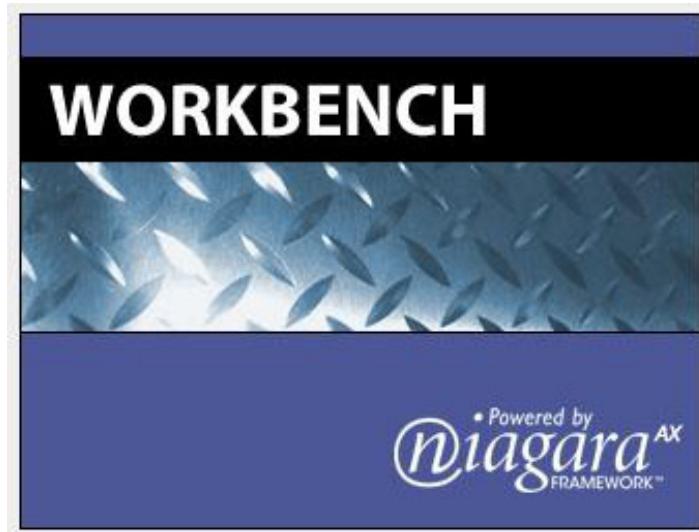


# Niagara Workbench Guide





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## Notes to Reader

The Niagara Workbench Guide is intended to be a support tool for controls and energy staff who are responsible to program, commission and service Tridium control systems.

The Workbench Guide has been designed to be part tutorial and procedural guide. The guide consists of ten (10) sections which can be printed out and blinded into a ten tab manual. Each section includes a reference to the appropriate Niagara Technical document (eg, Niagara AX-3.x User Guide).

This Acrobat PDF document is fully bookmarked for easy topic lookup.

### **1) Basic Steps**

- 10-Step Engineering Overview
- Workbench Overview
- NAV Sidebar Roadmap
- Niagara Architecture
- Network Basics
- Control Points
- Customization
- Installing AX Workbench & Licensing

### **2) Platform**

### **3) Station**

### **4) Integration**

- NDIO
- LON
- BACNET
- Honeywell XL5K + Synder

### **5) Control Strategies**

### **6) Alarms**

### **7) Scheduling**

### **8) Histories**

### **9) Px Graphics**

### **10) JACE**

The Niagara Workbench Guide has the following security restrictions:

- Document Open Password (user-specific)

### **Niagara Workbench Guide Ver. 2.3**

The author welcomes feedback on technical accuracy and content additions. Your PDF file is unique (user-specific password) and printer restriction is open.

Please send comments or request for a personal copy of the Workbench PDF (for another Tridium colleague) to:

tridiumtech

Email: tridiumtech88@gmail.com



# Nigara Engineering - Basic Steps

## Software Engineering

	Basics Steps	Guide Folder
1	Create Station	3-Station, 2-Platform
2	Create Network, Controller, Proxy Points	4-Integration (off-line)
3	Add Point Extensions	5-Control Strategies, 6-Alarm, 8-Histories
4	Control Strategies	5-Control Strategies
5	Alarms	6-Alarms
6	Scheduling	7-Schedules
7	Histories	8-Histories
8	Px Graphics	9-Px Graphics

## Hardware Engineering

9	Commission JACE Controller (install Station, modules, distribution file)	10-JACE, 2-Platform
10	Discover/Match, Commission, Download, Bind	4-Integration (on-line)

"SNaP CASH G" -

[ S - Station  
N - Network/Ctrlr.  
P - Proxy Points  
C - Control Strategies  
A - Alarms  
S - Scheduling  
H - Histories  
G - Graphics ]

## Platform Activity

- 1) Licence Mgr: Branding
- 2) Software Mgr: Modules (.jar files)
- 3) Application Director: Station Start/Stop

## Project Management

After configuring the proxy points (steps 1, 2) the Station project can be delivered to the commissioning team to field test the controller panels (permits off-line engineering in parallel with the commissioning effort).

# “SNaP CASH G”

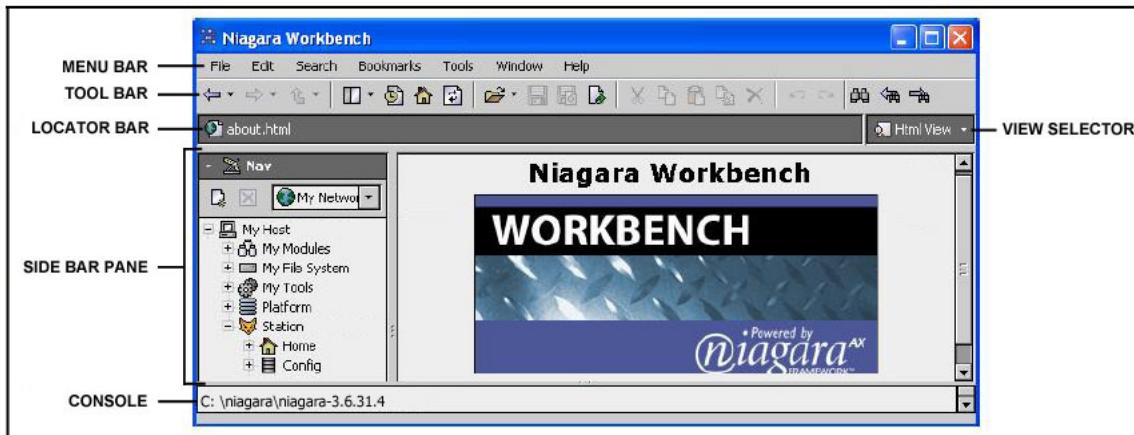
STATION	NETWORK	add POINTs	CONTROL STRATEGIES	ALARMS	SCHEDULES	HISTORIES	GRAPHICS						
S	N	aP	C	A	S	H	G						
Tools > New Stn.	Palettes: * LON * Bacnet * NDIO	<b>Smart Field Devices</b> LON 1) Add Lon Device (palette - manual method). 2) 'Match' Lon devices: Off-line & On-line DB. 3) 'Commission' Local Lon Device w/ Lon Device. 4) 'Download' Lon Device (state: 'Config Online'). 5) Discover Lon Nv Points (Lon Point Mgr) 6) Bind Lon Proxy Points (Link Mgr - Peer2Peer)  Bacnet 1) Add Bacnet Device (palette - manual method). 2) 'Match' Bacnet devices: Off-line & On-line DB. 3a) Add Bacnet points (palette - manual method). 3b) 'Discover' Bacnet points (Bacnet Point Mgr.)  <b>BAS Integration</b> LON 1) Local Lon Device: Ext. Config = True. 2) Create Lon Nv Points (Local Nv Mgr). 3) Link-Mark Nv pts. to AX proxy points. 4) BAS Lonworks tool: map BAS points to Nv pts.  Bacnet 1) Export Table: 'Discover' AX Proxy Points. 2) Point Edit: 1) Type = 'Prioritized', 2) Instance #. 3) BAS Bacnet tool: map BAS points to Export pts.	Palettes: * kitControl * Control  Logic: * Sequencing On-Off Control Lead-Lag CH Staging * Regulation Temperature (DAT, CHWSTSP) Speed (CHWP, CTFan) Pressure (AHU Static) CFM (SF, RF tracking) Valve Position (AHU CHWV %) Humidity/Enthalpy * Protection (Shutdown)	Palettes: * Alarm * kitControl * Email  * Alarm Ext. * Alarm Class * Console Recip. * Stn. Recipient * Alarm Service	Palettes: * Schedule  * Weekly * Calendar * Trigger * Selector	Palette: * History  * History Ext. * History Service * Niagara History Import Mgr. * Chart Builder	Palettes: * Bajaui * kitPx * ktPxHvac  * Px Libraries * Px File * Px 'New View' * Widget Wizard * Nav File						
File > Open													
Station-to-Station: NiagaraNetwork													
Station - Config - Services - UserService - CategoryService - AlarmService - HistoryService - PlatformServices - Drivers - NiagaraNetwork - BacnetNetwork - Local Device - Export Table - LonNetwork - Local Lon Device - Points - SchedOcc - Alarms - ControlStrategy - ChillerCntrl - CTCntrl - Files - Nav - px - History - (Station Name)													
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Platform</th> </tr> <tr> <th style="text-align: center;">Local Host</th> <th style="text-align: center;">Remote Host</th> </tr> </thead> <tbody> <tr> <td>  My Host            - Platform            - Application Director            - License Manager            - Platform Administration            - Software Manager            - Remote File System   Station         </td> <td>  99.127.57.182            - Platform            - Distribution File Installer            - File Transfer Client            - Platform Administration            - Station Copier            - TCP/IP Configuration   Station         </td> </tr> </tbody> </table>	Platform		Local Host	Remote Host	My Host - Platform - Application Director - License Manager - Platform Administration - Software Manager - Remote File System Station	99.127.57.182 - Platform - Distribution File Installer - File Transfer Client - Platform Administration - Station Copier - TCP/IP Configuration Station					
Platform													
Local Host	Remote Host												
My Host - Platform - Application Director - License Manager - Platform Administration - Software Manager - Remote File System Station	99.127.57.182 - Platform - Distribution File Installer - File Transfer Client - Platform Administration - Station Copier - TCP/IP Configuration Station												

## WORKBENCH

Workbench is a Windows-based CAE tool (the Niagara API) that permits the programmer to create and configure a Station (ie, control logic, alarms, trends, graphics).

Features:

- Menu, Toolbar, sidebar and views
- Browser-based navigation model
- Bookmarking
- Tabbed browsing
- Desktop and browser-based application



### Workbench Brands

Tridium and Honeywell's Workbench look the same. Johnson Controls Workbench is different looking. Vykon brand (Tridium) is the first with new releases.

Company	Workbench Tool Brand Name
Tridium	Vykon WorkPlace
Honeywell (No. America)	Comfort Point
Honeywell (Latin America)	WEBs
Johnson Controls	Facility Explorer
Schneider Electric	I/A Series
Lynxspring	JeneSys
Kele	Trion
Distech	EC-net

Local Host = Workbench tool on PC ("My Host").

Two types of end-user views:

1. Workbench views
2. Px Views (Presentation XML)

## **Performing Workbench Tasks**

Technical Document: Niagara AX-3.x User Guide, Ch. 10

### **Start AX Workbench**

From the Windows Start menu: Programs > Niagara 3.x.xx > Workbench

From the DOS command line: [root drive]:\Niagara\Niagara 3.x.xx\bin\wb\_w.exe

Auto start-up routine:

```
CD [root drive]:\Niagara\<Niagara 3.x.xx>\bin\  
START plat.exe installdemon  
START wb_w.exe && EXIT
```

### **Side Bar Pane**

The side bar pane displays all open side bars. The two key side bars are: 1) NAV (navigation), 2) Palette.

To Open: Window > Side Bars > select the appropriate side bar (eg, Nav).

To Close: from the side bar title bar dropdown menu (left side), select the 'Close' command.

### **Palette Side Bar**

The palette side bar permits using module components.

To Open:

1. Click the Open Palette button.
2. Select the appropriate palette from the list.

Note: to create a Personal Palette, see 'Basic Steps-Customization'.

### **Jobs Side Bar**

The Jobs side bar provides a place to view and manage current jobs. When a job is finished you are notified via the async notification feature.

To View Job Details: on the desired job, click the 'details' (>>) button.

### **Help Side Bar**

When you install AX Workbench for the first time the help side bar is empty. To initialize the Help Side Bar, select 'Help' > click on 'Load Help' (loads BajaDocs).

### **Bookmarks**

Bookmarks are simply linked shortcuts to quickly find views.

To Add:

1. Bookmarks: Add to Bookmarks.
2. Popup menu in the palette side bar: select 'Add to Bookmarks'.
3. Name the bookmark.
4. Select the folder where you want to locate the bookmark. Ok.

To Manage:

1. Bookmarks: Manage Bookmarks.
2. Popup menu in the palette side bar: select 'Manage Bookmarks'
3. Select the appropriate button.

### **To Customize the 'New' Menu**

See 'Basic Steps-Customization'

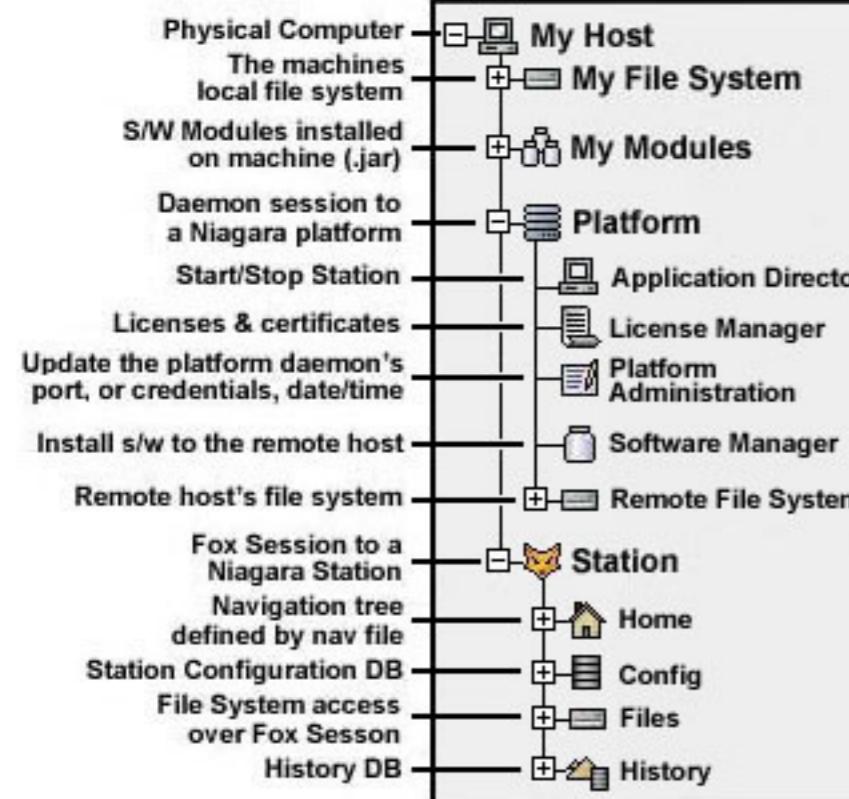
### **To Open a View Pane Tab**

1. Control 'T' (click on 'X' to close)

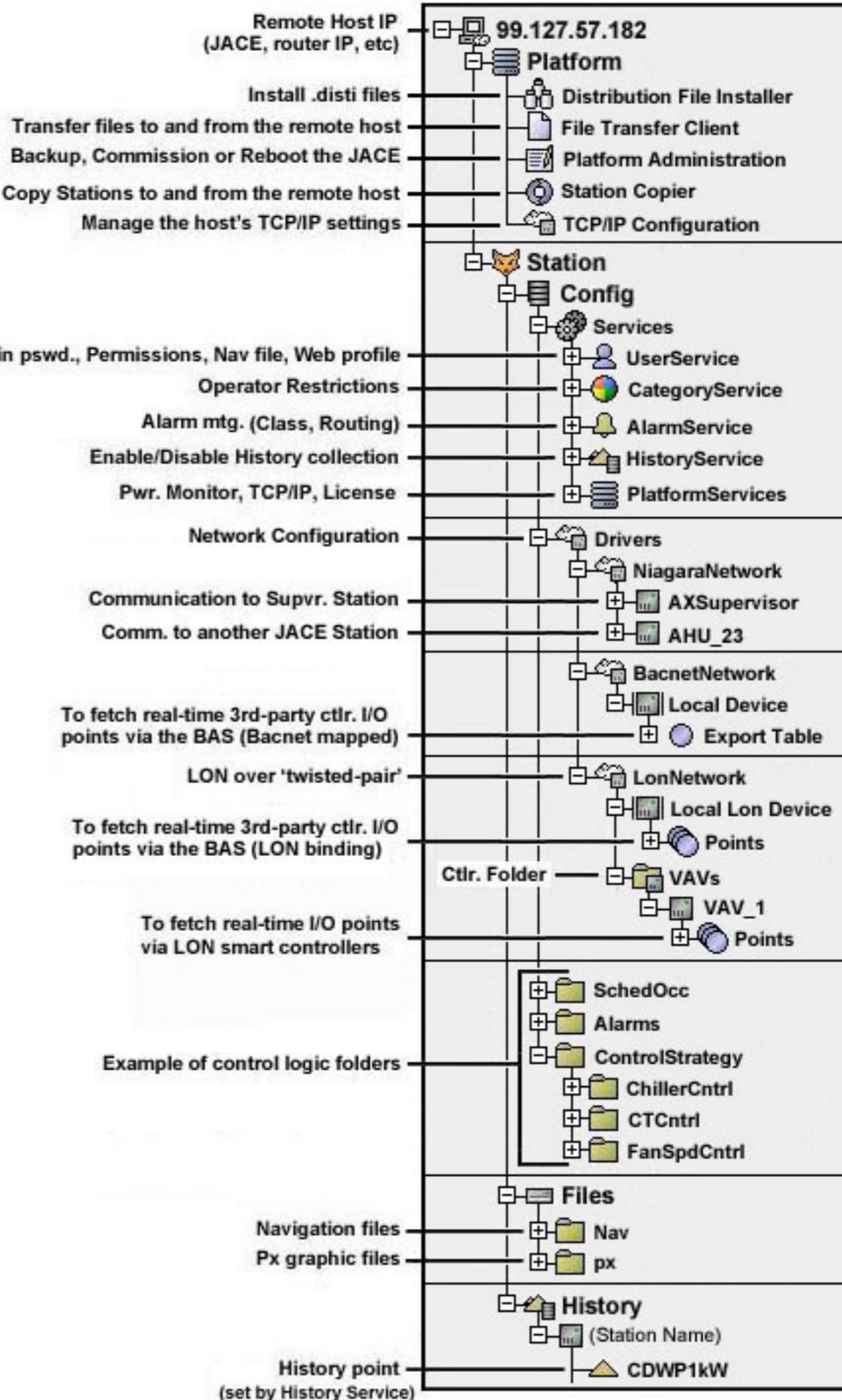
# NAV Sidebar Roadmap - Node Overview



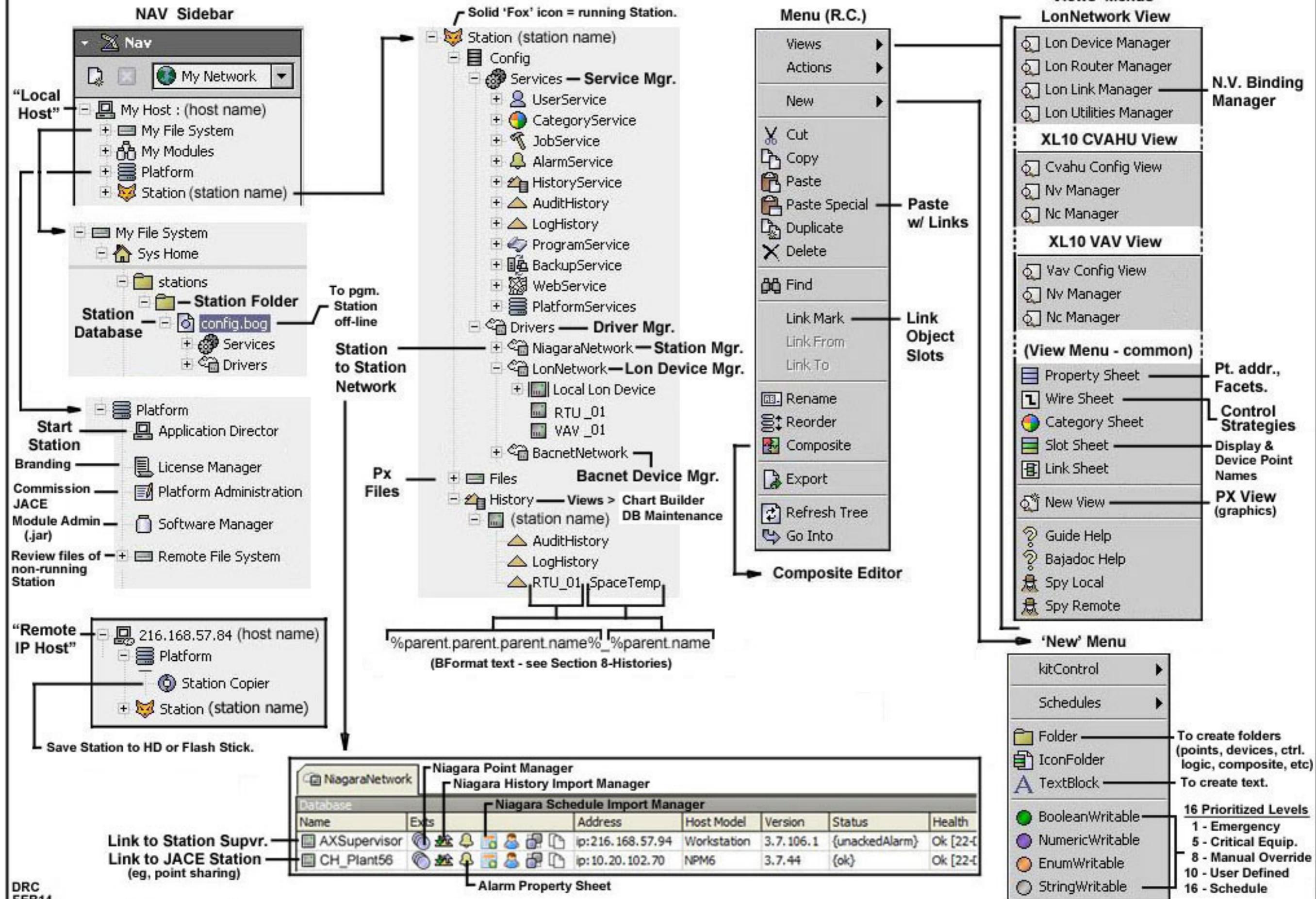
## Local Host



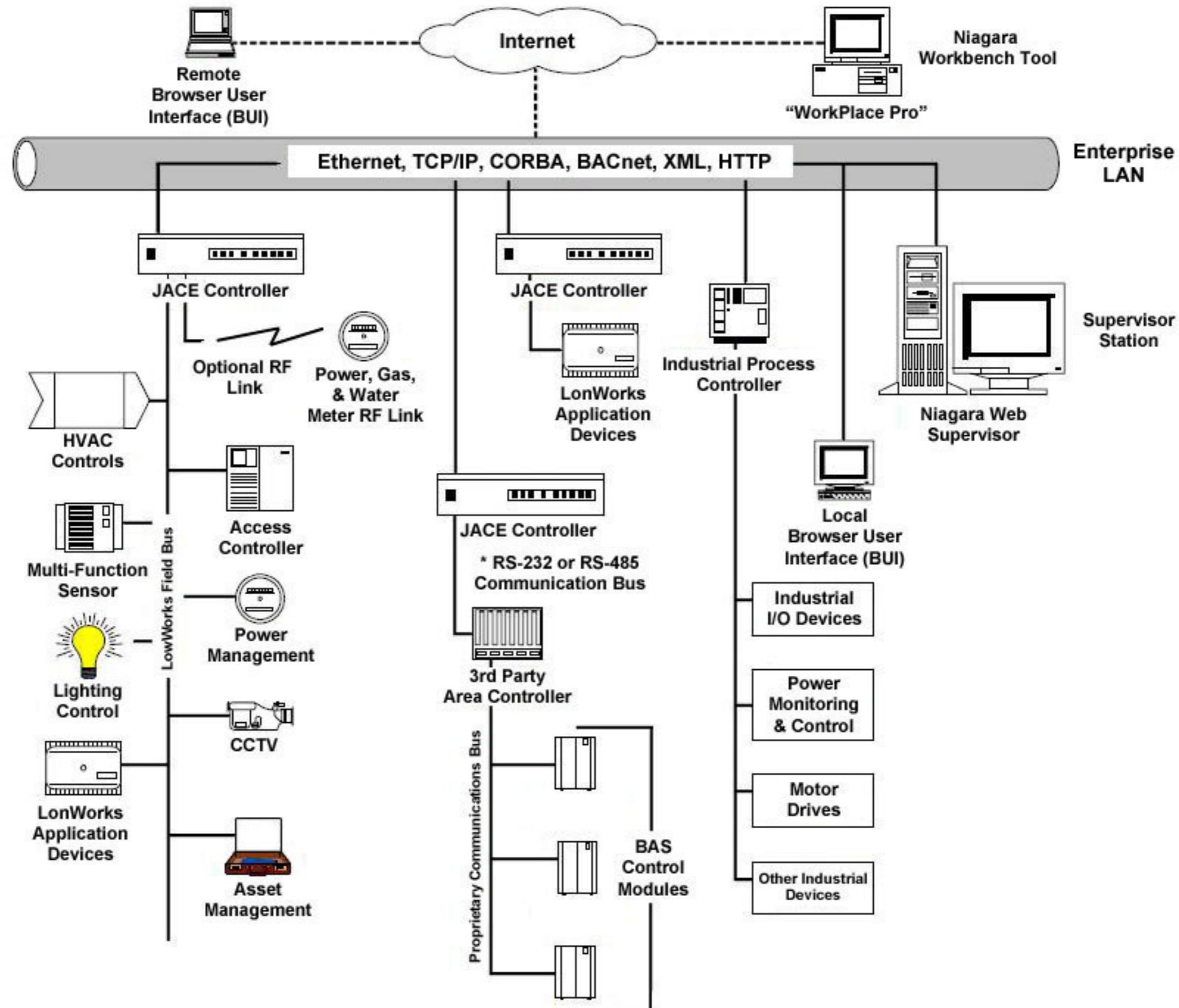
## Remote Host

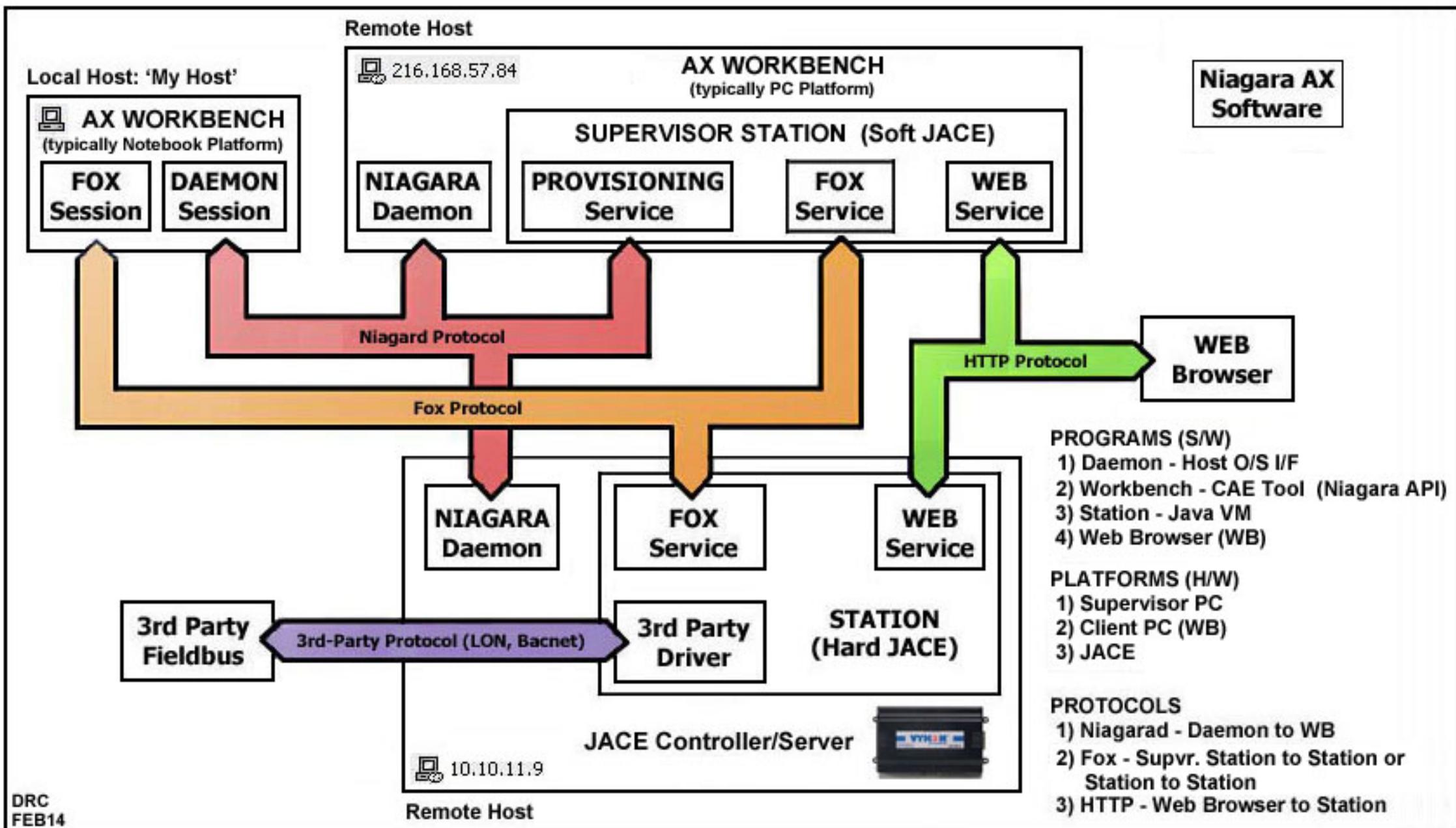


## NAV Sidebar Roadmap - Node Detail



# Niagara Single-Site Architecture





## Designing the LON Network Architecture

- Number of nodes allowed on an FT10 LonWorks bus segment = 64 nodes (end-to-end acknowledgement)..  
JACE, Host and controllers (Neuron ID) are nodes.  
Actual = 58 controllers + (1) JACE + (1) Host + 4 spare = 64 nodes
- Max. length of FT10 segment using 22 gage wire = 4,600 ft.
- Free topology requires one termination module. On the bus segment it should be placed at the router or at the JACE.
- If the bus topology is greater than 1,640 ft., two termination modules should be used. One at each end.
- Max. traffic that can be sustained on an FT10 channel = 150 packets/sec.  
Actual = 60% = 90 packets/sec.
- Honeywell tool to monitor traffic on a Lon network = Excelon

## LON Addressing

Every LonWorks packet contains the device address of the transmitting device (*source address*) and the address of the receiving devices (*destination address*) that can be a physical, device, group or a broadcast address.

1) Physical Address. Every LonWorks device has a 48-bit identifier called the Neuron ID. Does not change.

2) Device Address. A Lon device address has three components:

1. Domain ID – Devices must be in the same domain to exchange packets. 32,385 devices, max.
2. Subnet ID – Identifies a collection of devices that are on a single channel or a set of channels connected by repeaters. Subnet IDs are used to support efficient routing of packets in large networks. 255 subnets/domain, max.
3. Node ID – Identifies an individual device within a subnet.
- 3) Group Address. A group is a *logical* collection of devices within a domain. Unlike a subnet, devices are grouped together without regard for their *physical* location in a domain. There may be any number of devices in a group when unacknowledged messaging is used; groups are limited to 64 devices if acknowledged messaging is used. Groups are an efficient way to optimize network bandwidth for packets addressed to multiple devices.
- 4) Broadcast Address. Identifies all devices with a subnet, or all devices within a domain.

## LonWorks Protocol Limits

Each domain in a system using the LonWorks protocol can have up to 32,385 devices. There can be up to 256 groups in a domain and each group can have any number of devices assigned to it, except that when end-to-end acknowledgement is required, groups are limited to 64 devices. There can be up to 255 subnets in a domain and each subnet many have up to 127 devices.

## Limit Summary

Devices in a subnet	127
Subnets in a domain	255
Devices in a domain	32,385
Domains in a network	$2^{48}$
Max. devices in a system	$32K \times 2^{48}$
Members in a group (unack or repeated)	No Limit
Members in a group (ack. Or request response)	63
Groups in a domain	256
Channels in a network	No Limit
Bytes in a network variable	31
Bytes in an application or foreign frame message	228
Bytes in data file	$2^{32}$

## Message Services

The LonWorks protocol offers three basic types of messages plus authenticated messages.

1) Acknowledged Messaging. Provides for end-to-end acknowledgement (up to 64 devices). The number of retries and the timeout period are both configurable.

2) Repeated Messaging. Causes a message to be sent to a device or a group multiple times. Does not incur the overhead and delay of waiting for acknowledgements.

3) Unacknowledged Messaging. Causes each message to be sent once to a device or group and no response is expected. This messaging service has the lowest overhead and is the most typically used service.

4) Authenticated Service. Authentication prevents unauthorized access to devices and is implemented by distributing 48-bit keys to the devices at installation time. This service has the highest overhead.



## Network Basics

Technical Documents: Niagara Networking & Connectivity Guide. NiagaraAX 3.x Drivers Guide

### Network Types

Network Type	Description
LAN	Local Area Networks (LANs) are typically node-to-node communications within building or facility. Ethernet over twisted pair cabling and Wi-Fi are the two most common technologies to build LANs.
WAN	Wide Area Networks (WANs) are used where nodes are separated by large distances (ie, region-to-region). WANs are often built using private leased lines.
VPN	A Virtual Private Network (VPN) is a form of WAN where the difference is the ability to use public networks rather than private leased lines (eliminates long-distance charges). The user initiates a tunnel request through the Internet Service Provider (ISP). The VPN software encrypts the data, packages it in an IP packet (for compatibility with the Internet) and sends it through the tunnel, where it is decrypted at the other end (the server). There are several tunneling protocols: IP security (IPsec), Point-to-Point Tunneling Protocol (PPTP) and Layer 2 Tunneling Protocol (L2TP).

### Network Architecture

Architecture Type	Description
Peer-to-Peer	Peer-to-Peer networks are typically less expensive and simpler to design than client-Server network, but they do not offer the same performance with heavy traffic. In Peer-to-Peer networks each workstation has the same capabilities and responsibilities.
Client-Server	In a Client-Server network, some computers are dedicated to serving other computers. A server application waits for a client application to initiate contact.

### Network Devices

Network Device	Description
IP Router	An IP router routes TCP/IP packets from one network to another. By default, IP routers do not propagate broadcast packets.
LON IP Server	LON IP Server – Building industry name for an EIA-852 compliant, LonTalk-to-IP router that allows IP to be used as a LonWorks channel. Some ‘IP Servers’ have web server capabilities (Echelon iLON 1000), while others are just Layer 3 LonTalk routers (Echelon iLON 600). IP Servers do not support tables or access lists, nor does it participate in IP router discovery protocols (eg, RIP, OSPF). From the IP perspective, the ‘IP Server’ acts as an IP host. Configuration Server (CS) management is either software-based (iLON 600) which resides in the BMS server or ‘Point Server’ or is hardware based (Loytech’s LIP ‘IP Router’). The Config Server collects address information from each of the members of the Lon-IP channel, and then updates all the other members with the collected information. It necessary to have one central device responsible for member information since the EIA-852 protocol does not provide a mechanism for members to discover each other.
PAD	Packet Assembler/Dissembler. Wraps an IP ‘frame’ around an BACnet/Ethernet packet so it can be routed through a IP network. BACnet device object instances (how Bacnet devices reference each other) are translated into the IP address of the PAD.
BACnet Router	Converts BACnet/Ethernet to BACnet/IP.
BBMD	BACnet Broadcast Management Device. Since, by default, IP routers do not propagate broadcast packets, a BBMD intercepts a BACnet/IP broadcast packet (message) on a physical subnet and ‘forwards’ it to the BBMDs located on each physical subnet with BACnet devices. The BBMDs then ‘recreate’ the broadcast packet on their respective subnets.
Firewall	A computer, router or other communication device that controls data flow between networks. It is the first-line of defense against attacks from the outside world. A firewall can hardware-based or software-based. A h/w firewall is a special router with additional filter and management capabilities. A s/w firewall runs on top of the o/s and turns the PC into a firewall.
Gateway	A gateway performs routing functions and protocol conversions from one network to another.

## Ports

Client-Server networks use port numbers to identify particular client and server applications. A port number is a logical mapping number to link to applications (HTTP, FTP, AX Platform, AX Station, etc). Port numbers fall into two groups:

1. Well-Known: ports 0 to 1023
2. Registered: ports 1024 to 49151 (assigned by IANA)

Port Type	Port # / Listening Application
Well-Known	7 - Echo request 20/21 - File Transfer Protocol (FTP) 23 - Telnet 25 - Simple Mail Transfer Protocol (SMTP) 53 - Domain Name Server 80 - HTTP Server
Registered	8080 – HTTP alternative. Commonly used for Web proxy and caching server, or for running a Web server as a non-root user. The 8080 port can be used to view a router's configuration web page: <a href="http://&lt;IP address&gt;:8080/">http://&lt;IP address&gt;:8080/</a> 1911 – Niagara AX Station 3011 – Niagara AX Platform

## Internet Protocol (IP) Suite

The Internet protocol suite is the set of communication standards used for the Internet. It is the most popular protocol stack for WANs. It is commonly known as TCP/IP because of its important protocols: Transmission Control Protocol (TCP) and Internet Protocol (IP). TCP/IP provides end-to-end connectivity specifying how data should be formatted, addressed, transmitted, routed and received at the destination.

IP Suite has four abstraction layers, each with its own protocols: 1) Application, 2) Transport, 3) Internet (Network), 1) Link (Data). Abstraction layers can be thought of as the assembly line in the computer. At each layer, certain things happen to the data that prepare it for the next layer.

The four layers of the IP Suite protocol stack map into the OSI seven-layer network protocol model.

IP Suite 4-Layer	OSI 7-Layer	Protocol	Purpose
Application (4)	Application (7)	HTTP	Allows access to network resources. Troubleshoot: application program, resource device.
Transport (3)	Transport (4)	TCP	Provides reliable process-to-process message delivery and error recovery. Troubleshoot: Port #'s.
Internet (2)	Network (3)	IP	Moves packets from source to destination. Troubleshoot: Router (or Default Gateway).
Link (1)	Data Link (2) Physical (1)	Data Link: Ethernet Physical: wire, radio, fiber	<u>Data Link</u> : organized bits into frames. Provides hop-to-hop delivery. Troubleshoot: NIC cards/drivers, Switches. <u>Physical</u> : transmits over medium. Troubleshoot: CAT5 cable, connectors, hubs.

## Network Layer Comparison

OSI Layers	BACnet	LonWorks	ModBus	KNX/EIB
Application Network Process to Application	Object-oriented structures that defines how message data is presented	Defines network variables, node discovery, logical interfaces, and functional data profiles	MODBUS Application Protocol	Application Layer supports individual and group addresses
Presentation Data Representation and Encryption		Header encodes the semantics of data passed in Application layer and carries identifiers of data items		
Session Interhost Communication		Manages request and response services		
Transport End-to-End Connections and Reliability		Handles packet retransmission and duplicate detection via unicast and multicast transmissions		Uses connection-oriented communication and connectionless communications
Network Path Determination & Logical Addressing (IP)	Message routing	Provides addressing and routing of packets using hierarchical addresses (domain, subnet, and ID number)		
Data Link Physical Addressing (MAC & LLC)	4 LAN options (Ethernet, ARCNET, EIA-485, or LonTalk) P2P protocol (EIA-232 full duplex interface)	(MAC) layer control based on Carrier Sense Multiple Access (CSMA) and provides bit encoding and redundancy	MODBUS Serial Protocol	Supports logical and individual addresses, and unicast and multicast communications
Physical Media, Signal, and Binary Transmission		RS-485; free-topology (FT) and PLC transceivers; and 3rd-party wired wireless, and fiber transceivers	Serial connections are supported using EIA/TIA-232 or EIA/TIA-485 standards	LLC: Flow control and error control via datagrams MAC: Uses Carrier Sense Multiple Access (CSMA)  Twisted Pair (Types 0 and 1), PLC, RF, Ethernet

## Network Host

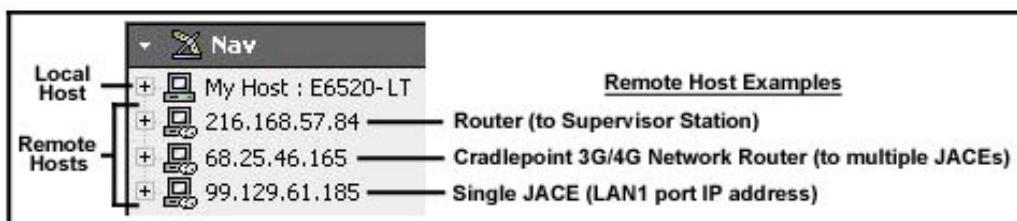
A network host is a computer connected to a computer network. Computers participating in networks that use the Internet Protocol Suite are called IP Hosts (or Internet Host).

### Niagara Hosts

**H = Host = Hardware**

A Niagara Host is a platform (hardware system) that provides the operating environment for a Niagara application. In the first level of the navigation tree, the host node is used to depict the platform. Hosts always represent a physical piece of hardware which is either a Localhost ('My Host'), which indicates the local machine, or a Remote host. In the navigation tree, remote hosts are always shown with an IP address.

There is usually a one-to-one correspondence between stations and host machines. To run additional stations on a host, the host must be configured to use different IP ports.



## Niagara Station Network Architecture

A Niagara Station uses a driver network to fetch real-time data which are modeled with proxy points. To support proxy points the Station must have that's drivers *network architecture*. For drivers that use field bus communications (eg, Lonworks, BACnet, Modbus), this often corresponds directly to a *physical network* of the devices. Often the network matches one-to-one with a specific comm port on the NiagaraAX host platform (JACE), such as a serial port, Lonworks FTT-10 port or Ethernet port. A BACnet Network is an exception since it can support multiple logical BACnet networks, which sometimes use different comm ports (see BACnet Guide).

## Niagara Station Network Architecture Cont.)

The NDIO (Niagara Direct I/O) and NRIO (Niagara Remote I/O) drivers are ‘non-field bus’ network architectures. The ‘rdbSqlServer’ driver is a database driver (only applies to Supervisor or AX SoftJACE hosts).

### **IP Address**

Internet Protocol (IP) address is a numerical label assigned to each device (ie, computer, printer) participating in a computer network that uses the Internet Protocol for communications. TCP/IP uses IP addresses. An IP address serves two functions: 1) host or network interface identification, 2) location addressing. Its role involves a *name* (what we seek), an *address* (where the device is) and a *route* (how to get there).

IP hosts have one or more IP address assigned to their network interfaces. The addresses are configured manually by an administrator (static IP) or automatically at startup by means of the Dynamic Host Configuration Protocol (DHCP). A disadvantage to DHCP is that a computer may be assigned a different IP address from day to day.

Every network host is a physical network node, but not every physical network node is a host. Devices such as modems, hubs and switches are not network hosts since they have not been assigned host addresses.

Network hosts that participate in applications that use the Client-Server model of computing are classified as server or client systems. Networks hosts may also function as nodes in peer-to-peer applications, in which all nodes share and consume resources equally.

