SECTION 250500 – INTEGRATED AUTOMATION

PART 1 - GENERAL

1.1   SUMMARY

A.   This Section includes requirements for integration with Indusoft SCADA and its coordination, supply, and integration of all equipment specified herein and supervision/coordination of referenced related Sections.

B.   The Contractor shall have total responsibility for the coordination, design, configuration, testing, start-up, commissioning, and implementation of a complete and fully operational project in the Indusoft WebStudio SCADA platform. The Contractor is ultimately responsible for providing a fully functioning interface through the Building Level OPC Server (BLOPC).

C.   All building mechanical, lighting, and metering systems shall interface with the existing University Supervisory Control and Data Acquisition (SCADA) system for graphic user interface, command, controls, and alarms, data collections, trending and reporting. All commercial-grade electronic controllers shall be BACnet (Building Automation and Control Networks) and OPC (Object Linking and Embedding for Process Control) UA (Unified Architecture) compliant.

D.   The Contractor shall supply a Building Level OPC UA server (BLOPC) which shall provide building level connectivity to the USCADA platform and shall support Building Automation Suite of drivers. Contractor shall provide OPC-UA licenses as required. Devices and controllers on Building Automation System (BAS), HVAC Controls, Plumbing Controls, Metering, Lighting controls, etc. shall be configured in accordance with contract documents and networked to the BLOPC.

E.   All building controls systems shall use the campus ITS ICS fiber optic Ethernet network for communication between building systems and the SCADA.

F.   The new BACnet based building BAS and other subsystems shall communicate all data to the Campus Indusoft WebStudio SCADA system via Building Level OPC UA server (BLOPC), which shall provide all supervisory and historian functions. All devices provided on this project shall be open protocol and contractor is responsible for seamless integration of systems.

G.   Any new work shall not negatively impact existing SCADA project(s) and the campus' continued access to existing project(s). All new work shall be performed in the development environment and pushed to the production environment only after formal approval from the University and shall be integrated with existing projects already in the SCADA production environment. Contractor shall coordinate with the University before

causing any downtime to the SCADA. Any such downtimes will be limited in number and frequency and may be required to be performed after hours. Contractor may be allowed to perform development work remotely/off-site but shall notify the University of all such remote work so that the University may monitor the system for any issues. Contractor shall be physically present on campus for coordination meetings, graphic display reviews, field testing, demonstration and commissioning, and training, unless allowed to attend remotely by the University.

H.   All work performed under this contract shall be the property of the University. No work shall be password protected or use proprietary materials that cannot be handed over to the University for complete access. If sections of the project need to be password protected for operational purposes or cybersecurity, such passwords shall be provided to the University at training and must be able to be changed by authorized University personnel.

1.2   DEFINITIONS

A.   BACnet: BACnet is a communications protocol for Building Automation and Control (BAC) networks that leverage the ASHRAE, ANSI, and ISO 16484-5 standard protocol.

B.   BBMD: BACnet/IP Broadcast Management Device.

C.   DDC: Direct digital control.

D.   I/O: Input/output.

E.   ISA 99: Control System Security/Cybersecurity

F.   ISA-101: Human Machine Interfaces standard

G.   OPC- UA: OLE for Process Control - Unified Architecture

H.   PID: Proportional plus integral plus derivative.

I.   RTD: Resistance temperature detector.

J.   BAS: Building Automation System.

K.   NRC: Network Router/Controller.

L.   SDCU: Stand Alone Digital Control Units.

M.   APW: Administration and Programming Workstation.

N.   WOW: Web-Based Operator Workstation.

O.   ODBC: Open Data Base Connectivity.

1.3   SYSTEM PERFORMANCE

A.   Comply with the following performance requirements:

1.   Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.

2.   Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.

3.   Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.

4.   Object Scan: Transmit change of state and change of analog values to control units or workstation within 6 seconds.

5.   Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within 5 seconds of each other.

1.4   SEQUENCE OF OPERATION

A.   Refer to "Sequence of Operations" under Division 23.

1.5   SUBMITTALS

A.   Qualifications: Submit a detailed "Qualifications Package" for the proposed SCADA Integrator to be assigned to this project. This qualifications package shall be formatted as follows:

1.   Company Background – Provide a brief company overview detailing the Integrator's experience, capabilities, and available resources.

