SECTION 25 15 00 – bas software and programming

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.
          2. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
          3. Section 23 05 13 Variable Frequency Drives
       2. SUMMARY
          1. Section Includes:

System Software.

Programming Description.

Control Algorithms.

Energy Management Applications.

Password Protection.

Alarm Reporting.

Trending.

Data Acquisition and Storage.

Point Structuring.

Dynamic Color Graphics.

* + - * 1. BJC Healthcare BAS controls are Johnson Metasys© systems.
        2. Fully configure systems and furnish and install all software, programming and dynamic color graphics for a complete and fully functioning system as specified.
        3. Refer to Section 25 00 00 - Building Automation System (BAS) General for general requirements as well as requirements for interface with Owner’s WAN.
      1. REFERENCE STANDARDS
         1. BJC Healthcare BAS Configuration Guide.
         2. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
         3. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
         4. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.

1. PRODUCTS
   * + 1. Point structuring and naming
          1. General:

The intent of this Section is to require a consistent means of naming points across the Owner’s WAN. Configure the systems from the perspective of the Owner’s WAN, not solely the local Project.

The following requirement establishes a standard for naming points and addressing Buildings, Networks, Devices, Instances, and the like.

The convention is tailored towards the Owner’s WAN and as such, the interface shall always use this naming convention.

Native BACnet systems shall also use this naming convention. For non-BACnet systems, the naming convention shall be implemented as much as practical, and any deviations from this naming convention shall be approved by the Owner.

Each controller shall have English language descriptors for all system points, variables, parameters etc. located and accessible from the controller memory. All point naming shall match between all system files and record documents.

* + - * 1. Point Summary Table:

The BAS Provider shall coordinate with the Owner’s Building Automation System department to compile and submit a proposed Point Summary Table for review prior to any object programming or project startup. The Contractor shall support and not impede direct negotiations between the BAS Provider and the Owner to allow the customizing necessary for structuring the BAS point names to meet the Owner’s needs. The B. Contactor shall ensure final BAS point names have the approval of the Owner’s Manager of Building Automation System prior to any object programming or project startup.

The Point Summary Table shall be kept current throughout the duration of the Project by the Contractor as the Master List of all points for the Project. Project closeout documents shall include an up-to-date accurate Point Summary Table. The Contractor shall deliver to the Owner the final Point Summary Table prior to final acceptance of the system. The Point Summary Table shall be used as a reference and guide during the commissioning process.

* + - * 1. Point Naming Convention

All proposed point names shall follow current edition of the BJC BAS Programming Guide. Deviations from the Guide shall be pre-approved in writing by the BJC Remote Operations Center (ROC) Manager.

* + - * 1. Device Addressing Convention:
      1. GENERAL
         1. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
      2. SYSTEM SOFTWARE-GENERAL
         1. Functionality and Completeness: Contractor shall furnish and install all software and programming necessary to provide a complete and functioning system as specified. Contractor shall include all software and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with these Specifications.
         2. Configuration: The software shall support the system as a distributed processing network configuration.
      3. Controller SOFTWARE
         1. Stand Alone Capability: NAE Series Supervisory Controller shall continue to perform all functions independent of a failure in other NAE’s Trends and runtime totalization shall be retained in memory. Runtime totalization shall be available on all digital input points that monitor electric motor status. Refer also to Section 25 14 00 for other aspects of stand alone functionality.
         2. Network Communications: Each controller shall include software/firmware that supports the networking of CUs on a common communications trunk that forms the respective LAN. Network support shall include the following:

Supervisory Controller/Primary LAN shall be a high-speed network designed and optimized for control system communication. If a Primary LAN communications trunk is severed, Supervisory Controllerscontinue operations without interruption or Operator intervention.

Controller communication software shall include error detection, correction, and re-transmission to ensure data integrity.

Operator/System communication software shall facilitate communications between other NAE Series Supervisory Controllers, all subordinate Field Controllers, Gateways and LAN Interface Devices or Operator Workstations. Software shall allow point interrogation, adjustment, addition/deletion, and programming while the controller is on line and functioning without disruption to unaffected points. The software architecture shall allow networked controllers to share selected physical and virtual point information throughout the entire system.

