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Project No. 02-4604, Contract No. CT03-2002
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- g. "Collapsible tree," dynamic system architecture diagram application:
 - 1) Showing the real-time status and definition details of all workstations and devices on a management level network
 - 2) Showing the real-time status and definition details of all DDC and HVAC Mechanical Controllers at the building level
 - 3) Showing the status and definition details of all field-level application controllers
- h. Definition and construction of dynamic color graphic displays.
- i. Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
- j. On-screen access to User Documentation, via online help or PDF-format electronic file.
- k. Automatic database backup at the workstation for database changes initiated at DDC Controller operator interface terminals.
- l. Display dynamic trend data graphical plot.

(Note: Option for Base Insight)**

- 1) Must be able to run multiple plots simultaneously
 - 2) Each plot must be capable of supporting 10 pts/plot minimum
 - 3) Must be able to command points directly off dynamic trend plot application.
 - 4) Must be able to plot both real-time and historical trend data
- m. Program editing
(Note: Option for Base Insight)**
 - n. Transfer trend data to 3rd party spreadsheet software.
 - o. Scheduling reports
(Note: Option for Base Insight)**
 - p. Operator Activity Log
(Note: Option for Base Insight)**
 - q. Open communications via OPC Server
(Note: Option)**
 - r. Open communications via BACnet Client & Server **(**Note: Option)**

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2. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a "drag and drop" approach to inter-application navigation. Selection of applications within the workstation software shall be via a graphical toolbar menu – the application toolbar menu shall have the option to be located in a docked position on any of the four sides of the visible desktop space on the workstation display monitor, and the option to automatically hide itself from the visible monitor workspace when not being actively manipulated by the user.
3. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run on a Windows 2000 or NT 32 bit operating system. Standard Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information.
 - a. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):
 1. Dynamic color graphics application
 2. Alarm management application
 3. Scheduling application
 4. Dynamic trend graph data plotter application
 5. Dynamic system architecture diagram application.
 6. Control Program and Point database editing applications
 7. Reporting applications
 - b. Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.
4. Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator/manager shall be able to grant discrete levels of access and

privileges, per user, for each point, graphic, report, schedule, and BAS workstation application. And each BAS workstation user account shall use a Windows 2000/NT user account as a foundation.

a. **(**Note: Option for Base Insight)**

The workstation software shall also include an application to track the actions of each individual operator, such as alarm acknowledgement, point commanding, schedule overriding, database editing, and logon/logoff. The application shall list each of the actions in a tabular format, and shall have sorting capabilities based on parameters such as ascending or descending time of the action, or name of the object on which the action was performed. The application shall also allow querying based on object name, operator, action, or time range.

5. Dynamic Color Graphics application shall include the following:

- a. Must include graphic editing and modifying capabilities
- b. A library of standard control application graphics and symbols must be included
- c. Must be able to command points directly off graphics application
- d. Graphic display shall include the ability to depict real-time point values dynamically with animation, symbol association, or dynamic informational text-blocks
- e. Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure
- f. Graphics viewing shall include zoom capabilities
- g. Graphics shall automatically display the HAND status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.

6. Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:

- a. A general listing of all or selected points in the network
- b. List of all points currently in alarm
- c. List of all points currently in override status
- d. List of all disabled points
- e. List of all points currently locked out
- f. List of user accounts and access levels
- g. List all weekly schedules and events
- h. List of holiday programming
- i. List of control limits and deadbands
- j. Custom reports from 3rd party software

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- k. System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points
- l. List of point definitions
- m. List of alarm strategy definitions
- n. List of DDC Control panels
- o. Point totalization report
- p. Point Trend data listings
- q. Initial Values report
- r. User activity report

7. Scheduling and override

Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation, DDC Controller, to ensure time equipment scheduling when PC is off-line -- PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:

- i. Weekly schedules
- ii. Zone schedules
- iii. Event schedules – an event consists of logical combinations of equipment and/or zones.
- iv. Report schedules
- v. Ability to schedule for a minimum of up to 365 days in advance

Additionally, the scheduling application shall:

- a. Provide filtering capabilities of schedules, based on name, time, frequency, and schedule type (event, zone, report)
- b. Provide sorting capabilities of schedules, based on name, time and type of schedule (zone, event, report)
- c. Provide searching capabilities of schedules based on name – with wildcarding options

8. Collections and Analysis of Historical Data

- a. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.
- b. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to

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allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.

- c. Provide additional functionality that allows the user to view real-time trend data on trend graphical plot displays. A minimum of ten points may be plotted, of either real-time or historical data. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of plot screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed. A minimum of 8 true graphs shall run simultaneously. Operator shall be able to command points directly on the trend plot by double clicking on the point. Operator shall be able to zoom in on a specific time range within a plot. The dynamic trend plotting application shall support the following types of graphs, with option to graph in 3D: line graph, area graph, curve graph, area-curve graph, step graph, and scatter graph. The user may customize each graph; graph type, graph text, titles, line styles and weight, colors, and configurable x- and y-axes.

B. Dynamic Color Graphic Displays

1. Create color graphic displays and system schematics for each building, including room level terminal units, pipe pressure and temperature readings, shall be provided by the BAS contractor as indicated in the point I/O schedule of this specification to optimize system performance, analysis and speed alarm recognition.
2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of Autocad or scanned pictures for use in the system.
3. Dynamic temperature values, pressure values, status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
 - a. Provide the user the ability to display real-time point values by animated visual representation. Animation shall depict movement of mechanical equipment, or air or fluid flow. A library (set) of animation symbols shall be included within the workstation software's graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed.

