PART 1 - GENERAL

1.01 SUMMARY

A. Building Controller (BC)

B. Advance Application Specific Controller (AAC)

C. Application Specific Controller (ASC)

1.02 RELATED DOCUMENTS:

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. See Division 01 for details.

B. Section 25 08 00 - Commissioning of Integrated Automation

C. Section 25 11 16 - Integrated Automation Network Routers, Bridges, Switches, Hubs, and Modems

D. (This Section) Section 25 14 13 - Integrated Automation Remote Control Panels

E. Section 25 15 16 - Integrated Automation Software for Control and Monitoring Networks

F. Section 25 35 00 – Integrated Automation Instrumentation Terminal Devices for HVAC

G. Section 25 35 13 – Integrated Automation Actuators and Operators

H. Section 25 35 16 – Integrated Automation Sensors and Transmitters

I. Section 25 35 19 – Integrated Automation Control Valves

J. Section 25 55 00 – Integrated Automation Control of HVAC

1.03 DESCRIPTION OF WORK:

A. Furnish and Install DDC Control units and/or Smart Devices required supporting specified building automation system functions.

B. Refer to Section 25 55 00 for general requirements.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide

1. Building Controllers (BC),

2. Advanced Application Controllers (AAC),

3. Application Specific Controllers (ASC),

4. Smart Actuators (SA), and

5. Smart Sensors (SS)

B. Products shall be provided as required to achieve performance specified in Sections 25 55 00. Every INSTALLER(s) device that must integrate with the BAS which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135-2008 Annex L.

C. All controller hardware shall be suitable for anticipated ambient conditions.

D. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -20 to 140°F.

E. Controllers used in conditioned spaces shall be mounted in dust-protective enclosures and shall be rated for operation at 32 to 120°F.

F. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

2.02 STAND-ALONE FUNCTIONALITY

A. These requirements clarify the requirement for stand-alone functionality relative to packaging I/O devices with a controller.

1. Stand-alone functionality is specified with the controller and for each Application Category specified in Part 3.

2. The BAS Contractor shall comply with Section 25 55 00 to select the appropriate controllers.

B. Provide controllers so that all points associated with and common to one unit or complete system/equipment shall reside within a single control unit. The boundaries of a standalone system shall be as dictated in the contract documents.

1. Generally systems specified for the Application Category will dictate the boundary of the standalone control functionality. See related restrictions below.

2. When referring to the controller as pertains to the standalone functionality, reference is specifically made to the processor. 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 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.

4. I/O point expansion devices connected to the main controller board via wiring for installation remote from the controller and that communicate via a sub-LAN protocol. To be considered standalone, such arrangement shall have:

    a. A sub-LAN that is dedicated to that controller and include no other controller devices (AACs or ASCs).

    b. All wiring to interconnect the I/O expander board shall comply with 25 55 00 and be:

        i. Contained in the control panel enclosure; OR

        ii. Wiring shall only be accessible at the terminations.

D. Multiple controllers enclosed in the same control panel to accomplish the point requirement are considered unacceptable with reference to a controller's standalone functionality.

E. Air terminal units for services indicated on Drawings shall be controlled by electronic controllers connected to a local communication bus.

F. In normal operation, components comprising the BAS system shall communicate over its own independent Ethernet LAN. However, control panels and controllers shall function independently in stand-alone mode, in the event of management workstation, BAS-server, or LAN failure.

G. BAS Local Area Network Level (LAN): The communication extension shall support a series of controllers and shall communicate bi-directionally with the peer-to-peer network for transmission of global data.

2.03 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.

    a. All necessary calculations required to achieve control shall be executed within the BC independent of any other device.

    b. All control strategies performed by the BC(s) shall be both operator definable and modifiable through the Operator Interfaces.

2. BCs shall perform:

    a. Overall system coordination

b. Accept control programs

c. Perform automated system functions

d. Control peripheral devices

e. Perform all necessary mathematical and logical functions.

3. BCs shall share information with the entire network of BCs and AACs/ASCs for full global control.

4. Each controller shall permit multi-user operation from multiple workstations and portable operator terminals connected either locally or over the Primary Controller LAN.

