DIVISION 25 – BUILDING AUTOMATION SYSTEMS (BAS)

Includes the following sections:
25 00 00 Building Automation System (BAS)

See Part II for additional information regarding Indoor Pollutant Reduction and Control, Energy Efficiency, etc.

Also refer to the following related Sections:
23 08 00 Commissioning of HVAC
23 09 00 Instrumentation and Control for HVAC
23 09 10 Instrumentation and Control for Lab HVAC
23 90 00 Mechanical Rooms

DESIGN REQUIREMENTS

DESIGN DOCUMENTS REQUIRED: BAS SYSTEMS STUDIES, SINGLE LINE DIAGRAMS, AND SEQUENCES OF OPERATIONS
The following shall be performed by the designer and submitted in addition to design drawings and specification documents for review:

1. Studies: Where new additional BAS controllers and points are being added to an existing BMS systems, the entire system shall be studied for existing JACE resource utilization performance, age, and suitability of continued use with the additional points. Designer shall confer with UC Engineering staff and Physical Plant BMS Shop for known limitations or problems associated with each existing JACE and temperature control panels that new points are being added to. Many older JACES are in poor shape (some are failing) and unsuitable for continued use and may be on a deferred maintenance list. All of these issues should discovered and documented during the design phase to ensure the new BMS systems are properly designed and budgeted for before going out to bid.
2. Coordination with Physical Plant BAS Shop: The service technicians have a lot of direct experience programming and maintaining existing BAS systems on Campus. They have design and equipment specification preferences that change regularly based on challenges encountered post construction on other projects, thus they should be engaged early in the design process to take advantage of lessons learned and identify designs and specifications of equipment they specifically don't want to have to maintain.
3. Controls Network Security: Any vendor provided devices must adhere to campus minimum network connectivity standards. Refer to https://policy.ucsc.edu/policies/its/it0004.html#appa
4. Single Line Diagrams Required:
    a) CONTROLS NETWORK ARCHITECTURE DIAGRAM: Diagram shall illustrate all DDC systems controls equipment including communications via internet web browser at remote location workstation, Ethernet cabling to routers and switches, operator workstation server (if used on site), JACE BMS control panel(s), LON cabling to field

controllers, MODBUS RS-485 cables to equipment gateways (boiler managers, chiller managers, split system managers), communications wiring to remote XI/O) panels, and for each JACE indicate notated “120V power provided by Division 26” and ITS “Data cabling and hot jack provided by Division 27”.

b) NETWORK RISER DIAGRAM FOR EVERY JACE: Diagram shall illustrate all DDC system controls equipment and communications cabling connected to the JACE via LON network (all local controllers for boilers, exhaust fans, air handlers, variable frequency drives, variable volume terminal devices, etc.), BACnet MS/TP for fume exhaust air valves, MODBUS for electrical meters, and BACnet IP for variable refrigerant gateways, etc.

c) Division 25 designer shall coordinate with the Division 26 and Division 27 designers to ensure these other designers are aware of the power and data requirements for each JACE and all terminal devices such as variable air volume boxes or lab air control valves.

d) Coordination of power requirements to each JACE: if the JACE controls any equipment that is on standby power, the JACE has to also be on standby power. If the JACE controls any equipment on emergency power, the JACE also has to be on emergency power. Note that JACES on emergency power are very rare (only special applications such as vivarium or seawater systems with livestock, otherwise the BMS system does not control life safety equipment) and should be discussed with UC Engineering staff.

5. Points Lists: Provide a list of all control points by name and signal type (AI, AO, DI, DO). Coordinate with Physical Plant for integration of specific equipment PLC read/write points to be mapped to the BAS.

6. Sequences of Operation: Provide sequences of operations for each controlled system including setpoints and alarms.

7. Zone Maps: provide a scaled zone map for each floor including what central equipment and terminal devices serve each zone. Indicate all BAS control panel locations.

8. Mechanical Rooms: Refer to 23 90 00 for BIM Modeling Requirements. BMS control panels with NEC clearances shall be shown and coordinated with other trades equipment and required access clearances.

9. Legacy of Single Line Diagrams: It is the University’s intent for the Single Line Diagrams to be the building’s perpetual living model documents that will be continuously modified and or updated for future building remodels, alterations, etc. For this reason, single line diagrams shall be updated and submitted by the Engineer of Record at the end of the project to reflect as-build conditions. In addition, as-built CAD and spreadsheet calculations shall be submitted in both native AutoCAD .DWG file format, Excel spreadsheet, and Acrobat PDF file formats. Before generating any single line diagrams or calculations, the Design Engineer should confer with Archives to determine if there are already AutoCAD single line diagrams and Excel spreadsheet files available to modify. The newer buildings on campus should have them, but the older ones won’t. If Archives

does not have them, they will need to be generated from scratch. It is the Design Engineer's responsibility to ensure they have included the appropriate time and fees in their proposal to generate and deliver these as-built single line diagrams and calculations.

OTHER DESIGN RELATED SUGGESTIONS

The following is a list of Building Committee Suggestions compiled by Physical Plant BMS Shop based on many years of lessons learned on past projects on campus and is provided herein in order to help the designer not repeat these lessons. Please note most of these suggestions are mandatory and are somewhat redundant to the above design guidelines, but there may still be some pearls of design wisdom to mine. Also, this list will also grow over time.

Building energy management systems

- Adhere to Tridium resource management limitation guidelines
- Follow campus ITS security guidelines
- No Beta testing of software or equipment & SOO strategies
- Use Tridium BAS systems on Niagara network
- Fully utilize LON Modbus or BackNet devices on HVAC systems
- ITS infrastructure activated with emphasis on BAS data port connections for commissioning of systems.
- ITS switches and BAS equipment should be on standby power

BMS sequences of operation

- Always provide third party commissioning agent
- Use demand controlled ventilation strategies by measuring Co2 levels.
- Use motion occupancy detectors to reset VAV supply airflow & zone set points for DCV
- Use motion & Co2 detectors in lecture halls and classrooms to reduce operating hours for DCV
- Alarm filter bank Differential Pressure to front end
- Design building HVAC / BAS to meet LEED certification level
- Use supply air static set-point reset.
- Use chilled / heating water D.P set point reset.
- Provide start up commissioning and change of season retro commissioning
- Consider Skyspark or other persistent commissioning software
- Provide alarm if VAV can't meet supply air flow set-point
- Utilize VAV DAT sensor and alarm SAT to zone
- Utilize building optimum start stop
- Utilize building Night purge
- Utilize OSA free cooling