* + - * 1. Point Database/Summary Table:

See BJC Healthcare Controls Configuration Guide..

* + - * 1. Diagnostic Software: Controller software shall include diagnostic software that checks memory and communications and reports any malfunctions
        2. Alarm/Messaging Software: Controller software shall support alarm/message processing and buffering software as more fully specified below.
        3. Application Programs: CUs shall support and execute application programs as more fully specified below:

All Direct Digital Control software, Energy Management Control software, and functional block application programming software templates shall be provided in a ‘ready-to-use’ state, and shall not require (but shall allow) Owner programming.

Line programs shall supply preprogrammed functions to support these energy management and functional block application algorithms. All functions shall be provided with printed narratives and/or flow diagrams to document algorithms and how to modify and use them.

* + - * 1. Direct Digital Control: Controller shall support application of Direct Digital Control Logic. All logic modules shall be provided pre-programmed with written documentation to support their application. Provide the following logic modules as a minimum:

Proportional-Integral-Derivative (PID) control with analog, PWM and floating output.

Two Position control (Hi or Low crossing with deadband).

Single-Pole Double-Throw relay.

Delay Timer (delay-on-make, delay-on-break, and interval).

Hi/Low Selection.

Reset or Scaling Module.

* + - * 1. Psychrometric Parameters: Controller software shall provide preprogrammed functions to calculated and present psychrometric parameters (given temperature and relative humidity) including the following as a minimum: Enthalpy, Wet Bulb Temperature.
        2. Updating/Storing Application Data: Site-specific programming residing in volatile memory shall be uploadable/downloadable from an OWS or CSS connected locally, to the Primary LAN, to the Local Supervisory LAN and remotely via the internet and modem and telephone lines as applicable but all must be available. Initiation of an upload or download shall include all of the following methods; Manually, Scheduled, and Automatically upon detection of a loss or change.
        3. Restart: System software shall provide for orderly shutdown upon loss of power and automatic restart upon power restoration. Volatile memory shall be retained; outputs shall go to programmed fail (open, closed, or last) position. Equipment restart shall include a user definable time delay on each piece of equipment to stagger the restart. Loss of power shall be alarmed at operator interface indicating date and time.
        4. Time Synchronization: Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device, devices on a single network, or all devices simultaneously. Automatic time synchronization shall be provided.
        5. Miscellaneous Calculations: System software shall automate calculation of psychometric functions, calendar functions, kWh/kW, and flow determination and totalization from pulsed or analog inputs, curve-fitting, look-up table, input/output scaling, time averaging of inputs and conversion coefficients.
      1. Application PROGRAMMING DESCRIPTION
         1. The application software shall be user programmable.
         2. This Specification generally requires a programming convention that is logical, easy to learn, use, and diagnose. General approaches to application programming shall be provided by one, or a combination, of the following conventions:

Point Definition: provide templates customized for point type, to support input of individual point information. Use standard BACnet Objects as applicable.

Graphical Block Programming: Manipulation of graphic icon ‘blocks’, each of which represents a subroutine, in a functional/logical manner forming a control logic diagram.

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Line Programming: Textual syntax-based programming in a language similar to BASIC designed specifically for HVAC control. Subroutines or functions for energy management applications, setpoints, and adjustable parameters shall be customizable, but shall be provided preprogrammed and documented.

* + - * 1. Provide a means for testing and/or debugging the control programs both off-line and on-line.
      1. ENERGY MANAGEMENT APPLICATIONS
         1. **[Edit following list per direction from BJC ROC Manager]** System shall have the ability to perform all of the following energy management routines via preprogrammed function blocks or template programs. As a minimum provide the following whether or not required in the software:

Time-of-Day Scheduling.

Calendar-Based Scheduling.

Holiday Scheduling.

Temporary Schedule Overrides.

Optimal Start/Optimal Stop-based on space temperature offset, outdoor air temperature, and building heating and cooling capacitance factors as a minimum.

