

# **KCTCS Building Automation Systems Implementation Guide for Tridium Niagara Web Supervisor Integration**

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## Revision History

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Complete revision history available on Master Doc. V 3.0.

## 1. Introduction

### A. Background

1. For several years, KCTCS facilities have been standardized on the Tridium Niagara platform. This platform is well-suited for the integration of the wide spectrum of controls and providers that KCTCS uses for its existing facilities and new construction projects. KCTCS recently invested in a new model to streamline the building automation system access throughout the network of its sixteen (16) colleges and the system office located in Versailles. All building-level JACEs will feed into a college server supervisor. Subsequently all college server supervisors will feed into a single Master Web Supervisor for the system.
2. This new model was developed by Paladin, Inc., a commissioning, and engineering firm based in Lexington, KY and Cochrane Supply and Engineering, a Tridium distribution company with experience in implementing enterprise-level systems. The process of adapting this new model includes a transitional period during which existing college servers will be moved to off-site virtual storage space and building automation systems lacking integration into the college servers will be added.

### B. KCTCS BAS Implementation Guide Objectives

1. The function of this document is to serve as a guide for controls suppliers and service providers in the installation of the new KCTCS building automation features for existing facilities and new construction projects. This guide describes all elements of the new controls' models including:
  - a. Owner Furnished Resources\_KCTCS Standard Objects
  - b. Coordination of IP addressing
  - c. Access to the KCTCS network
  - d. Integration to the college server
  - e. Close-out procedures and documentation
2. This guide is intended to complement the KCTCS controls supplier training program and the controls supplier's knowledge of Tridium programming. A KCTCS Standards Implementation Checklist is attached for controls suppliers and service providers to reference. As KCTCS's building inventory grows and software is periodically updated, those changes may necessitate future revisions and updates to this BAS Implementation Guide. Where a service, activity, or coordination process is unclear, users of this guide can contact the BAS Standards and Compliance team (listed in Section 1.3 Contacts). Industry best practices should be applied during all BAS work.

C. Contacts

KCTCS BAS Standards and Compliance Team		
Andy Casebier, Architect Assistant Vice President – Facilities and Support Services	Andy Casebier	(859) 256-3287 <a href="mailto:Andy.casebier@kctcs.edu">Andy.casebier@kctcs.edu</a>
KCTCS Facilities BAS Contact	Jeff Hall	(859) 753-1327 <a href="mailto:Jeff.hall@kctcs.edu">Jeff.hall@kctcs.edu</a>
KCTCS Technology Solutions Contact		
College IT Contact		

D. Overview of Installation Process

1. New Construction: The following is an outline of the general process for the implementation of the new BAS model for New Construction:
  - a. Bid Award
  - b. Pre-submittal Controls Coordination Meeting
  - c. Submittal Review and JACE Order Coordination
  - d. Pre-installation Controls Coordination Meeting
  - e. Installation
  - f. Completion and Compliance Review
  - g. Integration to College Supervisor
  - h. Owner Training
  - i. Warranty Period
  - j. Turnover to Service Provider
  
2. Existing Facilities: The following is an outline of the general process for the implementation of the new BAS model for Existing Facilities:
  - a. Initiation of College Upgrades
  - b. Service Provider Proposal and Acceptance
  - c. Installation of Upgrades and Standard Objects
  - d. Completion and Compliance Review
  - e. Integration to College Supervisor

**2. Owner Furnished Resources**

A. Virtual Servers

1. At the college and system levels, virtual servers will be established in conjunction with KCTCS Technology Solutions and hosted and managed off-site.
2. The process of implementing the new KCTCS standards and policies for existing facilities will generally coincide with the migration of the college servers to the new hosted space.
3. New construction projects will implement the KCTCS standards and policies regardless of the college virtual status during the transitional phase.

B. JACE

1. The JACE controller will be acquired by KCTCS through their service provider and be turned over to the control's supplier. The controls contractor should complete a JACE order form and submit it to KCTCS to initiate processing.
2. Typically, the JACE will arrive un-commissioned. The Controls Contractor MAY NOT commission the JACE in a proprietary fashion.
3. At the option of KCTCS, the JACE may be delivered with the approved setup and configuration, new KCTCS standard station and KCTCS standard objects pre-loaded.
4. The approved hardware devices used for all KCTCS projects will be J-8000 or higher. Sizing and other capacity concerns should be coordinated through the KCTCS Capital Projects Manager.