Remembering many IP address is difficult if not impossible. To simplify the matter, Windows uses a HOST file to map the computer name to its IP address. A Host file is like a phone book, enabling the user and the computer to communicate using computer names.

### **IP Address Classes (V4)**

An IP address (v4) consists of 32 bits which the dotted decimal notation conveniently represents as 4 x 8-bit groups known as octets.

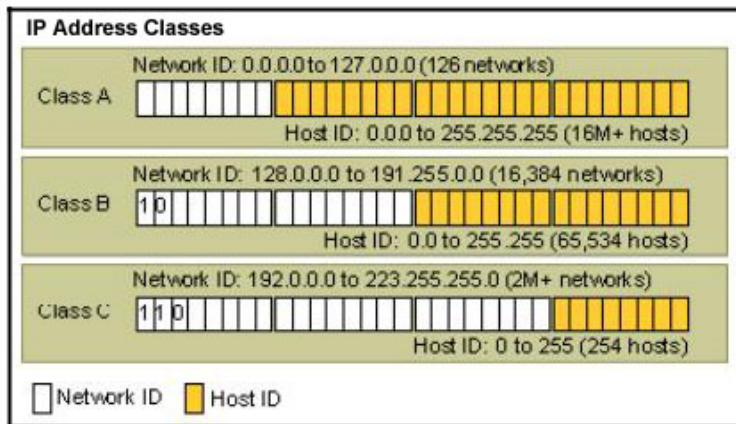
Notation	IP Address
Binary (32 bits)	10101100.00010000.11111110.00000001
Dotted Decimal (4 Octets)	172.16.254.1

The classful network architecture consists of three main IP address classes: A, B and C. The classful design allows for a larger number of individual network assignment and fine-grained subnetwork design. The class defines the possible number of networks and the number of hosts for each network.

Class	Network ID	# of Networks	Host ID	# of Hosts
A	0.0.0 to 127.0.0.0	126	0.0 to 255.255.255	16M+
B	128.0.0 to 191.255.0.0	16,384	0.0 to 255.255	65,534
C	192.0.0 to 223.255.255.0	2M+	0 to 255	254

## IP Address Classes (V4) Cont.)

To implement the class structure the IP address is divided into two parts: 1) subnetwork ID, 2) Host ID. The subnetwork ID is often called the 'subnet ID'. As an analogy, the subnet ID is similar to the area code of a telephone number and the Host ID is the telephone number itself.



## **Subnetting**

Subnetting is a scheme to allocate address space more efficiently. It can also enhance routing efficiency. The subnet process designates some high-order bits from the Host ID part and groups them with the network mask to form the subnet mask. This divides a network into smaller subnets.

For example, subnet mask 255.255.255.0 has a zero octet at end (8 bits at value '0'). That subnet mask screens out (ignores) the last octet of the IP address. If the IP address is 192.168.5.130, the Subnet ID becomes 192.168.5.0 and the Host ID is 0.0.0.130. 130 Hosts are available.

For subnet mask 255.255.255.192, the last octet is binary 11000000. The subnet mask now screens out 2 bits of the last octet of the IP Address. The subnet ID becomes 192.168.5.128 and the Host ID becomes 0.0.0.2. Only 2 Hosts are available.

## **Network Address Translation**

Network Address Translation (NAT) is a technique that hides a private network IP addresses behind a single IP address, typically a public address space (sometimes known as IP masquerading).

## **Network Troubleshooting**

**Network Testing**

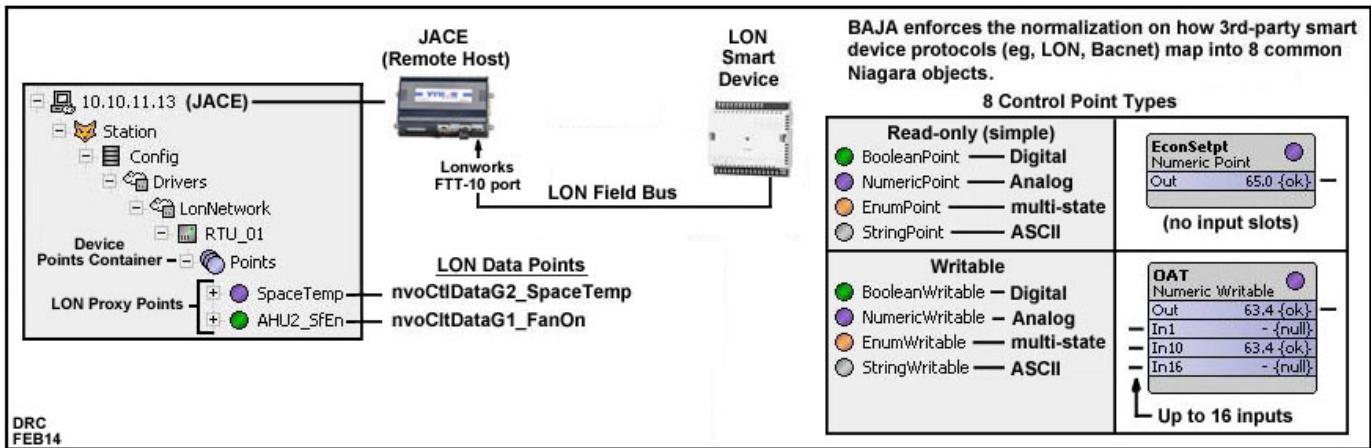
- 1a) c:\ping <IP addr or Host name>  
(connectivity test; pass=4 resolves)
- 1b) c:\ping <IP addr> -t  
(continuous; 'TTL'=Time to Live)
- 1c) c:\ping -a <IP addr>  
(resolve Host name)
- 1d) c:\ping <localhost>  
(test Host file installation)
- 1e) c:\ping <yourself>  
(test protocol binding to NIC)
- 1f) c:\ping 127.0.0.1  
(loopback test)
- 2) c:\ipconfig\all  
(TCP/IP properties: PC name & TCP/IP address)
- 3) c:\tracert <IP addr>  
(traces all routers to destination PC)
- 4) c:\arp -l or arp -a <IP address>  
(IP to MAC address mapping)
- 5) c:\netstat -a  
(active port connections)
- 6) c:\nbtstat -c  
(lists NBT's cache of remote names)



## CONTROL POINTS

Technical Document: Niagara AX-3.6 User Guide, 3-1 (pg. 71), Niagara AX-3.2 Developer Guide (pg. 39)

Niagara is protocol agnostic and vendor neutral. It transforms field bus data into normalized data components.



### Proxy Points

A Proxy Point is a software point in the Station that links to a point in the field device. It represents the unique relationship to the address of the physical point, the controller trunk and the AX driver (eg, LON, Bacnet). It has a *non-null* proxy extension, where the proxy extension (Proxy Ext) indicates the point's source. A point's proxy extension is either:

1. Null. A point that is copied from the 'control' palette or added using the right-click menu. The proxy extension is simply null (NullProxyExt). The point's source does *not* have a relationship to the address of a physical point.
2. Driver Type. Any point within the Points container of a device (eg, Lonworks, Bacnet). For example, a BooleanWritable proxy point under the Points container of a Bacnet Device has a proxy extension of 'BacnetBooleanProxyExt'. The point's source has a relationship to the address of a physical point.

### Point Naming – Syntax Rules

1. Use only alphanumeric (A-Z, a-z, 0-9) and underscore (\_).
2. Spaces, hyphens, or special characters (eg, %, &, ., #, etc) are illegal in component names.
3. The first character must be a letter (not a numeral).

Workbench permits improperly named components. Illegal characters are replaced with an 'escape' name based on the hex code of the illegal character (eg, a space becomes "\$20" or the dash (-) becomes "\$2d").

### Proxy States

In a connection between stations, a proxy component exists in three distinct states:

1. Unloaded: the proxy has not been loaded across the network.
2. Loaded: the proxy is loaded across the network and is known to the proxy VM; it may or may not be out-of-date with the master.
3. Subscribed: the proxy is actively synchronized with the master (auto-sync).

### Subscription (synchronization)

Components in a Station often represent an external system or device (ie, control points). Keeping components synchronized with their external representations is computationally expensive. Subscription is a mechanism that keeps components efficiently synchronized (between Niagara Stations).

### Licensing

Network and device drivers must be licensed and installed before networks or devices can be added to Niagara.

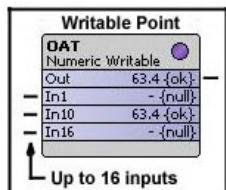
## Priority Level Conventions

Technical Document: Niagara AX-3.6 User Guide, 3-20 (pg. 90)

Writable points have 16 input properties (+ fallback) corresponding to priority levels.

Highest = Level 1 Slot (In 1)

Lowest = Level 16 Slot (In 16)



The effective input value is determined by an event driven priority scan, looking for a “non-auto” action at level 1 (emergency), then the value at the highest valid input, going from level 2 to 3 and so on to level 16 (at level 8, any “non-auto” action is evaluated as valid). Note: an input’s value typically comes from a link, however most inputs can also accept values entered directly from the point’s property sheet (as an alternative source).

A valid input is one with none of the following status bits set: down, fault, disabled, null, stale. If all 16 priority levels are evaluated *without* a valid input (*and* without an action at levels 1 and 8), then the *fallback value* is used. The fallback value can be set to ‘null’ so that the point’s Out has a null status in this condition. If you want a writable point to always have a Fallback of ‘null’ go to its slot sheet and set the “Hidden” Config flag on the “set” slot. Otherwise, a user can invoke a right-click command to set the Fallback to any value.

Only one link per input (level).

Priority levels 1 and 8 are reserved for actions (emergency and override). Levels above L8 override the manual operation.

Priority Level	Actions (Boolean Writeable)
1	Emergency Active Emergency Inactive Emergency Auto - release
8	Active – Permanent or Timer. Inactive – Permanent or Timer. Auto - release
Fallback	Set

Level	Description	Comment
1	<b>Emergency (Manual Life Safety)</b>	Unlinkable input, but available as action (command).
2	Automatic Life Safety	
3	(user defined)	
4	(user defined)	
5	Critical Equipment Control	Use for Safeties (FrzStat, SmokeDetector, Hi-Static, etc)
6	Minimum On/Off	If a BooleanWritable, level 6 is unavailable.
7	(user defined)	
8	<b>Override (Manual Operator)</b>	Unlinkable input, but available as action (command).
9	Demand Limiting	
10	<b>(user defined)</b>	Default Exposed Slot
11	Temperature Override	
12	Stop Optimization	
13	Start Optimization	
14	Duty Cycling	
15	Outside Air Optimization	
16	<b>Schedule</b>	Default Exposed Slot

### **Expose or Hide Point Slots**

1. Right-click the point.
2. Views > Pin Slots.
3. Select or de-select the appropriate slot(s).

### **Point Links**

To determine what points or control objects link to a point's input and where the point's output goes use the Link View.

1. Right-click the point.
2. Views > Link View.

### **Change the Name of a Point Slot**

1. Right-click the point.
2. Views > Slot View.
3. Select the slot.
4. Select Display name.
5. Modify the name.

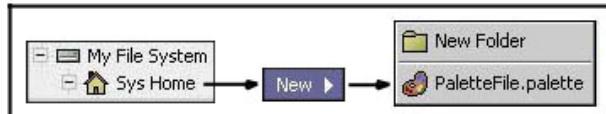


## CUSTOMIZATION

### Create a Personal Palette

Technical Document: Niagara AX-3.6 User Guide, 10-9

1. In the NAV side bar, expand the view of the 'My file System' folder.
2. R.C. 'SysHome' folder > New > Palettefile.palette



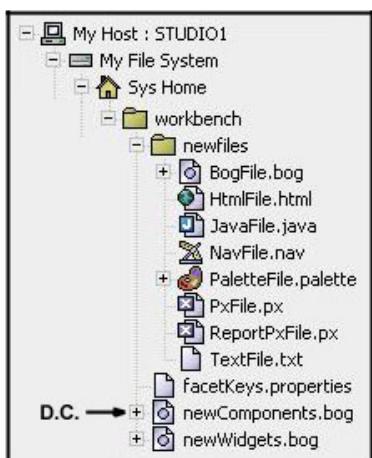
3. Name the new palette (the new palette is empty).
4. Open the Wire Sheet of the new palette (SysHome > R.C. <palette name> > Views > Wire Sheet)
5. Create a new folder (eg, Points, Schedules) and add the appropriate objects to the folder(s).
6. To add Extensions to the Personal Palette:
  - Open the 'Baja' palette.
  - Drag an 'Unrestricted Folder' onto the wire sheet.
  - Name the folder Extensions.
  - Open the Extensions folders and add the appropriate extensions.
7. Save the new Palette (File > Save Bog). The .palette file reside in the C:/Niagara root folder.

### To Open the Palette

1. Open the 'File Chooser'.
2. Select 'Browse' button and select the palette.

### To Customize the 'New' Menu

1. Expand 'Workbench' folder (My File System > SysHome > Workbench)
2. Open the Wire Sheet of "newComponents.bog" (double-click it)



3. Add an object or a palette object (eg, 'Trigger' folder from Control Palette).
4. Name the folder.
5. Select the Separator object that is already on the newComponents Wire Sheet. Use ctrl+D to duplicate the Separator.
6. To reorder the items, right-click the Wire Sheet, select 'Reorder'.
7. Arrange the list.

Example:

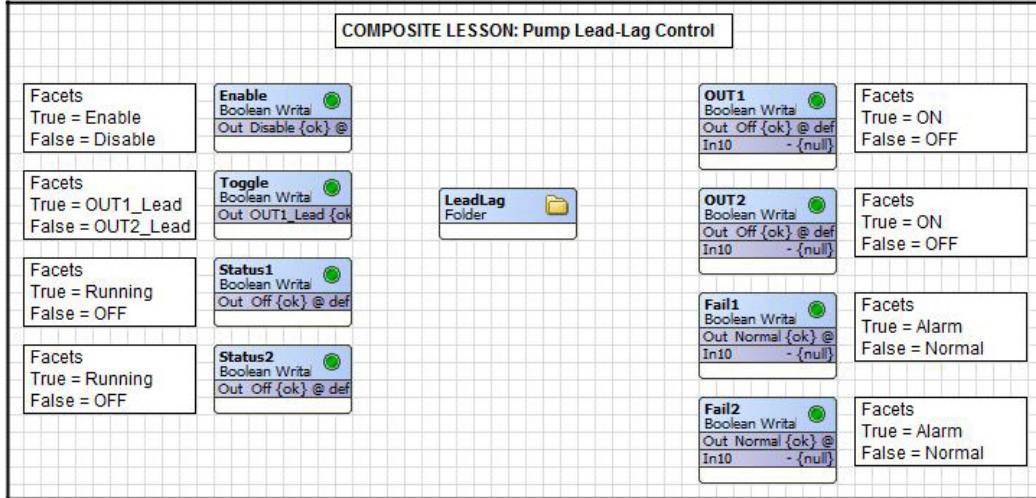


## Create a Control Composite

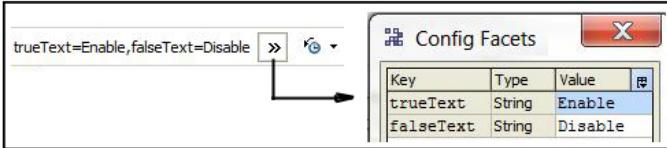
Goal: Create a Pump Lead-Lag Control Composite.

### 1. Create Control Points

1. Create a folder called 'PumpControl' (R.C. > New)
2. In the 'PumpControl' wire sheets add the Boolean Writable points (R.C. > New).
3. Create a folder called 'LeadLag'.



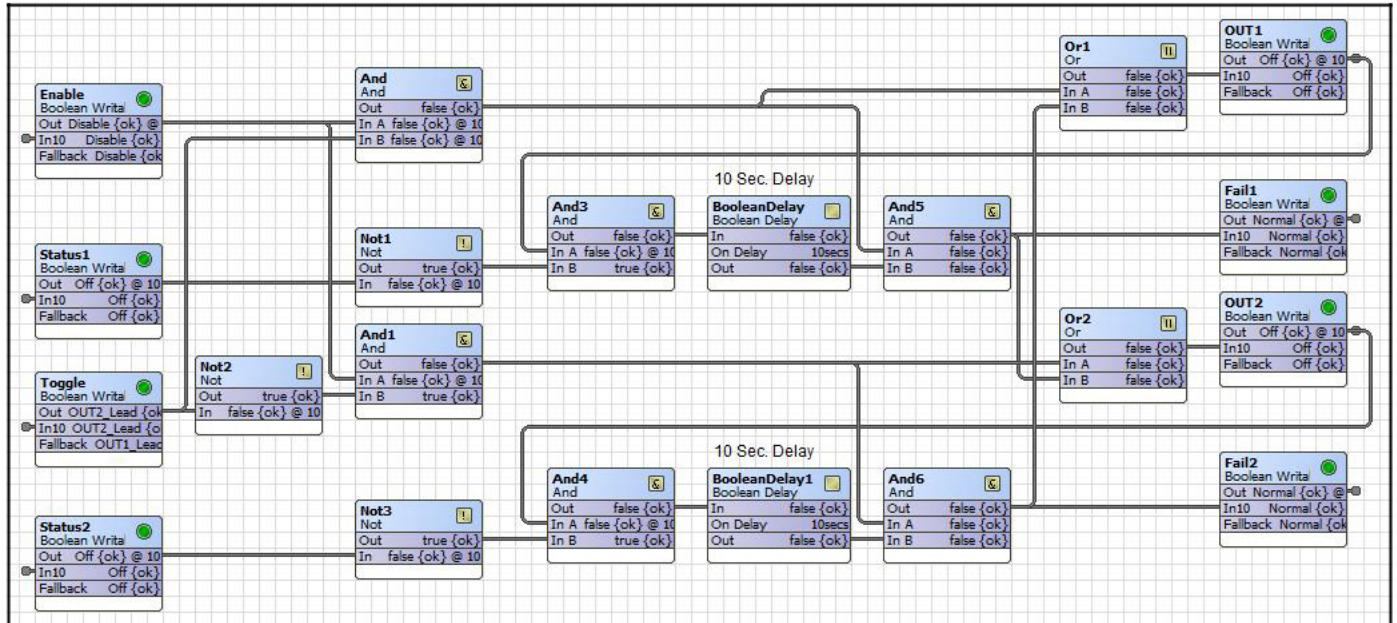
4. Set the Facets of the points.



### 2. Create Logic

1. Copy all the (8) points and paste them in the 'LeadLag' folder..
2. From the 'KitControl' palette add all the Lead-Lag logic to the wiresheet. Set the BooleanDelay time.
3. Connect all the logic with wire links.

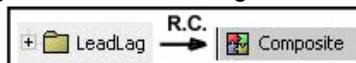
Note: having internal writable points is not required, just makes for convenient logic checkout.



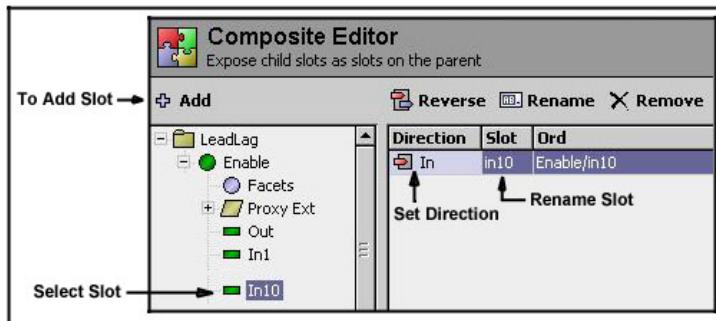
## Creating a Control Composite Cont.)

### 3. Composite Editor

1. Return to the 'Pump Control' folder.
2. Right click the 'LeadLag' folder and select 'Composite'.

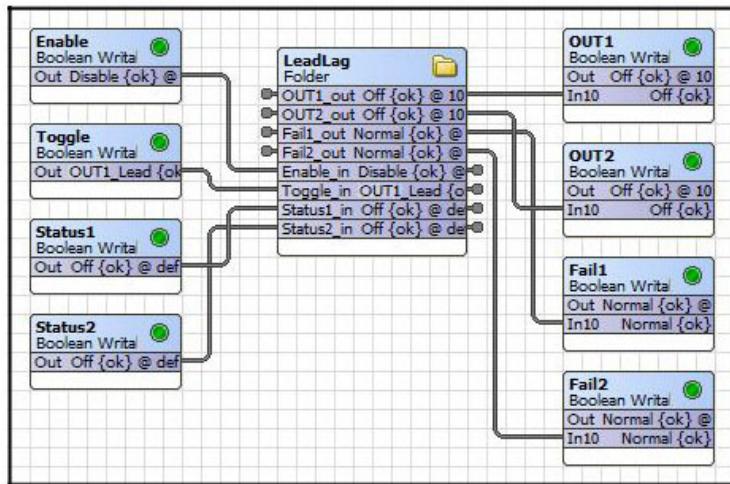


3. Open the main folder node in Composite Editor.
4. Open the appropriate point or control object.
5. Select the appropriate slot.
6. Click "+ Add".
7. Rename the Slot (use suffix "\_in" for inputs and "\_out" for outputs).



8. Reorder the slot positions in the final composite object (outputs on top). (R.C. the folder > 'Reorder').
9. Connect the links from the points to the new LeadLag composite.

Note: composite input slots will have link hubs on the right and output slots will have hubs on the left (don't delete the hubs).



### 4. Testing

- 1) Preset the inputs: Enable = 'Disable', Toggle = 'OUT1\_Lead', Status1 = OFF, Status2 = ON.
- 2) Set the Enable = 'Enable'.
- 3) Set the Status1 = 'Running'.
- 4) Verify the Outputs: OUT1=ON, OUT2=OFF, Fail1=Normal, Fail2=Normal.
- 5) Set Status1 = 'OFF'. Verify after 10 sec: OUT1=ON, OUT2=ON, Fail1=Alarm, Fail2=Normal
- 6) Set Status1 = 'Running'. Should be back to normal operation.
- 7) Switch the Toggle to OUT2\_Lead. Modify Status1 = 'OFF' & Status2 = 'Running'.
- 8) Verify the Outputs: OUT1=OFF, OUT2=ON, Fail1=Normal, Fail2=Normal.
- 9) Test Fail2.

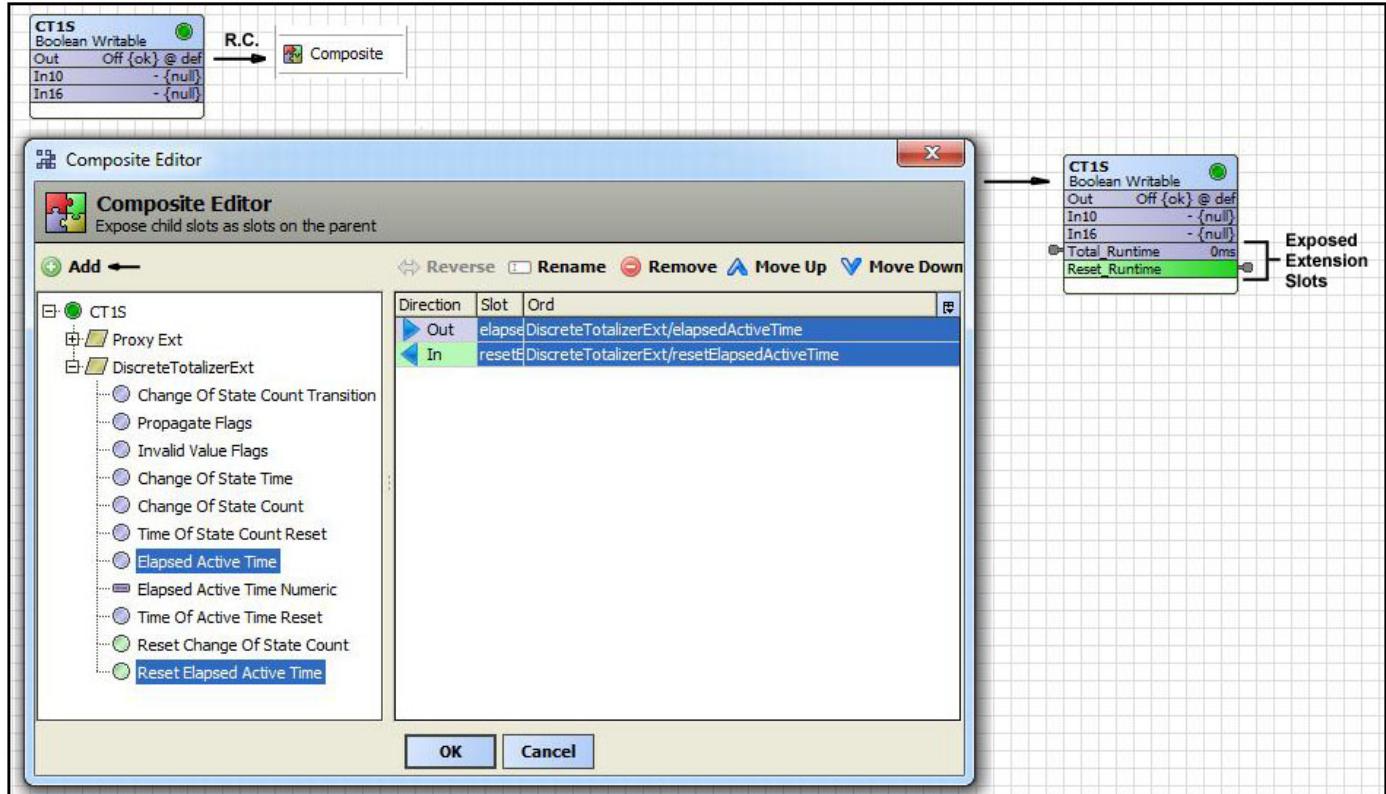
### Extra Credit

There is a 'bug' in the Lead-Lag operation (hint: 'double-trouble').

## Point Composite

Child slots of point extensions can be exposed as parent slots using the Composite Editor.

1. Right click the point and select 'Composite'.
2. Left Pane: Open the appropriate point extension (eg, DiscreteTotalizerExt).
3. Select the appropriate child slot (eg, 'Elapsed Active Time', 'Reset Elapsed Active Time').
4. Click +Add (or double-click child slot).
5. Right Pane: Rename the slot (eg, 'Total\_Runtime', 'Reset\_Runtime').
6. Reorder the slots (if necessary).

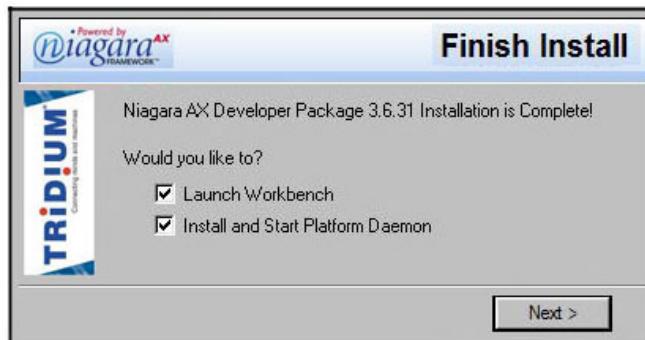
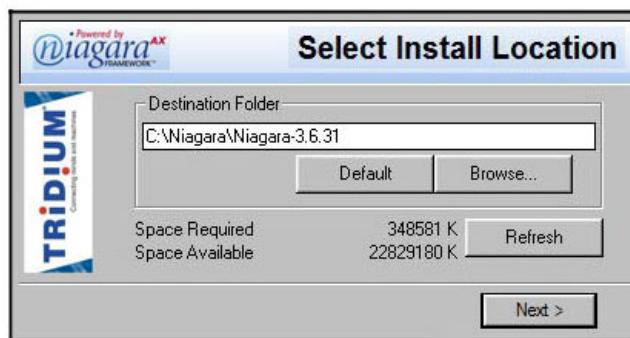
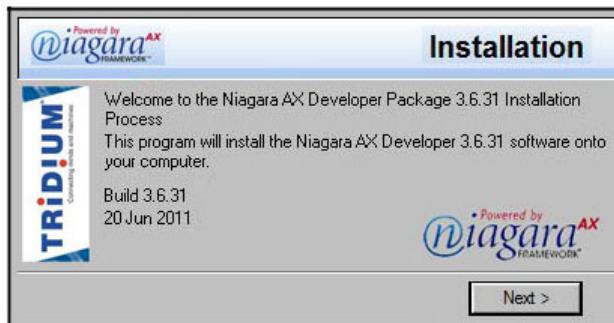


## To Add a New Slot

1. In the Slot Sheet view, right-click in the pane.
2. Popup menu: select 'Add Slot'.
3. Enter the properties:
  1. Name.
  2. Type: select from the drop-down option list.
  3. Choose the desired slot options from the Flags field.
4. OK.

## Installing AX Workbench

1. Install AX zip folder on workstation/notebook. (watch 32-bit or 64-bit install).
2. Extract folder.
3. Open extracted folder > run 'setup'.



### Stand-Alone Workplace AX

The stand-alone version of AX Workplace (Vyon mdl. WP-AX) does not permit running a Station on the local machine. You can see control/logic objects on a wiresheet, but they will not run. Can only run a Station on a Niagara device (eg, JACE).



## License Registration

### AX License Registration

Preliminary: Internet connection (access to Tridium license server required).

Launching unlicensed AX Workbench will generate the following message. The local PC will create a 'Host ID' number with the prefix 'Win' followed by 24 alphanumeric characters.

The screenshot shows a 'Request License' dialog box. It includes a section for requesting a license file via email, instructions to email information to a Vykon Distributor, and fields for entering a Host ID (set to 'Win-XXXX-XXXX-XXXX-XXXX'), Sales Order Number, Purchased From, Sales Order Item Number, Your Name, Your Company Name, and Your Email Address.

1. Submit the Host ID, Sales Order Number to Tridium or the AX distributor.
2. A License form and License Key will be delivered.

The screenshot shows a 'Request/Bind License' form from Niagara licensing. It has sections for 'License Details' (Host Id, License Key) and 'Requester Details' (Name, Company, E-mail). A 'Request Submitt...' button is at the top left.

3. Submit the License form.

The screenshot shows a 'Request Submitted' dialog box. It informs the user that an online license request has been submitted and provides an 'Exit' button.

4. Successful AX licensing will display:

The screenshot shows a 'License Installed' dialog box. It confirms that an online license request has been submitted and that the machine is now licensed. A 'Continue' button is present.

Ok to launch AX Workbench.

5. Use License Manger to view the license details.

## **License Update via LAR file** (AX Workbench currently licensed)

1. Change the file extension from .lar to .zip.
2. Unzip the file. This will create a ".license" file.
3. Paste the License file into the host's 'licenses' folder (put any certificate files in the 'certificates' directory).
4. Update the license with the License Manager.



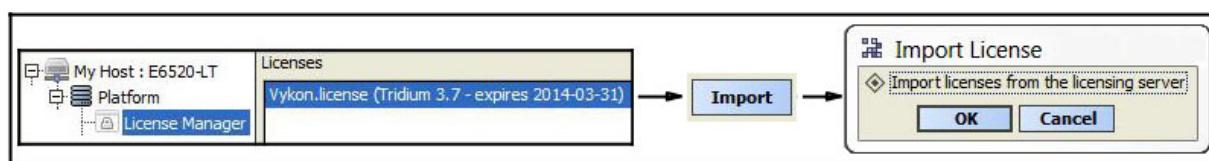
The license can be viewed with MS-Notepad (or similar text editor).

```
<license version="3.x" vendor="Tridium" generated="20xx-xx-x" expiration="20xx-xx-xx"
hostId="Win-xxxx-xxxx-xxxx-xxxx">
<feature name="brand" accept.station.in="**"
accept.station.out="*" accept.wb.out="*" brandId="vykon" accept.wb.in="*"/>
<feature
name="about" project="XXX-<companyname>"/>
```

("\*\*" = wildcard – no restrictions on brands or station)

### **License Manager:**

1. Platform > License Manager > highlight 'Vykon.license'.
2. Select the 'Import' button (bottom) > select 'Import licenses from the licensing server'



3. Verify license details > 'View' button (bottom).  
(eg, Bacnet license, Maxheap, etc).

### **32-Bit vs. 64-Bit Host IDs**

Host ID must be compatible with the Niagara Runtime: 32-bit or 64-bit. License upgrade required.



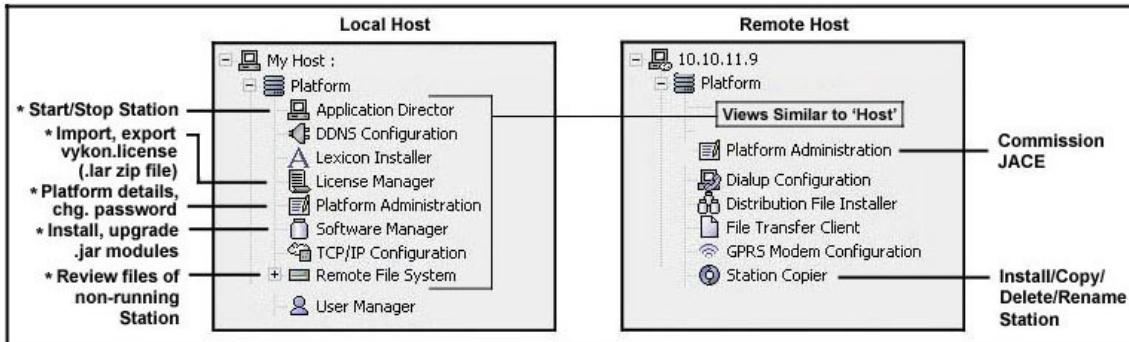
## PLATFORM

Technical Document: Niagara AX-3.x Platform Guide

A Platform or 'Host' is hardware. ("H" = Host = Hardware)

Host Type	Host Description
Local	Desktop or laptop PC (typically performing off-line Station programming).
Remote	JACE or Server (the server typically is the home of AX Supervisor Station).

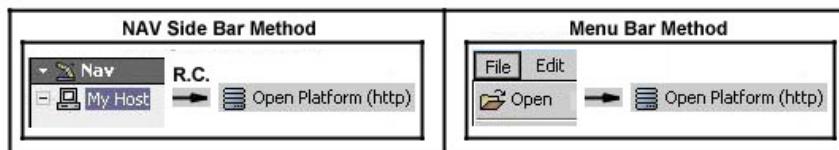
### Platform Views



### To Open a Platform Connection

Two Options:

- 1a. Nav Side Bar Option: R.C. 'My Host' > 'Open Platform'.
- 1b. Menu Bar Option: 'File' > 'Open' > 'Open Platform'.



Complete the fields in the 'Open Platform' dialog box:

1. Type: Platform Connection
2. Host IP (three options):
  - ① Local: PC Name (auto-fill)
  - ② Remote: enter JACE IP address
  - ③ Tunnel: 1) Host IP (typically Host IP = AX Supervisor IP), 2) Tunnel to: JACE IP
3. Port: 3011 (default)
4. Credentials.

Local Host: Refer to Windows User Accounts (Control Panel > User Accounts)

Remote Host (JACE): Factory Default: User: tridium Pswd: niagara

The screenshots show the 'Platform Sign-in' dialog for three different connection types:

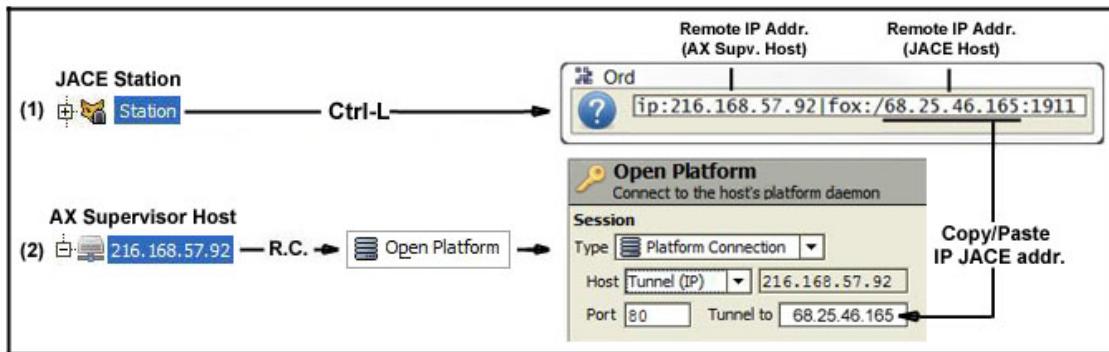
- ① Platform Sign-in: LOCAL HOST**: Shows 'Type: Platform Connection', 'Host: E6520-LT (PC Name)', 'Port: 3011', and 'Credentials' fields for 'Username' and 'Password'.
- ② Platform Sign-in: REMOTE HOST**: Shows 'Type: Platform Connection', 'Host: IP' (with dropdown for 'JACE IP Address'), 'Port: 3011', and 'Credentials' fields for 'Username' and 'Password'.
- ③ Platform Sign-in: TUNNEL REMOTE HOST**: Shows 'Type: Platform Connection', 'Host: Tunnel (IP)' (with dropdown for 'AX Supvr. IP Address'), 'Port: 80' (with note 'Tunnel to JACE IP Address'), and 'Credentials' fields for 'Username' and 'Password'.

Unable to open the Platform Connection?

- 1) If Windows account, confirm the username/password and the WIN administrator privileges.
- 2) Platform Daemon running? Windows: 'Start' > All Programs > Niagara AX 3.x > 'Install Platform'.
- 3) Use the Serial Shell interface to restore the Platform credentials back to the default factory settings.

## Quick Platform Connection to a remote JACE

1. Highlight JACE Station: Ctrl-L > copy JACE IP address (ctrl-c).
2. Highlight AX Supervisor Station > Open Platform > paste JACE IP address into 'Tunnel to' (ctrl-v).



**License Manager:** A JACE from the factory needs to be configured to use code. The Tridium Company charges for a license that allows a JACE to talk a network protocol other than its own (eg, BACnet, Modbus, LonWorks). A License file is unique to a specific Niagara Host and enables a set of vendor features. All Niagara hosts require a branded 'Tridium' license.

**Branding:** Tridium's OEM partners issue licenses that identify their particular product line by Brand. The OEM may define interoperability restrictions (Niagara Compatibility Statement). The wildcard '\*' means that all brands are allowed. Note: gov't jobs prefer open license connectivity. Order "open license".

accept.station.in = '\*' (the list of brands that the JACE will accept data from)

accept.station.out = '\*' (the list of brands that the JACE will share data with)

accept.wb.in = '\*' (the list of brands that engineer the JACE)

accept.wb.out = '\*' (the list of brands that the JACE can engineer)

**Device Integration:** limitations on BacNet, LonWorks, etc (devices, proxy pts, history trends, schedule import or export).

**Station & Web:** permission to run a Station on the licensed platform & permission to connect to a Station through a Web-browser.

**Workbench:** permission to launch the Niagara Workbench.

Max Heap: permits the use of the full RAM memory (-201, -601 JACE). JACE-201's before s/n 8454 are 64mB RAM and are not upgradeable.

MSTP: applies only to QNX-based JACEs. Permits the enabling of the BacNet MSTP port.

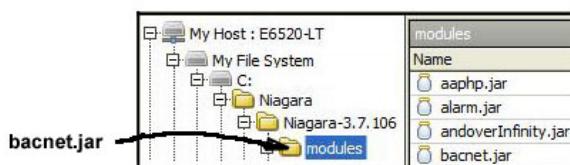
## Licensing process

See section 'Basic Steps-Installing AX'.

**Software Manager:** to install, upgrade or remove modules in a remote JACE. Niagara code is written in modules to minimize large file size. Use only the modules you need. Use 'Software Details' to list module requirement for LON, Bacnet, etc. For example, Lonworks integration requires the 'lonworks.jar' module. All modules are .jar files. JAR = Java Archive (compressed file; use WinZip to view).

## To Update a Module File

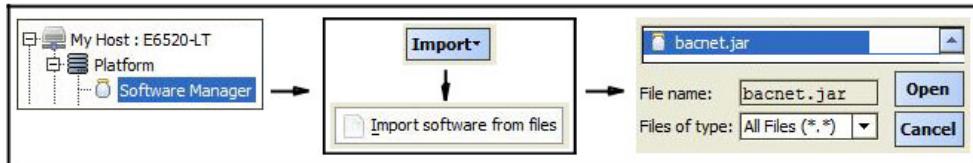
1. Copy the .jar file into the target host's 'module' folder.



1. Platform > Software Manager.
2. 'Import' button (bottom) > 'Import software from files'.

## To Update a Module File Cont.)

3. 'File Choose' > Highlight the new module > click 'Open'.



4. "Loading" message will appear.
5. Locate the module file. Compare the "Installed Version" vs. "Avail. Version".
6. If "Out of Date" is present, click 'Upgrade'. Status will change to "Upgrade to 3.x.x."
7. Click 'Commit'. If the Host is a JACE, rebooting is required.

## **Time & Date Setup**

1. Set PC Time Zone, Date & Time.
2. Set the Platform Time Zone (Platform > Platform Administration)

## **Modify Platform User Account**

1. Platform > Platform Administration > Update Authentication



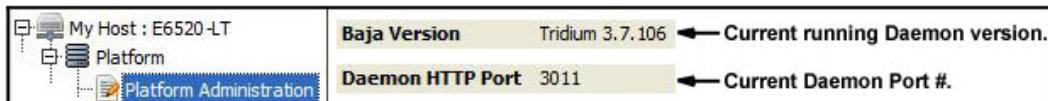
## **Provisioning**

Provisioning permits a Supervisor Station to automate platform tasks on subordinate JACEs on the Niagara Network. Automated tasks are limited. Refer to Technical Document Niagara AX 3.1 & 3.2 Provisioning Guide.

## **Platform Daemon**

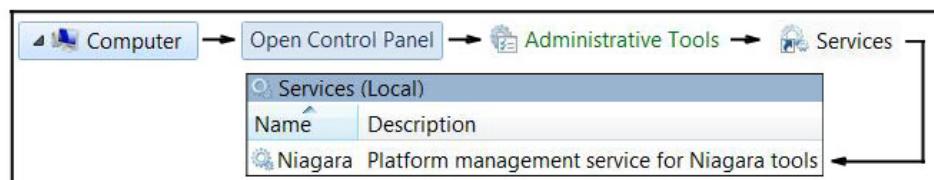
The Platform Daemon is a background server process (extension to the O/S) that enables a user to access platform tools through the Workbench. A Platform Daemon runs on Local or Remote Host. 'Niagarad' is the proprietary protocol used for workbench-to-daemon communication.

### To view the running Daemon version & Port #



Note: important that the running Daemon version is the same as the running Station version (files saving errors will result).

