SECTION 17000 - BAS CONTROLS INTEGRATION

[NOTE to Engineer-of-Record – This guide specification shall not be used verbatim in the project design documents. The Engineer-of-Record is responsible for reviewing/editing this document in its entirety to ensure that it meets the project requirements. To determine the control requirements specific to each project coordinate directly with the University of Alberta Operations Building Automation System Design Group. It is recommended that this coordination effort commence during schematic design to set design criteria for the detailed design. Once this coordination has happened, an editable version of this master specification will be provided to the Engineer-of-Record for use on the specific project.

In various locations there are bold/bracketed designer instructions (i.e., “[designer instructions in bold text]”) that are meant to help guide the Designer with the editing process. However, these instructions should not be seen as exhaustive – each project has unique requirements that cannot be anticipated by this document – and therefore each item in the document must be reviewed by the Designer for relevance to the specific project requirements.]

PART 1 GENERAL

1.01 INTRODUCTION

A. The work in this section applies to that needed on the University's Tridium Niagara AX Supervisor software (the “Niagara Supervisor”) for use as the operator interface to the project’s 15900 Building Controls System (BCS).

B. The work includes coordination with section 15900 concerning set up of the Building Control System (BCS) data used in operator interface (i.e., point and other object naming/addressing, start/stop scheduling, alarms, trends, etc.), mapping of this data into the Niagara Supervisor, and development of all operator interface screens (i.e., color-graphics, reports, etc.).

C. The Niagara Supervisor is an existing software system owned by the University and which operates on servers at the RCMS Shop, with mirrored servers in the Heating Plant. It provides Thin Client access to the BCS via PC’s provided by the University.

1. One server pair (referred to as the “University Server”) provides the Niagara Supervisor’s “alarm console” functions and is where the campus overview graphics operates.

2. One server pair dedicated to each BCS manufacturer’s products used on the campus (each is referred to as the “Vendor Server”). These servers provide the Niagara Supervisor’s other functions (e.g., all other graphic screens, trending, etc.).

D. There are two BCS architectures for which the Niagara Supervisor shall provide operator interface functions:

1. BACnet: An all BACnet system where all BCS Panels/Controllers are BTL-listed and communicate with the Niagara Supervisor using BACnet/IP.

2. Hybrid: A system using JACE’s which communicate to the Niagara Supervisor using proprietary Niagara Network communication. The JACE’s in turn use BACnet/IP...
communications to operate with BACnet/IP Distributed Control Panels and LonTalk Terminal Controllers.

See Section 15900 for more information about the above.

E. Abbreviations/Definitions

1. BACnet – ASHRAE standard 135 and/or the communications technology defined by this standard.

2. BACnet/IP – The use of the Ethernet/IP communications protocol for the transport of BACnet messages.

3. BAS – Building Automation System. Refers to that specified in sections 15900 (Building Controls), 15765 (Laboratory Controls), and this section.

4. BCI – BAS Controls Integration

5. BCS – Building Controls System specified in 15900

6. BTL – BACnet Testing Laboratory. Provides BACnet conformance testing (e.g., to confirm that a B-BC device meets all requirements set by the BACnet standard). If the device passes BTL testing it is said to be “BTL-listed” as, say, a “B-BC device”.

7. Communication Control Centre – Location of the main PC workstation thin clients and printers used with the Niagara Supervisor.

8. DCP – Distributed Control Panel used on central systems (i.e. air handling units heating water systems, chilled water systems, glycol systems, etc.)

9. Hybrid Architecture – A BCS architecture that uses JACE’s and Niagara Network communications with the Niagara Supervisor.

10. JACE – A Tridium JACE control panel or equivalent products


12. Niagara Network communications – Tridium’s proprietary messaging protocol using Ethernet/IP as the transport technology.