#### C. Niagara Software

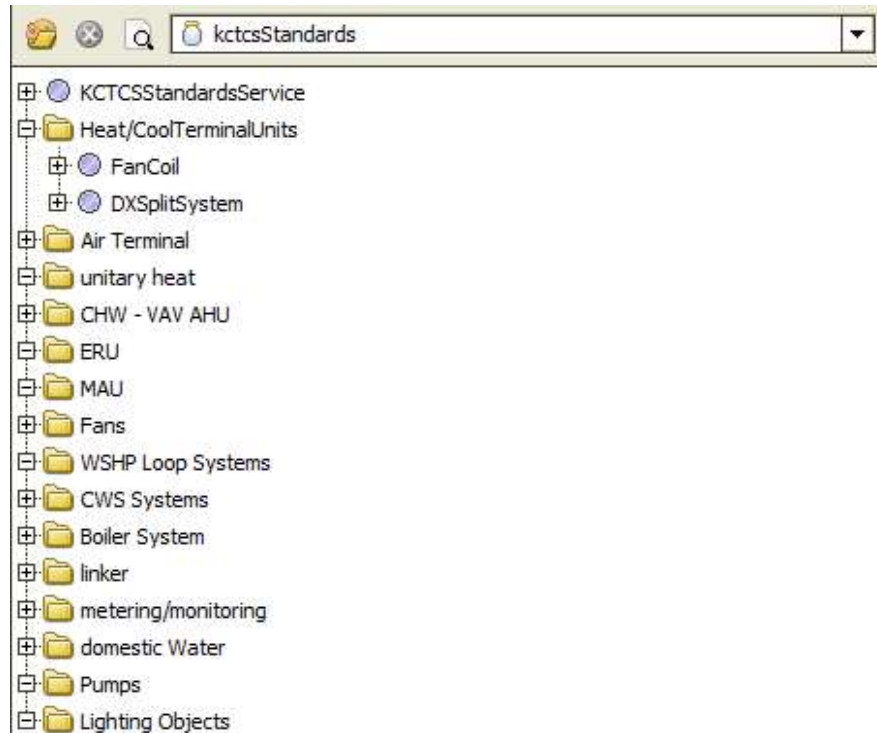
5. The Niagara Software and setup on each JACE/Server shall be standardized to the functional requirements of the new KCTCS Building Automation System Policies. The Autobox Service is a select feature created and demonstrated by Cochrane which has allowed KCTCS to execute the new enterprise model. This service provides a user interface which operates without Java Plug-in and can be viewed on mobile devices. The addition of this service creates fundamental changes in how KCTCS graphics are implemented and delivered.
6. Existing buildings will need to be upgraded to version of Niagara 4.3.58 and have the correct services added to the JACE prior to beginning the standardization process. At no time will the new JACE/Server software be a version ahead of the Master Web Server.

#### D. Automated Logic WebCTRL Software

1. ALC software must be version 7.0 and 7.0 compatible.
2. ALC naming convention will follow the Finance and Administration Cabinet's ALC naming convention.

### 3. KCTCS Standard Objects

- A. The current version of the KCTCS Standard Objects will be made available for loading on the station delivered to the controls supplier on the Owner Furnished JACE. These standard objects are packaged within the KCTCS Standards Service and are used in a palette. Each type of equipment is reflected in one of the available objects and provides the required points for integration with the College Supervisor and KCTCS Master Web Supervisor. For existing buildings, the current version of the KCTCS Standards Objects will be provided and added to the upgraded JACE. Standard objects will be maintained by the provisioning service from the KCTCS Master Web Supervisor down to the JACEs.
- B. Organization: The organization of the KCTCS Standards Jar file are organized by equipment type. Individual objects are located within folders as depicted in the image below. For example, 'Fan Coil' and 'DX Split System' are types 'Heat/Cool Terminal Units'.



