

Installation Guide

IAQ-Ny00-W

Indoor Air Quality Sensors for CO₂, Temperature and Relative Humidity with RS-485 BACnet and Modbus Output

For the following models:

- IAQ-N300-W:** CO₂, Relative Humidity and Temperature Sensor, Wall Mounted
- IAQ-N200-W:** Relative Humidity and Temperature Sensor, Wall Mounted
- IAQ-N100-W:** CO₂ Sensor, Wall Mounted

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LIST OF EFFECTIVE AND CHANGED PAGES

Insert latest changed pages (in bold text); remove and dispose of superseded pages.
Total number of pages in this manual is **20**.

Page No	Revision *	Description of Change	Date
1, 2	.R1B	Updated revision from R1A to R1B	05/12/2016
5	.R1B	Updated dimensions for consistency among products	05/12/2016
6-8	.R1B	Clarified notes regarding in-phase power connections	05/12/2016
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* R1A indicates an original page without change

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1. INTRODUCTION AND SCOPE

This Quick Installation Guide provides basic installation information for the equipment installer. Information includes physical installation, wiring instructions and initial setup of the instrument.

Ebtron's IAQ (indoor air quality) series of innovative wall mount CO2, relative humidity (RH) and temperature sensors provide precision measurement and BACnet[®] MS/TP or Modbus[®] RTU communications interface with modern building automation systems (BAS).

IAQ sensor products are available in the following configurations for wall or duct mounting:

IAQ-N100 with a single precision CO2 Sensor

1AQ-N200 with dual precision sensors for temperature and relative humidity

IAQ-N300 with three precision sensors for CO2, relative humidity and temperature measurement. For complete and detailed specifications, operating instructions and technical information, refer to the separate Installation, Operation and Maintenance Technical Manual **TM_IAQ-Ny00-W** under separate cover.



Figure 1. EBTRON IAQ-N300-W - CO2/RH/Temperature Wall Mount BACnet/Modbus RTU Sensor

2. IAQ-Ny00-W PLACEMENT CONSIDERATIONS

Figure 2 details the mechanical outline dimensions of the IAQ series wall mount sensors. The location selected for the IAQ sensor is important to ensure accurate readings that are representative of the area to be monitored. Preferred mounting locations are:

- On an interior wall that has no direct sunlight exposure and is near (but not directly in the airstream of) a return air duct. In areas with multiple return air ducts, locate the sensor at a point between them, observing the same precautions. Avoid areas with poor air circulation, such as behind doors or in alcoves where temperature fluctuations and moisture accumulation can affect sensor performance. Also, avoid areas that may expose the IAQ sensor to direct occupant breathing (e.g. water coolers, coffee machines, etc.).
- At a height of 4 to 6 feet from floor level, and at least 3 feet from a corner and 2 feet from an open doorway.
- Away from the direct airflow of windows, doorways, halls or other heating and cooling sources.
- Away from other equipment that could affect the sensor.

