BACnet DUCT SERIES

Installation & Operation Instructions

GENERAL INFORMATION

The BACnet Duct Series sensor is designed for use with electronic controllers in commercial heating and cooling building management systems. The ACI BACnet Duct Series sensor can be ordered to monitor temperature, RH, or temp/RH in commercial HVAC ductwork. It uses BACnet MS/TP for physical connection to a BAS or controller, has dip switches to set addresses and baud rate, and has on board end-of-line termination. There is no analog output.

WIRING INSTRUCTIONS

The BACnet Duct Series temperature sensor has a depluggable terminal block located on the front of the PCB. For ease of wiring, we recommend removing the block, wiring, and reattaching before mounting. 16 to 22 AWG two conductor shielded cable is recommended for powering the sensors.

ACI recommends using Belden 3105 or compatible cable for RS-485 communication wiring. This wire has 120 ohm input impendence. The terminal blocks allow for (1) or (2) wires to be connected in each position for daisy chaining. Daisy chain the RS-485 wiring and do not use "Star" or "T" wiring. Avoid running communication wires next to AC line voltage wires. These can be sources of noise that can affect signal quality.

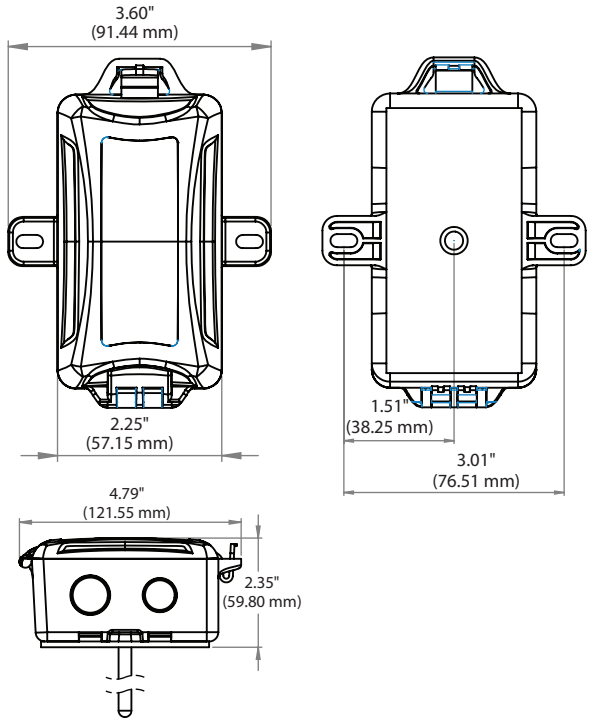
PRECAUTIONS

- **Remove power before wiring. Never connect or disconnect wiring with power applied.**

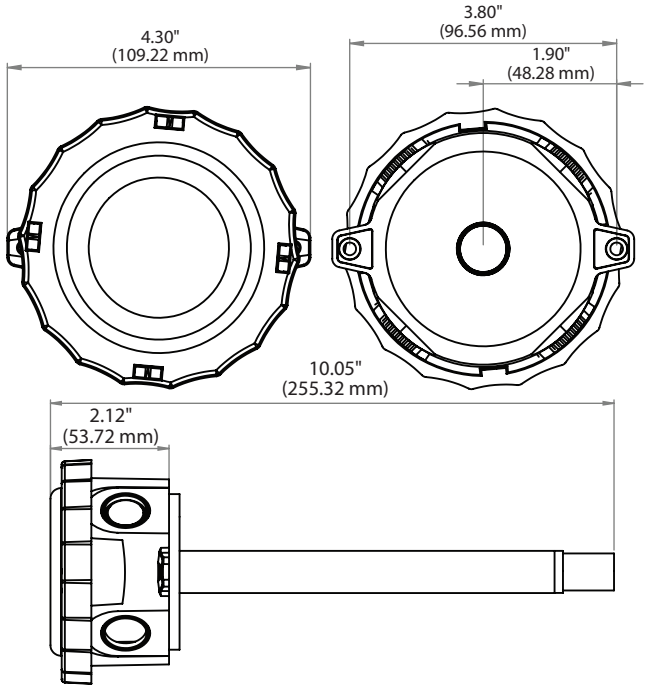
- **It is recommended you use an isolated UL-listed class 2 transformer when powering the unit with 24 VAC. Failure to wire the devices with the correct polarity when sharing transformers may result in damage to any device powered by the shared transformer.**

FIGURE 1: ENCLOSURE DIMENSIONS

PLASTIC BOX (-PB): TEMP. ONLY



EURO (-EH): RH and RH/TEMP.



Version 1.0
I0000804

PRECAUTIONS *(Continued)*

• DO NOT RUN THE WIRING IN ANY CONDUIT WITH LINE VOLTAGE (24/120/230 VAC).

