Overview

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

The ASM01819 is the Space Temperature Sensor only model and the ASM01820 & ASM02221 are a combination Space Temperature & Space Humidity Sensor model. The ASM02221 model includes an enclosure without LCD display, front LEDs, and buttons.

Any of the sensors can be used with the VCCX2 Controller and VCB-X Controller 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 ASM01819 model can be used with the VAV/Zone Controller. It is either hard-wired or connected via EBC E-BUS cable.

The ASM01819 & ASM01820 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 (ASM01820 model only)
- Displays Outdoor Air Relative Humidity (ASM01820 model if controller is configured with an OA Humidity Sensor)
- Displays the Current Zone Setpoint Temperature when slide adjust is entered
- Equipped with Push Buttons for changing the Zone Setpoint Temperature
- Equipped with an Override Button for forcing the VAV/Zone Controller or VCCX2 / VCB-X Controller into Occupied Operation from Unoccupied Operation
- Provides graphics to indicate the Mode of Operation
- Allows connection of a remote 10K Ohm, Type III thermistor temperature sensor (or 4 sensor averaging array). See Connecting a Remote Sensor section in the Appendix on page 15 for details.
- Provides LEDs to indicate Schedule Override, Button Push, Alarms, and Communications
- Can display Temperature reading from a Remote Temperature Sensor (see Figures 22 & 23, pages 15 & 16 for instructions)
BASIC OPERATION

Buttons and LEDs

Sensor Operation

When power is first applied to the ASM01819 E-BUS Digital Room Sensor, the sensor will display the Current Room Temperature and the current setting of the slide offset. The ASM01820 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) user-visible 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, page 7 for examples of operation modes.

LED Operation

Refer to Figure 3 for LED locations.

Alarm LED: The Alarm LED will light up solid when there is an alarm from the Controller. The default for the Alarm LED is to be disabled. The alarm LED can be enabled by configuring the VCCX2 Controller with the Service Tool.

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.
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).

Mounting

CAUTION: Do not touch the front face of the sensor while you are plugging in the modular sensor cable. Touching the front face of the sensor while plugging in the cable may prevent proper initialization and keep the buttons on the sensor from working properly.

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” mounting screws. The E-BUS cable is then plugged into the E-BUS connector 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. A locking screw secures the sensor to the wall. See Figure 4 for E-BUS Digital Room Sensor dimensions.

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 VCCX2 or 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 19, page 12 for wiring.

Optional Mounting Plate

Included with the Digital Room Sensor is a mounting plate that can be used, if necessary, to cover the sensor sheet rock opening. This mounting plate screws onto the back of the housing base. The mounting plate is then mounted and covers the recessed space in the wall. A locking screw secures the sensor to the wall. See Figure 26, page 18 for dimensions.
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 ASM01820 model). The second screen displays the Outside Air Temperature and/or Humidity if Outdoor Air Temperature and/or Outdoor Air Humidity that 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

The Main Display Screen displays the current room temperature, the humidity in the room (RH is available on the ASM01820 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, page 7 for operation mode screen examples.

Outside Air Temperature Humidity 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.

Figure 6: Outdoor Status Screen

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.

Figure 7: Unit Information Screen
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 VAV/Zone, VCCX2, or 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.

Figure 8: Setpoint Adjust Screen

NOTE: If the VAV/Zone or Unit Controller’s slide offset setpoint is set to Zero, this screen will not appear when you touch <△> or <▽>.

NOTE: If using multiple sensors for averaging, digital sensors addressed 2 or higher will not display the slide adjust.

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 the Temperature Only Sensor

Measuring Digital Sensor Resistance
Temperature Only Sensor

NOTE: For This Test, The Sensor Must Be Disconnected From Its E-BUS Cable As Shown. The Meter Must Be Set To Measure Resistance In Ohms. Use Table 1 To Determine If The Sensor Is Reading The Correct Resistance Value For The Ambient Temperature. This Resistance Value Should Match The Temperature Value Listed Next To The Resistance Value In The Table. The Temperature Should Be Measured With A Separate Accurate Temperature Measuring Device Located In The Area Where The Sensor Is Currently Located.

Figure 10: Temperature/Resistance Testing for ASM01819 - Temperature Only Sensor
## Temperature/Resistance Chart

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

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
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<tbody>
<tr>
<td>-10</td>
<td>93333</td>
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<tr>
<td>0</td>
<td>69822</td>
</tr>
<tr>
<td>5</td>
<td>60552</td>
</tr>
<tr>
<td>10</td>
<td>52500</td>
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<td>45902</td>
</tr>
<tr>
<td>20</td>
<td>40147</td>
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<tr>
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<td>35165</td>
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<td>30</td>
<td>30805</td>
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<table>
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<th>Resistance (Ohms)</th>
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</thead>
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</tr>
</tbody>
</table>

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Table 1: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors
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 11 when reading the instructions that follow.

Pixel Test Screen

To select the first option—Pixels—touch <△> while at the Sensor Configuration & Test Screen (Figure 12). 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

To select the second option—Info & LEDs—touch <▽> while at the Sensor Configuration & Test Screen (Figure 12). 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>.

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 11 which shows where to touch to access this option.)
LCD Backlight Test Screens

To select the third option—BACKLT—touch <Override> while at the Sensor Configuration & Test Screen (Figure 12, page 10). 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>.