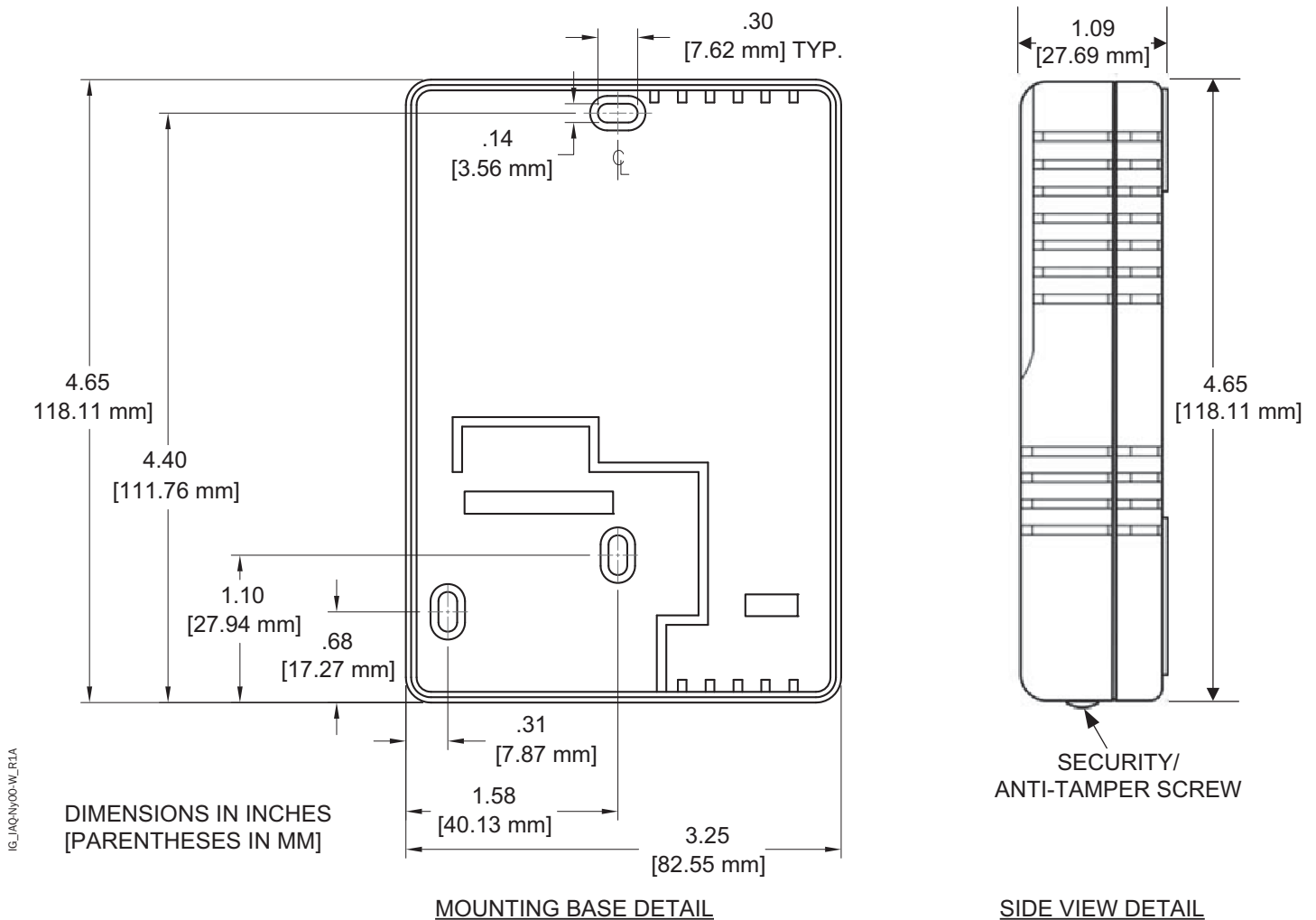


Figure 2. IAQ Sensor Outline Dimensions

3. INSTALLATION

Read and understand all installation instructions prior to installing the IAQ sensor. The IAQ wall mount sensor is designed for surface mount installation, or for installation onto a standard (field supplied) single gang electrical junction box. Installation and wiring of the IAQ sensor must be accomplished in accordance with all local electrical and mechanical codes to ensure safety and compliance. Refer to Figure 2 for IAQ sensor outline dimensions, and Figure 3 for mounting hole locations.



CAUTION

Deactivate 24 VAC power source until all connections to the IAQ sensor are complete.

When multiple devices are powered from a common 24VAC power source, ensure that all devices are wired in phase with L1 to L1, and L2 to L2! Damage will occur to the IAQ sensor and/or other devices if this caution is not observed.

The IAQ sensor contains electrostatic discharge (ESD) sensitive components. To prevent damage, observe ESD precautions when handling the instrument. Failure to comply can result in equipment damage.

The installed location of the IAQ sensor is critical for proper performance. Refer to the previous IAQ sensor PLACEMENT CONSIDERATIONS section of this document for additional recommendations.

Ensure that adequate clearance exists to permit installation and wiring of the IAQ sensor and to allow for access to the board mounted instrument configuration switches.

1. Carefully open the IAQ sensor package and inspect for damage. If any damage is noted, immediately file a claim with carrier.
2. Determine the IAQ sensor installation location as indicated on the engineer's plans, or determine placement using the previous guidelines.
3. Install IAQ sensor wiring to the desired location, observing the previous placement considerations. Wiring may be routed directly through wall for surface mounting of the IAQ sensor, or may be brought through a junction box depending upon local requirements. All wiring must be accomplished in accordance with local regulations and national codes.
4. Carefully remove the cover of the IAQ sensor. Depress the enclosure tab at the bottom of the enclosure, and swing the cover upward to disengage it from the base. The IAQ sensor includes two mounting screws for standard electrical junction box installations, and one security/tamper resistant screw to secure the cover. After IAQ sensor installation and configuration is complete, this screw may be installed at the bottom of the enclosure to prevent inadvertent or unauthorized opening of the enclosure.
5. Using the IAQ sensor base as a template, mark the location for the wiring pass-through slot and for the mounting screws. For mounting directly to a single-gang electrical junction box, proceed to step 8.
6. Drill holes sized for suitable wall anchors at the mounting locations marked, and install the wall anchors.
7. Drill another hole suitable to pass the IAQ sensor wiring through the wall at the marked wiring pass-through slot location. Pull wiring through hole, and allow 6 inches for wiring of the IAQ sensor.
8. Pass IAQ sensor wiring through the rear pass-through opening of the IAQ sensor base and mount the instrument at the desired location using appropriate hardware for the mounting method selected. Refer to the proceeding sections of this document for initial instrument set up and normal operation.

4. WIRING/INTERCONNECTIONS

CAUTION

Deactivate 24 VAC power source until all connections to the IAQ sensor are complete.

When multiple devices are powered from a common 24VAC power source, ensure that they are all wired in phase with L1 to L1, and L2 to L2! Damage will occur to the IAQ sensor and/or other devices if this caution is not observed.

The IAQ sensor contains electrostatic discharge (ESD) sensitive components. Observe ESD precautions when handling the instrument to prevent damage. Failure to comply can result in equipment damage.

All connections are accomplished on the IAQ sensor circuit board at terminal blocks J2 and J3 shown in Figures 4 and 5.

1. Connect 24VAC power to the IAQ sensor at terminal block J3 terminals L1 and L2. When powering multiple network devices from a common source, observe 24VAC phasing (L1 to L1, and L2 to L2 - see Caution above).
2. The L2 post of the 24VAC J3 terminal block can be connected to earth ground according to the following:

CAUTION

Damage to network devices may occur if L2 of the 24VAC J3 terminal block is connected to earth ground and the RS485 network is not earth grounded.

a) If the RS485 network connection for the IAQ sensor is ground referenced to earth, the L2 post of the 24VAC J3 terminal block can also be connected to a wire that is ground referenced to earth.

b) If the RS485 network connection for the IAQ sensor is not ground referenced to earth, then the L2 post of the 24VAC J3 terminal block must not be connected to a wire ground referenced to earth, as damage to other network devices may occur.

