SECTION 25 1400 – BMS FIELD PANELS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
   a. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.

   b. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.02 SUMMARY

A. Section includes:
   1. Building Controller (BC).
   2. Advance Application Specific Controller (AAC).
   3. Application Specific Controller (ASC).

B. Furnish and install DDC Control units and/or Smart Devices required to support specified building management system functions.

C. Refer to Section 25 0000 "Building Management System (BMS) General" for general requirements.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.02 MANUFACTURERS

A. Refer to Section 25 0000 “Building Management Systems (BMS) General” for acceptable manufacturers.

2.03 STAND-ALONE FUNCTIONALITY

A. General: These requirements clarify the requirement for stand-alone functionality relative to packaging I/O devices with a controller. Stand-alone functionality is specified with the controller and for each Application Category specified in this Section. This item refers to acceptable paradigms for associating the points with the processor.

B. Functional Boundary:
   1. Provide controllers so that all points associated with and common to one unit or other complete system/equipment shall reside within a single control unit. The boundaries of a standalone system shall be as dictated in the Contract Documents.
   2. Systems specified for the Application Category will dictate the boundary of the standalone control functionality. See related restrictions below.
   3. When referring to the controller as it pertains to the standalone functionality, reference is specifically made to the processor.
   4. One processor shall execute all the related I/O control logic via one operating system that uses a common programming and configuration tool.

C. The following configurations are considered acceptable with reference to a controller’s standalone functionality:
   1. Points packaged as integral to the controller such that the point configuration is listed as an essential piece of information for ordering the controller (having a unique ordering number).
   2. Controllers with processors and modular back planes that allow plug in point modules as an integral part of the controller.
   3. I/O point expander boards, plugged directly into the main controller board to expand the point capacity of the controller.

D. The following configurations are considered unacceptable with reference to a controller’s standalone functionality:

1. I/O point expansion devices connected to the main controller board via wiring and as such may be remote from the controller and that communicate via a sub LAN protocol.
2. Multiple controllers enclosed in the same control panel to accomplish the point requirement.

2.04 BUILDING CONTROLLER (BC)

A. General Requirements:
1. The BC(s) shall provide fully distributed control independent of the operational status of the OWSs and CSS. All necessary calculations required to achieve control shall be executed within the BC independent of any other device. All control strategies performed by the BC(s) shall be both operator definable and modifiable through the Operator Interfaces.
2. BCs shall perform overall system coordination, accept control programs, perform automated HVAC functions, control peripheral devices and perform all necessary mathematical and logical functions.
3. BCs shall share information with the entire network of BCs for full global control directly without requiring other BCs, LAN devices, Local Supervisory LAN gateways, routers etc. to assist, perform, or act as an intermediate device for communicating.
4. Each controller shall permit multi-user operation from multiple workstations and portable operator terminals connected either locally or over the Primary Controller LAN. Each unit shall have its own internal RAM, non-volatile memory, microprocessor, battery backup, regulated power supply, power conditioning equipment, ports for connection of operating interface devices, and control enclosure.
5. BCs shall be programmable from an operator workstation, portable operator terminal, or hand held operating device. BC shall contain sufficient memory for all specified global control strategies, user defined reports and trending, communication programs, and central alarming.
6. BCs shall be connected to a controller network that qualifies as a Primary Controlling LAN.
7. All BCs shall be protected from any memory loss due to a loss of power by one or a combination of the following:

    a. Volatile RAM shall have a battery backup using a lithium battery with a rated service life of fifty (50) hours, and a rated shelf life of at least five (5) years. Self-diagnostic routine shall report an alarm for a low battery condition.
    b. EEPROM, EPROM, or NOVROM non-volatile memory.

8. In addition, BCs shall provide intelligent, standalone control of HVAC functions. Each BC shall be capable of standalone direct digital operation utilizing its own processor, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and lightning protection devices. Refer to standalone functionality specified above.
9. The BC shall provide for point mix flexibility and expandability. This requirement may be met via either a family of expander boards, modular input/output configuration, or a combination thereof. Refer to stand alone functionality specified above.