### To view the Daemon service



### To view the Daemon Output

1. Expand Platform node > 'Application Director' > Select 'View Daemon Output'



## STATION

Technical Documents: Niagara AX-3.x User Guide, Ch. 1; Niagara AX-3.x Developer Guide

A Station is software ("S" = Station = Software)

Station is a Java Virtual Machine (JVM) that can run as Server or a Client. As a Server it responds to requests for information from another Station. As a Client it requests information from another station. Version 3.6 supports WIN7 (64-bit O/S).

Niagara architecture is based on JAR files called modules (JAR = Java Arkive). Modules are linked together to define an application which are executed using the Station JVM.

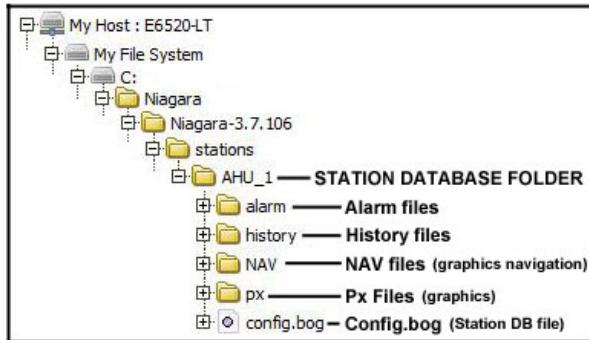
Typically, only one Station runs on one Host. To run more than one Station, unique port #'s must be assigned to each Station (default Fox Port # = 1911).

Station Functions:

- Programmable Controller – HVAC, lighting, energy control & monitoring, transportation systems, etc.
- Building Manager – alarms, schedules, monitoring & trending.
- Web Server – point data & graphics linked to a Web Browser.

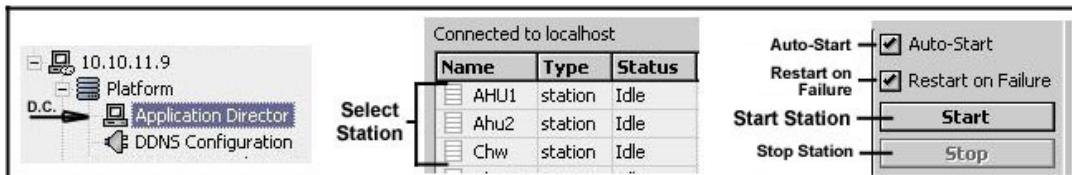
The entire Station database is represented by a folder. Within the Station folder is an XML file called 'config.bog' (Baja Object Graph). The programmed portion of the Station database is defined by the single config.bog file (graphics files are not in the bog file). Stations are booted from their config.bog file into a single VM process on the host machine.

Within the 'station' database folder, four default sub-folders: 1) Alarm, 2) History, 3) Nav and 4) Px (graphics).



### START: Station

1. Open Platform Connection (see 'Platform' section).
2. Double-click 'Application Director', select the appropriate station, right-click>'Start' or click 'Start' (side bar).



3. Verify 'Running' status.

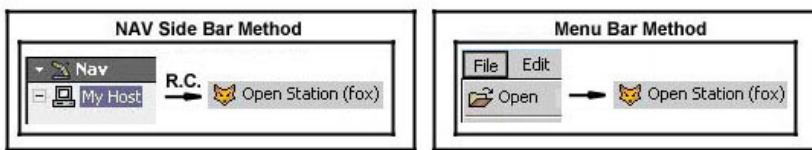
If Station fails to Start:

1. Verify User name & password.
2. Verify Station Port #.
3. Platform > Application Director > select 'Verify Software' (right side).
  1. Review 'Software Missing' list (items marked with '\*').
  2. Add appropriate software modules (see Platform section – "Software Manager").
4. Platform > License Manager: Check License

Note: if you stop a Remote Station (Hard JACE), it takes ~ 5 minutes to restart it. Status = "Halted" when stopped.

## OPEN: Station Connection

1. The Station must be running (see above to start the Station).
- 2a. Nav Side Bar Option: right-click 'My Host' > 'Open Station'.
- 2b. Menu Bar Option: 'File' > 'Open' > 'Open Station'



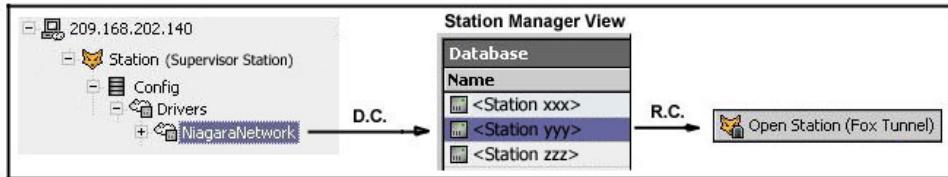
Complete the fields in the 'Open Station' dialog box:

1. Type: Station Connection
2. Host IP (three options):
  - ① Local: PC Name (auto-fill)
  - ② Remote: enter JACE IP address
  - ③ Tunnel: 1) Host IP (typically Host IP = AX Supervisor IP), 2) Tunnel to: JACE IP
3. Port: 1911 (default)
4. Credentials. User: admin (default) Password: (user defined)

<b>① Station Sign-in: LOCAL STATION</b> <b>Open Station</b> Connect to station using fox <b>Session</b> Type: Station Connection Host IP: E6520-LT (PC Name) Port: 1911 <b>Credentials</b> Username: _____ Password: _____	<b>② Station Sign-in: REMOTE STATION</b> <b>Open Station</b> Connect to station using fox <b>Session</b> Type: Station Connection Host IP: JACE IP Address Port: 1911 <b>Credentials</b> Username: _____ Password: _____	<b>③ Station Sign-in: TUNNEL REMOTE STATION</b> <b>Open Station</b> Connect to station using fox <b>Session</b> Type: Station Connection Host Tunnel (IP): AX Supvr. IP Address Port: 1911 Tunnel to: JACE IP Address <b>Credentials</b> Username: _____ Password: _____
---	---	--

## OPEN: Station Connection (Fox Tunnel)

1. Open the Station Manager of the AX Supervisor's NiagaraNetwork (double-click 'NiagaraNetwork')
2. Highlight the Station in the Database pane > Right-click.
3. Select 'Open Station (Fox Tunnel)'

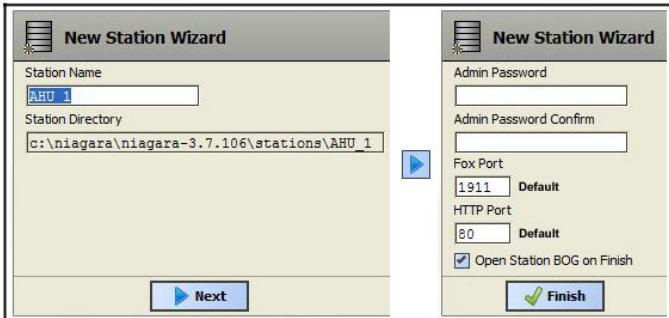


## **CREATE: New Station**

1. Menu Bar: Tools > 'New Station'



2. 'New Station Wizard' appears:

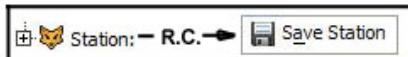


3. Create the Station name.
4. Create the Admin password (username = admin).
5. Assign Port # (default = 1911).
6. Click 'Finish'.
7. Verify the new Station folder: My Host > My File System > Sys Home > stations

## **SAVE: Station**

Running a Station occurs in the Host's RAM memory. Does not affect the .bog file. You must save the Station to update the config.bog file. Saving a Station on a JACE saves to flash memory.

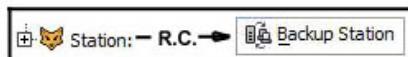
1. Right-click the 'Station' node. Select 'Save Station'.



## **BACKUP: Station**

Station backup saves everything (eg, graphics, history, alarm files) in a .DIST file. Use the Distribution File Installer in the Platform Tool to restore the backup (to restore: change the .dist extension to .zip and extract). Note: watch platform ver.

1. Right-click the 'Station' node. Select 'Backup Station' (creates .disti file: My File System > Sys Home > backups).



## **DELETE: Station on PC (Local Host)**

OK to perform with WIN Explorer.

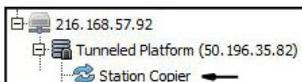
1. My File System > SysHome > Stations
2. Delete the Station folder (be careful).

## **DELETE: Station on JACE (Remote Host)**

1. Open a Platform connection on the JACE.
2. Select 'Station Copier'.
3. Highlight the Station in 'Stations on xxx.xxx.' (right pane).
4. Select 'Delete'.

## **COPY: Station on PC to JACE**

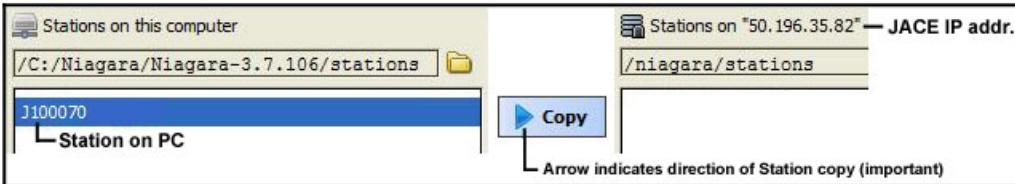
1. Open a Platform connection on the JACE > Select 'Station Copier'.



2. Selection the Station in 'Stations on this computer' (left pane).

## COPY: Station on PC to JACE Cont.)

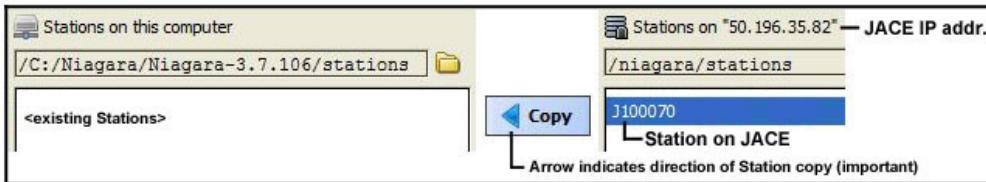
3. Select the → Copy button (watch arrow direction).



4. If 'Uncommissioned Host' message appears, the JACE needs to be commissioned. Commission the JACE (see JACE section for commissioning).
5. Station Transfer Wizard appears. Verify Station name and select 'Next'.
6. Select the appropriate file selection. Select 'Copy every file in the Station directory' if you want to include px files.
7. Auto-Start. Keep or deselect.
8. Keep 'Reboot the remote host after copying the station' selected (the JACE must reboot to restart it).
9. Review the changes and click 'Finish' to start the transfer to the JACE.
10. Wait for 'Transfer complete' message. Click 'Close'.
11. Open the Application direction of the JACE and start the Station.
12. Open the Station to verify successful transfer.

## **COPY: Station on JACE to PC**

1. Backup the Station.
2. Open a Platform connection on the JACE > Stop the Station if running (Stop = 'Halted').
3. Select 'Station Copier'.
4. Select the Station in 'Stations on xx.xx.xx.xx' (right pane).
5. Select the ← Copy button (watch arrow direction).

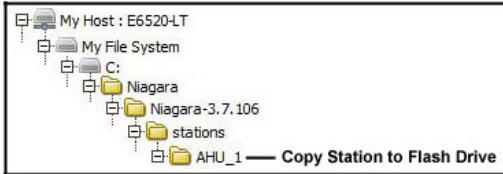


6. Station Transfer Wizard appears. Verify Station name and select 'Next'.
7. Select the appropriate file selection. Select 'Copy every file in the Station directory' if you want to include px files.
8. Select the appropriate delete/overwrite selection.
9. Click 'Finish' to start the transfer to the PC.
10. Wait for the 'Transfer complete' message. Click 'Close'.

## **COPY: PC to Flash Drive**

OK to perform with WIN Explorer.

1. Copy Station folder from <root drive/Niagara/> to Flash Drive.



## USER ACCOUNT: New or Edit Account

1. Open Config > Services.
2. Right-click 'UserService' > View > User Manager.



3. Select 'New' to create a new Account or 'Edit' to modify existing account

This screenshot shows the 'Edit' dialog box for a user account. The dialog is titled 'Edit' and contains the following fields with descriptions:

- Name:** admin — Log-in User Name.
- Enabled:** true — To enable/disable an account.
- Expiration:** Never Expires — Account expiration setting.
- Permissions:** Super User (checkbox checked) — 'Super User' = all permissions (permissions are category-based).
- Network User:** False — Permits a user to be available in other Stations. (prototypes permit user network sync)
- Prototype Name:** —
- Password:** [REDACTED] — Log-in User Password
- Confirm:** [REDACTED]
- Email:** — Supports alarm emailing.
- Cell Phone No.:** — Supports alarm notification.
- Facets:** Time Format (default) — Timestamp formatting.
- Unit Conversion:** None —
- Nav File:** file:^nav/XML.nav — Defines the 'Home' graphic link.
- Auto Logoff Enabled:** true —
- Auto Logoff Period:** 00008h 00m —
- Web Profile:** Default Wb Web Profile — Specifies the user's HTTP browser access. (supports web profiles for Px graphics)

4. Review/Set the global settings (applies to all accounts). (user property sheet).

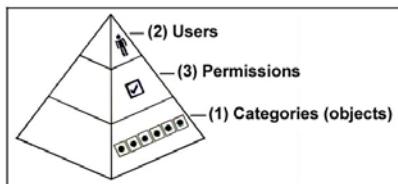
This screenshot shows the 'UserService (Global Account Settings)' dialog box. It contains the following settings:

- Require Strong Passwords:** true
- Lock Out Enabled:** true
- Lock Out Period:** +0h 01m 00s
- Max Bad Logins Before Lock Out:** 10 [1-10]
- Lock Out Window:** 0h 01m 00s

# Station Security & User Administration

Technical Document: NiagaraAX User Guide, Ch.7

A Station's security is determined by the combination of Users, Permissions and Categories. In general you create categories first, and then assign objects to them. Then create users, to which you assign permissions.



## Category Manager

Categories enable what the operator can do (eg, change setpoints or override points). The Station Category Manager is used to add, delete and edit categories.

### Create New Category

1. Expand the 'Services' node,
2. Right-click the CategoryService, select Views > Category Manager.
3. Set the index number and name the category (eg, General, HVAC, Boiler Plant, GeneralAlarms, Setpoints, etc). To restrict what the User sees use categories 2-8 (don't use Category 1).

	Inherit	Category 1	Category 2
Config	n/a	•	
Services		•	•
Control	✓	•	
Points		•	•
Files	n/a	•	•
NAV		•	•
px		•	•
ImageFolder	✓	•	
MainSummary.px		•	•
History	n/a	•	•

Category Browser Example: Limit 'Home' icon on the Customer account to display a single px graphic (MainSummary.px) with data values (eg, status, temps, kW, etc). NAV tree expansion is limited.

1. Services > CategoryService
2. Expand Config/Control > Select "Points" in Category 3 column.
3. Expand Files > Select "Nav" folder in Cat. 3 column.
4. Expand Files/Px > Select "MainSummary.px" in Cat. 3 column.
5. Select "History" in Cat. 3 column.
6. Log into Customer account. Click on the 'Home' icon – only the graphic 'MainSummary.px' should appear.

	Inherit	Category 1	Category 2	Category 3
Config	n/a	•		
Control	✓	•		
Points		•		•
Files	n/a	•		•
NAV		•		•
px		•		•
ImageFolder	✓	•		
MainSummary.px		•		•
History	n/a	•		•

## User Service

By themselves categories have little security meaning. Only when you set a user's permissions do the categories get referenced.

## Category Browser

The Category Browser is used to assign objects in the station to different categories. Every object must be assigned to at least one category.

### Create a New Browser

1. Expand the 'Services' node,
2. Right-click the 'CategoryService', select Views > Category Browser.
3. Click in table cells to add or remove category assignments. As an alternative to explicitly assigning one or more categories to an object, you can have it "inherit" the assigned categories of its parent. This affects the color of the rows:
  - Yellow Rows = objects explicitly assigned into one or more categories.
  - Dimmed Rows = objects inheriting their parent's category or categories.

Three permissions restrict what the user sees:

1. Read
2. Write
3. Invoke – use to control the 'Action' menu

The 3 permissions are assigned to two levels:

1. Operator
2. Administrator

Use the Slot Sheet to view the permissions > 'Flags' column:

'o' – operator  
'r' – read  
'h' – hidden

(operator level = lower case; admin = upper case)

Ability to view Wire Sheet: Admin Write permission

## Change Station Port #

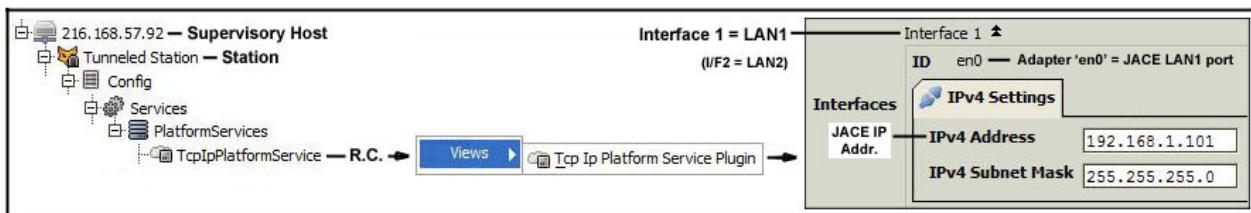
1. Open the Station Connection.
2. Config > Drivers.
3. Open the property sheet of the 'NiagaraNetwork'.
4. Open the 'Fox Service'.
5. Modify the port number.



## Locate Station Host ID & Serial # (without using Platform)

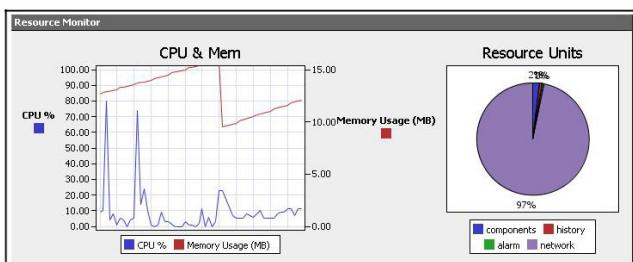


## Locate Station IP Address (without using Platform)



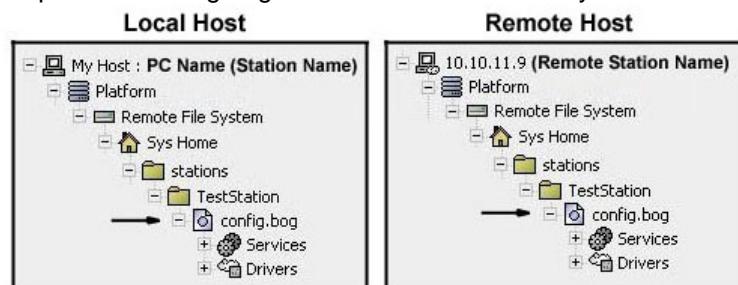
## Station Resource Manager

1. Right-click 'Station' node.
2. Select 'Views' > 'Resource Manager'.



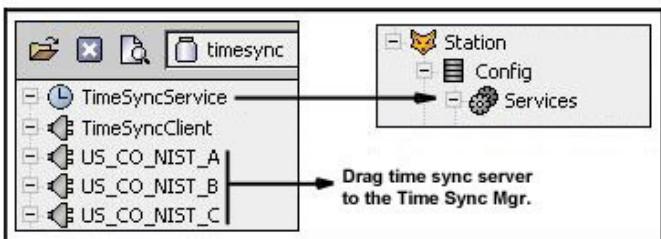
## To View the Database Files in a Non-Running Station

1. Expand 'Platform node', then 'Remote File System'.
2. Expand 'SysHome' > 'Stations' > <Station Name>
3. Expand the config.bog tree. The Remote File System is always Read-only (non-edits).



## **Syncing the Clock to an Internet Time Server**

1. Open the TimeSync palette.
2. Drag the 'TimeSyncService' to the Station's 'Services' folder.
3. Double-click the TimeSyncService item.
4. Drag the appropriate time sync server to the Time Sync Manager window.



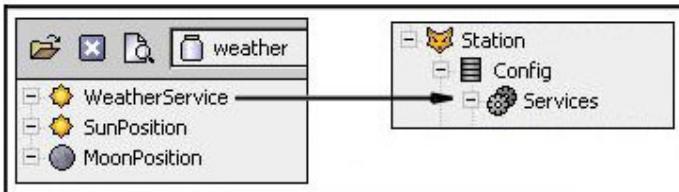
## Create a New Time Sync Client

1. Highlight 'TimeSyncService' > Next.
2. Rename
3. Server Name: Add IP address.

## **Adding a Weather Report to the Station**

Technical Document: Niagara AX Weather Guide

1. Open the Weather palette.
2. Drag the Weather Service to the Station's 'Services' folder.
3. Double-click the Weather Service item to open the Weather Manager.
4. Click the 'New' button and add a 'Nws Weather Provider' to the Station. Configure the weather report to display information for the service area (or the nearest service area).



## **Backup Service**

Update the Niagara Station for Backup.  
Config > Services > BackupService

## Troubleshooting

To check the 'Log History Service':

1. Application Director > select 'Stream to File' (right side).
2. Create filename.
3. 'Dump to Threads'.

Issue: No communication to AX Supervisor.

1. Station > Driver > NiagaraNetwork.
2. Highlight the Station in the Database view > Edit.
2. Verify that the Station name entry is same as the AX Supervisor name.

Issue: modules missing

1. Start/Stop Station if modules are not present.

Issue: Accidentally delete a service (eg, 'UserService').

Several alternatives:

1. Click the 'undo' arrow.
2. Copy service from a backup config.bog file.
3. Recover from .dist file.

Issue: Data Recovery Service dealing with high write volume (JACE 3E & 6E series with SRAM).

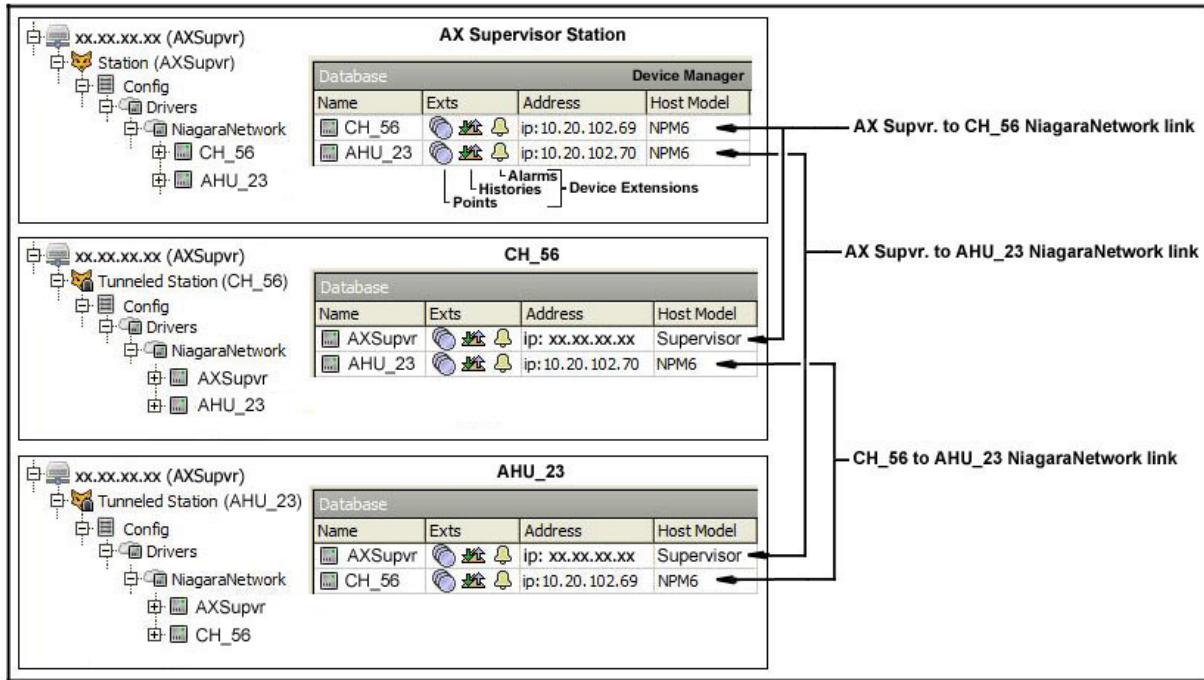
1. Right click on Station > Spy < Sysmanagars > Datarecoverymanager.
2. Review where the writes are coming from and their size. Writes are broken into three areas: Station, Alarm, or History. Additional statistics available to the bottom of the page.

## SUPERVISOR STATION

A Supervisory Station provides end-user supervisory functions to multiple JACEs (ie, history, alarm concentration).

Communication between Stations is established via the Niagara Network of each Station:

- 1) Supervisor Station to JACE Station(s).
- 2) JACE-to-JACE Station(s).



### 1) To Install the Supervisor Station on a JACE's Niagara Network

1. Connect to the JACE Station.
2. Config > Drivers.
3. Open the Station Manager of the JACE's NiagaraNetwork (R.C. > Views > Station Manager).
4. Select 'New' (bottom). Add (1) Niagara Station.
5. 'New' Dialog box should appear.
6. Set the properties:
 

1. Name (AX Supvr. Name)	5. Username (AX Supvr. User Account)
2. Address (AX Supvr. IP addr.)	6. Password
3. Fox Port: 1911	7. Enabled: true
4. Use Foxs: false	8. Virtuals Enabled: false

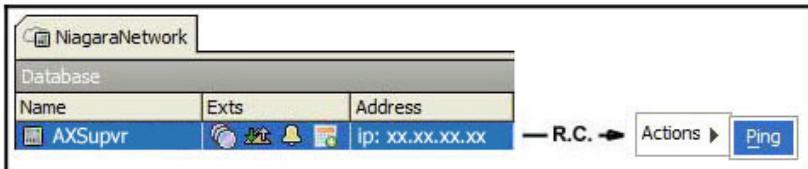


7. Check the 'Health' and 'Server Conn' status. Faulty Supervisor connections typically require IP address review or IT dept. support (IPSec rules).

Good Supervisor Connection						Faulty Supervisor Connection					
Database (JACE)						Database (JACE)					
Name	Exts	Address	Host Model	Health	Server Conn	Name	Exts	Address	Host Model	Health	Server Conn
AXSupvr	● ●	ip: xx.xx.xx.xx	Supervisor	Ok [date]	Connected [11772]	AXSupvr	● ●	ip: xx.xx.xx.xx	Supervisor	Fail [date]	Authentication Failed Not connected
Health = 'Ok' → Server Connection = 'Connected'						Health = 'Fail' → Server Connection = 'Not connected'					

## To Install the Supervisor Station on a JACE's Niagara Network Cont.)

### 8. Ping the AX Supervisor.



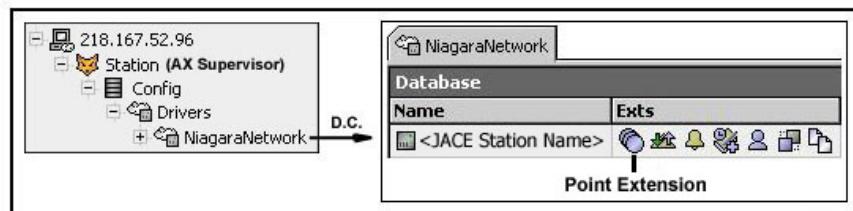
### 2) Enable the JACE Station on the AX Supervisor's Niagara Network

1. Open the Station Manager of the AX Supervisor Station's Niagara Network (R.C. > Views > Station Manager).
2. The JACE Station should appear in grey.
3. Double-click the JACE Station.
4. 'Edit' Dialog box should appear.
5. Set the properties:
  1. set the Enable to 'True'.
  2. verify/set the IP address.
6. Ping the JACE Station. The grey should be removed.



### To Upload JACE Points to the AX Supervisor

1. Connect to the AX Supervisor Station.
2. Open the Station Manager of the Niagara Network (R.C. > Views > Station Manager).
- 3a. Locate the Client Station.
- 3b. Open the Niagara Point Manager (D.C. on the Points Container icon - 3 blue circles in the 'Ext' column).



- 3c. Open the sub folder (if available).
- 4a. Click 'Discover'.
- 4b. Enter the client Station credentials.
5. Bql Query Builder appears. Click on magnifying glass. The 'Choose Root' dialog box appears.
6. Select the Control/Points folder. Ok. Ok.
7. Select the points in the 'Discovered' pane (upper). (avoid selecting math/logic objects)
8. Click 'Add'.
9. Select the points in the 'Add' box. Ok. (wait ~ 1min),
10. The points should appear in the 'Database' pane (lower).

### To Send JACE Alarm to the AX Supervisor

See Section 6 - Alarms

### To Upload JACE Histories to the AX Supervisor

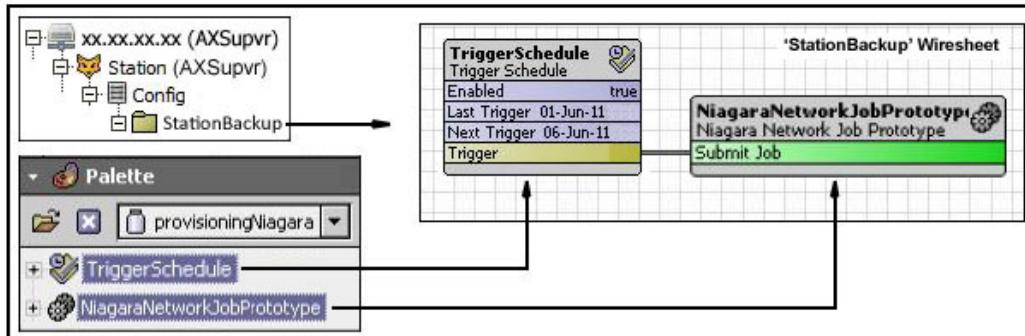
See Section 8 – Histories

## Auto Station Backup to AX Supervisor

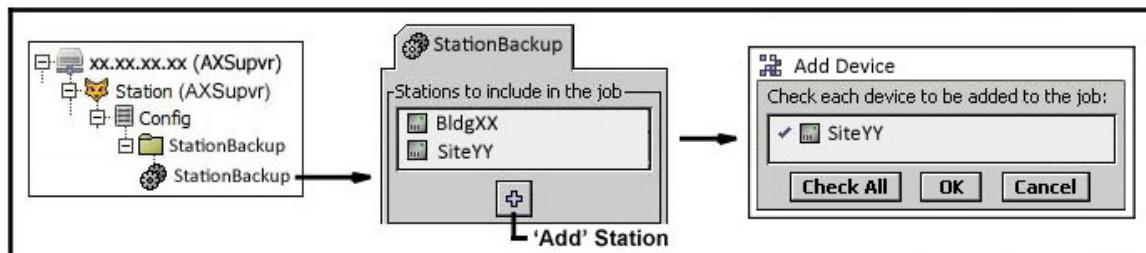
Technical Document: Niagara AX-3.x Provisioning Guide for Niagara Networks

The ProvisioningNiagara module permits automation of AX Supervisor task such as station backups.

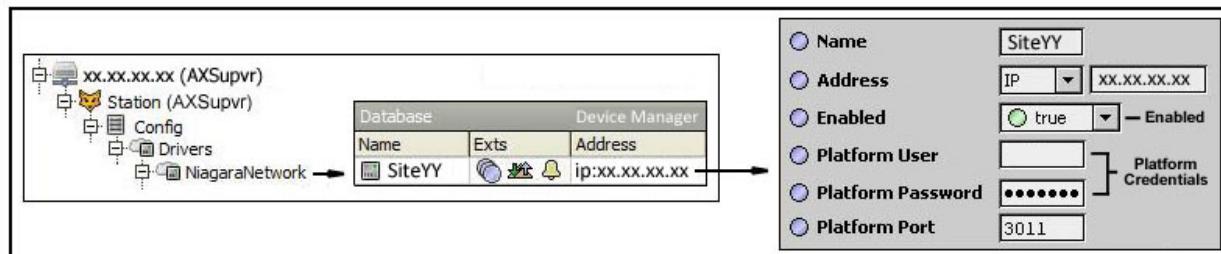
1. Create a backup folder under the 'Config' node of the AX Supervisor Station (eg, 'StationBackup').
2. Open the 'ProvisioningNiagara' Palette.
3. Drag the 'TriggerSchedule' and the 'NiagaraNetworkJobPrototype' components onto the 'StationBackup' wiresheet. (note: the TriggerSchedule is identical to the one in the 'Schedule' palette).



4. Set the schedule on the TriggerSchedule (eg, backup every Wednesday at 11:00pm).
5. Open the 'StationBackup' folder.
6. Double-click on the 'StationBackup' service object.
7. Click the '+' button to add an Station.
8. Select the station(s) from the list. A check will appear when the station is selected. OK.



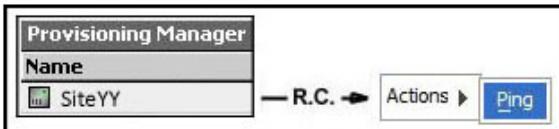
9. Verify the platform credentials of the Station on the AX Supervisor NiagaraNetwork. Station must be Enabled.



10. Verify the platform credentials of the Station in the AX Supervisor Provisioning Manager.

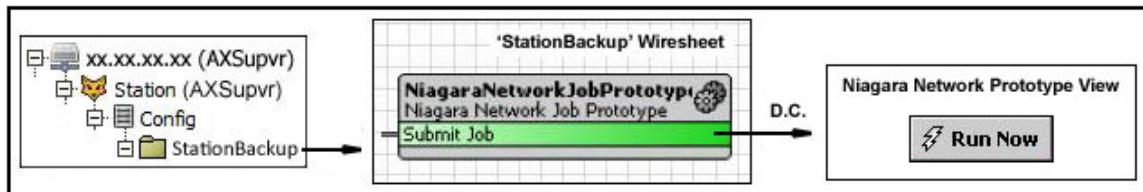


11. Ping the Station (sets credential updates).

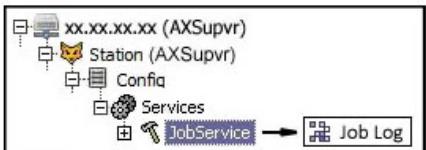


## Auto Station Backup to AX Supervisor Cont.)

12. Open the wiresheet of the 'StationBackup' folder.
13. Open the Niagara Network Prototype view (double-click on the Job Prototype).
14. Click the 'Run Now' button (bottom). Forces the AX Supervisor to retrieve a backup of the new job (in addition to every other job configured to Backup).



15. To verify the backup job, review the Station's 'Job Log' in the JobService.



## **IP Security VPN Tunnel**

### **IP Security Process**

(JACEs installed)

1. IPSec VPN Tunnel template sent to the client's IT staff.

Typical IT correspondance:

"The IPsec endpoint and protocol information has been summarized in the attached template. Please review and add your endpoint information. The encrypted domain was reduced to the single IP address since only one JACE controller will be in use initially".

2. Protocols are selected per firewall hardware compatibility and security preferences.

3. Shares key are only passed verbally.

### IPSec Site-to-site VPN Tunnel Properties

**IT Contacts**

Name	Title	Phone	Email

		Contractor	XYZ Company
<b>VPN Gateway device Type</b>		Cisco ASA 5510	Cisco ASA 5540
<b>VPN Gateway device IP (Peer)</b>		xxx.xxx.xxx.xxx	X.X.X.X
<b>Encryption Domain/ Network/ Host</b>		xxx.xxx.xxx.xxx/xx	JACE LAN1: <b>xxx.xxx.xxx.xx/xx</b>
<b>Negotiated Ports: 1911, 3011</b> <b>Bidirectional Traffic</b>			
<b>PHASE 1</b>	<b>Exchange Mode</b>	Main	Main
	<b>Authentication Method</b>	Pre-shared Key	Pre-shared Key
	<b>Encryption</b>	3DES	3DES
	<b>Hash</b>	SHA	SHA
	<b>Diffie-Hellman Group</b>	Group 2	Group 2
	<b>Lifetime (Seconds)</b>	43,200	43,200
	<b>Perfect Forward Secrecy</b>	Disabled	Disabled
<b>PHASE 2</b>	<b>Encryption</b>	3DES	3DES
	<b>Hash</b>	SHA	SHA
	<b>Diffie-Hellman Group</b>	Group 2	Group 2
	<b>Lifetime (Seconds)</b>	36000	36000
	<b>Perfect Forward Secrecy</b>	Disabled	Disabled

**JACE 1**

Addresses	LAN 1	LAN 2	NAT
<b>IP</b>	xxx.xxx.xxx.xxx	Not Used	xxx.xxx.xxx.xxx
<b>Subnet</b>	255.255.255.xxx		255.255.255.xxx
<b>Gateway</b>	xxx.xxx.xxx.xxx		n.a.
<b>BACnet Device</b>	101		n.a.

Job: \_\_\_\_\_

Job #: \_\_\_\_\_

### IPSec Site-to-site VPN Tunnel Properties

**IT Contacts**

Name	Title	Phone	Email

<b>VPN Gateway device Type</b>		
<b>VPN Gateway device IP (Peer)</b>		
<b>Encryption Domain/ Network/ Host</b>		
<b>Negotiated Ports:</b> <input type="checkbox"/> 1911 or _____, <input type="checkbox"/> 3011 or _____ <b>Bidirectional Traffic:</b> <input type="checkbox"/> Yes / <input type="checkbox"/> No		
<b>PHASE 1</b>	<b>Exchange Mode</b>	
	<b>Authentication Method</b>	
	<b>Encryption</b>	
	<b>Hash</b>	
	<b>Diffie-Hellman Group</b>	
	<b>Lifetime (Seconds)</b>	
	<b>Perfect Forward Secrecy</b>	
<b>PHASE 2</b>	<b>Encryption</b>	
	<b>Hash</b>	
	<b>Diffie-Hellman Group</b>	
	<b>Lifetime (Seconds)</b>	
	<b>Perfect Forward Secrecy</b>	

**JACE:**

Addresses	LAN 1	LAN 2	NAT
<b>IP</b>			
<b>Subnet</b>			
<b>Gateway</b>			n.a.
<b>BACnet Device</b>			n.a.



## NDIO INTEGRATION

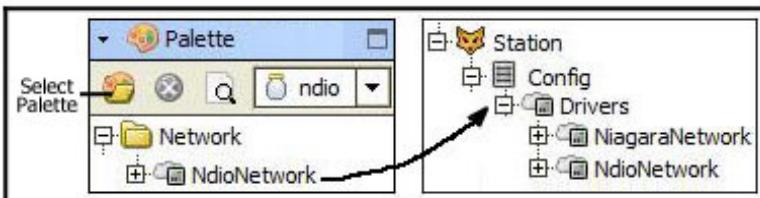
Technical Document: Niagara AX-3.x NDIO Guide

The Niagara Direct Input Output (NDIO) driver is the original Niagara AX driver for I/O hardware. There are two types of I/O: 1) Attachable, 2) On-Board.

Attachable I/O	On-Board I/O	No I/O
JACE-201, -600	JACE-403	JACE-545

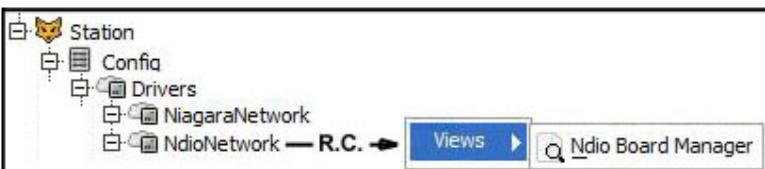
### 1 - Add a NDIO Network

1. Open the NDIO palette. (to open the palette side bar: Windows > Side Bars > Palette)
2. Drag an 'NdioNetwork' on to the 'Drivers' node of the Station.



### 2 - Add NDIO Network Board

1. Open the Ndio Board Manager. (double-click the 'NdioNetwork' or right-click > 'Views')
2. Click 'Discover'.
3. Drag the NdioBoard from the 'Discovered' pane (top) onto the 'Database' pane (bottom).
4. Rename the board to the specific plant or control function (eg, HWS\_BOARD).



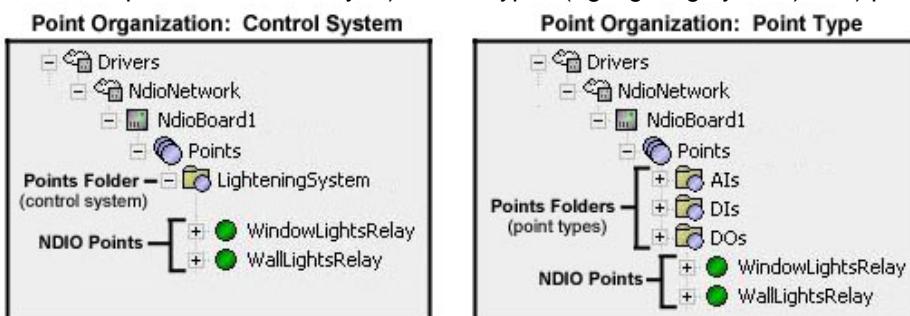
### 3a - Add NDIO Proxy Points – Discovery Method

The Discover process learns what I/O points are on the NdioBoard.

1. Open the Ndio Points Manager (double-click on the 'Points' folder).



- 2a. For point organization, select 'New Folder' (or use the 'NdioPointFolder' from the Ndio pallet). Optional.
- 2b. Create point sub-folders by: 1) control types (eg, lighting system) or 2) point types (eg, AI, DI).



3. Open the Ndio Point Manager (double-click 'Points' or the point sub-folder).
4. Click on 'Discover' (bottom)
5. Select the required points (upper pane)
6. Click 'Add'.
7. Define point names (watch syntax – see Basic Steps: Control Points).
8. Click 'Ok'.

#### **4 - Configure the NDIO Proxy Point Properties**

- 1) Facets: Units (for Temp = Units: temperature (K); fahrenheit (F) )
- 2) Proxy Ext:
  - Enabled: true
  - Conversion: Default, Linear, Reverse Polarity, Thermistor Type 3, Tabular Thermistor  
(for 10K ohm temp. sensor use 'Thermistor Type 3')
  - Address:** Set address to match field wiring address (typically from the control drawing).
- 3) Out: Current point value + (alarm status)
- 4) Linear Cal:
  - Scale: set scale factor
  - Offset: set offset factor
  - Units: select units. (for Temp = Units: temperature (K); fahrenheit (F) )
  - Flt Cause: displays source of fault
- 5) Additional properties will be Extensions (Alarm, History)

## LON INTEGRATION

Technical Documents: NiagaraAX 3.x Lonworks Guide, NiagaraAX 3.x Drivers Guide

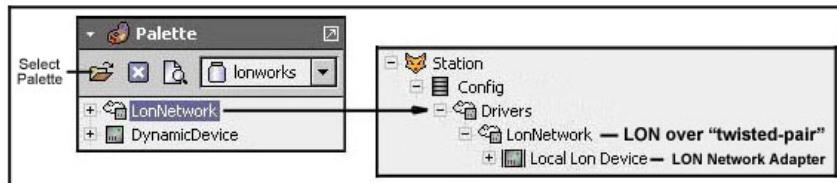
Note: the JACE must be licensed for LonWorks (see 'Basic Steps-Installing AX Workbench' section).