3. Connect the RS485 network connections at terminal block J2 as follows:

J2 Terminal Block	Network Connection
-	NET -
+	NET +
COM	NETWORK COMMON

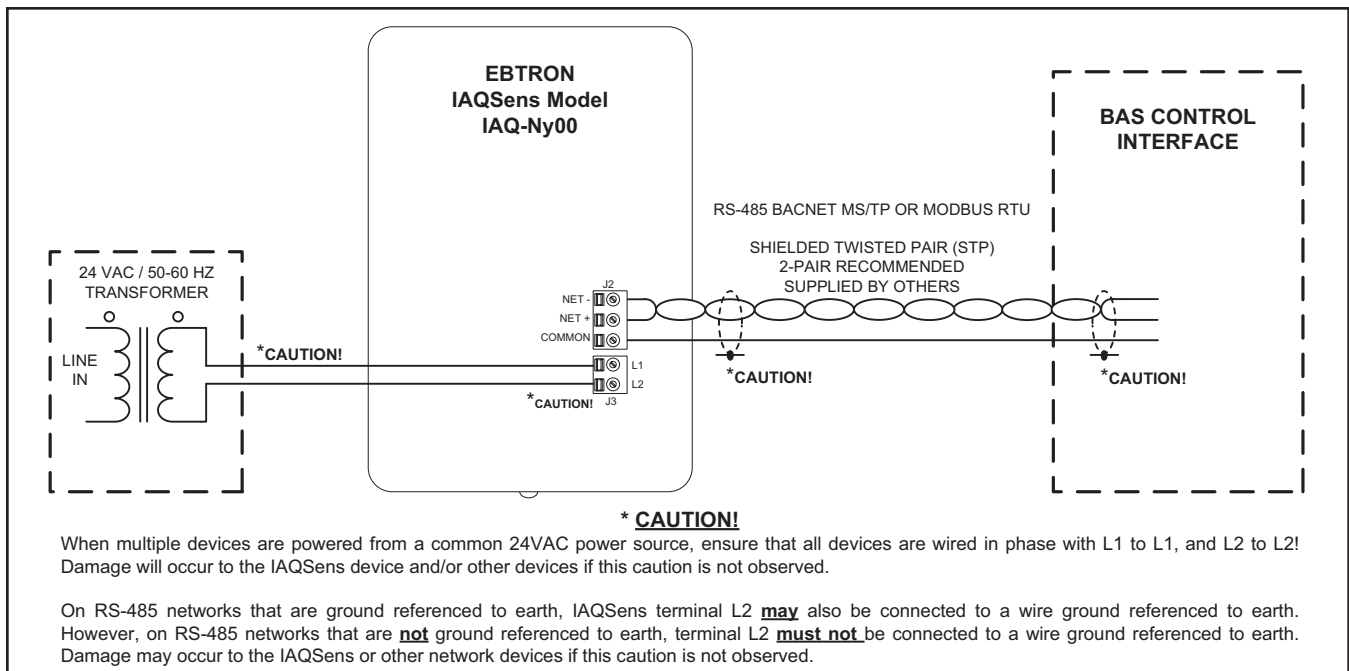


Figure 4. IAQ Sensor Typical Wiring Diagram to BAS Control Interface

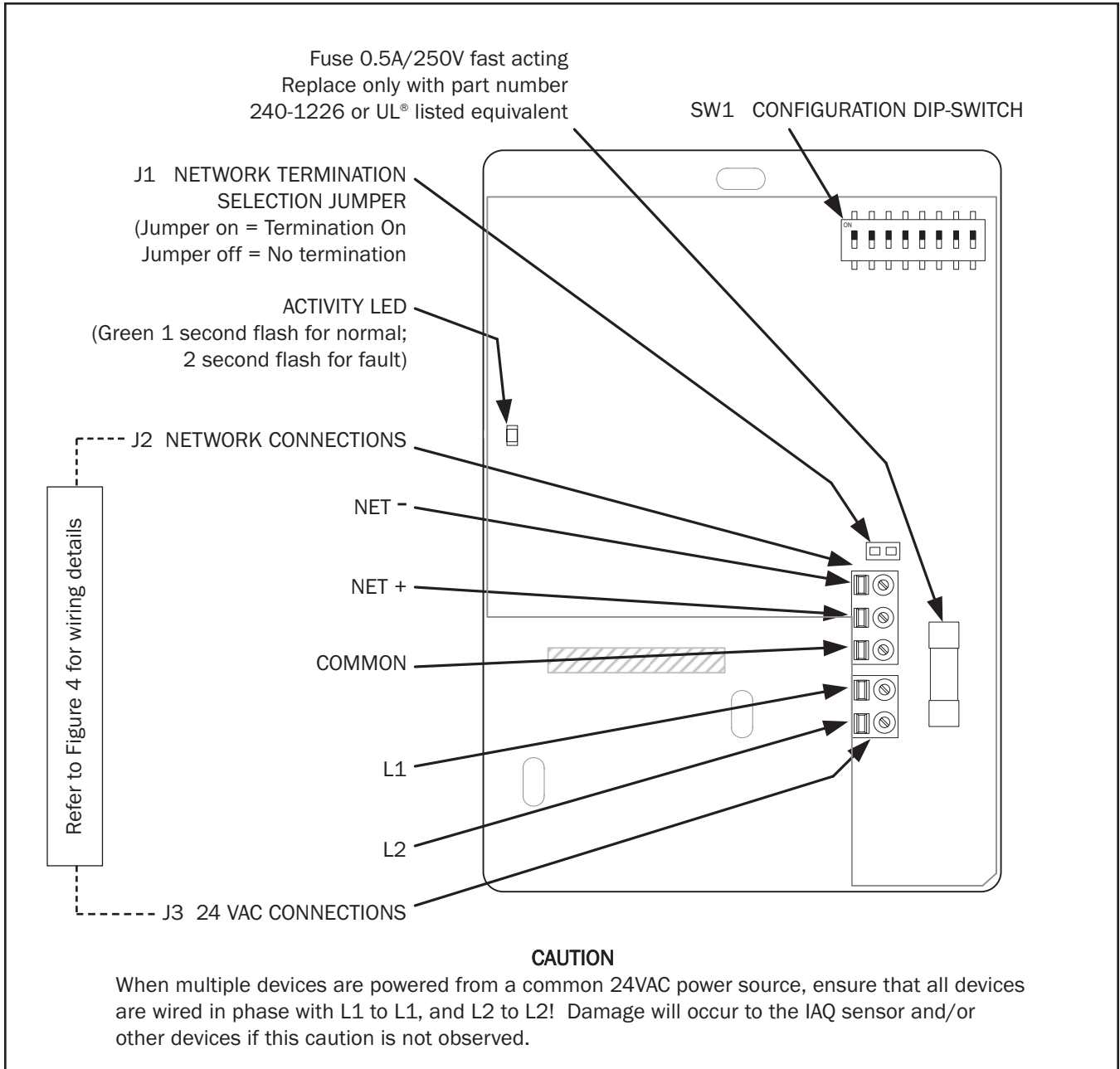


Figure 5. IAQ Sensor Interior Detail View

5. BACNET CONFIGURATION AND SET UP

The IAQ sensor is shipped from the factory for BACnet operation. If Modbus operation is desired, proceed to the **IAQ sensor Modbus CONFIGURATION** section of this document. The following paragraphs detail the initial set up instructions for the IAQ sensor when using BACnet device operation. Refer to Appendix A - IAQ sensor BACnet Device Operating Parameters for additional detail.

5.1 J1 - IAQ sensor RS485 Network Termination Selection

The IAQ sensor includes a network termination selection jumper at J1 (shown in Figure 4) to permit device installation at any point on an RS-485 network. When the IAQ sensor is located at either end of an RS-485 network or segment, it is recommended that the jumper at J1 be installed across both pins of J1. When the IAQ sensor is located at any other point on the RS-485 network, no termination is recommended, and the jumper should not be installed across J1.

5.2 Setting IAQ sensor Time

On models IAQ-N300 and IAQ-N100 the internal clock is used to establish the lowest CO₂ level. This clock must be set prior to placing the instrument in operation, or in the event of loss of power to the instrument.

Note:

When initially powered on (or following an interruption of 24 VAC power), the IAQ sensor internal time is set at 00:00:00 (midnight). The IAQ sensor will begin recording CO₂ PPM levels based on a 24-hour period starting at 00:00:00 and ending at 23:59:59. In order for the CO₂ sensor to record CO₂ levels accurately, the correct time must be entered.

