circuit board.

FIGURE 2
Diagram of Circuit Board

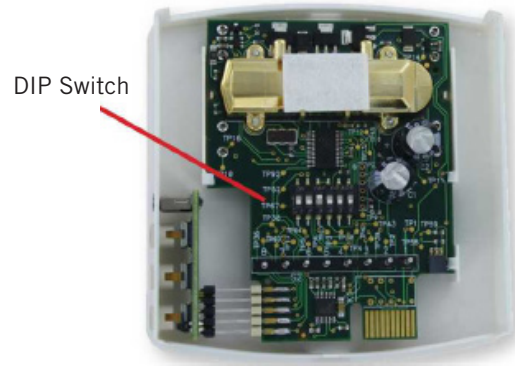
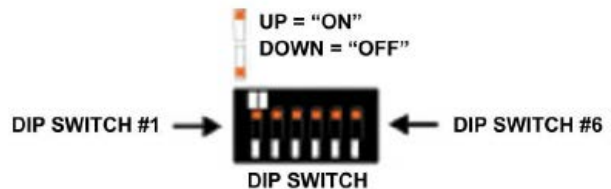


FIGURE 3
DIP Switches



DIP Switch Position 1: CO₂ Output Selection

ON: Output set to voltage output
 OFF: Output set to current output

DIP Switch Position 2: Temperature Output Selection

ON: Output set to voltage output
 OFF: Output set to current output

DIP Switch Positions 3 & 4: Current or Voltage Output Range Selection

Output Range	DIP Switch 3 Position	DIP Switch 4 Position
2-10 V 4-20 mA	ON	OFF
0-10 V 0-20 mA	OFF	OFF
0-5 V 0-10 mA	OFF	ON
1-5 V 2-10 mA	ON	ON

DIP Switch Position 5: Menu Access

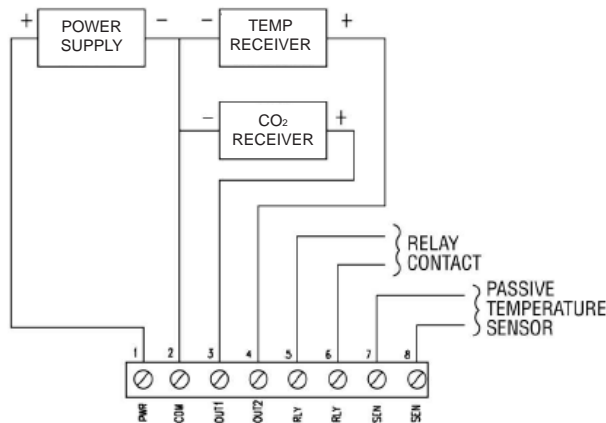
ON: Menu Enabled
 OFF: Menu Disabled

CURRENT/VOLTAGE OUTPUT

The transmitter may be wired for current or voltage output for both carbon dioxide and temperature. The transmitter can be powered with either 16-35 VDC or 19-28 VAC. Wire the transmitter according to Figure 4.

NOTICE Optional relay can be used as either a dry contact or low voltage switched circuit up to 2 A at 30 VDC

FIGURE 4
Active Output Wiring Diagram



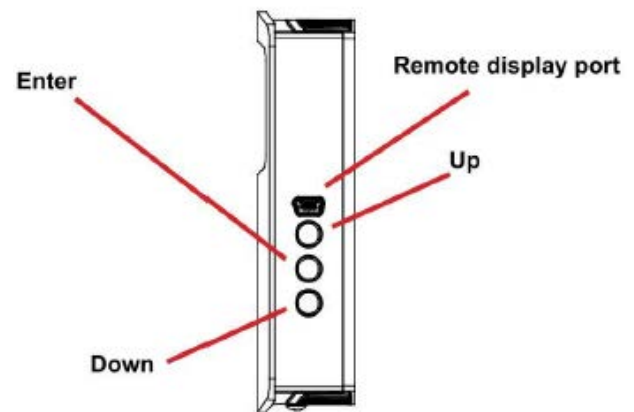
EDITING MENU PARAMETERS

Before any adjustment can be made to the transmitter, the Menu Lockout Dip Switch must be set to the "On" position (see Figure 3).

ACCESSING MENU PARAMETERS

- Step 1: To enter the menu structure, press Up button and Down button simultaneously for 5 seconds (see Figure 5). Display will show RON parameter.
- Step 2: Press Up button or Down button to cycle between menu items.
- Step 3: Press Enter to edit the value for the displayed menu item (SET will appear on display).
- Step 4: Press Up button or Down button to adjust the value of the menu item.
- Step 5: Press Enter button to save the changes (SET will disappear).
- Step 6: Repeat Steps 2 through 5 for each of the parameters.
- Step 7: To exit the menu at any time, press and hold Up button and Down button simultaneously for 5 seconds or wait 10 seconds without pushing any buttons.

