251000 Building Automation Network Equipment

1.1 General

A. The BAS network shall be implemented over the campus shared BAS virtual Ethernet system. The campus shared Ethernet backbone utilizes BACnet over IP as the standard network communication protocol.

B. All Building Level Software is required to be able to be updated by employees of the University.

1.2 Networking/Communications

A. The design of the hardware and software shall integrate with the existing vendor specific servers at the University of Florida campus using new or existing Building Level Controllers (BLC) or Advanced Application Controllers (AAC).

B. Ethernet home-runs: Each Ethernet connection shall be a home-run back to the nearest (within 100 Meters) telecom closet. The location shall be included on the riser diagram in the set of BAS shop drawings and engineers telecomm design drawings.

C. All network parameters must be assigned and approved (in writing) by the University's Facilities Services (FS) Controls group prior to implementation.

D. The system must be fully BACnet™ compliant at the time of installation. This means that the system must use BACnet™ as the native communication protocol between building level controllers and servers on the network. The communication between controllers shall be ARCNET or MS/TP over RS485 for all new and renovation projects.

E. The BACnet communication protocol is the required protocol for all tiers of the network.

2.3 Controllers

A. Controller Software Features:

1. Equipment Cycling Protection: Include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

2. Heavy Equipment Delays: Provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads (user selectable).

3. Power Fail-Motor Restart: Upon the resumption of normal power, the control system shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off in an orderly way to avoid large demands on the electrical system.

4. Incorporate comment lines for program clarity. Comment sections shall include a summary of the actual sequence of operation.

5. New supervisory device and controller installation shall be fully compatible with the current existing server for the purpose of archiving and restoring data. Discuss additional upgrade requirements with UF Facility Services (FS) Controls group prior to design.

B. Controller Hardware:

1. Failsafe hardware shall be provided such that BAS failures result in immediate return to local or default control. If the controller uses database values from other controllers, and

the communication network fails or malfunctions, control loop outputs shall continue to function using last value received from central BAS.

2. Controllers should not exceed 80% of I/O capacity. The 80% capacity requirement shall apply to inputs and outputs separately and not be an aggregate of both.

3. Controller memory shall not exceed 75% of processor/memory utilization when all required features and project programming has been implemented. The vendor shall provide a report that documents the initial processor/memory utilization upon completion of system startup/commissioning (See standards section 250000 for additional reporting requirements). Final percent utilization shall take into account all programs, trending, alarming and point count.

4. Multiple system controller sharing is strictly forbidden at the University of Florida. Each system/terminal unit requiring any type of PID control loop shall include a dedicated controller that can manage the assigned control loop without dependence on peer to peer communication. It is acceptable to combine multiple status or multiple start/stop points into one controller when no PID loop or complicated logic is required.

**** PROJECT NOTE, for the Consultant ****
The consultant shall consider UPS power backup for DDC controllers when a controlled shutdown/startup of equipment is required after standby power transfer. Power for BLC Controllers, AAC Controllers and ASC Controllers shall be served from emergency power when controlling emergency powered equipment. Note: all supervisory controllers located upstream of any controller powered from the emergency system in the network should be tied to emergency power to ensure communication integrity is maintained throughout the BAS Architecture.

5. Where applicable, all DDC control panels shall include an internal or external UPS power supply unit to ensure reliability of network communications through any power outage event. UPS shall be sized to provide no less than 15 minutes of standby power at full load conditions. The UPS shall be complete with batteries, external bypass and line conditioning. UPS units shall be monitored by the BAS.

6. The Controllers shall utilize FLASH memory, battery backed RAM or firmware which shall ensure the integrity of the database during brief power losses.