Night Setback and Morning Recovery Control, with ventilation only during occupancy.

Economizer Control (enthalpy or dry-bulb).

Peak Demand Limiting / Load Shedding.

Dead Band Control.

* + - * 1. All programs shall be executed automatically without the need for operator intervention.
      1. ALARM and Event Management REPORTING
         1. Alarm management shall be provided to monitor, buffer, and direct alarms and messages to operator devices and memory files. Each NAE shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall a NAE’s ability to report alarms be affected by either operator activity at an Operator Workstation or local handheld device, or by communications with other panels on the network.

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.

Alarm Prioritization:

The software shall allow users to define the handling and routing of each alarm by their assignment to discrete priority levels.

A minimum of ten (10) priority levels shall be provided.

All alarms shall display at the appropriate workstation alarm screen and each shall be assigned with the correct color and numeric value of priority.

Attention needs to be considered where instantaneous on / off alarms may occur and defined as being nuisance alarms. These types of alarms that activate and deactivate in a short time period shall be delayed or enhanced in such a way to prevent them from becoming nuisance alarms.

Users shall have the ability to manually inhibit alarm reporting for each individual alarm and for each priority level. Contractor shall coordinate with the Owner on establishing alarm priority definitions.

Alarm Report Routing: Each alarm shall be associated with a priority level and unique user-defined list of operator devices including any combination of local or remote workstations, printers, workstation disk files, e-mail addresses, and pagers. All alarms associated with a given priority level shall be routed to all operator devices on the user-defined list associated with that priority level.

Alarm Acknowledgment: For alarm priority levels that are directed to a workstation screen, 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 workstation hard disk.

* + - * 1. 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; based on the particular event algorithm (e.g., change of value, change of state, out of range, and so on); alarm priority; and notification class.
        2. Alarming Services:

All alarms and events shall be implemented using standard BACnet event detection and notification mechanisms. The workstation shall receive BACnet alarm and event notifications from any gateway or BACnet controller in the system and display them to an operator.

The alarm shall be linked to the system graphic it corresponds to. Either intrinsic reporting or algorithmic change reporting may be used but the intrinsic reporting method is preferred.

The workstation shall also log alarms and events, provide a way for an operator with sufficient privilege to acknowledge alarms, and log acknowledgements of alarms. It shall be possible for an operator to receive, at any time, a summary of all alarms that are currently in effect at any Site whether or not they have been acknowledged. Operators shall also be able to view and change alarm limits for any alarm at the appropriate password level

* + - * 1. Submit all alarms per Section 25 00 00.
      1. TRENDING
         1. The software shall display historical data in both a tabular and graphical format. The requirements of this trending shall include the following:

Provide trends for all physical points, virtual points and calculated variables.

BACnet Trend Objects are required and all trend data shall be stored in relational database format as specified in herein under Data Acquisition and Storage.

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

The trended value minumum range shall be per BJC BAS Programming Manual.

Where trended values on one table/graph are COV, s.