### 1 - CONFIGURE THE LON NETWORK

#### Add a LON Network

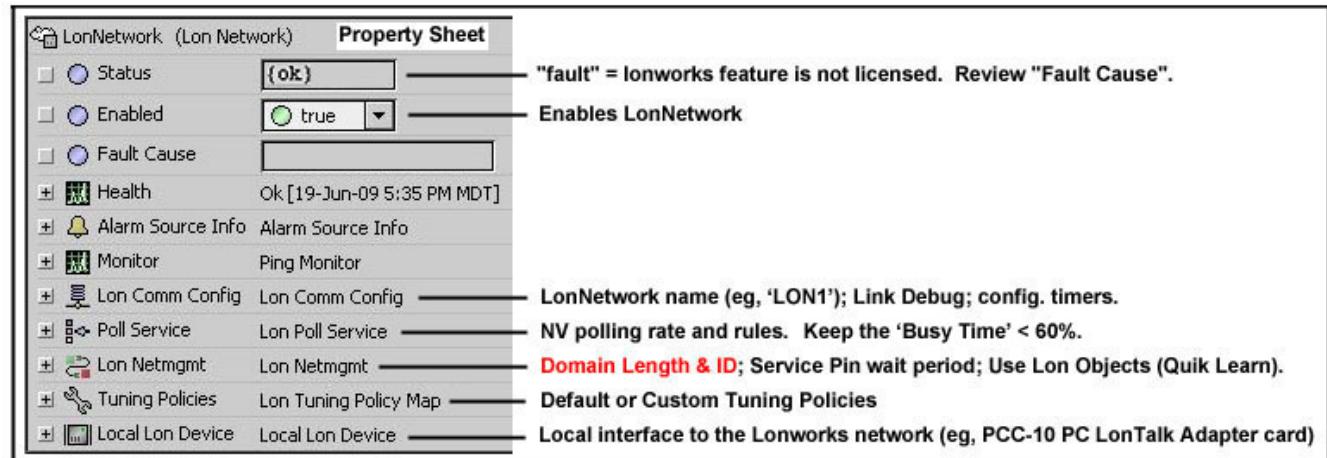
1. Open Config > Drivers.
2. Select 'lonworks' palette.
3. Drag the 'LonNetwork' component onto the 'Drivers' node (or select the 'New' button).
4. If the JACE has multiple LON ports, add a LonNetwork for each physical port. In 'Lon Comm Config' specify the port's Device Name (eg, LON1, LON2).

Note: the 'Local Lon Device' object represents the LON network adapter which Station uses to connect to the LON network.



#### Configure the LON Network Properties

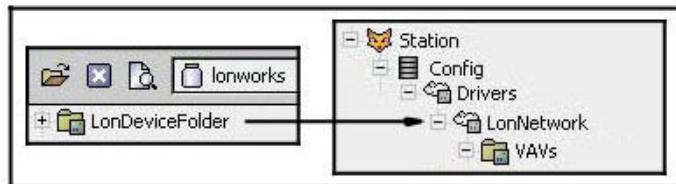
1. Open the LonNetwork Property Sheet (R.C. 'LonNetwork' > View)
  - 1) Alarm Source Info: set 'ToOffNormal' text (ping fail).
  - 2) Lon Comm Config: 'Device Name' must match the Host machine LON I/F device (eg, PCC10 card).
  - 3) Poll Service: if poll service > 60% during operation, set the service to Normal Rate (30sec).
  - 4) **Lon Netmgmt: default Domain length=0** (Honeywell default: Domain length=1; id = 2c). Important.
  - 5) Tuning Policy: duplicate a policy. Name it 'SlowPollPolicy' (freq=slow; max WT=2min; min=2s)
2. Set Unit Conversion to English (Tools > Options > General > Unit Conversion)
3. Set the Station Auto Save Frequency to 1 hour (Station > Config > Services > Platform Services)



### 2 – CREATE LON DEVICES

#### Manually Add Lon Devices (Off-line Engineering)

1. Open the 'lonworks' palette and drag a 'LonDeviceFolder' object onto the 'LonNetwork' node (for organization).
2. Name the folder (eg, VAVs).



3. Open the appropriate LON device palette.

4. Drag the LON device onto the Lon Device Folder (or 'LonNetwork' if not using folders).

## Manually Add LON Devices Cont.)

5. Name the device (eg, VAV\_1).

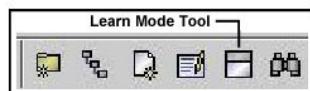


6. Set the device's configuration settings (eg, VAV: Ctr type, OccCool setpoint). (see Honeywell section for XL10 VAV configuration)
7. Repeat the process to add more Lon devices.
8. Save the Station (right-click 'Station' > Save Station)
9. Continue to Section 3 – Device Matching.

## **Using Online Discover to Add Lon Devices (On-line Engineering)**

The 'Discovery' process is an on-line process which learns what Lon devices are on the working domain (as defined in the LonNetwork property sheet; default Domain Len = 0).

1. Open the Lon Device Manager (double-click 'LonNetwork').
2. Click the 'Discover' button.
3. Discovered Lon devices will appear in the 'Discovered' pane (top).  
(if you do not see a Lon device in the Discover pane, check the Domain ID)
4. Select the devices then click 'Add'.
5. In the 'Add' dialog box edit the device name(s). OK.
6. The desired Lon devices should appear in the 'Database' pane (lower).
7. To close the split-pane, click the Learn Mode tool to toggle out of 'learn' mode.



## **Learn Lon Devices (On-line Engineering)**

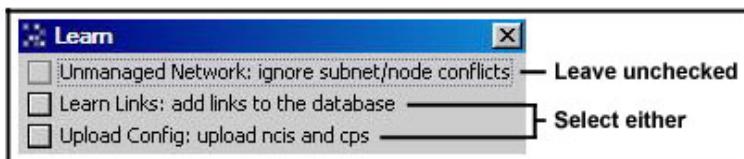
'Quik Learn' is a Device Manager tool that combines the 'Discover' and 'Add' steps into one operation. Besides *first-time learning* of new networks, Quik Learn can be used to add Lon devices to an already configured network.

Note: Quik Learn searches locally-installed Lon<vendor> modules to find possible .Inml files. This differs from a 'Discover' and 'Add', where all modules used by Workbench are searched. Important that any needed Lon modules are installed on the JACE platform before running Quik Learn.

### To Populate a New Network from a Previously Managed Network

Managed Lon devices have unique subnet/node addresses, are configured and often have bindings with other devices. In this case, you usually want to learn all the existing network management. "Managed" preserves the commissioning of all the nodes where the initial state is "Config Online".

1. Open the Lon Device Manager (double-click the 'LonNetwork').
2. Click the 'Quik Learn' button (bottom).
3. In the 'Learn' dialog, select "Learn Links" or "Upload Config" (leave "Unmanaged Network" cleared).



Learn Links: allows you to view the learned bindings in other views of the LonNetwork, including the LonWorks Link Manager view or in the network wire sheet view

Upload Config: allows you to see the values of any device's NCIs from its Nc Manager view (right-click the device and select Views > Nc Manager).

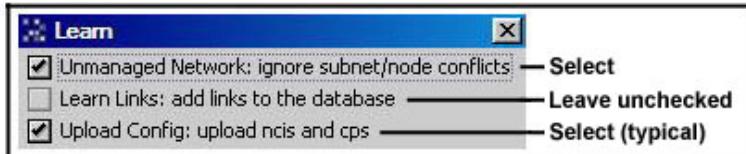
4. Learned Lon nodes are listed in the 'Database' table. All devices should appear listed with unique subnet/node address. Use the Lon Link Manager to view the learned bindings. To view the values of the device's ncis use the 'Nc Manager' (Views > Nc Manager). (note: 'Commission' is not performed in 'Previously Managed Network')

## Learn LON Devices Cont.)

### To Populate a New Network from Previously Unmanaged Network

Unmanaged Lon devices are unconfigured – Lon devices can only respond to its Neuron ID rather than the subnet/node address. Lon bindings between devices do not exist. There is no existing Lon network management to learn (only to be established for the first time). Avoids the strong possibility in having duplicate address or other address conflicts.

1. Open the Lon Device Manager (double-click the 'LonNetwork').
2. Click the 'Quick Learn' button (bottom).
3. In the 'Learn' dialog, select "Unmanaged Network" and, typically, "Upload Config".



4. Select all the devices in the 'Database' table.
5. Click the 'Commission' button.

## **3 – DEVICE MATCHING**

The 'Match' function maps the manually added Lon devices (off-line database) with on-line 'discovered' Lon devices. A match is possible only if the program IDs are the same. The match synchronizes the Lonworks neuron ID and applies appropriate subnet-node logical addressing. Note: JACE controllers must be commissioned before they can be discovered (see JACE section for commissioning).

### **Discover & Match Devices (On-line)**

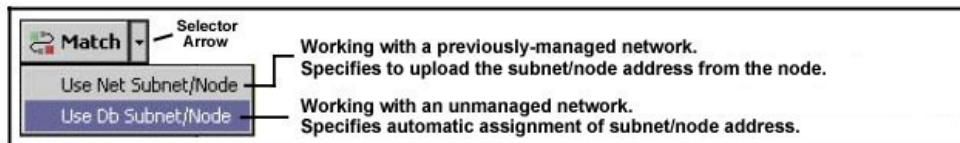
1. Open the Lon Device Manager (double-click the 'LonNetwork').
2. Locate the Lon Controller and double-click it.
3. Review the controller's logical address: 1) Channel ID, 2) Subnet #, 3) Node #. Update as required. Click OK.

<input type="radio"/> Channel Id	1
<input type="radio"/> Subnet	1
<input type="radio"/> Node	1

4. Click the 'Discover' button ('Discover' sends a broadcast message).

Discovered					
State	Subnet	Node	Manufacturer	Program Id	Neuron Id
Config Online	1	1	Honeywell	80 00 0c 50 1e 03 04 01	04 cd 84 42 02 00

5. Select (highlight) the controller in the 'Discovered' pane and in the 'Database' pane. If the controller does not show up in the 'Discovered' pane, use the controller's Service Pin to discover it.
- 6a. Select the appropriate Match function > Use the black arrow next to the 'Match' button, select:
  - "Use Net Subnet/Node" – to upload the logical address from the device (node).
  - "Use Db Subnet/Node" – for automatic assignment of logical address (subnet/node).(be careful with the selection tool – if the selection you want is already selected, click off the menu to close it.)



- 6b. Click the 'Match' button. As need, edit any properties (eg, Node #) as required.
7. Click OK.

## Commission & Download the Controller

Niagara Process:

- 1) Commission
- 2) Download
- 3) Bind

Commissioning sets the controller's logical address: 1) Channel ID, 2) Subnet #, 3) Node #.

1. Select the Lon Controller and the 'Local LON Device' in the Database window.

Database										2 objects	
Name	Type	Exts	State	Subnet	Node	Fault Cause	Manufacturer	Program Id	Neuron Id	Neuro	
Local Lon Device	Local Lon Device		Config Online	1	127		Tridium	90 00 8e 01 03 80 00 03	04 8d 1d 2		
RTU_01	Cvahu		Unknown	1	1		Honeywell	80 00 0c 50 1e 03 04 01	04 cd 84 4		

2. Click the 'Commission' button (note the status indicator at the top of the window).

3. Download when the commission is complete ( right-click the Lon Controller > Actions > Download).

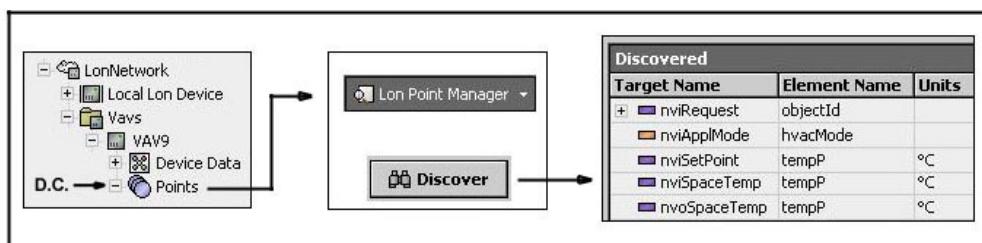
4. The controller state should display 'Config Online'.

## 4 – CREATE LON PROXY POINTS

### Proxy the Points into the Station

Discovering and adding points to the Station is known as 'proxying the points into the Station'.

1. Open the Lon Point Manager (double-click the 'Points' folder of the Lon device).
2. Click the 'Discover' button (bottom). Discovered network variables (nvi, nvo, nci) are listed in the top pane (split pane = learn mode). Each row in the Discovered table represents one Lon proxy point candidate.



3. Select the required points and drag and drop them from the 'Discover' pane (top) into the 'Database' pane (bottom).
4. Edit the point's properties (name, type, facets) as required.

LON Network Variable Prefixes	
nvi	Network Variable Input
nvo	Network Variable Output
nci	Configuration Property Network Variable Input stored in Non-Volatile Memory
nro	Network Variable Output stored in Non-Volatile Memory

## **Alternative Method: Add Points from a Personal Palette**

1. Open the Personal Palette and the appropriate folder (with the device's points).
2. Copy the required points and paste them into the Lon device's 'Points' folder (or sub-folder).

### Control Strategy Reminders

1. Edit the four numeric writable setpoints to establish default setpoint values (OccCool, UnOccCool, OccHeat, UnOccHeat). To set the setpoint value: right-click the setpoint > Actions > Set. Note: setpoints will not update until the device is on-line.
2. Add point extensions as required (eg, Totalizer, Alarm, History).
3. Use the Composite editor to expose required slots for specific control logic (eg, 'Reset Elapsed Active Time').

## **5 – BIND LON PROXY POINTS**

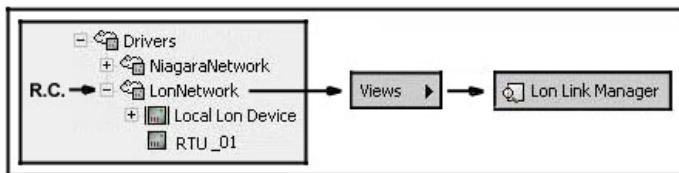
Sharing points (eg, OAT) between Lon Devices is a two-step process:

- 1) Binding: Peer-to-Peer Connection.
- 2) Linking the points.

### **Binding: Peer-to-Peer Connection**

The LON Link Manager changes what the station treats as polled connections into bound connections. After 'Binding' the link resides in the network rather than the JACE. This allows the connection to be a true peer-to-peer connection (LonTalk protocol – ISO 14908). Without using the Link Manager all communications must go through the station (JACE), because the LON devices don't know about the connections. Polled traffic typically results in more traffic on the Lon network. With Peer-to-Peer binding, communication between the Lon devices is unaffected if the JACE communication fails, or even if the JACE is turned off. If binding is not performed, the connection will still work, but the connection will function as a polled connection (JACE communication and power must be functional).

1. Open the Lon Link Manager (R.C. LonNetwork > Views > Lon Link Manager)



2. Select the desired binding connection.

If the point has multiple datafields, like 'nviTodEvent', select one of the point connections (eg, 'CurrentState'). All of the other datafields should highlight.

NetworkVariableLinks						
selector	linkStatus	srcDevice	srcNv	targetDevice	targetNv	linkType
1	New Link	RTU_01	nvoCtlDataG2	LocalDev	SpaceTemp	standard
3	New Link	LocalDev	CurrentState	RTU_01	nviTodEvent	standard
3	New Link	LocalDev	NextState	RTU_01	nviTodEvent	standard
3	New Link	LocalDev	TUNCO5	RTU_01	nviTodEvent	standard

3. Click the 'Set Service Type' button. Set the service type to 'Reliable' (repeated).

4. Click the Bind button (bottom) to complete the connection. This binds the JACE points to the network card.

Note1: with a functioning Lon card, you will see the connections, but the linkStatus will display as 'Device Error'.

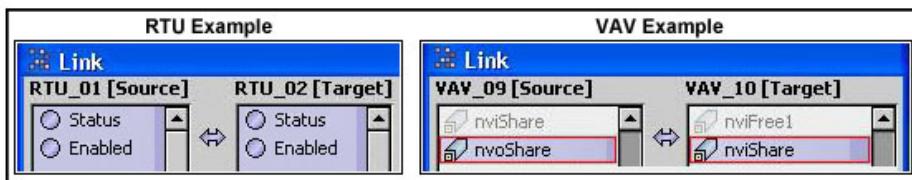
Note2: if the controller is re-commissioned the bindings will have to be redone.

### **Linking the Points**

1. R.C. the master Lon device (eg, with OAT sensor).
2. Select 'Copy'
3. R.C. the LonNetwork > 'Paste Special'.
4. Set the # of copies to 1
5. Select the 'Keep All Links' > 'OK'
6. Remote the OAT sensor from the slave Lon device (use the configuration window).
7. Open the Wire Sheet of the LonNetwork.
8. Connect the temperature points:

## Linking the Points\_ Cont.)

9. Drag a link from the output side of the grey bar (bottom) on the master Lon device to the input side of the grey bar on the slave Lon device. The Link Box will appear:



10. From the [Source] select 'nvoOdTemp'. From the [Target] select 'nviOdTemp'. Click 'OK'.
11. Copy the slave Lon device.
12. Create new Lon devices with the 'Paste Special' function. Keep all the links.
13. Open the Lon Link Manager.
14. Select all the new bindings.
15. Click the 'Selective Bind' button.

### Point Notes:

- 1) 'nviSetpoint' – not a true setpoint. Applies to middle of deadband. True setpoint is 'nvisetpoint' +/- the deviation.
- 2) Flow Setpoint is shared as a % of max. flow.
- 3) nvoShare linked to nviShare – all parameters get shared. Satellite function (group binding).
- 4) Lon Points in structured folders: CVAHU: 'nvoControlDataG1' & 'G2'; VAV: 'nvoControlDataG'.

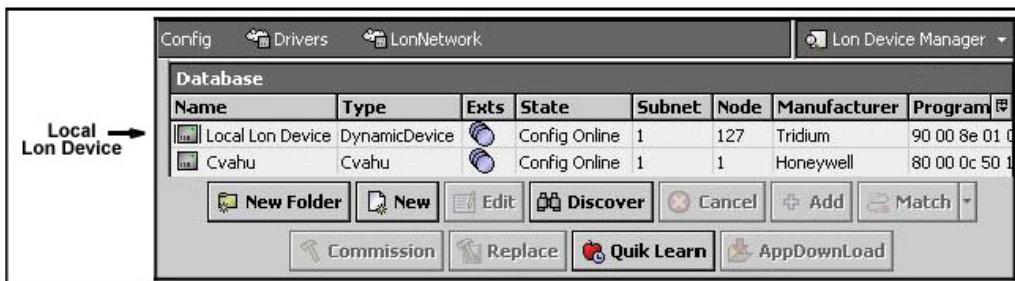
## LON NETWORK VIEWS

Technical Document: Niagara AX-3.x LonWorks Guide, pg. 3-13.

To facilitate network management, the LonNetwork provides four different manager views.

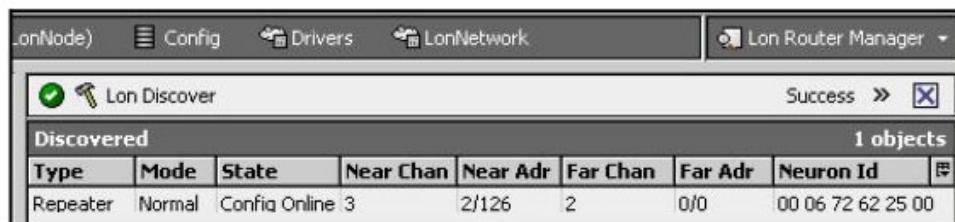
Right-click 'LonNetwork' > Views:

- 1) Lon Device Manager View** – provides support for learning (or discovering/adding) Lonworks devices to the database, for managing device addresses, and downloading standard applications to devices.

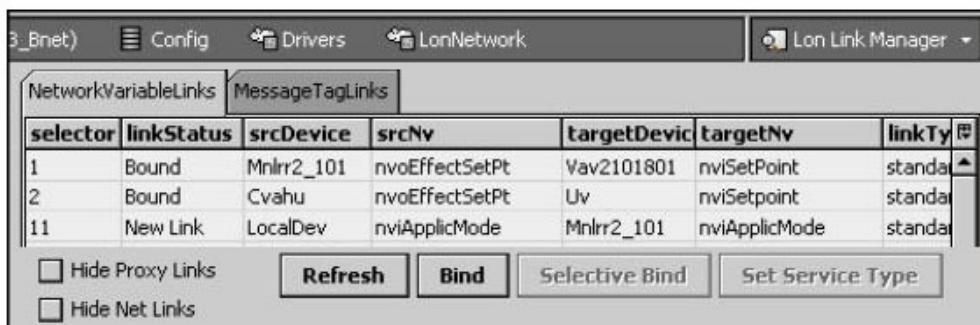


The 'Local Lon Device' represents the local interface to the LonWorks network. It is modeled similar to any other Lon device, however it cannot be deleted or duplicated. As of AX-3.4 you can use Workbench to create an .xif file (external I/F file) of the LocalLonDevice (right-click action). The .xif file describes the JACE's Lonworks capabilities and can be used by another LonWorks network management tool for offline engineering.

- 2) Lon Router Manager View** – provides support for discovering and adding Lonworks routers to the database, and for managing router addresses.



- 3) Lon Link Manager View** – provides support where you can review/manage the bindings of the network variables. Key view since Niagara Station is typically "the network manager".



- 4) Lon Utilities Manager View** – provides support to perform a variety of queries to both devices in the LonNetwork and discovered nodes. Example: see [Tasks] – 'To Identify a LON Device Using its Service Pin'.

## LON DEVICE VIEWS

Technical Document: Niagara AX-3.x LonWorks Guide, pg. 3-31.

Any Lon device has two special manager views, in addition to the standard component views (property sheet, wire sheet, category sheet, slot sheet, link sheet). These views are:

**1a) Local Nv Manager** – applies only to the 'Local Lon Device'. Used to view custom Lon network variables (nvis, nvos, ncis) when the station is configured as a 'Lon Node' (see section 'Station as a Lon Node').

**1b) Nv Manager View** – allows you to browse through a table of the devices nvs (nvi, nvo) LonComponents, showing a number of sortable columns of data. You can use the standard table edit controls to change the number and types of data displayed in this view. Summary data is updated dynamically through polling.

**2) Nc Manager View** – allows you to browse through a table of the devices ncis Lon Components.

## LON DEVICE ACTIONS

Each Lon device has the following right-click actions:

**1) Ping** – attempts communication with the device. If successful, the devices status is ok. If this fails, the device status is set to down.

**2) Upload** – reads transient (nvs) and persistent (ncis and cps) data from the device and writes to the station database (Lon device). Recursive upload is always recommended. After using ‘Discover’ and ‘Add’ to create a new Lon device (and assigning the device a Lon Xml file), you can use Upload to populate current LonData in the device’s LonComponents (nvs, ncis, cps). The Quik Learn feature includes the Upload process.

**3) Download** – writes persistent data (ncis and cps) to the device from values in the station database (Lon Device).

**4) Reset** – issues a reset command to the device.

**5) Learn Nv** – builds the Lon device’s child LonComponents as a collection of nvs, ncis, and (if available) cps based on the Lonworks self-documentation that resides in the device. Use Learn Nv *only* if there is no available Lon Xml (lnml) file for a device, or if the device has a programmable (changeable) external interface.

Note: if you perform a Learn Nv on any Lon device previously using a Lon Xml file, LonComponent data from any manufacture-define type info is lost. Workbench does not allow a Learn Nv if the Lon device has an “Xml File” property that is not “null”.

**6) Trim** – used to automatically *remove* a Lon devices’ LonComponent nvi and nvo slots that do not have an associated Lon proxy point, or that are not linked, or have a Px bind. This can conserve station memory and allows database support for more devices. Otherwise, you can manually delete individual nvi/nvo LonComponent slots that have no interest. To restore deleted nvls and nvos, perform an ImportXml command on the device.

## [Tasks]

### Sharing a Wall Module between two VAV Controllers

The steps below shows how to bind two VAV controllers (Lon devices). The binding is peer-to-peer so that each VAV can communicate with each other without having to go through the WEB Controller (JACE).

1. Open the Configuration Window on the 'slave' VAV controller.
2. Change the Flow Type setting to 'Shared Wall Module'.
3. Open the wire sheet of the LonNetwork.
4. Drag a link from the output side of the grey bar (bottom) on the master controller to the input side of the grey bar on the slave controller. The Link Box will appear:

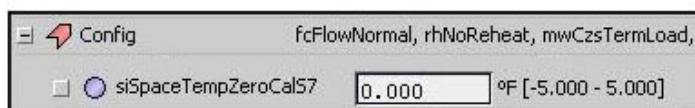


5. From the [Source] select 'nvoShare'. From the [Target] select 'nviShare'. Click 'OK'
6. Open the Points Folder in the slave VAV controller.
7. Delete all the point from the Points folder except the following:
  - FlowControlPt
  - BoxFlow
  - DamperPos
  - ReheatPos
8. Open the LON Link Manager (R.C. LonNetwork > View > LON Link Manager).
9. Review the connections in the window.
10. Click the 'Bind' button to complete the connections

### Calibrating the Sensor of an VAV or CVAHU Controller

#### VAV Controller

1. Open the VAV controller Property Sheet.
2. Temperature: locate the 'siSpaceTempZeroCalS7' object from the Config object:



3. Set the value (the entered value is added to the sensed value).
4. Save the change.

#### CVAHU Controller

1. Open the CVAHU controller Property Sheet.
2. Expand the view of the 'nciconfig' object
3. Temperature: locate the 'SpaceTempZeroCal'. Set the appropriate value.
4. Resistive: locate the 'ResistiveOffsetCalAI1'. Set the appropriate value.
5. Save the change.

### To View a Device Current Domain Table

The device's Domain Table lists the domain length and ID. If the device's domain length must match the LonNetwork's working domain (to edit: LonNetwork > View).

1. Right-click the LonNetwork > Views > Lon Utilities Manager.
2. Near the bottom, click the (device) drop-down and select the node just found from a service pin.
3. Click the lower-left drop-down control (command menu) and select 'Data Structs'. To the right (command submenu), click the drop-down control and select 'Domain Table'.
4. Click the 'Execute' button.

## **To Import an XML File to a Remote JACE**

Each Lon device (DynamicDevice) has an available right-click ‘ImportXml’ command in Workbench. This command provides a popup dialog that displays the specified .lnml file – as stored in the device’s ‘Lon Xml’ property, and allows you to change it (if needed).

Typically, this command is used only if programming offline, when devices (and their associated lnml files) cannot be automatically learned. This same functionality is automatically provided when you “Add” discovered Lon devices, providing that a Lon Xml file was found for the device.

Issue: If a remote JACE does not have the same module already installed at the local host.

1. Right-click the device (that came from local module palette).
2. Select the ‘ImportXmlCommand’.
3. The following should appear: “module://lon<vendor>/<device>.lnml”.
4. Click OK.

Data will be read from the local .lnml file into the device component in the remote station. The device is now ready for offline programming, or if online with the JACE, ready for matching with an actual device.

## **To Add a Dynamic Device**

(See Honeywell: XL5K Integration)

### **Saving the Device and Points in the Personal Palette**

1. Open the Wire Sheet of your Personal Palette (create a new folder if necessary).
2. Copy the Lon device onto the Wire Sheet.
3. Save the palette.

## **To Replicate a Device**

1. ‘Copy’ the first device.
2. Select ‘Paste Special’.
3. Choose ‘Keep All Links’ and specify the number of copies.

Note: if you modify any of the settings (eg, Float Reheat), click on the ‘Commit’ button.

## **To Create a Device Folder**

1. To organize the devices within a project, special device folders are used.
2. Open the ‘lonworks’ palette.
3. Drag a ‘LonDeviceFolder’ onto the ‘LonNetwork’.
4. Name the folder (eg, RTU\_Devices)
5. Select all the devices and ‘move’ them to the new folder.
6. Repeat for other types of devices (eg, VAV\_1F)

Note: R.C. the LonDeviceFolder > Actions > Download option available.

## **To duplicate Folders**

1. R.C. folder (eg, VAV\_1F)
2. Select ‘Copy’.
3. R.C. the ‘LonNetwork’.
4. Select ‘Paste Special’ & ‘Keep Links’.
5. Name the new folder (eg, VAV\_2F).
6. Use the ‘Replace With’ function to rename the devices within the folders.

## To Identify a LON Device Using its Service Pin

In Niagara AX you do not have to expressly listen for a service pin message. In the Lon Device Manager, any unsolicited service pin message is handled as follows:

- If the node is *not* represented *in the database*, it is added to the Discovery table (learn mode).
- If the node *is already* *in the database*, it becomes *selected* (highlighted) in the Database table.

1. Open the Lon Utilities Manager (right-click 'LonNetwork' > Views)

2. Configure the drop-down menus (bottom):

1) Command: select 'Identify'.

2) SubCommand: select 'Service Pin'.



3. Click the 'Execute' button.

4. Press the service Pin of the Lon Device.

5. Review the device's Domain Length and ID. It must match the LonNetwork's working domain (see the LonNetwork's property sheet).

## To Replace a LON Device

Before removal, if possible, run a verify report using the Lon Utilities Manager. Review for any errors. Confirm that the device's NV bind configuration matches the network management stored in Niagara.

1. Remove the Lon device and replace with an identical type.

2. Open Lon Device Manager.

3. Highlight the original device.

4. Click on 'Replace' (bottom).

5. Use Service Pin or Neuron ID to set the physical address.

6. Verification is made that the new device's program ID matches the programId stored in the existing Lon Device. The devices domain table is initialized and the all entries in the address table at set to match the station database.

7. The Node is set to state: "Configured, online".

8. Using Lon Utilities Manager, examine the device's interal tables.

## To determine the Busy Time of a Lon Network

1. Close any Property Sheets or Control Programs that may be in use.

2. LonNetwork > Lon Link Manager view. Verify that all links are bound.

3. Open the LonNetwork property sheet and expand the Poll Service property.

4. Right-click the Poll Service property > Actions > Reset Statistics.

5. Wait a few minutes for new data to be collected.

6. If the Busy Time exceeds 60%, increase the Normal Rate poll interval and repeat steps 4-6. (A good starting Normal Rate value is 30 seconds.)

## Troubleshooting

Issue: VAV Box Effective Setpoint is locked; unable to change setpoints; very high cfm #.

Resolve: configuration is ok; ‘commission’ doesn’t work; Power boot VAV controller doesn’t work.

Fix: Rediscover VAV controller.

Record all the VAV setpoints (ie Occ. Htg/Clg; Unocc. Htg/Clg)

### 1) LON Device Manager:

1. Delete VAV controller.
2. Discover.
3. Add
  - 1) Name: (VAV box name)
  - 2) Type: Excel10VAV (important)
  - 3) LON Xml File: local module://lonhoneywellAxWizards/vavxxx.lnml
4. Commission

### 2) Graphics Update:

- 1a. Right click VAV box: ‘New View’ > select existing template (eg, ‘VAV’)
- 1b. “File already exists”
- 1c. Reuse.
- 2a. Copy all the points from a good VAV box (point container).
- 2b. Paste the points to the new VAV box (point container). Auto recognize.
3. Update the Setpoints
4. Update the VAV Menu: jump to VAV graphic
  - 1) Drag the updated VAV Box to the PxEditor.
  - 2) Record the slot path.
  - 3) Update the VAV ‘jump to graphic’ properties using the slot path:
    1. Ord
    2. Hyperlink
- 3) Unable to write to a nci point (LON heat pump).
  1. Review the .lnml file.
  2. Replaced all modifyFlag fields that contained the value “mfgOnly” with “readWrite” for all of the nci points (use a text editor).
  3. Discover as writable points.

## Misc. Notes

### nviTodEvent & Intelligent Recovery

Niagara requires more engineering than Honeywell regarding the nviTodEvent point.

nviTodEvent point has three parts:

1. 'Current State' - Enum writable
2. 'Next State' – Enum writable
3. 'Time to Next State' (also known as TUNCOS – 'Time Until Next Change of State'). Starts at a predetermined value and counts down to zero.

Intelligent Recovery avoids a sudden step change in setpoint by gradually ramping down the setpoint.

If you don't specify 'Next State' the ctrlr. will assume Occupied.

If you don't specify 'TUNCOS' the ctrlr. will assume the value '0'.

Niagara does not compensate for this, you must manage it.

Edit the Current State, Next State, TUNCOS: text, Facets, etc

Niagara does not provide a slot for TUNCOS in the Enum Schedule. Resolve: use schedule from the Personal Palette called "EnumScheduleWithTUNCOS".

Note: if performing multiple controllers copies, the schedule in the controller logic will get repeated as well. Typically, only one master schedule is required.

To cancel Intelligent Recovery you must command it (no need for TUNCOS).

### Network Variables

SNVT – Std. NV Types. Permits successful data interchange between manufacturers' controllers. Rules like temperature is broadcast as Celsius.

UNVT – User-defined NV Types. (eg, nvoCtlDataG1 – structured NV). Not required to follow LonMark rules.

You can select points within nvoCtlDataG1, put into the Database and Edit in the 'Add' window.

Boolean Point must have "TrueText" and "FalseText" facets.

Types are Read only for nvo's (no writable points).



## Station as a LON Node

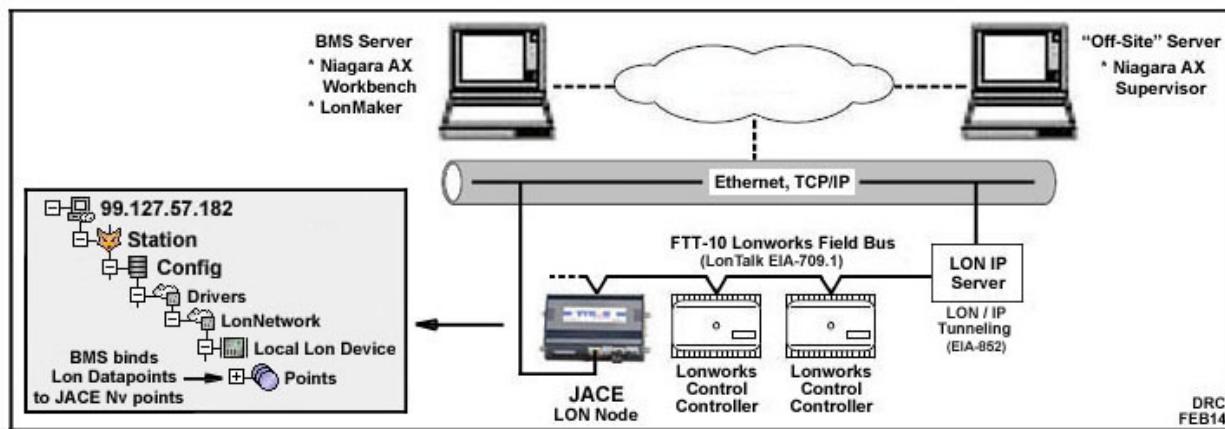
Technical Documents: NiagaraAX 3.x Lonworks Guide, NiagaraAX 3.x Drivers Guide

Note: the JACE must be licensed for LonWorks (see 'Basic Steps-Installing AX Workbench' section).

When configuring the Station as a Lonworks node (only), the Station appears as a "peer" Lonworks device. In this scenario, Lonworks network management is not handled by the Station. You do not use the various LonNetwork views that provide the interface to Lonworks network management. Instead, you work only in (and under) the 'Local Lon Device' when engineering the Station.

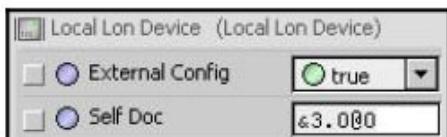
When a JACE is installed as another 'Lonworks node', where another (external) Lonworks network management tool is used (eg, LonMaker), you configure the 'Local Lon Device' to not perform network management. You expose Station data as network variables (nvs) and ncis under the Local Lon Device. The Container 'Points' of the Local Lon Device is equivalent to the 'Export Table' of the Bacnet Local Device ('Export Points').

One application is the data sharing between a BAS server and a JACE. Lon 'binding' is required on the BAS side.



### Set the Local Lon Device: External Config Property

1. Set External Config = True.
2. Set Self Doc = &3.0@0 < other text>



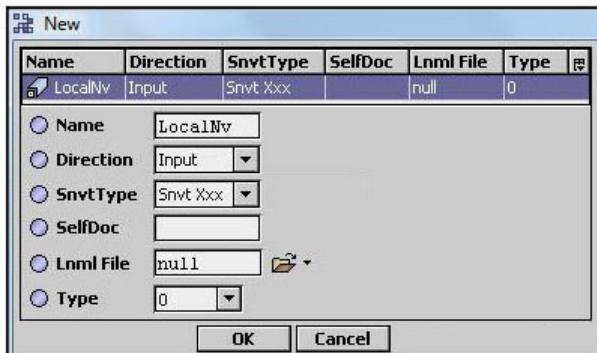
### Create New LON Network Variable (Nv) Point

1. Open the Local Nv Manager (double click 'Local Lon Device')
2. Select 'New' (bottom).

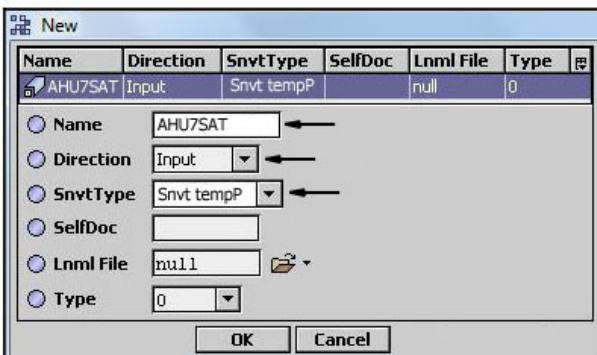


3. For more than 1 point, update the 'Number to Add' field. OK.

## Create New LON Network Variable (Nv) Point Cont.)



4. Update: 1) Name, 2) Direction (input=data from BMS; output=data to BMS), 3) Snvt Type.

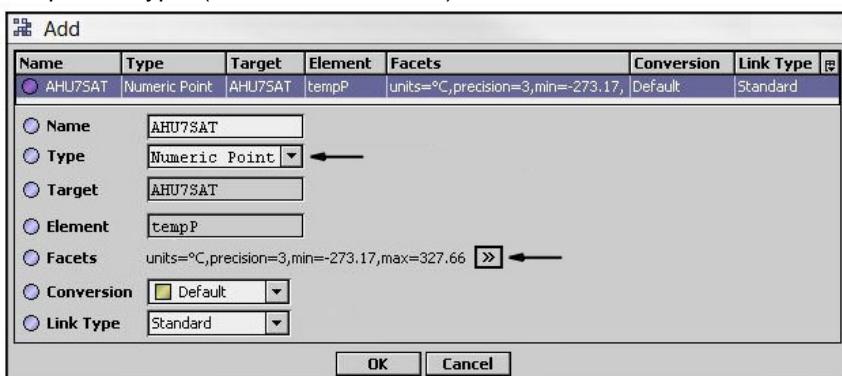


5. OK.

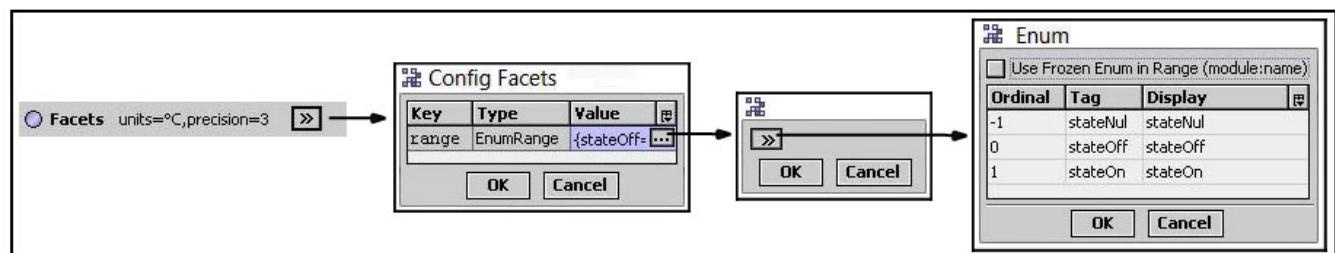
6. Right-click the new Nv point > '+Add'.



7. Update 'Type' (Numeric or Boolean)



8. Update Facets & precision. For Boolean points, the following instructs on how to modify the facets of the Off/On states.



## Create New LON Network Variable (Nv) Point Cont.)

9. Remove the “-1” Ordinal.

Enum		
<input type="checkbox"/> Use Frozen Enum in Range		
Ordinal	Tag	Display
-1	stateNul	stateNul
0	stateOff	stateOff
1	stateOn	stateOn

10. Modify the display text for the ‘0’{Off} and ‘1’{On} states.

'0' State {Off} = 'Disable'		
Ordinal	Tag	Display
0	stateOff	stateOff
1	stateOr	stateOr

'1' State {On} = 'Enable'		
Ordinal	Tag	Display
0	Disable	Disable
1	stateOn	stateOn

11. Repeat steps 1-10 for other points.

12. Link-Mark Nv point to Proxy Point.

13. Use BAS LonWorks tool to map BAS Lon datapoints to JACE Nv points (in Container Points folder).

### Technical Notes

For LNS compatibility, LocalLonDevice requires:

- 1) SNVT\_obj\_request
- 2) SNVT\_obj\_status

### LocalLonDevice Startup

1. Address is set to default: channel Id 1, subnet node 1/127
2. DeviceData is filled in from local neuron: Neuron Id, Address Count,

Upon Station startup, the following occurs:

1. Updates to domain table, address table, and device state per station database.
2. Program Id is set.
3. Executes ping.



## LON Integration: LON Over IP

Technical Document: NiagaraAX 3.x Lonworks Guide, Appendix C

In LON Over IP ('LonIpNetwork' driver) LonTalk packets are transmitted over the Ethernet Port. In this scenario the Neuron ID is virtual which requires that the network manager be an *external* manager (eg, LonMaker). Station is not the network manager.

LON Over IP is useful if you need to integrate an existing LON network with a new JACE + associated LON devices (eg, microzone controllers). This eliminates the need to re-engineer existing bindings.

The restriction of LON Over IP is that you cannot use the Points Container of the Local Lon Device to export data to a BMS server (due to a virtual Neuron ID). (to pass Lon data to & from a BMS server, see 'Station as LON Node').





