SECTION 15900

TEMPERATURE CONTROLS

1. PART 1 - GENERAL

1.1. SUMMARY

1.1.1. Furnish all labor, materials, equipment, and service necessary for a complete and operating temperature control system, utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.

1.1.2.

1.1.3. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

1.1.4.

1.1.5. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.2. SYSTEM DESCRIPTION

1.2.1. The entire temperature control System shall be comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark/LonTalk communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be manufactured by Honeywell. Equivalent LonWorks products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.

1.2.2. The Temperature Control System as provided in this Division shall be based on the Honeywell WEBs-AX System incorporating the Niagara Framework™. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara Framework platform are unacceptable.

1.3. SUBMITTAL

1.3.1. Eight copies of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.

1.3.2. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.

1.3.3. Submittal shall also include a complete point list of all points to be connected to the temperature control system. Controls Contractor shall provide necessary point lists, protocol documentation, and factory support information for systems provided.

1.3.4. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner.

1.3.5. Include the following display graphics for each of the sites:

1.3.5.1. Site plan view of entire campus identifying each building – include the display of outside air temperature & humidity.

1.3.5.2. Individual buildings, including room layout with display of all space temperatures and occupied mode, outside air temperature & humidity.

1.3.5.3. Mechanical equipment display for each AC unit to include space temperature, heating and cooling setpoints, supply air temperature, fan status, occupied mode, outside temperature & humidity.

1.3.5.4. Boiler and hot water pumps showing all related points.

1.3.5.5. Page showing all room temperatures, room temperature setpoints, occupied mode, AC unit fan status and AC unit mode (heating or cooling).

1.3.5.6. Page showing all miscellaneous points.

1.3.6. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Controls Contractor shall provide as-builts for their portions of work.

1.4. SPECIFICATION NOMENCLATURE

1.4.1. Acronyms used in this specification are as follows:

1.4.1.1. NAC Network Area Controller

1.4.1.2. IDC Interoperable Digital Controller

1.4.1.3. IBC Interoperable BACnet Controller

1.4.1.4. GUI Graphical User Interface

1.4.1.5. WBI Web Browser Interface

1.4.1.6. POT Portable Operator's Terminal

1.4.1.7. PMI Power Measurement Interface

1.4.1.8. DDC Direct Digital Controls

1.4.1.9. LAN Local Area Network

1.4.1.10. WAN Wide Area Network

1.4.1.11. OOT Object Oriented Technology

1.4.1.12. PICS Product Interoperability Compliance Statement

1.5. AGENCY AND CODE APPROVALS

1.5.1. All products of the temperature control system shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1.5.1.1. UL-916; Energy Management Systems

1.5.1.2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "signal Equipment"

1.5.1.3. CE

1.5.1.4. FCC, Part 15, Subpart J, Class A Computing Devices

1.6. SOFTWARE LICENSE AGREEMENT

1.6.1. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

1.6.2. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner. The owner shall determine which organizations to be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.8. JOB CONDITIONS

1.8.1. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

2. PART 2 - MATERIALS

2.1. ACCEPTABLE CONTROL MANUFACTURER/CONTRACTOR

2.1.1. Honeywell "Authorized Controls Integrator" – R & R Controls Inc.

4564 B Alvarado Canyon Road

San Diego, CA 92120

619-516-1880 Office

619 516-1881 Fax

2.2. GENERAL

2.2.1. The temperature control system shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein. All systems and software within temperature control system shall be Year 2000 compliant and shall be supported by compliance documentation from the manufacturer.

2.2.2. The installed system shall provide secure password access to all features, functions and data contained in the overall temperature control system.

2.3. OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

2.3.1. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

2.3.2. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

2.3.3. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

2.3.4. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

2.3.5. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

2.3.5.1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.

2.3.5.2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4. NETWORKS

2.4.1. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

2.4.2. Local area network minimum physical and media access requirements:

2.4.2.1. Ethernet; IEEE standard 802.3

2.4.2.2. Cable; 100 Base-T, UTP-8 wire, category 5

2.4.2.3. Minimum throughput; 100 Mbps.

2.5. NETWORK ACCESS

2.5.1. Remote Access. - For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.6. NETWORK AREA CONTROLLER (NAC)

2.6.1. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

2.6.1.1. Calendar functions

2.6.1.2. Scheduling

2.6.1.3. Trending

2.6.1.4. Alarm monitoring and routing

2.6.1.5. Time synchronization

2.6.1.6. Integration of LonWorks controller data and BACnet controller data

2.6.1.7. Network Management functions for all LonWorks based devices

2.6.2. The Network Area Controller must provide the following hardware features as a minimum:

2.6.2.1. One Ethernet Port – 10/100 Mbps

2.6.2.2. One RS-232 port

2.6.2.3. One LonWorks Interface Port – 78KB FTT-10A

2.6.2.4. One RS-485 ports

2.6.2.5. Battery Backup

2.6.2.6. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)

2.6.2.7. The NAC must be capable of operation over a temperature range of 32 to 122°F

2.6.2.8. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F

2.6.2.9. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

2.6.3. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

2.6.4. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

2.6.5. Event Alarm Notification and actions

2.6.5.1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

2.6.5.2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.