5. 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.

6. BCs shall be programmable from an operator workstation, portable operator's terminal, or hand held operating device.

7. BC shall contain sufficient memory for all specified global control strategies, user defined reports and trending, communication programs, and central alarming.

8. BCs shall be connected to a controller network that qualifies as a Primary Controlling LAN.

9. 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 years. Self-diagnostic routine shall report an alarm for a low battery condition.

    b. EEPROM, EPROM, or NOVROM non-volatile memory

10. BCs shall provide intelligent, standalone control of system or equipment 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.

11. The BC shall provide for point (DI, DO, AI, AO) mix flexibility and expandability. This requirement may be met with a family of expander boards, modular input/output configuration, or a combination thereof. Refer to stand alone functionality specified above.

12. All BC point data, algorithms and application software shall be modifiable from the Operator Workstation.

13. 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.

14. BC shall provide memory buffer for holding alarms, messages, trends etc.

15. 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.

16. Each BC shall contain software to perform full DDC/PID control loops.

17. For systems requiring end-of-line resistors those resistors shall be located in the BC.

18. Input-Output Processing:

    a. Digital Outputs (DO):

        i. Outputs shall be rated for a minimum 24 Vac or Vdc, 1 amp maximum current.

        ii. Each shall be configurable as normally open or normally closed.

        iii. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturer's board is unacceptable).

        iv. Provide suppression to limit transients to acceptable levels.

    b. Analog Inputs (AI):

        i. AI shall be 0-5 Vdc, 0-10 Vdc, and 0-20 mA.

        ii. Provide signal conditioning, and zero and span calibration for each input.

        iii. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise).

        iv. A/D converters shall have a minimum resolution of 12 bits.

    c. Digital Inputs (DI):

        i. Monitor dry contact closures.

        ii. Accept pulsed inputs of at least one per second.

        iii. 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) shall serve as either AI or DI as specified above.

e. Electronic Analog Outputs (AO)

i. Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA.

ii. Provide zero and span calibration and circuit protection.

iii. Pulse Width Modulated (PWM) AO via a DO is acceptable only with the Owner approval.

1. 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.

2. Where these are allowed, transducer/actuator shall be programmable for normally open, normally closed, or hold last position and shall allow adjustable timing.

3. 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 10 bits.

f. Pulsed Inputs:

i. Capable of counting up to 8 pulses per second with buffer to accumulate pulse count.

ii. Pulses shall be counted at all times.

19. A communication port for operator interface through a terminal shall be provided in each BC.

a. It shall be possible to perform all program and database back-up, system monitoring, control functions, and BC diagnostics through this port.

b. Standalone BC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or workstations.

20. Each BC shall be equipped with loop tuning algorithm for precise proportional, integral, derivative (PID) control.

a. Loop tuning tools provided with the Operator Workstation software is acceptable.

b. Tools to support loop tuning must be provided such that P, I, and D gains are automatically calculated.

21. All analog output points shall have a selectable out of range alarm.

a. The BC shall be capable of maintaining this failure set point 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.

b. The failure set point shall be selectable on a per point basis.

22. Slope intercepts and gain adjustments shall be available on a per-point basis.

23. 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.

    c. An alarm diagnostic message shall indicate that the BC is under battery power.

    d. Upon restoration of power within the specified battery backup period, the BC shall resume full operation without operator intervention.

    e. 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.

    f. 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.

    g. The system 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 from the operator workstation via the local area network, or the local communications port automatically and manually.

24. BC Failure:

    a. Building Controller LAN Data Transmission Failure:

        i. BC shall continue to operate in stand-alone mode.

        ii. BC shall store loss of communication alarm along with the time of the event.

        iii. All control functions shall continue with the global values programmable to either last value or a specified value.

        iv. Peer BCs shall recognize the loss, report alarm and reconfigure the LAN.

    b. BC Hardware Failure:

i. BC shall cease operation and terminate communication with other devices.

ii. All outputs shall go to their specified fail position.

25. 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.).