2.   Experience in Building Automation Applications – Provide a list and detailed descriptions of projects involving Building Automation Systems with Integrated subsystems including HVAC controls, Chiller Plants, Cooling Towers, Heating Water Plants, Plumbing Controls, Metering, Lighting, and Variable Frequency Drives that the Integrator has successfully performed.

3.   Project Personnel Plan – Provide a brief project task list detailing the personnel to be utilized for engineering, Cyber Security and SCADA implementation and training for this project. Include resumes for all personnel which will be performing services for this project. Provide name and resume for the proposed project manager for this project.

4.   Quality Assurance Plan – Provide a brief summary of the Integrator's in-place quality assurance plans for performing work from engineering through startup and training.

5.   Training – Provide an overview of training programs and capabilities to be used for this project for both on-site training and off-site training.

6. Deviations: If deviations to the Contract Documents are proposed, submit a detailed description and explanation for each proposed deviation to the Contract

B. Field Testing and Demonstration Plan

1. Contractor shall coordinate a testing and demonstration plan for Building Level OPC server with BAS, Lighting, metering, HVAC and Plumbing Controllers and all other systems as detailed in the other specification sections in the project. The plan shall consist of two main components, 1) testing and 2) demonstration. Both testing and demonstration shall include subsystem vendor's pre-validated communications to individual field devices, individual pieces of equipment, and systems.

2. Once the BMS vendor has validated their system at the Building Level OPC-server, the SCADA consultant shall work with the BMS vendor and the commissioning agent to complete the final commissioning of the Supervisory system's proper operation.

3. The demonstration plan shall be similar to the testing plan in that the same tests shall be performed for the demonstration as were performed during testing, for the purposes of demonstrating the operation of the individual pieces of equipment, instrumentation and systems. It shall also serve the purposes of completing a final checkout of the systems. The contractor shall notify the Owner in writing a minimum of 7 calendar days prior to performing demonstration of operation of the equipment and systems. The contractor shall coordinate the various subsystem vendors' attendance during the demonstration phase of this project.

C. Graphical Displays

1. Provide a list of the color graphic screens. For each screen, provide a conceptual layout of pictures and data and show or explain which other screens can be directly accessed.

2. Provide screen prints of graphical displays.

3. Displays shall be developed over workshops with the University staff and submitted at the 30%, 60% and 90% level for review and final approval.

D. Prior to the design of the integration of the BAS and other subsystems into the SCADA, the contractor shall provide to the University and seek approval on the following:

1. Minimum required control points list and the points monitored and/or controlled by SCADA at the University Indusoft platform.

2. Available capacity of DDC panels and nodes for connection to BLOPC and SCADA system.

3. How the respective system dynamic information is reported back to the SCADA platform. A network connection into the building subnet along with IP address, hostname, net mask address and default route address shall be provided by the University. These are required to get the system data from the building location to BLOPC and SCADA.

4. Points List: Provide a complete points list with address in Microsoft Excel or Word table format. Points list shall include all controlled and monitored systems, including but not limited to, third party monitored systems. All point/tag names shall follow the University standard for naming.

1.6   CLOSEOUT SUBMITTALS

A.   Operations and Maintenance Data:

1. Operation and Maintenance (O&M) Manual. This shall include as-built versions of the submittal data. In addition to the information required for submittals, the O&M manual shall include:

   a. Names, addresses, and 24-hour telephone numbers of contractors installing equipment, and the control systems and service representatives of each.

   b. Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending and historizing data, overriding computer control, changing setpoints and other variables, and programming and revising schedules.

   c. One (1) set of Programming Manuals with a description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.

   d. One set of magnetic/optical media containing files of the software and database also shall be provided.

   e. Complete original issue discs for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

   f. Licenses, guarantees, and warranty documents for all equipment and systems.

g.   O&M's shall be accessible in PDF format from graphical screen.