• If the 24 VDC or 24VAC power is shared with devices that have coils such as relays, solenoids, or other inductors, each coil must have an MOV, DC/AC Transorb, Transient Voltage Suppressor (ACI Part: 142583), or diode placed across the coil or inductor. The cathode, or banded side of the DC Transorb or diode, connects to the positive side of the power supply. Without these snubbers, coils produce very large voltage spikes when de-energizing that can cause malfunction or destruction of electronic circuits.

MOUNTING INSTRUCTIONS

For optimal readings, follow these tips:

- **The sensor should be mounted in the middle of the duct where air circulation is well mixed (no stratification), and not blocked by obstructions. Stratification and obstructions can cause sensing errors. An example is downstream from a heating or cooling coil.**

- **Duct probe should be placed (3) to (4) duct segments down from any bend or obstructions and away from 90° bends.**

FIGURE 2: LAYOUT

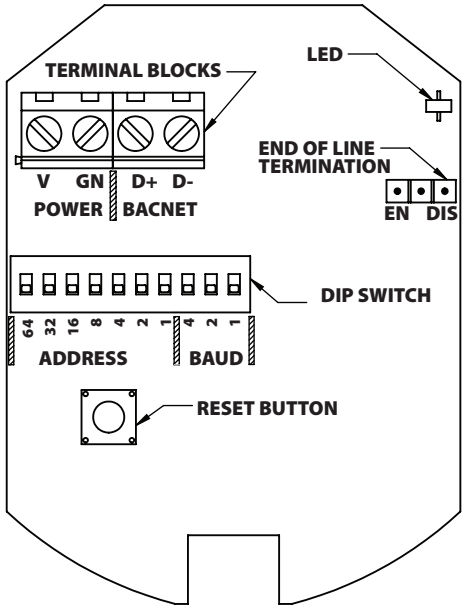


TABLE 1: WIRING CONNECTIONS

TERMINAL BLOCKS	CONNECTIONS
+V	Power Supply Positive 12-36VDC / 24VAC
GN	Power Supply Common or Ground
D-	EIA-485 Data Negative
D+	EIA-485 Data Positive

• Mount the sensor on the top or sides of duct work; mounting on the bottom risks damage due to moisture.

The BACnet Duct Temperature-only sensor uses the Plastic Box (-PB) enclosure. Alternatively, the Euro (-EH) enclosure is used for the BACnet Relative Humidity (RH) sensor and BACnet RH/Temperature Combo sensor (see **FIGURE 1**). Be sure to follow the instructions listed for your enclosure.

PLASTIC BOX (-PB) ENCLOSURE INSTALLATION

Drill a 3/8" hole in the duct and insert the probe through the hole until the foam pad is tight to the duct.

Drill pilot holes for the (2) mounting screws. Use the enclosure flange as a guide, or use the dimensions listed on page 1 to measure out.

Now fasten and insert (2) screws #8 x ¾" TEK (provided and recommended) through the mounting holes in the flange and tighten until the unit is held firmly to the duct.

Refer to the wiring instructions (p. 2) to make necessary connections. After wiring, shut the cover of the enclosure.

***Reference FIGURE 2**

Version 1.0
I0000804

MOUNTING INSTRUCTIONS *(Continued)*

EURO (-EH) ENCLOSURE INSTALLATION

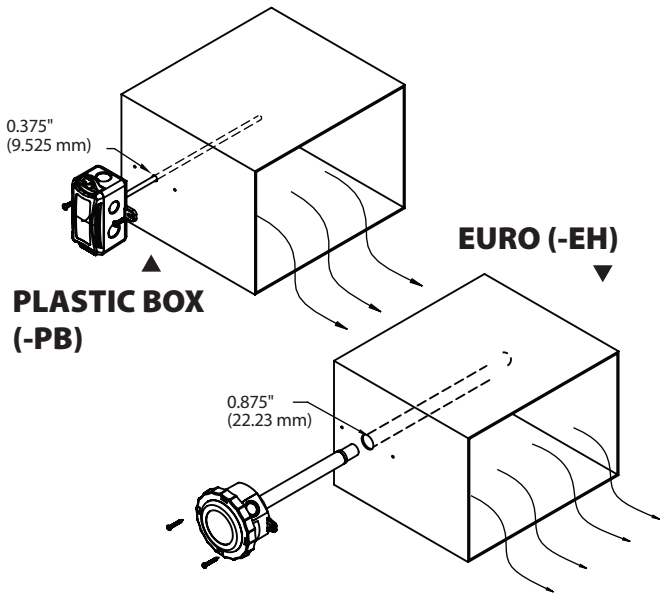
Drill a 7/8" hole in the duct and insert the probe through the hole until the foam pad is tight to the duct. Drill pilot holes for the (2) mounting screws. Use the enclosure flange as a guide, or use the dimensions listed on page 1 to measure out.

