



E-BUS Digital Room Sensor Technical Guide



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PART NUMBER CROSS REFERENCE TABLE	
PART DESCRIPTION	ORION
E-BUS LCD Digital Room Sensor Temp Only	OE217-02
E-BUS LCD Room Sensor Temp & Humidity	OE217-03
E-BUS Digital Room Sensor Temp & Humidity	OE217-04
E-BUS CO ₂ Sensor	OE256-05
E-BUS Duct Mounted CO ₂ Sensor (RA or SA)	OE256-06
Return Air Temperature Sensor	OE231
VCB-X Controller	OE335-23-VCBX



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Overview

The OE217 series of E-BUS Digital Room Sensors are used to sense Space Temperature only or Space Temperature & Space Humidity. See **Figures 1 & 2**.

The OE217-02 model is the Space Temperature Sensor only model and the OE217-03 & OE217-04 models are a combination Space Temperature & Space Humidity Sensor model. The OE217-04 model includes an enclosure without LCD display, front LEDs, and buttons.

The sensors can be used with the VCB-X Controller (OE335-23-VCBX) and connect to the controller using various lengths of EBC E-BUS cables connected between the controller and the sensor. The EBC E-BUS cables should not run in conduit with other AC line voltage wiring or with any conductors carrying highly inductive loads.

The OE217-02 & OE217-03 sensors provide the following useful functions:

- Provides 112 x 64 monochrome Graphical LCD display with LED backlight
- Displays the Current Space Temperature

- Displays Outdoor Air Temperature (if controller is configured with an OA Temperature Sensor)
- Displays the Current Space Humidity (OE217-03 Model Only)
- Displays Outdoor Air Relative Humidity (OE217-03 Model if controller is configured with an OA Humidity Sensor)
- Displays the Current Zone Setpoint Temperature
- Equipped with Push Buttons for changing the Zone Setpoint Temperature
- Equipped with an Override Button for forcing the VCB-X Controller into Occupied Operation from Unoccupied Operation
- Provides graphics to indicate the Mode of Operation
- Provides LEDs to indicate Schedule Override, Button Push, and Alarms
- Can display Temperature reading from a Remote Temperature Sensor (see **Figure 22** on page 15 for instructions)

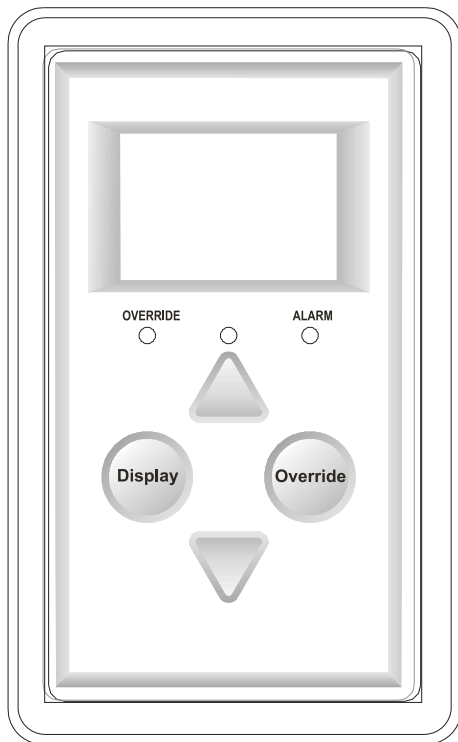


Figure 1: OE217-02 & OE217-03 E-BUS Digital Room Sensor

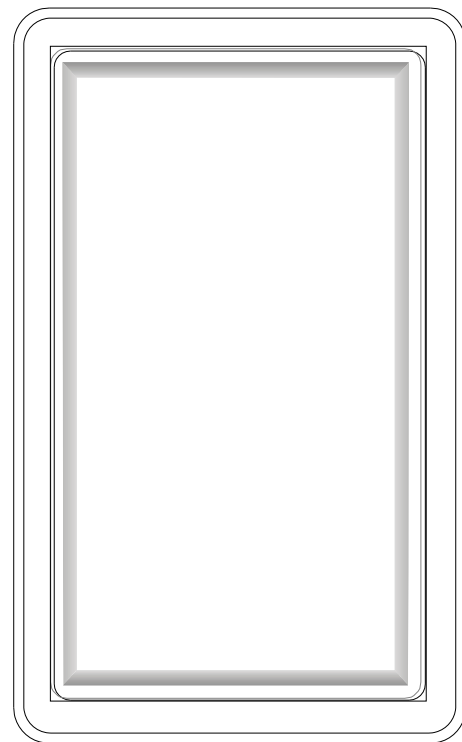


Figure 2: OE217-04 E-BUS Digital Room Sensor

Basic Operation

Sensor Operation

When power is first applied to the OE217-02 E-BUS Digital Room Sensor, the sensor will display the Current Room Temperature and the current setting of the slide offset. The OE217-03 model will also display Relative Humidity.

NOTE: The sensor readings are not accurate until the controller that the sensor is connected to is done calibrating.

The sensor has 4 buttons—<Display>, <Override>, <Up>, and <Down>. You can also access certain functions by *touching* the area below the <Display> and <Override> buttons. The sensor has 3 LEDs—one to indicate an Override, one to indicate an Alarm, and one to indicate that a button has been pressed. See **Figure 3** for LED and Button Descriptions.

An icon for the current mode of operation will appear in the sensor display. The operation mode icons are a Snowflake for Cooling Mode, a Flame for Heating Mode, a Fan in motion for Vent Mode, and a Moon for Unoccupied Mode. When the unit is in Unoccupied Mode, the screen's background will turn dark. See **Figure 9** on page 7 for examples of operation modes.

LED Operation

Refer to **Figure 3** below for LED locations.

Alarm LED: The Alarm LED will blink when there is an alarm from the Controller.

Sense LED: The Sense LED will blink when the sensor gets a valid touch.