C. Metadata

1. The KCTCS Standards Service uses metadata to tag and organize points for integration with the Supervisor, groupings of the histories, user-friendly sort-and-search techniques and distributing the histories to the Commonwealth Energy Management and Controls System (CEMCS) database.
2. The Properties View of the Service provides fields that must be completed by the control's supplier for each JACE. (See screenshot)

KCTCSStandardsService (KCTCS Standards Service)

<input type="checkbox"/> <input checked="" type="radio"/> College	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Campus	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Address	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> City	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> State	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Zip Code	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Time Zone	Eastern ▾
<input type="checkbox"/> <input checked="" type="radio"/> Campus Contact	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Service Contact	<input type="text"/>

3. The Properties View of each object also provides metadata which must be entered. Only the blank fields of the object properties will need to be completed as the other properties will inherit the metadata from the service. (See screenshot)

<input checked="" type="radio"/> FanCoil (KCTCS Fan Coil)	
<input type="checkbox"/> <input checked="" type="radio"/> Ky Archibus Building Id	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Building Name	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Building Area Served	<input type="text"/>
<input type="checkbox"/> <input checked="" type="radio"/> Drawing Layers	Mh ▼
<input type="checkbox"/> <input checked="" type="radio"/> System Group	<input type="text"/>

4. Most information for these Properties should be available in the project documents. However, items such as the Kentucky Archibus Building ID number may need to be requested from the KCTCS Capital Projects Manager overseeing the new construction. Building area should reflect a floor and/or wing of the building based on the designations selected in the drawings. Existing building standard object metadata should reflect common area names used by the owner. The drawing layer category indicates the discipline under which the equipment falls: (See table)

M	Mechanical
Mh	Mechanical HVAC
Mp	Mechanical Plumbing
E	Electrical
Ep	Electrical Power
EI	Electrical Lighting

5. System Group is a field provided to record the primary system connected to the equipment object. The System Group field for a terminal unit would be the name of the its handling unit. The System Group for a pump manager would be the chilled or hot water system it serves.

#### D. Standard Object Point Characteristics

##### 1. Points List

- The points programmed into each standard object include the primary operating control points and the required points for common configurations of CEMCS integration for that device type.
- For that reason, the VAV object points list shown below includes command and status points for a fan and for instances of VAV boxes that are not fan-powered, that slot will remain unused.

Vav (KCTCS Vav Folder)		
<input type="checkbox"/>	<input type="radio"/>	ZN_T 0.0 °F {ok}
<input type="checkbox"/>	<input type="radio"/>	ZN_T_SPT 0.0 °F {ok}
<input type="checkbox"/>	<input type="radio"/>	EFF_ZN_T_SPT 0.0 °F {ok}
<input type="checkbox"/>	<input type="radio"/>	OCC_HTG_SPT 0.0 °F {ok}
<input type="checkbox"/>	<input type="radio"/>	OCC_CLG_SPT 0.0 °F {ok}
<input type="checkbox"/>	<input type="radio"/>	UNOCC_HTG_SPT 0.0 °F {ok}
<input type="checkbox"/>	<input type="radio"/>	UNOCC_CLG_SPT 0.0 °F {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	ZN_T_OVRD Normal {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	OCC_S Unoccupied {ok}
<input type="checkbox"/>	<input type="radio"/>	DA_T 0.0 °F {ok}
<input type="checkbox"/>	<input type="radio"/>	ZN_CO2 0.0 ppm {ok}
<input type="checkbox"/>	<input type="radio"/>	ZN_CO2_SPT 0.0 ppm {ok}
<input type="checkbox"/>	<input type="radio"/>	ZN_RH 0.0 %RH {ok}
<input type="checkbox"/>	<input type="radio"/>	SA_FL_S 0.0 cfm {ok}
<input type="checkbox"/>	<input type="radio"/>	SA_FL_SPT 0.0 cfm {ok}
<input type="checkbox"/>	<input type="radio"/>	EFF_SA_FL_SPT 0.0 cfm {ok}
<input type="checkbox"/>	<input type="radio"/>	ZN_DPR_C 0.0 % {ok}
<input type="checkbox"/>	<input type="radio"/>	HT_VLV_C 0.0 % {ok}
<input type="checkbox"/>	<input type="radio"/>	HT_VLV_C_OVRD 0.0 % {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_1_C Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_2_C Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_3_C Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_4_C Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_1_C_OVRD Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_2_C_OVRD Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_3_C_OVRD Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	HT_4_C_OVRD Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	FAN_C Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	FAN_C_OVRD Off {ok}
<input type="checkbox"/>	<input checked="" type="radio"/>	FAN_S Off {ok}