10. All BC point data, algorithms and application software shall be modifiable from the Operator Workstation.
11. Each BC shall execute application programs, calculations, and commands via a microprocessor resident in the BC. The database and all application programs for each BC shall be stored in non-volatile or battery backed volatile memory within the BC and will be able to upload/download to/from the OWS and/or CSS.
12. BC shall provide buffer for holding alarms and messages. Alarms and messages shall reside in a buffer within the controller and be delivered up to the CSS via the LAN when the buffer is full or when scheduled.
13. BC shall provide buffer for holding trends. Trends shall reside in a buffer within the controller and be delivered up to the CSS via the LAN when the buffer is full or when scheduled.
14. Each BC shall include self-test diagnostics, which allow the BC to automatically alarm any malfunctions, or alarm conditions that exceed desired parameters as determined by programming input.
15. Each BC shall contain software to perform full DDC/PID control loops.
16. For systems requiring end-of-line resistors, locate resistors in the BC.
17. Input-Output Processing:

    a. Digital Outputs (DO):

        1) Outputs shall be rated for a minimum 24 Vac or Vdc, 1 amp maximum current. Each shall be configurable as normally open or normally closed.
        2) Each output shall have an LED to indicate the operating mode of the output and a manual hand off or auto switch to allow for override. Provide feedback to remotely indicate the HOA is not in the Auto position. If these HOA switches are not provided on the main board they shall be provided via isolation relays within the control enclosure.
        3) Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.

    b. Analog Inputs (AI):

        1) AI shall be O-5 Vdc, 0-10 Vdc, 0-20 Vdc, and 0-20 mA. Provide signal conditioning, and zero and span calibration for each input.
        2) Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise).
        3) A/D converters shall have a minimum resolution of twelve (12) bits.

    c. Digital Inputs (DI):

        1) Monitor dry contact closures.
        2) Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board.

    d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.

e. Electronic Analog Outputs (AO):

1) Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection.
2) Pulse Width Modulated (PWM) analog via a DO and transducer is acceptable only with Owner approval (Generally these will not be allowed on loops with a short time constant such as discharge temperature loops, economizer loops, pressure control loops and the like. They are generally acceptable for standard room temperature control loops).
3) Where these are allowed, transducer/actuator shall be programmable for normally open, normally closed, or hold last position and shall allow adjustable timing. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturers board is unacceptable). D/A converters shall have a minimum resolution of ten (10) bits.

f. Analog Output Pneumatic (AOP), 0-20 psi:

1) Pneumatic outputs via an I/P transducer, or digital to pneumatic transducer are acceptable.
2) Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the BC and provide individual feedback.
3) Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.

g. Pulsed Inputs:

1) Capable of counting up to eight (8) pulses per second with buffer to accumulate pulse count.
2) Pulses shall be counted at all times.

18. A communication port for operator interface through a terminal shall be provided in each BC. It shall be possible to perform all program and database back-up, system monitoring, control functions, and BC diagnostics through this port. Standalone BC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or workstations.
19. Each BC shall be equipped with loop tuning algorithm for precise proportional, integral, derivative (PID) control. Loop tuning tools provided with the Operator Workstation software is acceptable. In any case, tools to support loop tuning must be provided such that P, I, and D gains are automatically calculated.
20. All analog output points shall have a selectable failure setpoint. The BC shall be capable of maintaining this failure setpoint in the event of a system malfunction, which causes loss of BC control, or loss of output signal, as long as power is available at the BC. The failure setpoint shall be selectable on a per point basis.
21. Slope intercepts and gain adjustments shall be available on a per-point basis.
22. BC Power Loss:
    a. Upon a loss of power to any BC, the other units on the primary controlling network shall not in any way be affected.

