SECTION 230906 – BAS OPERATOR INTERFACE

***Note to the Design AE*: The AE and project manager should discuss the project with Applicable UNC Facilities personnel. There is a 'Preface' document describing how to employ this and other UNC controls-related Guide Specifications. The AE is instructed to consult the Preface document for guidance on the nature of this specification, methods for deleting non-applicable text, and the use and deletion of Editor's Note's before proceeding to customize this specification.**

PART 1. GENERAL

1.01 SECTION INCLUDES

A. Local System Architecture

1.02 RELATED DOCUMENTS

A. Section 230900 –Building Automation System (BAS) General

B. Section 230901 - Building Automation System (BAS) Basic Materials, Interface Devices, and Sensors

C. Section 230904 - BAS Communication Devices

D. Section 230905 - BAS Software and Programming

E. Section 230801 - BAS Commissioning

1.03 DESCRIPTION OF WORK

A. Refer to Section 230900 for general requirements.

B. The scope of this section is to provide BAS graphics, alarming, scheduling and trending.

PART 2. PRODUCTS

2.01 OPERATOR INTERFACE (OI)

A. UNC provides the Local Control Station (LCS) that will interface with the EMCS server that will host the OI. Refer to 230900/I.13 SYSTEM ARCHITECTURE/D/3 for details on LCS configuration.

B. Contractor shall install a local operator's interface on the University provided LCS during construction and on the EMCS server prior to the project completion. All

necessary bindings and IP addressing necessary to accomplish items listed in this section shall be provided.

C. The new OI shall allow all levels of user access to the local system.

{Coordinate with UNC regarding Graphic Interface requirement}

2.02 Operator Interface Graphic Software (General):

A. Graphic software shall facilitate user-friendly interface to all aspects of the System Software specified above. The intent of this specification is to require a graphic package that provides for intuitive operation of the systems without extensive training and experience. It shall facilitate logical and simple system interrogation, modification, configuration, and diagnosis.

B. Graphic software shall provide for multitasking such that third-party programs can be used while the OI software is on line. Software shall provide the ability to alarm graphically even when operator is in another software package.

C. Dynamic Data Displays: Dynamic physical point values shall automatically updated at a minimum frequency of 10 updates per minute without operator intervention. Point value fields shall be displayed with a color code depicting normal, abnormal, offline or loss of communications, override and alarm conditions.

D. Point Override Feature: Each displayed point shall be individually enabled/disabled to allow mouse-driven override of digital points or changing of analog points. Such overrides or changes shall occur in the control unit, not just in the workstation software. The graphic point override feature shall be subject to password level protection. Points that are overridden shall be reported as an alarm, and shall be displayed in a coded color on the BAS graphic screens for that applicable system. The alarm message shall include the operator's user name. A list of points that are currently in an override state shall be available through menu selection.

2.03 Graphic Software (Design Requirements):

A. Floor Plan Layout Graphics:

1. Provide floor plan graphics for all areas/ floors served by BAS controlled equipment
2. Provide links from large floor plans to smaller, more detailed graphics (Zoom in feature).
3. Locate all controlled or monitored equipment on the floor plan graphics with a link to the equipment.
4. Show locations of all terminal unit Zone Sensors on the floor plans,
5. Areas served by zone level equipment shall be clearly delineated and color coded. Color coding shall be chosen so that adjacent zones are different colors or, are clearly outlined to designate the area served by the equipment. This is especially important when a zone includes multiple rooms.

6. Ensure room numbers reported on the floor plan graphics match the room number signage locate at each room. These numbers may or may not correspond to the numbers presented on the contract documents. This contractor is responsible for coordinating with the owner to verify final room numbering signage.
7. Review the floor plan layout design with the owner prior to installation on the server. This contractor is responsible for coordinating and receiving acceptance of the graphic layout design from the Owner.

B. Equipment Graphics (General):

1. All specified I/O points for the unit shall be shown on the graphic.
2. In addition, display all setpoints for any controlled components on the graphic. The setpoint shall be changeable from the graphic interface
3. Provide a link and description of <u>any</u> "Parent" equipment feeding the equipment/unit that is controlled by the BAS. Also, provide the current primary value of the service being provided. i.e.: For an AHU, provide a link to the ChW & HW systems providing heating and cooling water to the unit on the unit's graphic. Next to the link, display the current supply temperature.
4. For any equipment that has remotely located sensors, the graphic for that unit shall contain a detailed decription of the location of the sensor (i.e. down duct static pressure sensors, remote hydronic DP sensors, etc.). Ideally, provide the actual room number where the sensor is located and any other descriptive information (above ceiling, etc.)
5. Provide and install an electronic version of the as built control schematics on the gateway server. Provide a link to the electronic control schematics on each major equipment page.

