PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. This section of the Specifications details the components to be provided by the BMCS subcontractor relating to the following:
1. Temperature and Humidity Sensor - Outside Air.
2. Temperature Sensor - Outside Air.
3. Temperature Sensor - Duct Mounted - Single Point.
4. Temperature Sensor - Duct Mounted - Averaging.
5. Temperature Sensor - Wall Mounted - Tenant Spaces.
6. Temperature Sensor - Wall Mounted - Lobby and Public Spaces.
7. Temperature Sensor - Wall Mounted - Back of House
8. Thermostat
9. Freezestat Assembly.
10. Relative Humidity Sensor - Outside Air.
11. Relative Humidity Sensor - Duct Mounted.
12. Relative Humidity Sensor - Wall Mounted.
13. Combination Relative Humidity and Temperature Sensors.
14. Static Pressure Sensor - Duct Mounted.
15. Static Pressure Sensor - Space.
16. Static Pressure Sensor - Underfloor.
17. Air Flowrate Sensor - Duct Mounted Differential Pressure.
18. Air Flowrate Sensor - Duct Mounted Thermal Dispersion.
19. Air Flowrate Sensor - Fan Inlet Thermal Dispersion.
20. Differential Pressure Switch - Air - Fan Shutdown.
21. Differential Pressure Switch - Air - Fan Status.
22. Air Quality Sensors.
23. Wind Speed Indicator.
24. Wind Direction Indicator.
25. Natural Gas Flow Totalizer.

1.2 RTD TRANSMITTERS

A. Where reference is made in this Section to an RTD transmitter, it shall be interpreted as follows:
1. If the RTD is 100 ohm Pt, provide a transmitter located at the RTD.
2. If the RTD is 1,000 ohm Pt, provide a transmitter at the RTD:
3. If the I/O subsystem at the UC or DCP cannot interface directly to an RTD.
4. If the distance between the RTD and the associated UC or DCP exceeds 20 feet.
5. Where necessary to meet monitoring accuracy requirements provide a 3-wire or 4-wire configuration. Select a range which is appropriate for the climate. Temperature range should be between -76 Deg. F. and 32 Deg. F. at the low end and shall be between +104 Deg. F. and +140 Deg. F. at the upper end.
6. Thermistors will be acceptable in lieu of RTD provided the thermistor carries a five-year guarantee that the device will maintain its accuracy within tolerance of 0.5 Deg. F. between 32 Deg. F. and 150 Deg. F.

B. Transmitter output shall be 4 to 20mA proportional to temperature and shall cover a temperature range as indicated in Part 2 of this Section. The analog-to-analog conversion of the transmitter shall be such that the monitored temperature is reported by the BMCS within the accuracy requirements detailed for the individual temperature sensors.

PART 2 - PRODUCTS

2.1 TEMPERATURE AND HUMIDITY SENSOR - OUTSIDE AIR

A. Provide outside air temperature and humidity sensors as indicated. Outside air temperature and humidity sensors shall meet, at minimum, the following requirements:
1. ABS plastic housing.

2. Radiation shield with filtering.
3. Precipitation shield
4. Suitable construction for exterior mounting.
5. Weather proof enclosure with conduit fitting.
6. Chrome coated aluminum probe.
7. 1,000 ohm platinum RTD temperature sensor.
8. Operating temperature range limits of -40 Deg. F. to +140 Deg. F.
9. Two wire 4-20 mA outputs proportional to relative humidity and temperature.
10. 10-35 VDC or 24VAC input power.
11. Temperature measurement range of -40 Deg. F. to +140 Deg. F.
12. Humidity measurement range of 0% RH to 100% RH.
13. Temperature accuracy of 0.4 Deg. F. at 68 Deg. F.
14. Humidity accuracy of 2.0% (0-90% RH) and 2.5% (90-100% RH).
15 NIST traceable certification.