2.6.5.3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to: Alarm, Return to normal, Fault and Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.

2.6.6. Provide timed (schedule) routing of alarms by class, object, group, or node.

2.6.7. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

2.6.8. Control equipment and network failures shall be treated as alarms and annunciated.

2.6.9. Alarms shall be annunciated in any of the following manners as defined by the user:

2.6.9.1. Screen message text

2.6.9.2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on: Day of week, Time of day and Recipient.

2.6.9.3. Pagers via paging services that initiate a page on receipt of email message

2.6.9.4. Graphic with flashing alarm object(s)

2.6.9.5. Printed message, routed directly to a dedicated alarm printer

2.6.10. The following shall be recorded by the NAC for each alarm (at a minimum):

2.6.10.1. Time and date

2.6.10.2. Location (building, floor, zone, office number, etc.)

2.6.10.3. Equipment (air handler #, access way, etc.)

2.6.10.4. Acknowledge time, date, and user who issued acknowledgement.

2.6.10.5. Number of occurrences since last acknowledgement.

2.6.11. Alarm actions may be initiated by user defined programmable objects created for that purpose.

2.6.12. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

2.6.13. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

2.6.14. Provide a "query" feature to allow review of specific alarms by user-defined parameters.

2.6.15. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

2.6.16. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.7. DATA COLLECTION AND STORAGE

2.7.1. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

2.7.2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

2.7.2.1. Designating the log as interval or deviation.

2.7.2.2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

2.7.2.3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.

2.7.2.4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.

2.7.2.5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

2.7.3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.

2.7.4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

2.7.5. All log data shall be available to the user in the following data formats:

2.7.5.1. HTML

2.7.5.2. XML

2.7.5.3. Plain Text

2.7.5.4. Comma or tab separated values

2.7.6. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

2.7.7. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:

2.7.7.1. Archive on time of day

2.7.7.2. Archive on user-defined number of data stores in the log (buffer size)

2.7.7.3. Archive when log has reached it's user-defined capacity of data stores

2.7.7.4. Provide ability to clear logs once archived

2.8. AUDIT LOG

2.8.1. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

2.8.1.1. Time and date

2.8.1.2. User ID

2.8.1.3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.9. DATABASE BACKUP AND STORAGE

2.9.1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

2.9.2. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

2.9.3. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.10. INTEROPERABLE DIGITAL CONTROLLER (IDC)

2.10.1. Controls shall be Honeywell Excel 10 microprocessor based Interoperable LonWorks Controllers (IDC) or approved equal. Where possible, all Interoperable Digital Controllers shall bear the applicable LonMark™ interoperability logo on each product delivered.

2.10.2. HVAC control shall be accomplished using LonMark™ based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each LonWorks / LonMark controller defining the programming or setup of each device. The Controls Contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.

2.10.3. The Controls Contractor shall run the LonWorks network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC to ensure that maximum network wiring distances, as specified by the LonWorks wiring guidelines, are not exceeded. A maximum of 126 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.

2.10.4. The Network Area Controller (NAC) will provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.

2.10.5. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

2.10.6. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

2.10.7. The Controls Contractor supplying the IDC's shall provide documentation for each device, with the following information at a minimum:

2.10.7.1. Network Variable Inputs (nvi's); name and type

2.10.7.2. Network Variable Outputs (nvo's); name and type

2.10.7.3. Network configuration parameters (nci, nco); name and type

2.10.8. It is the responsibility of the Division 15 contractor to ensure that the proper Network Variable Inputs and Outputs (nvi and nvo) are provided in each IDC, as required by the point charts.

2.10.9. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.11. GRAPHICAL USER INTERFACE SOFTWARE

2.11.1. Operating System: *WEBSTATION-AX*™

2.11.2. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

2.11.3. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

2.11.3.1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.

2.11.3.2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.

2.11.3.3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.

2.11.3.4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.