C. Building Level Controller (BLC) and Advanced Application Controllers (AAC) -Hardware

**** PROJECT NOTE, for the Consultant ****These types of controllers are typically used in major equipment only (AHU's, chillers, boilers, pumping systems exhaust systems, complicated laboratories, or for overall building management services etc…… Consider listing the applicable job specific system types to ensure the appropriate controller and features needed for the project are clearly communicated

1. Acceptable BLC or AAC Products used for building level supervisory control:

   a) ALC: LGR Ethernet Router or newer
   ~~b)~~ Johnson Controls – SNE (Series Network Engine) or newer; No SNC ~~Network Automation Engine (NAE-55)~~
   c) Siemens Apogee - PXC (Programmable Controller) Modular / Compact or newer

2. The BLC/AAC shall be a microprocessor based communications device. One of the functions of the BLC/AAC is to provide a communications gateway between the building BAS network and the IP Ethernet network. The BLC/AAC shall communicate via IP and be connected to the UF FS campus Ethernet infrastructure. A sufficient number of

controllers shall be supplied to fully meet the requirements of the project. Controller networks shall use the BACnet protocol.

3. The BLC/AAC when used as a supervisory device shall support a network of at least 90 controllers, but no more than 60 controllers may be placed on any building level BACnet network (BLC and AAC) so that adequate future capacity is reserved for the University.

4. The BLC/ALC when used as a supervisory device shall provide a port which can be connected to Operator Workstations or portable computers.

5. The BLC/ALC when used as a supervisory device shall provide full arbitration between multiple users, whether they are communicating through the same or different BLC/AACs.

6. The BAS vendor shall not use 100% of the manufacturers' published object count or resources of the BLC/AAV. At least 20% of the published rating shall be reserved for future use by UF FS.

7. The BLC/ALC when used as a supervisory device shall not be used as both a major or critical system controller and router. Each major or critical system shall have a dedicated controller(s) that are not also tasked to route system information to and from the campus BAS network.

8. The BLC/ALC when used as a supervisory device and if the memory is lost for any reason, the user shall have the capability of reloading the BLC/AAC via the Local Area Network (LAN) or via central server.

9. Memory: Each BLC/ALC when used as a supervisory device shall have sufficient memory to support its own operating system and databases including:

    a. Control processes

    b. Energy management applications

    c. Alarm management

    d. Historical/Trend data for 100% of all physical I/O for all programs in any controller connected to the Global Building Controller, at a minimum of 500 samples per trend

    e. Maintenance Support Applications

    f. Custom processes

    g. Operator I/O

10. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.

11. An Uninterruptible Power Supply (UPS) unit is required for the BLC/AAC supervisory controllers, repeater(s) and/or Application Controllers (on primary or terminal equipment) that serve or monitor emergency and/or critical equipment, locations or points.

12. The operator shall have the ability to manually override DO automatic or centrally executed commands at the BLC/AAC via local display unit or by way of a local manual Hand/Off/Auto (HOA) device. Local terminal display unit (IF USED) shall be permanently installed in each BLC/AAC panel and shall be password protected. Controlled equipment with external HOA capability shall satisfy this requirement. In all cases the BAS shall monitor and report when any output has been placed in Hand mode.

13. The operator shall have the ability to manually override AO automatic or centrally executed commands at the BLC/AAC via local display unit or by way of a local manual Hand/Off/Auto (HOA) device. Local terminal display unit (IF USED) shall be permanently installed in each BLC/AAC panel and shall be password protected. External equipment override (e.g. VFD speed override) shall satisfy this requirement. In all cases the BAS shall monitor and report when any output has been placed in Hand mode.

14. When utilizing hardwired components for the override functions, they shall be mounted within the controller's key-accessed enclosure.

B. Application Specific Controllers (ASC'S)

**** PROJECT NOTE, for the Consultant ****These types of controllers are typically used in terminal units, fan coil units, chilled beams, and simple laboratory applications… Consider listing the job specific system types here to ensure the appropriate controller and features needed for the project are clearly communicated.

1. Performance and capacity of AAC/BLC units shall be extended through the use of stand-alone remote ASC'S.

2. If being installed outdoors, the Application Controllers shall be capable of being mounted directly in or on the equipment located outdoors.

3. Primary Equipment shall be controlled using one Application Controller. A single controller with adequate Input/Output and resource capacity shall be used for a single piece of equipment as opposed to using two or more smaller controllers to house the programs for one piece of equipment. All exceptions must be pre-approved by UF FS on a per project basis.