B. Provide Vaisala HMT100 Series sensors, transmitters and accessories model number HMT100A02A122A2C1CB00 or equal.

2.2 TEMPERATURE SENSOR - OUTSIDE AIR

A. Provide outside air temperature sensors as indicated within the Field Termination Schedules. Temperature sensors shall meet, at minimum, the following requirements:
1. Ventilated white PVC sun shield.
2. Weather proof enclosure with conduit fitting.
3. 100 or 1,000 ohm platinum RTD with a minimum temperature coefficient of resistance of 0.00385 ohm/ohm/Deg. C.
4. BMCS shall report the monitored temperature with an accuracy of 1.0 Deg. F.
5. Temperature range of -50 Deg. F. to +120 Deg. F.

B. If it meets the above requirements, provide Automation Components Inc (ACI) or approved equal.

2.3 TEMPERATURE SENSOR - DUCT MOUNTED - SINGLE POINT

A. Provide duct mounted, single point, temperature sensors as indicated within the Field Termination Schedules. Temperature sensors shall meet, at minimum, the following requirements:
1. Stainless steel probe, minimum 12 inch length or as required to extend two-thirds of the duct width.
2. 100 or 1,000 ohm platinum RTD with a minimum temperature coefficient of resistance of 0.00385 ohm/ohm/Deg. C.
3. BMCS shall report the monitored temperature with an accuracy of 1.0 Deg. F.
4. Temperature range of 32 Deg. F to 122 Deg. F.
5. Duct mounted moisture/waterproof housing with conduit fitting.

B. If it meets the above requirements, provide Automation Components Inc. (ACI) or approved equal.

2.4 TEMPERATURE SENSOR - DUCT MOUNTED - AVERAGING

A. Provide duct mounted, averaging temperature sensors as indicated within the Field Termination Schedules. Temperature sensors shall meet, at minimum, the following requirements:
1. Probe length of 12 feet minimum or one linear foot per square foot of duct cross-sectional area, whichever is greater. Use of single point temperature sensors shall be acceptable for duct cross sectional areas of less than eight square feet.
2. Copper sheathed construction.
3. 1,000 ohm platinum RTD with a minimum temperature coefficient of resistance of 0.00385 ohm/ohm/Deg. C.
4. Accuracy of 1.0 Deg. F.
5. Temperature range of 32 Deg. F to 122 Deg. F.
6. Duct mounted moisture/waterproof housing with conduit fitting.
7. Suitable supports at all bends and at intermediate points to prevent movement in the air stream.

B. If it meets the above requirements, provide Automation Components Inc. (ACI) or approved equal.

2.5 TEMPERATURE SENSOR - WALL MOUNTED - TENANT SPACES

A. Provide wall mounted temperature sensors for tenant spaces served by terminal units as indicated within the Field Termination Schedules. Temperature sensors shall meet, at minimum, the following requirements:
   1. White protective enclosure. There shall be no manufacturer's logos, name or markings on casing.
   2. The sensor shall not have any control adjustments available to the tenant.
   3. 1,000 ohm platinum RTD with a minimum temperature coefficient of resistance of 0.00385 ohm/ohm/Deg. C.
   4. Accuracy of 0.5 Deg. F.
   5. Temperature range of 32 Deg. F. to 100 Deg. F.
   6. Cover shall be removable to allow access to the plug for the ROW and HHD, as applicable.

B. If it meets the above requirements, provide Automation Components Inc. (ACI) or approved equal.

2.6 TEMPERATURE SENSOR - WALL MOUNTED - LOBBY AND PUBLIC SPACES

A. Provide wall mounted recessed temperature sensors for lobbies and public spaces as indicated within the Field Termination Schedules. Temperature sensors shall meet, at minimum, the following requirements:
   1. Brass or stainless steel button type sensors of maximum diameter 0.75 inches.
   2. Sensor shall be painted in accordance with the Architects instructions.
   3. 100 or 1,000 ohm platinum RTD with a minimum temperature coefficient of resistance of 0.00385 ohm/ohm/Deg. C.
   4. BMCS shall report the monitored temperature with an accuracy of 1.0 Deg. F.
   5. Temperature range of 32 Deg. F. to 100 Deg. F.