* + - * 1. Data Buffering and Archiving: Trend data shall be buffered at the Supervisory Controller, All archived trends shall be transmitted to the on-Site OWS or Supervisory COntroller as applicable. Uploads shall occur based upon a user-defined interval, manual command, or automatically when the trend buffers become full.
        2. Time Synchronization: Provide a time master that is installed and configured to synchronize the clocks of all BACnet devices supporting time synchronization. Synchronization shall be done using Coordinated Universal Time (UTC). All trend sample times, both BACnet and LonTalk, shall be able to be synchronized. The frequency of time synchronization message transmission shall be selectable by the operator.
        3. Submit all Trends per Section 25 00 00.
      1. Data acquisition and Storage
         1. All points included in the typical equipment point list must be represented in a common, open or accessible format. All points should be provided as BACnet standard analog, binary, schedule, or trend objects. Naming conventions for these points and network addressing are discussed in the ‘Point Naming Conventions’ paragraph below.
         2. Repository shall be enabled for all trends on major equipment
      2. TOTALIZATION
         1. The software shall support totalizing analog, digital, and pulsed inputs and be capable of accumulating, storing, and converting these totals to engineering units used in the documents. These values shall generally be accessible to the Operator Interfaces to support management-reporting functions.
         2. Totalization of electricity use/demand shall allow application of totals to different rate periods, which shall be user definable.
         3. When specified to provide electrical or utility Use/Demand, the Contractor shall obtain from the local utility all information required to obtain meter data, including k factors, conversion constants, and the like.
      3. EQUIPMENT SCHEDULING
         1. Provide a graphic utility for user-friendly operator interface to adjust equipment-operating Setpoints.
         2. All operators shall be able to view the entries for a schedule. Operators with sufficient privilege shall be able to modify schedule entries from any workstation.
         3. 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.
         4. Scheduling feature shall allow for each individual equipment unit to be assigned to one of the master schedules.
         5. Timed override feature shall allow an operator to temporarily change the state of scheduled equipment. An override command shall be selectable to apply to an individual unit, all units assigned to a given master schedule, or to all units in a building. .
         6. 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.
      4. Point structuring and naming
         1. Per BJC Healthcare BAS Configuration Guide.
         2. Point Summary Table:

The term ‘Point’ is a generic description for the class of object represented by analog and binary inputs, outputs, and values.

Point Summary Table shall be per the BJC Healthcare BAS Configuration Guide.

Additional fields for non-BACnet systems shall be appended to each row. Point Summary Table shall be provided in both hard copy and in electronic format (ODBC-compliant).

The BAS Provider shall coordinate with the Owner’s representative to compile and submit a proposed Point Summary Table for review prior to any object programming or Project startup. The Contractor shall support and not impede direct negotiations between the BAS Provider and the Owner to allow the customizing necessary for structuring the BAS point names to meet the Owner’s needs. The Owner shall grant approval of final point names to be verified through Commissioning by issuing the approved alarms to the Contractor.

* + - * 1. Point Naming Convention: All point names shall adhere to the format as established in the BJC Healthcare BAS Configuration Guide.
        2. Device Addressing Convention: Per BJC BAS Programming Manual.
      1. OPERATOR INTERFACE GRAPHIC SOFTWARE
         1. 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.
         2. Graphic software shall support multiple simultaneous screens to be displayed and resizable in a ‘Windows’-like environment. All functions excepting text entry functions shall be executable with a mouse.
         3. Graphic software shall provide for multitasking such that third-party programs can be used while the OWS software is on line. Software shall provide the ability to alarm graphically even when operator is in another software package.
         4. The software shall allow for Owner creation of user-defined, color graphic displays of geographic maps, building plans, floor plans, and mechanical and electrical system schematics. These graphics shall be capable of displaying all point information from the database including any attributes associated with each point (i.e., engineering units, etc.). In addition, operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse
         5. Screen Penetration: The operator interface shall allow users to access the various system graphic screens via a graphical penetration scheme by using the mouse to select from menus or ‘button’ icons. Each graphic screen shall be capable of having a unique list of other graphic screens that are directly linked through the selection of a menu item or button icon.
         6. Dynamic Data Displays: Dynamic physical point values shall automatically updated at a minimum frequency of six (6) updates per minute without operator intervention. Point value fields shall be displayed with a color code depicting normal, abnormal, override and alarm conditions.
         7. 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. 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.
         8. Submit all Graphics per Section 25 00 00.
         9. Dynamic Symbols: Provide a selection of standard symbols that change in appearance based on the value of an associated point.

Analog symbol: Provide a symbol that represents the value of an analog point as the length of a line or linear bar.

Digital symbol: Provide symbols such as switches, pilot lights, rotating fan wheels, etc. to represent the value of digital input and output points.

Point Status Color: Graphic presentations shall indicate different colors for different point statuses. (For instance, green = normal, red = alarm, gray (or ‘???’) for non-response.