FIGURE 5
Side View of Transmitter



MENU DESCRIPTIONS

RON Relay on setpoint

Sets the CO₂ concentration which the optional relay is energized.

ROF Relay off setpoint

Sets the CO₂ concentration which the optional relay is de-energized. Setting value lower than RON provides direct action for detecting high concentrations of CO₂. Setting value higher than RON provides indirect action for detecting low concentrations of CO₂. Up button and Down button on the LCD display will be lit to indicate when the relay is energized.

Low limit: 0 PPM
Factory setting: 950 PPM
High limit: 2000 PPM

DSP Display configuration

Determines the LCD display configuration during normal operation. The LCD display can indicate the CO₂ concentration, temperature and CO₂ concentration.

CT CO₂ concentration and temperature
(NOT USED)

C CO₂ concentration only
(RECOMMENDED SETTING)

T Temperature only
(NOT USED)

UNI Units selection

Temperature and barometric pressure measurements can be displayed in US engineering units or SI engineering units. The factory default is to display US engineering units.

US units °F for temperature and in Hg for barometric pressure

SI units °C for temperature and hPa for barometric pressure

COL CO₂ low output range

Sets the CO₂ concentration for the lowest output (4 mA or 0 VDC).

Low limit: 0 PPM
Factory setting: 0 PPM
High limit: 2000 PPM

COH CO₂ high output range

Sets the CO₂ concentration for the highest output (20 mA, 5 VDC or 10 VDC). When COH is set above COL, the transmitter is direct acting and the output will increase with an increase in CO₂ level. When COH is below COL, the transmitter is reverse acting and the output will increase with a decrease in CO₂ level.

Low limit: 0 PPM
Factory setting: 2000 PPM
High limit: 2000 PPM

AAC Average Atmospheric Carbon Dioxide value

Sets the value at which the sensors automatic background calibration will reference. Factory setting derived from research from the National Oceanic and Atmospheric Administration (NOAA).

Low limit: 200 PPM
Factory setting: Current NOAA value
High limit: 9999 PPM

TOL **NOT USED**

TOH **NOT USED**

BAR Barometric pressure

Sets the typical barometric pressure for the location where the transmitter 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. Refer to the elevation charts in Table 1 for typical barometric pressures at a given elevation.

Low limit: 20.0 in Hg/677 hPa
Factory setting: 29.9 in Hg/1013 hPa
High limit: 32.0 in Hg/1084 hPa

CAL Calibration

Calibrates the carbon dioxide sensor to a known gas value. Read **CALIBRATING SENSOR** on page 5 before using this feature. Hold Enter button for 5 seconds.

RST Reset to Factory Defaults

Resets all menu settings to their default value and clears zero and span.

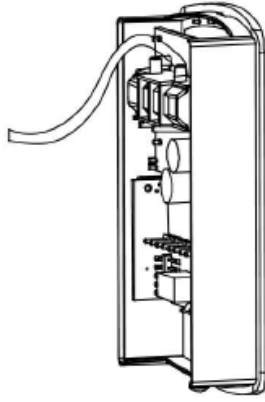
YES: Press and hold -- button for several seconds to reset settings

NO: Press -- button to exit this menu item without resetting

CALIBRATING SENSOR

- Step 1: Remove the cover as shown in Figure 1.
- Step 2: Remove one of the gas nipple covers on the CO₂ sensor and attach tubing from the gas pressure regulator to the nipple (see Figure 6).

FIGURE 6
Calibration



- Step 3: Attach the terminal block accessory to the circuit board so that the power wires line up with terminals 1 and 2. Plug in the power supply to power up the transmitter.
- Step 4: Hold housing so that the sensor is in the vertical plane as shown in Figure 6.
- Step 5: Flow zero reference gas at 0.3 SLPM for 5 minutes.
- Step 6: Press and hold the Up and Down buttons simultaneously for 5 seconds to enter the menu parameters. The display will show the "RON" parameter.
- Step 7: Press the Up or Down button to access the calibration parameter menu which will display as "CAL".
- Step 8: Press the Enter button. "SET" will then appear on the display.
- Step 9: Press the Down arrow for 3 seconds. All dashes will appear on the display, then release the button. Then after 10 seconds "SET" will disappear.
- Step 10: Exit the parameter menu by pressing and holding the Up and Down buttons simultaneously for 5 seconds or wait 10 seconds.
- Step 11: Flow the full scale reference gas at 0.3 SLPM for 5 minutes.
- Step 12: Repeat steps 6 through 8.
- Step 13: Press the Up arrow for 3 seconds. All dashes will appear on the display, then release the button. Then after 10 seconds "SET" will disappear.

- Step 14: Exit the parameter menu by pressing and holding the Up and Down buttons simultaneously for 5 seconds or wait 10 seconds.
- Step 15: Disconnect the power supply from the power source and remove the terminal block from the circuit board.
- Step 16: Remove tubing from sensor and re-attach the gas nipple cover to the sensor.
- Step 17: Re-attach the cover to the back plate.

