





Niagara Specifications

Tridium - Connecting Minds and Machines

Founded in 1996, Tridium became a wholly owned, independent business entity of Honeywell in 2005

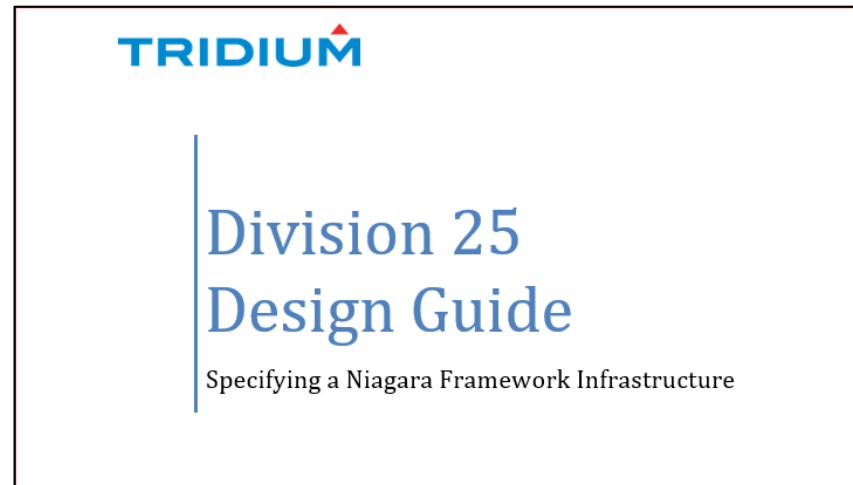
Global leader in Open Platform Building Automation

- **1 Million+** instances of Niagara operational
- **5500+** partner companies
- **30,000+** certified professionals
- **1000+** developer partners
- Customers in **77+** countries
- **60+** OEM Partners (brands) with Niagara products



Developing a solid specification

- A Team Effort between the End User, Specifier (and specifier departments), and in many cases, Vendor(s)
- Important regardless of product/technology/protocol
- Clearly defined scope
- Detailed coordination with various integrations with systems and equipment specified in other sections (drives, switchgear, fire alarm etc.).
- **Execution** is just as important as products
- Clearly define method of commissioning and accepting the system



Specifier

- Owns the Design
- Overall responsibility to collect needs and goals, provide technical expertise and be primary author
- Define the functionality required
- Collaborate with all departments
- Define criteria for selecting a system, price, value criteria.
- Define scope.
- Review submittals for compliance.
- Participate in commissioning/acceptance

Owner/End-user

- Provide detailed requirements, needs, goals to specifier
- Continuously review and comment as spec/design is refined
 - Comments at 95% spec submittal is too late!
- Provide budget guidance
- Define roles/needs of each person using the system.
- Vendor, protocol, equipment, systems preferences
- Fund the support and training requirements for ongoing proper operation

Facility Executive Questions

- What are my goals and the mission of my department/organization?
- What tools and systems are required to help me meet my goals?
- Who will use these systems? Can the system be easily customized for each role? Will these solutions add value to my team?
- How will I be assured the system is working properly?
- How many bids will I get? More important- how many bids will I get when I expand my system?
- Will the system be able to add value to my operation by interfacing to my corporate enterprise system?
- Should I get the IT department involved?
 - When?

Equipment/Control/Automation Vendors

- Educate
- Understand the importance of system integration and the collaboration requirements to support a good design
- Provide accurate and complete technical information
- Provide accurate and complete budgeting information
 - Budget early and refine, refine, refine
 - Budget @ 95% spec submittal is too late!

Some features of a good spec?

- Specifier standpoint
 - Few clarification requests prior to bid
 - No change orders
 - A quality, on time project
 - Happy customer
 - A reference project
- MSI standpoint
 - I am not excluded from bidding
 - I know what and how I am integrating with systems specified in other sections/divisions of the spec.
 - I can provide a very accurate/low risk estimate of my costs so I can submit the best solution at the best price.
- End user standpoint
 - I get the system that meets my needs
 - That has features and functionality I asked the for
 - Was installed on time
 - Within budget
 - Helping me meet my goals