B.   Include locations of controllers on Record Drawings including panel/controller address.

    1.   Points List: Provide a complete points list with address in Microsoft Excel or Word table format. Points List shall include all controlled and monitored systems, including but not limited to, third party monitored systems.

    2.   Point naming: Point/tag naming shall follow standards as provided by the University.

    3.   Sequence of Operations in simple English as programmed.

1.7   QUALITY ASSURANCE

A.   Codes and Standards:

    1.   Electrical Standards: Provide electrical components of direct digital control system which have been UL listed and labeled, and comply with NEMA standards.

    2.   NEMA Compliance: Comply with NEMA standards pertaining to components and devices for direct digital control systems.

    3.   NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

    4.   UL Compliance: Provide direct digital control devices which are UL listed as a signal appliance with listings as indicated below.

    5.   Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Digital control devices shall be listed and labeled by a NRTL. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

    6.   BACnet BTL certification.

1.8   DELIVERY, STORAGE, AND HANDLING

A.   Factory Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B.   System Software: Update to latest version of software at Project completion. Any upgrades to software or licenses required for the project shall be implemented with express approval from campus. All software and license ownership shall be transferred to the University at the end of the project.

1.9   COORDINATION

A.   Coordination with Mechanical Equipment Manufacturers and Vendors:

1.   The contractor shall be responsible for coordinating with mechanical equipment manufacturers and vendors in order to obtain control system communications information and special control components. The contractor shall review and coordinate with the equipment manufacturer's submittals.

2.   Obtain written verification from the equipment and control vendors pertaining to compatibility of control devices, such as BAS controllers, VFDs, EPMS, Lighting Controls, etc. to the SCADA.

3.   Initial Coordination Meeting: The contractor shall be responsible for scheduling and holding an initial coordination meeting with the Owner, subcontractors, vendors, and the SCADA integrator to review the scope and schedule of the project. This meeting shall be attended by the contractor project manager, and all other parties that shall be involved in the integration of the BAS, EMS, and Lighting controls and other Subsystems.

4.   Regular Coordination Meetings: The contractor shall be responsible for scheduling and holding coordination meetings weekly, bi-weekly, or other required frequency to ensure mutual progress on the project.

B.   Coordinate equipment with Division 22 Section "DOMESTIC HOT WATER HEATERS and HOT WATER DISTRIBUTION SYSTEMS" to achieve compatibility of communication interfaces.

C.   Coordinate equipment with Division 23 Section "BUILDING AUTOMATION SYSTEM "to achieve compatibility of communication interfaces.

D.   Coordinate equipment with Division 26 Section "ELECTRIC POWER AND ENERGY METERING" to achieve compatibility of communication interfaces.

E.   Coordinate equipment with Division 26 Section "LIGHTING CONTROL DEVICES "to achieve compatibility of communication interfaces.

1.10   WARRANTY

A.   Warrant all work as follows:

1.   Labor and materials for the contractor provided devices and Software specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The Contractor shall respond to the Owner's requires for warranty service within 24 hours during normal business hours.

2. All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period.

3. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Commissioning Agent, the Agent shall sign certificates certifying that the SCADA operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.

4. SCADA software, project-specific software, and database software, updates that resolve known software deficiencies as identified by the Contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above-mentioned items also can be provided during the warranty period for an additional charge to the Owner by purchasing an in-warranty service agreement from the Contractor. Written authorization by the Owner must, however, be granted prior to the installation of any of the above-mentioned items.

5. Exception: The Contractor shall not be required to warrant reused devices or systems.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide PC Server class machine by one of the following:

1. Dell – Poweredge T330 or equal

B. SCADA Platform:

1. Existing Campus Indusoft WebStudio SCADA servers and Historians will be utilized for Operator HMI functions.

2. Provide SNMP driver configuration for access to traps on new BAS / Building Level managed switch.

C. Graphics Library:

1. Provide a Site License of BAS Custom Graphics library, latest version.

2. Provide Full Library, including, any custom systems listed in this project.

D. The Campus SCADA system is Indusoft WebStudio and is hosted within facilities Virtual Server infrastructure.

2.2   COMMUNICATION

A.   General:

1.   The Indusoft SCADA resides in the Campus Virtualized Server Environment and shall communicate to the Building Level OPC server (BLOPC) via OPC UA communications. This interface shall be designed and configured using the latest OPC UA Security, Discovery and Encryption structures. Each Building Level subsystem vendor shall provide BACNet configuration information and testing into BLOPC Server.