b. Upon a loss of power to any BC, the battery backup shall ensure that the energy management control software, the Direct Digital Control software, the database parameters, and all other programs and data stored in the RAM are retained for a minimum of fifty (50) hours. An alarm diagnostic message shall indicate that the BC is under battery power.
c. Upon restoration of power within the specified battery backup period, the BC shall resume full operation without operator intervention. The BC shall automatically reset its clock such that proper operation of any time dependent function is possible without manual reset of the clock. All monitored functions shall be updated.
d. Should the duration of a loss of power exceed the specified battery back-up period or BC panel memory be lost for any reason, the panel shall automatically report the condition (upon resumption of power) and be capable of receiving a download via the network, and connected computer. In addition, the Owner shall be able to upload the most current versions of all energy management control programs, Direct Digital Control programs, database parameters, and all other data and programs in the memory of each BC to the operator workstation via the local area network, or via the telephone line dial-up modem where applicable, or to the laptop PC via the local RS-232C port.

23. BC Failure:
    a. Building Controller LAN Data Transmission Failure: BC shall continue to operate in stand-alone mode. BC shall store loss of communication alarm along with the time of the event. All control functions shall continue with the global values programmable to either last value or a specified value. Peer BCs shall recognize the loss, report alarm and reconfigure the LAN.
    b. BC Hardware Failure: BC shall cease operation and terminate communication with other devices. All outputs shall go to their specified fail position.

24. Each BC shall be equipped with firmware resident self-diagnostics for sensors and be capable of assessing an open or shorted sensor circuit and taking an appropriate control action (close valve, damper, etc.).
25. BCs may include LAN communications interface functions for controlling secondary controlling LANs Refer to Section 25 3000 - BMS System Communications Devices for requirements if this function is packaged with the BC.
26. A minimum of four (4) levels of password protection shall be provided at each BC.
27. BCs shall be mounted in packaged equipment enclosures, or locking wall mounted in an enclosure, as specified elsewhere.
28. In the last month of the Warranty Period, all controller firmware, software, drivers, etc. will be upgraded to the latest release (version) in effect at the end of the Warranty Period.
29. All BC naming conventions shall adhere to the format as established by the Owner's Standard Acronyms document.

B. I/O Point Expansion Devices communicating to BC via a sub LAN protocol:

1. Utilizing any point from a point expansion device communicating to BC via a sub LAN protocol to support the BC's Stand Alone Functionality requirement is not allowed.

2. Point expansion devices shall be mounted in packaged equipment enclosures or locking wall mounted enclosure in a readily accessible location. Identify panel enclosure with the entire point address of point expansion device(s) on the nameplate.
3. The Owner shall approve the location of point expansion devices mounted above finished ceiling prior to installation. An Owner-approved ceiling tag shall identify the specific location of the point expansion device location.
4. Each point expansion device shall be identified in the database with the location of where the device is physically installed to allow the Owner to service these devices when needed. The Owner shall approve the final method identifying the locations with the available software options.

C. BACnet Building Controller Requirements:

1. The BC(s) shall support all BIBBs defined in the BACnet Building Controller (B-BC) device profile as defined in the BACnet standard.
2. BCs shall communicate over the BACnet Building Controller LAN.
3. Each BC shall be connected to the BACnet Building Controller LAN communicating to/from other BCs.

2.05 ADVANCED APPLICATION SPECIFIC CONTROLLER (AAC) AND APPLICATION SPECIFIC CONTROLLER (ASC)

A. General Requirements:

1. AACs and ASCs shall provide intelligent, standalone control of HVAC equipment. Each unit shall have its own internal RAM, non-volatile memory and will continue to operate all local control functions in the event of a loss of communications on the ASC LAN or sub-LAN. Refer to standalone requirements by application specified in this Section. In addition, it shall be able to share information with every other BC and AAC /ASC on the entire network.
2. Each AAC and ASC shall include self-test diagnostics that allow the AAC /ASC to automatically relay to the BC, LAN Interface Device or workstation, any malfunctions or abnormal conditions within the AAC /ASC or alarm conditions of inputs that exceed desired parameters as determined by programming input.
3. AACs and ASCs shall include sufficient memory to perform the specific control functions required for its application and to communicate with other devices.
4. Each AAC and ASC must be capable of stand-alone direct digital operation utilizing its own processor, non-volatile memory, input/output, minimum eight (8) bit A to D conversion, voltage transient and lightning protection devices. All volatile memory shall have a battery backup of at least fifty (50) hours with a battery life of five (5) years.
5. All point data; algorithms and application software within an AAC /ASC shall be modifiable from the Operator Workstation.
6. In the last month of the Warranty Period, all controller firmware, software, drivers, etc. will be upgraded to the latest release (version) in effect at the end of the Warranty Period.
7. AAC and ASC Input-Output Processing