1. EXECUTION
   * + 1. SYSTEM CONFIGURATION
          1. Contractor shall thoroughly and completely configure BAS system software, supplemental software, network communications, CSS, OWS, remote operator workstation, portable operators terminal, printer, and remote communications.
       2. SITE-SPECIFIC APPLICATION PROGRAMMING
          1. Provide all database creation and Site-specific application control programming as required by these Specifications, national and local standards and for a fully functioning system. Provide all initial Site-specific application programming and thoroughly document programming. Generally meet the intent of the written sequence of operation. It is the Contractor’s responsibility to request clarification on sequence issues that require such clarification.
          2. All programming, graphics and data files must be maintained in a logical system of directories. All file names shall adhere to the naming convention format as established in the Owner’s Standard Acronyms documentation. All files developed for the Project will be the property of the Owner and shall remain on the workstation(s)/server(s) at the completion of the Project.
       3. POINT PARAMETERS
          1. Provide the following minimum programming for each analog input:

Name.

Address.

Scanning frequency or COV threshold.

Engineering units.

Offset calibration and scaling factor for engineering units.

High and low alarm values and alarm differentials for return to normal condition.

High and low value reporting limits (reasonableness values), which shall prevent control logic from using shorted or open circuit values.

Default value to be used when the actual measured value is not reporting. This is required only for points that are transferred across the primary and/or secondary controlling networks and used in control programs residing in control units other than the one in which the point resides. Events causing the default value to be used shall include failure of the control unit in which the point resides, or failure of any network over which the point value is transferred.

Selectable averaging function that shall average the measured value over a user selected number of scans for reporting.

* + - * 1. Provide the following minimum programming for each analog output:

Name.

Address.

Output updating frequency.

Engineering units.

Offset calibration and scaling factor for engineering units.

Output Range.

Default value to be used when the normal controlling value is not reporting.

* + - * 1. Provide the following minimum programming for each digital input:

Name.

Address.

Engineering units (on/off, open/closed, freeze/normal, etc.).

Debounce time delay.

Message and alarm reporting as specified.

Reporting of each change of state, and memory storage of the time of the last change of state.

Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

* + - * 1. Provide the following minimum programming for each digital output:

Name.

Address.

Output updating frequency.

Engineering units (on/off, open/closed, freeze/normal, etc.).

Direct or Reverse action selection.

Minimum on-time.

Minimum off-time.

Status association with a DI and failure alarming (as applicable).

Reporting of each change of state, and memory storage of the time of the last change of state.

Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

Default value to be used when the normal controlling value is not reporting.

* + - 1. Trends
         1. Contractor shall establish and store trend logs. Trend logs shall be prepared for each physical input and output point, and all dynamic virtual points such as setpoints subject to a reset schedule, intermediate setpoint values for cascaded control loops, and the like as directed by the Owner.
         2. The Owner will analyze trend logs of the system operating parameters to evaluate normal system functionality. Contractor shall establish these trends and ensure they are being stored properly.

Data shall include a single row of field headings and the data thereafter shall be contiguous. Each record shall include a date and time field or single date stamp. Recorded parameters for a given piece of equipment or component shall be trended at the same intervals and be presented in a maximum of two separate 2-dimensional formats with time being the row heading and field name being the column heading.

* + - * 1. Binary Point Sample times indicated as COV (±) or change-of-value mean that the changed parameter only needs to be recorded after the value changes by the amount listed. When output to the trending file, the latest recorded value shall be listed with any given time increment record. The samples shall be filled with the latest values also if the points include different time intervals.
        2. Trending intervals or COV thresholds shall be dictated by the Owner upon system start-up.
        3. The Contractor shall demonstrate functional trends as specified for a period of 30 days after successful system demonstration before final acceptance of the system.
      1. TREND Graphs
         1. Prepare controller and workstation software to display graphical format trends. Trended values and intervals shall be the same as those specified
         2. Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.
         3. Indicate engineering units of the y-axis values; e.g. degrees F., inches w.g., Btu/lb, percent open, etc.
         4. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.
         5. Trend outside air temperature, humidity, and enthalpy during each period in which any other points are trended.
         6. All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period.
         7. Each graph shall be clearly labeled with HVAC subsystem title, date, and times.

[Engineer must edit the following to be Project specific.]