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- b. Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the set point.
 - c. Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
 - d. Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or set point.
 - e. State text for digital points can be user-defined up to eight characters.
- 4. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.
 - 5. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
 - 6. Off the shelf graphic software, Microgafx Designer or Corel Draw software shall be provided to allow the user to add, modify or delete system graphic background displays.
 - 7. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.

C. System Configuration & Definition

- 1. A "Collapsible tree," dynamic system architecture diagram/display application of the site-specific architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, DDC Controllers as well as 3rd-party integrated components. Symbols/Icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons representing 3rd-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration and diagnostics of dial-up modems to DDC Controllers.
- 2. Network wide control strategies shall not be restricted to a single DDC Controller but shall be able to include data from any and all other network panels to allow the development of Global control strategies.
- 3. Provide automatic backup and restore of all DDC controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC

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Controller. Changes made at the user-interface of DDC controller shall be automatically uploaded to the workstation, ensuring system continuity.

4. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system backup must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.
 5. Point database configuration shall be available to the user within a dedicated point database editor application included in the workstation software. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database. The point editor shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the option for editing the point database in an online or offline mode with the DDC Controllers.
 - a. The workstation software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points. This function shall allow the user to choose the properties to copy from a selected point to another point or set of points. The selectable attributes shall include, but are not limited to, Alarm management definitions and Trend definitions.
 6. Control program configuration shall be available to the user within a dedicated control program editor application included in the workstation software. The editor shall allow for creation, modification and deletion of control programs. The editor shall include a programming assistance feature that interactively guides the user through parameters required to generate a control program. The editor shall also include the ability to automatically compile the program to ensure its compatibility with the DDC Controllers. The editor shall provide the option for editing the control programs in an online or offline mode, and also the ability to selectively enable or disable the live program execution within the DDC Controllers.
- D. Remote notification of messages
- a. Workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), and email accounts based on a point's alarm condition.
 - b. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices that can receive messages from the system.
 - c. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
 - d. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
 - e. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.

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- f. Message detail shall be configurable on a per user basis.
- g. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
- h. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

E. Workstation Communications

- 1. Provide automatic dial-up communications for buildings as specified. Automatic *dial-up communications* shall include the following features as a minimum:
 - a. Dial-Out
 - 1) Manual dial-out from the workstation to remote networks shall be accomplishable using only a mouse to select and request the desired remote connection.
 - b. Dial-In
 - 1) Alarms shall automatically dial into the workstation for display at the workstation monitor and for hard copy printout at the associated event printer.
 - 2) Trend data from remote networks shall be scheduled for automatic updating to the workstation at operator-selected times. The operator shall also have the option of manually collecting trend data at any time.

3.0 EXECUTION

3.1 Installation

- .1 Supply and install control panels, and interconnect

3.2 Commissioning, Testing And Acceptance

- 1. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets that shall be submitted prior to acceptance testing. Commissioning work that requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the owner and construction manager to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.

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2. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:
 - a. Sensor accuracy at 10, 50 and 90% of range.
 - b. Sensor range.
 - c. Verify analog limit and binary alarm reporting.
 - d. Point value reporting.
 - e. Binary alarm and switch settings.
 - f. Actuator ranges.
 - g. Fail safe operation on loss of control signal, electric power, and network communications.
3. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BMS program shall be put on line and commissioned. The contractor shall, in the presence of the owner and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.
4. After all BMS programs have been commissioned; the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:
 1. Data communication, both normal and failure modes.
 2. Fully loaded system response time.
 3. Impact of component failures on system performance and system operation.
 4. Time/Date changes.
 5. End of month/ end of year operation.
 6. Season changeover.
 7. Global application programs and point sharing.
 8. System backup and reloading.
 9. System status displays.
 10. Diagnostic functions.
 11. Power failure routines.

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12. Battery backup.
 13. Smoke Control, stair pressurization, stair, vents, in concert with Fire Alarm System testing.
 14. Testing of all electrical and HVAC systems with other division of work
5. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.
 6. Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate all system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.
 7. The contractor shall supply all instruments for testing and turn over it to the owner after acceptance testing.
 1. All test instruments shall be submitted for approval.

Test Instrument Accuracy:

Temperature: 1/4F or 1/2% full scale, whichever is less.

Pressure: High Pressure (psi): 1/2 psi or 1/2% full scale, whichever is less.

Low Pressure: 1/2% of full scale (in w.c.)

Humidity: 2% RH

Electrical: 1/4% full scale

8. After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty-day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the owner may request that performance tests be repeated.

3.3 Existing Control Devices

- .1 The bid for the control work shall be based on the premise that existing control devices are operational and are not in need of repair or replacement, unless otherwise noted.
- .2 This subcontractor shall notify the owner's representative of existing control devices that need to be replaced or repaired that may be noted in the process of installation of the new work.

3.4 Training

- .1 The manufacturer shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with

all aspects of the subject matter they are to teach. The manufacturer shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

.2 Provide 40 hours of training for Owner's designated operating personnel. Training shall include:

- .1 Explanation of drawings, operations and maintenance manuals
- .2 Walk-through of the job to locate control components
- .3 Operator workstation and peripherals
- .4 DDC controller and ASC operation/function
- .5 Operator control functions including graphic generation and field panel programming
- .6 Operation of portable operator's terminal
- .7 Explanation of adjustment, calibration and replacement procedures
- .8 Student binder with training modules

3.2 Field Quality Control

- .1 Upon completion of sectional tests, undertake group testing.
- .2 Check out complete system for operational sequencing.

END OF SECTION