B. If it meets the above requirements, provide Automation Components Inc. (ACI) SBS or BBS as selected by the Architect.

2.7 TEMPERATURE SENSOR - WALL MOUNTED – BACK OF HOUSE SPACES

A. Provide wall mounted temperature sensors for tenant spaces served by terminal units as indicated within the Field Termination Schedules. Temperature sensors shall meet, at minimum, the following requirements:
   1. Protective enclosure.
   2. 1,000 ohm platinum RTD with a minimum temperature coefficient of resistance of 0.00385 ohm/ohm/Deg. C.
   3. Accuracy of 0.5 Deg. F.
   4. Temperature range of 32 Deg. F. to 100 Deg. F.

B. If it meets the above requirements, provide Automation Components Inc. (ACI) or approved equal.

2.8 THERMOSTAT

A. Provide thermostat controls for all air handling units. Thermostat controls for the air handling units shall meet, at minimum, the following requirements:
   1. Line voltage (coordinate voltage with unit manufacturer).
   2. Wall mounted.
   3. Variable room temperature setpoint adjustment between 60 to 80 Deg. F.
   4. 2 Deg. F. deadband at mid setpoint range.
   5. Mounted at locations as approved indicated on the Mechanical Drawings.
   6 Cover plate shall be blank (no thermometer or "logo") and shall be of a finish to be approved by the Owner.

B. If it meets the above requirements, provide Honeywell Multipro, Model TB7100A1000 or approved equal.

2.9 FREEZESTAT ASSEMBLY

A. Provide freezestat assembly with freezestat, time delay relay, momentary relay, and momentary

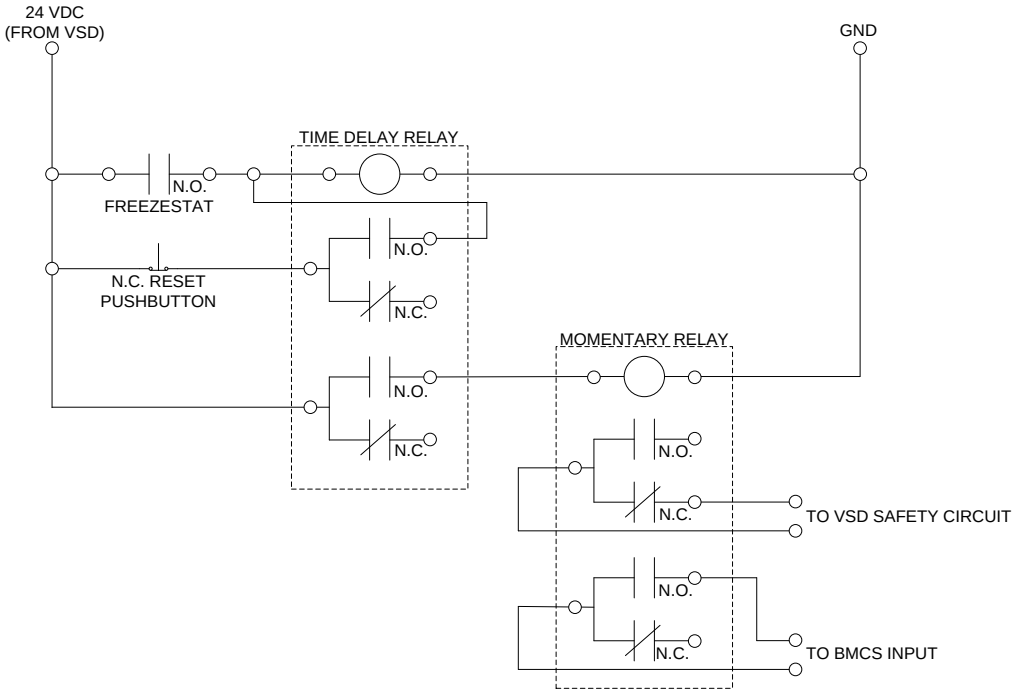
pushbutton on systems indicated within the Field Termination Schedules.