C. Terminal Unit Graphics:

1. All specified I/O points for the unit shall be shown on the graphic.
2. In addition, display all setpoints for any controlled components on the graphic. The setpoint shall be changeable from the graphic interface.
3. The following additional points shall also be included (where applicable):
4. Minimum Flow Setpoint (VAV terminal unit)
5. Maximum Flow Setpoint (VAV terminal unit)
6. Heating Maximum Flow Setpoint (VAV terminal unit)
7. Base Zone Temperature setpoint
8. Setpoint adjust
9. Effective Heating setpoint
10. Effective Cooling setpoint
11. Occupancy Mode/Command
12. Terminal Load (% Heating/Cooling)
13. Any Active Alarms (status)
14. Provide a link and description of any "Parent" equipment feeding the terminal unit. Also, provide the current primary value of the service being provided. i.e.: For a VAV box, provide a link to the AHU providing supply air to the terminal unit on the terminal unit's graphic. Next to the link, display current the supply air temperature. Similarly, provide a link to the HW system and the HW Supply

temperature. This applies to all terminal equipment and to any unit that is served by another system (i.e. AHUs, Energy Recovery Systems, etc.).

2.04 Operator Interface Alarm and Event Reporting

{Coordinate with UNC regarding Alarm Interface requirement}

A. Alarm management shall be provided to monitor, buffer, and direct alarms and messages to the LCS operator interface. At no time shall the ability to report alarms be affected by either operator activity at the LCS, or by communications with other panels on the network.

B. **Alarm Descriptor**: Each alarm or point change shall include that point's English language description, and the time and date of occurrence. In addition to the alarm's descriptor and the time and date, the user shall be able to print, display and store an alarm message to more fully describe the alarm condition or direct operator response.

C. **Alarm Prioritization**: The software shall allow users to define the handling and routing of each alarm by their assignment to discrete priority levels. For each priority level, users shall have the ability to enable or disable an audible tone whenever an alarm is reported and whenever an alarm returns to normal condition. Users shall have the ability to manually inhibit alarm reporting for each individual alarm and for each priority level. Contractor shall coordinate with UNC on establishing alarm priority definitions.

D. **Alarm Acknowledgment**: For alarm priority levels directed to the LCS, an indication of alarm receipt shall be displayed immediately regardless of the application in use at the workstation, and shall remain on the screen until acknowledged by a user having a password that allows alarm acknowledgment. Upon acknowledgment, the complete alarm message string (including date, time, and user name of acknowledging operator) shall be stored in a selected file on the LCS hard disk.

E. It shall be possible for any operator to receive a summary of all alarms regardless of acknowledgement status; for which a particular recipient is enrolled for notification; based on current event state; alarm priority; and notification class.

F. Typically, alarms will be specified in the sequence of operations or the control system logic diagrams. However, alarm points shall be as dictated by the owner. The following guide is presented for use in further determining what points to initially set up for any given system/ equipment/ unit, etc. This contractor shall coordinate all alarm requirements with the owner. For systems not listed here, the requirements should be extrapolated from similar systems that are listed. The minimum alarm requirements for the systems listed below are as follows:

1. STANDARD AHU ALARMS
   a) Fan Failure --- should reference command
   b) Pump Failure --- should reference command
   c) Freeze stat --- alarm enabled at all times

d) Fire Alarm --- alarm enabled at all times

e) Hi Fan Static --- alarm enabled at all times

f) Filter Alarm --- alarm enable at all times

g) Damper Status --- smoke dampers controlled by fire alarm system --- alarm enable at all times

h) Damper Status --- smoke and isolation dampers controlled by BAS system --- - alarm disabled when system is shutdown.

i) Mixed air temp below 40 on units without preheat, no alarm on units with preheat and minimum OA requirements - alarm enabled at all times

j) Preheat temp below 40 on units with preheat --- alarm enabled at all times

k) Heat Recovery temp below 40 --- alarm enabled at all times

l) Zone temps below 65 or above 83 with 2 degree differential and an occupancy schedule ---- alarm @ 65 normal at 67 and alarm at 83 normal at 81

m) Zone temps below 67 or above 80 with 2 degree differential and no occupancy schedule---- alarm @ 67 normal at 69 and alarm at 80 normal at 78

n) Discharge temps 2 degrees above and below the min and max reset set points if using resets 1 degree differential, set up warning to indicate temp 1 degree off of set point for more than 5 minutes --- alarm disabled when system is shut down and have a 5 minute delay after system restarts.

o) Duct Static pressures should alarm when more than a .25 inch or 10% off of set point --- alarm disabled when system is shut down and have a 5 minute delay after system restarts.