26. BCs may include LAN communications interface functions for controlling secondary controlling LANs.

27. BCs shall be mounted in packaged equipment enclosures or in locking wall mounted enclosures.

28. BC must be capable of performing primary integration to third party BACnet devices and in this case comply as a BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE Standard 135-2008 Annex L.

29. Include multi-level user access control, password protected. At highest level of access, allow operator to select overrides and change database.

30. Maintain programming in non-volatile memory or 72 hour battery backed RAM.

31. Each unit shall have an accurate real time clock that can be synchronized from a Supervisory Station or any controller on data highway.

32. Permit readout of variables, override of control, modification of attributes and scheduling changes while printing messages, trends, reports or alarms.

33. Each BC shall contain all input/output points necessary to provide control and monitoring of connected system in accordance with the sequence of operation. BC shall include 50 percent spare memory to allow for future code expansion.

34. BC units in system shall be connected by a common data base.

    a. Permit access to any BC on data highway from any location.

    b. Include full read-write capability from operational and programming standpoint.

    c. Total system information shall be available simultaneously to all Supervisory Stations at any point on data highway.

    d. All set point and programming change requests shall be coordinated with the Facilities operator.

35. Transmit messages to other units on data highway.

    a. Messages transmitted shall be positively acknowledged as received or negatively acknowledged as not received.

b. Negative acknowledgements shall immediately force retransmission of message.

36. Data Sharing:

    a. BC units shall share appropriate point information such that control sequences or control loops, executed at one unit, receive input signals from appropriate sensors connected to other units within network.

    b. When data highway fails or other BC units malfunction, control loop shall continue to function using last value received from network.

37. Fail-Safe Operation:

    a. Provide self-diagnostics that continuously monitor operation of unit.

    b. Automatically report malfunction of controller, distributed slave module, or associated communication link.

    c. Display failure condition with time and date.

    d. Upon detection of a memory error, each processor shall correct error or halt to prevent erroneous operation.

    e. Report "halts" as an alarm at Operators Workstations.

    f. Upon loss of communication with any controller on the network shall initiate an alarm message. Upon communication being reconnected, a "Return to Normal" message shall be generated.

    g. Upon power restoration after failure, provide automatic sequential restart of equipment based on current program time and program requirements without operator intervention. Provide prioritized restart of systems and equipment as defined on Contract Documents.

    h. A dedicated fail-safe relay in BC controller shall change state on a hardware and/or software fault. Relay contacts shall be used to set a fixed fail-safe position for designated output controlled devices.

38. Alarm management:

    a. Monitor and direct alarm information to operator devices.

    b. Each BC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network communications traffic, and prevent alarms from being lost.

    c. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point.

d. Direct alarms to Supervisory Station for annunciation or printout, as directed by Owner. Printer shall provide time and date of acknowledgment.

e. When alarm sent to the Supervisory Station is not acknowledged within a selected time, provide dial out alarm message to Owner supplied phone numbers.

39. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points documented in control descriptions.

40. Any point, physical or calculated may be designated for trending.

    a. Any point, regardless of physical location in the network, may be collected and stored in each BC point group. Two methods of collection shall be allowed:

        i. Either by a pre-defined time interval or

        ii. Upon a pre-defined change of value.

    b. Each BC shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 25,000 data samples.

41. Trend data shall be stored at the BC and uploaded to the supervisory station when retrieval is desired and scheduled.

    a. Uploads shall occur based upon either:

        i. User-defined interval, or

        ii. Manual command, or

        iii. When the trend buffers are full.

    b. All trend data shall be available for use in 3rd party personal computer software.

42. BC shall provide high resolution sampling capability for verification of control loop performance.

    a. Operator initiated automatic and manual loop tuning algorithms shall be provided for operator selected PID control loops.

    b. Provide ability to view or print trend and tuning reports.

    c. In automatic mode, controller shall perform a step response test with a minimum one-second resolution, evaluate trend data, calculate new PID gains and input these values into the selected loop.

    d. For troubleshooting in manual mode, operator shall be able to select variables to override default values. Calculated PID gains shall then be reviewed before they are inserted into the selected loop.

e. Loop tuning shall be capable of being initiated either locally at BC, from a supervisory station or remotely using dial-in modems.

f. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

43. BC shall automatically accumulate and store run-time hours for all major mechanical equipment (Fans, Pumps, etc.).

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

A. General Requirements:

1. AACs and ASCs shall provide intelligent, standalone control of systems and equipment.

2. 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 Part 3 of this section.