B. Freezestats shall meet, at minimum, the following requirements:
   1. Minimum 6 feet to 20 feet vapor tension element, which shall serpentine the inlet face on all coils. Provide additional sensors, wired in parallel, to provide one linear foot per square foot of coil surface area.
   2. Interlock to the associated fan so that fan will shut down when HOA switch is in Hand or Auto position. Provide 0-10 minute adjustable time delay relay to minimize nuisance freezestat trips.
   3. Auto reset.
   4. Setpoint shall be adjustable in the range of, at minimum, 32 Deg. F. to 45 Deg. F. Provide a scale with temperature setting clearly displayed.
   5. One SPST Normally Open contact for interface to time delay relay.
   6. Provide suitable supports.
   7. If it meets the above requirements, provide Johnson Controls A70 Series or approved equal.

C. The time delay relay, momentary relay, and momentary pushbutton shall meet the requirements identified elsewhere in these specifications.

D. The freezestat assembly shall be powered from the associated variable speed drive and shall be configured to provide the following functionality:
   1. Upon a low temperature condition, the freezestat sensor shall energize the time delay relay coil.
   2. After the associated time delay, the time delay relay shall energize the momentary relay and the time delay relay shall stay energized until the reset pushbutton has been activated.
   3. Once the momentary relay is energized, the associated variable speed drive shall be disabled via the VSD safety circuit and the BMCS shall alarm.
   4. The reset pushbutton shall reset the freezestat assembly only if the freezestat sensor does not a sense a low temperature condition.
   5. The freezestat assembly shall be configured such that disabling power to the variable speed drive shall not activate the freezestat assembly causing a false alarm.

E. A sample wiring schematic for the freezestat assembly is below. Alternate wiring options shall be permitted provided the desired functionality is provided.



2.10 RELATIVE HUMIDITY SENSOR - OUTSIDE AIR

A. Provide outside air relative humidity sensors as indicated within the Field Termination Schedules. Humidity sensors shall meet, at minimum, the following requirements:
   1. Non-corroding outdoor shield to minimize wind effects and solar heating.
   2. Weather proof enclosure with conduit fitting.
   3. Two wire, 4-20 mA output proportional to relative humidity range of 0% to 100%.
   4. 2% accuracy (5 - 95% RH).
   5. Humidity sensor shall be replaceable. Operating temperature range shall be appropriate for the climate.
   6. Sensor and transmitter shall be rated for operation in ambient temperatures of, at minimum, 10 Deg. F. below and above the ASHRAE 1% and 99% Design Conditions for the local.

B. If it meets the above requirements, provide, Veris Industries HO Series or approved equal.

2.11 RELATIVE HUMIDITY SENSOR - DUCT MOUNTED

A. Provide duct mounted relative humidity sensors as indicated within the Field Termination Schedules. Duct mounted relative humidity sensors shall meet, at minimum, the following requirements:
   1. Duct mount moisture resistant enclosure with conduit fitting.
   2. 4-20 mA output proportional to relative humidity range of 0% to 100%.
   3. Humidity sensor shall be replaceable or transmitter field capable of being calibrated.
   4. 2% accuracy (5 - 95% RH).
   5. Drift less than 2% over 5 years.
   6. Repeatability 0.5%.
   7. Operating temperature range of 32 Deg. F to 122 Deg. F.