## 2. Point Properties and Extensions

- a. The points programmed into each standard object are designed to standardize the alarming criteria and trending intervals for all similar devices with KCTCS Standards and Policies.
- b. There are history extensions which are established to save point data at the rate consistent with CEMCS standards for all required points. There are also alarm extensions to govern the 'out of range' alarm source information to align with the approved operating guidelines for KCTCS facilities.

## E. Adding and Using Standard Objects (Example VAV Box)

### 1. New Construction

- a. The standard objects do not replace the work normally performed by the controls suppliers to implement equipment folders, point-to-point connections, logic and sequencing.
- b. The objects are a means of consistently conveying the naming convention used in the KCTCS System and managing history building and alarming functions.

VAV1	
KCTCS Vav	
ZN_T	72.2 °F {ok}
ZN_T_SPT	- {null} @ def
EFF_ZN_T_SPT	72.0 °F {ok}
HTGOFFSET_SPT	- {null} @ def
CLGOFFSET_SPT	- {null} @ def
OCC_S	Occupied {ok}
ZN_T_OVRD	Normal {ok}
DA_T	67.7 °F {ok}
DA_T_SPT	- {null} @ def
ZN_CO2	0.0 ppm {ok}
ZN_CO2_SPT	- {null} @ def
ZN_RH	0.0 %RH {ok}
SA_FL_S	345.4 cfm {ok}
SA_FL_SPT	- {null} @ def
EFF_SA_FL_SPT	349.6 cfm {ok}
ZN_DMPR_C	46.3 % {ok}
HT_S	Off {ok}
HT_VLV_C	0.0 % {ok}
HT_1_C	Off {ok}
HT_2_C	Off {ok}
HT_3_C	Off {ok}
HT_4_C	Off {ok}
FAN_C	Off {ok}
FAN_S	On {ok}

## 2. Existing Facilities

- a. The KCTCS Standard Objects can be added and linked to an existing set of points for each piece of connected equipment. Equipment operation remains controlled by the existing logic and programming. However, the point nomenclature, trending intervals, and alarming source information will be updated.
- b. As the Standards Service and Object use large amounts of memory, the JACEs for existing facilities will need to be reviewed for potential upgrades. This requires clean-up after the addition of the standard objects on the wiring diagrams to remove any redundant alarms and history extensions.

## 3. Device Naming

- a. Each device should be uniquely named based on the engineer's provisions in the construction documentation.
- b. Device naming for existing facilities should remain consistent with the existing nomenclature for maintenance and operational personnel's reference.
- c. Certain characters and character lengths may need to be altered for one of two reasons:
  - 1) Equipment names longer than fifteen (15) characters will cause issues with the creation of certain point histories; and
  - 2) Spaces should be replaced by underscores in a consistent naming convention.
- d. When standard objects are added to the wireframe, the initial pop-up request is for the Equipment Tag. For each standard object, enter the equipment name into this field and continue.

## F. Historic Data Storage

1. The standard time intervals for point trending have been pre-programmed into the standard objects for each device.



2. Linking the correct point with the correct slot on the standard object prepares it for integration with both the college and master web supervisor servers. The set of all linked points still needs to be enabled from the History Service (or on an individual basis at each extension).
3. NOTE: Best practice is to fill out all appropriate metadata in the Standard Object before enabling the histories for associated points.