3. It shall be able to share information with every other BC and AAC /ASC on the entire network.

4. 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.

5. AACs and ASCs shall include sufficient memory to perform the specific control functions required for its application and to communicate with other devices.

6. Each AAC and ASC must be capable of stand-alone direct digital operation utilizing its own processor, non-volatile memory, input/output, minimum 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 years.

7. All point data, algorithms and application software within an AAC /ASC shall be modifiable from the Operator Workstation.

8. AAC and ASC Input-Output Processing

a. Digital Outputs (DO):

i. Outputs shall be rated for a minimum 24 VAC or Vdc, 1 amp maximum current.

ii. Each shall be configurable as normally open or normally closed.

iii. Each DO shall be discrete outputs from the AAC/ASC's board (multiplexing to a separate manufacturer's board is unacceptable).

iv. Provide suppression to limit transients to acceptable levels.

b. Analog Inputs (AI):

i. AI shall be 0-5Vdc, 0-10Vdc, 0-20Vdc, and 0-20 mA.

ii. Provide signal conditioning, and zero and span calibration for each input.

iii. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise).

iv. A/D converters shall have a minimum resolution of 8-10 bits depending on application.

c. Digital Inputs (DI):

i. Monitor dry contact closures.

ii. Accept pulsed inputs of at least one per second.

iii. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board.

iv. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of Architect/Engineer

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

e. Electronic Analog Outputs (AO) as required by application:

i. Voltage mode, 0-5Vdc and 0-10Vdc

ii. Current mode, 4-20 mA

iii. Provide zero and span calibration and circuit protection.

iv. D/A converters shall have a minimum resolution of 8 bits.

f. Analog Output Pneumatic (AOP)

i. 0-20 psi

ii. Pneumatic outputs via an I/P transducer or 0-10Vdc to pneumatic transducer are acceptable.

iii. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.

B. Air Terminal Unit Controllers:

1. Terminal box controllers used in HVAC applications 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.

3. 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.

4. The software shall select scheduled boxes randomly and shall not allow more than 5% of the total quantity of controllers in a building to perform this function at the same time.

5. When possible the controllers shall perform this function when the supply or exhaust air system is not operating or is unoccupied.

PART 3 - EXECUTION

3.01 INSPECTION

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 the BAS Contractor.

3.02 INSTALLATION OF CONTROL SYSTEMS:

A. Install systems and materials in accordance with manufacturer's instructions, specifications roughing-in drawings and details shown on drawings.

B. BAS Contractor shall install all controllers in accordance with manufacturer’s installation procedures and practices.

C. Mount BC and controllers and Field Equipment Panels (FEP) adjacent to associated equipment on vibration free walls or freestanding angle iron or iron channel supports similar or equal to Unistrut.

1. Do not mount on AHU housing.

2. Coordinate with locations shown on Duct Drawings.

3. Provide nameplates for instruments and controls inside and identify associated system on face of cabinet.

4. Provide mechanically fastened cabinet nameplates, using nomenclature shown on submittal drawings.

5. Mount a laminated copy of panel of As-Built drawing(s) inside each cabinet.

3.03 HARDWARE APPLICATION REQUIREMENTS

A. General: The functional intent of this specification is to allow cost effective application of the control system while maintaining the integrity and reliability of the control functions. Specific requirements indicated below are required for the respective application.

B. Standalone Capability

1. Each Control Unit (CU) 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.

3. Refer to Part 2.02 above for physical limitations of standalone functionality. 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 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, BAS Contractor shall verify and document that the network bandwidth is acceptable for such trends and is still capable of acceptable and timely control function.