p) Space or return humidity above 60% or below 30% (DLAM area only) with a 5% differential --- alarm @ 60% normal at 55% and alarm at 30% normal @ 35%--- alarm enabled at all times

q) Discharge humidity above 90% --- alarm enabled at all times

r) CO2 above 1000ppm --- alarm enabled at all times

s) Return temp above 80 or below 68 with 2 degree differential --- alarm @ 80 normal at 78 and alarm at 68 normal at 70 --- alarm disabled when system is shut down and have a 30 minute delay after system restarts.

t) Building Static pressure above 0.05 and below -0.005 with 0.0 inwg differential --- alarm @ 0.05 normal at and alarm at 0.0 normal at 70 --- alarm enabled at all times on a 180 second time delay.

u) Chill water supply above 50 with 3 degree differential

2. STANDARD HRU AND EF ALARM

a) Fan Failure --- should reference command

b) Pump Failure --- should reference command

c) Fire Alarm --- alarm enabled at all times

d) Hi Fan Static --- alarm enabled at all times

e) Filter Alarm

f) Low glycol tank alarm --- alarm enable at all times

g) High glycol tank alarm --- alarm enable at all times

h) Damper Status --- smoke dampers controlled by fire alarm system --- alarm enable at all times

i) Damper Status --- smoke and isolation dampers controlled by BAS system --- - alarm disabled when system is shutdown.

j) Heat Recovery loop temp below 50 --- alarm enabled at all times

k) Duct Static pressures should alarm when more than a 1/4 inch off of set point --- alarm disabled when system is shutdown and have a 5 minute delay after system restarts.

l) Fume Hood Alarm --- alarm disabled when system is shutdown

m) Bio Safety Cabinet Alarm --- alarm disabled when system is shutdown

n) Face Velocity Alarm ---- below 80 fpm with 5 fpm differential --- alarm @ 80 normal @ 85

3. STANDARD HOT WATER SYSTEM ALARMS

a) Pump Failure --- should reference command

b) Low steam pressure alarm --- alarm enabled at all times

c) Make up water flow alarm ---- alarm enabled at all times

d) Low system pressure alarm --- alarm disabled when system is shutdown

e) Hot water supply temps should alarm above 200 degrees and should give us a warning if more than 5

f) degrees off of set point for more than 5 minutes - alarm disabled when system is shutdown and have a 15 minute delay after system restarts.

g) System pressures should alarm when more than a 2 PSID off of set point --- alarm disabled when system is shutdown and have a 5 minute delay after system restarts.

4. STANDARD PCHW SYSTEM ALARMS

a) Pump Failure --- should reference command

b) Make up water flow alarm ---- alarm enabled at all times

c) Walk in Cooler temp alarm --- alarm enabled at all times

d) Low system pressure alarm --- alarm disabled when system is shutdown

e) Chill water supply above 50 with 3 degree differential --- alarm @ 50 normal @ 47

f) Process chill water supply temps should alarm above 55 degrees and should give us a warning if more than 5 degree's off of set point for more than 5 minutes - alarm disabled when system is shutdown and have a 15 minute delay after system restarts.

g) System pressures should alarm when more than a 2 PSID off of set point --- alarm disabled when system is shut down and have a 5 minute delay after system restarts.

5. STANDARD BSL-3 LAB ALARMS

a) Fan Failure --- should reference command

b) Supply air flow alarm --- alarm 10% above or below flow set point with 5% differential

c) Exhaust air flow alarm --- alarm 10% above or below flow set point with 5% differential

d) Damper Status --- smoke dampers controlled by fire alarm system --- alarm enable at all times

e) Damper Status --- smoke and isolation dampers controlled by BAS system --- - alarm disabled when system is shutdown.

f) Duct Static pressures should alarm when more than a 1/4 inch off of set point --- alarm disabled when system is shut down and have a 5 minute delay after system restarts.

g) Zone temps below 67 or above 80 with 2 degree differential and no occupancy schedule---- alarm @ 67 normal at 69 and alarm at 80 normal at 78

h) Lab pressures should alarm when more negative than -0.1"w.c. and less negative than -0.01"w.c. for more than 60 seconds.

i) Bio Safety Cabinet Alarm Face Velocity Alarm ---- below 80 fpm with 5 fpm differential --- alarm @ 80 normal @ 85--- alarm disabled when system is shutdown.