2.11.3.5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

2.11.3.6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

2.11.4. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

2.11.4.1. Create, delete or modify control strategies.

2.11.4.2. Add/delete objects to the system.

2.11.4.3. Tune control loops through the adjustment of control loop parameters.

2.11.4.4. Enable or disable control strategies.

2.11.4.5. Generate hard copy records or control strategies on a printer.

2.11.4.6. Select points to be alarmable and define the alarm state.

2.11.4.7. Select points to be trended over a period of time and initiate the recording of values automatically.

2.11.5. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

2.11.6. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

2.11.7. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

2.11.8. Alarm Console

2.11.8.1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.

2.11.8.2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.12. WEB BROWSER CLIENTS

2.12.1. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

2.12.2. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.

2.12.3. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

2.12.4. The Web browser client shall support at a minimum, the following functions:

2.12.4.1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

2.12.4.2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

2.12.4.3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

2.12.4.4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

2.12.4.5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.

2.12.4.6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

View logs and charts

View and acknowledge alarms

Setup and execute SQL queries on log and archive information

2.12.4.7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

2.12.4.8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.13. SERVER FUNCTIONS AND HARDWARE

2.13.1. The WEBSTATION -AX™ central server shall be installed in the Maintenance Office. The server shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.

2.13.2. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.

2.13.3. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

2.13.4. The server shall provide the following functions, at a minimum:

2.13.4.1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.

2.13.4.2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.

2.13.4.3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).

2.13.4.4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.

2.13.4.5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.

2.13.4.6. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

2.13.4.7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.

2.13.4.8. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

2.13.4.9. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include: Routing of alarms to display, printer, email and pagers, View and acknowledge alarms and Query alarm logs based on user-defined parameters.

2.13.4.10. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include: Viewing and printing log data, Exporting log data to other software applications and Query log data based on user-defined parameters.

2.13.4.11. Server Hardware Requirements: The server hardware platform shall have the following requirements:

The computer shall be, at minimum, an Intel Core 2 Duo Processor based computer (minimum processing speed of 2.66 GHz with 2 GB RAM and a 120-gigabyte minimum SATA hard drive). It shall include a DVD-RW Drive, 1GB Non-ECC DDR2 (1 module), mouse, keyboard, asynchronous serial port, and 2-USB ports. A minimum 17" flat panel

color monitor, 1280 x 1024 optimal preset resolution, with a minimum 80HZ refresh rate shall also be included.

The server operating system shall be Microsoft Windows XP Professional. Include Microsoft Internet Explorer 6.0 or later.

Connection to the FMCS network shall be via an Ethernet network interface card, 10/100/1000 Mbps.

2.14. SYSTEM PROGRAMMING

2.14.1. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

2.14.2. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

2.14.3. Programming Methods

2.14.3.1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

2.14.3.2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

2.14.3.3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

2.14.3.4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.

2.14.3.5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.15. LONWORKS NETWORK MANAGEMENT

2.15.1. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.

2.15.2. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

2.15.3. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

2.15.4. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

2.15.5. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

2.16. OBJECT LIBRARIES

2.16.1. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

2.16.2. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

2.16.3. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

2.16.4. All control objects shall conform to the control objects specified in the BACnet specification.

2.16.5. The library shall include applications or objects for the following functions, at a minimum:

2.16.5.1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.

2.16.5.2. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.

2.16.5.3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals

2.16.5.4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.

2.16.5.5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.

2.16.5.6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

2.16.6. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.

2.16.6.1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.

2.16.6.2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.

2.16.6.3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.

2.16.6.4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.

2.16.6.5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.

2.16.6.6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.

2.16.6.7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

2.16.6.8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.

2.16.6.9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

2.16.6.10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.

2.16.6.11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.

2.16.7. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:

2.16.7.1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.

2.16.7.2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.

2.16.7.3. For BACnet devices, provide the following objects at a minimum: Analog In, Analog Out, Analog Value, Binary, Binary In, Binary Out, Binary Value, Multi-State In, Multi-State Out, Multi-State Value,Schedule Export, Calendar Export, Trend Export and Device

2.16.7.4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

2.16.7.5. For BACnet devices, provide the following support at a minimum

Segmentation, Segmented Request, Segmented Response, Application Services, Read Property, Read Property Multiple, Write Property, Write Property Multiple, Confirmed Event Notification, Unconfirmed Event Notification, Acknowledge Alarm, Get Alarm Summary, Who-has, I-have, Who-is, I-am, Subscribe COV, Confirmed COV notification, Unconfirmed COV notification, Media Types, Ethernet, BACnet IP Annex J, MSTP, BACnet Broadcast Management Device (BBMD) function, Routing

2.17. MODBUS SYSTEM INTEGRATION

2.17.1. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.