2.   The system shall be designed with a 10/100/1000bT Ethernet network, using the BACnet/IP protocol with Ethernet-level controller/routers.

3.   The BAS shall provide all necessary data to campus Indusoft SCADA server/ BACnet OPC server via BACnet/IP communications protocol.

4.   Each vendor shall maintain, and trouble shoot communications to the BLOPC server via the Integrated OPC quick client.

B.   Network Description:

1.   The main backbone of the system shall be an Ethernet 10/100/1000bT LAN/WAN, using BACnet/IP as the communications protocol. Network Router/Controllers, Operator Workstations, and the BLOPC Server shall connect directly to this network without the need for Gateway devices. This network consists of various subsystems, such as, of Lighting Systems, energy metering, generators and BAS.

2.   BLOPC Server shall provide OPC UA communications to the University Centralized SCADA Platform

C.   Building Level LAN Segmentation:

1.   The Building Level Control network shall be capable of being segmented, through software, into multiple Local Area Networks (LANs) distributed over a Wide Area Network (WAN), sharing the Single Building Level OPC UA Server (BLOPC). This enables SCADA to manage a single LAN (or building), and/or the entire system with all devices being assured of being updated by and sharing the most current database. In the case of a single BLOPC system, the workstation shall contain the entire database with no need for a separate file server.

D.   Standard Network Support:

1.   All NRCs, Workstation(s), and BLOPC Server shall be capable of residing directly on the Owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore,

the NRCs, Workstation(s) and BLOPC Server shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches, and hubs. With this design, the Owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the Owner's Information Systems Department as all devices utilize standard TCP/IP components.

E. Support for Open Systems Protocols:

1. All hardware and software included under this section shall conform to BACnet standard 135-2001 and addenda 135-2016bd to promote interoperability between building subsystems. Additionally, the BAS design must include solutions for the integration of the following "open systems" protocols: LonTalkTm, LONWorks, Modbus, Modbus TCP and digital data communication to third party microprocessors such as chiller controllers, fire panels, and variable frequency drives (VFDs).

2.3   OPERATOR WORKSTATION REQUIREMENTS

A. General:

1. The Campus-wide Indusoft Webstudio SCADA system shall function as the operator interface for this building. Provide all communication cabling required to allow control interface between the SCADA and this building.

2. All Data shall be provided via the Building Level OPC Server (BLOPC) and shall integrated the various BACNet/IP subsystems within the building.

3. Contractor shall provide (4) thin clients for operator use in the building to access SCADA HMI functions.

4. Provide a local head-end at the building including all required functionality for the building systems control including graphical user interface screens showing system schematics, functional logic, and all control parameters, monitoring points, alarms and events, and data logs, trends and reporting. The operator interface shall allow for different adjustable levels of user access for viewing only and multiple levels of parameter modification access as defined by the University.

B. Color Graphic Displays:

1. Standard Graphics: Provide graphics for all mechanical, plumbing, lighting, and metering systems as required by the Project and floor plans of the building. Point information on the graphic displays shall dynamically update. Show on each

graphic all input and output points for the system. Also show relevant calculated points such as setpoints. Contractor shall review existing SCADA graphics and get approval from the University on how the new graphics will be placed within existing graphics on the SCADA system. All new graphics must follow the standards already established by previous projects within SCADA.

2.   Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point shown.

3.   The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

4.   BAS, EMS, Lighting and other Subsystem vendor shall provide to SCADA Integrator individual listing of tags, address, BACnet ID instances. organized by system and controllers. The OPC server shall be fully configured and documented before integration with SCADA.

C.   Automatic Monitoring:

1.   The software shall automatically collect data and reports from any controller through network communication link. The frequency of data collection shall be completely user-configurable and shall be minimum 15-minutes.