The IAQ sensor time setting must be re-synchronized with the network following a power loss or interruption. For BACnet applications, a timesync command (see Appendix A) must be sent to the IAQ sensor using appropriate network software. For Modbus applications, the current time (in hours and minutes) must be reset using appropriate network software at registers 30025 and 30026 respectively (see Appendix B).

5.3 SW1 - IAQ sensor Configuration DIP Switch Settings

The configuration DIP switch contains eight separate dual-position switches in a dual inline package (DIP) as shown in Figures 5 and 6. These switches allow for setting the following IAQ sensor network parameters:

- Setting the MAC Address/Slave ID - using Switches 1 through 7
- Setting BACnet Device Object Instance Number (if the same as the MAC Address) - using Switch 8
- Setting BACnet Baud Rate - using Switches 1 through 4
- Restoring Defaults - using Switches 1-8
- Enabling Modbus network operation - using Switches 1 through 4
- Performing CO₂ Calibration - using Switches 1-8

NOTE:

Prior to initializing the IAQ sensor, the MAC address and the baud rate parameters must be assigned.

The following paragraphs provide detail for setting the network parameters using Configuration DIP Switch SW1.

WALL MOUNT BACNET/MODBUS CO2, R/H & TEMPERATURE SENSORS

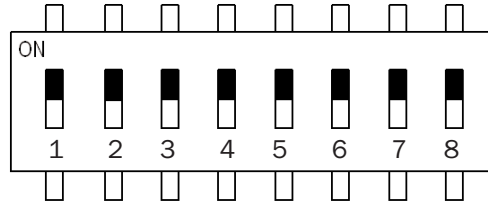


Figure 6. SW1 - Configuration DIP Switch Detail View

5.3.1 Setting the MAC Address

The default IAQ sensor MAC Address is set at the factory for a value of 2. If it is necessary to change the MAC address use switches 1 through 7 of SW1 to set the MAC Address to set any network address between 0 and 127 as follows:

1. Deactivate 24VAC power to the IAQ sensor.
2. Set SW1 switches 1-7 to the desired address as shown in Figure 7. Record the new MAC address value for future reference.
3. Reapply 24VAC power to the IAQ sensor. After a short delay (approximately 20 seconds) the new MAC address is now active.