MAINTENANCE

Upon final installation of the transmitter, no routine maintenance is required. Transmitters are not field serviceable and should be returned if repair is needed. Field repair should not be attempted and may void warranty.



This symbol indicates waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your Local Authority or retailer for recycling advice.

TABLE 1
Elevation

US Customary Units		SI Units	
ft	in Hg	m	hPa
0	29.92	0	1013
400	29.50	100	1002
800	29.10	200	990
1200	28.69	300	979
1600	28.29	400	968
2000	27.90	500	957
2400	27.51	600	946
2800	27.13	700	935
3200	26.76	800	924
3600	26.39	900	914
4000	26.02	1000	904
4400	25.66	1100	893
4800	25.30	1200	883
5200	24.95	1300	873
5600	24.60	1400	863
6000	24.26	1500	853
6400	23.93	1600	844
6800	23.60	1700	834
7200	23.27	1800	824
7600	22.94	1900	815
8000	22.63	2000	806
8400	22.31	2100	797
8800	22.00	2200	787
9200	21.70	2300	779
9600	21.40	2400	770
10000	21.40	2500	761

TABLE 2
Resistance vs. Temperature

Temperature		Resistance Curves (in Ω)					
$^{\circ}\text{C}$	$^{\circ}\text{F}$	A	B	C	D	E	F
-55	-67.0	607800.00	963849.00	289154.70	78.32	783.2	2394000.00
-50	-58.0	441200.00	670166.00	201049.80	80.31	803.1	1646200.00
-45	-49.0	323600.00	471985.00	141595.50	82.29	822.9	1145800.00
-40	-40.0	239700.00	336479.00	100943.70	84.27	842.7	806800.00
-35	-31.0	179200.00	242681.00	72804.30	86.25	862.5	574400.00
-30	-22.0	135200.00	176974.00	53092.20	88.22	882.2	413400.00
-25	-13.0	102900.00	130421.00	39126.30	90.19	901.9	300400.00
-20	-4.0	78910.00	97081.00	29124.30	92.16	921.6	220600.00
-15	5.0	61020.00	72957.00	21887.10	94.12	941.2	163500.00
-10	14.0	47540.00	55329.00	16598.70	96.09	960.9	122280.00
-5	23.0	37310.00	42327.00	12698.10	98.04	980.4	92240.00
0	32.0	29490.00	32650.00	9795.00	100.00	1000.0	70160.00
5	41.0	23460.00	25392.00	7617.60	101.95	1019.5	53780.00
10	50.0	18780.00	19901.00	5970.30	103.90	1039.0	41560.00
15	59.0	15130.00	15712.00	4713.60	105.85	1058.5	32340.00
20	68.0	12260.00	12493.00	3747.90	107.79	1077.9	25360.00
25	77.0	10000.00	10000.00	3000.00	109.74	1097.4	20000.00
30	86.0	8194.00	8057.00	2417.10	111.67	1116.7	15892.00
35	95.0	6752.00	6531.00	1959.30	113.61	1136.1	12704.00
40	104.0	5592.00	5326.00	1597.80	115.54	1155.4	10216.00
45	113.0	4655.00	4368.00	1310.40	117.47	1174.7	8264.00
50	122.0	3893.00	3602.00	1080.60	119.40	1194.0	6722.00
55	131.0	3271.00	2986.00	895.80	121.32	1213.2	5498.00
60	140.0	2760.00	2488.00	746.40	123.24	1232.4	4520.00
65	149.0	2339.00	2083.00	624.90	125.16	1251.6	3734.00
70	158.0	1990.00	1752.00	525.60	127.08	1270.8	3100.00
75	167.0	1700.00	1480.00	444.00	128.99	1289.9	2586.00
80	176.0	1458.00	1255.00	376.50	130.90	1309.0	2166.00
85	185.0	1255.00	1070.00	321.00	132.80	1328.0	1822.60
90	194.0	1084.00	915.50	274.65	134.71	1347.1	1540.00
95	203.0	939.30	786.60	235.98	136.61	1366.1	1306.40
100	212.0	816.80	678.60	203.58	138.51	1385.1	1112.60
105	221.0	712.60	587.60	176.28	140.40	1404.0	951.00
110	230.0	623.60	510.60	153.18	142.29	1422.9	815.80
115	239.0	547.30	445.30	133.59	144.18	1441.8	702.20
120	248.0	481.80	389.60	116.88	146.07	1460.7	606.40
125	257.0	425.30	341.90	102.57	147.95	1479.5	525.60
130	266.0	376.40	301.00	90.30	149.83	1498.3	N/A
135	275.0	334.00	265.80	79.74	151.71	1517.1	N/A
140	284.0	297.20	235.30	70.59	153.58	1535.8	N/A
145	293.0	265.10	208.90	62.67	155.46	1554.6	N/A
150	302.0	237.00	186.10	55.83	157.33	1573.3	N/A