#### G. Alarms

1. The standard parameters for alarming have been pre-programmed into the standard object each device.
2. Linking the correct point with the correct slot on the standard object enables notification once the console has been established and readies the device for integration with the college web supervisor alarm console.
3. Alarm tuning is a likely exercise that will need to occur once the building is on-line and operators begin receiving alarms.
4. Alarm tuning is the responsibility of the controls installing contractor. This includes ensuring proper out-of-range alarm limits are configured correctly in Standard Object, along with linking corresponding points that have alarm dependencies.

#### H. Graphics

1. Graphics associated with the KCTCS Standard Objects will be hosted and integrated at the college server level. These standard graphics will be developed and maintained by the Capital Project Manager or Designated Representative.
2. Graphics associated with Custom Equipment will be developed by the Capital Project Manager or Designated Representative, specific for the application using the Niagara kitPxN4svg tools.
3. Graphics for Building and Building Systems level applications will be developed specific for the application by the Capital Project Manager or Designated Representative using the Niagara kitPxN4svg tools. These graphics will be hosted and integrated with the college-level servers.

### 4. Controls Supplier Coordination

#### A. New IP Address and VPN Access Requests

1. With the establishment of a new BAS model, KCTCS Technology Solutions understood the opportunity to improve the security of the KCTCS network by assigning private IP addresses for all JACEs.
2. These private IP addresses will be coordinated with the College IT and KCTCS Technology Solutions departments.
3. To add a JACE to the network or if remote access to the JACE is required, controls suppliers should complete and submit a New IP Address and VPN Access Request Form.

#### B. New User Requests

1. A New User Request Form is completed and submitted by the controls supplier when a new user for the company requires access to the browser site for any KCTCS facility.
2. Users will enter through the Master Web Supervisor and have access to the college supervisor and sites as requested.

3. New User Request forms should be submitted to KCTCS BAS Facility Manager for approval.

C. Transfer of Commissioned JACE

1. Typically, Owner-furnished JACE's will be delivered directly to the controls vendor.

**5. Controls Supplier Installation**

A. User Service and Security

1. The controls supplier should add any relevant user profiles to the JACE for programming and monitoring as required for project.
2. It is recommended that those usernames follow the pattern user 'First Initial' plus last name. (Example: rsmith).
3. These users should be set to have one of the following standard prototypes: System Operator, System Administrator, Service Operator, Service Administrator, Facilities Operator, Facilities Administrator, Scheduling, or Reporting.

B. KCTCS Standard Objects

1. The controls supplier shall complete all fields of the KCTCS Standards Service and the fields for all devices throughout the facility.
2. Select the applicable equipment type consistent with the direction on the engineer's points list for each device and place on the wireframe. Link the controls points for the selected device to the correct slot on the object, being cognizant of the points' function as input or output.
3. Supply links to all slots indicated as required points on the engineer's points list.

C. Scheduling

1. There is no change to how schedules are implemented at the JACE level.
2. Schedules will be integrated to the College Level Supervisor and Master Web Supervisor tiers.
3. Linkage of schedules to appropriate equipment in the JACE is the responsibility of the installing contractor. The KCTCS Capital Project Manager or Designated Representative will be responsible for integration of schedules to college servers.

D. Backups

1. Once integration is complete, the Capital Project Manager or Designated Representative will set up an automatic backup job on the associated college server to back up the JACE weekly. A retention policy of "last 5" will be enforced.

E. Best Practices

**6. Integration to College Supervisor**

A. Notification

1. For new construction, the controls supplier should notify the KCTCS Capital Project Manager or Designated Representative of their readiness according to the schedule determined during the HVAC Instrumentation and Controls Scheduling Meeting.
2. In order for the integration to occur, the following must be satisfied:
  - a. JACE communicating over KPEN
  - b. JACE on secured ports

- c. JACE credentials delivered to KCTCS BAS Standards and Compliance Team
- d. JACE Toolkit transmitted
- e. All standard objects must be generated and linked to the correct points
- f. All appropriate metadata in Standard Objects are completed and saved.
- g. All histories are enabled from Standard Objects that have point links.
- h. No points other than Standard Object points have histories appended.