* + - 1. ALARMS
         1. This Section supersedes and over rules all references to building automation alarms in the Contract Documents, including all sequences of operations and other sections of the BAS Specification in regards to alarms. The Contractor shall support and not impede direct negotiations between the BAS Provider and the Owner to allow the customizing necessary for customizing alarms and alarm parameters to meet the Owner’s needs.
         2. The BAS Provider is required to submit a point summary to confirm building automation point names as specified herein The BAS Provider shall submit this point summary with the addition of identifying all alarms which includes detail information on the alarm parameters to the BJC ROC Manager for approval prior to the beginning of any Commissioning process of the building automation system.
         3. The BJC ROC Manager will provide the format form to the BAS Provider upon request. The Owner shall grant approval of alarms to be verified through Commissioning by issuing the approved alarms to the Contractor. The approved alarms issued to the Contractor shall be used for the Functional Test Procedures alarms tested. The Contractor shall initiate the start of this process immediately after building automation submittal have been approved and monitor the progress to ensure the construction schedule is not delayed.
         4. Analog Input Alarms:

Duct Static Pressure:

Alarm @ +(-) 0.3 inches from set point for 5 minutes

Normal @ +(-) 0.2 inches from set point for 5 minutes.

Alarm is active after fan is proven ON for the minimum time necessary to allow the sensor to be within the alarm parameter.

Alarm is deactivated after fan is proven OFF.

Duct Air Temperatures:

Alarm @ +(-) 5.0 degrees F from set point for 5 minutes

Normal @ +(-) 3.0 degrees F from set point for 5 minutes.

Alarm is active after fan is proven ON for the minimum time necessary to allow the sensor to be within the alarm parameter.

Alarm is deactivated after fan is proven OFF.

Space or Room Temperature:

Typically will not be alarmable.

Duct or Space Humidity:

Alarm @ (+) 15 percent from set point (60 percent) for 5 minutes @ Priority 3.

Alarm @ (-) 20 percent from set point (60 percent) for 5 minutes @ Priority 3.

Normal @ 5 percent from offset alarm parameters for 5 minutes.

Point is always ready to alarm.

Water temperature sensors which are inputs to control loops:

Submit reasonable alarm parameter to prevent nuisance alarming

Owner will confirm alarm.

All other Analog Inputs:

BAS Provider shall utilize their expertise and recommend not less than three (3) analog input alarms which protect the Owner’s best interests.

Identify recommended alarms in submittal.

Owner will confirm alarm.

* + - * 1. Digital Inputs Alarms:

Proofs (current sensor, air flow switches, water differential pressure switches etc).

Digital inputs paired with BAS digital output will have the ability to alarm at all times.

Alarm will delay for the reason time needed when the state of the digital output changes to prevent nuisance alarms.

Point in alarmed condition when the value of the digital input does not equal the value of the digital output after the time delay.

Point is in the Normal condition when the value of the digital input equals the value of the digital output after the time delay.

Digital input proofs without a paired digital output shall not alarm and be for monitoring purposes only.

Safeties (high static cutout, freeze condition, excessive vibration, high humidity cutout, VFD fault, etc.).

The digital input shall be always ready to alarm without delay.

The digital input shall display “ALARM” at Priority 3 at the Alarm screen when activated.

The digital input shall display “NORMAL” at the Alarm screen when deactivated.

Monitoring Digital Inputs (auxiliary drain pan alarm, Liebert Unit general alarm, water detector, etc) the exception is air filter differential pressure switch.

All digital inputs which “deactivated” is the normal state of planed operations shall alarm when the normal state of planed operation changes.

The digital input shall display “ALARM” at the Alarm screen when activated.

The digital input shall display “NORMAL” at the Alarm screen when deactivated.

Air Filters:

The digital input shall display “DIRTY” when activated.

The digital input shall display “CLEAN” when deactivated

* + - * 1. Analog Outputs Alarms:

All Analog Outputs:

BAS Provider shall utilize their expertise and recommend any analog output alarms which protect the Owner’s best interests.

Owner will confirm any alarms.