## BACNET INTEGRATION

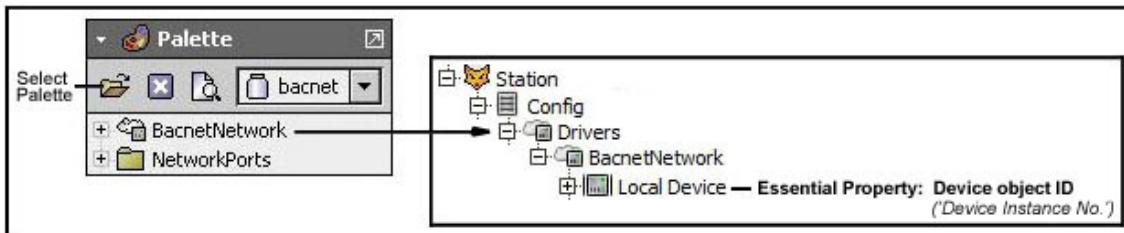
Technical Documents: NiagaraAX 3.x Bacnet Guide, NiagaraAX

Note: the JACE must be licensed for BACnet (see 'Basic Steps-Installing AX Workbench' section).

### 1 - CONFIGURE THE BACNET NETWORK

#### Add a BACNET Network

1. Open Config > Drivers.
2. Select 'bacnet' palette.
3. Drag the 'BacnetNetwork' component onto the 'Drivers' node (or select the 'New' button).



#### Configure the Local Device

Bacnet devices and objects have three key properties: 1) Identifier, 2) Name, 3) Type. The "Object Identifier" (ID) is often referred to as the "instance number" (essential property).

1. Expand the BacnetNetwork.
2. Open the Property Sheet of 'Local Device'.
3. Set the Object ID (Instance Number; default = -1)



#### Configure the Network Ports

##### To Configure a BACnet/IP Port

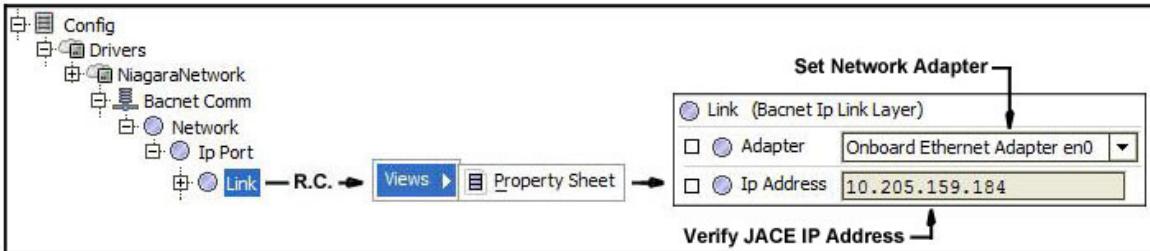
1. Expand Tree: BacnetNetwork > Bacnet Comm > Network.
2. Open the Property Sheet of 'Ip Port'.
3. Set the Network number (typically 1).



4. Expand Tree: BacnetNetwork > Bacnet Comm > Network > Ip Port
5. Open the Property Sheet of 'Link'.
6. Set the Network Adapter. Typical is 'Adapter en0'.  
Adapter en0 = JACE LAN #1 port (right side; typically connected to the Internet to AX Supervisor).  
Adapter en1 = JACE LAN #2 port (left side)

## To Configure a BACnet/IP Port Cont.)

7. Verify the correct JACE IP address.



8. Review the Udp port setting (default = 0xBAC0, hexdecimal, 47808, decimal).

9. Click the Save button to save Ip Port changes.

10. Enable the Ip Port (right-click 'Ip Port' > Actions > Enable). The 'Status' field of the Ip Port should read 'ok'. (note: to configure a BACnet/Ethernet port or BACnet/MSTP port, refer to the Niagara AX-3.x Bacnet Guide)

## 2 – CREATE BACNET DEVICES

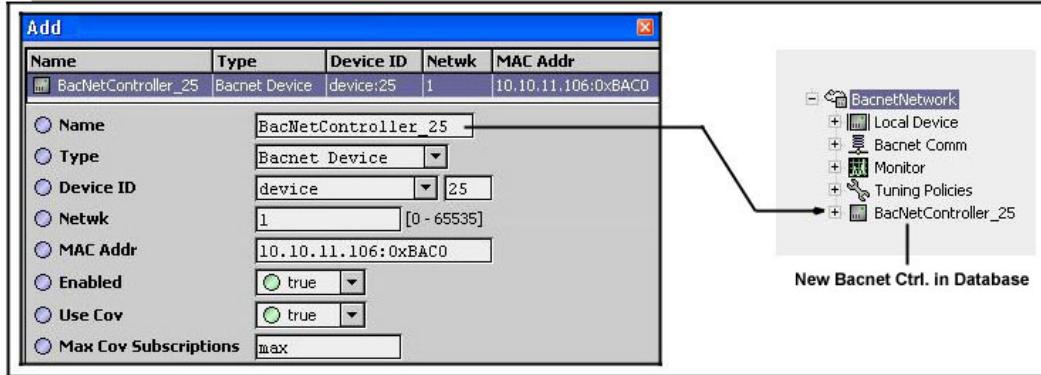
### Manually Add Bacnet Devices (Off-line Engineering)

Three Options:

- 1) Drag a BacnetDevice from the 'bacnet' palette.
- 2) Device Manager's 'New' device wizard.
- 3) Device Manager's 'Match' function (match a manually added device with a discovered device).

### Using Online Discover to Add Bacnet Devices (On-line Engineering)

1. Open the Bacnet Device Manager. (double-click 'BacnetNetwork')
2. Click 'Discover' (bottom).
3. Discovered Bacnet devices will appear in the 'Discovered' pane (top).
4. Select the devices then click 'Add'.
5. In the 'Add' dialog box edit the device properties (name, instance #, enable=true). OK.
6. The desired Bacnet devices should appear in the 'Database' pane (lower).



## 3 – CREATE BACNET PROXY POINTS

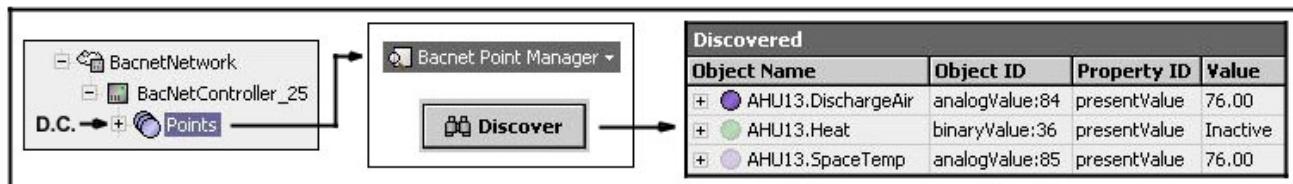
### Manually Add Bacnet Proxy Points (Off-line Engineering)

Two Options:

- 1) Drag a Bacnet point from the 'bacnet' palette.
- 2) Bacnet Point Manager's 'New' button.

### Using Online Discover to Add Bacnet Proxy Points (On-line Engineering)

1. Expand Tree: BacnetNetwork > Bacnet Controller\_xx



## Using Online Discover to Add Bacnet Proxy Points Cont.)

2. Open the Bacnet Point Manager (double-click the ‘Points’ folder).
3. Add a Bacnet Point Folder, if required:
  1. Click ‘New Folder’ (or drag ‘BacnetPointFolder’ from the Bacnet palette).
  2. Open the ‘Bacnet Point Manager’ of the folder (double-click it).
4. Click the ‘Discover’ (bottom).
5. Select the required points in the ‘Discovered’ pane (top). (watch the point type).
6. Click ‘Add’. The points should appear in the ‘Database’ pane (bottom).
7. Edit the point’s properties (name, type, facets) as required.
8. OK.

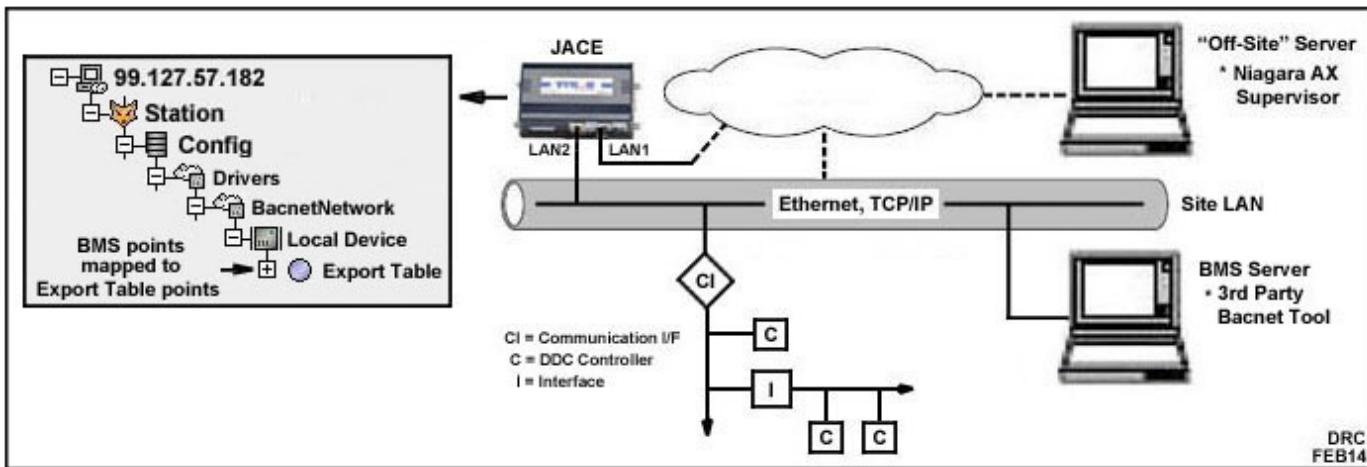
### **[Notes]**

- Bacnet does not have a ‘Bacnet’ card like LON does.
- It is better to host Bacnet on a PC than a JACE (since Bacnet is a ‘Host-level’ protocol). To export BAS Bacnet points to a JACE, see “Bacnet Export Table”.



## BACNET EXPORT TABLE

One application of using the Bacnet 'Export Table' is data sharing between a BAS server and a JACE. Bacnet mapping is required on the BAS side. Bacnet 'Export' licensing is required (export='true').



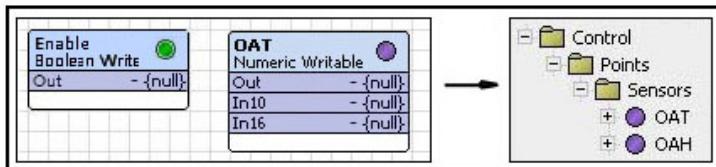
### Configure the Bacnet Network

See "Bacnet Integration – Configure the Bacnet Network"

Verify that the device Object ID of the Local Device is a valid instance number.

### Create Writable Points

- Add all the appropriate Boolean and Numeric writable points to the wiresheet(s). Note: the wiresheet(s) will be outside the 'Drivers' node. The writable points have {null} ProxyExt.



- Set the Facets.

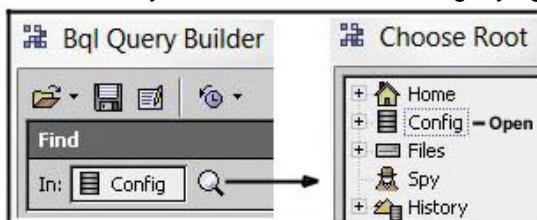
### Create Export Table Points

- Open Config > Drivers > BacnetNetwork > Local Device
- Highlight the 'Export Table'



- Click 'Discover'.

- BQL Query Builder: click on the magnifying glass.



- From 'Choose Root' box, open the 'Config' node, highlight the appropriate point folder of the writable points (don't open the folder). OK.
- Points will appear in the upper pane.
- Highlight the point(s). Select 'Add'.

## Create Export Table Points Cont.)

### 8. Edit the Point:

1. Object Name: Simplify the ORD path to just the point name.
2. Type: select 'Prioritized Descriptor' type for Analog or Boolean Value. 'BACnet Writable' line will appear.
3. Inst Num: Add the Bacnet Instance number.
4. BACnet Writable. Select 'All' (all slots) or otherwise. Establishes the prioritized link(s) between the Export Table points and the wiresheet writable points.
5. OK.

Add

Name	Object Name	Type	Object Type	Inst N
 analogValue_0	OAT	Bacnet Analog Value Prioritized Descriptor	Analog Value	0
<input checked="" type="radio"/> Name	analogValue_0			
<input checked="" type="radio"/> Object Name	OAT			
<input checked="" type="radio"/> Type	Bacnet Analog Value Prioritized Descriptor			
<input checked="" type="radio"/> Object Type	Analog Value	Prioritized Descriptor		
<input checked="" type="radio"/> Inst Num	1521 [0 - 4194302]			
<input checked="" type="radio"/> Export Ord	h:cd7ae			
<input checked="" type="radio"/> Description				
<input checked="" type="radio"/> BACnet Writable	<input checked="" type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 <input checked="" type="checkbox"/> 4 <input checked="" type="checkbox"/> 5 <input checked="" type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input checked="" type="checkbox"/> 9 <input checked="" type="checkbox"/> 10 <input checked="" type="checkbox"/> 11 <input checked="" type="checkbox"/> 12 <input checked="" type="checkbox"/> 13 <input checked="" type="checkbox"/> 14 <input checked="" type="checkbox"/> 15 <input checked="" type="checkbox"/> 16	<input type="button" value="clr"/>	<input type="button" value="all"/>	

### 9. Confirm the links.

## **Bacnet Network Adapter Setting**

Set the Bacnet network adapter settings for JACE LAN1 and LAN2 ports.

Adapter en0 = JACE LAN #1 port (right side; connection to the Internet to AX Supervisor).

Adapter en1 = JACE LAN #2 port (left side; connection to the site LAN to the BAS Server)

See "Bacnet Integration" section, 'Set the Network Parameters'.

## **BACnet Mapping**

### 1. Use the BAS Bacnet mapping tool to map the BMS points to the Export Table Bacnet points.

Export Table

Exported Objects

Target Name	Object Name	Object Type	Inst Num	Value	Export	BACnet Writable
 CH1CDWVLV	CH1CDWVLV	Binary Value	53	true {ok} @ 16	{ok}	in1,in2,in3,in4,in5,in6,in7,in8,in9,in10,in11,in12,in13,in14,in15,in16
 CH1COM1IGV	CH1COM1IGV	Analog Value	73	- {null} @ def	{fault}	in1,in2,in3,in4,in5,in6,in7,in8,in9,in10,in11,in12,in13,in14,in15,in16

 {ok} = Point Mapped

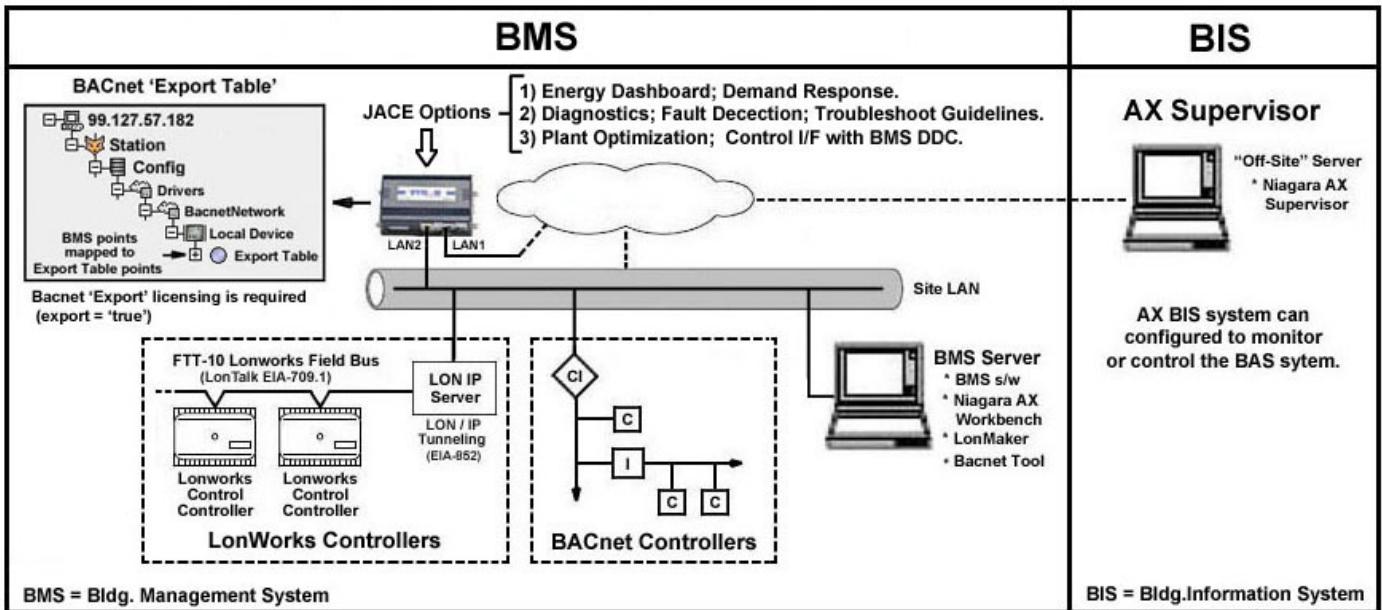
### 2. Export Column: {ok} = Point Mapped. If a mapped point value reads {null}, switch to the point wiresheet and return to the Export Table.

Note: for Siemens DDC equipment, after the mapping it is sometimes necessary to 'toggle' the point (boolean) or get a COV event (numeric) for the mapping to 'lock' in.

## BMS-BIS Architecture

The illustration below shows how the BACnet Export Table can be used to extend the BMS system to a Building Information System (BIS).

If the JACE is to perform actual BMS control override, it is strongly suggested to implement logic that detects an off-line JACE and overrides back to BMS control (or to an alternate JACE).



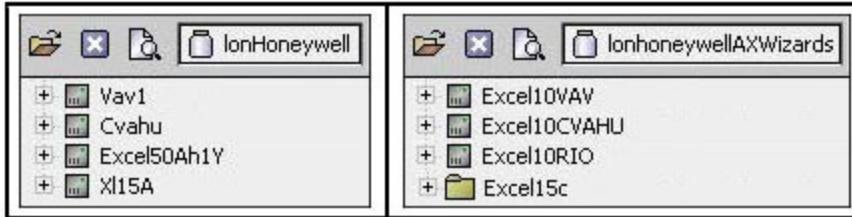


## Honeywell Zone Controller Configuration

Integrating Honeywell application Zone controllers are performed through the Lon Network.

Preliminary:

- 1) LON application-specific devices have been installed. (see LON Integration).



### Set the LON VAV Configuration

1. Set the configuration settings

**'lonhoneywell' Configuration**  
Configures the controller via the Lon property sheet (setting nvi, nvo, nci points).

**'lonhoneywellAXWizards' Configuration**  
Configures the controller with a user-friendly interface

**Cvahu Configuration Wizard**

Outputs	Controller Type	w7750A
Inputs	Power Frequency	60 Hz
Equipment Control	Equipment Type	Conventional

### 'Lonhoneywell' Configuration

Expand the appropriate nv folders and set the properties. Examples:

- nciTempSetPts: set the OccCool, StandbyCool, UnoCool, OccHeat, StandbyHeat, UnOccHeat
- nciloSelect: set ResistiveAI1 to Discharge20Kntc. Set Digital Out1 = DOFan; DO2 = DOheatStage1
- nciConfig: set FanMode to fanContinous.

### 'LonhoneywellAXWizards' Configuration

Open the Configuration Wizard (double-click the controller)

- configure the parameters: Outputs, Inputs, Configuration, Control Parameters,
- click the 'Commit' button to accept the settings (important).

2. Repeat the process.



## Honeywell Field-Programmable Controller Integration

Technical Document: NiagaraAX 3.x Lonworks Guide, Appendix A

Integrating Honeywell field-programmable XL50 and XL500 controllers are performed through the Lon Network. The factory .XIF file (external interface file) of XL5K controller is required. (note: the following procedures are not supported by Honeywell).

### Lon Xml File Overview

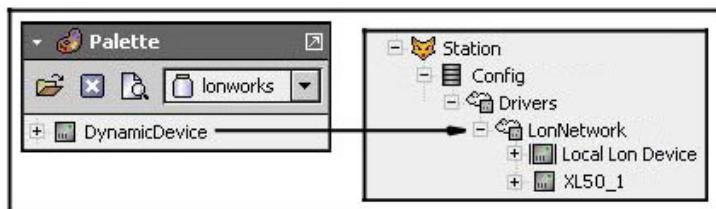
Lon Xml (.lnml) are used to describe specific Lonworks devices to NiagaraAX. The device is derived from the manufacturer's .xif file (external I/F file). Manufacturer-specific datatype for nvs, ncis and cps are derived from resource files.

The lon<vendor> module jars (eg, lonhoneywell) include many of the standard lnml files for the Lon device. During a Lon Device Manager 'Discovery', the lnml files are automatically searched, according to the Program ID returned by each device.

The Lon Xml Tool permits integration of LonWorks devices without depending on Tridium to issue updated lon<vendor> modules.

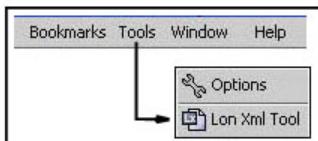
### 1 - Add a Dynamic Device

1. Open the 'lonworks' palette and drag a 'DynamicDevice' object onto the 'LonNetwork' node.
2. Name the controller (eg, XL50\_1).



### 2 – Import XML File

1. Open the 'Lon XML Tool' (click 'Tools' on the menu bar).



2. In the XIF field, select the .xif file for the XL5K controller.
3. Click the 'Compile' button. Review any warning or errors listed in the report window. An .lnml file for the device is created in the working directory. Note the name of the file created. If using resource files, a 'datatypes' subdirectory is also created (under the working directory).
4. Right-click the XL5K controller in the NAV side bar > Choose 'ImportXML' > click OK.

### 3- Add XL5K Proxy Points

1. Expand the XL5K controller in the NAV side bar.
2. Open the Lon Point Manager (double-click the 'Points' folder of the XL5K device).
3. Click the 'Discover' button (bottom) (if no points appear, click the 'Refresh' button).
4. Select the required nvi and nvo points and drag and drop them from the 'Discover' pane (top) into the 'Database' pane (bottom).

### 4 – Configure the XL5K Proxy Point Properties

1. Modify the Point Name and Point Type as required.
2. Set the Facets (click the edit '>>' button).



## LONSPYDER INTEGRATION

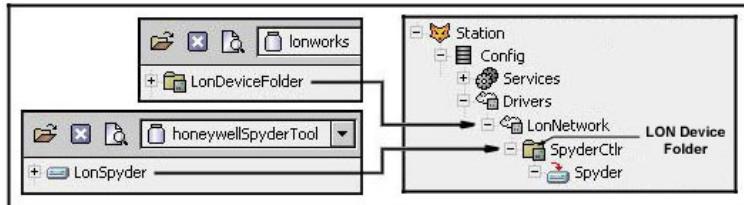
Technical Document: Honeywell Spyder User Guide

### 1 - Add a LON Network & Configure the Network Properties (see LON Integration).

#### 2 - Add a Honeywell Spyder Controller

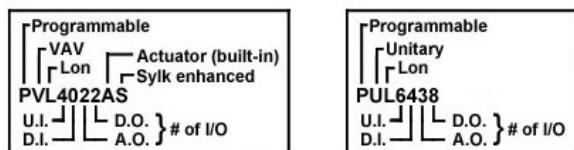
1. Open the 'lonworks' palette and drag a 'LonDeviceFolder' object onto the 'LonNetwork' node (for organization).
2. Name the folder (eg, 'SpyderCtrl').
3. Open the 'honeywellSpyderTool' palette and drag a LonSpyder controller onto the device folder.
4. Name the controller (eg, 'Spyder').

Note: Honeywell TAC advises not to Copy/Paste or duplicate Spyders. Use "Save to Library" C:\Niagara/applib



#### Configure the Spyder Controller Properties

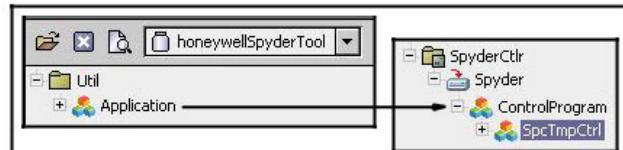
1. Open the Controller Summary View (double-click the Spyder controller).
2. Set the model type (VAV or Unitary controller). (note: 'PUB' & 'PVB' are BACnet MS/TP devices).



3. Click the 'Save' button. (note the warning that changing the controller model may change the programming).

#### Adding an Application to the Spyder Controller

1. Open the 'honeywellSpyderTool' palette's 'Util' folder.
2. Drag the 'Application' object onto the Spyder controller's 'ControlProgram' node.
3. Name the application (eg. SpcTmpCtrl).



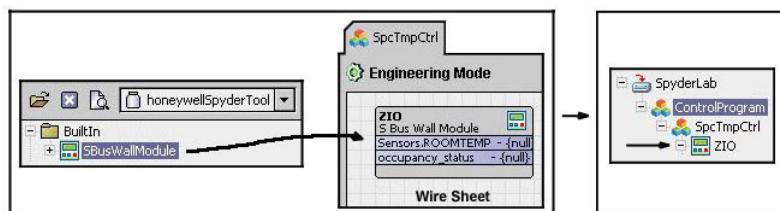
4. Add control objects from the SpyderTool to build control applications

#### Terminal Assignment Tool

1. Right-click the controller > Views > Terminal Assignment View.
2. Update the terminations as required.

#### Adding ZIO Wall Module to the Spyder Application

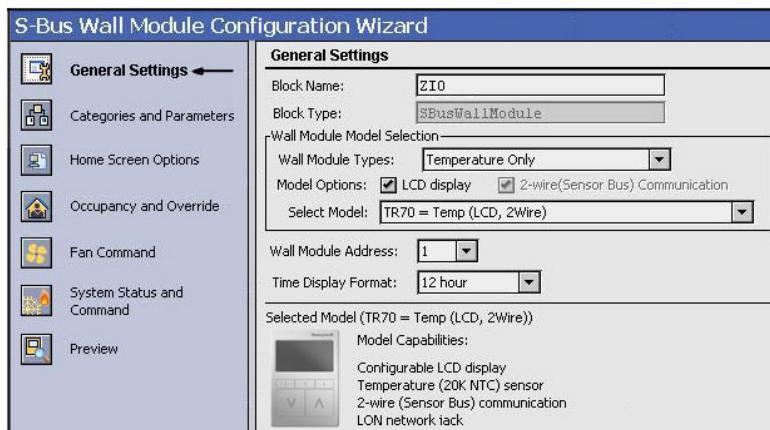
1. Open the Wire Sheet of the Spyder application (ie, double-click the Application).
2. Open the 'honeywellSpyderTool' palette's 'BuiltIn' folder.
3. Drag the 'SBusWallModule' onto the application's Wire Sheet.
4. Name the Wall Module (eg, ZIO).



5. Add control strategy logic to the Application (see 4-Control Strategy).

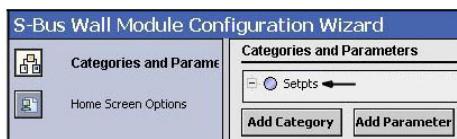
## Configuring the ZIO Wall Module Properties

1. Right-click the Zio > 'ConfigureProperties' > click the 'General Settings' button.
2. Review the settings and update as required.



3. 'Categories and Parameters' > click 'Add Categories'.

4. Name the category (eg, 'Setpts')



5. Select the new category ('Setpts') > click 'Add Parameter'.

6. Edit the parameters (examples):

Parameter Type:	'Value From Wall Module'
Parameter Name:	'Setpt'
Number of Decimals:	1
Increment/Decrement:	0.1
Default Value:	72F
Low Limit:	55F
High Limit:	82F

Check the Boxes: 'Viewable by Tenant' + 'Editable by Tenant'

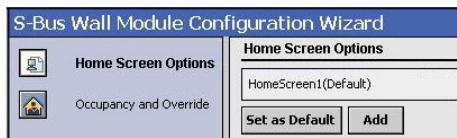
7. Click the 'Room' and 'Setpoint' options of the green screen simulation (lower right corner).

8. Add a category called 'Points' with a parameter (eg, RaTemp) (see steps 2, 3).

9. Edit the parameters (examples):

Parameter Type:	'Controller Value'
Number of Decimals:	1
Check the Boxes:	'Viewable by Tenant'
Pre-view:	'Temperature'

10. Click the 'Home Screen Options' button. Click the 'Add' button. Set the name or leave at default.



11. Option Type: select 'Multiple Parameter'.

12. In the green setup window, set the upper left field to display the controller setpoint (select 'More', then choose the 'Setpoints' category. Select the setpoint parameter name (eg, 'Setpt').

13. In the upper right corner, set the display to the value of the return air temperature (eg, RaTemp).

14. Set the middle display to show the room temperature.

15. Set the new home screen as the default home screen.

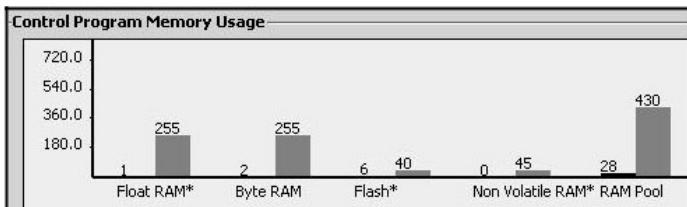
16. Click the 'Save' button, then 'Finish' button.

## Modifying the Execution Order of the Control Objects

1. Right-click the application folder.
2. Arrange the order to optimize the execution.

## Validating the Application

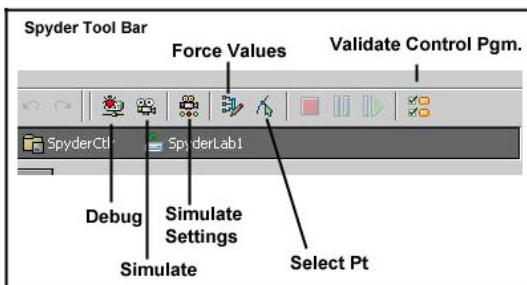
1. Right-click the controller > Views > Resource Usage
2. Click the 'Validate Control Program' button (lower right)



3. Review errors (eg, unconnected blocks)

## Spyder Simulation Tool

1. On the Tool Bar click 'Simulator Settings'



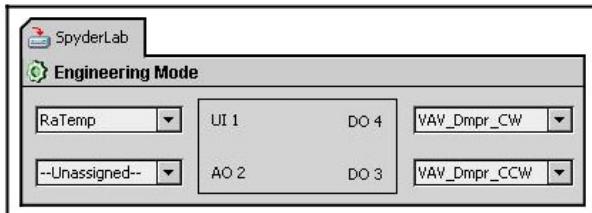
2. Change the Simulation Speed to 'Simulate at Speed of Controller'. Click OK.
3. Click the 'Simulate' button. Reply 'No' to removing overridden input point values.
4. Click on the 'ForceInputConfig' button on the button bar. Set the points. Monitor the output fields to verify the control sequence.
5. Right-click the object (eg, Zio) or point (eg, DaTemp) and choose 'Force Values'. Modify a parameter. Click OK.
6. Review the operation.
7. Using the Force Command function to raise and lower the setpoint.
8. Stop the simulation, replying 'No' to removing the overridden input values.

## Creating a Macro

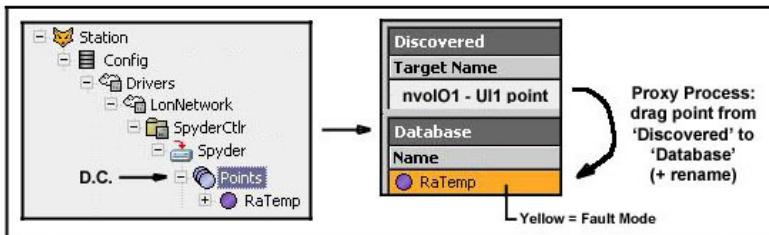
1. From the 'Util' folder in the Spyder palette, add a 'Macro' object to the Wire Sheet.
2. Name the Macro.
3. Select the control objects to be added to the macro (click each one while holding down the control key).
4. Cut the object from the Wire Sheet.
5. In the NAV side bar, right-click the Macro name and paste the objects.
6. Open the Composite Editor and composite the required slots. Rename the slots as needed.
7. Refresh the screen after closing the Composite Editor.
8. Connect the control logic to the Macro.
9. Modify the Execution Order so that the macro runs first (right-click the application folder).

## Bringing Spyder Controller Points into a Station

1. Open the Terminal Assignment View. Verify that the point assignments are correct.
  1. In the NAV side bar, right-click the Spyder controller.
  2. Choose Views > Terminal Assignment View.
  3. Review the assignments (eg, RaTemp=UI1). Save the changes.



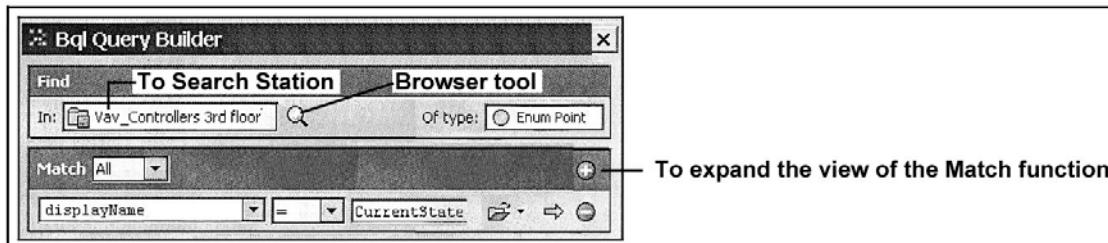
2. Open the Point Manager (double-click the 'Points' folder)
3. Proxy the required points (drag from 'Discovered' pane to 'Database' pane).



4. Set the point facets, rename the points. For a temperature point, open the Property Sheet, set the 'Proxy Ext' conversion property to Linear, Scale = 1.
5. The point in yellow is in Fault mode. To clear:
  1. Open the point Property Sheet (right-click the point > Views)
  2. Expand the view of the Proxy Extension
  3. Locate the 'Conversion' slot. Set the conversion tool to 'Linear'.
  4. 'Scale' & 'Offset' will appear. Leave the setting at the defaults.
  5. Save the changes. The fault should be cleared.
6. Open the Lon Link Manager. Perform a Bind operation to ensure all the points are bound.
7. Right-click on the 'Points' folder in the Spyder Controller > choose Views > New View.
8. Name the new graphics (eg, SpyderView).
9. Add the previously exposed points to the graphics as 'Bound Labels' with 'Display Name Labels'.

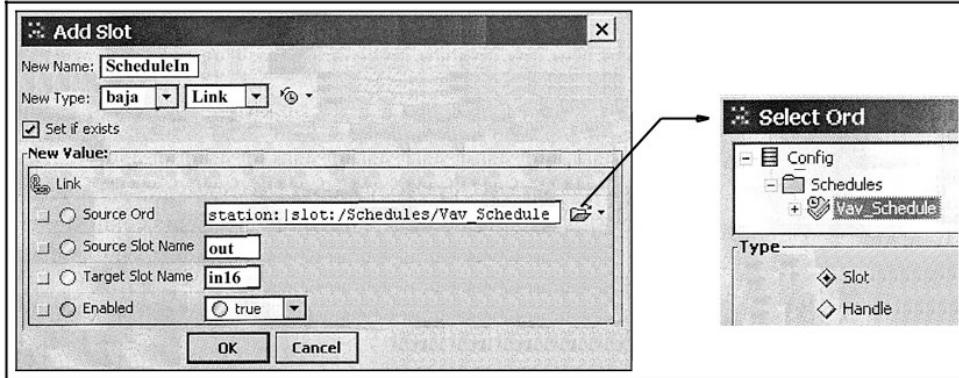
## Creating Multiple Bindings Using the Batch Editor

1. Use the 'Duplicate' function to duplicate Lon device folder (eg, VAV\_2F). Don't use the copy/paste special.
2. Name the new folder (eg, VAV\_3F).
3. Rename the controllers.
4. The new devices are not scheduled. In the 'Services' component of the Station, double-click 'Program Services'.
5. Click the 'Find Object' button (bottom).
6. In the 'Bql Query Builder' click the (+) button (lower right).
7. Set the 'Of Type' setting to 'Enum Point'.
8. Set the 'Match' selection to 'Display Name'.
9. Type in the 'CurrentState' as the point name.



10. Click the OK button to display the points in the Station.
11. Select the points you don't want to include in the binding. Right-click the selections and choose 'Clear Selected Items'.

12. Click the 'Add Slot' button (bottom). Set the settings as shown in the figure below:



13. Click OK to create the binding.

14. Use the BatchEditor Results to verify that the connections were created.

15. Open the Link Sheet for the Vav\_Schedule to review the created bindings.

16. Repeat these steps to link the following slots from the schedule to the same 3<sup>rd</sup> floor Vav controller:

1. Schedule's 'Next State/ slot to the NextState point's in16 (source slot should be configured as 'nextValue'. Review the schedule's slot sheet to note actual slot names).
2. Schedule's 'TUNCOS' slot to TUNCOS point's in16 (you'll have to change the search function to look for numeric points for this connection).
3. Review the schedule's Slot Sheet to review the new connection. Complete the connections in the Lon Link Manager.

## Spyder Library

### Saving the Application or Controller

1. In the NAV sidebar, open the view of the Spyder controller.
2. Right-click the Application folder or the Spyder Controller > choose 'Save to Library'.
3. Name the file. Note the directory that the application is stored in.

### Using a Saved Application or Controller

1. Open the Spyder Library (click the Sidebar button on the tool bar > choose Spyder Library).
2. Locate the application or controller in the appropriate folder (eg, 'Applications', 'Devices').
- 3a. If an application, drag it onto the 'ControlProgram' node in the NAV sidebar.
- 3b. If a controller, drag it onto the 'LonNetwork' node in the NAV sidebar.
4. Rename the application or controller.

### Importing a JAR file

1. Open the Import view of the Spyder Library.
2. Browse into the Sys Home directory.
3. Locate and select the .jar file (eg, SBusWallModuleConfigs\_V\_1.0.jar).
4. Click the 'Open' button to import the file.

### [Notes]

Niagara Process:

- 1) Commission
- 2) Download
- 3) Bind

Spyder does all three in one process.

Spyder objects are not Niagara objects (download required after program modifications 

Spyder Rule: DI point are always Normally Open. Use UI Point if need Normally Closed

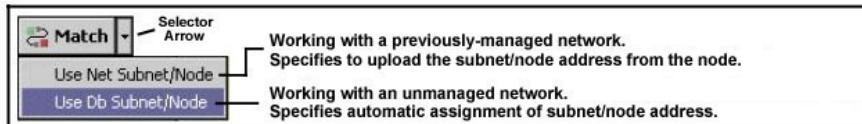
Spyder does not permit text on Control Program. Use "Pass Thru" object for better visual in linking data from application to application (Pass Thru title shows name).

## FIELD ENGINEERING

A 'Discover' and 'Match' process is performed on-line. After an on-line discovery of the LON devices, the 'Match' feature maps the LON devices in the 'database' with 'discovered' Lon devices. A match is possible only if the program IDs are the same. The match synchronizes the Lonworks neuron ID and applies appropriate subnet-node addressing.

### 1 – Discover & Match Devices (on-line)

1. Verify that the PC is connected to the Spyder controller.
2. Open the Lon Device Manager (double-click the 'LonNetwork').
3. Click the 'Discover' button ('Discover' sends a broadcast message).
4. Select (highlight) the controller in the 'Discovered' pane and in the 'Database' pane. If the controller does not show up in the 'Discovered' pane, use the controller's Service Pin to discover it.
- 5a. Select the appropriate Match function > Use the black arrow next to the 'Match' button, select:
  - "Use Net Subnet/Node" – to upload the logical address from the device (node).
  - "Use Db Subnet/Node" – for automatic assignment of logical address (subnet/node).(be careful with the selection tool – if the selection you want is already selected, click off the menu to close it.)



- 5b. Click the 'Match' button. As need, edit any property required. Click OK.

### 2 - Commission & Download the Controller

Commissioning tells the controller what its domain, subnet and node numbers are.

1. Select the Spyder Controller in the Database window.
2. Click the 'Commission' button (note the status indicator at the top of the window).
3. Download. (right-click the Spyder Controller > 'Actions' > 'Download'). Note: Downloads can be either 'recursive' or 'full'. Full downloads can "flush" out anything that may not have been properly to the controller (use the Debug feature to check logic issues). In earlier versions, 'recursive' was the default.

### 3 - NV Bindings

1. Open the Lon Link Manager (right-click 'LonNetwork' > 'Views').
  2. Select the nv point.
  3. Click the 'Set Service Type' button. Set the service type (eg, 'Reliable' = Repeated).
  4. Click the Bind button (bottom) to complete the connection. This binds the JACE points to the network card.
- Note1: with a functioning Lon card, you will see the connections, but the linkStatus will display as 'Device Error'.  
Note2: if the controller is re-commissioned the bindings will have to be redone.

### 4 – Set Time & Programming Testing

1. Right-click the Spyder controller in the NAV side bar. Choose 'Set Time' from the menu.
2. Review the values in the Spyder's Points folder (eg, RaTemp).
3. Test the programming in the Spyder controller in the 'Debug' mode (eg, modify the setpoint).
4. After exiting Debug mode. Right-click the Spyder (NAV). Run diagnostics on the Spyder outputs. Click "Select Points" button, select 'All'.

## Troubleshooting

Issue: Need to review the logic of a field-installed PUL6438 Spyder controller (programmed by a 3<sup>rd</sup> party). On site re-Commissioning will break the nv-bindings.

1. Disconnect the Spyder controller from the LON network
2. Connect the Spyder to the laptop using an Echelon U10 USB Network Interface.
3. Create a Station with a LON network.
4. Perform a device discovery.
5. Drop the Spyder into the system tree.
6. Do not Commission. Not using AX to take over the network managing.
7. Perform a Learn Logic. This will learn the Spyder controller. Since there's no matching application in the parent path it will dump all the logic blocks on top of each other.
8. Separate out the logic blocks.

Note: if you make any changes, download the file back to it. Note the original nvi debugindex settings (may need to be put back after downloading). If any modules have been added they will have to be learned by the Supervisor.