2.17.2. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:

2.17.2.1. Read/Write Modbus AI Registers

2.17.2.2. Read/Write Modbus AO Registers

2.17.2.3. Read/Write Modbus BI Registers

2.17.2.4. Read/Write Modbus BO Registers

2.17.3. The Network Area Controller shall perform all scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices.

2.17.4. The Controls Contractor shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning

2.18. OTHER CONTROL SYSTEM HARDWARE

2.18.1. Space Temperature Wall Module. Wall Module shall be Honeywell or equivalent.

2.18.1.1. Wall module shall have a 20K Ohm NTC thermistor temperature sensor with operating range of 45 to 99 F under a locking cover/enclosure with UL 916 listing designed for mounting on a standard electrical switch box.

2.18.1.2. Space temperature sensors shall be accurate to plus or minus one F degree.

2.18.1.3. Where specified, space temperature sensors shall have a setpoint knob calibrated for warmer-cooler adjustments

2.18.1.4. Where specified, wall module shall also have an after-hours override pushbutton and LED override indicator.

2.18.1.5. Insulating foam shall be installed on the back of all space temperature wall modules to prevent air infiltration from wall opening.

2.18.2. Duct Mount and Outside Air Temperature Sensors: Temperature sensors with an accuracy of + 0.3° F. Temperature sensors shall be Honeywell or equivalent.

2.18.2.1. Outside air sensors shall include an integral sun shield.

2.18.2.2. Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.

2.18.2.3. Multipoint averaging element sensors shall be provided where specified and shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).

2.18.2.4. Pipe mount sensors shall have copper, or stainless steel separable wells.

2.18.3. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified. Current switches shall include an integral LED for indication of trip condition and a current level below trip set point.

2.18.4. Humidity Sensors. Humidity sensors shall be Honeywell or equivalent.

2.18.4.1. Duct and room sensors shall have a sensing range of 5% to 95%.

2.18.4.2. Duct sensors shall be provided with a sampling chamber.

2.18.4.3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall have a compensated ambient temperature range of -40°F to 170° F.

2.18.4.4. Control Panels: Furnish control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All external wiring shall be connected to terminal strips mounted within the panel. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

3. PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. All work described in this section shall be performed by a Honeywell "Authorized Controls Integrator" that has a successful history in the design and installation of integrated control systems using Niagara Framework™. The installing contractor shall have a local office located within 90 miles from the Palm Springs Animal Care Facility and a minimum of ten years of integration experience installing Honeywell DDC control systems and shall provide documentation in the submittal package verifying the company's experience.

3.1.2. The Controls Contractor shall have employees at the local branch that are fully trained and certified for the Honeywell WEBs Systems incorporating Niagara Framework™. Copies of the employees Niagara Training Certificates shall be included in the submittals.

3.1.3. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

3.1.4. Drawings of the temperature control system network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Owner shall be furnished and installed without additional cost.

3.1.5. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.

3.1.6. Controls Contractors shall have a C-10 License in good standing in the state of California.

3.2. WIRING

3.2.1. All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be installed in conduit and be the responsibility of the Controls Contractor.

3.2.2. All wiring shall be in accordance with the National Electrical Code and any applicable local codes. All temperature control system wiring shall be installed in the conduit types allowed by the National Electrical Code or applicable local codes. Where plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.2.3. Echelon Compliant Direct Burial Cable shall be used for all underground communication bus wiring between buildings to prevent damage from moisture. The existing underground conduit systems are not watertight.

3.3. WARRANTY

3.3.1. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

3.3.2. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this contractor at no expense to the Owner.

3.4. WARRANTY ACCESS

3.4.1. The Owner shall grant to this contractor, reasonable access to the temperature control system during the warranty period.

3.4.2. The owner shall allow the contractor to access the temperature control system from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5. SOFTWARE LICENSE

3.5.1. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner, or his appointed agent, shall determine which organizations to be named in the "orgid" of all Niagara Framework software licenses.

3.5.2. The owner, or his appointed agent, shall be free to direct the modification of the "orgid" in any Niagara Framework software license, regardless of supplier.

3.5.3. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

3.6. ACCEPTANCE TESTING

3.6.1. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

3.6.2. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

3.6.3. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

3.6.4. System Acceptance: Satisfactory completion is when this contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.7. OPERATOR INSTRUCTION, TRAINING

3.7.1. During system commissioning and at such time acceptable performance of the temperature control system hardware and software has been established this contractor shall provide both off-site and on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by factory-trained personal that are familiar with the system hardware, software and accessories.