a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 VAC or VDC, 1 amp maximum current. Each shall be configurable as normally open or normally closed. Each DO shall be discrete outputs from the AAC/ASC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.
b. Analog Inputs (AI): AI shall be O-5 Vdc, 0-10Vdc, 0-20Vdc, and 0-20 mA. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of eight to ten bits depending on application.
c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board.
d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
e. Electronic Analog Outputs (AO) as required by application:

1) Voltage mode, 0-5VDC and 0-10VDC; current mode (4-20 mA). Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog via a DO and transducer is acceptable only with Owner approval (Generally, PWM will not be allowed on loops with a short time constant such as discharge temperature loops, economizer loops, pressure control loops and the like. They are generally acceptable for standard room temperature control loops.).
2) Where PWM is allowed, transducer/actuator shall be programmable for normally open, normally closed, or hold last position and shall allow adjustable timing. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturers board is unacceptable).
3) D/A converters shall have a minimum resolution of eight (8) bits.

Keep paragraph below if project is using pneumatic controls.

f. Analog Output Pneumatic (AOP), 0-20 psi: Pneumatic outputs via an I/P transducer, PWM/P transducer, or digital to pneumatic transducer are acceptable. Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the AAC /ASC and provide individual feedback. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.

B. BACnet AAC(s) and ASC(s) Requirements:

1. The AAC(s) and ASC(s) shall support all BIBBs defined in the BACnet Building Controller (B-AAC and B-ASC) device profile as defined in the BACnet standard.
2. AAC(s) and ASC(s) shall communicate over the BACnet Building Controller LAN or the ASC LAN or sub-LAN.
3. Each BC shall be connected to the BACnet Building Controller LAN communicating to/from other BCs.

C. Terminal Unit Controllers:

1. Terminal unit controllers controlling damper positions to maintain a quantity of supply or exhaust air serving a space shall have an automatically initiated function that resets the volume regulator damper to the fully closed position on a scheduled basis.
2. The controllers shall initially be set up to perform this function once every 24 hours. The purpose of this required function is to reset and synchronize the actual damper position with the calculated damper position and to assure the damper will completely close when commanded.
3. The software shall select scheduled terminal units randomly and shall not allow more than 5 percent of the total quantity of controllers in a building to perform this function at the same time. When possible, the controllers shall perform this function when the supply or exhaust air system is not operating or is unoccupied.

2.06 FUTURE EXPANDABILITY

A. Include spare I/O point capacity for each controller as follows:

1. Building Controllers: [25] percent of each AI, AO, DI and DO point connected to controller.
   a. Minimum spare I/O per controller:

      1) AIs: Two.
      2) AOs: Two.
      3) DIs: Two.
      4) DOs: Two
2. Advanced Application Specific Controller: [25] percent of each AI, AO, DI and DO point connected to controller.
   a. Minimum spare I/O per controller:

      1) AIs: Two.
      2) AOs: Two.
      3) DIs: Two.
      4) DOs: Two
3. Application Specific Controller: [10] percent of each AI, AO, DI and DO point connected to controller.
   a. Minimum spare I/O per controller:

      1) AIs: One.
      2) AOs: One.
      3) DIs: One.
      4) DOs: One.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. All Division 25 installation including, but not limited to, cable and wiring, grounding, raceway and conduit, electrical circuit and panel identifications, wiring devices, and lighting shall comply with Division 26 installation requirements. In addition to the Division 26 requirements, Contractor shall label panel board name and circuit number in an Owner-approved manner at each BMS field panel, control cabinet, or point of termination in which a 120VAC control circuit is utilized.

Keep paragraph below for new construction.