# Palettes

**alarm**

- + **AlarmService**
- + **MemoryAlarmService**
- **AlarmClass**
- **AlarmClassFolder**
- **ConsoleRecipient**
- + **StationRecipient**
- + **LinePrinterRecipient**
- **Extensions**
  - + **OutOfRangeAlarmExt**
  - + **StringChangeOfValueAlarmExt**
  - + **BooleanChangeOfStateAlarmExt**
  - + **BooleanCommandFailureAlarmExt**
  - + **EnumChangeOfStateAlarmExt**
  - + **EnumCommandFailureAlarmExt**
  - + **StatusAlarmExt**

**kitControl**

- **Alarm**
  - + **LoopAlarmExt**
  - + **ElapsedActiveTimeAlarmExt**
  - + **ChangeOfStateCountAlarmExt**
  - + **AlarmCountToRelay**

**bacnet**

- **BacnetNetwork**
  - + **Local Device**
  - + **Bacnet Comm**
  - + **Monitor**
  - + **Tuning Policies**
- **NetworkPorts**
  - + **IpPort**
  - + **EthernetPort**
  - + **MstPPort**
- **BacnetDeviceFolder**
- + **BacnetDevice**
- + **BacnetTuningPolicy**
- **Points**
  - + **BacnetPointFolder**
  - + **BacnetBooleanPoint**
  - + **BacnetBooleanWritable**
  - + **BacnetNumericPoint**
  - + **BacnetNumericWritable**
  - + **BacnetEnumPoint**
  - + **BacnetEnumWritable**
  - + **BacnetStringPoint**
  - + **BacnetStringWritable**
- **Alarming**
  - + **BacnetDestination**
- **Scheduling**
  - + **BacnetScheduleImportExt**
  - + **BacnetScheduleExport**
- **Trending**
  - + **ClientTrending**
  - + **BACnetLogExtensions**
- + **Config**
- + **Server**

**bacnet**

- + **BACnetLogExtensions**
- **Config**
  - + **ConfigFolder**
  - + **BacnetObject**
- + **AI**
- + **AO**
- + **AV**
- + **BI**
- + **BO**
- + **BV**
- + **Cal**
- + **EE**
- + **File**
- + **Grp**
- + **Loop**
- + **MSI**
- + **MSO**
- + **MSV**
- + **NC**
- + **Prog**
- + **Sched**
- + **TLog**

**control**

- **Server**
  - + **ExportFolder**
  - + **ServerAIDesc**
  - + **ServerAODesc**
  - + **ServerAVDesc**
  - + **ServerAVPDesc**
  - + **ServerBIDesc**
  - + **ServerBODesc**
  - + **ServerBVDesc**
  - + **ServerBVPDesc**
  - + **ServerCalendarDesc**
  - + **ServerFileDesc**
  - + **ServerLoopDesc**
  - + **ServerMSIDesc**
  - + **ServerMSODesc**
  - + **ServerMSVDesc**
  - + **ServerMSVPDesc**
  - + **ServerNCDesc**
  - + **ServerBoolSchedDesc**
  - + **ServerNumSchedDesc**
  - + **ServerEnumSchedDesc**
  - + **ServerStringSchedDesc**
  - + **ServerNiagaraHistoryDesc**

**control**

- **Points (writable points)**
  - + **BooleanPoint**
  - + **BooleanWritable**
  - + **NumericPoint**
  - + **NumericWritable**
  - + **EnumPoint**
  - + **EnumWritable**
  - + **StringPoint**
  - + **StringWritable**

**control**

- + **Extensions**
  - + **DiscreteTotalizerExt**
  - + **NumericTotalizerExt**
  - + **NullProxyExt**
- **Trigger**
  - + **Interval**
  - + **Daily**
- + **StringPoint**
- + **StringWritable**

**email**

- **EmailService**
- **IncomingAccount**
- **OutgoingAccount**
- **EmailRecipient**
- **EmailAlarmAcknowledger**

**history**

- + **HistoryService**
- + **AuditHistoryService**
- + **LogHistoryService**
- **HistoryPointList**
- **HistoryPointListItem**
- **Extensions**
  - + **NumericInterval**
  - + **NumericCov**
  - + **BooleanInterval**
  - + **BooleanCov**
  - + **EnumInterval**
  - + **EnumCov**
  - + **StringInterval**
  - + **StringCov**

**kitControl**

- **ControlPalette**
  - **Points (simple points)**
    - + **BooleanPoint**
    - + **BooleanWritable**
    - + **NumericPoint**
    - + **NumericWritable**
    - + **EnumPoint**
    - + **EnumWritable**
    - + **StringPoint**
    - + **StringWritable**
  - **Extensions**
    - + **DiscreteTotalizerExt**
    - + **NumericTotalizerExt**
    - + **NullProxyExt**
  - **Trigger**
    - + **Interval**
    - + **Daily**
  - **Alarm**
    - + **LoopAlarmExt**
    - + **ElapsedActiveTimeAlarmExt**
    - + **ChangeOfStateCountAlarmExt**
    - + **AlarmCountToRelay**
  - **Constants**
    - + **BooleanConst**
    - + **EnumConst**
    - + **NumericConst**
    - + **StringConst**

# Palettes

kitControl

- Conversion
  - BooleanToStatusBoolean
  - DoubleToStatusNumeric
  - EnumToStatusEnum
  - FloatToStatusNumeric
  - IntToStatusNumeric
  - LongToStatusNumeric
  - StringToStatusString
  - StatusBooleanToBoolean
  - StatusEnumToInt
  - StatusEnumToStatusBoolean
  - StatusEnumToStatusNumeric
  - StatusNumericToStatusEnum
  - StatusNumeric.ToDouble
  - StatusNumericToFloat
  - StatusNumericToInt
  - StatusStringToStatusNumeric
  - StatusNumericToStatusString
  - NumericUnitConverter
- Energy
  - DegreeDays
  - ElectricalDemandLimit
  - NightPurge
  - OptimizedStartStop
  - OutsideAirOptimization
  - Psychrometric
  - SetpointLoadShed
  - SetpointOffset
  - ShedControl
  - SlidingWindowDemandCalc
- HVAC
  - InterstartDelayMaster
  - InterstartDelayControl
  - LeadLagCycles
  - LeadLagRuntime
  - LoopPoint
  - SequenceLinear
  - SequenceBinary
  - Tstat
  - RaiseLower
- Latches
  - BooleanLatch
  - EnumLatch
  - NumericLatch
  - StringLatch
- Logic
  - And
  - Equal
  - GreaterThan
  - GreaterThanOrEqualTo
  - LessThan
  - LessThanOrEqualTo
  - NotEqual
  - Or
  - Xor
  - Not
  - ExprLogic

kitControl

- Math
  - AbsValue
  - Add
  - ArcCosine
  - ArcSine
  - ArcTangent
  - Average
  - Cosine
  - Divide
  - Exponential
  - Factorial
  - LogBase10
  - LogNatural
  - Maximum
  - Minimum
  - Modulus
  - Multiply
  - Negative
  - Power
  - Reset
  - Sine
  - SquareRoot
  - Subtract
  - Tangent
  - ExprMath
- Selects
  - BooleanSelect
  - EnumSelect
  - NumericSelect
  - StringSelect
- String
  - StringConcat
  - StringIndexOf
  - StringLen
  - StringSubstring
  - StringTest
  - StringTrim
- Timer
  - BooleanDelay
  - CurrentTime
  - NumericDelay
  - OneShot
  - TimeDifference
- Util
  - BooleanSwitch
  - Counter
  - EnumSwitch
  - MinMaxAvg
  - MultiVibrator
  - NumericBitAnd
  - NumericBitOr
  - NumericBitXor
  - NumericSwitch
  - Ramp
  - Random
  - SineWave
  - StatusDemux
  - NumericToBitsDemux
  - DigitalInputDemux
  - Expr

kitLon

- LonTime
- LonTodEvent
- LonPoint
- LonReplace
- BufferParams

IonHoneywell

- Q7300
- XI10Chc1
- XI10Hyd2
- Aixfl521
- Aoxfl522
- Cvahu
- Dixfl523
- Doxfl524
- Excel50Ah1Y
- Excel50Ah2Y
- Excel50Ht1Y
- Rfg
- Rio
- Smartio1
- T7350Cs
- T7350CsV2
- T7780a
- Uv
- Vav1
- Vav2101801
- W7742defg
- XL10Fc2
- XI12F4L
- XI12Fcli
- XI12Fls
- XI15A

IonhoneywellAXWizards

- CXVariableFrequencyDrive
- Excel10CHC1
- Excel10CVAHU
- Excel10FCU2
- Excel10HYD
- Excel10RIO
- Excel10UnitVent
- Excel10VAV
- NXVariableFrequencyConverter
- T7350
- Excel15c

IonIp

- LonIpNetwork
  - Local Lon Device
    - Alarm Source Info
    - Device Data
    - Points
  - ipChannel
    - Network Config
    - Member Table

# Palettes

lontunnel

- TunnelService
- + LonTunnel

lonworks

- LonNetwork
  - Local Lon Device
    - + Alarm Source Info
    - + Device Data
    - + Points
  - DynamicDevice
    - Alarm Source Info
    - + Device Data
    - + Points
  - LonRouter
    - + Near Device Data
    - + Far Device Data
  - + LonDeviceFolder
  - + LonObjectFolder
  - LonPointFolder
  - LonTuningPolicy
  - + LinkFilter

ndio

- Network
  - NdioNetwork
- Devices
  - NdioBoardFolder
  - NdioBoard
    - + Alarm Source Info
    - + Points
- Points
  - NdioPointFolder
  - + NdioVoltagePoint
  - + NdioResistivePoint
  - + NdioThermistorPoint
  - + NdioCounterPoint
  - + NdioBooleanPoint
  - + NdioVoltageWritable
  - + NdioBooleanWritable
- Extensions
  - + LinearCalibrationExtension

onCall

- OnCallService
- OnCallRecipient
- + On Call List Schedule

report

- Reporting
  - ReportService
  - + ExportSource
  - + EmailRecipient
  - + FileRecipient
  - + BqlGrid
  - + ComponentGrid

report

- ReportWidgets
  - + ReportPane
  - + SectionHeader
  - + CanvasPane
  - + BoundLabel
  - + BoundTable

schedule

- + BooleanSchedule \*
- + EnumSchedule
- + NumericSchedule
- + StringSchedule
- + CalendarSchedule
- + TriggerSchedule
- + BooleanScheduleSelector
- + NumericScheduleSelector
- + StringScheduleSelector
- + EnumScheduleSelector

Schedule with TUNCOS

- + RtuSchedule
- + CurrentTime
- + TimeDifference
- + NumericUnitConverter
- + Minimum
- + TextBlock
- + TextBlock1
- + EnumScheduleWithTUNCOS

honeywellSpyderTool

- + BACnetSpyder
- + LonSpyder
- PhysicalPoints
  - + ModulatingInput
  - + ModulatingOutput
  - + BinaryInput
  - + BinaryOutput
- SoftwarePoints
  - + Constant
  - + NetworkInput
  - + NetworkSetPoint
  - + NetworkOutput
- Analog
  - + AnalogLatch
  - + Average
  - + Compare
  - + Encode
  - + HystericRelay
  - + Maximum
  - + Minimum
  - + PrioritySelect
  - + Select
  - + Switch

honeywellSpyderTool

- Logic
  - + AND
  - + OneShot
  - + OR
  - + XOR
- Math
  - + Add
  - + DigitalFilter
  - + Divide
  - + Enthalpy
  - + Exponential
  - + FlowVelocity
  - + Limit
  - + Multiply
  - + Ratio
  - + Reset
  - + SquareRoot
  - + Subtract
- Control
  - + AIA
  - + Cycler
  - + FlowControl
  - + PID
  - + RateLimit
  - + Stager
  - + StageDriver
- DataFunction
  - + Alarm
  - + Counter
  - + Override
  - + RunTimeAccumulate
  - + PriorityOverride
- ZoneArbitration
  - + GeneralSetpointCalculator
  - + OccupancyArbitrator
  - + SetTemperatureMode
  - + TemperatureSetpointCalculator
- BuiltIn
  - + Schedule
  - + ConventionalWallModule
  - + SBusWallModule
- Util
  - + PassThru
  - + Macro
  - + Application

timesync

- TimeSyncService
  - Client Schedule
- TimeSyncClient
- US\_CO\_NIST\_A
- US\_CO\_NIST\_B
- US\_CO\_NIST\_C
- US\_CO\_UC\_Boulder
- US\_MD\_NIST\_A
- US\_MD\_NIST\_B
- US\_WA\_MSFT

# Palettes

weather

- WeatherService
- SunPosition
- MoonPosition

## PX WIDGET PALETTES

bajau

- Widgets
  - + BoundTable
  - + Button
  - + RadioButton
  - + Label
  - + HyperlinkLabel
  - + Separator
  - + PxInclude
- Shape
  - + Ellipse
  - + Line
  - + Path
  - + Polygon
  - + Rect
- Panes
  - + BorderPane
  - + CanvasPane
  - + EdgePane
  - + GridPane
  - + ScrollPane
  - + SplitPane
  - + TabbedPane

kitPx

- + ActionButton
- + HyperlinkButton
- + SaveButton
- + RefreshButton
- + ExportButton
- + BackButton
- + ForwardButton
- + LogoffButton
- + RebootButton
- + ButtonGroup
- + AnalogMeter
- + Bargraph
- + SetPointSlider
- + SetPointToggleButton
- + SetPointCheckBox
- + IncrementSetPointButton
- + DecrementSetPointButton
- + SetPointFieldEditor
- + GenericFieldEditor
- + BooleanImage
- + NumericImage
- + EnumImage
- + LocalizableButton
- + LocalizableLabel

kitPxHvac

- boolean
  - + bulbSmall
  - + bulb
  - + occupiedSmall
  - + occupied
- coils
  - + coolingCoil
  - + coolingCoilv2wL
  - + coolingCoilv2wR
  - + coolingCoilv3wL
  - + coolingCoilv3wR
  - + electricHeatingCoil
  - + filterV
  - + heatingCoil
  - + heatingCoilv2wL
  - + heatingCoilv2wR
  - + heatingCoilv3wL
  - + heatingCoilv3wR
- dampers
  - + damperH
  - + damperV
  - + vavDamperA
  - + vavDamperB
- devices
  - + dpsLongBtmAlarm
  - + dpsLongBtmNorm
  - + dpsLongTopAlarm
  - + dpsLongTopNorm
  - + dpsShortBtmAlarm
  - + dpsShortBtmNorm
  - + dpsShortTopAlarm
  - + dpsShortTopNorm
  - + flowSensorCircle
  - + flowSensorCross
  - + humidifier
  - + pipeSensorBottom
  - + pipeSensorLeft
  - + pipeSensorRight
  - + pipeSensorTop
  - + smokeDetector
  - + tempSensorBottom
  - + tempSensorLeft
  - + tempSensorTop
- ducts
  - + ductA
  - + ductB
  - + ductC
  - + ductD
  - + hbreak
  - + hblend
  - + hmid
  - + hmidSmall
  - + hrbreak
  - + hrend
  - + hrendGrate
  - + hrendHole
  - + hrendSolid
  - + hrwhy

kitPxHvac

- ducts
  - + hrwhyLeft
  - + hrwhy3wayL
  - + hrwhy3wayR
  - + roundLEnd
  - + roundLTrans
  - + roundMid
  - + roundREnd
  - + roundRTrans
  - + tnorth
  - + tsouth
  - + vbend
  - + vmid
  - + vtend
- equipment
  - + chillerBasic
  - + coolingTower
  - + exhaustFan
  - + fanLeft
  - + fanRight
  - + generator
  - + heatExchanger
  - + heatExchangerPF
  - + meterDial
  - + meterDialLeft
  - + meterDialRight
  - + meterDigital
  - + pumpColdLeft
  - + pumpColdRight
  - + pumpCoolLeft
  - + pumpCoolRight
  - + pumpHotLeft
  - + pumpHotRight
  - + pumpLeft
  - + pumpRight
  - + pumpWarmLeft
  - + pumpWarmRight
- misc
  - + arrowDown
  - + arrowLeft
  - + arrowRight
  - + arrowUp
  - + cArrowDown
  - + cArrowLeft
  - + cArrowRight
  - + cArrowUp
  - + cPipeArrowDown
  - + cPipeArrowLeft
  - + cPipeArrowRight
  - + cPipeArrowUp
  - + dialSwitch2PosLeft
  - + dialSwitch2PosRight
  - + dialSwitch3PosLeft
  - + dialSwitch3PosMiddle
  - + dialSwitch3PosRight
  - + hArrowDown
  - + hArrowLeft
  - + hArrowRight

# Palettes

kitPxHvac

- misc
  - + A hArrowUp
  - + A hPipeArrowDown
  - + A hPipeArrowLeft
  - + A hPipeArrowRight
  - + A hPipeArrowUp
  - + A meterNiagara
  - + A pDeckFull
  - + A pDeckLimited
  - + A pDeckVacancy
  - + A pipeArrowDown
  - + A pipeArrowLeft
  - + A pipeArrowRight
  - + A pipeArrowUp
  - + A textPlateDepressedLeft
  - + A textPlateDepressedMid
  - + A textPlateDepressedRight
  - + A textPlateLEDGreen
  - + A textPlateLEDRed
  - + A textPlateLEDYellow
  - + A textPlateLeft
  - + A textPlateMid
  - + A textPlateRight
  - + A thermometer
  - + A thermometerSpectrum
- piping
  - + A coldCross
  - + A coldElbowNE
  - + A coldElbowNW
  - + A coldElbowSE
  - + A coldElbowSW
  - + A coldHoriz
  - + A coldTeeE
  - + A coldTeeN
  - + A coldTeeS
  - + A coldTeeW
  - + A coldVert
  - + A coolCross
  - + A coolElbowNE
  - + A coolElbowNW
  - + A coolElbowSE
  - + A coolElbowSW
  - + A coolHoriz
  - + A coolTeeE
  - + A coolTeeN
  - + A coolTeeS
  - + A coolTeeW
  - + A coolVert
  - + A hotCross
  - + A hotElbowNE
  - + A hotElbowNW
  - + A hotElbowSE
  - + A hotElbowSW
  - + A hotHoriz
  - + A hotTeeE
  - + A hotTeeN + A hotTeeW
  - + A hotTeeS + A hotVert

kitPxHvac

- piping
  - + A coldCross
  - + A nCross
  - + A nElbowNE
  - + A nElbowNW
  - + A nElbowSE
  - + A nElbowSW
  - + A nHoriz
  - + A nTeeE
  - + A nTeeN
  - + A nTeeS
  - + A nTeeW
  - + A nVert
  - + A warmCross
  - + A warmElbowNE
  - + A warmElbowNW
  - + A warmElbowSE
  - + A warmElbowSW
  - + A warmHoriz
  - + A warmTeeE
  - + A warmTeeN
  - + A warmTeeS
  - + A warmTeeW
  - + A warmVert
- valves
  - + A cValve2wayL
  - + A cValve2wayLTop
  - + A cValve2wayR
  - + A cValve2wayRTop
  - + A cValve3wayL
  - + A cValve3wayLTop
  - + A cValve3wayR
  - + A cValve3wayRTop
  - + A globeValve2Way
  - + A globeValve3Way
  - + A hValve2wayL
  - + A hValve2wayLTop
  - + A hValve2wayR
  - + A hValve2wayRTop
  - + A hValve3wayL
  - + A hValve3wayLTop
  - + A hValve3wayR
  - + A hValve3wayRTop



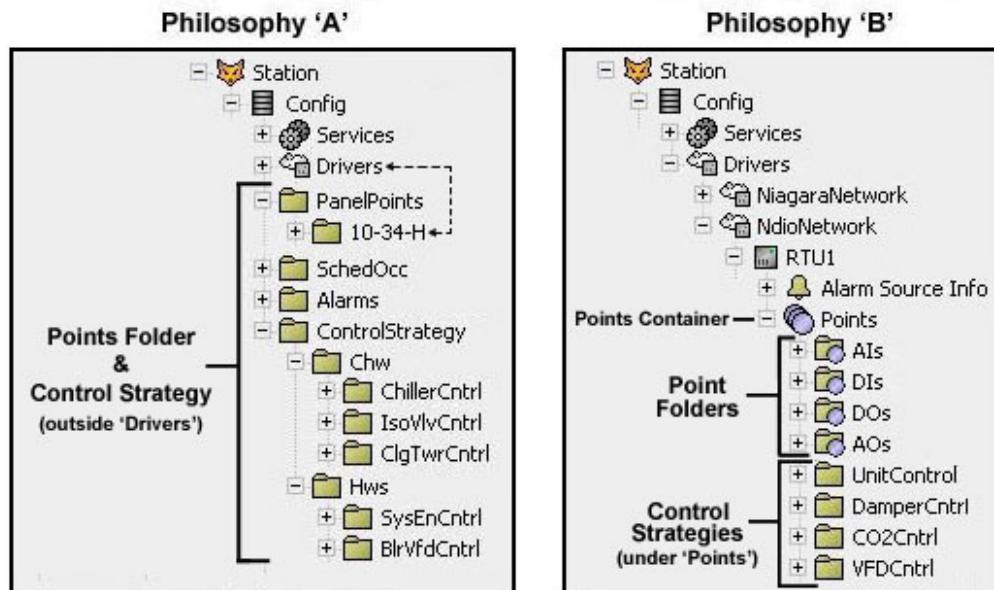
## CONTROL STRATEGIES - NIAGARA

Technical Document: Niagara AX-3.x Kit Control Guide

Niagara AX Kit Control Guide (pg. 1-3) discusses the two "best practice" philosophies about locating control logic:

**Philosophy A.** Where Proxy Points in the Points Container (under 'Driver') are Link-Marked to points (eg, 'Panel Points') outside the 'Drivers' node. Control Strategy (+ schedule, etc) folders are also located outside the 'Drivers' node. This method requires more links, but gives quick visibility to locate points and logic. Further, the external points and control strategy folders permits off-line engineering (I/O simulation is possible) along with simultaneous field commissioning (point discovery). The off-line engineering folders can be added to the JACE (with real-time Container Points) at a later time. Live Container Points are then Linked-Marked to the folder points.

**Philosophy B.** Control Strategy folders are located in the Points Container. This method has the least amount of internal links and offers more "portability" of each application, allowing easy replication and reuse at a "device level."

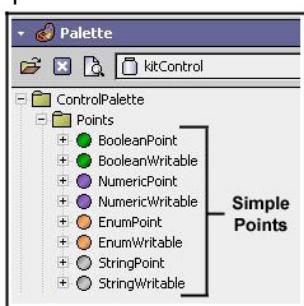


### Adding Control Logic to the Wiresheet

1. Decide on control logic philosophy 'A' or 'B' on where to locate the control strategies.
2. Create custom folders for the control strategies (eg, Chilled Water System, AHU, FanSpdCtrl, etc).
3. Open the 'kitControl' palette.
4. Drag the appropriate control components to the Wiresheet (eg, Tstat)
5. To hide slots use the 'Pin Slots' function: R.C. on the Component > 'Pin Slots'.
6. To expose child-slots use the Composite Editor: R.C. on the Component > 'Composite'.

### Adding Pseudo Points to the Wiresheet

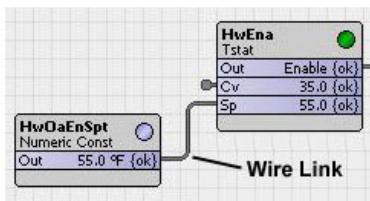
1. Open the KitControl palette.
2. Expand 'ControlPalette' folder, then the 'Points' folder (simple points).



3. Drag the appropriate pseudo points (eg, setpoints, constants) onto the wiresheet.
4. Set the valve. (R.C. Set > enter value).

## Connect Physical Points, Pseudo Points & Control Logic with Wire Links

1. Click the 'source' Component Slot (hold down the right mouse key).
  2. Drag the link to the 'target' Component Slot (release mouse key).
  3. Wire link will appear.
- note: to delete the link, click on the link (it will highlight), select the 'Delete' icon in the menu bar.



## Connect Points and Control Logic using the Link Mark Function

Use Link Mark function to avoid using a wire link on a wire sheet (space issue) or to link components on separate wire sheets (wiresheets in different control strategies).

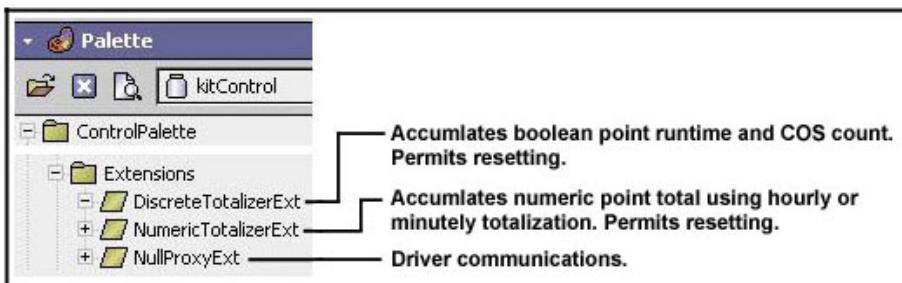
1. Right Click on Source Component > 'Link Mark'
2. Locate the Target Component.
3. Right Click the Target Component > 'Link From'



## Adding Control Extension to a Point

Technical Document: Niagara AX-3.x User Guide, 3-11.

1. Select the 'kitControl' Palette.
2. Expand the 'ControlPalette' folder, then the 'Extensions' folder.



3. Open the Property Sheet of the control point ('Points' Container).
4. Drag the appropriate Control Extension on to the point (point turns green).
5. Define the control extension properties (ie, 'Change of State Count Transition' = Active)

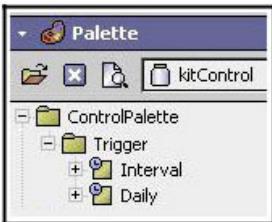
Note: extensions can be copied and pasted other similar points.

## Control Strategy Examples

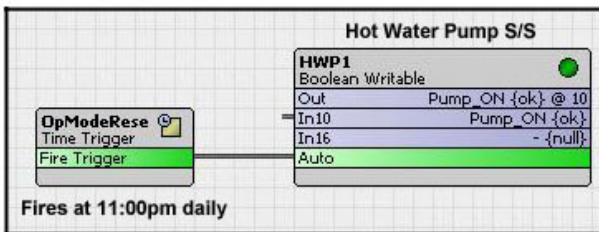
### Automatically Reset HW Pump to Auto Mode

Goal: automatically set the Hot Water pump to auto mode at 11:00pm every day. Eliminate possible control issues due to an operator overriding a point to manual and forgetting (common customer service issue).

1. Select the 'kitControl' Palette.
2. Expand the 'ControlPalette' folder, then the 'Trigger' folder.



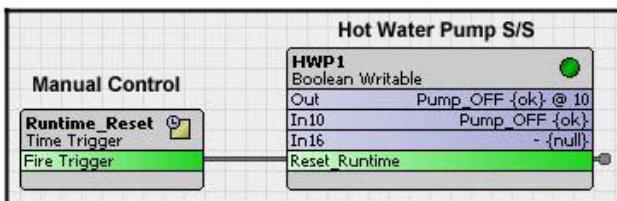
3. Add a 'Daily' trigger to the Wire Sheet. Rename it to 'OpModeReset'.
4. Open the trigger's Property Sheet. Configure the trigger to fire every night at 11:00pm
5. Expose the Fire Trigger output slot (right-click the point, choose Pin Slots).
6. Link the trigger's Fire Trigger slot to the exposed 'Auto' slot of the HWP Boolean Writable point.



### Manually Reset HW Pump Runtime

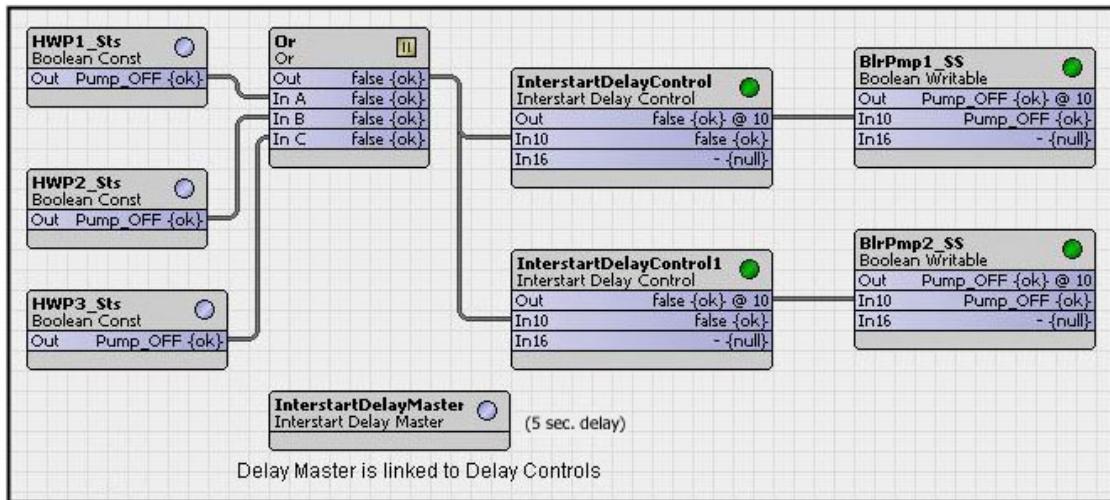
Goal: provide commandable object to manually reset the runtime.

1. Select the 'kitControl' Palette.
2. Expand the 'ControlPalette' folder, then the 'Trigger' folder.
3. Add a trigger to the Wire Sheet. Rename it to 'Runtime\_Reset'.
4. Open the trigger's Property Sheet. Configure the trigger for Manual control.
5. Expose the Fire Trigger output slot (right-click the point, choose Pin Slots).
6. Open the Composite Editor for the HW Pump (right-click the point, choose Composite).
7. Composite the 'Reset Elapsed Active Time' slot (exposing the 'child' slot). Rename it to 'Reset\_Runtime'.
8. Link the trigger's Fire Trigger slot to the exposed 'Reset\_Runtime' slot of the HW Pump point.

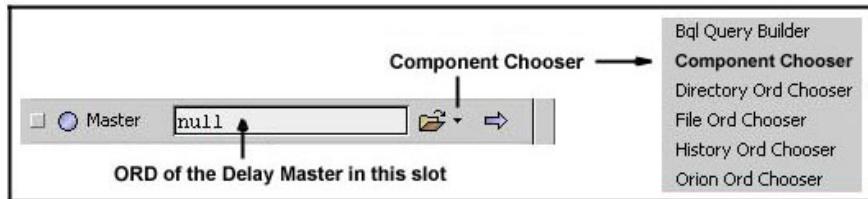


To manual the "Runtime\_Reset" object (Time Trigger) right-click and select 'Actions'.

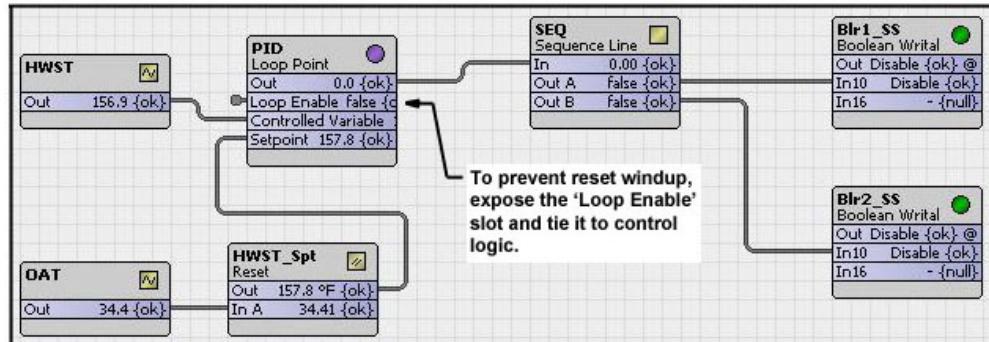
## Interstart Delay Pump Control



1. Add an 'InterstartDelayMaster' to the Wire Sheet from the kitControl palette, HVAC folder.
2. Set the Default Delay to 5 seconds.
3. Add the 'InterstartDelayControl' objects to the Wire Sheet.
4. Link the InterstartDelayMaster to the InterstartDelayControl objects using the Component Chooser (in the property of the delay control object, right side of the Master slot, click the little black arrow).



## Boiler Control with PID + SequenceLinear

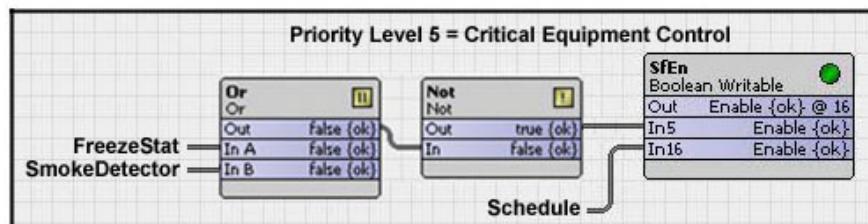


The SequenceLinear object provides sequenced rotating 'staging' control of 2 to 10 Boolean Writables based upon the status numeric In value (0-100). An adjustable delay time is also provided.

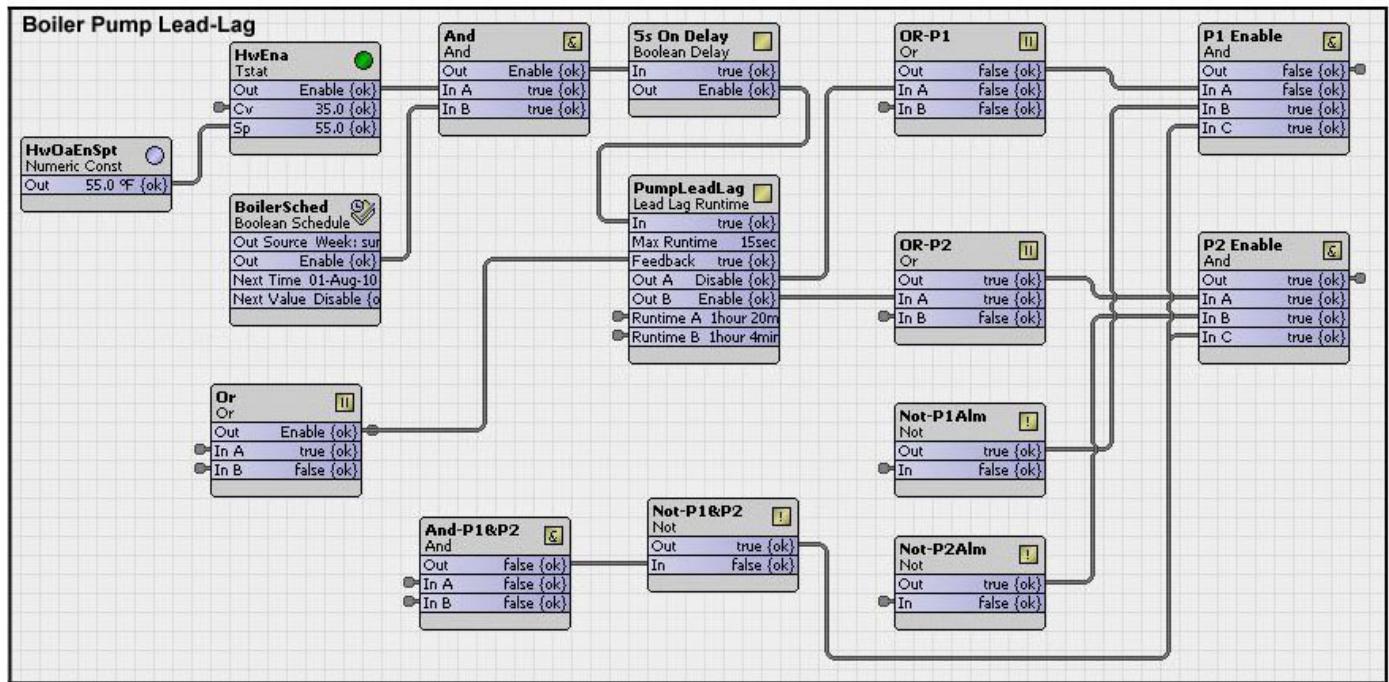
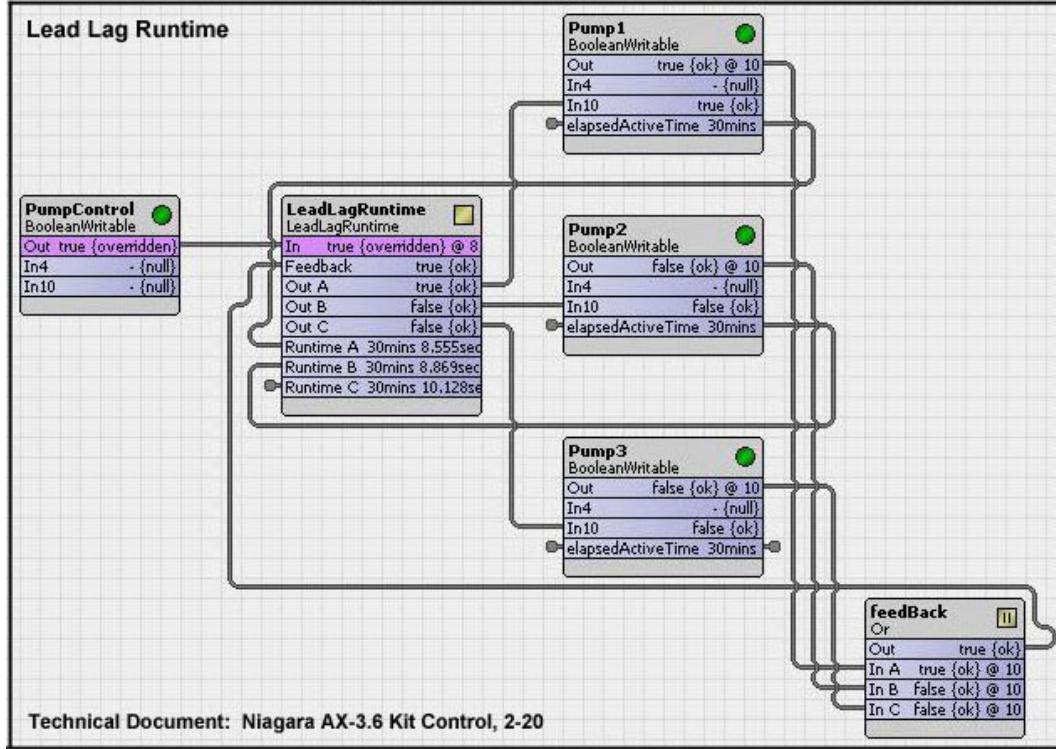
## Safety Shutdown

Goal: override the time schedule per safeties (eg, freezestat, smoke detector). (see 'Basic Steps-Control Points' for Priority Level conventions)

Action: tie safety logic to Priority Level **In5** of the Boolean Writable object.



## Lead-Lag Examples

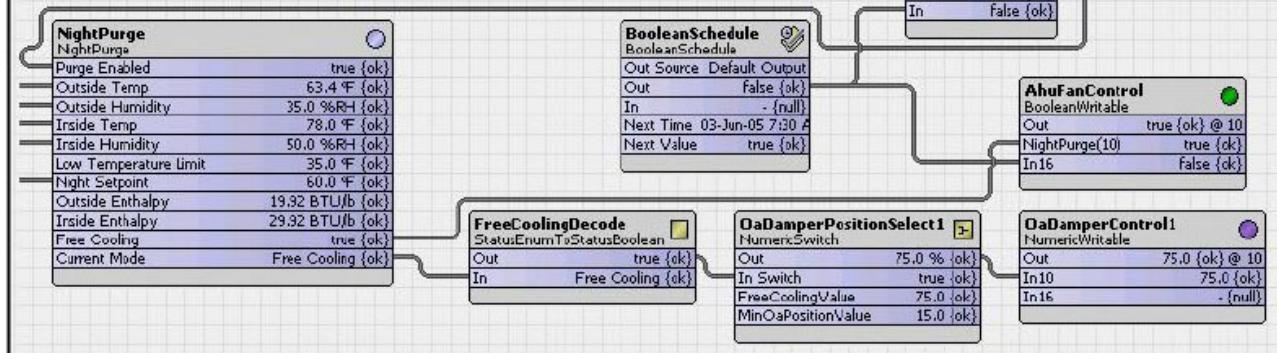


Note: see 'Basic Steps-Customization' for Lead-Lag composite built with out-of-the-box logic.

## Night Purge

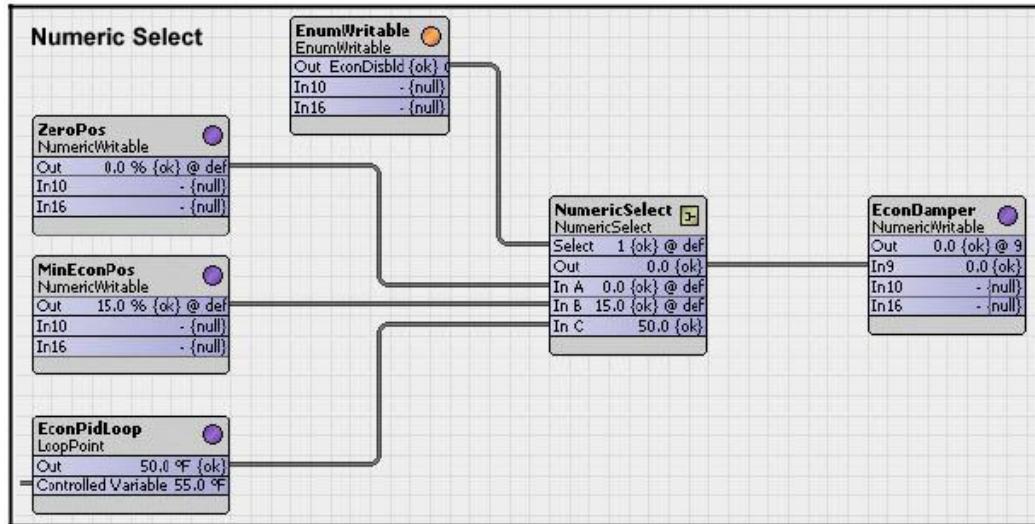
Technical Document: Niagara AX-3.x Kit Control, 2-28

### Night Purge



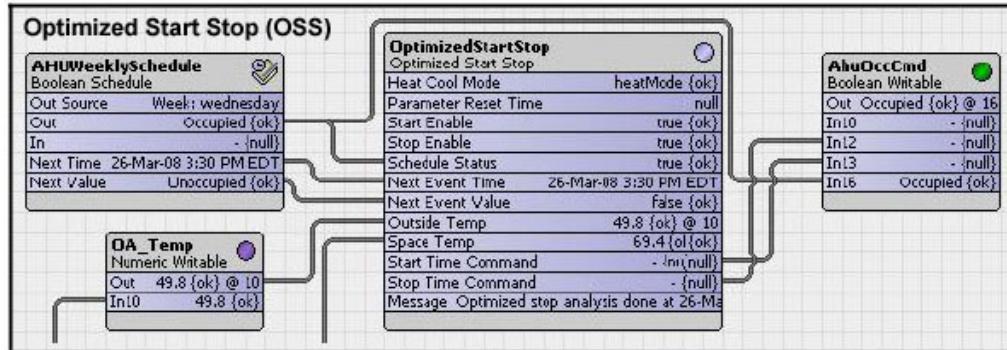
## Numeric Select

Technical Document: Niagara AX-3.x Kit Control, 2-31



## Optimized Start Stop

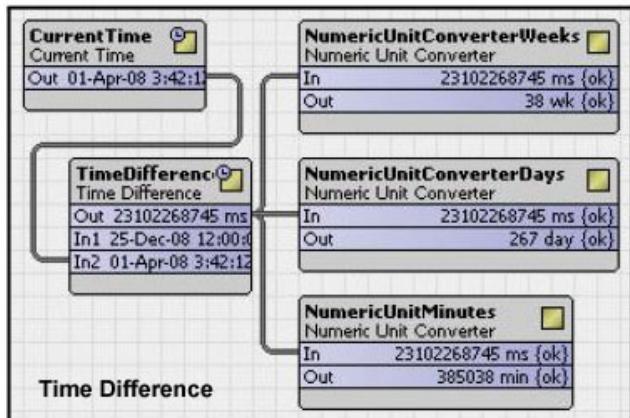
Technical Document: Niagara AX-3.x Kit Control, 2-36



Note: OSS goes to full output to reach the target. TUNCOOS gradually modifies the setpoint to get to the target (ramp rate technique).