Common Spec Issues

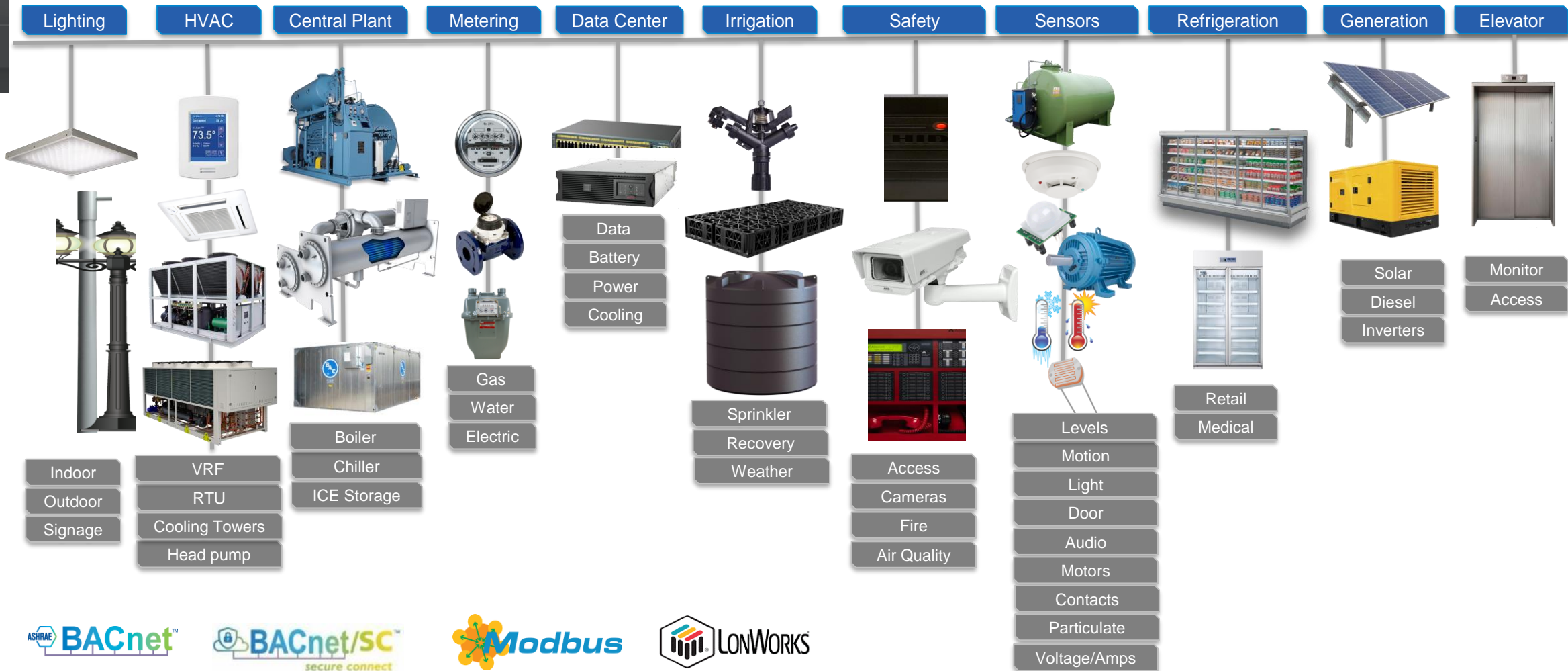
- Ambiguity
- Division of Contractual Responsibility
 - 23, 25, 26, 28
- Coordination of Integrations
 - Not enough detail
- Graphic User Interface
 - Trending, alarming, tagging analytics, scheduling
- Cyber Security, User Management, Network
- Hand-off of documentation, training, security info, licensing