Override LED: The Override LED is inoperable when in Occupied Mode. In Unoccupied Mode, if you *touch* the <Override> button, the Override LED will blink, indicating an override request. The Controller will respond by sending the unit into override. The Override LED will then stay on for the duration of the Override. Any time the Unit is in Override, you can request to cancel the override by *touching* the <Override> button, and the Override LED will blink. The Unit will then cancel the override. The Override LED will then turn off.

Comm LED: The Comm LED located on the back of the sensor blinks on whenever communications are sensed.

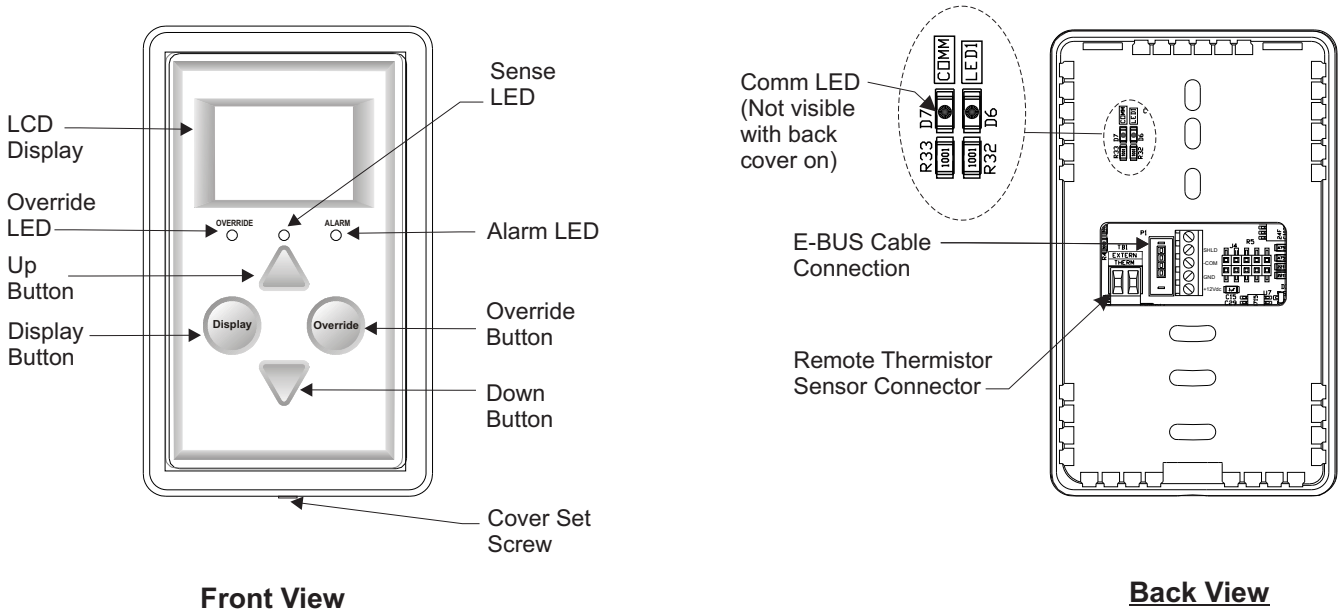


Figure 3: E-BUS Digital Room Sensor Components

Environmental Requirements

The E-BUS Digital Room Sensor needs to be installed in an environment that does not exceed a temperature greater than 150°F or less than -30°F and does not exceed 90% relative humidity levels (non-condensing).

Indoor Reading Range

The E-BUS Digital Room Sensor's Indoor Reading Range is 40°F to 120°F and 0-100% RH (RH is available on the OE217-03 & OE217-04 models). Its temperature reading accuracy is +/- .5°F, and its RH reading accuracy is +/-2%. Its sensor element is the integral communicating digital sensing device or external Type III Thermistor 10K Ohm @ 77°F.

Outdoor Reading Range

If your E-BUS Digital Room Sensor is set up to read an Outdoor Air Temperature Sensor, any outdoor air temperature below -40°F will not appear on the E-BUS Digital Room Sensor's display.

Important Wiring Considerations

The E-BUS Digital Room Sensors connect to the VCB-X Controller using various lengths of EBC E-BUS cable connected between the controller and the sensor. The EBC E-BUS cables should not run in conduit with other AC line voltage wiring or with any conductors carrying highly inductive loads. See **Figure 17** on page 10 for wiring.

Mounting

The E-BUS Digital Room Sensor is designed to be mounted to a vertical 2" x 4" electrical box recessed in the wall. If the wall cannot be penetrated, a plastic surface mount box such as those made by Wiremold™ may be used to mount the sensor to the wall surface. The Sensor should be mounted at least 5 feet above the floor.

The Sensor is mounted by removing the front cover and fastening the housing base to the electrical box using the supplied (2) 6/32" x 1" machine screws. The modular cable is then plugged into the phone jack located on the circuit board that is mounted on the cover. The cover is then placed onto the housing base, and the Allen Screw on the bottom of the base is adjusted to hold the cover in place.

See **Figure 4** for E-BUS Digital Room Sensor dimensions.