13. Niagara Supervisor – The University’s Tridium Niagara AX Supervisor system.

14. BCS Service Software (referred to as “Service Software” in 15900) – A suite of software modules/functions provided under section 15900 used only for the proprietary components of the BCS (and other BCS components of the same manufacturer installed on the campus). These functions include system database configuration, sequence of operation programming, operator interface functions used during startup and initial operation, etc.

15. TC – Terminal Controller used on terminal/zone equipment (i.e., VAV box, Fan Coil, radiation, etc.).

16. Thin Client – A PC that accesses the Niagara Supervisor via a Web Browser.

17. University Server – The server pair on which the Niagara Supervisors “alarm console” and the campus overview graphics operate.
18. Vendor Server – A server pair dedicated to a BCS manufacturer on which all Niagara Supervisor’s functions are performed, except for the “alarm console” and the campus overview graphics.

1.02 GENERAL REQUIREMENTS

[Consult with the University concerning the following choices:]

A. The University shall perform all services listed in this specification (i.e., they are to be considered the “BCI Contractor” or the Contractor responsible for this section). [Note that this does not free the Engineer-of-Record from taking responsibility for the inclusion of this section in the specification nor the editing of it to fit the project’s requirements.]

B. The BAS Controls Integration Contractor (the “BCI Contractor” or simply “the Contractor”) shall be listed on the University Approved Vendor List and shall only utilize products that meet the requirements of this specification. This list of Contractors includes:

1. Automatic Controls Ltd.
2. Siemens Building Technologies
3. [Consult with the University to determine the additional bidders to be listed.]

C. The Contractor shall submit prices as detailed on the tender form. The prices submitted shall be based on labor that meets every requirement of the technical specifications detailed in this document unless the Contractor has indicated an item with which the Contractor cannot comply in the proposal submittal.

D. The Contractor shall provide complete details in the submittals concerning the form, format and quantity/type of Niagara Supervisor graphic screens that will be provided to meet the scope of work as specified.

E. The Contractor shall use the University’s standards for developing the Niagara Supervisor functions for the project (see Part 3 for more details).

F. Comply with manufacturer's recommendations concerning the use of the Niagara Supervisor in developing the operator interface functions for this project.

1.03 DESCRIPTION OF WORK

A. This section includes the labor involved in using the Niagara Supervisor software tools to develop the operator interface functions for this project’s BCS. These “functions” include:

1. BCS data discovery/mapping,
2. Graphic screens including point/data override/change capability,
3. Start/stop schedule viewing/modifications,
4. Alarm reporting and management,
5. Historical Trend data viewing and archiving,
6. Equipment Run Timer viewing and archiving,
1.04 RELATED WORK

A. The BCS - Both this section and Section 15900 are responsible for the joint efforts involved in integrating the BCS to the Niagara Supervisor.

1. The BCS shall be set up to communicate all data specified in 15900 to the Niagara Supervisor. “Communicate” in this case means two way communications with alarm and event messages being sent by the BCS to the Niagara Supervisor and all other messaging (status, file upload, backup, time synch, etc.) being initiated by the Niagara Supervisor (e.g., a BACnet Read Property service). The integration shall not depend solely on so-called “polling” of the BCS by the Niagara Supervisor.

2. All modifications/additions to the Niagara Supervisor for representing/controlling data from the BCS (e.g., graphics, alarm reporting, trend data presentation, schedule viewing/changes, etc.) are the responsibility of the Contractor.

3. Section 15900 shall coordinate with the Contractor concerning all BCS data (including that from BCS interfaces to third party systems) that must be communicated to/from the Niagara Supervisor.

4. The Contractor shall review Section 15900 to determine the complete scope of communicated data and operator interface functions for the BCS.

5. BCS communications addressing (networks, devices, objects) are the responsibility of Section 15900. Consult with the Section 15900 Contractor for any information needed concerning BCS communications addressing.

6. See Part 3 of this section for more information.

B. Campus IP Communications – The Niagara Supervisor shall communicate with the BCS via campus Facility IP LAN. This infrastructure is the responsibility of the University. Consult with the University concerning any questions/concerns about the IP communications between the Niagara Supervisor and the BCS.