6. STANDARD VAV ZONE ALARMS

a) Zone temps below 65 or above 83 with 2 degree differential and an occupancy schedule ---- alarm @ 65 normal at 67 and alarm at 83 normal at 81

b) Zone temps below 67 or above 80 with 2 degree differential and no occupancy schedule---- alarm @ 67 normal at 69 and alarm at 80 normal at 78

c) Supply air flow alarm --- alarm 10% above or below flow set point with 5% differential --- lab boxes only ---alarm disabled when system is shut down and have a 5 minute delay after system restarts.

d) Exhaust air flow alarm --- alarm 10% above or below flow set point with 5% differential --- lab boxes only--- alarm disabled when system is shut down and have a 5 minute delay after system restarts.

e) Space humidity above 60% or below 30% with a 5% differential --- alarm @ 60% normal at 55% and alarm at 30% normal @ 35%--- alarm enabled at all times

f) Box discharge temp below 55 with 2 degree differential --- alarm @ 55 normal @ 57

2.05 OPERATOR INTERFACE TRENDING

{Coordinate with UNC regarding Trending requirement}

A. The LCS shall be able to display historical data in both a tabular and graphical format. The requirements of this trending shall include the following:

B. Provide trends for all physical points, setpoints, other virtual points (as indicated) and calculated variables. A minimum of 80% of the systems AI/AO trends can be active without impacting remote data access performance defined in 230900/I.13/F.

C. In the graphical format, the trend shall plot at least 4 different values for a given time period superimposed on the same graph. The 4 values shall be distinguishable by using unique colors. Displayed trend graphs shall indicate the engineering units for each trended value.

D. The sample rate (up to 5 second interval) and data selection shall be selectable by the operator.

E. The trended value range shall be selectable by the operator.

F. Where trended values on one table/graph are COV, software shall automatically fill the trend samples between COV entries.

G. Trending Requirements: All I/O points on primary equipment shall be trended throughout the Cx process on 10 min. intervals for analog values and change-of-value for binary values. Trends shall include but are not necessarily limited to the following points:

1. Outside air temperature
2. Outside air relative humidity
3. Outside air enthalpy
4. Cooling tons
5. All sensed hydronic temperatures
6. All sensed air temperatures and relative humidity measurements on primary equipment
7. All damper outputs on primary equipment
8. All valve outputs on primary equipment
9. All sensed fan volumes (flow) on primary equipment

10. All inputs and outputs to VSDs
11. Return (or exhaust) air temperature on each air handler
12. All safety indications
13. Status on all primary equipment
14. All air and water pressures on primary equipment or systems
15. Zone temperatures
16. Electricity consumption where monitored.
17. Basically all points on primary equipment and selected sampling of terminal points unless approved otherwise

H. A total of 1 week of data (minimum) shall be stored locally at the controller/ gateway. Older data shall be archived to the central server by the BAS.

I. Data Buffering and Archiving: Trend data shall be buffered at the building BAS gateway, and uploaded to remote storage when archival is desired. Archive shall be capable of storing 14 days of trend data accessible at the operator's interface. Storage and retrieval of the archive shall not impact remote data access performance defined in 230900/I.13/F. All archived trends shall be accessible to the LCS as applicable. Uploads shall occur based upon a user-defined interval, manual command, or automatically when the trend buffers become full.

J. All trends shall be accessed from the user graphic displayed I/O point, not only through a trend menu.

2.06 Operator Interface Equipment Scheduling

{Coordinate with UNC regarding Scheduling requirement}

A. Provide a graphic utility for user-friendly operator interface to adjust equipment-operating schedules.

B. Scheduling feature shall include multiple seven-day master schedules, plus holiday schedule, each with start time and stop time. Master schedules shall be individually editable for each day and holiday.

C. Scheduling feature shall allow for each individual equipment unit to be assigned to one of the master schedules.

D. A yearly calendar feature shall allow assignment of holidays, and automatic reset of system real time clocks for transitions between daylight savings time and standard time.

2.07 Gateway/BPOC

A. Furnish and install all Routers and Gateways/ Building Point of Connection (BPOC) gateways as required for the BAS to function locally. One VLAN connection will be provided to the LCS for connectivity of the OI.

2.08 Submittals

A. **Electronic Submittals**: While all requirements for hard copy submittal apply, these control submittals shall also be provided in electronic format as follows:

1. **Graphic Files**: Graphic drawings shall be provided on electronic media as an Acrobat PDF. Each unique graphic shall be represented one time. This submittal must be approved by the ***Owner*** **60 days** prior to the operator interface installation and/or the start of commissioning activities (whichever comes first).

B. Submit BAS User's Guides (Operating Manuals) and BAS Advanced Programming Manuals for all workstation software not installed by UNC.

PART 3. EXECUTION

3.01 INSTALLATION

A. Set up the workstation (OI) as indicated on the drawings. Install all software and verify that the systems are fully operational. Ensure licensing is provided for all software.

B. No license, software component, key, etc or any piece of information required to install, configure, operate, diagnose and maintain the system shall be withheld.

C. Set up portable operator terminal and configure it as the remote workstation. Install all software and verify that the system is fully operational.

D. Install systems and materials in accordance with manufacturer's instructions.

END OF SECTION 230906