D.   Alarm Management:

1.   The Alarms shall be managed via standard BACnet objects and shall be presented via OPC Alarm and Events. Contractor shall test each alarm and verify it is presented to OPC interface correctly and provide associated alarm message.

E.   Custom Report Generation:

1.   All custom report generation shall be via the Campus Dream Reports software.

2.   Contractor shall provide up to 10 custom reports as requested by owner. The reports may include pulling various trend points and virtual points, performing calculations (such as calculating tonnage based on flow and temperatures) and creating and scheduling reports in simple tabular format. Advanced graphical reports are not anticipated.

F. Scheduling:

1. Contractor shall interface setup schedules for all pieces of equipment that is required to be operated based on a time schedule in the SCADA platform.

2. Schedules for any of the controllers on the network shall be available to be configured and downloaded from the workstation. All Schedule objects shall be BACnet compliant and validated via OPC interface.

   a. Time of day schedules shall be in a calendar style and shall be programmable for a minimum of one (1) year in advance. Each standard day of the week and user-defined day types shall be able to be associated with a color so that when the schedule is viewed it is very easy, at-a-glance, to determine the schedule for a particular day even from the yearly view. To change the schedule for a particular day, a user shall simply click on the day and then click on the day type.

   b. Each schedule will appear on the screen viewable as the entire year, monthly, week and day. A simple mouse click shall allow switching between views. It shall also be possible to scroll from one month to the next and view or alter any of the schedule times.

   c. Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.

   d. Scheduling shall allow for multiple schedules for a single 24-hour period and events that span more than a 24-hour period.

   e. Global scheduling shall be available to create a weekly schedule in SCADA that shall be utilized by multiple controllers on the network.

G. Data Logging:

1. The existing USCADA historian shall be utilized to configure groups of data points with trend logs and display the trend log data. A group of data points shall be created by drag-and-drop method of the points into a folder. The trend log data shall be displayed through a simple menu selection, or from a hot spot on a graphic display. This data shall be able to be saved to file and/or printed.

2. All points shall be available to be trended. Trends shall be able to pull both historical and real-time data.

3. Trend data shall be configured within the campus Webstudio SQL Historian.

H. History Logging:

1. The Campus Web Studio SQL Historian shall be utilized for logging any input, output, calculated value or other system variable to/from local controllers over user defined time intervals, with default histories set up at 15-minute intervals. Any system can be logged in history and all control points shall have histories enabled. A minimum of 3-years of values shall be stored in each log. Each log can record either the instantaneous, average, minimum, or maximum value of the point. Logged data shall be downloadable from the Operator Workstation in spreadsheet format or any format via SQL query and triggered via Dream Reports.

2. All points shall be historized.

I. Audit Trail:

1. The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.

2.4 BUILDING LEVEL OPC SERVER

A. Contractor shall provide the Building Level OPC server which will serve data from building subsystems such as BAS, Lighting, Power management, etc.

B. Provide a Building Level server machine with the following minimum features:

1. 2U rack mount Industrial PC Intel i7 Quad Core processor (University will supply Windows Operating System)

2. 32 GB of RAM, 512 GB Solid State SATA HDD, 1GB Dual Port Network Card.

3. Include a 3-year onsite warranty and site repair plan.

C. Contractor shall provide and install (1) OPC Tunneling software (such as OPC Expert Pro, https://opcexpert.com/shop/) at the BL-OPC to manage the connection between the BL-OPC and Indusoft SCADA. Contractor shall coordinate with campus ITS to install the software.

2.5 DREAM REPORTS

A. Contractor shall create a minimum of 10 custom reports within Dream Reports.

PART 3 - EXECUTION

3.1 SECTION INCLUDES

A. Examination.

INTEGRATED AUTOMATION

B. Protection.

C. Coordination.

D. General Workmanship.

E. Training.

3.2 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Construction Manager and Architect/Engineer, for resolution before rough-in work is started.

B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Construction Manager and Architect/Engineer for resolution before rough-in work is started.

C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate-or if any discrepancies occur between the plans and the Contractor's work and the plans and the work of others, the Contractor shall report these discrepancies to the Construction Manager and Architect/Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by, and at the expense of, this Contractor.