B. If it meets the above requirements, provide Veris Industries HD series or approved equal.

2.12 RELATIVE HUMIDITY SENSOR - WALL MOUNTED - NON-PUBLIC SPACES

A. Provide wall mounted relative humidity sensors as indicated within the Field Termination Schedules. Humidity sensors shall meet, at minimum, the following requirements:
   1. Wall mount enclosure with white cover. There shall be no manufacturer's logos, name on casing.
   2. Two wire, 4-20 mA output proportional to relative humidity range of 0% to 100%.
   3. Humidity sensor shall be replaceable.
   4. 2% accuracy (5 - 95% RH).
   5. Operating temperature range of 10 Deg. C. to 33 Deg. C. (50 Deg. F to 90 Deg. F.).

B. If it meets the above requirements, provide Veris Industries HW Series or approved equal.

2.13 COMBINATION RELATIVE HUMIDITY AND TEMPERATURE SENSORS

A. Where there is a requirement for the monitoring of both relative humidity and temperature at the same location, the BMCS contractor may provide a combination relative humidity sensor and temperature sensor. The individual sensors must each meet the specifications detailed above.

B. If it meets the above requirements, provide Veris Industries Alta Labs HD series with temperature option or approved equal for duct mounted applications.

C. If it meets the above requirements, provide Veris Industries Alta Labs HW series with temperature option or approved equal for interior wall mounted applications in non-public spaces.

D. If it meets the above requirements, provide Veris Industries Alta Labs HO series with temperature option or approved equal for outside wall mounted applications.

E. If it meets the above requirements, provide Veris Industries Alta Labs HR series with temperature option or approved equal for interior wall mounted applications in lobbies and vestibules.

2.14 STATIC PRESSURE SENSOR - DUCT MOUNTED

A. Provide duct mounted static pressure sensors as indicated within the Field Termination Schedules. Static pressure sensors shall meet, at minimum, the following requirements:
   1. Field selectable Unidirectional or Bidirectional input.
   2. Field selectable input range of 1.0/2.5/5.0/10.0 inches w.g.
   3. Initial input range shall be 0 to 2.5 inches w.g.
   4. 4-20 mA or 0-10 VDC output proportional to pressure input range.
   5. 1% accuracy of field selected range.
   6. Operating temperature range of O Deg. C. to 60 Deg. C. (32 Deg. F to 140 Deg. F.).
   7. Easily accessible, integral non-interacting zero and span adjustment.
   8. Minimum over pressure input protection of five times rated input.
   9. If the sensor is mounted remotely from the sensing location, provide equal length reference tubing/piping.

B. If it meets the above requirements, provide Veris Industries PXU-2 series or approved equal.

2.15 STATIC PRESSURE SENSOR - SPACE

A. Provide space static pressure sensors as indicated within the Field Termination Schedules. Static pressure sensors shall meet, at minimum, the following requirements:
   1. Field selectable Unidirectional or Bidirectional input.
   2. Field selectable input range of 0.1/0.25/1.0/2.5/5/10 inches w.g.
   3. Initial input range of -0.1 to +0.1 inches w.g.
   4. 4-20 mA or 0-10 VDC output proportional to pressure input range.
   5. 1% accuracy of field selected range.
   6. Temperature range of 32 Deg. F to 140 Deg. F.
   7. Easily accessible, integral non-interacting zero and span adjustment.
   8. Over pressure input protection of five times rated input.
   9. Space static pressure references shall be routed to the exterior. Coordinate exact mounting locations of exterior static pressure reference points. Dampening pots for the reference riser shall be manufactured by Dwyer, Model A-306 or approved equal.
   10. Lobby space pressure sensor requirements shall be coordinated with Owner/Architect.

