

SECTION 23 09 13.23 SENSORS AND TRANSMITTERS, Combination CO₂/Relative Humidity/Temperature Measurement Devices

Data contained in this guide specification may be placed in either of the following sections, depending on the specifics of the system design, or incorporated within the next higher level controls specifications (23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC or even higher in 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC).

PART 1 GENERAL**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes monitoring and control instrumentation for HVAC air handling, distribution systems and components.
- B. Related Sections include the following:
1. Section 23 09 93 Sequence of Operations for HVAC Controls
 2. Section 23 36 16 Variable-Air-Volume Terminal Units
 3. Section 23 72 00 Air-to-Air Energy Recovery Equipment
 4. Section 23 73 00 Indoor Central-Station Air-Handling Units
 5. Section 23 74 00 Packaged Outdoor HVAC Equipment
 6. Section 23 75 00 Custom-Packaged Outdoor HVAC Equipment
 7. Section 25 01 30 Operation and Maintenance of Integrated Automation Instrumentation and Terminal Devices
 8. Section 25 01 90 Diagnostic Systems for Integrated Automation
 9. Section 25 14 19 Integrated Automation Terminal Control Units
 10. Section 25 35 00 Integrated Automation Instrumentation and Terminal Devices for HVAC
 11. Section 25 35 16 Integrated Automation Sensors and Transmitters
 12. Section 25 95 00 Integrated Automation Control Sequences for HVAC

1.3 REFERENCES

- A. ANSI / ASHRAE Standard 135-2012, *BACnet® – A Data Communication Protocol for Building Automation and Control Networks*
- B. ANSI / ASHRAE Standard 135.1-2013, *Method of Testing for Conformance to BACnet*
- C. ANSI / ASHRAE Standard 62.1-2013, *Ventilation for Acceptable Indoor Air Quality*
- D. ANSI / ASHRAE / IESNA Standard 90.1-2013, *Energy Standard for Buildings, Except Low-Rise Residential*

1.4 SUBMITTALS

- A. Submit complete product data sheets for all RS-485 network (BACnet MS/TP or Modbus-RTU) combination CO₂/RH/Temperature measuring devices indicating placement requirements, sensor technology employed, sensor calibration certification, sensor maintenance requirements and installed accuracy available to the host control system.
- B. Submit a schedule of network measuring devices indicating compliance with specified sensor performance throughout the CO₂, RH and temperature measurement and operating ranges.
- C. Submit installation, operation and maintenance documentation.

1.5 SEQUENCE(S) OF OPERATION

Integrated Automation Control Sequences for HVAC

1.6 QUALIFICATIONS AND QUALITY ASSURANCE

- A. Manufacturer Qualifications: The successful firm shall have a minimum of five years experience producing microprocessor-based RS-485 network (BACnet MS/TP and Modbus-RTU) sensors and shall have a record of successful in-service performance verified by the consulting mechanical engineer. All BACnet products shall be BTL Listed.
- B. Installer Qualifications: An experienced installer who is trained and/or approved by the instrument manufacturer for both installation and maintenance of units required under this specification.

1.7 SYSTEM RESPONSIBILITY

- A. The contractor shall be responsible for any and all costs associated with changes resulting from the use of a supplier other than the listed acceptable manufacturer.

1.8 WARRANTY

- A. Provide a manufacturer's parts warranty covering 36 months from the date of product shipment.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Combination CO₂, RH and Temperature measuring devices shall be kept clean and dry, protected from all damage, including that due to weather and construction traffic.
- B. All handling and storage procedures shall conform to the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 PRODUCTS INCLUDED IN THIS SECTION

- A. RS-485 network combination CO₂/RH/temperature measuring devices (BACnet MS/TP or Modbus-RTU), wall mounted

2.2 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with performance and design requirements of this Section, provide products that comply with this specification by one of the following vendors:
 1. EBTRON, Inc. Model IAQ-N300-W (basis of design)
 2. Alternatives requesting acceptance as equal less than 60 days prior to bid date or products submitted in non-conformance with the requirements of this specification will not be considered.
 - a) For any product to be considered for substitution, a written section-by-section document detailing exceptions and compliance shall be submitted to the Engineer before approval will be considered.