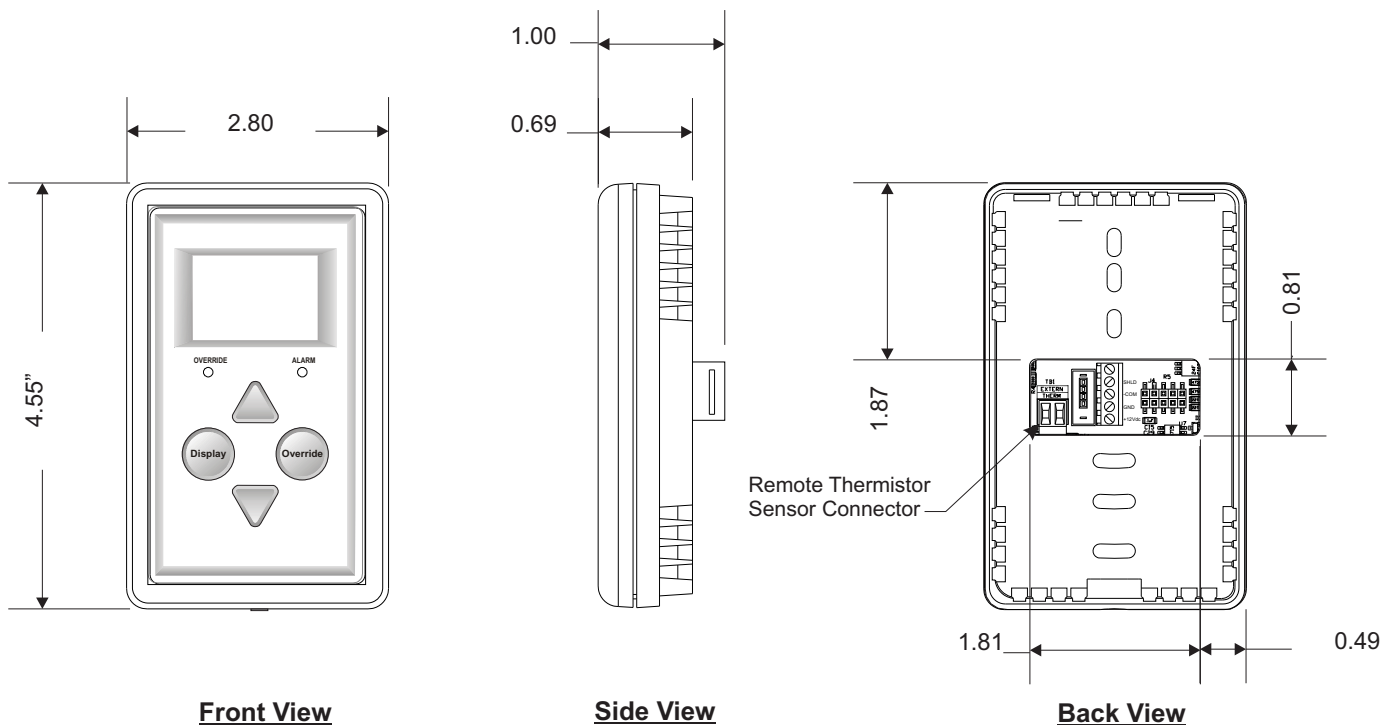


Figure 4: E-BUS Digital Room Sensor Dimensions

Sensor Operation

Main Sensor Display Screens

There are 3 Main Sensor Display Screens. The first screen displays the Current Room Temperature, Operation Mode, Slide Offset, and RH (RH is available on the OE217-03 Model). The second screen displays the Outside Air Temperature and/or Humidity if Outdoor Air Temperature and/or Outdoor Air Humidity is being monitored. The third screen displays the unit information for the controller that the Digital Room Sensor is connected to.

Temperature and Humidity Status Screen

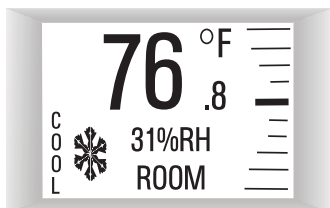


Figure 5: Main Display Screen

The *Main Display Screen* displays the current room temperature, the humidity in the room (RH is available on the OE217-03 Model), the current setting of the slide offset, and an icon for the current mode of operation once the controller it is connected to is done calibrating.

The different icons shown are a Snowflake for cooling mode, a Flame for heating mode, a Fan in motion for vent mode, and a Moon for unoccupied mode. When the unit is in unoccupied mode, the screen's background will turn dark. Refer to

Figure 9 for operation mode screen examples.

Outside Air Temperature Humidity Status Screen

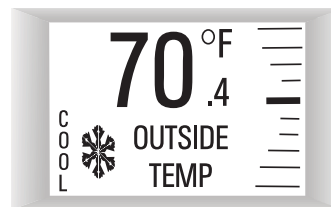


Figure 6: Outdoor Status Screen

If the connected controller is receiving an outdoor air temperature and/or humidity broadcast, *touching* <Display> will first bring up the *Outdoor Status Screen*.

Unit Information Screen

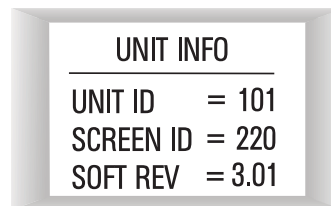


Figure 7: Unit Information Screen

Touching <Display> again will bring up the *Unit Information Screen* which contains the controller's address or ID number, screen ID, and software version of the controller connected to the sensor.

Setpoint Adjust Screen

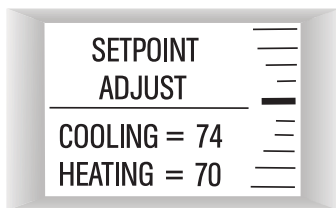


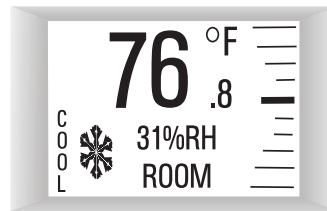
Figure 8: Setpoint Adjust Screen

Touching <△> or <▽> will display the *Setpoint Adjust Screen*. You can adjust the cooling and heating setpoints from this screen based on the VCB-X Controller slide offset setpoint. For example, if the connected controller's Max Slide Offset Setpoint is set for five, you can adjust the setpoint up five degrees and down five degrees.

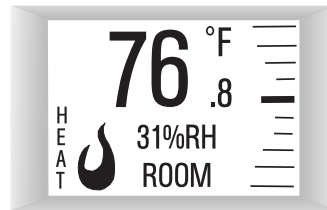
NOTE: If the VCB-X Controller's slide offset setpoint is set to Zero, this screen will not appear when you touch <△> or <▽>.