B. If it meets the above requirements, provide Veris Industries PXU-5 series or approved equal.

2.16 STATIC PRESSURE SENSOR - UNDERFLOOR

A. Provide underfloor static pressure sensors as indicated within the Field Termination Schedules. Static pressure sensors shall meet, at minimum, the following requirements:
   1. Field selectable Unidirectional or Bidirectional input.
   2. Field selectable input range of 0.1/0.25/1.0/2.5/5/10 inches w.g.
   3. Initial input range of -0.1 to + 0.1 inches w.g.
   4. 4-20 mA output proportional to pressure input range.
   5. 1% accuracy of field selected range.
   6. Temperature range of 32 Deg. F to 140 Deg. F.
   7. Easily accessible, integral non-interacting zero and span adjustment.
   8. Over pressure input protection of five times rated input.
   9. Underfloor static pressure sensor shall monitor underfloor static pressure in reference to the space.

B. If it meets the above requirements, provide Veris Industries PXU-5 series or approved equal.

2.17 AIR FLOWRATE SENSOR - DUCT MOUNTED DIFFERENTIAL PRESSURE

A. Provide air flowrate sensors and transducers as indicated in the Field Termination Schedules. Air flowrate sensors and transducer shall meet, at minimum, the following requirements:
   1. Monitor the differential pressures generated by a multi-point averaging device.
   2. The multi-point averaging device shall meet, at minimum, the following requirements:
      a. Minimum of four (4) measuring points parallel to the take-off point from the sensor in the duct for the zone.
      b. Minimum pressure signal of at 0.03” w.g. at a zone duct velocity of 500 fpm.
   3. Provide tubing from the multi-point averaging devices to the UC air flowrate transducer.
   4. Provide a one-micron filter on the high side of the pressure differential sensor.

5. The differential pressure sensors shall be Honeywell Microbridge DP sensors or equivalent and shall monitor the flowrates with an accuracy of + or - 5 percent in the flow range of 1.5 to 15 meters per second (300 to 3,000 feet per minute). The BMCS subcontractor shall calibrate each differential pressure sensor in the field following installation.
6. If an automatic calibration program requires the automatic zeroing of the flow sensor and transducer, provide a coordinated sequence of operation that ensures the associated AHU is not operating during the automatic calibration procedure.

B. If it meets the above requirements, provide Kele FXP Air Velocity Probe with Honeywell Microbridge DP sensor or approved equal.

2.18 AIR FLOWRATE SENSOR - DUCT MOUNTED THERMAL DISPERSION

A. Provide air flowrate sensors and transducers as indicated in the Field Termination Schedules. Air flowrate sensors and transducer shall meet, at minimum, the following requirements:
1. Multiple independent grid measuring devices. Each measuring device shall be dual glass beaded thermistor sensing probes
2. Size of grid and quantity of measuring devices shall be appropriate for application to achieve the specified accuracy.
3. Internal materials of the measuring devices and transducer suitable for continuous contact with air.
4. Sensing support grid shall be constructed of aluminum.
5. Microprocessor based digital transmitter.
6. Output signal of 0-10VDC or 4-20 mA proportional to cfm.
7. Temperature range of 0 Deg. F. to 120 Deg. F.
8. 3% accuracy of measured value (not full scale).

B. If it meets the above requirements, provide Ebtron Gold Series GTx116 or approved equal.

2.19 AIR FLOWRATE SENSOR - FAN INLET THERMAL DISPERSION

A. Provide air flowrate sensors and transducers as indicated in the Field Termination Schedules. Air flowrate sensors and transducer shall meet, at minimum, the following requirements:
1. Multiple independent grid measuring devices. Each measuring device shall be dual glass beaded thermistor sensing probes
2. Size of grid and quantity of measuring devices shall be appropriate for application to achieve the specified accuracy. Coordinate the exact requirements with the fan manufacturer.
3. Internal materials of the measuring devices and transducer suitable for continuous contact with air.
4. Sensing support grid shall be constructed of aluminum.
5. Microprocessor based digital transmitter.
6. Output signal of 0-10VDC or 4-20 mA proportional to cfm.
7. Temperature range of 0 Deg. F. to 120 Deg. F.
8. 3% accuracy of measured value (not full scale).