Getting Started

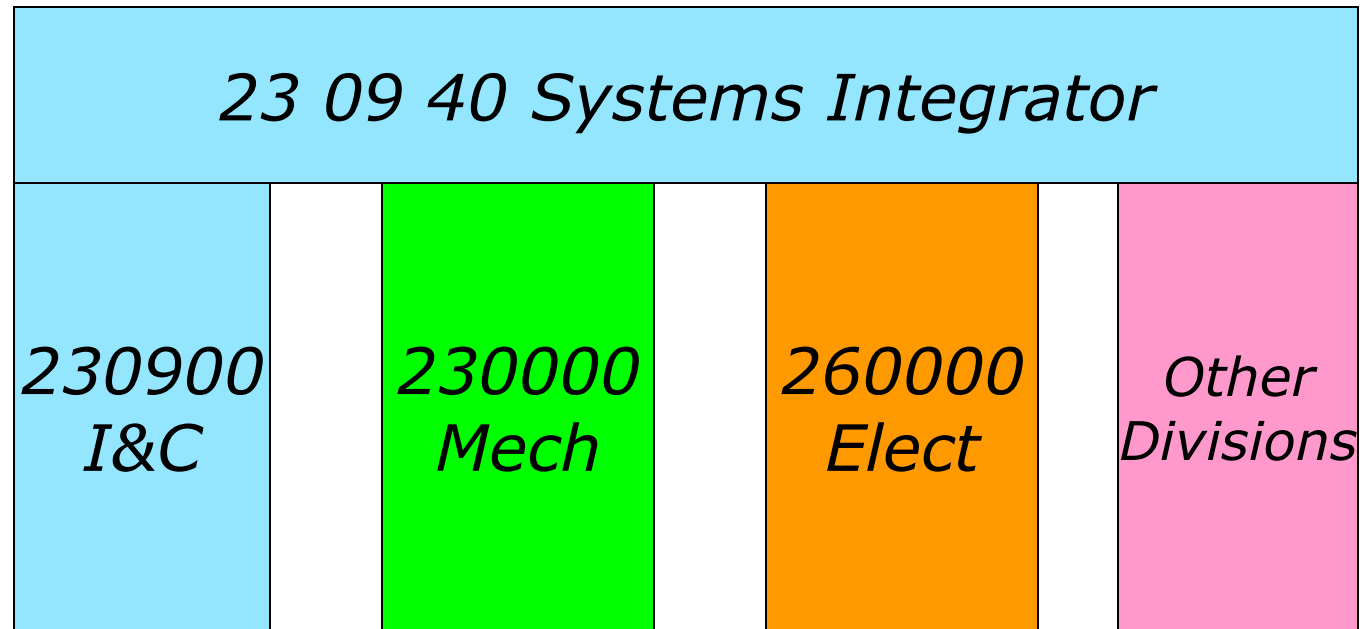
Limitless Device Integrations with Niagara

Means detailed coordination is essential!