MAC ADDRESS SETTINGS
SW1 DIP Switches 1-7

DIP Switch Number and Position								Network Address
1	2	3	4	5	6	7	8	
off	off	off	off	off	off	off	off	0
on	off	off	off	off	off	off	off	1
off	on	off	off	off	off	off	off	2 (Default)
on	on	off	off	off	off	off	off	3
↓	↓	↓	↓	↓	↓	↓	off	↓
on	on	on	on	on	on	on	off	127

Only SW1 Switches 1 through 7 are used to set the MAC Address - See text for detail.

Figure 7. MAC Address Selection Settings

NOTE:

When IAQ sensor configuration is completed, confirm that the new MAC address has been set correctly using appropriate BACnet software

5.3.2 Changing BACnet Device Object Instance Number

The BACnet Device Object Instance Number is set at the factory to match the factory default address of 2. If necessary, the BACnet Device Object Instance Number can be set to match the user assigned MAC address as follows:

1. Deactivate 24VAC power to the IAQ sensor.
2. Slide DIP Switch 8 to the ON position.
3. Restore 24VAC power to the IAQ sensor. Allow a short delay (approximately 20 seconds) for the new BACnet Device Object Instance Number to be recognized.
4. Restore DIP Switch 8 to the OFF position.

The BACnet Device Object Instance Number can also be set to another value that does not match the MAC address by using suitable BACnet software to write to the Device Object Identifier property of the Device Object. Refer to Appendix A for additional detail.

5.3.3 Setting the MS/TP Baud Rate

The IAQ sensor is shipped from the factory for BACnet operation with a baud rate of 76,800bps. The baud rate can be changed to 38,400, 19,200 or 9,600bps. Changes can be accomplished remotely over the network using BACnet Analog Value AV3 (Table A3), or locally at the IAQ sensor by using internal DIP Switch SW1 as follows:

1. Record the currently assigned MAC Address (SW1 switches 1 through 7 - See Figure 7).
2. Set the desired baud rate using Address Switches 1 through 4 as shown in Figure 8.

Baud Rate Selection

SW1 DIP Switches 1-4

ADDRESS DIP Switch Number/Position								MS/TP Baud Rate
1	2	3	4	5	6	7	8	
on	off	off	off	X	X	X	X	76,800
off	on	off	off	X	X	X	X	38,400
off	off	on	off	X	X	X	X	19,200
off	off	off	on	X	X	X	X	9,600

Only SW1 Switches 1 through 4 are used to set the Baud Rate - See text for detail.

Figure 8. Baud Rate Selection Settings

3. Set DIP Switch 8 to the ON position. Allow a short delay (approximately 20 seconds) for the new baud rate to be recognized.
4. Restore DIP Switch 8 to the OFF position.
5. Restore DIP switches 1-7 to the MAC address recorded in step 1.

5.4 Restoring Factory Default Settings

The following procedure can be used to restore the factory default settings to the IAQ sensor:

1. If the current MAC Address will be reused, record the currently assigned address (SW1 switches 1 through 7 - see Figure 7).
2. Deactivate 24VAC power to the IAQ sensor.
3. Set all 8 of the DIP switches (1-8) to the ON position.
4. Restore 24VAC power to the IAQ sensor. Allow a short delay (approximately 20 seconds) for the factory default settings to be recognized.
5. Deactivate 24VAC power to the IAQ sensor.
6. Set all 8 of the DIP switches (1-8) to the OFF position.
7. Restore DIP switches 1-7 to the MAC address recorded in step 1.
8. Restore 24VAC power to the IAQ sensor to return it to service with factory default settings.

6. IAQ SENSOR MODBUS CONFIGURATION

The IAQ sensor is preset at the factory for BACnet network operation. To set the IAQ sensor for Modbus network operation, perform the following steps. Refer to Appendix B - IAQ sensor Modbus Device Operating Parameters for available register values and settings.

1. The default network address is set at the factory for a value of 2. Any value between 1 and 127 can be assigned for the IAQ sensor using Configuration DIP Switch SW1 as outlined in the **Setting the MAC Address** paragraph of this document. If the current network address will be reused, record the current settings of DIP switches 1 through 7.
2. With the IAQ sensor powered on, set Configuration DIP switches 1 through 4 to the ON position.
3. Toggle DIP switch 8 to the ON position for 5 seconds, and then back to OFF.

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4. Restore DIP switches 1-7 to the network address recorded in step 1.
5. The IAQ sensor is now set for Modbus operation with a baud rate of 19,200bps. If necessary, the baud rate can be changed as outlined previously in the **Setting the Baud Rate** paragraph of this document.
6. Configure the necessary Modbus register values as outlined in Appendix B.

7. IAQ SENSOR START-UP

The following procedure is intended for initial start up of the instrument.

1. Confirm that the IAQ sensor is installed and wired properly as outlined in **IAQ SENSOR INSTALLATION** and IAQ sensor **INTERCONNECTIONS** sections of this document.
2. Confirm that network termination, address, baud rate and device object instance number (as applicable) have all been properly set as outlined previously in the **IAQ sensor BACnet CONFIGURATION** or **IAQ sensor MODBUS CONFIGURATION** sections of this document.
3. Apply 24VAC power to the IAQ sensor. After a brief initialization (approximately 20 seconds) observe that the green Activity LED flashes on for 1 second, then OFF for one second indicating normal operation.
4. Install IAQ sensor cover by engaging the small molded hinges at the top of the cover with the base, and then gently swinging the cover downward into the closed position. The cover will latch via the tab located at the bottom of the enclosure. If required, install Security/Tamper resist screw at the bottom of the IAQ sensor enclosure (as shown in Figure 3).
5. Using suitable software, set current IAQ sensor Time (refer to Appendices A and B for BACnet and Modbus network details).
6. Confirm network device settings and operation using Appendices A and B for BACnet and Modbus applications respectively.
7. The IAQ sensor is now ready for normal network operation.