Operation Modes

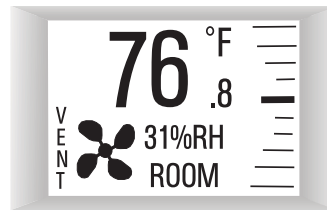
Refer to **Figure 9** for operation mode screen examples. The different icons shown are a Snowflake for cooling mode, a Flame for heating mode, a Fan in motion for vent mode, and a Moon for unoccupied mode. When the unit is in unoccupied mode, the screen's background will turn dark.



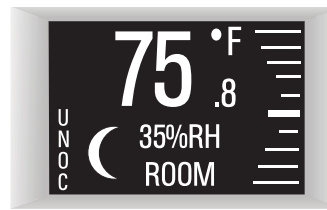
Cooling Mode with Snowflake Icon



Heating Mode with Flame Icon



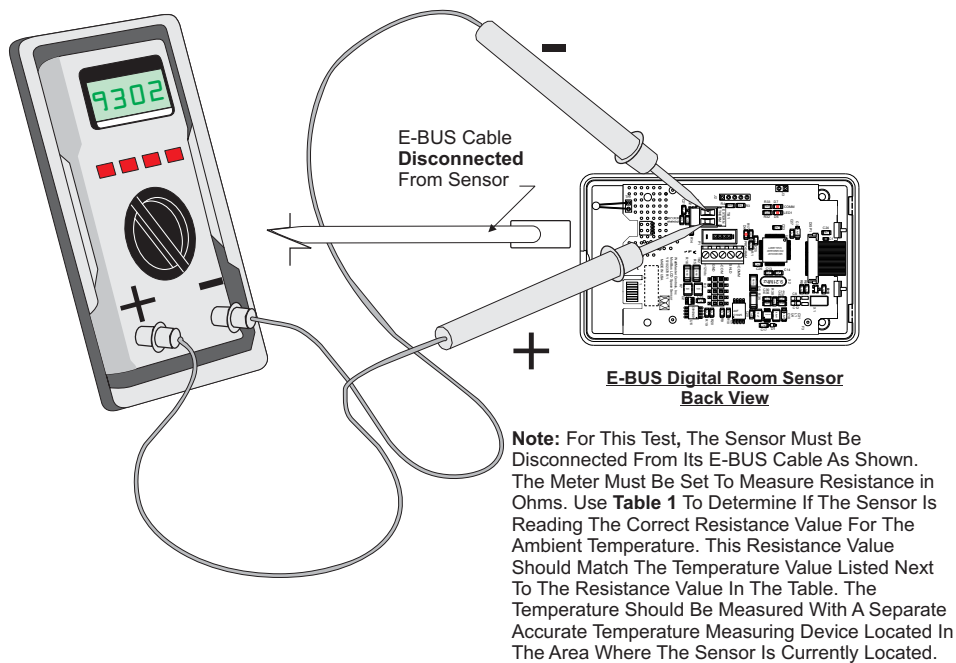
Vent Mode with Fan in Motion Icon



Unoccupied Mode with Moon Icon

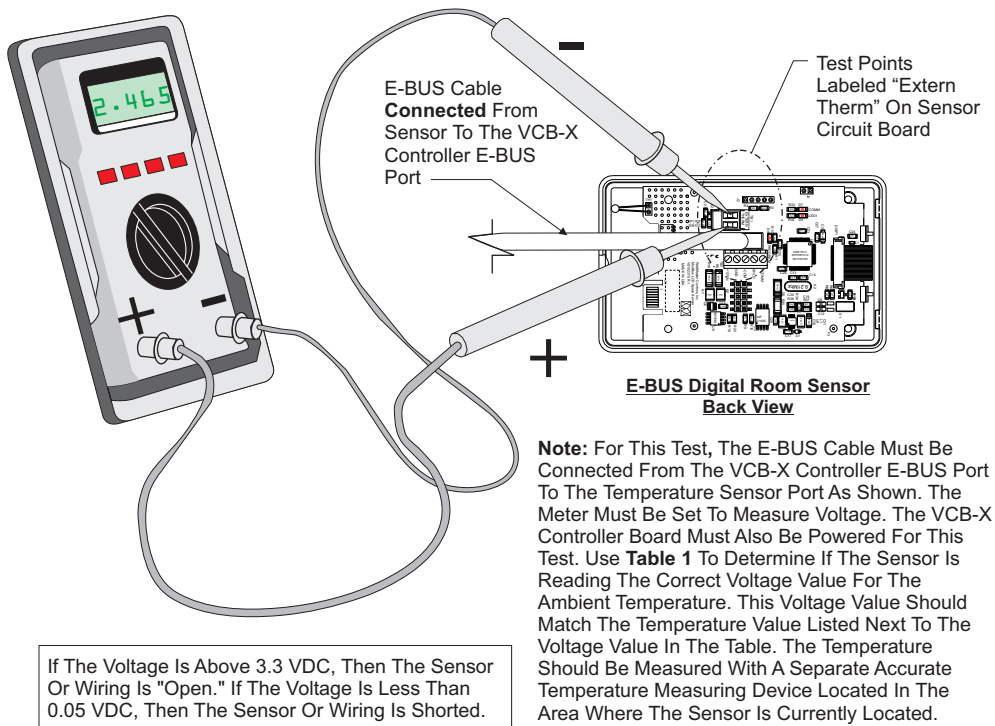
Figure 9: Operation Mode Screens

Troubleshooting



Measuring Digital Sensor Resistance

Figure 10: Temperature/Resistance Testing



Measuring Digital Sensor Voltage

Figure 11: Temperature/Voltage Testing

Temperature - Resistance - Voltage for Type III 10K Ohm Thermistor Sensors		
Temp (°F)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	93333	2.98
-5	80531	2.94
0	69822	2.89
5	60552	2.83
10	52500	2.77
15	45902	2.71
20	40147	2.64
25	35165	2.57
30	30805	2.49
35	27140	2.41
40	23874	2.33
45	21094	2.24
50	18655	2.15
52	17799	2.11
54	16956	2.08
56	16164	2.04
58	15385	2.00
60	14681	1.96
62	14014	1.93
64	13382	1.89
66	12758	1.85
68	12191	1.81
69	11906	1.79
70	11652	1.78

