State of Hawaii, Dept of Defense, Hawaii Army National Guard, Energy Management Control System

Scope of Work

All digital controls equipment in the building should be designed to be part of a single networked system, which is designed to be connected to the existing State of Hawaii, Dept of Defense, Hawaii Army National Guard, Energy Management Controls System (EMCS). The building's EMCS will be user-friendly functionality utilize a web-based user interface, accessible by any standard web browser. The web page files to support the user interface will reside on the existing State DOD central server.

The primary building controllers that connect to the EMCS must be fully compatible BACnet interface with owner's central server. All controls components must be fully compatible and able to communicate with each other and central server, and provide single web-based, uniform user interface at all buildings.

BACnet

All controllers connected to the primary controller should communicate using BACnet communication protocol, unless specifically approved in advance by the building owner. BACnet is an open communication protocol systems whose functional profiles conform the guidelines of the BACnet Manufacturers Association, and are certified compliant by that organization.

Third party control systems

Third party control systems should be avoided as much as possible, and if used, must be COMPLETELY integrated into the building EMCS system, with all points and control parameters fully accessible from the EMCS system.   Owner's representative shall verify that specifications for any third party control systems used, and the control systems of all mechanical equipment controlled by the building EMCS system, specify controls and equipment that will be fully compatible with the EMCS.

A. **Specifications**

Specifications are to include a concise statement of work for the project, briefly describing the principal features of work to be performed. Include a consolidated list of material submittals (actual materials, shop drawings, brochures, "cut-sheets", etc.) which are to be submitted to the Project Manager for approval for acceptance prior to the actual construction of the project. All references to material approvals shall state the Project Manager is the acceptance authority.

CSI Section 23 09 00: Instrumentation and Control for HVAC

CSI Section 23 09 23: Direct-Digital Control System for HVAC

CSI Section 23 09 93: Sequence of Operations for HVAC Controls

ASHRAE 135.1: BACnet: Data Communication Protocol for Building Automation and Control Networks

Controllers must be provided with an open license, open system design to include:

Property	Value
Station Compatibility In	All
Station Compatibility Out	All
Tool Compatibility In	All
Tool Compatibility Out	All

Points of Interest for each VAV (3 analog, 2 digital, if applicable)
- Zone temp

- Thermostat setpoint
- Static pressure
- VAV actuator open
- VAV actuator close

Points of Interest for each Exhaust Fan (1 analog input/ 1 digital output, if applicable)
- Current sensing
- On/off

Points of Interest for each Split System (3 analog inputs, if applicable)
- Zone temperature
- Supply air temperature
- Condenser current sensing

Furnish and install replacement VFD (if applicable)
- Duct static pressure sensor
- DDC controller
- 3 contactor bypass
- 3% AC line reactors

In the future, we would also like to have the ability to monitor the condensing units for operability with the following data points:
- Saturated liquid refrigerant temperature
- Superheated refrigerant vapors
- High & low pressure sensing (both analog)
- Oil pressure sensing (can be I/O or analog transducer)
- Compressor amps

B. Notes:
C-15: mechanical and electrical licenses will be accepted provided prime contractor holds a B or C license so control work can be subcontracted out.

C. Equipment
VFD: Danfoss HVAC-VLT drive, with bypass and 3% input AC line reactors (or approved equal).
VAV: Metalaire, model TH-5000 with 120/24VAC transformers included and mounted on box (or approved equal).
DDC controller: Automated Logic ZN141v+ (or approved equal).
Thermostats: Automated Logic ZS Pro Room Sensor ZSP-HC-ALC (or approved equal).
Occupancy sensor: IR-TEC HVAC Occupancy Sensor OS-363 (or approved equal).

D. Criteria

1) Web-based system (internet access available). Bldg XX shall be interfaced to State DOD computer server and software.
2) System security protection will include area dependant access. Access for each user will be Bldg XX only, RTI only, or Bldg XX & RTI access, etc.

3) Browser interface to system, additional or special workstation (HMI) software will not be accepted. System must be web-based and compatible with existing State DOD website.
4) Distributed process shall be used. Each major piece of equipment or equipment plant will have a dedicated direct digital controller with battery back-up. Residing in each controller shall be, at minimum, time schedules (including all holidays for the year), system program, and trend logs for a minimum of one day. Major equipment shall include: one control module for the chilled water plant with outdoor rated NEMA enclosure, one control module per AHU, one control module per FCU and one control module per VAV box. Use of multiple modules for any of this equipment shall not be acceptable.
5) Room Sensors (thermostats) shall have digital displays, setpoint adjustment and local (after-hours occupancy) occupancy override.
6) All direct digital controllers shall be native BACnet.
7) Communication cabling shall be high speed ARCnet (156k) using low-capacitance cable.
8) Provide communication output from meters. Provide cabling to existing HIARNG network switch.
9) Provide mapping to existing State DOD statewide BACnet server. (Note: Mapping must be performed by an authorized Automated Logic vendor).
10) The programming language shall be graphical programming, line programming is not acceptable. The system HMI shall include a LOGIC page for every system. This logic page shall allow the operator to view the program logic with the live data display throughout the logic. Authorized operators shall have the capability to change parameters on-line. Programming changes shall be in background mode only.
11) Provide Energy Report software as an integral part of the EMCS.
12) Provide Environmental Index software.
13) Color graphics shall follow the DoD EMCS Graphic Standard.
14) Color computer Graphics shall be provided for each piece of equipment.
15) Color computer Graphic floor plans shall be provided with thermal graphs. Thermal graphs will indicate each AHU, FCU or VAV Box zone within the floor plan with room numbers and changing colors to indicate the following:
    a. If the space is unoccupied the color will be GRAY
    b. If the space is occupied:
        i. GREEN shall indicate the zone is at set-point.
        ii. YELLOW shall indicate the zone is slightly warmer than set-point.
        iii. ORANGE shall indicate the zone is well above set-point.
        iv. LIGHT BLUE shall indicate the zone is slightly cooler than set-point.
        v. DARK BLUE shall indicate the zone is well below set-point.
        vi. RED shall indicate the zone is in alarm.
        vii. CHARTRUSSE shall indicate that there is not communications to the DDC module.
16) Trending shall be required for every point in the system. Every trend shall be historically trended and saved in the hard drive data base. Exporting of trends shall be included, trends shall be exported to an Excel spreadsheet without the use of any specialty software.
17) All software tools shall be provided and installed on the system computer server. Software tools shall include at minimum:
    a. Data base configuration software and tools.
    b. Graphic programming software.

     c.   Graphic designing software.

     d.   All implementation software tools required to build this system from scratch.

18) Lighting control shall control each individual circuit based on timed scheduling.

     a.   Lighting control shall be an integral part of the EMCS.

     b.   All zone controllers shall be native BACnet. No gateways shall be allowed.

     c.   Provide lighting floor plans for indoor lighting control with changing colors to indicate the following:

     d.   WHITE shall indicate the zone lighting is "ON".

     e.   GRAY shall indicate that the zone lighting is "OFF".

     f.   CHARTRUSSE shall indicate that there is not communications to the DDC module.

19) Outdoor lighting control shall be individual circuit based on a Sunset/Sunrise schedule based on the longitude and latitude of the facilities. Lighting shall turn "ON" one half hour before Sunset (adjustable) and one half hour after Sunrise (adjustable).

     a.   Outdoor lighting control shall be an integral part of the EMCS.

     b.   Provide graphics to indicate when lighting is ON or OFF.