D. Figures A and B (below) illustrate the required layout of a Building Management Panel in new construction.

Keep paragraph below for retrofit projects.

E. Figure A (below) illustrates the required layout of a Building Automation Panel in retrofit construction.

3.03 SYSTEM ACCESS

A. Provide an Ethernet connection and a 5 port hub at each panel housing a controller or controllers that provides access to the Local Supervisory LAN and to the Control System Server for all Controllers, other than an Application Category 1 Controllers. The user shall be able to access each controller on the system using this connection via the Control System Server database for graphics, schedules, programming, controller configuration etc.

3.04 HARDWARE APPLICATION REQUIREMENTS

A. General:

1. The functional intent of this specification is to allow cost effective application of manufacturers standard products while maintain the integrity and reliability of the control functions.
2. A Building Controller as specified above is generally fully featured and customizable whereas the AAC/ASC refers to a more cost-effective unit designed for lower-end applications. Specific requirements indicated below are required for the respective application. Manufacturer may apply the most cost-effective unit that meets the requirement of that application.

B. Standalone Capability:

1. Each Control Unit shall be capable of performing the required sequence of operation for the associated equipment.
2. All physical point data and calculated values required to accomplish the sequence of operation shall originate within the associated CU with only the exceptions enumerated below. Listed below are functional point data and calculated values that shall be allowed to be obtained from or stored by other CUs or SDs via LAN.

C. Where associated control functions involve functions from different categories identified below, the requirements for the most restrictive category shall be met.

D. Application Category 0 (Distributed Monitoring):

1. Applications in this category include the following:
   a. Monitoring of variables that are not used in a control loop, sequence logic, or safety.
2. Points on BCs, AACs, and ASCs may be used in these applications as well as SDs and/or general-purpose I/O modules.
3. Where these points are trended, Contractor shall verify and document that the network bandwidth is acceptable for such trends and is still capable of acceptable and timely control function.

Delete equipment that is not applicable – do not move equipment types from one category to another.

E. Application Category 1 (Application Specific Controller):

1. Applications in this category include, but are not limited to, the following. If a specific sequence of operation requires a controller with more features than what is available with an application specific controller, provide that controller.
   a. Fan Coil Units.
   b. Airflow Control Boxes (VAV and Constant Volume Terminal Units).
   c. Miscellaneous Heaters.
   d. Unitary equipment <15 tons (Package Terminal AC Units, Package Terminal Heat Pumps, Split-System AC Units, Split-System Heat Pumps, Water-Source Heat Pumps).
   e. Induction Units.
   f. Dual Duct Zone Dampers.
2. ASCs may be used in these applications.
3. Standalone Capability:

a. Provide capability to execute control functions for the application for a given setpoint or mode, which shall generally be occupied mode control.
b. Only the following data (as applicable) may be acquired from other controllers via LANs. In the event of a loss of communications with any other controller, or any fault in any system hardware that interrupts the acquisition of any of these values, the ASC shall use the last value obtained before the fault occurred.
c. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

PHYSICAL/VIRTUAL POINT	Default Value
Scheduling Period	Normal
Morning Warm-Up	Off (cold discharge air)
Load Shed	Off (no shedding)
Summer/Winter	Winter
Trend Data	N/A
[Smoke Pressurization Mode]	[Normal Mode]

4. Mounting:
   a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment in an accessible enclosure and shall be rated for plenum use.
   b. ASCs that control equipment mounted in a mechanical room may either be mounted in, on the equipment, or on the wall of the mechanical room at an adjacent, accessible location.
   c. ASCs that control equipment mounted outside or in occupied spaces shall either be located in the unit or in a proximate mechanical/utility space.

      1) If the controller is located outdoors, the controller shall be installed in a NEMA 4X enclosure.

   d. BMS Provider may furnish ASCs to the terminal unit manufacturer for factory mounting.

5. Programmability: Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings. Application-specific block control algorithms may be used to meet the sequence of operations. The ability to customize the control algorithm is not required unless specifically indicated otherwise.
6. LAN Restrictions: For networks operating at 38.4 kbps or less, limit the number of nodes on the network to meet all system performance criteria and to no more than 80 percent of the maximum recommended by the manufacturer. For networks operating at greater than 38.4 kbps limit the number of nodes on the network to meet all system performance criteria up to the maximum recommended by the manufacturer.