3.7.2. This contractor shall provide 4 hours of instruction to the owner's designated personnel on the operation of the temperature control system and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation. .

4. PART 4 - SEQUENCES OF OPERATION

4.1. VARIABLE AIR VOLUME AIR HANDLING SYSTEMS

4.1.1. General:

4.1.1.1. System on/off status shall be based on schedule programmed into FMCS system.

4.1.1.2. Failure of system to start based on supply fan motor current sensor shall signal alarm.

4.1.1.3. Activation of duct smoke detector shall shut down system signal local control panel alarm and signal fire alarm system.

4.1.1.4. Manual reset pressure switches shall automatically shut down system and send alarm signal whenever a high suction or high discharge pressure condition occurs such as that caused by damper closure.

4.1.1.5. Minimum outside air damper and economizer outside air dampers shall close and recirculation damper shall open whenever system shuts down.

4.1.1.6. Upon activation, manual reset freeze stat shall close outside exhaust air dampers, open recirculation damper, stop supply fan and signal alarm.

4.1.1.7. Duct static pressure sensor (located near end of supply duct main) shall modulate AHU supply fan via variable frequency drive to maintain setpoint (adj.).

4.1.1.8. Building static pressure controller shall modulate AHU return fan via variable frequency drive to maintain 0.05" (adj.) positive building static pressure based on sensed differential pressure between lowest pressure sensed at either first or second floor and building exterior.

4.1.1.9. Upon receiving signal from fire alarm system, AHU shall shut down. FMS contractor shall provide contacts for receiving signal at AHU control panel and subsequent control wiring devices necessary to shut down system.

4.1.1.10. Differential static pressure sensor across filters shall indicate when filters are dirty.

4.1.1.11. Return air RH sensor with discharge air RH high limit sensor shall modulate humidifier valve to maintain setpoint (adj.).

4.1.2. Summer Occupied Operation:

4.1.2.1. 1. AHU fans operate continuously.

4.1.2.2. 2. Intake and exhaust dampers shall remain at minimum position.

4.1.2.3. 3. Discharge temperature sensor shall operate chilled water valve to maintain setpoint.

4.1.2.4. 4. Humidifier control valve shall be positively closed.

4.1.3. Summer Unoccupied Operation:

4.1.3.1. Fans shall be off.

4.1.4. Winter Occupied Operation:

4.1.4.1. Upon start-up, outside air, exhaust air and recirculation dampers shall move to their minimum position.

4.1.4.2. Discharge air temperature sensor shall modulate hot water control valve and dampers beyond minimum position in non-overlapping sequence to maintain setpoint.

4.1.4.3. If average space temperature, as sensed by return air temperature, sensor falls below 66 ° F. there shall be an automatic override sequence such that outdoor/return dampers maintain minimum position, all system VAV boxes are signaled to provide 100% reheat flow, all reheat valves are opened, and the AHU hot water coil valve is controlled to provide 90° F. discharge until such time as return air temperature rises to 72 ° F. At this time, supply air discharge stat shall again assume control as specified previously. This shall also act as a "warm-up" cycle.

4.1.5. Winter Unoccupied Operation:

4.1.5.1. Fans shall be off.

4.1.5.2. If system room thermostats sense a temperature below the night setback temperature setpoint, system shall start in "warm-up" cycle until such time as thermostat is satisfied.

4.1.6. Input/Output Schedule (Minimum Points Required):

4.1.6.1.	1. Supply fan start/stop	Digital Output (DO)
4.1.6.2.	2. Return fan start/stop	DO
4.1.6.3.	3. Blocking damper open/close	DO
4.1.6.4.	4. Supply fan status	Digital Input (DI)
4.1.6.5.	5. Return fan status	DI
4.1.6.6.	6. High static limit	DI
4.1.6.7.	7. Low static limit	DI
4.1.6.8.	8. Smoke detectors	DI
4.1.6.9.	9. Filter alarm	DI
4.1.6.10.	10. Low Temp Alarm (freeze stat)	DI
4.1.6.11.	11. Supply fan variable frequency drive (VFD)	Analog Output (AO)
4.1.6.12.	12. Return fan variable frequency drive (VFD)	AO
4.1.6.13.	13. Cooling coil valve	AO
4.1.6.14.	14. OA/RA/EA Dampers	AO
4.1.6.15.	15. Heating coil valve	AO