C. Commissioning – [Reference the commissioning specification, if applicable, and state that the requirements therein include efforts that are to be provided in addition to that specified in this specification. If there is no commissioning process/spec on this project delete this and all other commissioning requirements in this specification.]

D. Niagara Supervisor Software and/or Server Upgrades: The University shall provide any modifications to this Software/Hardware needed to support this project (i.e., a Tridium license for additional BACnet objects, additional server capacity, etc.).

1.05 SUBMITTALS

A. Pre-Construction Submittals:

1. Graphic Screens and Reports:

   a. Within 30 days of contract award and prior to generating the submittal meet with the University concerning the specific operator interface requirements, layout and graphic screens required for this project.
b. Submit for approval a list of the graphic screens to be provided; and, for each screen, provide a conceptual layout of the screen and data, including those linkages to other screens, the alarm consoles, start/stop schedules and trend logs. Details on the required graphics are specified in Part 3 of this specification.

1) All BCS data shall be represented or listed.

2) All operator interface functions required by this specification shall be represented.

3) For each screen proposed include a list of all BCS setpoints and other operating parameters to be available via the Niagara Supervisor.

4) Identify any new graphic symbols (i.e., those not already in the Niagara Supervisor’s graphics library) needed for this project’s graphic screens.

5) Coordinate the above effort with Section 15900 to ensure that it properly represents the BCS design.

2. System Test Plan – Submit the plan and forms to be used in the System Test procedures specified in Part 3.

   a. The test forms shall include space for signatures or initials for each of the participated parties (i.e., Contractor, Section 15900 Contractor, University, Engineer) for use as an indication that the test results were as documented.

   b. The test forms shall also include space for dates to indicate when each party performed their test functions.

3. Commissioning: Provide for approval of all materials as required by the Commissioning Specification.

4. Niagara Supervisor Software and/or Server Upgrades: Determine and document the modifications needed to support this project (i.e., a Tridium license for additional BACnet objects, additional server capacity, etc.).

B. Record Document Submittals

   a. Completed System Test Forms

1.05 WARRANTY

   A. Provide labor necessary to assure proper operation of the system according to the design for a period of one year after substantial completion of the project. All warranty or final completion service shall be scheduled with the Owner to minimize disruptions to facility operations.
B. Emergency Service: Owner will initiate service calls when the Niagara Supervisor functions for this project are not functioning properly. BCI Contractor personnel shall be available to provide emergency warranty service. The Owner shall be provided with a telephone number where service representative can be reached at all times. Service personnel shall take action remotely or on site within 24 hours after receiving a request for service. The Contractor shall restore the system to proper operating condition within two (2) days.

PART 2 - PRODUCTS

No Requirements

PART 3 – EXECUTION

3.01 GENERAL

A. All work shall comply and/or be based on the University’s “Tridium AX Standards” Document and “Tridium Templates”, and shall use existing graphic symbols, where applicable, in the Niagara Supervisor graphics library.

   1. Any new graphic symbols developed for this project shall be added to the Niagara Supervisor graphics library and be available for use on other projects by other contractors.

B. No work shall disturb the operation of the Communication Control Centre’s use of the Niagara Supervisor, nor disrupt the operation and monitoring of any other buildings and/or systems. Any necessary disruptions shall be scheduled in advance with the University using the University’s Shutdown Procedure.

C. The work shall be performed in coordination with Section 15900’s schedule so that Section 15900 personnel can be readily available on-site for any required support efforts.

3.02 BCS COORDINATION/INTEGRATION

A. Scope of the Data Integration

   1. All BCS points shall be integrated into the Niagara Supervisor. See the 15900 specification for a list of all systems/equipment and points that shall be integrated into the system.

   2. See Part 3 of the 15900 specification for an initial list (along with guidelines for finishing this list) of the specific operating data (i.e., setpoints and other operating parameters), alarms (and associated alarm information), schedules, historical trends, and run time data that shall be integrated into the Niagara Supervisor.