E. Application Category 1 (Application Specific Controller):

1. Applications in this category include the following:

a. Fan Coil Units

b. Airflow Control Boxes (VAV and Constant Volume Terminal Units)

c. Misc. Heaters

d. Single Zone Unitary equipment less than 15 tons including:

i. Package Terminal AC Units

ii. Package Terminal Heat Pumps

iii. Split-System AC Units

iv. Split-System Heat Pumps

v. Water-Source Heat Pumps

e. Induction Units

f. Variable Speed Drive (VSD) controllers not requiring safety shutdowns of the controlled device

2. ASCs or BCs may be used in these applications.

3. Standalone Capability

a. Provide capability to execute control functions for the application for a given set point or mode, which shall generally be occupied mode control.

b. Only the following data (as applicable) may be acquired from other controllers via LANs.

i. 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 CU shall use the last value obtained before the fault occurred or use a pre-programmed default values in the ASC.

ii. If such a 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.

4. Mounting:

a. Refer to Section 25 55 00 paragraph 3.10 for details of mounting enclosures.

b. CU mounting shall not interfere with access to other elements of the equipment they are associated with such as filters, coil access, fan access, etc. and shall in so way restrict service access to the equipment they control.

c. CUs that control equipment located above accessible ceilings shall be mounted on the equipment in an accessible enclosure (36” clearance required) and shall be rated for plenum use.

d. CUs 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.

e. CUs that control equipment mounted outside or in occupied spaces shall either be located in the unit (responsibility for physical fit remains with the contractor) or in a proximate mechanical space.

f. The BAS Contractor may furnish CUs to the terminal unit manufacturer for factory mounting.

5. Programmability:

a. The Operator shall be able to modify all set points, scheduling parameters associated with the unit, tuning and set up parameters, inter-stage timing parameters, and mode settings.

b. 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.

F. Network Restrictions: Limit the number of nodes on the network to the maximum recommended by the manufacturer.

1. Application Category 2 (General Purpose Terminal Controller)

a. Applications in this category include the following:

i. Unitary Equipment greater than or equal to 15 ton:

ii. Air Conditioners

iii. Heat Pumps

b. Packaged Heating/Cooling Units

c. Small, Constant Volume Single Zone Air Handling Units

d. Constant Volume Pump Start/Stop

e. Misc. Equipment Start/Stop

f. Misc. 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 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: Only the following data (as applicable) may be acquired from other CUs via LANs. In the event of a loss of communications with any other CUs, or any fault in any system hardware that interrupts the acquisition of any of these values, the CU shall use the last value obtained before the fault occurred.

5. Mounting:

a. Refer to Section 25 55 00 paragraph 3.10 for details of mounting enclosures.

b. CU mounting shall not interfere with access to other elements of the equipment they are associated with such as filters, coil access, fan access, etc. and shall in so way restrict service access to the equipment they control.

c. CUs that control equipment located above accessible (36” clearance required) ceilings shall be mounted on the equipment and shall be rated for plenum use.

d. CUs 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 locking enclosure.

6. Programmability:

a. Operator shall be able to modify all set points, scheduling parameters associated with the unit, tuning and set up parameters, inter-stage timing parameters, and mode settings.

b. Operator shall be able to address and configure spare inputs for monitoring.

c. Application-specific block control algorithms may be used to meet the sequence of operations.

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

G. Application Category 3 (Advanced Application Controller)

1. Applications in this category include the following:

a. Large Constant Volume Air Handlers

b. VAV Air Handlers (generally greater than 5,000 cfm and less than 10,000 cfm)

c. Dual Duct Air Handlers (generally greater than 5,000 cfm and less than 10,000 cfm) Multi-zone Air Handlers

d. Self-Contained VAV Units

2. BCs may be used in these applications.

3. AAC’s may be used in these applications provided:

a. The AAC’s meets all requirements specified below.

b. All control functions and physical I/O associated with a given unit resides in one AAC.

c. Input A/D is 10-bit. Exception: 8-bit input A/D can be used when matched with high accuracy sensors, the range of which meets the resolution requirements specified for the applicable sensor in Section 23 09 13.13.

d. Pulsed inputs required for the application can be monitored and accumulated effectively.