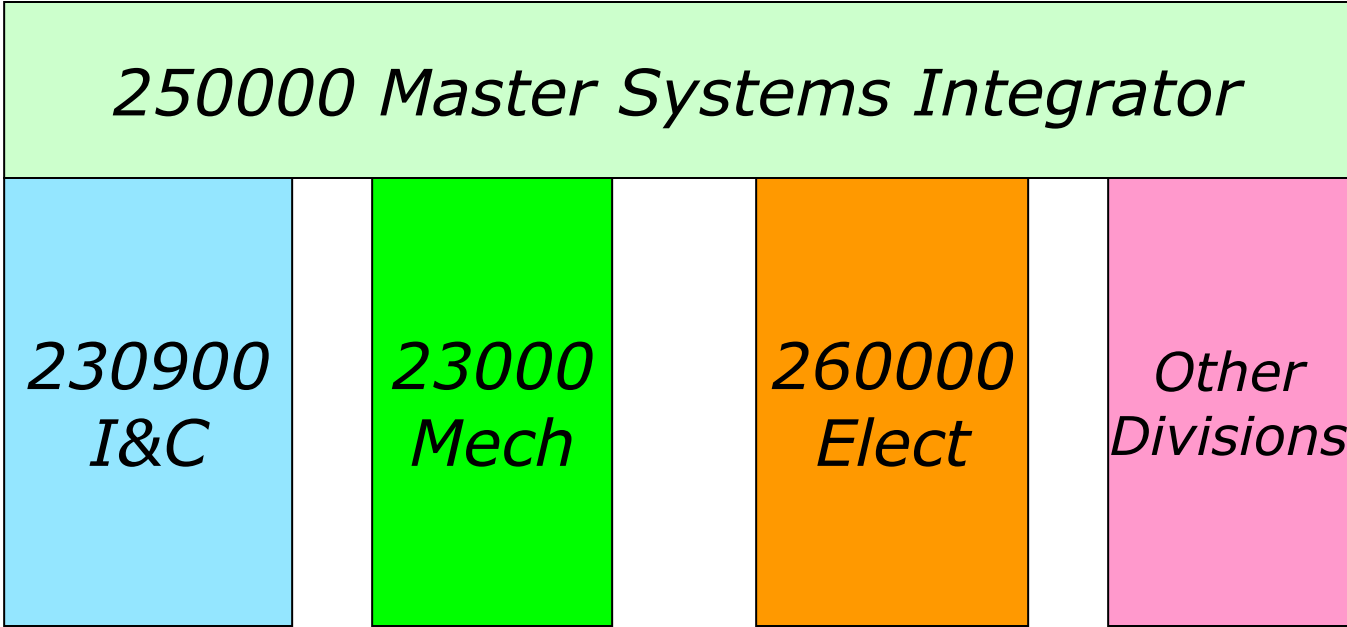
Division of Responsibility

- Systems Integration and Instrumentation & Control by 23 09 xx



Division of Responsibility

- Systems Integration by MSI 25 00 00



25 00 00	Integrated Automation System General
25 05 00	Common Work Integrated Automation System
25 08 00	Commissioning of Integrated Automation System
25 11 00	Integrated Automation System Inputs/Outputs
25 11 05	Advanced Power Meters
25 12 00	Third Party Interfaces
25 14 00	Integrated Automation System Field Panels
25 15 00	Integrated Automation System Software
25 60 00	Integrated Automation System Operation and Maintenance
25 70 00	Integrated Automation System Training
25 90 00	Sequences of Operation
25 05 50	Common Work Integrated Automation System
25 08 50	Commissioning of Integrated Automation System
25 11 55	Advanced Power Meters
25 11 59	Network Electronics
25 12 50	Third Party Interfaces
25 14 50	Integrated Automation System Field Panels
25 15 50	Integrated Automation System Software
25 60 50	Integrated Automation System Operation and Maintenance
25 70 50	Integrated Automation System Training
25 90 50	Sequences of Operation

Integration Details - The Point List

- Necessary
- Not enough
- More data is now available from smart devices and equipment

BAS Graphic User Interface (GUI) Control Functions and I/O Summary								
System Description	Network Area Controller (NAC) Application Programs						Trend	Schedule
	Demand Limiting	Optimum Start/Stop	Setback/ Setup	Night Purge	Duty Cycling	Other?		
AHU-1	X	X	X					
Point Description	Point Type	Units	Default Value	Read	Write	Alarm	Trend	Schedule
Supply Fan Start/Stop	BO	On/Off	Off	X	X			X
Supply Fan Status	BI	On/Off		X		X		
Return Fan Start/Stop	BO	On/Off	Off	X	X			X
Return Fan Status	BI	On/Off		X		X		
Supply Fan Static Pressure Setpoint	AO	in. H ₂ O	1.0 in. H ₂ O	X	X			
Supply Fan Static Pressure	AI	in. H ₂ O		X		X	X	
Supply Fan VSD Speed	AO	% Speed	20%	X	X		X	
Supply Fan kW	AI	kW		X			X	
Supply Fan Runtime	VI	Hours		X		X		
Building Static Pressure Setpoint	AO	in. H ₂ O	0.1 in. H ₂ O	X	X			
Building Static Pressure	AI	in. H ₂ O		X		X	X	
Return Fan VSD Speed	AO	% Speed	20%	X	X		X	
Return Fan kW	AI	kW		X			X	
Return Fan Runtime	VI	Hours		X		X		
Return Air Temp	AI	deg F		X		X	X	
Return Air Relative Humidity	AI	% RH		X		X	X	
Return Air CO ₂ Setpoint	AO	PPM	800 PPM	X	X			
Return Air CO ₂	AI	PPM		X		X	X	
Return Air Smoke Detector	BI	Nrm/Alm		X		X		
Outside Air Damper Position	AO	% Open	0%	X	X		X	
Outside Air Flow	AI	CFM		X		X	X	
Air Filter Status	BI	Nrm/Alm		X		X		
Mixed Air Temp	AI	deg F		X		X	X	
Supply Air Temp Setpoint	AO	deg F	55 deg F	X	X			
Supply Air Temp	AI	deg F		X		X	X	
Supply Air Smoke Detector	BI	Nrm/Alm		X		X		
Cooling Valve Position	AO	% Open	100%	X	X		X	
Heating Valve Position	AO	% Open	0%	X	X		X	

Ingesting Data

- Hardwired Points
- Points via a standard protocol or API
- Linked Points
 - On a graphics or in a chart, trend or alarm
- Virtual Points
 - Points that you use for troubleshooting tuning etc. They are only connected when requested by the Niagara station. Don't count against point license limits.
- Example
 - A package RTU may have 30 linked points used for day-to-day monitoring, energy optimization etc.
 - However, there are another 100 points that may be useful for tuning and or troubleshooting. Special technician graphic.
 - Suction Pressure
 - Discharge Pressure
 - Damper torque
 -