4.1.6.16.	16. Humidifier	AO
4.1.6.17.	17. Supply duct static pressure	Analog Input (AI)
4.1.6.18.	18. Supply fan air flow	AI
4.1.6.19.	19. Supply discharge temperature	AI
4.1.6.20.	20. Supply air RH	AI
4.1.6.21.	21. Building static pressure	AI
4.1.6.22.	22. Return fan air flow	AI
4.1.6.23.	23. Return air temperature	AI
4.1.6.24.	24. Return air RH	AI
4.1.6.25.	25. Mixed air temperature	AI
4.1.6.26.	26. Outside air temperature	AI
4.1.6.27.	27. Outside air humidity	AI

4.2. CONSTANT VOLUME AIR HANDLING UNIT, 1-STAGE COOLING, 1-STAGE HEATING, WITH ECONOMIZER ENABLED FROM OUTSIDE AIR DRY BULB TEMPERATURE.

4.2.1. Constant Volume HVAC Unit Controller Software. The constant volume unit controller shall be configurable for air handlers with staged or analog heating and cooling, minimum or modulating economizer outside or mixing damper dampers, and enthalpy or dry bulb economizer changeover. Controller shall comply with LonMark HVAC profile #8030.

4.2.2. General:

4.2.2.1. Fan Off. Anytime the fan is off, all system heating and cooling shall be off, and the mixing dampers shall be positioned closed to the outside air.

4.2.2.2. Fan and Mode Control. System fan and heating/cooling temperature setpoints shall normally be placed in the occupied, standby, or unoccupied mode of operation and control via a system scheduler unique seven-day schedule. Prior to scheduled occupied periods, the unoccupied temperature setpoint shall be ramped up to the occupied setpoint over a time period proportional to the temperature difference between the room temperature and the occupied temperature setpoint such that at occupancy time the occupied temperature is reached. During unoccupied and standby periods the outside air damper shall be closed and the fan shall remain off until heating or cooling is demanded to satisfy the unoccupied and standby temperature setpoints. The standby mode of operation is for periods of temporary vacancy such as the lunch hour, and shall use owner determined temperature setpoints a degree or two away from the occupied comfort settings.

4.2.2.3. System shall automatically revert to the proper mode of operation after restoration of power after a power failure. Units shall restart at a random staggered time interval after power restoration.

4.2.2.4. Occupant Schedule Override Control. When any room HVAC system is operating in a mode other than OCCUPIED, each room temperature sensor wall module schedule override button shall provide the room occupant with ability to place the system in the occupied mode of operation for 60 (180 default, user programmable) minutes by pressing the module override button. Via the button, the occupant shall also have the ability to cancel the override command, or to place the system in the unoccupied mode when operating in the occupied mode. Via the module LED, the occupant shall have the ability to note the status of the system overrides as being in the override mode, override unoccupied mode, continuously occupied mode via a network command, or in the normal mode of operation (LED off).

4.2.2.5. Fan Fail Alarm. Any time the fan is commanded on and the fan differential pressure switch piped across the fan, or a fan current sensor, does not prove air flow or fan operation, a fan-failed alarm shall be presented to the operator station. This alarm check shall be delayed upon fan start for 10 seconds (adjustable) to give the system time to prove flow prior to creating a false alarm.

4.2.2.6. Temperature Control, Occupied Periods. Heating control shall operate with 6 cycles per hour, and cooling control shall operate with 4 cycles per hour unless the equipment manufacturer dictates other parameters. If the scheduler commands the fan to stop during periods of electric duct heating, the heater shall be de-energized and the fan shall continue to run for 60 seconds to dissipate the residual heater heat prior to stopping airflow. A staging PID algorithm with heating and cooling anticipation features shall be employed for all staging control. Upon a drop in space temperature below the heating setpoint, the lead duct heater shall be energized, the on time proportional to the heating load. After the lead heater stage becomes full on, a further increase in the heating load shall cause the lag heating stage to be cycled, the on time proportional to the increasing load. The reverse of this shall happen on a decrease in heating load. Upon a rise in space temperature above the cooling setpoint, the lead compressor/coil shall be energized, the on time proportional to the cooling load. After the lead cooling stage becomes full on, a further increase in the cooling load shall cause the lag compressor/coil stage to be cycled, the on time proportional to the increasing load. The reverse of this shall happen on a decrease in cooling load.

4.2.2.7. If the space temperature drops or rises to either the heating or cooling unoccupied temperature setpoint during unoccupied periods, the system shall start and operate in the heating or cooling mode until the unoccupied temperature setpoints have been satisfied. The same operation shall occur for the standby mode of operation where specified.