Temperature - Resistance - Voltage for Type III 10K Ohm Thermistor Sensors		
Temp (°F)	Resistance (Ohms)	Voltage @ Input (VDC)
71	11379	1.76
72	11136	1.74
73	10878	1.72
74	10625	1.70
75	10398	1.68
76	10158	1.66
78	9711	1.63
80	9302	1.59
82	8893	1.55
84	8514	1.52
86	8153	1.48
88	7805	1.45
90	7472	1.41
95	6716	1.33
100	6047	1.24
105	5453	1.16
110	4923	1.09
115	4449	1.02
120	4030	.95
125	3656	.88
130	3317	.82
135	3015	.76
140	2743	.71
145	2502	.66
150	2288	.61

Table 1: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Appendix

Sensor Configuration and Test Screens

To access the *Sensor Configuration & Test Screens*, you first need to access the *Unit Information Screen* by touching <Display> while at the *Main Display Screen*.

NOTE: While in the *Sensor Configuration & Test Screens*, the <Display> button functions as an exit key to return to the previous screen or menu. After a few seconds, however, the sensor will automatically revert to the *Main Display Screen*. Refer to **Figure 12** when reading the instructions that follow.

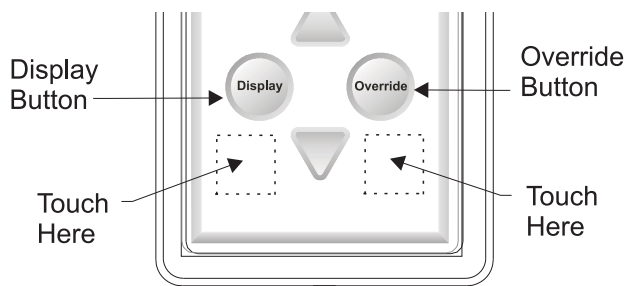


Figure 12: E-BUS Digital Room Sensor Buttons

Sensor Configuration & Test Screen

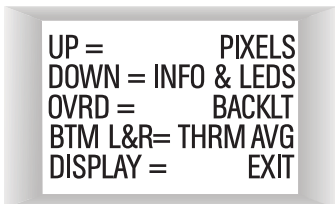


Figure 13: Sensor Configuration & Test Screen

While the *Unit Information Screen* is being displayed, you can enter the *Sensor Configuration & Test Screen* options by touching simultaneously below the <Display> and <Override> buttons. (See **Figure 12** which shows where to touch to access this option.)

Pixel Test Screen

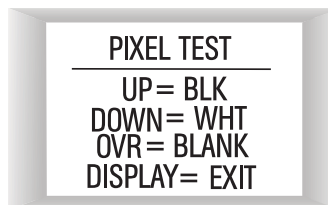


Figure 14: Sensor Info & LED Test Screen

To select the first option—**Pixels**—touch <△> while at the *Sensor Configuration & Test Screen* (**Figure 13**). The *Pixel Test Screen* tests the pixels of the LCD display, allowing you to make the screen white with black characters, black with white characters, or a black or white screen. To exit this screen, touch <Display>.

Sensor Info & LED Test Screen

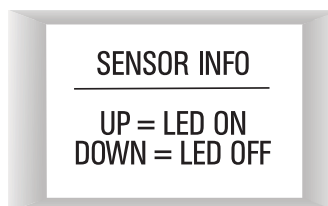


Figure 15: Sensor Info & LED Test Screen

To select the second option—**Info & LEDS**—touch <▽> while at the *Sensor Configuration & Test Screen* (**Figure 13**). The *Sensor Info & LED Test Screen* shows the version of software that the sensor is running and allows you to test the LEDs that are used on the controller. Touching <△> will turn the LEDs on and touching <▽> will turn the LEDs off. To exit this screen, touch <Display>.

LCD Backlight Test Screens

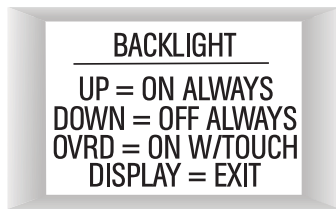


Figure 16: Backlight Test & Configuration Screen

To select the third option—**BACKLT**—*touch* <Override> while at the *Sensor Configuration & Test Screen* (Figure 13). This option allows you to control when the LCD backlight turns on and off. You can configure the backlight to stay on at all times, remain off at all times, or to come on when any button is touched on the sensor.

To exit this screen, *touch* <Display>.

Address Screen

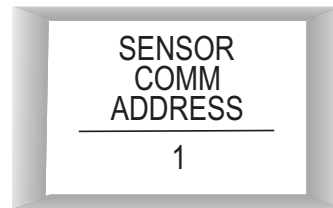


Figure 18: Address Screen

To access the *Address Screen*, while at the *Thermistor Averaging Screen*, (Figure 17), *touch* the <Override> button.

This option allows you to set the address—from 1-10. *Touch* <Δ> to increase the number and *touch* <∇> to decrease the number. The default is 1.

To exit this screen, *touch* <Display>.

Thermistor Averaging Screen

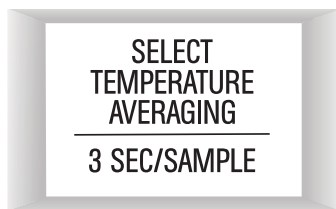


Figure 17: Temperature Averaging Screen

To select the fourth and final option—**THRM AVG**—, while at the *Sensor Configuration & Test Screen* (Figure 13), *touch* simultaneously below the <Display> and <Override> buttons. (See Figure 11 which shows where to touch to access this option.)

This option allows you to set the rate—from 1-15 seconds—at which the sensor takes a new temperature reading. *Touch* <Δ> to increase the number of seconds and *touch* <∇> to decrease the number of seconds.