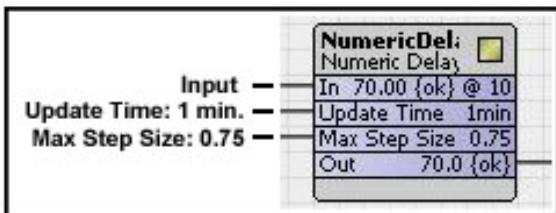
## Time Difference

Technical Document: Niagara AX-3.x Kit Control, 2-52



## Numeric Delay

Goal: provide a time-base step ramp on dynamic value. In the illustration below the input value will increase by 0.75 every minute.



The Numeric Delay with step ramp control can be incorporated in 'trim-and-respond' self-balancing algorithms:

### A sample strategy for supply air temperature reset using trim-and-response:

- 1) Establish min. and max. SAT setpoints at 55F and 65F, respectively.
- 2) Min. SAT is required when units are coming out of economizer mode, typical > 70F (adj.), and can be raised proportionally to the max. SAT as the OAT drops to 65F.
- 3) While the fan is proven ON, increase the setpoint by 0.2F (trim) every 2 minutes, as long as there are no cooling requests. 1 Cooling request = 1 VAV box with the damper position > 90%.
- 4) If there are more than 2 (adj.) cooling requests, decrease the setpoint by 0.2F (respond).

### A sample strategy for duct static pressure reset using trim-and-response:

- 1) Establish min. and max. static pressure at 0.5iwc and 1.5iwc.
2. While the fan is proven ON, reduce the static pressure setpoint by 0.04iwc (trim) every 2 minutes, as long as there are no pressure requests. 1 Pressure request = 1 VAV box with the damper position > 90%.
- 3) If there are more than two (adj.) pressure request, increase the setpoint 0.04iwc (respond).

It is important that the control logic be slow acting to avoid hunting. Hunting occurs when the control loop is not satisfied, which causes the control output to oscillate out of control.

## **Wire Sheet Notes**

### **To add Text to Wire Sheet:**

Right-click: New > Text Block

### **Paste Special**

Paste Special permits multiple copies: 'Keeping Links'.

### **Using the Slot Sheet**

Technical Document: NiagaraAX User Guide, 10-18 (pg. 330).

Two types of slots: 1) Property, 2) Action

#### To add a new slot

1. 'Slot Sheet' view: right-click in the pane.
2. From the popup menu, select the 'Add Slot' command.
3. Enter the slot Name and Type. Select the desired Flag. Click OK.

A slot can have two names: 1) display name, 2) slot name.

To get two or more links on to one slot: Add Flag 'L'. The slot select the other link upon a state change.

Use the Slot Sheet to view the permissions: 'Flags' column. 'Action' Slot > Right-click the 'Config Flag'.

<b>o</b>	operator
<b>r</b>	read
<b>h</b>	hidden

### **Using the Link Sheet**

Technical Document: NiagaraAX User Guide, 10-19 (pg. 331).

#### To edit a link using the link sheet

1. 'Link Sheet' view: right-click on the link that you want to edit.
2. From the popup menu, select the Edit command.
3. Edit the fields: Source Ord, Source Slot Name, Target Slot Name, Enable ('True' enables the link). Click OK.

#### To change the link order

1. To reorder, break the links and redo.

### **Linking Mechanism**

Drag output slot to bottom of object. Link box appears.

Drag grey bottom to bottom of object. Link box appears.

### **Display ORDs**

Highlight Object: Ctrl L ('Open ORD' box appears). Can also do on Node (eg, Ctrl-L on 'Station' will give IP addresses).

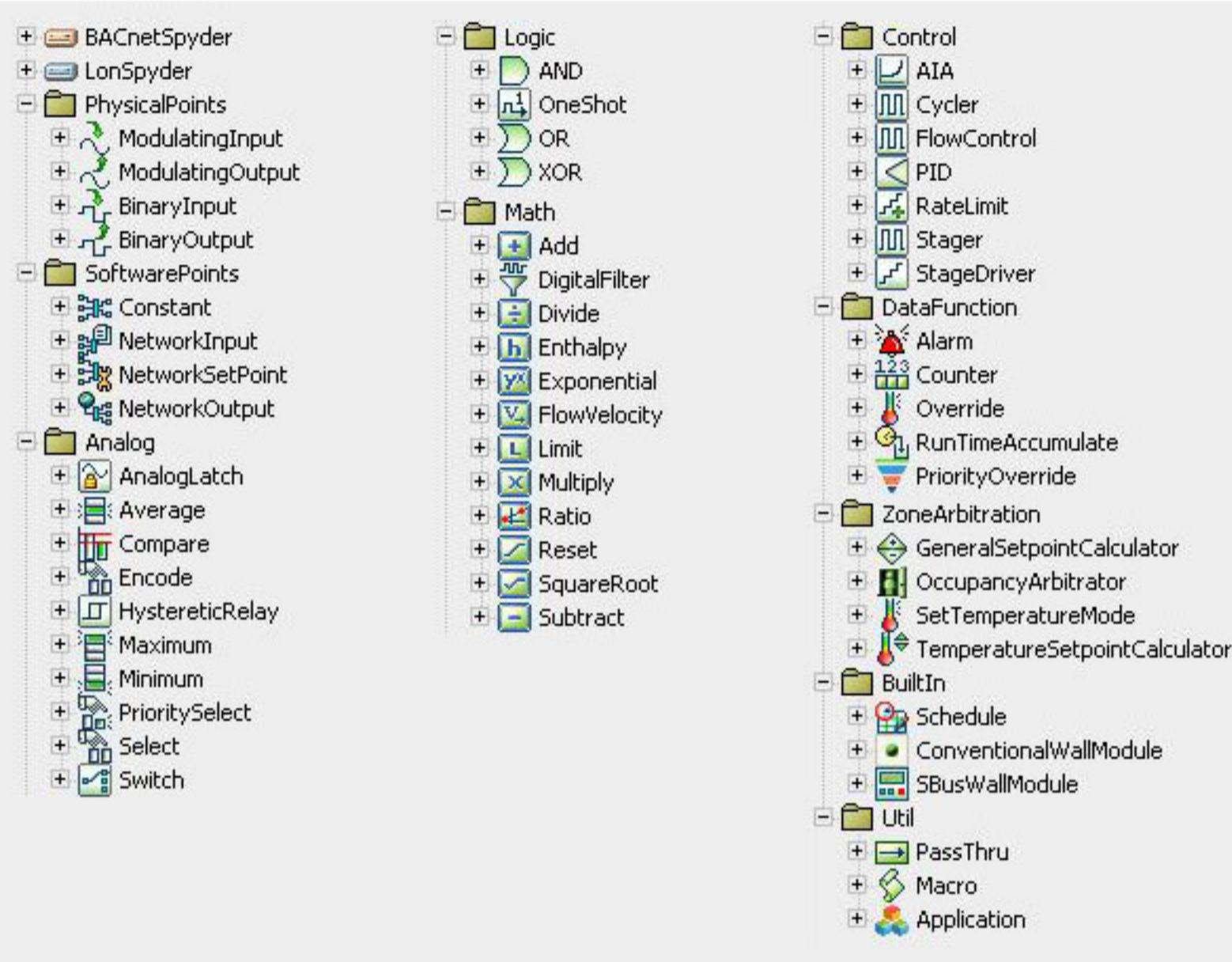
### **Flexible Data Type Connection**

Niagara 3.6+ permits flexible data type connection (Link Sheet does not show Data Type). Numerical output from the 'Loop Point' can be link to a Boolean Writable.

### **[Other]**

- To move the Wire Sheet Thumbnail: Hold down the Ctrl. Key. To get rid of it: Menu: Wire Sheet
- Update ORDs if objects are moved.
- Link Color Legend:
  - 1) Grey = Niagara component connection.
  - 2) Green = Peer-to-peer connection.
  - 3) 'Other Color' = Non-Niagara component connection (ie, Honeywell Spyder ).
- Don't connect objects to NCI network variables – writes to EEPROM (limited write cycles).
- If you drag a physical point from the Points Container onto another wire sheet, a point duplication fault error will result ('stale' point in yellow). Resolve: use Mark-Link.

# Honeywell Spyder Tool





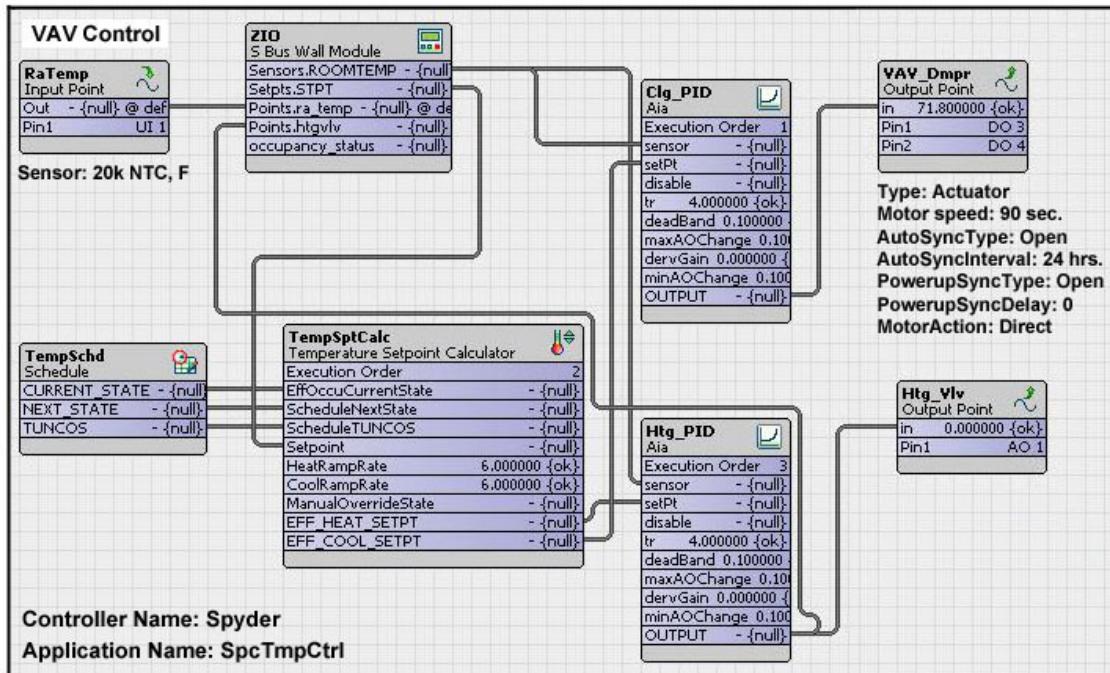
## CONTROL STRATEGIES – HONEYWELL SPYDER

Technical Document: Honeywell Spyder User Guide

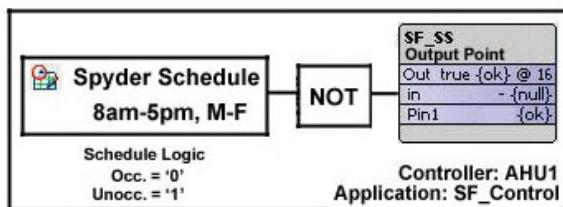
### VAV Example: RaTemp Control

Control objects are selected from the following folders of the 'honeywellSpyderTool' palette:

Folder	Control Object
Builtin	Schedule
ZoneArbitration	Temperature Setpoint Calculator
Control	AIA (Adaptive Integral Action)
PhysicalPoints	Modulating Output (VAV dmpr) Modulating Input (RaTemp)



### AHU Example: SF Control with Local Spyder Schedule



From the 'BuiltIn' folder, add a Spyder 'Schedule'. Must use a 'NOT' block to correct the Schedule Logic.

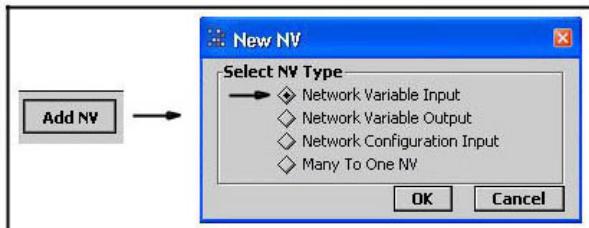
#### Schedule Setup

1. Open the Configuration Properties of the schedule block.
2. Set the Occupied and Unoccupied schedule for the week.
3. Click the 'Holidays' tab.
4. Click the 'Load US Holidays' button.
5. Add the appropriate holiday that repeat every year.

### AHU Example: SF Control with Station Schedule & Backup Spyder Schedule

The sequence of operation requires commanding the supply fan from a Station schedule and a Spyder schedule as a backup. The general strategy is to create a nvi point that is linked to the Station schedule. The Occupancy Arbitrator object is used to compare the status of the nvi schedule point and the local Spyder schedule.

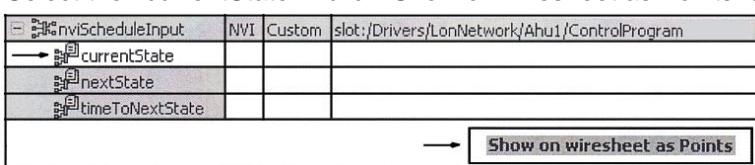
1. Open the NV Configuration View of the Application (right-click 'SF\_Control' > Views > NV Config. View).
2. Create a NV Input point (click the 'Add NV' button > select 'Network Variable Input' > click OK.)



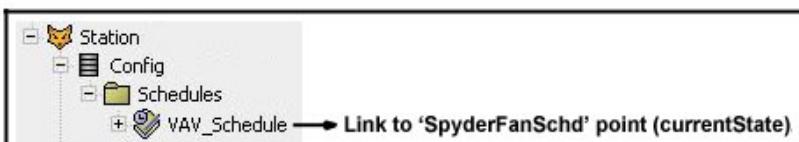
3. Name the point (eg, 'nviScheduleInput'). Set the other NV Input fields:

Fail Detect	True
Copy NV From	Standard NV
NV Type	SNVT_tod_event
Internal Data Type	SNVT_Occupancy

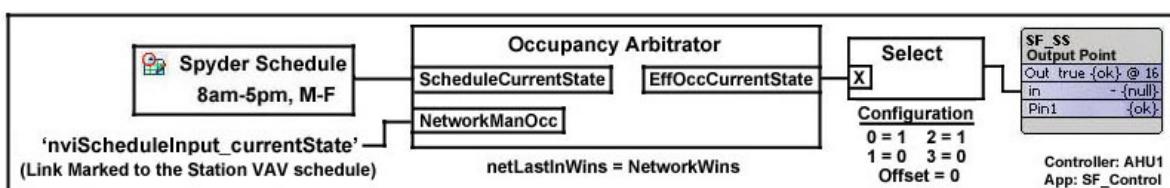
4. In the NVs window, expand the view of the new NV.
5. Select the 'currentState' > click 'Show on wiresheet as Points' button. Click the OK button to add the point.



6. Generate the NVs. (right-click the Spyder controller ('AHU1') > Actions > Generate NVs).
7. View the Points folder of the AHU1 Spyder controller. If points are not present in the window, click 'Discover'.
8. Locate the new schedule point ('nviScheduleInput').
9. Drag the 'CurrentState' to the Database window.
10. Rename the point (eg, 'SpyderFanSchdIn'). Note: facets are assigned to the CurrentState point. Ok to update to 'LonOccupancyEnum' for text listing of state (eg, 'Occ', 'Unocc').
11. Link Mark the Station VAV schedule (source) to the 'SpyderFanSchd' point (target). (to create a Station schedule, see the 'Scheduling' section).



12. Logic for SF\_Control Wire Sheet. The Occupancy Arbitrator object knows the logic of the Spyder Schedule, so a 'NOT' block is not required between them.



13. Validate the program and run the simulator.

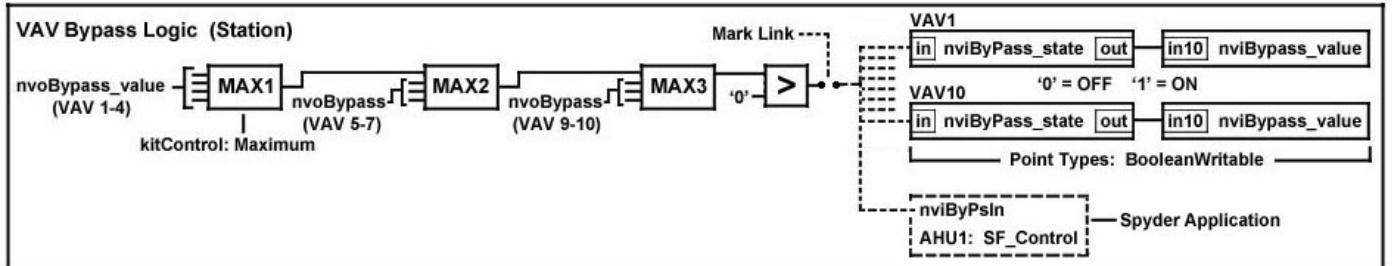
Note: other points from the Spyder can be proxied into the Station using the same method. Add the points to the Database window in the Points folder under the Spyder folder.

## AHU Example: Starting the fan in bypass + Commanding VAV's to Bypass Mode

The sequence of operation requires starting the supply and commanding ten (10) VAV zones to bypass mode when any one of the bypass buttons are pushed.

### Station Logic: VAV Bypass

1. In the Station VAV controller folder, create a new folder (eg, 'VAVBypass').
2. Proxy into the VAV controller the nviBypass point's 'State' and 'Value' field. Change the point types to 'Boolean Writeable'. Set the facets to 'On' and 'Off'. (Proxy process: Point Mgr. > drag point from Discover to DB pane).
3. Using the kitControl palette, add the following control logic to the Wire Sheet:



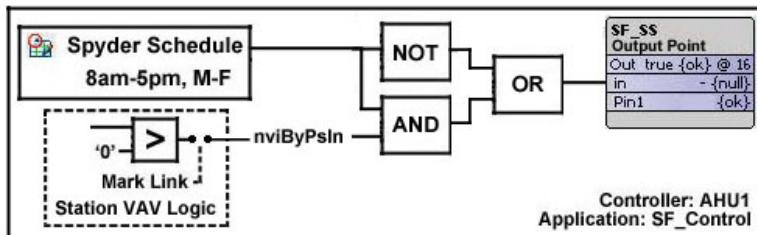
4. Link Mark the 'GreaterThan' object to VAV1's 'nviByPass\_state' point.
5. Connect the output of the 'nviByPass\_state' point to the in10 slot of the 'nviBypass\_value' point. In an XL10 controller, it is necessary to write a non-zero value to each of these data fields in order for the point to turn on. In Spyder programming, this is not performed when writing to a SNVT\_Switch network variable.
6. Copy the 'nviByPass\_state' and 'nviBypass-value' points and Paste Special the two points into the 'Points' folder in each of the VAV controllers (1-10). Choose 'Keep All Links' when pasting.

### Synder Logic: Bypass Fan Start

1. Open the NV Configuration View of the Application (right-click 'SF\_Control' > Views > NV Config. View).
2. Create a new NV Input point (click the 'Add NV' button > select 'Network Variable Input' > click OK.)
3. Name the point (eg, 'nviByPsln'). Set the other NV Input fields:

Fail Detect	True
Copy NV From	Standard NV
NV Type	SNVT_Switch

4. In the NVs window, select the nvi point.
5. Click on the 'Show on wiresheet as Points' button. Click the OK button to add the point.
6. Add the appropriate logic to the Spyder Application (eg, Fan\_Control).

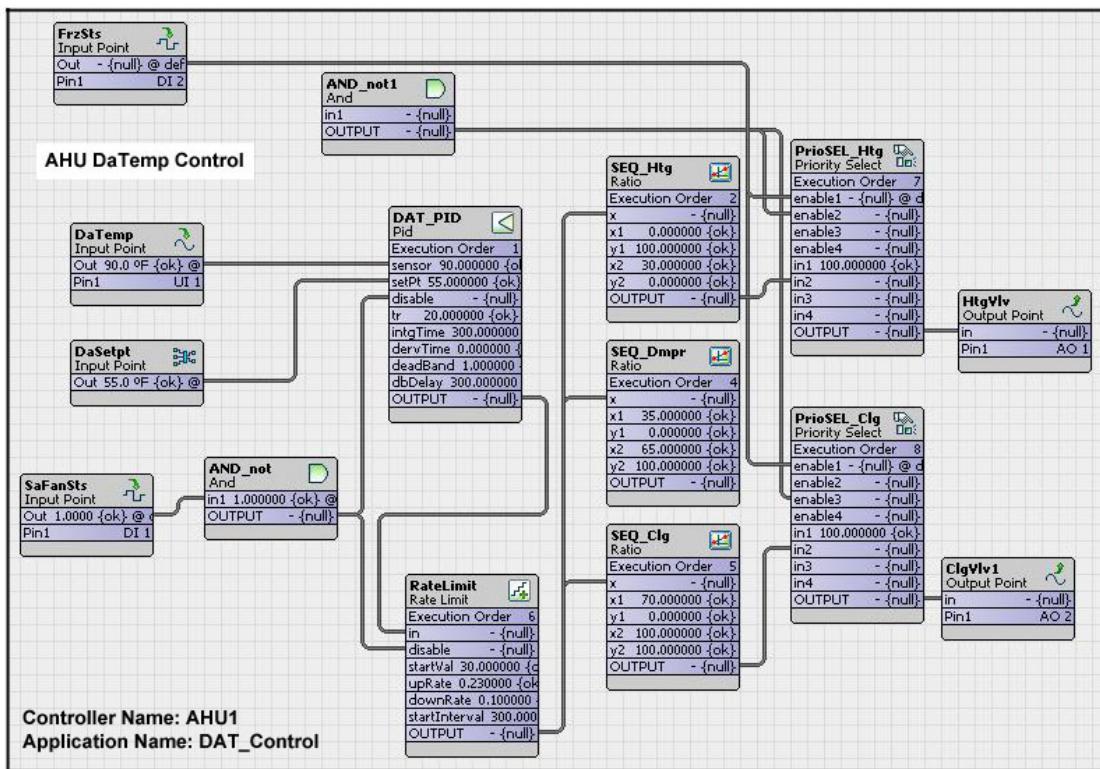


7. Generate NVs in the Spyder (right-click the Spyder controller ('AHU1') > Actions > Generate NVs).
8. Double-click the Spyder 'Points' folder. Proxy in the 'nviByPsln' point into the Station. Select 'BooleanWritable' as the point type with On/Off facets. Connect the 'Greater Than' object in the Station logic to the 'nviByPsln' point.

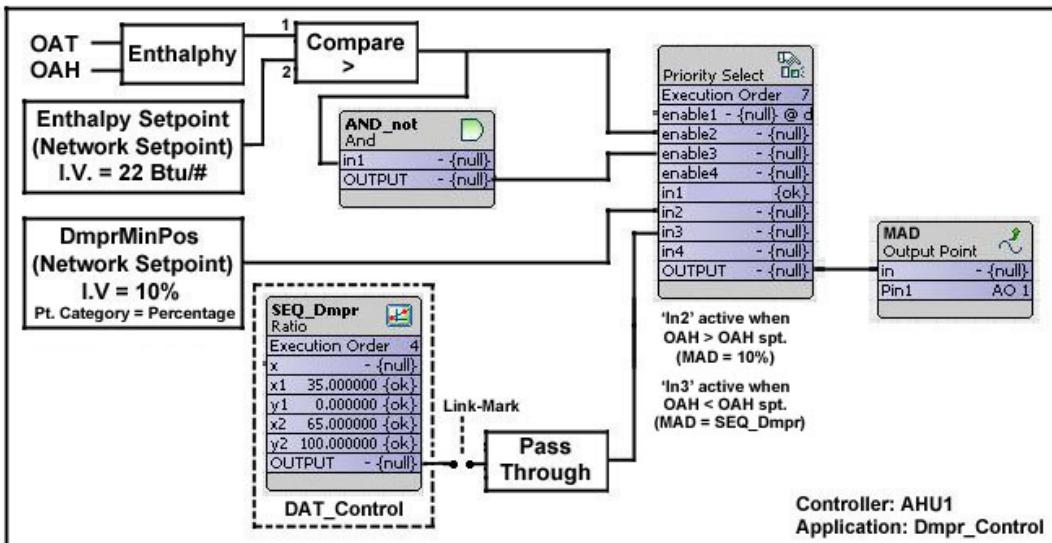
## AHU Example: DaTemp Control

Control objects selected from the following folders of the 'honeywellSpyderTool' palette:

Folder	Control Object
Control	PID
Math	Ratio
Analog	Priority Select
SoftwarePoints	Constant (DaSetpt)
PhysicalPoints	Binary Input (SaFanSts, FrzSts) Modulating Output (HtgVlv, ClvVlv) Modulating Input (DaTemp)



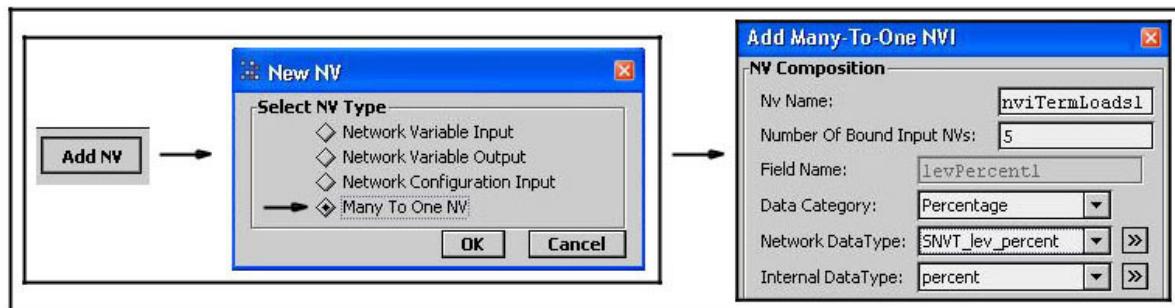
## AHU Example: Economizer



## AHU Example: Calculating the Max & Average Terminal Loads

The sequence of operation requires calculating the Minimum and Maximum terminal load values of ten (10) VAV zones.

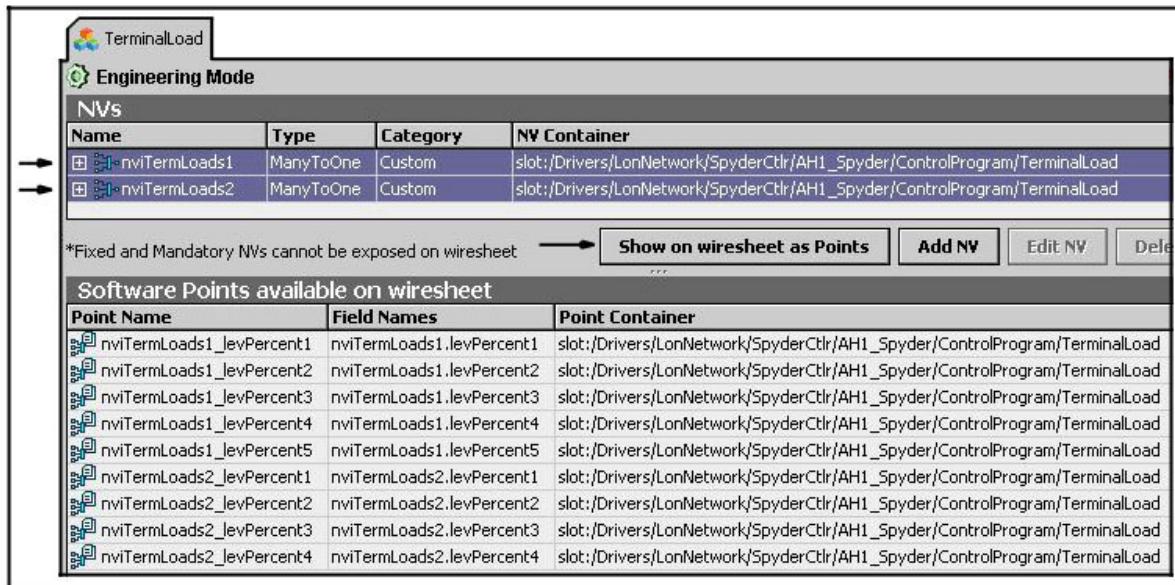
1. Create an Application to the AHU1 controller (eg, 'TerminalLoad').
2. Open the NV Configuration View of the Application (right-click on the application > Views > NV Config. View).
3. Create a Many-to-One NV point (click the 'Add NV' button > select 'Many to One NV' > click OK.)



4. Define the Nv Name (eg, 'nviTermLoads1'). Set the other Many-to-One fields:

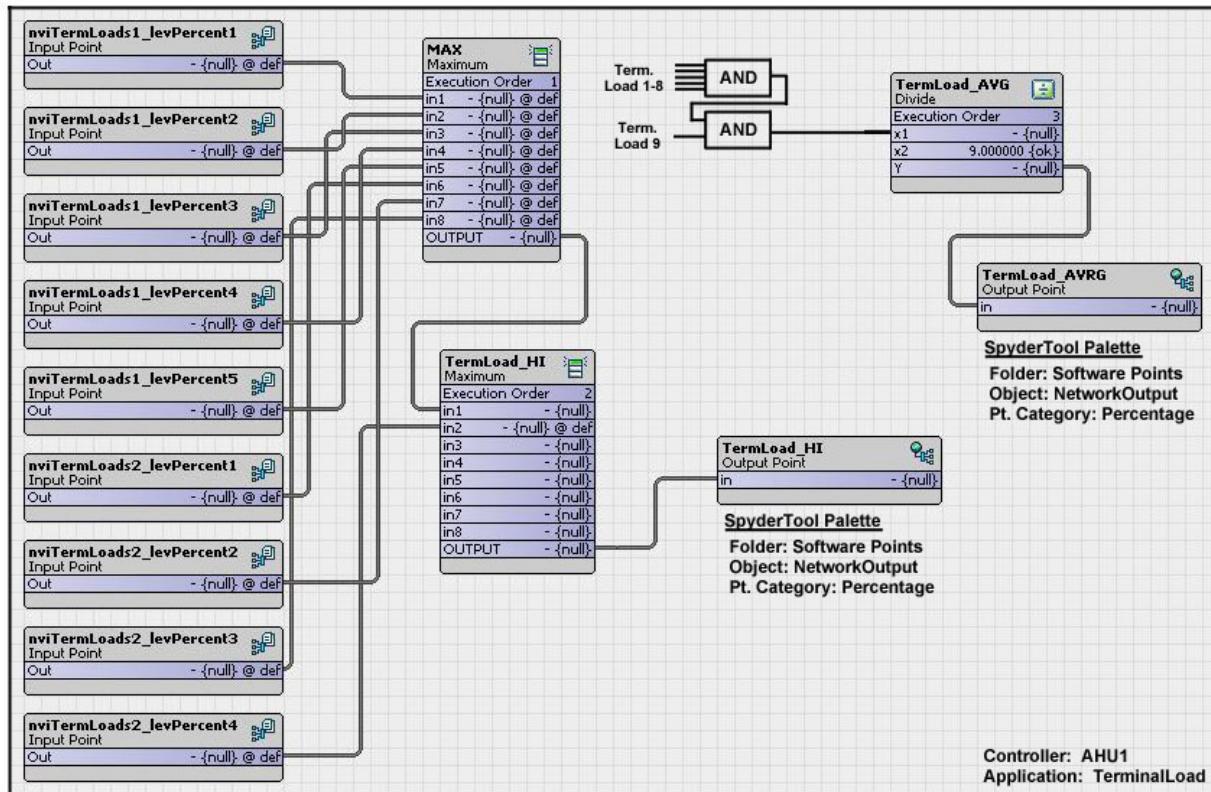
Number of Bound Input NVs	5 (max allowed = 8)
Data Category	Percentage
Network Data Type	SNVT_lev_percent
Internal Data Type	percent

5. Create another 'Many to One NV' NVI (step 3). Set the second point for 4 Bound NVs.
6. In the NV window click on the new NVs.
7. Click on the 'Show On Wiresheet as Point' button. Click OK.



## AHU Example: Calculating the Max & Average Terminal Loads Cont.)

8. Return to the Wire Sheet of the AHU1 controller's 'TerminalLoad' folder.
9. Add the following logic:



10. Before terminal load points in the VAV controllers can be binded to the new terminal load software points, the following needs to be performed:

1. Validate the application on the resource usage page to ensure that no errors are in the program.
2. Generate NVs. (right-click the Spyder controller > Actions > Generate NVs).
11. Bind the VAV 'nvoTerminalLoad' point to the 'nviTermLoad1' and 'nviTermLoad2' points:
  1. Open the Wire Sheet of VAV controllers.
  2. Link Mark the VAV controller's nvo Terminal Load point (source) to the nvi Terminal Load point (target). (right-click on the Source > 'Link To' > Select Target > use Link Window: link Source point to Target point).

Source Point (VAV Controller)	Target Point (Many-to-One Point)
'nvoTerminalLoad'	'nviTermLoads1_levPercent1'

3. Repeat the process for the remaining VAV controllers.
4. If errors occur, regenerate the Spyder NVs.
12. Edit the Network Outputs: 1) 'TermLoad\_HI', 2) 'TermLoad\_AVRG':
  1. Open the 'NV configuration View' of the 'TerminalLoad' application (right-click the application > Views).
  2. Verify the check box for 'Guaranteed Periodic Refresh' is checked.
  3. Set the 'Significant Event Notification' to 5%.

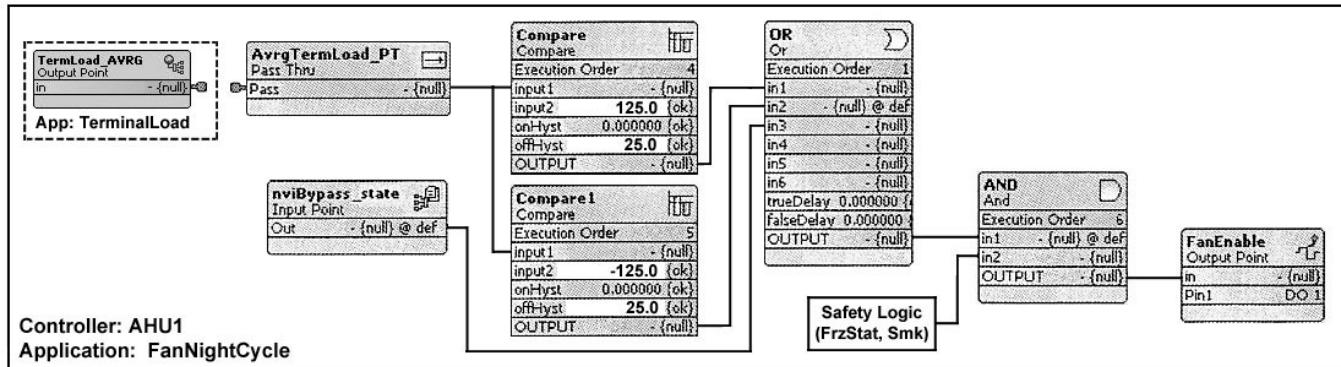
### AHU Example: Night Cycle

The sequence of operation requires that the supply be commanded ON when the room temperature drops below the unoccupied heating setpoint or rises above the occupied cooling setpoint.

To assure that the VAV terminals ask for heating or cooling before the fan starts up, the Terminal Load Average is used (see previous example).

The LonMark 'TerminalLoad' address reports the demand for supply energy. Positive numbers are cooling demand and negative numbers are heating demand. 100% is the maximum for the terminal capacity (damper/htg. valve at 100% setting). Terminal loads greater than 100% indicate that the terminal is not able to supply the required heating or cooling energy. The limits of 'TerminalLoad' is -163.8% to +163.8%.

The two Compare objects have setpoints of 125% and -125% with a deadband of 25% (offHyst) which turns the off the fan when the average terminal load is 100% or -100%.



### AHU Example: Sharing a Point Value from the Spyder to a Lon Device

The sequence of operation requires to start an exhaust fan when the supply fan is started. The exhaust fan is terminated on a digital output of a Lon device (eg, XL10 controller).

1. Open the Lon configuration property sheet or the configuration wizard for the Lon device (double-click it).
2. Configure the D.O. point (eg, Free1).
3. Open the NV Configuration View of the supply fan Application (right-click 'SF\_Control' > Views > NV Config. View).
4. Create a new NV Output point (click the 'Add NV' button > select 'Network Variable Output' > click OK.)
5. Name the point (eg, 'nvoExhFan'). Set the other NV Output fields:

Guaranteed Period Refresh	True
Message Service	UnackedRpt (repeated)
Copy NV From	Standard NV
NV Type	SNVT_Switch
Internal Data Type	(default)

5. In the NVs window, select the new nvo point.
6. Click on the 'Show on wiresheet as Points' button. Click the OK button to add the point.
7. Generate NVs in the Spyder Controller (right-click the Spyder controller > Actions > Generate NVs).
8. Link Mark the Spyder controller.
9. Right-click the XL10 controller > choose Link From <AHU1>.
10. Connect the 'nvoExhFan' point to the 'nviFree1' input on the XL10 controller.
11. Use the Link Manager to bind the connection.

## Pump Lead-Lag Example

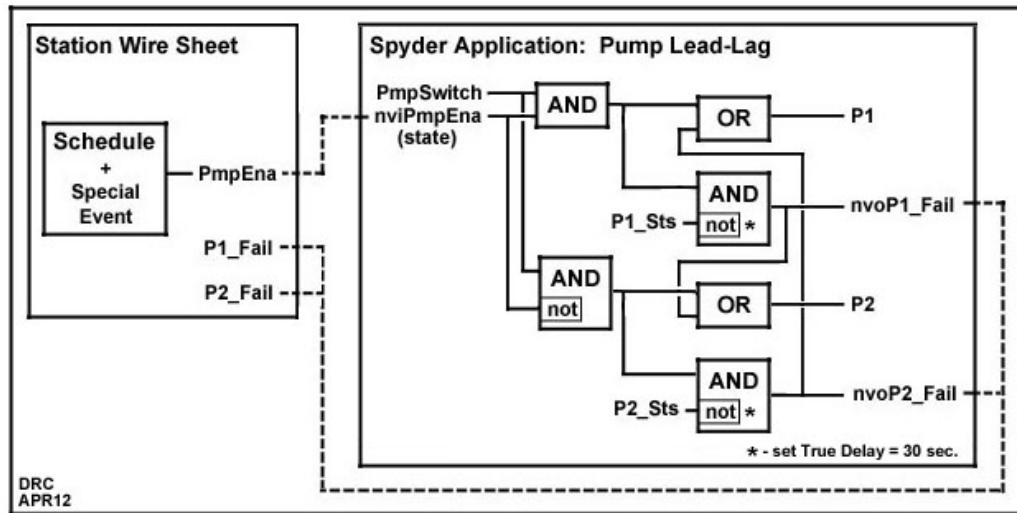
The sequence of operation requires a pump lead-lag based on monthly date change.

### Spyder Tool

1. Create a new Spyder Application (eg, Pump Lead-Lag).
2. Add the control logic from the 'honeywellSpyderTool' palette.
3. Create nvi and nvo with the 'Add NV' button. Configure the both nv types to be SNVT\_Switch. Configure the nvo fail points to use 'Acknowledge' service and guaranteed refresh.
4. In the NVs window, select the 'nviPmpEna' and click the 'Show on wiresheet as Points' button.
5. Use the Action command and 'Generate NVs' to create the NVs.

### Workbench Tool

1. Proxy the nv points (created with the Spyder Tool) into the Station using the Discovery + drag/drop process.
2. Set the schedule facets to P1Lead and P2Lead. Set the default output setting to P1Lead.
3. Click the Special Events tab in the schedule. Name the Event 'P2LeadJAN'. Type = Date. Configure the settings: Any Weekday, Any Day, January, Any Year. Set the event to P2Lead.
4. Click the Special Events tab in the schedule. Name the Event 'P2LeadMAR'. Type = Date. Configure the settings: Any Weekday, Any Day, March, Any Year. Set the event to P2Lead.
5. Repeat the process to create a special event for every other month, setting pump 2 as the lead pump.
6. Cut the Schedule from the wire sheet and paste it into the Schedule folder (optional).

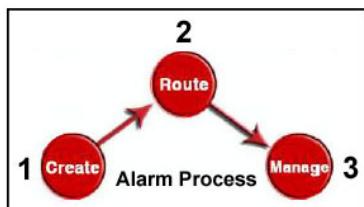


Note: see 'Basic Steps-Customization' for Lead-Lag composite built with out-of-the-box Niagara logic.

## ALARMS

Technical Document: Niagara AX-3.x User Guide, Ch. 5

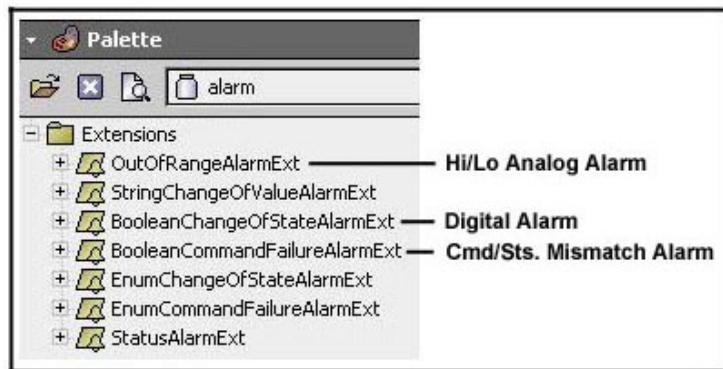
### ALARM PROCESS



#### 1 – CREATE

##### Adding an Alarm Extension to a Point

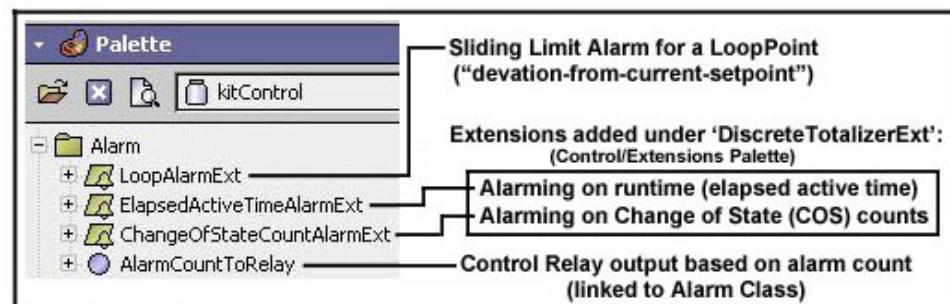
1. Select the 'Alarm' Palette.
2. Expand the 'Extensions' folder.