4.2.2.8. Discharge Low Limit. If at any time the discharge airdrops below the user defined discharge air temperature low limit, an alarm shall be issued and the mixing dampers shall be driven closed to the outside air. As the temperature rises, the dampers shall modulate open to the minimum ventilation position and the alarm shall clear.

4.2.2.9. Wall Sensor Module. Wall temperature sensor module shall be located where shown on the plans, and shall include the temperature sensor, the occupied/unoccupied override selection push button with override status LED (where specified), a warmer-cooler setpoint adjustment knob (where specified), and a jack for connecting to the LonTalk communication network. The system owner determines the normal heating and cooling room temperature setpoints for all wall module sensors (such as 73F & 77F). The warmer-cooler adjustment knob on the wall module shall give room occupants the ability to vary these values by an owner determined increment, such as two degrees, by rotating the setpoint knob. The setpoint knob shall not affect Setpoints in use when the room is unoccupied.

4.2.3. VAV Box, Cooling Only, Pressure Independent:

4.2.3.1. Temperature Control. Zone temperature cooling setpoint shall normally be placed in the occupied, standby, or unoccupied mode of operation and controlled via a system scheduler seven-day schedule. Prior to scheduled occupied periods, the unoccupied temperature setpoint shall be ramped down to the occupied setpoint over a time period proportional to the temperature difference between the room temperature and the occupied temperature setpoint such that at occupancy time the occupied temperature is reached. During unoccupied and standby periods the unoccupied and standby temperature setpoints shall be maintained. The standby mode of operation is for periods of temporary vacancy such as the lunch hour, and shall use owner determined temperature setpoints that fall between the unoccupied setpoint and the occupied setpoint.

4.2.3.2. VAV box controls shall be enabled anytime the respective VAV AHU fan operates. Each VAV box shall have unique design minimum and maximum primary air cfm setpoints. As the cooling load varies, a PID algorithm shall reset the box cfm setpoint between these min and max values to maintain the setpoint. An AIA algorithm shall modulate the box damper to maintain the cfm setpoint.

4.2.3.3. Occupant Schedule Override Control. When any room HVAC system is operating in a mode other than OCCUPIED, each temperature sensor wall module (where specified) shall provide the room occupant with ability to place the system in the occupied mode of operation for 60 (180 default, user programmable) minutes by pressing the wall module override button. Via the button, the occupant shall also have the ability to cancel the override command, or to place the system in the unoccupied mode when operating in the occupied mode. Via the module LED, the occupant shall have the ability to note the status of the system overrides as being in the override mode, override unoccupied mode, continuously occupied mode via a network command, or in the normal mode of operation (LED off).

4.2.3.4. Wall Sensor Module. Wall temperature sensor module shall be located where shown on the plans, and shall include the temperature sensor, the occupied/unoccupied override selection push button with override status LED (where specified), a warmer-cooler setpoint adjustment knob (where specified), and a jack for connecting to the LonWorks communication network. The system owner determines the normal heating and cooling room temperature setpoints for all wall module sensors (such as 73F & 77F). The warmer-cooler adjustment knob on the wall module shall give room occupants the ability to vary these values by an owner determined increment, such as two degrees, by rotating the setpoint knob. Setpoints in use when the room is unoccupied shall not be affected by the setpoint knob.

4.2.3.5. Input/Output Schedule (Minimum Points Required): VAV box space temperature (each) Analog Input (AI), VAV box space temperature setpoint (each) AI, VAV box primary air CFM (each) AI and VAV box damper position (each) Analog Output (AO)

4.2.4. VAV Box, Reheat and/or Radiation, Pressure Independent:

4.2.4.1. Temperature Control. Zone temperature setpoint shall normally be placed in the occupied, standby, or unoccupied mode of operation and controlled via a system scheduler seven-day schedule. Prior to scheduled occupied periods, the unoccupied temperature setpoint shall be ramped to the occupied setpoint over a time period proportional to the temperature difference between the room temperature and the occupied temperature setpoint such that at occupancy time the occupied temperature is reached. During unoccupied and standby periods the unoccupied and standby temperature setpoints shall be maintained. The standby mode of operation is for periods of temporary vacancy such as the lunch hour, and shall use owner determined temperature setpoints that fall between the unoccupied setpoint and the occupied setpoint. Occupied Heating, Occupied Cooling, Standby Heating, Standby Cooling, Unoccupied Heating and Unoccupied Cooling setpoint defaults shall be programmed in the controller.

4.2.4.2. VAV box controls shall be enabled anytime the respective VAV AHU fan operates. Each VAV box shall have unique design minimum and maximum primary air cfm setpoints. As the cooling load varies, a PID algorithm shall reset the box cfm setpoint between these min and max values to maintain the setpoint. An AIA algorithm shall modulate the box damper to maintain the cfm setpoint.