   3. Coordinate with the 15900 Contractor to determine the specific points, data, alarms, schedules and trends to be communicated from the BCS.

B. Data Naming - Meet with the University and the Section 15900 Contractor within 30 days of contract award to determine and/or refine the character point/data naming convention to be
used for this project. The same point and data names shall be used in both the Niagara Supervisor and the BCS.

C. Time Synchronization - All BCS components with real-time clocks (i.e. JACE’s, Management Level Panels, DCP’s, etc.) shall be synchronized from the real-time clock in the Niagara Supervisor at least once every 24 hours.

D. BCS I/O Point Data (present value, reliability, etc.) shall be automatically communicated to the Niagara Supervisor upon a change of value (i.e., using a BACnet …COV Notification service). Regular polling by the Niagara Supervisor shall not be required.

E. Point/Data Operator Override - Any manual operator actions described by the BCS sequences shall be made available from the Niagara Supervisor.

F. Point/Data Override Priorities – Coordinate with the Section 15900 Contractor to ensure that commandable points/data (e.g., a BACnet Binary Output object) are written to at the correct priority level by the Niagara Supervisor.

G. Setpoints and other Operating Parameters shall be communicated to the Niagara Supervisor upon request by the Niagara Supervisor (e.g., via a ReadProperty service executed to update the data on a graphic screen). Where any of these setpoints and other operating parameters are to be commandable by the Operator, they shall also be writeable at the correct priority level by the Niagara Supervisor including “set” and “override” functionality.

H. Alarms

1. All alarms (i.e. limits, messages, priorities) shall be set up in the BCS under Section 15900.

2. Alarms shall be automatically communicated from the BCS to the Niagara Supervisor by the BCS in real-time.

3. When requested by the Niagara Supervisor the BCS shall provide an alarm summary.

4. Alarm priority – Coordinate with Section 15900 concerning the specific alarm priority values to be used in meeting the University standard alarm priority levels (see Part 3 of 15900 for these standard levels).

5. If a new University Server is provided as part of this project the Contractor shall set up the alarm consoles and routing to match that in the existing system.

I. Historical Data Trending and Equipment Run Timers

1. Trends and Timers shall be set up in the BCS under Section 15900.

2. The Niagara Supervisor shall read trend data (i.e., via the BACnet Trend Log object) or run timers from the BCS at intervals defined in 15900.
a. If a trend log has exceeded its threshold sample capacity prior to the 48hrs, the BCS shall notify the Niagara Supervisor (by an EventNotification service) to read the trend log immediately.

b. Coordinate with the 15900 contractor to ensure that the above function is set up properly (i.e., that the Niagara Supervisor is enrolled to receive the EventNotification message and that the message triggers the reading of the appropriate trend log).

3.03 ALARM/EVENT REPORTING AND MANAGEMENT

A. Alarms or other events shall be output at one or more alarm consoles based on the category of alarm on an individual alarm basis. Unless directed otherwise by the University, the Contractor shall set up the system such that all alarms shall be output at the alarm consoles on the University Niagara Server.

Or

Alarms or other events shall be output at one or more alarm consoles based on the category of alarm on an individual alarm basis. During construction and prior to turn over of the project, all alarms shall be directed to a set of alarm consoles on the Vendor Server pair associated with the BCS Contractor. Once commissioning and testing is complete the system is ready for turnover to the University, the Contractor shall redirect the alarms such that all alarms are output at the alarm consoles on the University Niagara Server.

[ Consult with the University to determine if the specific project warrants the temporary redirection of alarms during construction. The purpose of the redirection is to segregate interim alarming so as to minimize nuisance alarming on the active alarm consoles, and for ease of troubleshooting during construction commissioning and testing.]

B. Critical alarms shall be output on the Communication Control Centre’s BAS alarm printer. Coordinate with the Section 15900 Contractor and the University to determine alarm priorities for all alarms, and which are to be printed.