4. Standalone Capability: Only the following data (as applicable) may be acquired from other CUs via LANs. In the event of a loss of communications with any other CUs, or any fault in any system hardware that interrupts the acquisition of any of these values, the CU shall use the last value obtained before the fault occurred.

5. Mounting:

    a. Refer to Section 25 55 00 paragraph 3.10 for details of mounting enclosures.

    b. CU mounting shall not interfere with access to other elements of the equipment they are associated with such as filters, coil access, fan access, etc. and shall in so way restrict service access to the equipment they control.

    c. CUs that control equipment located above accessible (36” clearance required) ceilings shall be mounted on the equipment and shall be rated for plenum use.

    d. CUs 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 locking enclosure.

6. Programmability:

    a. Operator shall be able to modify all set points (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, inter-stage timing parameters, and mode settings.

    b. Operator shall be able to address and configure spare inputs for monitoring.

    c. Operator shall be able to program custom DDC control algorithms and specify trending parameters, which will be retained in memory in the event of a loss of communications.

    d. Application-specific block control algorithms may be used provided they meet the sequence of operations. The control algorithms shall be completely customizable.

7. Network Restrictions: Each LAN which participates in the transfer of data between the CU and the local operator workstation shall be subject to the following criteria:

    a. Limit the number of nodes servicing any one of these applications on the AAC/ASC LAN to 16.

    b. The building controller LAN shall be subject only to manufacturer’s published LAN limitations.

H. Application Category 4

1. Applications in this category include the following:

    a. Central Cooling Plant

b. Central Heating Plant

c. Cooling Towers

d. Sequenced or Variable Speed Pump Control

e. Local Chiller Control (unit specific)

f. Local Free Cooling Heat Exchanger Control

g. Air Handlers over 10,000 cfm or serving critical areas

h. Variable Speed Drive (VSD) controllers for air handlers, exhaust systems and variable volume pumping

2. BCs shall be used in these applications.

3.04 NETWORK BANDWIDTH MANAGEMENT

A. Scan times from the first controller to the last controller within the building network that exceed 2 seconds are not acceptable. If scan times of 2 seconds or less cannot be achieved, contact the Owner with recommendations for improvement.

B. Once the network is properly configured, the BAS Contractor shall provide a network bandwidth analysis of the controller network. The analysis shall confirm network bandwidth utilization does not exceed the requirements stated above for a continuous one hour period that incorporates a full system trend collection and 2 OWS Graphical Displays presenting data; controller network will be redesigned at the BAS Contractors cost until scan times meet criteria.

3.05 CONTROL UNIT REQUIREMENTS

A. Refer to Section 25 55 00 for requirements pertaining to control unit quantity and location.

3.06 CONTROL MODULE INSTALLATION

A. Building Controller (BC):

1. The BAS Contractor shall follow the specifications shown in the manufacturer's hardware installation guide unless stated otherwise herein.

2. Ensure proper shield grounding is applied on any RS485 connections, proper network repeaters are installed if necessary or any other network devices required to achieve the required network performance metric stated in paragraph 3.04.

3. Refer to Section 25 55 00.3.11 for power supply requirements. Power shall enter the control panel at an internal junction box that includes a standard receptacle and switch for panel power.

B. Field Bus Controllers (AAC/ASC):

1. The BAS Contractor shall follow the specifications shown in the manufacturer's hardware installation guide unless stated otherwise herein.

2. Controller Power shall have a separate disconnect (or fuse) for each controller.

3. All digital outputs must be equipped with a relay rated to manage the connected load.

4. Only two pair (incoming & outgoing) communication wires shall be connected to the communication terminal on the controller. (No "star" network configurations)

C. Expansion Modules:

1. The BAS Contractor shall follow the specifications shown in the manufacturer's hardware installation guide unless stated otherwise herein.

2. The use of DCC expansion Modules, including quantity, shall be pre-approved by the Owner. As a general rule no expansion device shall be used that does not represent itself as a unique physical device within the BAS System Profile.

END OF SECTION