Integration Matrix

Smart Building System Integration Matrix				Update 10-02-22 EJM	EXAMPLE - Modify for specific project		
System	Specification Section/Furnished By	Protocol	Connection	Master Systems Integrator - Div. 25	Control System Contractor - Div. 23	Network Contractor	Division 26 Electrical Contractor
OT Network (OTN)	Owner	TCP/IP	RJ-45	Makes final connection to networked device, configures OTN		Install LAN, Cable, Switches , provide LAN drops with cable connector. Set up Firewalls, security, etc. .	Install LAN, Cable, Hubs, provide LAN drops with cable connector.
NOC Servers, Printers, Furniture	Owner	TCP/IP	RJ-45	Provide installation of displays and pc, keyboard etc. in console. Set up displays and browser connections as required.			Provide Power
Niagara Enterprise Web Supervisor Software	Division 25/MSI	TCP/IP	RJ-45	Install software , program, connect			
JACE - 8000, VEC-10	Division 25/MSI	FOXS	RJ-45	Furnish, install, program, commission JACE, EDGE 10. Integrate Data from Jaces to Niagara Enterprise Web Supervisor (NEWS)	Install, program, connect local controllers to JACE in cooperation with MSI		Provide Power
Lighting Control	Division 26 Electrical	Appropriate open protocol BACnet IP MODBUS Custom API	RJ-45	Integrate Lighting data into NEWS. Program graphics. Integrate occupancy indications with local HVAC zones. Provide occupancy commands to JACE.			Furnish, install, program, connect to OT Network as directed. Expose lighting points to network, provide documentation to MSI
Electrical Switchgear and Generators	Base Building Division 26	MODBUS RTU/TCP	RS-485/RJ-45	Integrate Electrical data into Jace and NEWS. Provide MODBUS RS-485/RJ-45 port on Jace-8000			Furnish, install, program, connect to OT Network. Expose Modbus points to network, provide documentation to MSI.

Integration Matrix

Smart Building System Integration Matrix				Update 10-02-22 EJM	EXAMPLE - Modify for specific project	
System	Specification Section/Furnished By	Protocol	Connection	Master Systems Integrator - Div. 25	Control System Contractor - Div. 23	Division 26 Electrical Contractor
IAQ Monitoring System	Division 23 Controls Contractor.	WIFI and Modbus TCP to Edge 10 or Modbus RTU via JACE-8000 .	RS-45, RS-485	Furnish, install, program, commission JACE, EDGE 10. Integrate Data from Jaces to NEWS.	Furnish, Install, Program, Commission IAQ devices. Connect to local JACE, Edge 10.	Provide Line Voltage Power
Tenant Submetering	Division 23 Controls Contractor.	Modbus TCP to local JACE/Edge 10	RJ-45	Furnish, install, program, commission JACE, EDGE 10. Integrate Data from Jaces to NEWS.	Furnish, Program, Commission smart meters . Connect into JACE/Edge 10S. Coordinate installation with Div. 26 contractor.	Install Meters under direction of Div. 23 Contractor
User Experience Center - Purpl	Owner	TCP/IP	RJ-45	Push necessary building data to User Experience system via database or REST API connectivity TBD. Coordinate with owner UExp supplier (Purpl)		
CRAC and VRF	Division 23 Mechanical	BACnet IP/MSTP	RJ-45/RJ-485	Integrate data from CRAC/VRF to JACE-8000 and to NEWS		
ERU /DOAS	Division 23 Mechanical	BACnet IP/MSTP	RJ-45/RJ-485	Integrate data from ERU/DOAS to JACE-8000 to NEWS		
Parking System	Building Parking Contractor	TCP/IP	RJ-45	Integrate parking data from parking system via Rest API		

A low-angle, upward-looking photograph of several modern skyscrapers with glass facades. The buildings are reflected in each other, creating a complex geometric pattern. The sky is visible at the top, and the overall color palette is dominated by blues and greys.

Key Spec Components

Open Systems

Open Licensing and Access

Niagara Information and Conformance Statement (NICS)

The Niagara Compatibility Statement (NICS) for all Niagara Software shall allow open access and be set as follows: accept.station.in="*" accept.station.out="*" accept.wb.out="*" accept.wb.in="*". In any case, the end user shall maintain the right to instruct the contractor to modify any software license, regardless of supplier, as desired by the end user. *The contractor shall not install any “brand-specific” software, applications or utilities on Niagara Framework-based devices unless accessible by any brand of Niagara tools.*

All hardware and field-level devices installed shall not be limited in their ability to communicate with a specific brand of Niagara Framework JACE. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed, in replacement of or in parallel with existing components. *All plant and application controllers must be able to be programmed within the Niagara Workbench.*

At the completion of the project, the owner shall be given all existing platform and station login credentials to include; super user (admin) usernames; passwords and passphrases.