To exit this screen, *touch* <Display>.

NOTE: The sensor takes the average of the last 10 readings based on the number that is entered in this screen. For example, if you want a 3-second sample, the sensor will take the average of the last 10 readings every 3 seconds over a 30-second span. Therefore, if you have your sensor next to an outside doorway, you would want to enter a higher number for your sample to give a more accurate reading for the room temperature in case the outside door is opened often.

Appendix - E-BUS Digital Room Sensor Wiring

E-BUS Digital Room Sensor

The OE217-02, OE217-03 or OE217-04 E-BUS Digital Room Sensor connects to the VCB-X Controller with the EBC E-BUS expansion cable. It can also be daisy-chained with an E-BUS CO₂ Sensor for applications requiring both a wall-mounted or duct mounted E-BUS CO₂ sensor and an E-BUS space temperature sensor.

The Digital Room Sensor should be mounted at approximately 5 Ft. above the floor on the wall in an area that does not have drafts or is exposed to direct sunlight. See **Figure 19** for wiring details.

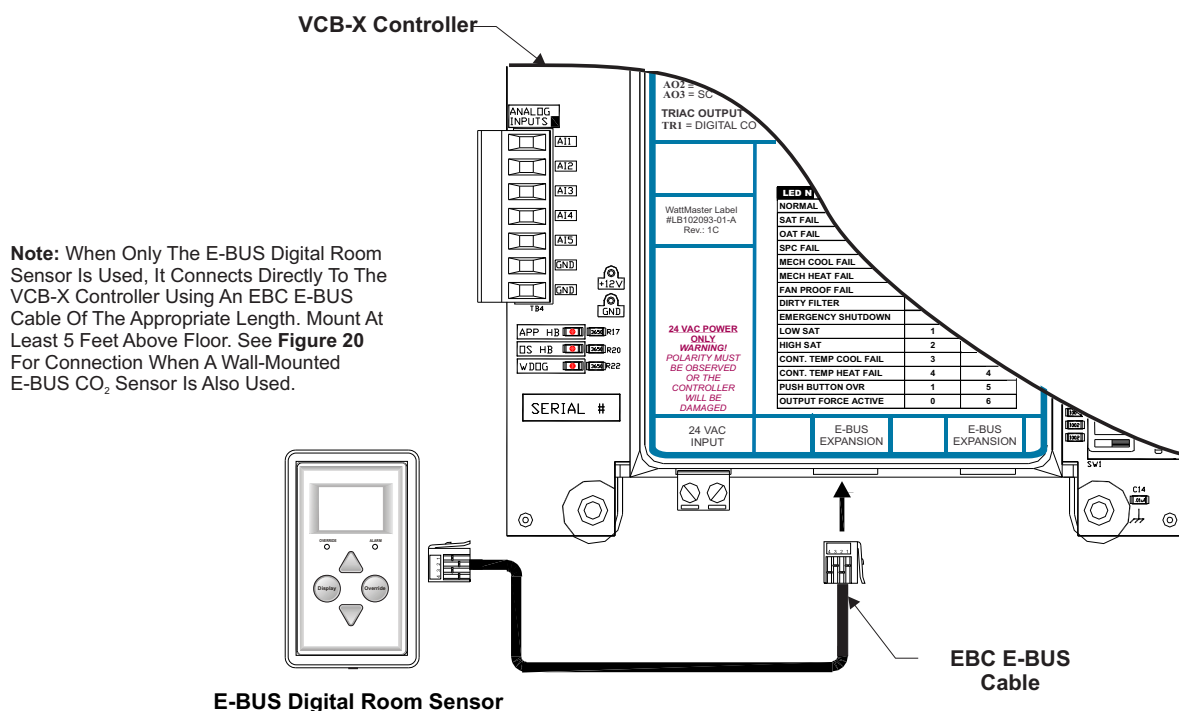


Figure 19: OE217-02, OE217-03 & OE217-04 – E-BUS Digital Room Sensor Wiring

Appendix - Wall Mounted CO₂ Sensor Wiring

E-BUS CO₂ Wall-Mounted Sensor

The OE256-05 Wall Mounted E-BUS CO₂ Sensor is used to monitor CO₂ levels in the space served by the HVAC unit. The CO₂ Sensor connects to the VCB-X Controller with an EBC E-BUS cable. It can be daisy-chained with the E-BUS Digital Room Sensor (OE217-02, OE217-03, OE217-04) for applications requiring both a room CO₂ sensor and room temperature sensor.

It should be mounted at approximately 5 Ft. above the floor on the wall in an area that does not have drafts or is exposed to direct sunlight. See **Figure 20** for wiring details and installation notes. A Duct Mounted E-BUS CO₂ Sensor can be used if desired instead of the Wall Mounted E-BUS CO₂ Sensor. See **Figure 21** for Duct Mounted E-BUS CO₂ Sensor wiring details.