Thermistor Averaging Screen

To select the fourth and final option—THRM AVG—, while at the Sensor Configuration & Test Screen (Figure 12, page 10), touch simultaneously below the <Display> and <Override> buttons. (See Figure 11, page 10 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 <△> 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.
E-BUS Digital Room Sensor to HVAC Unit Controller Wiring

The E-BUS Digital Room Sensor connects to the VCCX2 or VCB-X Controller with the EBC E-BUS expansion cable.

The E-BUS 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.

NOTE: When Only The E-BUS Digital Room Sensor Is Used, It Connects Directly To The Unit Controller Using An EBC E-BUS Cable Of The Appropriate Length. Mount At Least 5 Feet Above Floor. See Figure 20 on page 13 For Connection When A Wall-Mounted E-BUS CO₂ Sensor Is Also Used.

**Figure 19: E-BUS Digital Room Sensor Wiring**
E-BUS CO₂ Wall Mounted Sensor to HVAC Unit Controller Wiring

The ASM01829 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 VCCX2 or VCB-X Controller with an EBC E-BUS cable. It can be daisy-chained with the E-BUS Digital Room Sensor 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.

NOTE: The ASM01831 Duct Mounted E-BUS CO₂ Sensor can be used if desired instead of the Wall Mounted E-BUS CO₂ Sensor. However, the E-BUS Digital Room Sensor does not directly connect to the Duct Mounted E-BUS CO₂ Sensor. See the Duct Mounted E-BUS CO₂ Sensor Technical Guide for Duct Mounted E-BUS CO₂ Sensor wiring details.
E-BUS Digital Room Sensor to VAV/Zone Controller Wiring

The Temperature Only E-BUS Digital Room Sensor connects to the VAV/Zone Controller with an EBC E-BUS expansion cable. It can also be hard-wired to the VAV/Zone Controller.

The E-BUS 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 21 for wiring details.

**Figure 21:** VAV/Zone Controller E-BUS Digital Room Sensor Wiring
Connecting a Remote Sensor

If the job requires this Sensor to be mounted outside of a conditioned space, a remote Standard Space Sensor (ASM02227) or Return Air Temperature Sensor (G051250), or any 2-wire 10K Ohm, Type III thermistor temperature sensor can be hard-wired to the E-BUS Digital Room Sensor. Other versions of the AAON standard space sensors (ASM01638, ASM01642, ASM01643) with slide adjust and/or override button should not be used as the remote sensor.

Contact AAON Controls for wiring information if a four sensor averaging array will be used as the “remote sensor”.

See Figure 22 for Return Air Temperature Sensor wiring. See Figure 23, page 16 for Space Sensor wiring.

E-BUS Digital Room Temperature Only Sensor

Disconnect the modular cable from the E-BUS Digital Room Sensor before performing the following modifications.

If using the Temperature Only version of the Digital Room Sensor, you must first remove the Sensor’s back cover. You will see a loop of wire hanging off of the sensor circuit board. See Figure 24, page 17. This is the external thermistor loop wire. Clip the external 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 Digital Room Sensor.

If using the Standard Space Sensor as the remote sensor, you must clip off the C1 capacitor from the back of the Sensor. Be sure to cycle power to begin reading the remote sensor. See Figure 23, page 16.

E-BUS Digital Room Temperature and Humidity Sensor

Disconnect the modular cable from the Digital Room Sensor before performing the following modifications.

If using the Temperature and Humidity versions of the Digital Room Sensor, you only need to wire the remote sensor to the remote sensor terminal block on the Digital Room Sensor. DO NOT CLIP OFF OR REMOVE the temperature/humidity sensor element on the Digital Room Sensor. See Figure 25, page 17. When the remote temperature sensor is wired in, it will override the on-board temperature value of the Digital Room Sensor, even though the sensor element remains attached.

If using a Standard Space Sensor as the remote sensor, you must clip off the C1 capacitor from the back of the sensor. Be sure to cycle power to begin reading the remote sensor. See Figure 23, page 16.
Figure 23: Attaching the ASM02227 Space Room Sensor

**ASM02227 Space Temperature Sensor Back View**

**E-BUS Digital Room Sensor Back View**

Sensor Shown With Back Cover Removed

Remove C1 Capacitor
Connecting a Remote Sensor

WARNING: DO NOT CLIP OFF OR REMOVE THE TEMPERATURE & HUMIDITY SENSING ELEMENT

Figure 24: Wire Clipping Instructions For Digital Room Temperature Only Sensor

Figure 25: Instructions For Digital Room Temperature & Humidity Sensor
Optional Mounting Plate

Included with the Digital Room Sensor is a mounting plate that can be used, if necessary, to cover the sensor sheet rock opening. This mounting plate screws onto the back of the housing base. The mounting plate is then mounted and covers the recessed space in the wall. A locking screw secures the sensor to the wall. See Figure 26 for dimensions.
AAON Factory Technical Support: 918-382-6450
technicalsupport@aaon.com

AAON Controls Support: 866-918-1100
Monday through Friday, 7:00 AM to 5:00 PM central standard time.

NOTE: Before calling Technical Support, please have the model and serial number of the unit available.

PARTS: For replacement parts please contact your local AAON Representative.