Now fasten and insert (2) screws #8 x ¾" TEK (provided and recommended) through the mounting holes in the flange and tighten until the unit is held firmly to the duct.

Refer to the wiring instructions (p. 2) to make necessary connections. After wiring, twist the cover until the enclosure is tightly sealed.

***Reference FIGURE 2**

FIGURE 3: DUCT MOUNTING



BACnet MS/TP INTERFACE

The BACnet Master-Slave/Token-Passing (MS/TP) data link protocol uses EIA-485 as a two-wire, daisy chain network. A branch is a discrete chain of devices connected to a controller. The max number of devices per segment is (32), as per the BACnet specifications. 4000 ft (1219.2 m) is the maximum recommended length for a segment, which includes all devices from the controller to the last device in the daisy chain. ACI's BACnet sensors are master devices. Only master nodes are allowed to send and receive tokens on the MSTP network.

Each branch must have all devices connected with (+) connected to (+) and (-) connected to (-). If a shielded cable is used, this is not to be connected to the devices. The shield cable should only be connected on one end to earth ground, usually at the controller. The start and end of each branch should have a termination resistor at the device level or at the controller.

Each device must be configured for the correct baud rate and have a unique address in each branch. The baud rate for the branch is set by the controller. This product has auto-baud for ease of network configuration but setting the baud rate using the DIP switches is recommended.

ADDRESS SELECTION

Switches 1-7 are used to set the BACnet address. Refer to **TABLE 2** for switch settings. Each device in a network branch must have a unique address. The value of each position is printed on the board. By default, the address is (0). If the device is powered when a change is made, the device must be power cycled or reset for changes in address to be made.

TABLE 2: ADDRESS SELECTION

ADDRESS	SW 1 (64)	SW 2 (32)	SW 3 (16)	SW 4 (8)	SW 5 (4)	SW 6 (2)	SW 7 (1)
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1
12	0	0	0	1	1	0	0

Version 1.0
I0000804

BAUD RATE SELECTION

Switches 8-10 are used to set the BACnet baud rate. Refer to **TABLE 3** for switch settings. Where (0) is low and (1) is high. By default, the device is in auto-baud. If the system's baud rate is known, it is recommended to set the specific baud rate to match the system.If the device is powered when a change is made, the device must be power cycled or reset for changes in baud rate to be made.

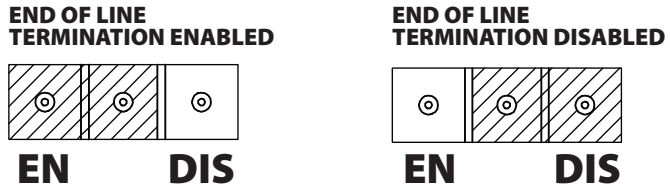
TABLE 3: BAUD RATE SELECTION

BAUD RATE	SW 8	SW 9	SW 10
Auto-Baud	0	0	0
9600	0	0	1
19200	0	1	0
38400	0	1	1
57600	1	0	0
76800	1	0	1
115200	1	1	0

EOL TERMINATION RESISTANCE SELECTION

RS-485 requires that the last device in a chain have a termination resistor. This is controlled using a jumper in the EN (enabled) position marked on **FIGURE 4** (right). When the jumper is set to EN (enabled), a 120 Ω resistance is added in parallel to the data line. When the jumper is set to DIS (disabled), the resistance is not added. By default, the jumper is placed in the DIS (disabled) position.

FIGURE 4: EOL TERMINATION JUMPERS



DEVICE CONFIGURATION THROUGH BACnet

DEVICE INSTANCE

The Device Instance, by default, is 1035000 plus the Address. For example, an Address of 21 results in a default address of 1035021. This can be changed once the device is connected to the network, but each device instance must be unique within the network. The device instance must be unique throughout the entire BACnet network, not just this segment.

DEVICE LOCATION

The device location is optional but is intended to allow for further definition of the device's location. The device location can be a character string up to 64 characters in length.

DEVICE NAME

By default, the device name is based on the type of device and the address. The device name can be a character string up to (32) characters in length. This can be changed once the device is connected to the network. For example: Temperature Sensor - 034. The device name must be unique throughout the entire BACnet network, not just this segment.

DEVICE DESCRIPTION

By default, the device name is based on the type of device and the address. The device name can be a character string up to (32) characters in length. This can be changed once the device is connected to the network. For example: Temperature Sensor - 034. The device name must be unique throughout the entire BACnet network, not just this segment.