8. IAQ SENSOR NORMAL OPERATION

During normal operation of the IAQ sensor, no further user activity is required.

The IAQ sensor features a green “Activity” light emitting diode (LED - see Figure 5) that flashes to indicate the operating status of the instrument. Following application of 24VAC power and a brief instrument initialization of approximately 20 seconds, the LED will begin to flash.

During normal IAQ sensor operation the Activity LED will continuously flash ON for 1 second, then OFF for 1 second.

During IAQ sensor fault conditions, the LED will continuously flash ON for 2 seconds, and then OFF for 2 seconds.

Refer to Appendix A and Appendix B for BACnet and Modbus device network values available during operation of the IAQ sensor.

9. BACnet NETWORK DEVICE OPERATING PARAMETERS

Appendix A contains a detailed listing of all IAQ sensor BACnet network variables and values.

10. MODBUS NETWORK DEVICE OPERATING PARAMETERS

Appendix B contains a detailed listing of all IAQ sensor Modbus network variables and values.

APPENDIX A - BACnet NETWORK DEVICE OPERATING PARAMETERS

IAQ SENSOR BACnet OVERVIEW

The BACnet objects associated with the IAQ Sensor permit display of current values, device configuration, and calibration of the CO2 sensor. The BACnet object categories for the IAQ sensor (below) are described in the following paragraphs:

- A1 - BACnet Device Object
- A2 - BACnet Analog Input (AI) Objects
- A3 - BACnet Analog Value (AV) Objects
- A4 - BACnet Binary Value Objects

A1. BACnet Device Object

The device object allows configuration of the IAQ sensor. Object properties can be specified as shown in Table A1.

Table A1. BACnet Device Object

BACnet® Object	Description
IAQ-N100 (or IAQ-N200) (or IAQ-N300)	This object allows the operator to specify the following: Device name Device location Time and Date Universal Time Coordinated Offset APDU properties MS/TP properties Object Identifier

A2. BACnet Analog Input (AI) Objects

The analog input BACnet objects permit display of the present values for the items detailed in Table A2. In addition, analog input change of value (AI COV) subscriptions for these objects can be configured as follows:

AI COV: A confirmed or unconfirmed COV (Change of Value) notification can be subscribed to for each analog input object (below). The COV increment value can be set through each AI.

Table A2. BACnet Analog Input (AI) Objects

Model	BACnet® Object	Default Present-Value	Range	Description
IAQ-N100	CO2 PPM (AI1)	Display Only	NA	Displays the present value of CO2 in parts per million.
	Lowest PPM (AI2)	Display Only	NA	Displays the lowest CO2 PPM value for the past 24 hour period. Any value written to this object will reset the Lowest PPM value to the present CO2 reading.
IAQ-N200	RH (AI1)	Display Only	NA	Displays the present value of relative humidity in percent.
	Temperature (AI2)	Display Only	NA	Displays the present value of ambient room temperature in degrees F (can be changed to degrees C if desired).
IAQ-N300	CO2 PPM (AI1)	Display Only	NA	Displays the present value of CO2 in parts per million.
	RH (AI2)	Display Only	NA	Displays the present value of relative humidity in percent.
	Temperature (AI3)	Display Only	NA	Displays the present value of ambient room temperature in degrees F (can be changed to degrees C if desired).
	Lowest PPM (AI4)	Display Only	NA	Displays the lowest CO2 PPM value for the past 24 hour period. Any value written to this object will reset the Lowest PPM value to the present CO2 reading.

A3. BACnet Analog Value Objects

The analog value BACnet objects allow for configuration of variables that affect instrument operation and individual sensor measurement accuracy.

Table A3-1. Model IAQ-N100 BACnet Analog Value Objects

Model	BACnet® Object	Default Present-Value	Range	Description
IAQ-N100	Elevation (AV1)	0 feet	0-5000 feet	This object allows specifying the elevation that the IAQ-100 is installed in feet above sea level.
	CO2 Sample Rate (AV2)	10 seconds	1-600 seconds	This register specifies how often the CO2 sensor is sampled in seconds.
	Baud Rate (AV3)	76,800	Optional	This object allows specifying RS485 Baud rate.
	Single Point PPM (AV4)	-1	0 to 10000 ppm* (*See NOTE below)	This object allows calibration of the CO2 sensor. A '-1' value indicates that the new calibration data was successfully written. A '-2' value indicates that calibration was accomplished successfully. A '-3' value indicates that calibration was not successful.
	ABC Logic Status (AV5)	1	Either 1 or 0	Writing a '1' to this will turn the ABC Logic™ on, writing a '0' will turn it off. This data is non-volatile and saved by the CO2 module.
	CO2 Gain (AV6)	1	0 - 100	This object allows specifying a gain to the raw CO2 sensor reading or to the EBTRON factory calibration gain adjustment setting.
	CO2 Offset (AV7)	0	+/-10,000* (*See NOTE below)	This object allows specifying an offset to raw CO2 sensor reading or to the EBTRON factory calibration offset adjustment setting.