#### Toolkits

- 1. The installing contractor shall be responsible for delivering a complete toolkit, in Microsoft Excel format, to the KCTCS Capital Project Manager or Designated Representative.
- 2. The toolkit shall detail all JACE information, including IP addresses, platform/station ports, platform/station credentials, station name.
- 3. The toolkit shall outline all equipment to be integrated by the KCTCS Capital Project Manager or Designated Representative. All points, Standard Object or custom, shall be outlined for each piece of equipment, and whether histories or alarms are associated with each.
- 4. The toolkit shall outline any desired schedules to be integrated, or created.

#### B. Compliance Review

- 1. Upon notification, the KCTCS Capital Project Manager or Designated Representative will review the controls supplier's completion of standard object and connections. A JACE Commissioning Report will be generated and provided to the Controls Vendor. Outstanding corrective action will need to be completed prior to integration.
- 2. Once the JACE is deemed ready for integration, the KCTCS Capital Project Manager or Designated Representative will then initiate integration. Compliance and integration is to be performed leaving adequate time for commissioning of controls, substantial completion date, and owner training.

### 7. Close-out Procedures and Record Documentation

#### A. Turnover of Credentials

- 1. The platform and station access credentials shall be recorded and transferred to the owner at the time of occupancy.
- 2. At the end of the warranty period on a new construction project, the controls vendor's access will be removed.

#### B. Record Documentation

- 1. Single-line diagrams
  - a. Within the as-built documentation, there must be a layout of the equipment which demonstrates primary and secondary device relationships.
  - b. CEMCS requires a schematic or table showing which terminal units are connected to each air handling unit and which pumping, heating and cooling equipment is related to each respective heating or cooling hydronic system.
  - c. This applies to all mechanical, electrical, and plumbing systems that are controlled by the building automation system.

## KCTCS Standards Implementation Checklist

Secure JACE hardware and complete physical connections to local devices and equipment.

### JACE Settings

- Ensure that the correct Niagara version (~~AX or~~ 4.X) is running on the JACE
- Enable SSL connections and ports per the KCTCS BAS Policy
- Change Platform access from default credentials to meet KCTCS BAS Policy
- Setup the Admin account at the station level per the KCTCS BAS Policy
- Setup the NiagaraUser account at the station level
- Add the current version of KCTCS Standards module to the JACE and drop the KCTCS Standards Service in the Services folder
- Setup the Classes and Recipients in Alarm Service per KCTCS BAS Policy
- Add the current version of Email module to the JACE and drop the Email Service in the Services folder
- Set NtpPlatformServiceQnx under Platform Services to sync time with college server
- Set Audit History configuration to 2500 records.
- Add Report Service and generate Downed Device reports for each communication protocol

Create communication drivers and programming per standard practices. Utilize attached “KCTCS Standard Object Toolkit.xls” to document objects, points, histories, and alarms for remaining station setup.

### KCTCS Standards Service and Objects

- Open KCTCS Standards Service property sheet and complete all empty fields
- Open the KCTCS Standards module in the Palette
- Open the wire sheet of each piece of equipment on the JACE, add the appropriate Standard Object, name the Object with the appropriate Equipment Tag, and link all applicable points to the correct slot on the Object
- Open the Object’s property sheet and complete all empty fields
- Repeat as necessary for all equipment and objects.
- Backup and save the Station, email copy of backup to KCTCS Capital Project Manager or Designated Representative
- FOR EXISTING BUILDINGS: Save the history database under the Actions tab of the History Service, then disable and delete all existing / old histories
- Enable histories for all newly linked points, do not enable histories for unlinked points
- Disable all unused alarms for Standard Object points that are unlinked or not used
- FOR EXISTING BUILDINGS: Disable duplicate and nuisance alarms, ensure existing critical alarms are rerouted to be Priority 1 or 2
- Establish communication over Niagara Network with college server (to be coordinated with KCTCS Capital Project Manager or Designated Representative)
- Import schedule(s) from college server to JACE and link to appropriate objects

### Turnover

- Record JACE IP Address, Station Admin Username and Password
- Transmit the completed “KCTCS Standard Object Toolkit.xls” to the KCTCS Standards & Compliance Team.

- FOR NEW CONSTRUCTION: Prepare record single-line diagram of equipment and systems