3.3 PROTECTION

A. The Contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The Contractor shall be responsible for all work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.4 COORDINATION

A. Site:

1. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

B. Submittals. Refer to the "Submittals" Article in Part 1 of this specification for requirements.

C. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of

or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the CONTRACTOR as follows:

1. All communication media and equipment provided as specified in other Sections of this Specification.

2. Each supplier of a controls product is responsible for their configuration, programming, startup and testing of that system to meet the sequences of operation described in this specification.

3. The Contractor shall coordinate and identify any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of the Specification.

4. The Contractor is responsible for interfacing the BLOPC server to the Campus SCADA server (USCADA).

5. The Contractor shall coordinate with the Project Commissioning Agent to insure they have access to the graphics, programming, data, reports and historian functions necessary to perform final building commissioning.

3.5   PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25 percent of available memory free for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index. Utilize naming convention consistent with the Campus standards for all control points, devices, components, and controllers newly installed in this building. Point name shall include building number, system, sub-system, measurement.

C. BACnet Instance IDs tags, etc. shall be submitted during review process to insure consistency with Campus standard.

D. Utilize existing virtual servers in Uptown Campus Data Center for all software to reside.

E. Operator Interface:

1. Contractor shall provide (4) thin clients for operator use in the building to access SCADA HMI functions.

2. Provide graphics package for review before writing final software to generate graphical representation of all systems under control. Graphics shall be reviewed by the Campus at 30%, 60% and 90% and approved.

3.6   SYSTEM DEMONSTRATION AND ACCEPTANCE

A.   Demonstration:

1. Prior to acceptance, the USCADA system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests and all contractors have validated the BLOPC server communications.

2. The Construction Manager, Commissioning Agent, Architect/Engineer, and Owner will be present to observe and review these tests. All parties shall be notified at least 10 days in advance of the start of the testing procedures.

3. Demonstrate complete operation of operator interface via the USCADA and BLOPC.

4. Interface to the building fire alarm system via the BAS System & BACNet/IP.

B.   Acceptance:

1. All tests described in this Specification shall have been performed to the satisfaction of the Construction Manager, Commissioning Agent, Architect/ Engineer, and Owner prior to the acceptance of the USCADA as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the completion requirements if stated as such in writing by the Construction Manager, Commissioning Agent, and Architect/Engineer. Such tests shall then be performed as part of the warranty.

3.7   TRAINING

A.   Provide 80 hours at startup. Arrangement of hours to be determined during testing and commissioning.

B.   Provide two (2) additional training sessions at 6- and 11-months following building turnover. Each session shall be 24 hours and must be coordinated with the building Owner.

C.   Train the designated staff of Owner's representative and Owner to enable them to do the following:

1. Day-to-Day Operators:

    a. Proficiently operate the system.

    b. Understand USCADA system architecture and configuration.

    c. Understand USCADA system software components.

    d. Operate the workstation and peripherals.

    e. Log on and off the system.

    f. Access graphics, point reports, and trend logs.

    g. Adjust and change system setpoints, time schedules, and holiday schedules.

    h. Acknowledge alarms.

    i. Trend real-time and history points.

    j. Add points to history.

    k. Create and run reports.

    l. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.

2. Advanced Operators:

    a. Make and change graphics on the workstation.

    b. Create, delete, and modify alarms, including annunciation and routing of these.

    c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals.

    d. Add operator interface stations.

    e. Create, delete, and modify system displays, both graphical and others.

    f. Perform workstation and peripheral operation and maintenance procedures.

3. System Managers/Administrators:

    a. Maintain software and prepare backups.

    b. Interface with job-specific, third-party operator software.

    c. Add new uses and understand password security procedures.

D. These objectives will be divided into three logical groupings. Participants may attend one or more of these, depending on level of knowledge required.

1.   Day-to-Day Operators.

2.   Advanced Operators.

3.   System Managers/Administrators.

E.   Provide course outline and materials in accordance with the "Submittals" article in Part 1 of this specification. The instructor(s) shall provide one copy of training materials per student.

END OF SECTION 25050