B. If it meets the above requirements, provide Ebtron Gold Series GTx116 or approved equal.

2.20 DIFFERENTIAL PRESSURE SWITCH - AIR - FAN SHUTDOWN

A. Provide air differential pressure switches as indicated in the Field Termination Schedules to shut down the associated fan in the event of sensing high differential pressure. Air differential pressure switches shall meet, at minimum, the following requirements:
1. UL approved.
2. One SPST Normally Closed contact for alarm monitoring and one SPST Normally Closed contact for fan interlock, rated for 10 amps minimum at 120 Vac. Use of SPDT contacts shall not be permitted. Use of internal or external momentary relays shall not be permitted such that the safety interlock does not rely on any external power source.
3. Adjustable setpoint with a setpoint range of 0 to 10 inches w.g.
4. 1/4 inch compression fittings suitable for copper sensing tubing.
5. Temperature range of -18 Deg. C. to 71 Deg. C. (0 Deg. F. to 160 Deg. F.).
6. Manual reset.

B. If it meets the above requirements, provide Kele Model AFS-460-DSS or approved equal.

2.21 DIFFERENTIAL PRESSURE SWITCH - AIR - FAN STATUS

A. Provide air differential pressure switches as indicated in the Field Termination Schedules to indicate fan status. Air differential pressure switches shall meet, at minimum, the following requirements:
1. UL approved.
2. SPDT or two SPST contacts rated for 10 amps minimum at 120 Vac.
3. Setpoint and range suitable for the associate fans system to sense operating status of fan.
4. 1/4 inch compression fittings suitable for copper sensing tubing.
5. Temperature range of -18 Deg. C. to 71 Deg. C. (0 Deg. F. to 160 Deg. F.).

B. If it meets the above requirements, provide Cleveland Controls, Inc. Model AFS-222 or approved equal.

2.22 CARBON MONOXIDE DETECTION SENSOR

A. Provide carbon monoxide gas detection sensors as indicated within the Field Termination Schedules. Carbon monoxide detection sensors shall meet, at minimum, the following requirements:
1. Negligible temperature and humidity effect on accuracy.
2. 4-20 mA transducer interface with the BMCS proportional to 0 to 300 ppm of CO concentration.
3. 10 to 26 VAC or VDC voltage
4. Accuracy of 5ppm of measured value (not full scale).

B. If it meets the above requirements, provide BAPI, Model 420CO or approved equal.

2.23 CARBON DIOXIDE DETECTION SENSOR - DUCT

A. Provide carbon dioxide gas detection sensors as indicated within the Field Termination Schedules. Carbon dioxide detection sensors shall meet, at minimum, the following requirements:
1. Non-dispersive infrared technology.
2. Rated for air duct velocity of 0 to 1500 fpm.
3. Temperature dependence of 0.1% of full scale per Deg. F.
4. 0-10 VDC transducer interface with the BMCS proportional to 0 to 2,000 ppm of carbon dioxide concentration.
5. Accuracy of +/- 40 ppm +3% reading.
6. Stability less than 2% of full scale over life of the sensor.
7. Non-linearity less than 1% of full scale.
8. Pressure dependence of 0.13% of reading per 0.54” w.g.
9. Automatic calibration with no calibration interval.
10. Operating temperature of 0 Deg. C. to 50 Deg. C. (32 Deg. F. to 122 Deg. F.).
11. Operating humidity of 0% to 95% RH noncondensing.
12. Suitable for duct mounting or outside air installations as appropriate.