* + - * 1. Digital Outputs Alarms:

Refer to digital inputs paired with digital outputs as specified herein.

All Digital Outputs:

BAS Provider shall utilize their expertise and recommend any digital output alarms which protect the Owner’s best interests.

Identify recommended alarms in submittal.

Owner will confirm any alarms.

* + - * 1. Nuisance Alarms: All alarms which have been identified by the Owner as a nuisance alarm due to numerous times in and out of alarm, shall be addressed and corrected by the Contractor in a manner that the Owner has approved.
        2. See requirements for additional equipment-specific alarms specified in the Contract Documents.
      1. GRAPHIC SCREENS

[Engineer must provide electronic control design floor plans.]

* + - * 1. Floor Plan Screens: The Contract Document Drawings will be made available to the Contractor in AutoCAD LT 2002 format upon request. These Drawings may be used only for developing backgrounds for specified graphic screens; however the Owner does not guarantee the suitability of these Drawings for the Contractor’s purpose. Graphic Screens shall be submitted for approval.

Provide graphic floor plan screens for each floor [wing] [tower] [other] of each building.

Indicate the location of all equipment that is not located on the equipment room screens.

Indicate the location of temperature sensors associated with each temperature-controlled zone (i.e., VAV terminals, fan-coils, single-zone AHUs, etc.) on the floor plan screens.

Use a distinct line symbol to demarcate each terminal unit zone boundary. Use distinct colors to demarcate each air handling unit zone.

Mechanical floor plan Drawings will be made available to the Contractor upon request for the purpose of determining zone boundaries. Indicate room numbers as provided by the Owner.

Provide a drawing link from each space temperature sensor symbol and equipment symbol shown on the graphic floor plan screens to each corresponding equipment schematic graphic screen.

Provide graphic floor plan screens for each mechanical equipment room and a plan screen of the roof. Indicate the location of each item of mechanical equipment. Provide a drawing link from each equipment symbol shown on the graphic plan view screen to each corresponding mechanical system schematic graphic screen.

If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link graphic building key plan to larger scale partial floor plans. Provide links from each larger scale graphic floor plan screen to the building key plan and to each of the other graphic floor plan screens.

Provide a graphic Site plan with links to and from each building plan.

* + - * 1. System Schematic Screens: Provide graphic system schematic screen for each HVAC subsystem controlled with each I/O point in the Project appearing on at least one graphic screen. System graphics shall include flow diagrams with status, setpoints, current analog input and output values, operator commands, etc. as applicable. General layout of the system shall be schematically correct. Input/output devices shall be shown in their schematically correct locations. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the mouse. Indicate all adjustable setpoints on the applicable system schematic graphic screen or, if space does not allow, on a supplemental linked-setpoint screen.

Provide graphic screens for each air handling system. Indicate outside air temperature and enthalpy, and mode of operation as applicable (i.e., occupied, unoccupied, warm-up, cool-down). Link screens for air handlers to the heating system and cooling system graphics. Link screens for supply and exhaust systems if they are not combined onto one screen.

Provide a graphic screen for each zone. Provide links to graphic system schematic screens of air handling units that serve the corresponding zone.

Provide a cooling system graphic screen showing all points associated with the chillers, cooling towers and pumps. Indicate outside air dry-bulb temperature and calculated wet-bulb temperature. Link screens for chilled water and condenser water systems if they cannot fit onto one cooling plant graphic screen.

Link screens for heating and cooling system graphics to utility history reports showing current and monthly electric uses, demands, peak values, and other pertinent values.

Water coils on graphic flow diagrams shall indicate percentage of capacity by color (red for hot, blue for Cold)

* + - * 1. Alarms: Each programmed alarm shall appear on at least one graphic screen. In general, alarms shall be displayed on the graphic system schematic screen for the system that the alarm is associated with (for example, chiller alarm shall be shown on graphic cooling system schematic screen). For all graphic screens, display analog values that are in a ‘high alarm’ condition in a red color, ‘low alarm’ condition in a blue color. Indicate digital values that are in alarm condition in a red color.

END OF SECTION 25 15 00