NOTE:

*To ensure measurement accuracy, CO₂ calibration must always be performed within the range of 400-2,000 PPM.

Table A3-2. Model IAQ-N200 BACnet Analog Value Objects

Model	BACnet® Object	Default Present-Value	Range	Description
IAQ-N200	Baud Rate (AV1)	76,800	Optional	This object allows specifying the RS485 Baud rate.
	Relative Humidity Gain (AV2)	1	0 - 100	This object allows specifying a gain to the raw Relative Humidity sensor reading or to the EBTRON factory calibration gain adjustment setting.
	Temperature Gain (AV3)	1	0 - 100	This object allows specifying a gain to raw Temperature sensor reading or to the EBTRON factory calibration gain adjustment setting.
	Relative Humidity Offset (AV4)	0	+/-100	This object allows specifying an offset to raw Relative Humidity sensor reading or to the EBTRON factory calibration offset adjustment setting.
	Temperature Offset (AV5)	0	+/-200	This object allows specifying an offset to raw Temperature sensor reading or to the EBTRON factory calibration offset adjustment setting.

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Table A3-3. Model IAQ-N300 BACnet Analog Value Objects

Model	BACnet® Object	Default Present-Value	Range	Description
IAQ-N300	Elevation (AV1)	0 feet	0-5000 feet	This object allows specifying the elevation that the IAQ-300 is installed in feet above sea level.
	CO2 Sample Rate (AV2)	10 seconds	1-600 seconds	This register specifies how often the CO2 sensor is sampled in seconds.
	Baud Rate (AV3)	76,800	Optional	This object allows specifying the RS485 Baud rate.
	Single Point PPM (AV4)	-1	0 to 10000 ppm* (*See NOTE below)	This object allows calibration of the CO2 sensor. A '-1' value indicates that the new calibration data was successfully written. A '-2' value indicates that calibration was accomplished successfully. A '-3' value indicates that calibration was not successful.
	ABC Logic Status (AV5)	1	Either 1 or 0	Writing a '1' to this will turn the ABC Logic™ on, writing a '0' will turn it off. This data is non-volatile and saved by the CO2 module.
	CO2 Gain (AV6)	1	0 - 100	This object allows specifying a gain to the raw CO2 sensor reading or to the EBTRON factory calibration gain adjustment setting.
	Relative Humidity Gain (AV7)	1	0 - 100	This object allows specifying a gain to the raw Relative Humidity sensor reading or to the EBTRON factory calibration gain adjustment setting.
	Temperature Gain (AV8)	1	0 - 100	This object allows specifying a gain to raw Temperature sensor reading or to the EBTRON factory calibration gain adjustment setting.
	CO2 Offset (AV9)	0	+/-10,000* (*See NOTE below)	This object allows specifying an offset to raw CO2 sensor reading or to the EBTRON factory calibration offset adjustment setting.
	Relative Humidity Offset (AV10)	0	+/-100	This object allows specifying an offset to raw Relative Humidity sensor reading or to the EBTRON factory calibration offset adjustment setting.
	Temperature Offset (AV11)	0	+/-200	This object allows specifying an offset to raw Temperature sensor reading or to the EBTRON factory calibration offset adjustment setting.

A4. BACnet Binary Value Objects

The binary value BACnet objects allow for application of the EBTRON factory calibration values for individual sensor gain and offset factors.

Table A4. BACnet Binary Value Objects

IAQ-N100	IAQ-N 200	IAQ-N300	BACnet® Object	Default Present-Value	Range	Description
BV1	---	BV1	Factory CO2 Gain/Offset Status	Active	Active/ Inactive	When this object is set to Active, the CO ₂ sensor will operate with the EBTRON factory calibration values for gain and offset.
---	BV1	BV2	Factory Relative Humidity Gain/Offset Status	Active	Active/ Inactive	When this object is set to Active, the Relative Humidity sensor will operate with the EBTRON factory calibration values for gain and offset.
---	BV2	BV3	Factory Temperature Gain/Offset Status	Active	Active/ Inactive	When this object is set to Active, the Temperature sensor will operate with the EBTRON factory calibration values for gain and offset.

APPENDIX B - MODBUS NETWORK DEVICE OPERATING PARAMETERS

IAQ Sensor Modbus Register Overview

For Modbus, all communication is 8 Data Bits, 1 Stop Bit and no parity. The Modbus registers associated with the IAQ sensor permit display of current values, device configuration, and calibration of the CO₂ sensor. They are detailed in the following paragraphs:

- B1 - Standard Modbus Commands Supported
- B2 - Read-only registers consisting of three 4-byte floats (high word/low word)
- B3 - Read/write registers consisting of seven 4-byte floats (high word/low word)
- B4 - Read/write 2-byte registers.

B1. Modbus Command Functions

Table B1 identifies the IAQ Sensor supported standard Modbus command functions.

Table B1. IAQ Sensor Standard Modbus Command Functions Supported

Command	Description
04	Read input registers (refer to Tables B2 through B6).
06	Write registers (refer to Tables B2 through B6).
16	Write multiple registers (refer to Tables B2 through B6).

B2. Modbus 4-Byte Floats - Read Only Properties

The 4-byte floats with read only properties permit display of each of the three sensors values in the IAQ sensor as detailed in Table B2.