Graphics

Graphic User Interface

- Graphics Technology has changed but most specs still say “provide 1 graphic per AHU, Chiller etc.”
- Graphics are usually built for a very technical user
 - The GUI must meet the needs of the user
 - With Web Based Systems more diverse users have access
- Graphic Views should be based on the role of the user
 - CFO, Technician, Tenant, etc.
 - Spectrum objects, logs, embedded sequences are nice features, but they must be specified
- Must “responsive” to the device
 - Big Screen, Phone, Tablet, Kiosk

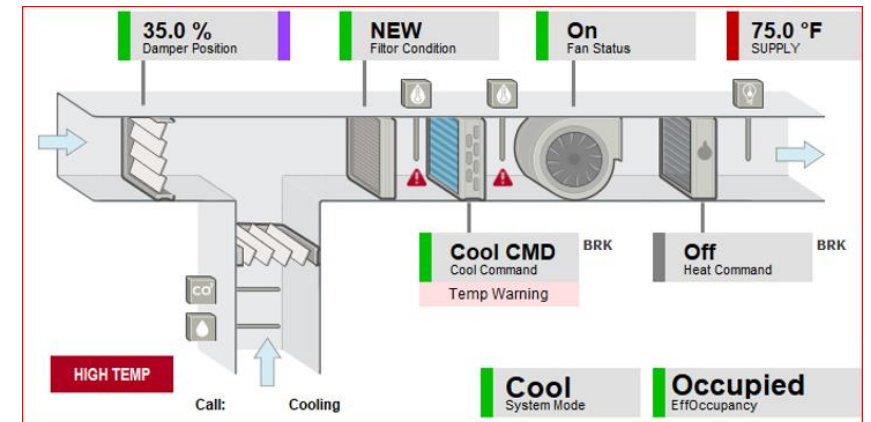
“Graphics. Provide Graphics as described in System Integration Matrix and point lists. All graphics shall be designed using Niagara “Responsive Pane” to utilize a single graphic implementation to render on a variety devices and window or screen sizes (mobile, tablet desktop). “

Tridium Graphics Design Guide

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Graphic User Interface

- Prepare a Graphics Schedule that is more than just a check box on a point list
- A detailed description or example of each graphic and functionality
 - Graphic Library
 - Standard Niagara
 - Owner Library & Standards
 - Graphic symbols, animations, size
- A navigation methodology
 - Tree, navigation buttons etc.
- Access methodology
 - User capabilities read, write, etc.



OR

Graphic User Interface

- Establish a Graphics Budget in the spec for a specific number of graphics, with minimum number of points, navigation
 - Example: “*Each VAV graphic (500) shall contain 25 points, sequence link, O&M manual link, link to detailed set point page, animated fan, 3-dimensional ductwork and devices.*”
- Establish final Graphic Schedule as a team
 - End User, Specifier, SI meet in graphics development meeting, so graphics are designed one time
 - Meeting will be more effective once submittals are approved
 - Actual equipment and capabilities built into the design.
 - One four-hour meeting can save a lot of changes.

Point & Graphics Info on Integration matrix

System	Specification Section/Furnished By	Approximate Integration Point Count	Approximate Graphic Page Count
OT Network (OTN)	Owner	500	10 Graphic Architecture Diagrams. Indicate health of each Niagara device. Link to Niagara Security Dashboard for each Jace, Ciper and NEWS.
Lighting Control	Division 26 Electrical	1000	Floor Plan Graphics (1 per floor). \$ Outdoor Façade graphics, 1 Key lighting system health/operational graphic with 25 points.
Electrical Switchgear and Generators	Base Building Division 26	500	Provide electrical data graphics with roll ups of power by floor and building. Utilize Niagara Analytics for details of power rollups.
Fire Alarm System	Division 26 Electrical	1000	Show data on all floor plan graphics. Add FA Panel graphic with 10 key operational parameters

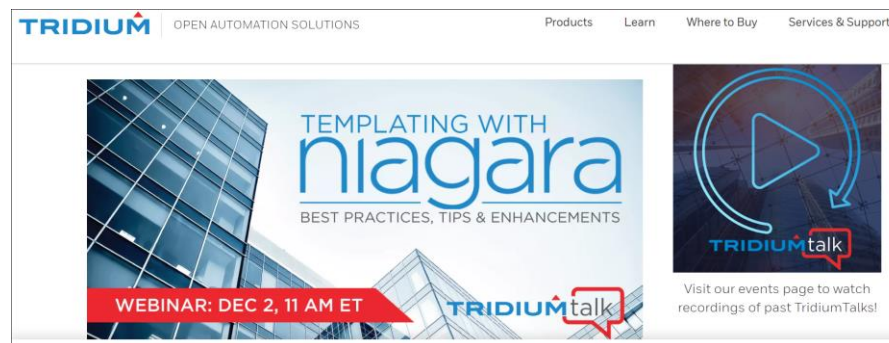


Templates

Templates for JACE and Edge 10 Controllers

Pre-configured system templates

- *“All Niagara based controllers shall employ Niagara template functionality.*
- *Templates are a containerized set of configured data tags, graphics, histories, alarms that are set to be deployed as a unit based upon manufacturer’s controller and relationships.*
- *Templates shall be employed in this project and used in the JACE. Template files shall be provided to the owner.*
- *All lower level communicating controllers connected to the JACE (AHU,PEC, AUC, VAV, VFD...) shall have an associated template file for reuse on future project additions.”*