C. Provide hyperlinks for all alarms to link to the associated graphic to aide in troubleshooting.

3.04 REPORTS [Engineer to consult with the University to determine if any custom reports are needed for the project. If so, they shall be described here; if not, delete this paragraph.]

3.05 GRAPHIC SCREENS

A. All graphics shall use or be based on the University’s standards referenced earlier in this section.
B. Link alarms received by the University Server alarm consoles to the associated graphic screen and displayed point (i.e., so that the points provide alarm status information to the user from the graphic screen).

C. Graphic Screen Location and Linking
   1. Changes made to the campus overview graphics (i.e., showing a new building or addition) shall link to the associated graphics developed for this project in the Vendor Server.
   2. Graphics developed for this project shall be linked to the alarm consoles in the University server.

D. All graphics developed by the BCI Contractor shall reside in the Niagara Supervisor, not in any of the project’s JACE panels, if applicable.

E. The following graphic screens as a minimum shall be developed (or edited if existing) for this project:
   1. The campus overview (edit existing in University Server)
   2. Building overview with each floor’s plan (edit if existing in Vendor Server)
   3. [Engineer to list the specific system/equipment graphics required.]
   4. The above list shall be refined and finalized per the Part 1 Submittals requirements.

F. Provide hyperlinks to other related graphics where systems are related. Also include “home”, “back” and “forward” hyperlinks on all graphics.

G. As-built sequences of operation shall be shown on graphic screens linked to each corresponding system/equipment.

3.06 SYSTEM TESTING

A. The Contractor shall be equipped with communications and/or protocol analysis tools (i.e., Wireshark) during the testing. These tools shall be used for verifying that Niagara Supervisor BACnet messages are properly formed and/or to diagnose any problems that arise with BCS communications.

B. All tests that involve communications with the BCS shall be coordinated with and include the Section 15900 Contractor.
   1. The Section 15900 Contractor shall observe system response on the BCS Service Software as part of confirmation that the test is successful.
   2. The Section 15900 Contractor shall sign or initial the test forms as an indication that the results were as documented.
C. The University or University’s Representative will carry out inspections and prepare deficiency lists during and on completion of construction. University personnel or their representatives may choose to observe some or all of the testing procedures. Advise the University, in writing, at least three weeks in advance of commencing this phase of the project. Any deficiencies or defects noted shall be corrected and observation of a partial re-test may be requested.

D. Test a sample of each data type (e.g., point objects, schedule, trend, alarm, etc.) and message type (e.g., ReadProperty, WriteProperty, EventNotification, Time Sync, etc.) used in the BCS integration.

1. These tests shall be performed “end-to-end” with the BCS (i.e., the Contractor shall confirm that the data and message match that sent by/to the Niagara Supervisor).

2. These tests shall be performed in both directions (i.e., a schedule shall be both read by the Niagara Supervisor and written to the BCS).

E. Fully test that the screen hierarchy and navigation (i.e., hot buttons to jump to other screens) is as submitted.

F. Test all graphic screens to demonstrate that:

1. The screen/data is displayed in the specified time

2. The required data is represented

3. Systems, equipment, components, points, setpoints, etc. are properly/clearly documented on the screen

4. Values are dynamically updated and the update time matches that of the BCS

5. The required colour change or status change occurs when a point’s operating or alarm state changes.

6. The points/data can be overridden, and any other actions to be accessible from the screen (i.e., trend data) are operational.

7. That an indication of any alarm appears on the screen when the alarm occurs.

8. Links to all other graphics from a respective graphic are functional and correct.

9. A sample of unique set of terminal controller graphic screens (i.e., each type of VAV box) shall be tested per the above.