Table B2. Modbus 4-Byte Floats - Read-Only Properties

Name	IAQ-N100 Address	IAQ-N200 Address	IAQ-N300 Address	Default Register Value	Range	Description
Present CO2 PPM	30001 - 30002	-----	30001 - 30002	Display Only	NA	These paired registers contain the present CO ₂ parts per million.
Present Relative Humidity	-----	30001 - 30002	30003 - 30004	Display Only	NA	These paired registers contain the present relative humidity percentage.
Present Temperature	-----	30003 - 30004	30005 - 30006	Display Only	NA	These paired registers contain the present ambient room temperature in degrees F.

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B3. Modbus 4-Byte Floats - Read/Write Properties

The 4-byte floats with read and write properties detailed in Table B3 allow the configuration of sensor gain and offset variables that affect the measurement accuracy of the three sensors.

Table B3. Modbus 4-Byte Floats - Read/Write Properties

Name	IAQ-N100 Address	IAQ-N200 Address	IAQ-N300 Address	Default Register Value	Range	Description
Lowest CO2PPM	30003 - 30004	-----	30007 - 30008	Present Value	Any Value	These paired registers allow the display of (or change to) the lowest CO2PPM value in the past 24 hour period. Any value written to this object will reset the Lowest CO2 PPM to the Present CO2 PPM value.
CO2 Gain	30005 - 30006	-----	30009 - 30010	1	0 - 100	These paired registers allow specifying a gain value to the raw CO2 sensor reading or to the EBTRON factory gain adjustment setting.
Relative Humidity Gain	-----	30005 - 30006	30011 - 30012	1	0 - 100	These paired registers allow specifying a gain value to the raw Relative Humidity sensor reading or to the EBTRON factory gain adjustment setting.
Temperature Gain	-----	30007 - 30008	30013 - 30014	1	0 - 100	These paired registers allow specifying a gain value to the raw Temperature sensor reading or to the EBTRON factory gain adjustment setting.
CO2 Offset	30007 - 30008	-----	30015 - 30016	0	+/-10,000* (*See NOTE below)	These paired registers allow specifying an offset value to the raw CO2 sensor reading or to the EBTRON factory offset adjustment setting.
Relative Humidity Offset	-----	30009 - 30010	30017 - 30018	0	+/-100	These paired registers allow specifying an offset value to the raw Relative Humidity sensor reading or to the EBTRON factory offset adjustment setting.
Temperature Offset		300011 - 30012	30019 - 30020	0	+/-200	These paired registers allow specifying an offset value to the raw Temperature sensor reading or to the EBTRON factory offset adjustment setting.

NOTE:

*CO2 Offset does not affect sensor accuracy. Specified sensor accuracy is valid over the range of 400-2,000 PPM.

B4. Modbus 2-Byte Registers - Read/Write Properties

The 2-byte registers with read and write properties detailed in Table B4 allow configuration of the additional variables that affect the performance of the three sensors.

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Table B4. Modbus 2-Byte Registers - Read/Write Properties

Name	IAQ-N100 Address	IAQ-N200 Address	IAQ-N300 Address	Default Register Value	Range	Description
Elevation of IAQ Sensor	30009	-----	30021	0 feet	0-5000 feet	This register allows specifying the elevation that the IAQ-100 or IAQ-300 is installed in feet above sea level.
CO2 Sample Rate	30010	-----	30022	10 seconds	1-600 seconds	This register specifies how often the CO2 sensor is sampled in seconds.
CO2 Sensor Calibration	30011	-----	30023	-1	0 to 10000 ppm* (*See NOTE below)	This object allows calibration of the CO2 sensor. '-1' value indicates new calibration data was successfully written. '-2' value indicates calibration was accomplished successfully. '-3' value indicates calibration was not successful.
CO2 Sensor ABC Logic Disable	30012	-----	30024	1	1 or 0	Writing a '1' to this register will turn the ABC Logic™ on; writing a '0' will turn it off. This data is non-volatile and is saved by the CO2 module.
IAQ Sensor Time Hours	30013	30013	30025	0	0 - 23	Register allows setting the current time (hours).
IAQ Sensor Time Minutes	30014	30014	30026	0	0 - 59	Register allows setting the current time (minutes).
Float Invert	30015	30015	30027	0	0 or 1	This register allows change to the order of register that is read or written first in the 4-byte floats. When set to 0 (default) the high word is read or written first; when set to 1 the low word is read or written first.
Factory CO2 Gain/Offset Status	30016	-----	30028	1	1 or 0	When set to 1 (default) the CO2 sensor will operate with the EBTRON factory gain and offset adjustment. When set to 0, the CO2 sensor will operate without the EBTRON factory gain and offset adjustment.
Factory Relative Humidity Gain/Offset Status	-----	30016	30029	1	1 or 0	When set to 1 (default) the Relative Humidity sensor operates with EBTRON factory gain and offset adjustment. When set to 0, the Relative Humidity sensor operates without factory gain and offset adjustment.
Factory Temperature Gain/Offset Status	-----	30017	30030	1	1 or 0	When set to 1 (default) the Temperature sensor operates with EBTRON factory gain and offset adjustment. When set to 0, the Temperature sensor operates without EBTRON factory gain and offset adjustment.
Temperature Units of Measurement Units	-----	30018	30031	0	0 or 1	This register allows setting the Present Temperature register units to Fahrenheit or Celsius. When set to 0 (default), units of temperature measurement is Fahrenheit. When set to 1, the unit of temperature measurement is Celsius.

NOTE:

*To ensure measurement accuracy, CO₂ calibration must always be performed within the range of 400-2,000 PPM.