4. Specific to air terminal unit controllers

   a. The controller shall be capable of controlling the air terminal unit in all control strategies as described in contract documents.

   b. If required by the sequence of operation, ASC's used as a zone air terminal unit controller shall be able to accept a relay input from an occupancy sensor. This input shall toggle the air terminal unit between occupied and unoccupied modes using internal logic and incorporate occupied/unoccupied scheduling information that the air terminal unit receives from the BLC or AAC.

   c. Provide a means of automatically disconnecting the differential pressure sensing lines to ensure a true no flow condition during automatic recalibration events.

   d. Each Application Controller for VAV applications shall have an integral direct coupled electronic actuator. The assembly shall mount directly to the damper operating shaft with a universal V-Bolt clamp assembly. The actuator shall not require any limit switches, and shall be electronically protected against overload. When reaching the damper or actuator end position, the actuator shall automatically stop. The gears shall be manually disengaged with a button on the assembly cover. The position of the actuator shall be indicated by a visual pointer. The assembly shall have an anti-rotational strap.

C. BAS Servers:

**** PROJECT NOTE, for the Consultant ****The consultant shall discuss existing server requirements with

Facilities Services to determine whether the existing server (s) might need upgrades to support the project requirements.

1. Servers are existing

**** PROJECT NOTE, for the Consultant ****Consultant shall coordinate laptop requirements with UF FS. Not all projects will require a supplemental laptop.

D. Laptop PC – Service Tool: Contractor shall include a $3000 allowance for Laptop PC and selection of hardware shall be by UF FS. All laptops shall meet the minimum UFIT requirements.

1. Laptop shall include manufacturer's control system engineering tool set needed to commission and reconfigure system programs and databases and include all required interface cables. The laptop shall have the ability to plug directly into all controllers and include one standard Ethernet connection. Provide a user-friendly, English language-prompted interface for quick access to system information, not codes requiring look-up charts.

2. Functional requirements of the laptop pc-service tool connected at any general controller:

a. Backup and /or restore controller databases for all system panels.

b. Display all point logs.

c. Add, modify and/or delete any existing or new system point.

d. Command; change set point, enable/disable any system point.

e. Re-program and load custom control sequences as well as standard energy management programs.

f. Configure controllers and any programmed point.

3. Connection of a laptop to any controller shall not interrupt nor interfere with normal network operation in any way, prevent alarms from being transmitted to server or preclude centrally initiated commands and system modification.

2.2 BAS Interfacing With 3rd Party Sub-Systems

A. General: The BAS vendor shall be responsible for connecting all 3rd party sub-systems to the BAS via native BACnet interface provided by the original equipment manufacturer (OEM), or if not native BACnet, a sub-system that shall be integrated via a gateway that converts the proprietary protocol to the BACnet protocol. In general all packaged HVAC equipment shall be integrated including packaged HVAC equipment, VFD(s), Chiller(s), Electrical Monitoring, etc… as applicable to the specific project requirements. These sub-systems shall be controlled and monitored as applicable through the Graphical User Interface (GUI) software of the BAS.

**** PROJECT NOTE, for the Consultant ****Consultant shall verify/coordinate with FS other non HVAC equipment integration requirements.

B. Gateway: When applicable the gateway(s), required for the sub-system(s), shall be provided by the equipment OEM. The gateway(s) is(are) further specified below:

1. The gateway submittal shall be provided by the OEM to the BAS vendor to be included with the BAS Shop Drawings Submittal, for review and approval by the University's FS group.

2. All system information specified in the sequence of operation and related documents shall be available to the BAS. Read and write capability, as indicated by an object table provided by the OEM, shall be provided for the mechanical and electrical equipment indicated and be available to the BAS system. The OEM shall provide to the BAS vendor, a table of gateway objects and their functionality, including normal operating limits (i.e. High and Low Oil Temperature Limits from a Chiller control panel). The equipment OEM will expose all available objects as BACnet objects for use by BAS vendor.

C. A Modbus interface may be used only when a BACnet interface is not available from the equipment OEM. If the equipment manufacturer does not have this capability, they shall contact the authorized representative of the BAS vendor for assistance and shall include in their equipment price any necessary hardware and/or software obtained from the BAS vendor to comply with this section. Cost alone is not an acceptable reason for not providing a BACnet interface.

D. OEM Configuration Tools and Licenses: Configuration Tools, software and all software licenses, required to configure all OEM controllers installed on this project, shall be provided by the project.