4.2.4.3. Heating/Cooling Mode: Heating/cooling mode shall be determined by the heating/cooling demand in the space with respect to active setpoint. Heating mode shall be disabled when system heating is unavailable to eliminate overcooling the space. An adjustable deadband shall prevent the control from cycling between heating and cooling modes.

4.2.4.4. Cooling mode: The VAV box damper shall modulate to provide airflow between the minimum and maximum cfm setpoints proportional to the cooling demand.

4.2.4.5. Heating mode: The VAV box damper modulates to provide minimum air flow as the radiator valve (if present) opens. As the heating demand increases the reheat valve modulates open, and the VAV box damper modulates to provide airflow at the reheat cfm setpoint.

4.2.4.6. Warm-up mode: Warm-up mode is initiated via the NAC based on average temperatures in the building. The controller modulates the VAV box damper to control airflow at maximum flow setpoint, and disables the reheat/radiation controls until the command is received to return to normal control.

4.2.4.7. Occupant Schedule Override Control. When any room HVAC system is operating in a mode other than OCCUPIED, each temperature sensor wall module (where specified) shall provide the room occupant with ability to place the system in the occupied mode of operation for 60 (180 default, user programmable) minutes by pressing the wall module override button. Via the button, the occupant shall also have the ability to cancel the override command, or to place the system in the unoccupied mode when operating in the occupied mode. Via the module LED, the occupant shall have the ability to note the status of the system overrides as being in the override mode, override unoccupied mode, continuously occupied mode via a network command, or in the normal mode of operation (LED off).

4.2.4.8. Wall Sensor Module. Wall temperature sensor module shall be located where shown on the plans, and shall include the temperature sensor, the occupied/unoccupied override selection push button with override status LED (where specified), a warmer-cooler setpoint adjustment knob (where specified), and a jack for connecting to the LonWorks communication network. The system owner determines the normal heating and cooling room temperature setpoints for all wall module sensors (such as 73F & 77F). The warmer-cooler adjustment knob on the wall module shall give room occupants the ability to vary these values by an owner determined increment, such as two degrees, by rotating the setpoint knob. Setpoints in use when the room is unoccupied shall not be affected by the setpoint knob.

4.2.4.9. Input/Output Schedule (Minimum Points Required): VAV box space temperature (each) Analog Input (AI), VAV box space active setpoint (each) AI, VAV box primary air CFM (each) AI, VAV box discharge temperature (each) AI, VAV box damper position (each) Analog Output (AO), Radiation Valve position (each) AO and Reheat Valve position (each) AO.

5. PART 5 POINT LISTS

5.1. SUMMARY

5.1.1. The points in the following table shall be accessible from the Graphical User Interface (GUI) and/or the Web browser interface (WBI). The supplier of the IDC and IBC devices shall ensure that the points listed in this table are accessible on their respective networks, by the Network Area Controller (NAC).

5.1.2. The following abbreviations apply to the point table to indicate what level of functionality must be provided:

5.1.2.1. D = Display only

5.1.2.2. M = Modify value

5.1.2.3. A = Alarm

5.1.2.4. L = Log

5.1.2.5. S = Schedule

5.1.2.6. GC = Global supervisory control routine such as demand limiting

Typical for all AC Units	D	M	A	L	S	GC
AC Unit S/S		X			X	X
AC Unit Status	X		X	X		
AC Unit Supply Air Temperature	X		X	X		
Space Temperature	X		X	X		
Space Cooling Setpoint		X		X		X
Space Heating Setpoint		X		X		X
Cooling Stage	X			X		
Heating Stage	X			X		
Smoke Detector	X		X			
Typical for all VAV zones	D	M	A	L	S	GC
Space Temperature	X		X	X		
Space Cooling Setpoint		X		X		X
Space Heating Setpoint		X		X		X

Outside Air Temperature	X		X	X		
Outside Air Humidity	X		X	X		
MDF Room Temperature	X		X	X		

5.1.2.7. D = Display only

5.1.2.8. M = Modify value

5.1.2.9. A = Alarm

5.1.2.10. L = Log

5.1.2.11. S = Schedule

5.1.2.12. GC = Global supervisory control routine such as demand limiting

6. COMMISSIONING

6.1.1. Provide LEED commissioning of HVAC systems.

6.1.2. Provide all equipment and resources required to perform the LEED required commissioning of the HVAC systems.

6.1.3. Follow LEED guidelines for commissioning.

END OF SECTION