B. If it meets the above requirements, provide GE 8401 Series or approved equal.

2.24 CARBON DIOXIDE DETECTION SENSOR - SPACE

A. Provide carbon dioxide gas detection sensors as indicated within the Field Termination Schedules. Carbon dioxide detection sensors shall meet, at minimum, the following requirements:
1. White protective enclosure. There shall be no manufacturer's logos, name or markings on casing.
2. Non-dispersive infrared technology.
3. Temperature dependence of 0.1% of full scale per Deg. F.
4. 0-10 VDC transducer interface with the BMCS proportional to 0 to 2,000 ppm of carbon dioxide concentration.
5. Accuracy of +/- 100 ppm at 72 Deg. F.
6. Stability less than 2% of full scale over life of the sensor.
7. Non-linearity less than 1% of full scale.
8. Pressure dependence of 0.13% of reading per 0.54” w.g.
9. Automatic calibration with no calibration interval.

10. Operating temperature of 0 Deg. C. to 50 Deg. C. (32 Deg. F. to 122 Deg. F.).
11. Operating humidity of 0% to 95% RH noncondensing.

B. If it meets the above requirements, provide GE 5001 Series or approved equal.

2.25 NITROGEN DIOXIDE DETECTION SENSOR

A. Provide nitrogen dioxide gas detection sensors as indicated within the Field Termination Schedules. Detection sensors shall meet, at minimum, the following requirements:
1. Negligible temperature and humidity effect on accuracy.
2. 0-10 VDC or 4-20 mA transducer interface with the BMCS proportional to nitrous oxide.
3. 24 VAC or VDC @ 400 mA max voltage.
4. Sensor replacement not required before three years.
5. Accuracy of 3% of reading.
6. Range of 0 to 10 ppm.
7. Operating temperature of 0 Deg. C. to 50 Deg. C. (32 Deg. F. to 122 Deg. F.).

B. If it meets the above requirements, provide Kele & Associates GMT or approved equal.

2.26 WIND SPEED INDICATOR

A. Provide wind speed indicators as indicated within the Field Termination Schedules. Wind speed indicators shall meet, at minimum, the following requirements:

1. Measure with a three cup anemometer.
2. 4-20 mA or 0-10 VDC output.
3. 5% accuracy of range above 10 mph wind speed.
4. Standard range of 3-100 mph wind speed.
5. Operating temperature of -40 to 140 degrees Fahrenheit.
6. Operating power of 12-24 VDC 30 mA maximum.

B. If it meets the above requirements, provide Kele & Associates Model A70-SL or approved equal.

2.27 WIND DIRECTION INDICATOR

A. Provide wind direction indicators as indicated within the Field Termination Schedules. Wind direction indicators shall meet, at minimum, the following requirements:

1. Measure with a precision potentiometric wind vane.
2. 4-20 mA or 0-10 VDC output.
3. 10 degree accuracy range.
4. Standard range of 0-360 degrees.
5. Operating temperature of -40 to 140 Deg. F.
6. Operating power of 12-24 VDC 30 mA maximum.

B. If it meets the above requirements, provide Kele & Associates Model A70-DL or approved equal.

2.28 NATURAL GAS FLOW TOTALIZER

A. Provide natural gas flow totalizers as indicated within the Field Termination Schedules. Detection sensors shall meet, at minimum, the following requirements:
1. Built-in temperature compensation.
2. 4 pulsed output channels.
3. Adjustable pulse duration from 10 milliseconds to 2 seconds.
4. Internal MODBUS communication.
5. Sized appropriately for the application.
6. Operating temperature of -40 Deg. C. to 60 Deg. C. (-40 Deg. F. to 140 Deg. F.).

B. If it meets the above requirements, provide Itron Dattus III or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sensors in accordance with the manufacturer's recommendations to sense the variables specified.

B. Mount sensors securely. Mountings shall be suitable for the environment within which the sensor operates.

C. Install sensors as required to properly sense the controlled medium. Sensor locations shall be such that access to the instruments can be obtained for service and removal. If the installation location is found to be unacceptable by the Consultant, then the sensors shall be relocated as directed at no additional cost to the Owner.

D. Sensors mounted on water lines shall have isolation valves that shall enable the sensor to be easily removed without the need to drain any lines or portions of lines.

END OF SECTION