Delete equipment that is not applicable – do not move equipment types from one category to another.

F. Application Category 2 (General Purpose Terminal Controller):

a. Applications in this category include the following:
b. Unitary Equipment >= 15 tons (Air Conditioners, Heat Pumps, Packaged Heating/Cooling Units, and similar).
c. Small, Constant Volume Single Zone Air Handling Units (Less than 5,000 cfm).
d. Constant Volume Pump Start/Stop.
e. Miscellaneous Equipment (Exhaust Fan) Start/Stop.
f. Miscellaneous Monitoring (not directly associated with a control sequence and where trending is not critical).

2. BCs may be used in these applications.
3. ASC's or AAC's may be used in these applications provided the ASC meets all requirements specified below. This category requires a general-purpose ASC to which application-specific control algorithms can be attached.
4. Standalone Capability:
   a. Only the following data (as applicable) may be acquired from other ASCs via LANs. In the event of a loss of communications with any other ASCs, or any fault in any system hardware that interrupts the acquisition of any of these values, the AAC/ASC shall use the last value obtained before the fault occurred.
   b. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

Physical/Virtual Point	Default Delay Time	Default Value
Outside Air Temperature	3 minutes	80°F
Outside Air Humidity	3 minutes	60% RH
Outside Air Enthalpy	3 minutes	30 Btu/lb
Trend Data	3 minutes	N/A
Cooling/Heating Requests	3 minutes	None
[Smoke Pressurization Mode]	[3 minutes]	[Normal Mode]
[Smoke Exhaust Command]	[3 minutes]	[Normal Mode]

5. Mounting:
   a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment and shall be rated for plenum use.
   b. ASCs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with the Contractor) or in a nearby mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.

      1) If the controller is located outdoors, the controller shall be installed in a NEMA 4X enclosure.

6. Programmability:
   a. Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings.

b. Operator shall be able to address and configure spare inputs for monitoring.
c. Operator shall be able to address and configure spare outputs for simple single loop control actions or event initiated actions.
d. Application-specific block control algorithms shall be used to meet the sequence of operations. The ability to customize the control algorithm is not required unless specifically indicated otherwise.

7. LAN Restrictions: Limit the number of nodes servicing any one of these applications on the AAC/ASC LAN to 32.

Delete equipment that is not applicable – do not move equipment types from one category to another.

G. Application Category 3 (Advanced Application Controller):

1. Applications in this category include the following:
a. Steam Pressure Reducing Station Control.
b. Steam Converter Control.
c. Large Constant Volume Air Handlers (Greater than or equal to 5,000 cfm).
d. VAV Air Handlers.
e. Dual Duct Air Handlers.
f. Multizone Air Handlers.
g. Self Contained VAV Units.
h. Air Handlers serving critical areas.
i. Central Cooling Plant.
j. Central Heating Plant.
k. Cooling Towers.
l. Sequenced or Variable Speed Pump Control.
m. Local Chiller Control (unit specific).
n. Campus Loop Chilled Water Control.

2. BCs shall be used in these applications.
3. LAN Restrictions: Comply with Part Two requirements, Stand-Alone Functionality.
4. Controller Enclosures: Locate controllers in protected enclosures as follows:
a. Indoors, Heated and Conditioned Space: NEMA 1 or 2.
b. Indoors, Unconditioned Space: NEMA 1 or 2.
c. Indoors, Areas exposed to Washdown: NEMA 4X.
d. Indoors, In Duct Systems where condensation is not possible: NEMA 12.
e. Indoors, In Duct Systems where condensation is possible: NEMA 4X.
f. Outdoors: NEMA 4X.

3.05 CONTROL UNIT REQUIREMENTS

A. Refer to Section 25 0000 “Building Management Systems (BMS) General” for requirements pertaining to control unit quantity and location.

END OF SECTION 25 1400