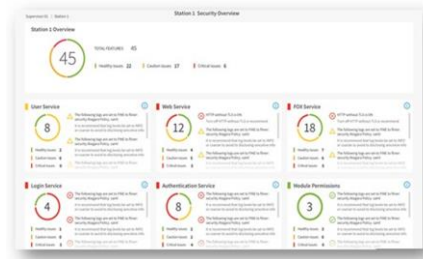
The background of the slide is a low-angle, upward-looking photograph of several modern skyscrapers with glass facades. The buildings are reflected in each other, creating a complex, geometric pattern of blue and white. The sky is visible at the top, appearing as a pale blue. The overall tone is professional and technological.

Cyber and User Management

Alarm, Schedule, Backup Management

Cyber Security, Users, Audits

- “Installation, set-up, and programming shall be in accordance with latest revision of the **Tridium Niagara Hardening Guide**”
- “Enable Niagara Security Dashboard for each Jace and Web Supervisor”
- “Enable audit logs for all functions including system operation, programming and cyber security. ”
- “Utilize Owners LDAP/Active Directory Infrastructure for all Users”
- “Provide unique credentials for up to **25** users with roles and permissions provided by the owner”



Security Access: Systems Access from the web browser GUI to BAS server shall require a Login Name and Strong Password. Access to different areas of the BAS system shall be defined in terms of Role-Based Access Control privileges as specified:

1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of 'easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
 - a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
 - b. Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.
 - c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.

Wednesday October 12th

Writing Cybersecure Specifications for Buildings: What You Need to Know!

-Kevin Smith, CTO at Tridium and Director of Cybersecurity, Honeywell

-Fred Gordy, Director of Cybersecurity, Intelligent Buildings



Alarm Management

- Alarm Classes
 - Maintenance, Electrical, HVAC, Plumbing, Critical, Safety
 - Specific criteria for how each class is annunciated, routed, and escalated
 - *“Specific alarm class information (up to 10) will be provided by the owner along with specific messaging and alarm limit criteria.”*
- Alarm Escalations
 - Critical Alarm Escalation until alarm is acknowledge
 - *“Set up Alarm Service recipients and escalation levels as directed by owner for 10 users. Critical Alarms shall be escalated to the next level after an alarm remains unacknowledged for XX minutes.”*

Schedules

- Schedules
 - Geographic
 - System
 - HVAC
 - Lighting
 - Integrated Schedules
 - Occupancy
 - Cleaning
 - Maintenance Schedules
 - Generator Test
- Master Schedules for critical events
 - Weather
- Special Reoccurring Schedules
 - Sporting Events
 - Board meetings
- One Time Special Event
- Owner/End User is best resource for schedule planning

- I. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day 'Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the 'Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
 1. Schedules: Schedules shall comply with the LonWorks standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
 - a. Types of schedules shall be Normal, Holiday or Override
 - b. A specific date,
 - c. A range of dates,
 - d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
 - e. Wildcard (example, allow combinations like second Tuesday of every month).
 2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for

Provisioning/Backup/SMA

- *“System shall be installed with latest revision of the Niagara Framework (currently 4.12) at the time of acceptance.”*
- *“Set up the Niagara provisioning service to provide daily backups of all JACEs to the Niagara Web Supervisor. Coordinate with owner's IT department to set up backup of the Web Supervisor by the owner.”*
- *“Provided 5-year Software Maintenance Agreement at no additional cost to the owner”*

Wednesday, November 16th

Specifying an OT Network

-Greg Fitzpatrick, Business Development Leader - IoT and Integration,
Cochrane Supply and Engineering





Tagging, Analytics, Commissioning

Tagging & Analytics

Tridium Niagara Analytics 2.0 Guide Specification

SECTION 258000 – IAS FAULT DETECTION AND DIAGNOSTICS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
- C. Refer to Divisions 1 through 28 for project related standards pertaining to installations that shall apply to this Division.