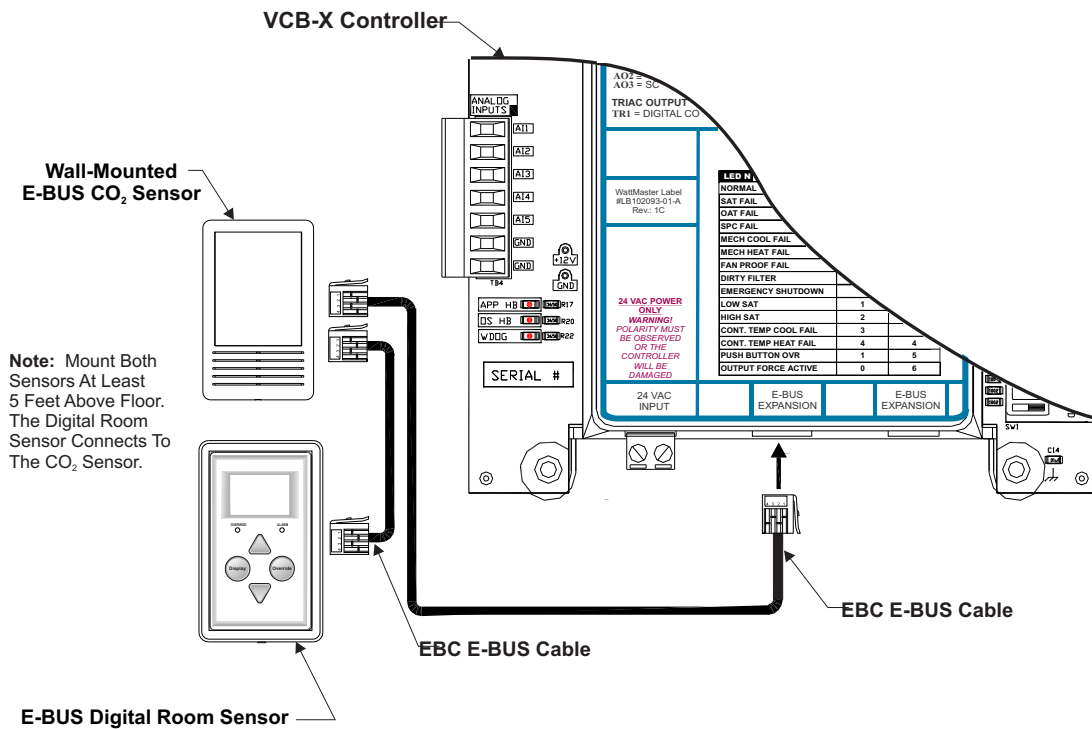


Figure 20: OE256-05 – Wall Mounted E-BUS CO₂ Sensor Wiring

Appendix - Duct Mounted E-BUS CO₂ Sensor

Duct Mounted E-BUS CO₂ Sensor

The OE256-06 Duct Mounted CO₂ Sensor is used for sensing the current CO₂ level in the HVAC unit's return air stream. This is useful when you want an average CO₂ reading in the area served by the HVAC unit or when you don't want a wall mounted CO₂ sensor due to sensor tampering concerns in the space.

The OE256-06 E-BUS Duct Mounted Return Air CO₂ Sensor is comprised of the OE256-05 E-BUS CO₂ Sensor and the WattMaster Aspiration Box Assembly.

The Duct Mounted Return Air E-BUS CO₂ Sensor is designed to be mounted in the return air duct of the HVAC unit and uses its integral aspiration box to sample the CO₂ level in the duct. See the dimensional and installation information in **Figure 21** below for wiring and installation details.

Note:
1.) The CO₂ Sensor Connects To The VCB-X Controller Using An EBC E-BUS Cable Of The Required Length. If Also Using a Digital Room Sensor, Connect the Digital Room Sensor to the CO₂ Sensor Using Another EBC E-BUS Cable

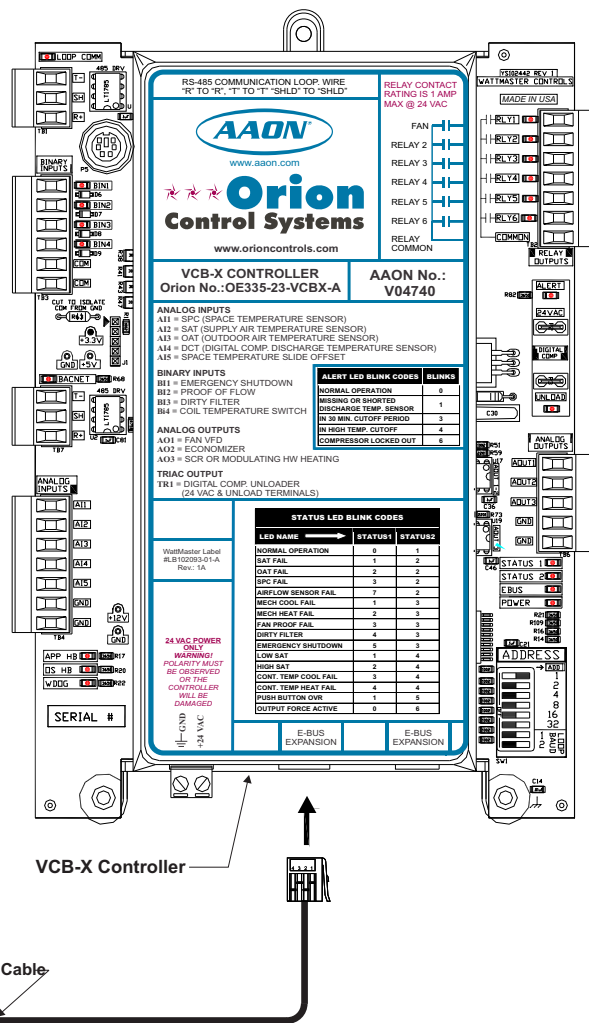
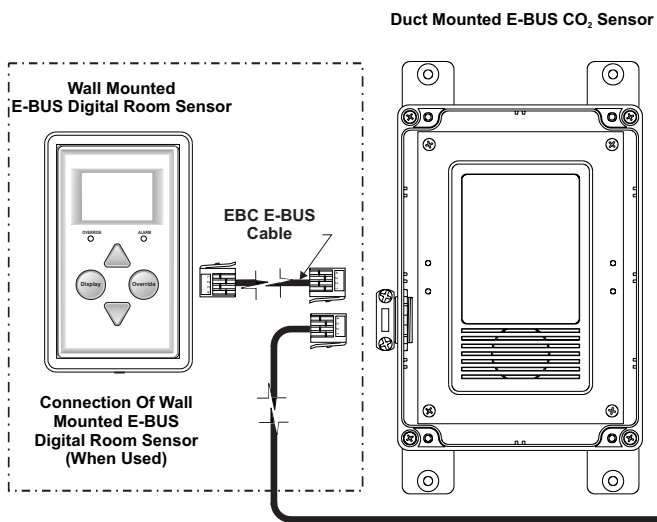


Figure 21: OE256-06 - Duct Mounted CO₂ Sensor Wiring

Connecting a Remote Sensor

Connecting a Remote Sensor

Sometimes due to the requirements of a job, the temperature sensor must be located outside the conditioned space due to special requirements such as hospital surgical room codes, security, or tampering considerations. In these cases, the E-BUS Digital Room Sensor can be mounted in a different room and have a remote temperature sensor connected to it. Typically, this would be a Return Air Duct Temperature Sensor. Usually, you will be using the OE231 Return Air Temperature Sensor, but you can also use any Type III 10K Ohm Thermistor Sensor.