Version 1.0
I0000804

DEVICE CONFIGURATION THROUGH BACnet *(Continued)*

LED INFORMATION

One LED indicates three statuses. Solid green shows that power is good, but no data is transmitting. A solid Amber indicates that auto-baud is set and no data has been received to set a baud rate. Green/Amber flashing indicates data is being transmitted or received. Solid Red LED status indicates an error state, usually loss of communication on the network. If this status remains for (10) times the APDU timeout, the device will automatically reset. If this state remains longer than that, reset the device.

TEMPERATURE CONFIGURATION

One LED indicates three statuses. Solid green shows that power is good, but no data is transmitting. A solid Amber indicates that auto-baud is set and no data has been received to set a baud rate. Green/Amber flashing indicates data is being transmitted or received. Solid Red LED status indicates an error state, usually loss of communication on the network. If this status remains for (10) times the APDU timeout, the device will automatically reset. If this state remains longer than that, reset the device.

TABLE 4: UNIT SETTING

UNITS	VALUE
°F	64
K	63
°C	62

TEMPERATURE AND RH OFFSET

This device allows for a temperature offset of +/-5 °C (9 °F) and an RH offset of +/-10%. By default, these values are set to (0), meaning no offset is added.

These are set by writing to the present value of the Temperature Calibration Offset (AV0) or RH Calibration Offset (AV1). The value written must be within the specified range or an error will be returned. To set these back to factory settings, write any changed values to (0).

TEST MODE

For the Sensor objects (AI0 and AI1), a test mode can be set by writing the Boolean value true to the "out-of-service" property. Then the present-value can be set to any valid test value the user requires. This allows a user to test reactions to specific values returned by this device.

RESET

The reset button can be used to reset the device without disconnecting power. The location of this button is shown in **FIGURE 3**.

TABLE 5: BACnet OBJECT TABLE

OBJECT TYPE	OBJECT ID	OBJECT NAME	RANGE	BACnet ENGINEERING UNITS
Device	----------	BN11x0	0-4194302	-------------------------
Analog Inputs	AI-0	Temperature Sensor	-40.0 - 302.0	degrees-Fahrenheit (64) - default
	AI-1	RH Sensor	0.0 - 100	percent-relative-humidity (29)
Analog Values	AV-0	Temperature Calibration Offset	-9.0 - 9.0	delta-degrees-Fahrenheit (120)
	AV-1	RH Calibration Offset	-10.0 -10.0	percent-relative-humidity (29)

PRODUCT SPECIFICATIONS

Supply Voltage:	12 to 36 VDC / 24 VAC +/- 10%, 50/60 Hz (Reverse Polarity Protected)
Current Consumption:	25 mA maximum (0.67 VA)
Number Temperature Sensing Points:	One
Operating Temperature Range:	
For Board:	-22 to 176°F (-30 to 80°C)
For Sensor (Temp-Only):	-40 to 302°F (-40 to 150°C)
For Sensor (RH and Temp/RH):	-40 to 176°F (-40 to 80°C)
Temperature Measurement Accuracy:	**@ 77°F (25°C):** +/- 1.0°F (+/- 0.5°C)
Temperature Calibration Offset:	+/- 9°F (+/- 5°C) (Field Configurable)
Number RH Sensing Points:	One
RH Measurement Range:	0 to 100%
RH Measurement Accuracy:	**@ 77°F (25°C):** +/- 2% from 10 to 90% RH
RH Calibration Offset:	+/- 10% RH (Field Configurable)
Temperature / RH Update Rate:	4 seconds
Communication Protocol:	BACnet MS/TP; EIA RS-485
Sensor Addresses:	0 to 127 (0 (**Default**); Field Selectable)
Supported Baud Rates:	Auto Baud (**Default**), 9600, 19200, 38400, 57600, 76800, 115200 (Field Selectable)
Device Instance Number:	1035000 + Address (example: Address 127 = 1035127; Field Configurable)
Connections / Wire Size:	Screw Terminal Blocks / 16 AWG (1.31 mm^2) to 22 AWG (0.33 mm^2)
Terminal Block Torque Rating:	0.45 lbf-in (0.5 Nm) nominal
Storage Temperature Range:	-40 to 185°F (-40 to 85°C)
Operating Humidity Range:	10 to 95% RH, non-condensing
Sensing Probe & Filter Material:	304 Stainless Steel | Diameter: 0.750" (19.05 mm)
Enclosure Specifications:	**"-PB" Enclosure:** ABS Plastic, UL94-HB, Plenum Rated **"-EH" Enclosure:** ABS Plastic with UV Protectant, UL94-V0
Foam Pad Material / Flammability:	Neoprene/EPDM/SBR Polymer / UL94-HBF; FMVSS-302; MIL-R-6130C

W.E.E.E. DIRECTIVE

At the end of their useful life the packaging and product should be disposed of via a suitable recycling centre. Do not dispose of with household waste. Do not burn.

Version 1.0
I0000804