1.2 SUMMARY OF WORK

3.2 DATA CONVENTIONS, FDD|TOOLS AND APPLICATIONS

- ▲ A. The fault detection and diagnostic applications shall employ standardized naming conventions and employ “semantic tagging”, pattern recognition, functional rules processing and other techniques to enable advanced diagnostics and analytics for extended databases. Tags are added to data items as needed to convey definitions and associations. For example, an air handler might have tags that define its location (site, building, floor), fact that it is an electric load, manufacturer, capacity, schedule, associated control parameters, etc. Records can have as many tags as needed and new tags can be added. Solution should follow the **(Project Haystack, Niagara, Custom)** guidelines. **Project Haystack is an open source initiative to streamline working with data from the Internet of Things.** The initiative standardizes semantic data models and web services with the goal of making it easier to unlock value from the vast quantity of data being generated by the smart devices that permeate our homes, buildings, factories, and cities. Applications include automation, control, energy, HVAC, lighting, and other environmental systems.ad hoc whenever needed. Tags provide the hooks that the analytics engine uses to correlate and analyze the data.

3.4.5 HVAC Control System Fault Definitions

Fault Rule Name	Fault Rule Short Description
AHU Cooling & Heating Cycling	Finds periods when the heating and cooling are cycling between each other within a threshold. This indicates that the unit is fighting back and forth between its mechanical
AHU Cooling & Heating Simultaneously	Finds periods when discharge fan is on, heating is on and cooling is on for over a duration.
AHU Cooling Failure	Finds periods when discharge fan is on, cooling is on, and discharge temperature sensor is not under mixed air sensor minus a threshold for over a duration.

Thursday, November 3rd

Writing Analytics Specifications for Smart Buildings

-Stephen Holicky, Director of Product Management, Tridium

-Chris Larry, Director of Energy Engineering, EXP US Services, Inc.



The Hand Off

“Provide commissioning engineer for cyber security testing and set up using the Niagara Hardening Guide and under direction of the owner’s Corporate Cyber Security Team.”

- Start-Up & Commissioning
 - Specify any special Logs & Charts & Queries in spec to facilitate
- Training
 - Project Specific Onsite
 - Factory (provide a minimum of 1 Operator and 1 Tridium certification class)
- Documentation – Sequence, Drawings, M&O
 - Stored in the JACE and Web Supervisor as PDF
 - Links on the graphics to specific documentation
- Security – Id/Passwords, Admin Access
 - **Make sure you get OS & BAS ADMIN passwords**

E. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following:

1. Graphics navigation.
2. Trend data collection and presentation.
3. Alarm handling, acknowledgement, and routing.
4. Time schedule editing.
5. Application parameter adjustment.
6. Manual control.
7. Report execution.
8. Automatic backups.
9. Web Client access.

Specifying Niagara

— *Tridium resources available to you*

Specifications and Guides

- Division 23 and 25 Niagara Framework Guide Specifications
- Section 258000- IAS Fault Detection and Diagnostics
- Tridium Division 25 Design Guide
- Tridium Graphics Standards Guide
- Niagara Facility Integration Matrix
- Guide Specification for Niagara Edge 10 Controller
- Niagara Enterprise Security Guide Specification
- Niagara Information & Compatibility Statement Data Sheet
- Tridium Niagara 4 Hardening Guide

Requesting Specification Documents

If you need information that is not already downloadable on Tridium.com, you can make requests on the Specifiers Page at

<https://www.tridium.com/us/en/Learn/by-role/specifyingengineer>

Just click

Talk to a Niagara Expert

CONTACT US

More Tools & Resources

Thank you for your interest in Tridium

Please complete the form below so that we can respond to you with further information quickly and accurately.

* Required

* First name

* Last name

* Company name

Company website

* Customer type

* Email

Select...

- Corporate information / proposal request
- Developer inquiry
- End user assistance
- General inquiry
- Media inquiry
- Niagara Marketplace
- Partner inquiry
- Request a demo
- Sales inquiry
- Specification / Design Information**
- Tridium Professional Services
- Tridium University

Specification / Design Information

When do you expect to have a new project?

Upcoming Specifier Series Installments

Wednesday October 12th

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-Fred Gordy, Director of Cybersecurity, Intelligent Buildings

Thursday, November 3rd

Writing Analytics Specifications for Smart Buildings

-Stephen Holicky, Director of Product Management, Tridium

-Chris Larry, Director of Energy Engineering, EXP US Services, Inc.

Wednesday, November 16th

Specifying an OT Network

-Greg Fitzpatrick, Business Development Leader - IoT and Integration,
Cochrane Supply and Engineering

Question and Answer Time



Thank you