2.3 NETWORK COMBINATION SENSORS

- A. Provide RS-485 network (BACnet MS/TP or Modbus-RTU) combination CO₂/RH/Temperature measuring devices for mounting where indicated on the plans.
- B. Each combination sensor shall consist of an integrated system of three or more environment sensing functions in a wall mounted package, with an integral microprocessor-based design capable of continuous operation despite failure of a single sensor node per measurement location.
- C. Combination sensors shall have an environmental operating range of no less than 32 – 122° F (0 – 50° C) and 5 – 95% RH, non-condensing.
- D. CO₂ Sensor Design and Performance
 1. CO₂ measurement shall be accomplished with Non-Dispersive Infrared (NDIR) technology using gold plated optics and diffusion sampling.
 2. CO₂ measurement accuracy shall be ±3% of reading or ±30 ppm @400 to 1250 ppm, whichever is greater and ±30 ppm @1250 ppm to 2000 ppm.
 3. CO₂ measurement stability shall be <2% FS over the expected 15 year life of the typical sensor.
 4. Each CO₂ sensor node shall be factory calibrated and shall have the capability to automatically self-calibrate during operation.
 5. Each CO₂ sensor node shall have two calibration ports for field calibration using an external nitrogen source.
- E. Relative Humidity (RH) Sensor Design and Performance
 1. Each RH sensor node shall measure ambient RH using planar laminated, electrolytic polymer capacitor technology.
 2. RH measurement range shall be 0 – 100% RH, non-condensing.
 3. RH measurement accuracy shall be ±3% at less than 20% RH, ±2% from 20%-80% RH, ±3% greater than 80% RH.
 4. RH output resolution shall be at least 0.4% of Reading.
- F. Temperature Sensor Design and Performance
 1. Each temperature sensor node shall sense changes using integral bandgap voltage reference circuitry and perfectly proportional to absolute temperature (PTAT) ΔV technology.
 2. Temperature measurement accuracy shall be equal to or greater than ±1.08° F at 77° F (±0.6° C at 25° C)
 3. The operating temperature range shall be at least 32° F to 122° F (0° C to 50° C).
 4. Output resolution shall be at least 0.36° F (0.2° C).
- G. Power, Connectivity and Communications

1. The combination sensor shall be capable of communicating with other devices using an RS-485 standard interface using either BACnet-MS/TP protocol implemented as a Master node or Modbus RTU protocol.
 - a) Communication speed shall be field-selectable between 9.6, 19.2, 38.4 and 76.8 kBaud.
 2. BACnet devices shall implement the open protocol in compliance of the requirements of ASHRAE Standard 135-2012 and all BACnet products shall be BTL Listed.
 3. The combination sensor shall be capable of field set-up and configuration using a simple dip-switch interface.
 4. The combination sensor shall operate on 24 VAC (22.8 to 26.4 VAC), 50/60Hz.
 - a) The combination sensor design shall include protection from over voltage, over current transients and power surges.
 - b) The combination sensor shall use "watch-dog" circuitry to assure automatic processor reset after power disruption, transients and brown-outs.
 5. The combination sensor design shall be capable of communicating to the network if one of the sensor functions becomes faulty, and will continue to operate the remaining CO₂, RH or Temp sensor nodes.
- H. The combination sensor enclosure shall be a low profile wall mount type, compatible in size for mounting with a standard single-gang electrical box or for surface mount applications.
1. The sensors shall be installed at locations that are protected from weather and/or water.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install combination measurement devices in accordance with manufacturer's instructions at the locations indicated on the plans.
 1. A written report shall be submitted to the consulting mechanical engineer if any discrepancies are found.
- B. Install labels and nameplates to identify control components according to Section 23 33 00 or 25 35 00.
- C. Install electronic cables according to Section 25 05 00 "Common Work Results for Integrated Automation."
- D. Install low-voltage power, signal and communication cable according to Sections 25 05 13 "Conductors and Cables for Integrated Automation," 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and/or 27 15 00 "Communications Horizontal Cabling."

END OF SECTION **23 09 13.23**

Sensors and Transmitters, **Combination CO₂/RH/Temperature Measurement Devices**