To connect a remote temperature sensor to the Digital Room Sensor, you must first remove the E-BUS Digital Sensor's back cover. You will see a loop of wire hanging off of the sensor circuit board. See **Figure 22**. This is the sensor's temperature sensing element (thermistor). Clip the thermistor loop wire so that the sensor will read the remote temperature input. Be sure to cut the ends of the wire close to the circuit board so that the sensor loop wire ends won't short between each other. The remote sensor then wires to the remote sensor terminal block on the back of the E-BUS Digital Room Sensor.

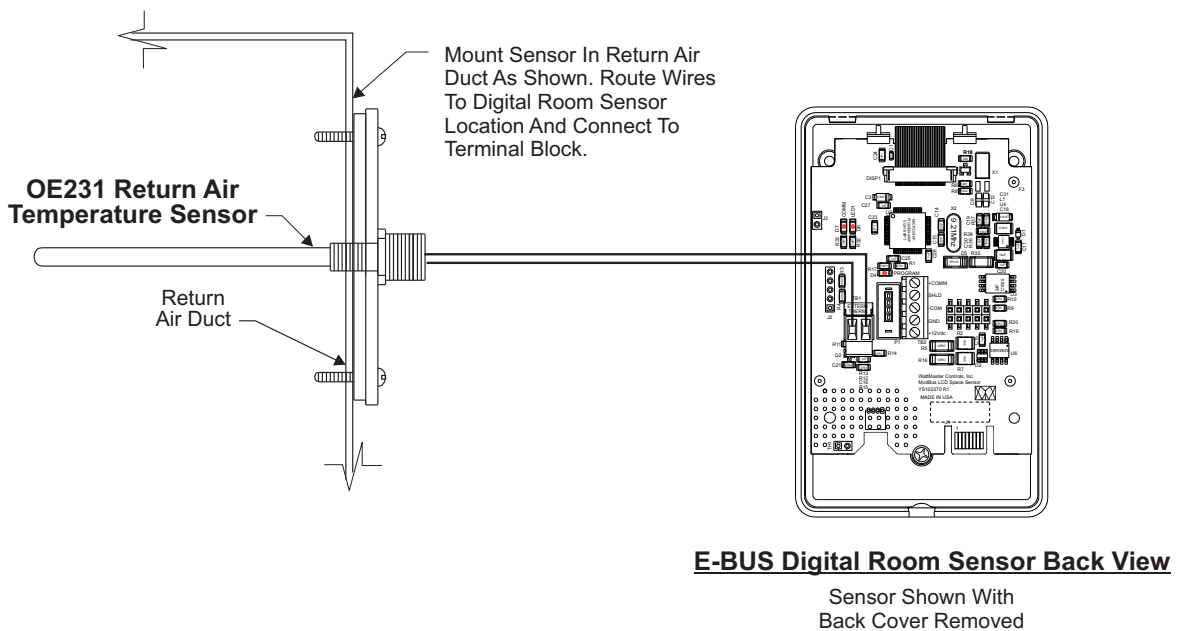
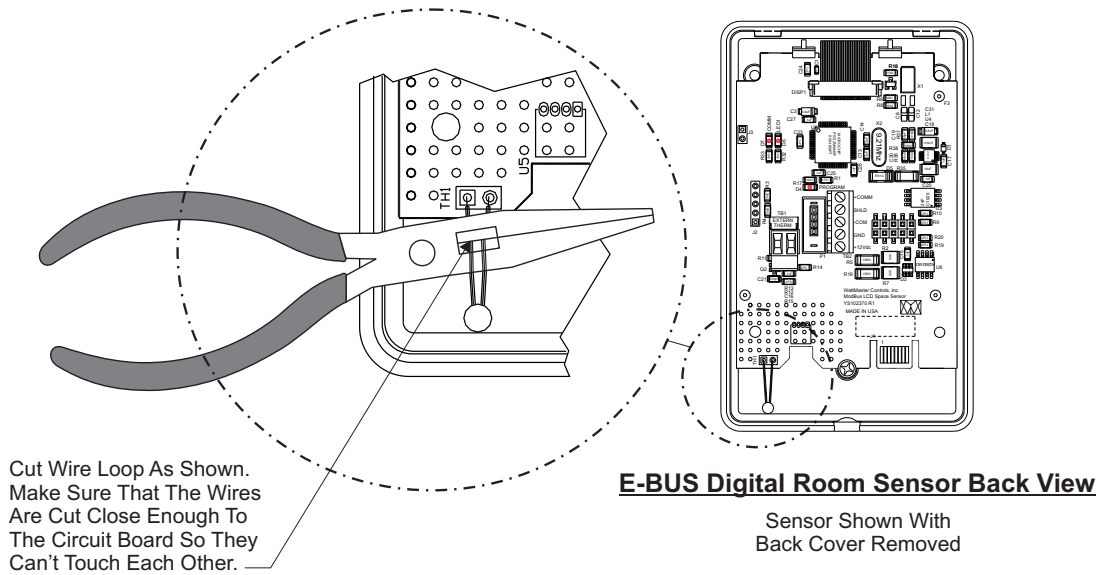


Figure 22: Attaching a Remote Sensor



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