G. Scheduling – Demonstrate that all of the required start/stop schedules are set up and operational.

H. Alarm Reporting and Management

1. Test that a variety of BCS alarm types are received by the Niagara Workstation with all associated data (i.e., message, time, etc.). The test sample shall include:
a. All main/central systems (i.e., heating/cooling water distribution systems, AHU’s, etc.).

b. [Choose a percent appropriate to this project's criticality] % of terminal controller equipment alarms.

c. The following critical terminal equipment and/or space condition alarms: [List the critical items for this project; i.e., lab areas, etc.]

2. Demonstrate that the various BCS alarm priorities are handled as specified by the Niagara Server.

3. Test the proper operation of alarm acknowledgements.

I. Trending

1. Observe trend data dynamically updating on the system and compare with that on the BCS.

2. Read a trend log from the BCS and compare it on an item-by-item basis with that in the BCS.

3. Confirm that all trend logs have been integrated from all BCS controllers.

J. Run Timers

1. Observe a run timer report dynamically updating on the system and compare with that on the BCS.

2. Confirm that all run timers have been integrated from all BCS controllers.

3.07 COMMISSIONING [Delete if there is no commissioning agent and/or edit further based on coordination with the commissioning requirements.]

A. Prior to Commissioning provide the system testing services specified above and/or in the Commissioning Specification.

B. Participate in commissioning process as required by the Commissioning Specification. Coordinate with the Commissioning Agent concerning the details of this effort.

3.08 TRAINING

A. Provide training focused on the use of the specific operator interface functions/screens developed for this project.

B. Training shall be provided initially after project completion and/or over the term of the warranty period.
C. Introductory training on the system (i.e., screen navigation, alarm response, viewing reports, etc.) shall be provided to 20 people in two separate sessions (10 people in one session and 10 people in a second session) on successive days. Provide this training three weeks prior to building turnover.

D. Provide an additional [Select a number of hours appropriate for the project – consult with the University.] hours training to 10 people within six months after Substantial Performance. Topics to be determined by the University.

E. Submit an outline of the training courses to the University. This outline shall include a schedule of the training sessions in at least one-half day increments, indication of the topics to be covered in each session and any prerequisite requirements that should be met prior to attendance. The training outline shall be submitted with the initial shop drawing and submittals packages. Training shall not commence unless the University has approved the training outline. Training shall be coordinated with the University.

F. Training sessions shall include classroom type instruction and "hands on" instruction and shall be given by the BCI Contractor at their local facilities in the Edmonton Capital Region or at the University. Regardless of the location the Contractor is responsible for all costs associated with training. The trainers shall be factory trained, shall be experienced with the software and shall be experienced trainers. The resumes of the trainers shall be submitted to the University for approval. The resumes shall indicate clearly the experience and expertise of the proposed training staff with regard to both their technical and training capabilities. The BCI Contractor shall certify that the proposed training staff are specialist trainers. The BCI Contractor shall advise the University of the recommended qualifications for the potential trainees.

G. Provide all training materials (training manual, hand-outs, textbooks, workbooks etc.) and any audiovisual equipment required to execute the training. The training manuals shall be submitted to the University for approval and any changes requested by the University shall be made at no additional cost to the University. The training manual shall include all of the topics included in the training sessions and shall be customised for this installation. Provide two (2) hardcopies and one (1) electronic copy of the final version of the training manual to the University at least six (6) weeks prior to the commencement of the training. The final version of the training manuals shall be provided to each of the training course participants at the time the training commences. Provide one (1) electronic copy of the final version of the training course.

H. Training sessions shall be formatted to maximize the usage of time of the attendees and prevent redundant coverage of materials for advanced students. Training sessions shall be designed on the basis of experience and knowledge of the attendees scheduled to participate and shall differentiate between the requirements of supervisory, operations and maintenance personnel. The training shall be specific to this project and shall cover, at minimum, the following:

1. System graphic/report architecture
2. General operator interface features
3. Data base features
4. Graphics
5. Reports
6. Alarms
7. Trends
8. Operator definable values.

I. All training on the user interface provided by the BCI Contractor shall be given in conjunction with the BCS contractors training.

END OF SECTION