3. Expand the device 'Points' Container folder.
4. Open the property sheet of the appropriate point.
5. Drag the appropriate Alarm Extension on to the point (point turns green).
6. Name the Alarm Point.

More alarm extensions are available in the kitControl palette (Alarm folder).

Technical Document: Niagara AX-3.6 kitControl Guide, 1-4.



#### Enable Alarm & Define Properties

1. Expand the Alarm Point & define the alarm extension properties (see table next page).
2. 'Alarm Enable': Set to True.
  - 'toOffnormal': select for Alarms (point changes to Red).
  - 'toFault': select for Fault alarm (point changes to Orange).
3. 'Algorithms': 1) Hi/Lo limits, 2) Hi/Lo text, 3) Hi/Lo Limit Enable.
4. 'Alarm Class': set the Alarm Class for efficient Alarm Routing.
5. Save the changes.

## Alarm Extension Properties

Alarm Ext. Property	Description
Alarm Inhibit	'False' = Alarm Active. 'True' = Alarm Inactive (use external logic to inhibit alarm)
Inhibit Time	Delay time during True-to-False or False-to-True transition
Alarm State	Current Alarm state
Time Delay	Min. time for an alarm condition to exist before the alarm is sent.
Alarm Enable	'toOffNormal': "Alarm" status. Point in Red. 'toFault': "Fault" status. Point in Yellow.
To Offnormal Times	Timestamps for Alarm, Ack or Normal Events. 'Null' = No Event.
To Fault Times	Timestamps for Alarm, Ack or Normal Events. 'Null' = No Event.
Time In Current State	Elapsed time since transition to current stat.
Source Name	Add direct text or B-format text (see below)
To Fault Text	"Fault" state text.
To Offnormal Text	Add direct text or B-format text (see below)
To Normal Text	Normal state text.
Hyperlink Ord	Associate Hyperlink button. Test by clicking Arrow icon.
Sound File	Associate Sound file. Test by clicking Arrow icon.
Alarm Icon	Associate Graphic file. Test by clicking Arrow icon.
Alarm Instructions	Additional alarm instruction text.
Fault Algorithm	Parameters: 1) Hi/Lo Limits, 2) Hi/Lo Text, 3) Hi/Lo Enable
Offnormal Algorithm	Hi/Lo parameters for numeric; on/off parameters for Boolean (eg, sts. fbk)
Alarm Class	Alarm routing options. See 'AlarmService' (Config > Services)
Meta Data	To create new facets using meta data.

B-format options:

Source Name: %parent.parent.parent.name%\_%parent.name% (lists controller + point name)

Offnormal Text: %alarmData.sourceName%

(see 'Section 8 - Histories' for B-Format overview)

## Alarm Extension Examples

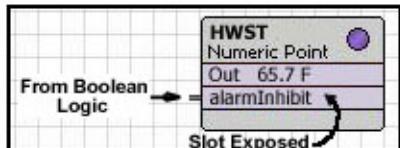
### To enable alarm based on Command & Status

1. From the Alarm palette add the "BooleanCommandFailureAlarmExt" to Pump S/S point .
2. Expose 'Feedback value' slot (Composite Editor)
3. Link Pump Status point to 'Feedback value.'
4. Set the Alarm Class.

### Inhibit Temperature Alarm

Goal: prevent low temp. alarm when boiler is off.

1. From the Alarm palette add the "OutOfRangeAlarmExt" to the temperature point (eg, HWST).
2. Open the wiresheet view that shows the temperature point.
3. Use the Composite Editor to expose the 'Inhibit Alarm' slot on the temperature point.



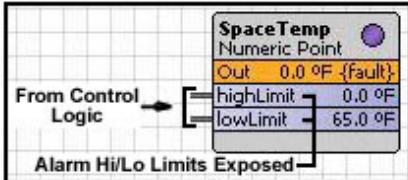
4. Connect the 'Inhibit Alarm' slot to the appropriate Boolean logic (eg, boiler status, SysEna, schedule, etc).
5. Set the Alarm Class.

## Alarm Extension Examples Cont.)

### Dynamic Alarm Setpoints

Goal: alarm setpoints are modified by control logic.

1. From the Alarm palette add the “OutofRangeAlarmExt” extension to the numeric point.
2. Open the property sheet: enable the High Limit and Low Limit function by clicking the boxes.
3. Open the wireshheet to show the numeric points.
4. Use the Composite Editor to expose the High Limit and Low Limit slots.



5. Connect the HI & LO slots to the appropriate logic (eg, NumericSwitch).
6. Set the Alarm Class.

### 'Floating' PV-SP Alarm

Goal: generate an alarm when the setpoint (SP) and the temperature (PV) deviate by more than 15 degrees.

1. From the “KitControl-Alarm” palette add the “LoopAlarmExt” to the LoopPoint (PID controller).
2. Configure the extension’s ‘Offnormal Algorithm’:
  - ‘Off Normal Error Limit’: 15
  - ‘Deadband’: 5
3. Set the ‘To Offnormal Text’ to the appropriate text (eg, “Setpoint Deviation too Large”)
4. Set the Alarm Class.

### Runtime Alarm

Goal: generate an alarm when a pump runs for more than 5 minutes.

1. From the "KitControl-Extensions" palette add the "DiscreteTotalizerExt" to the pump point.
2. From the “KitControl-Alarm” palette add the “ElapsedActiveTimeAlarmExt” to the totalizer extension.
3. Configure the ‘Offnormal Algorithm’. Set the Error Limit to 5 minutes.



## **2 – ROUTE**

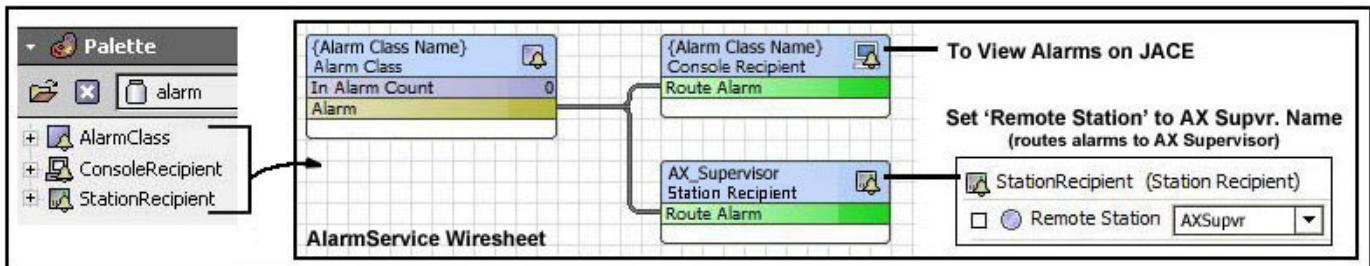
The “Default Alarm Class” object is automatically created (under the ‘AlarmService’). It can exist by itself, but ALL alarms will get sent everywhere. To segregate alarms unique Alarm Classes must be created (eg, CH\_Alarm, Alarms\_to\_Email, etc).



### **AlarmService Setup**

1. Open the wireshheet of the ‘AlarmService’ (Config > Services > AlarmService).  
(if the ‘AlarmService’ is not present, add it from the ‘Alarm’ palette).
2. From the Alarm palette, add the following to the AlarmService wireshheet.
  1. Alarm Class.
  2. Console Recipient (to view alarms on the JACE)
  3. Station Recipient (to route JACE alarms to the AX Supervisor or other Stations)

## AlarmService Setup Cont.)



3. Update the Alarm Class and Recipient names. (eg, Critical\_Alarms, CH\_Alarms, Blr\_Alarms, AX\_Supervisor, etc). (note: the new 'Alarm Class' names will appear in the drop-selection of the 'Alarm Class' within the point's AlarmExt).
4. Link the Alarm Class to the appropriate Console Recipient and Station Recipient.
5. Set the StationRecipient 'Remote Station' to the appropriate Supervisor (or other remote Station). This permits routing of JACE alarms to the AX Supervisor.

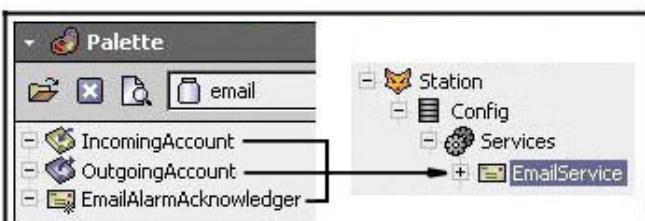
### Emailing Alarms

Technical Document: Niagara AX-3.x User Guide, 5-16

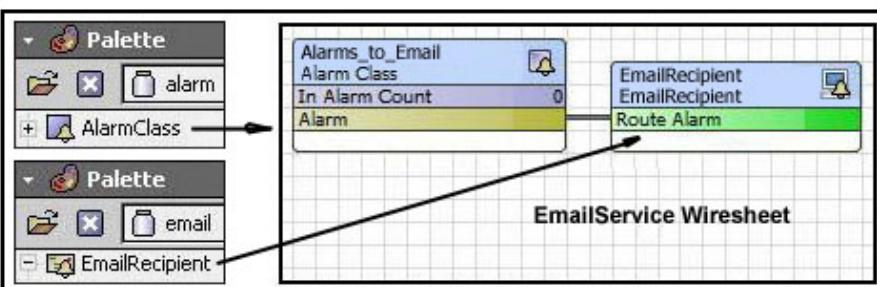
1. Open the Email palette.
2. Add an 'EmailService' to the 'Services' folder of the Station.



3. Add the following to the EmailService:
  1. 'IncommingAccount'.
  2. 'OutgoingAccount'.
  3. 'EmailAlarmAcknowledger'.



4. Configure the accounts. OutgoingAccount: add email address (property sheet).
5. From the Alarm palette, add an AlarmClass to the EmailService wiresheet.
6. From the Email palette, add an Email recipient to the EmailService wiresheet.

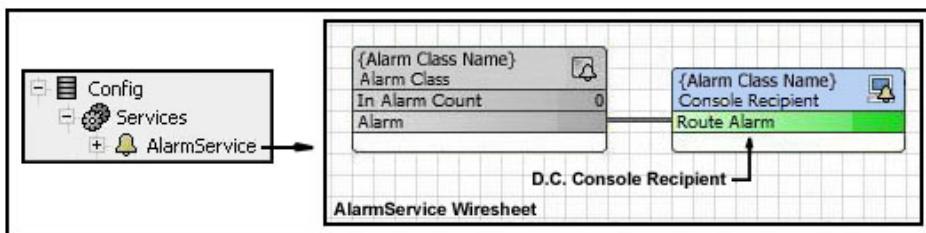


7. Update the Alarm Class and Recipient names. (eg, Alarms\_to\_Email).
8. Connect the 'Alarm' output slot to the 'Route Alarm' slot of the Email Recipient.
9. In the Email Recipient property sheet configure:  
"To:" add email address.  
"Subject": Text + B-format + UUID: %uuid% (required for the EmailAlarmAcknowledger to work properly; last entry identifies all similar alarms).

### 3 – MANAGE

#### VIEW: Alarms

1. Open the Wire Sheet of the 'AlarmService' folder.
2. Double-click on the appropriate 'Console Recipient' (or R.C. > Views > Alarm Console).



3. Review &/or acknowledge the alarms.

Open Alarm Sources			
Timestamp	Source State	Ack State	Source
20-Aug-09 11:52:43 AM EDT	Offnormal	0 Acked / 12 Unacked	HW_Temp
19-Aug-09 8:35:16 PM EDT	Normal	0 Acked / 1 Unacked	BacnetNetwork.BAC_AX_0

#### Alarm Color Legend

Bell Color	Alarm Status	Acknowledged
Red	Alarm	No
Orange	Fault	No
Tan	Alarm/Fault	Yes
Green	Normal	No
No bell	Normal	Yes

#### REMOVE: Alarms

1. To remove an alarm: Right-click the alarm > 'Force Clear'

#### Alarm Service Views

1. Right-click the 'AlarmService' > 'View'.

The screenshot shows a 'View Selector' dialog box. On the left is a tree view of nodes: Station, Home, Config, PxHome, Services, and AlarmService. A bracket on the right groups the 'Services' and 'AlarmService' nodes. To the right of the selector are six items:
 

- Wire Sheet** — to view all the alarm extension (use the refresh button)
- Alarm Ext Manager** — # of past & present alarms; unack'd alarms; timestamp.
- Alarm Instructions Manager** — to remove alarms. Select 'Run Maintenance'.
- Alarm Class Summary** — to view alarm status (double-click alarm for better presentation)
- Alarm Db Maintenance** — to histories in the History node.
- Alarm Db View** — select an alarm; double-click to view details

Alarm Service View	Description
Alarm Ext Manager	To view all the alarm extensions. note the 'toOffNormalEnabled' setting for each alarm extension.
Alarm Db Maintenance	to histories in the History node.
Alarm Db View	select an alarm; double-click to view details

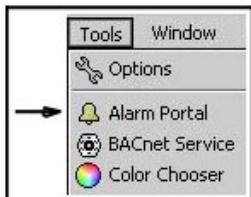
#### To Create Alarm PDF File

Click the 'Export' button on the button bar and 'Export' the console to pdf. Close the Reader after reviewing the report.

## Configuring the Alarm Portal

The alarm portal is a separate software program which permits viewing and acknowledging alarms from many different Stations (can be purchased separately). It is not necessary to have a Station opened to run Alarm Portal. It is configured by connecting to the Console Recipient. An Alarm Portal icon appears in the system tray when active.

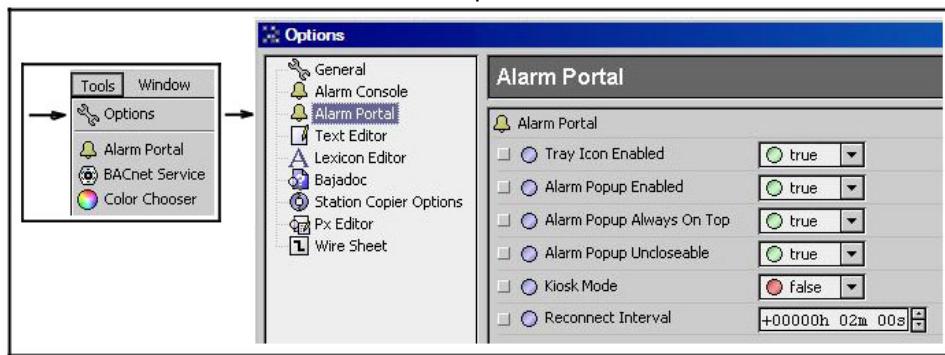
1. Workbench Tools Menu: select Alarm Portal



2. In the white space in the Alarm console Monitor window, right-click and choose 'Add Alarm Console'.
3. Type in the IP address of the appropriate PC.
4. Add a username and password as needed.
5. Click Next.
6. Select the console you wish to monitor. Click the Finish button.
7. Review and acknowledge the alarms that are displayed.
8. To remove the Alarm console from the monitor window: right-click on the console, choose 'Remove Alarm Console'.
9. Close the Alarm Portal by opening a different window in the workbench.

## Alarm Portal Options

Workbench Tools Menu: select Tools > Options

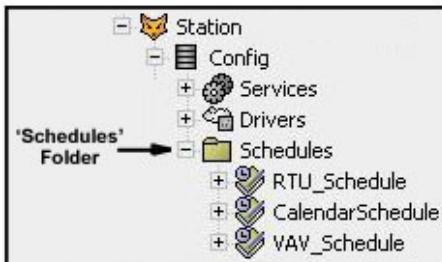


## SCHEDULING

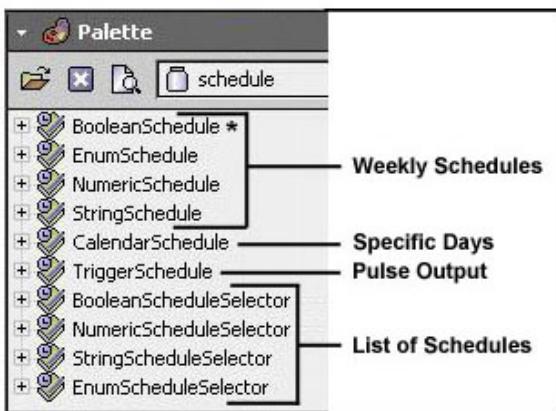
Technical Document: Niagara AX-3.x User Guide, Ch. 8

### Adding a Schedule

- If the schedule is to control multiple units it is best to create a 'Schedules' folder under the 'Config' folder (outside the 'Drivers' node). Duplicating a controller with the schedule in the 'Points' container will result in multiple schedules – conflicts with a master schedule requirement (also easier to locate the schedule).

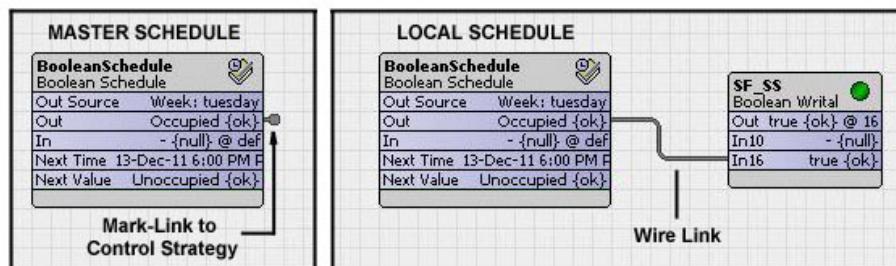


- Open the schedule Wire Sheet.
- Open the Schedule palette:

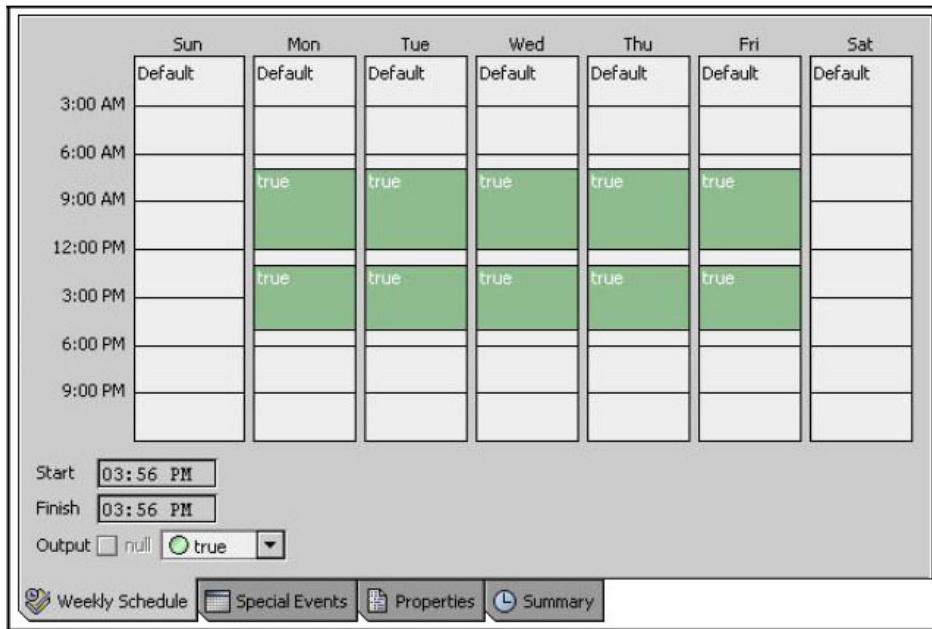


Category	Schedule	Description
Weekly	BooleanSchedule	The most used weekly schedule. Control BooleanWritable point (eg, AHU S/S, SysEna).
	EnumSchedule	Control EnumWritable point (multi-state). (note: the Facets must match).
	NumericSchedule	Control a NumericWritable point (eg, setpoints, limits).
	StringSchedule	Control a StringWritable point (eg, text message).
Calendar	CalendarSchedule	Schedule specific days (eg, Holidays, special events). Links to Weekly 'Special Events' (Reference).
Trigger	Trigger Schedule	Schedule a trigger (pulse output) for a specific time and date (eg, reset runtime and end of month).
Selector	BooleanSchedule	Provides a list of schedules to control BooleanWritable points.
	EnumScheduleSelector	Provides a list of schedules to control EnumWritable points.
	NumericScheduleSelector	Provides a list of schedules to control NumericWritable points.
	StringScheduleSelector	Provides a list of schedules to control StringWritable points.

- Place the schedule on the Wire Sheet and name it. Assign the facets (eg, Occupied, Unoccupied).
- Link the schedule to the appropriate logic.



6. Configure the schedules' time-of-day and day-of-week.



### Adding a Calendar Schedule

Calendar Schedules are used for holidays or special events.

1. From the Schedule palette drag a 'CalendarSchedule' on to the Wire Sheet. Name the schedule (eg, Xmas).
2. Set the Date (eg, 25DEC).
3. Double-click the weekly schedule (eg, Boolean Schedule). Select the 'Special Events' tab (used to link the weekly schedule to the calendar schedule).
4. Click the 'Add' button.
5. Name the Event.
6. Select the Type. Drop-down menu: 'Date', 'Date Range', 'Week And Day', 'Custom', 'Reference' (for Holidays use 'Reference').
7. The 'Calendars' field will list the various Calendar Schedule(s). (eg, slot:/Schedules/HolidayCalendarSchedule).
8. Set the Time (right side). Save.

Add Event Name      Select "Reference" for Holidays      Set the Time

Add

Name: Event  
Type: Reference

Date Range  
Week And Day  
Custom  
Reference

Calendars: CalendarSched

9:00 AM  
12:00 PM  
3:00 PM  
6:00 PM  
9:00 PM 72.0 °F

Event Start: 09:00 PM  
Event Finish: 12:00 AM  
Event Output:  null  72.0 °F

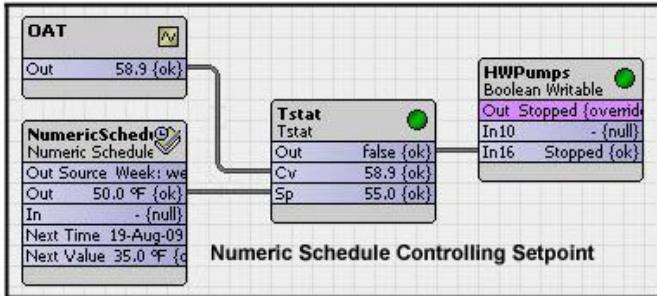
Weekly Schedule Special Events Properties Summary

Click on the calendar schedule to select it. Otherwise the reference will be Null, and it won't work.

Note: Use 'priority' button to arrange the order in the list to resolve conflicts.

## Schedule Examples

### Numeric Schedule Controlling Setpoint



### Schedule Override

1. Place a BooleanWritable point on the Wire Sheet. Name the Point (eg, SchedOverride). Assign the facets.
2. Connect the SchedOverride point to the **In** slot on the BooleanSchedule.
3. Right-click the SchedOverride point and choose Cut.
4. Open the Wire Sheet view of the BooleanSchedule.
5. Right-click the Wire Sheet and choose Paste. Return to the main Wire Sheet.
6. Open the Composite editor for the BooleanSchedule.
7. From the SchedOverride point, composite out:
  - Active slot. Rename to 'Override to Occ Mode'.
  - Inactive slot. Rename to 'Override to Unocc'.
  - Auto slot. Rename to 'Auto Schedule Mode'.

### Configuring a Global Schedule

#### Part 1 – Creating the Schedule That Will Be Shared

1. In the Supervisor Station, under the Config node, create a folder called 'GlobalSchedules'.
2. From the Schedules palette, add a Boolean schedule to the GlobalSchedules Wire Sheet (don't use the "New" menu to create the schedule).
3. Rename it 'GlobalBooleanSchedule'.
4. Set the Occupied times and dates.

#### Part 2 – Sending the Schedule to the JACE

1. In the station on the JACE, expand the view of the AXSupervisor station in the Niagara Network.
2. Double-click the Schedules node under the AXSupervisor station. Click the 'Discover' button to see the schedules in the AXSupervisor station that can be shared.
3. Drag the Boolean Schedule into the Database window. Note the 'Last Success' display.
4. Right-click the Boolean Schedule in the Database window. In the menu, select the 'Import' item.
5. In the NAV side bar, expand the view of the station in the JACE. Expand the view of the Niagara Network. Expand the view of the Schedules node of the AXSupervisor station. You should see the imported Boolean schedule.
6. Double-click the Boolean Schedule to see the scheduled events. Note that the events cannot be modified here (special event can be set up).
7. In the Niagara Network on the JACE, right-click the 'GlobalBooleanSchedule' node. Choose 'Views', then Property Sheet. Expand the ext of the object, expand the Execution Time folder. Note the Trigger Mode and Interval settings. Typically these setting are set for Manual (the Supervisor will automatically push the schedule to the JACE within 5 minutes of a schedule change. An Interval import can be set up to assure synchronization.

#### Part 3 – Using the Global Schedule in the JACE

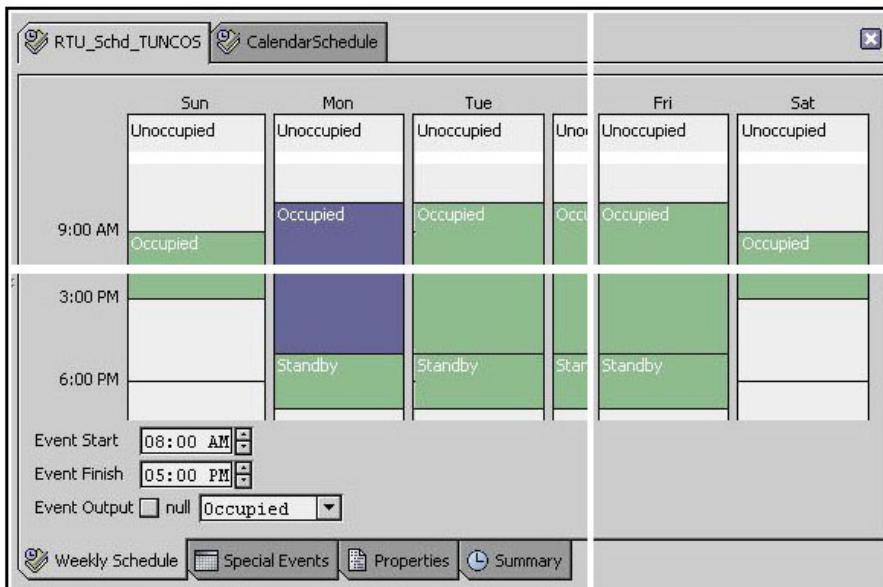
1. Right-click the imported schedule in the JACE's Niagara Network and choose Link Mark.
2. Create a new folder called 'GlobalSchedule' under the Config node in the station running on the JACE. Open the Wire Sheet of this folder.
3. Add a BooleanWriteable point to the Wire Sheet. Assign appropriate facets to the point.
4. Right-click the new BooleanWritable point. Choose Link From "GlobalBooleanSchedule". Note the updating of the points value when the link is complete.

## Add a Schedule to Application Specific Controller

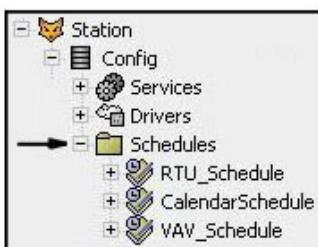
Two ways to add a schedule to a Honeywell XL10: 1) Personal Palette Method, 2) Direct LON Schedule.

### Personal Palette Method

1. Open the Wire Sheet of the Controller (eg, CVAHU, VAV)
2. Open the Schedule palette.
3. Drag and drop a CalenderSchedule block onto the wire sheet.
4. Configure the holidays.
5. Open the personal palette called Schedule with TUNCOS (Time Until Next Change of State).
6. Add the EnumScheduleWithTUNCOS palette to the XL10 controller's Points folder.
7. Rename the schedule 'XL10\_Schedule'
8. In the schedule, click the Properties tab (bottom).
9. Set the Facets for 'Lonworks: LonOccupancyEnum'.
10. Deselect the Null check box for the Default Output and set the field to Unoccupied.
11. Click the Weekly Schedule tab and set the Occupied and Standby periods.



12. Click the Special Events button.
13. Add a reference to the Calendar Schedule created in step #4.
14. Set the event to be an All Day unoccupied event.
15. Click the Save button.
16. Return to the XL10 Wire Sheet.
17. Connect:
  - The out slot (Current State) in the schedule to the in16 slot on the Current State point.
  - The next Value (Next State) output on the schedule to the in16 slot of the NextState point.
  - The TUNCOS slot to the in16 slot on the TUNCOS point.
18. Create a new folder called Schedules under the Config node in the station (R.C. Config > New > Folder)
19. Cut the calendar and the XL10 schedules from the wire sheet and past them into the new Schedules folder:



20. Open the XL10\_Schedule's Scheduler view > Open the Special Events tab.
21. Record the ORD for the Reference holiday event (ORD no longer valid since the Calendar Schedule was moved). (double-click the event to open the Edit view).
22. From the list, choose the Calendar Schedule in its current location.

### Direct LON Schedule

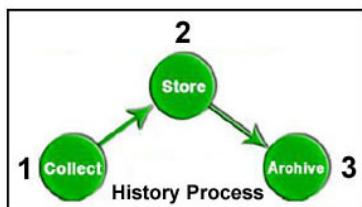
1. Open the 'honeywellVenomLon' palette. Copy the Direct LON Schedule object onto the LonNetwork in the station.
2. Double-click the schedule to open it.
3. Set the schedule hours for Occupied, Standby & Unoccupied.
4. Add a Reference special event that references the Calendar schedule in the Station. Set the event to have the schedule output Unoccupied for all 24 hours.
5. LinkMark the schedule.
6. R.C. the XL10 controller > select 'Link From DirecLonSchedule'.
7. Choose 'TodEvent' as the source point and 'nviOccSchedule' as the destination point.
8. Complete the Link. The Direct Lon Schedule will only work properly after the bindings are complete.  
For Spyder controllers, rebinding is required after any Spyder controller download.



## HISTORIES

Technical Document: Niagara AX-3.x User Guide, Ch. 4

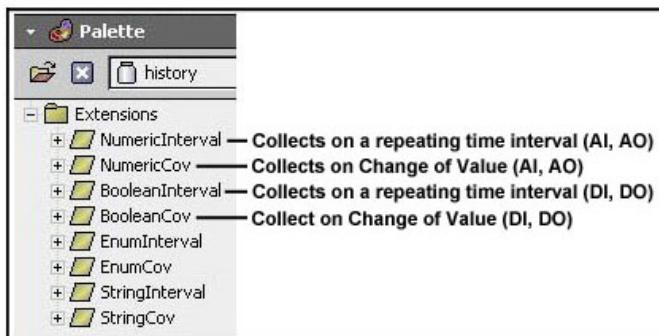
### HISTORY PROCESS



#### 1 – COLLECT

##### Adding a History Extension to a Point

1. Select 'history' Palette.
2. Open 'Extensions' folder.



3. Expand the device 'Points' container folder.
4. Open the property sheet of the appropriate point.
5. Drag the appropriate History Extension on to the point (point turns green). Time Interval histories forces a network request; potential to over-poll the point before it changes which can create excess network traffic. COV histories collect data only when the value has changed (change delta definable).
6. Name the History Point.

Note: extensions can be copied and pasted to a similar type of point.

#### Define History Properties

1. Open the Property Sheet of the point.

2. Expand the History Extension. Define the properties:

Enable = True

History Name = use BFormat; see below.

Capacity = 500 (default)

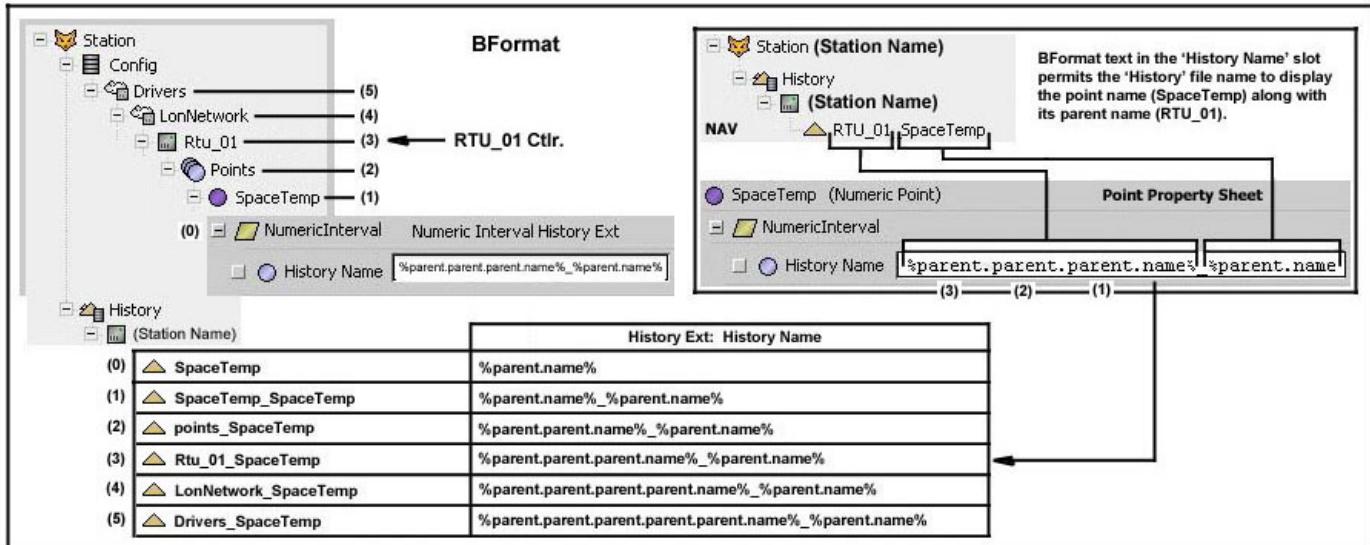
Collection Interval = 5 min.

This screenshot shows the property sheet for a 'SpaceTemp (Numeric Point)' object. The 'History Extension' section is expanded, showing a 'Proxy Ext' entry for 'nvoCtlDataG2/SpaceTemp'. The 'Enabled' section is also expanded, showing 'true' selected for 'Enabled'. The 'Use BFormat' section is expanded, showing the 'History Name' field set to '%parent.parent.parent.name% %parent.name%' and the 'BFormat text' field set to '%parent.parent.parent.name% %parent.name%'. To the right, a detailed 'History Config' configuration window is open, showing settings like 'Record Type: history', 'Capacity: 500', 'Interval: regular', and 'Precision: 32 bit'. The 'Last Record' field shows '17-Nov-2012 04:12 PM PST' with a value of '75.64'. The 'Interval' field shows '00000h 05m 00s [1ms - +Inf]'.

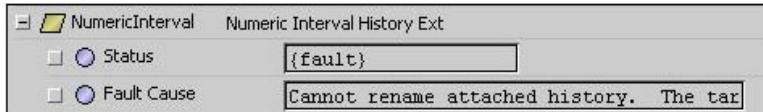
## Define History Properties Cont.)

3. To permit auto placement of the point name with the controller name (or plant name), Bformat (Baja-format) text is used in the 'History Name' field of the history extension property sheet.

The example below shows an RTU controller (RTU\_01) with a temperature point ('SpaceTemp'). For the history point record to display "RTU\_01\_SpaceTemp" the BFormat text is: %parent.parent.parent.name%\_%parent.name%. The NumericInterval history extension is at 'Level 0'. 'SpaceTemp' is at 'Level 1'. 'Points' is at 'Level 2'. Since 'Rtu\_01' is at 'Level 3', three (3) bformat 'parents' are required in the header (before %parent.name%).

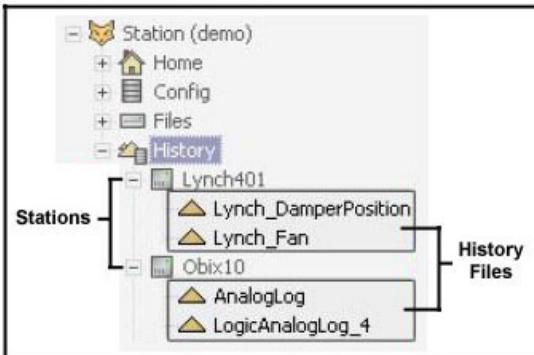


Note: a fault condition will occur if the history names are similar. Similar name faults can occur if points with BFormat text are relocated to different folders.



## 2 – STORE

Histories are organized by their source Station.

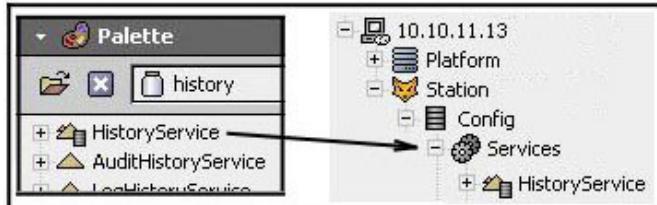


## History Service

To use histories, each station must contain a single history service that provides http access to all of the histories in a station. The service is responsible for creating the history database and enabling the collection and storage of histories in the database.

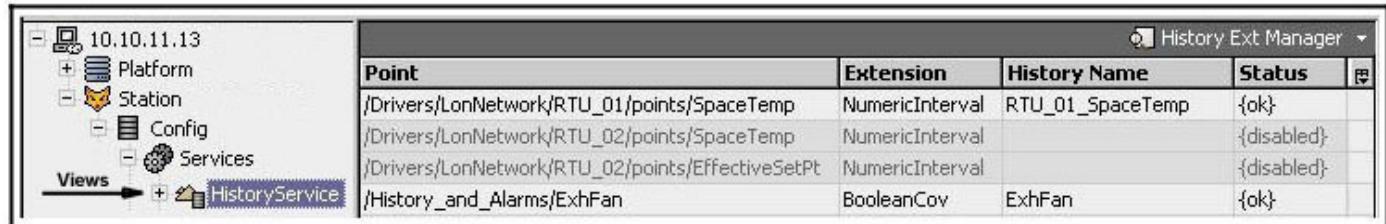
## History Service Cont.)

To add the History Service, drag a copy from the History palette to the Station's 'Services' node.



### **Enable History Collection**

1. Open the 'History Extension Manager' (right-click 'HistoryService' > Views)
2. Check 'Status' column for faults (view 'Fault Cause' in the point's History Extension)



3. Select the appropriate histories.
4. Right-click > select 'Enable Collection'.
5. Verify history points in the main 'History' node.

### **Renaming Points or Controllers**

The History Service must be updated if controllers or points are renamed.

1. Open the History Service (Config > Services > History Service).
2. Select all the updated points.
3. Toggle the status: Enable → Disable → Enable.

### **Audit History Service**

The Audit History Service keeps a history of the changes that are made by users. When this service is enabled it becomes the system auditor (Operator Activity Log). To add the Audit History Service, drag a copy from the History palette to the Station's 'Services' node. Default: 500 entries.

### **Log History Service**

The Log History Service keeps a History of Niagara log records. The service maintains a buffered history ('LogHistory') of some of the messages seen in the station's standard output. Helpful for troubleshooting (ie, error message review). To add the Log History Service, drag a copy from the History palette to the Station's 'Services' node.

### **View Histories**

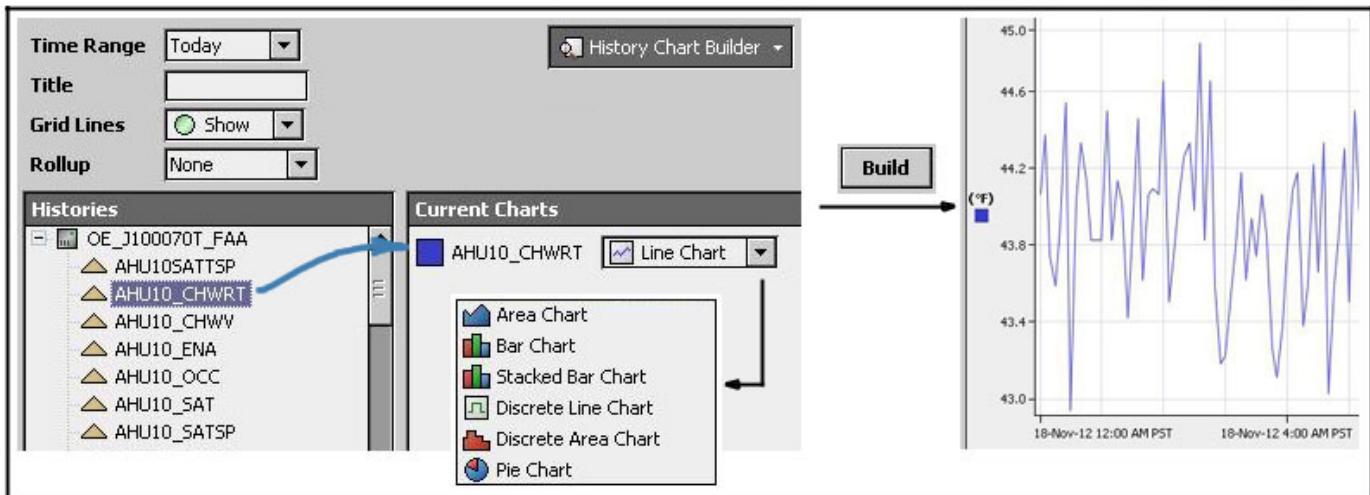
1. Open the 'History' folder under 'Station'.
2. Open the Station sub-folder.
3. Review the histories.
4. View the charts and/or tables for each history by double-clicking the history file.

## History Chart Builder

1. Right-click the 'History' node under 'Station'.
2. Views > 'History Chart Builder' (clear out current chart if present)



3. Set the Time Range to the appropriate time range.
4. Drag the point to be trended onto the 'Current Chart' pane.



- 5a. Analog Points: select 'Line Chart'.
- 5b. Digital Points: select 'Discrete Line Chart'.
6. Click the Clock icon that displays, set the ranges to 'Fixed'.
7. Click the 'Build' button (bottom).

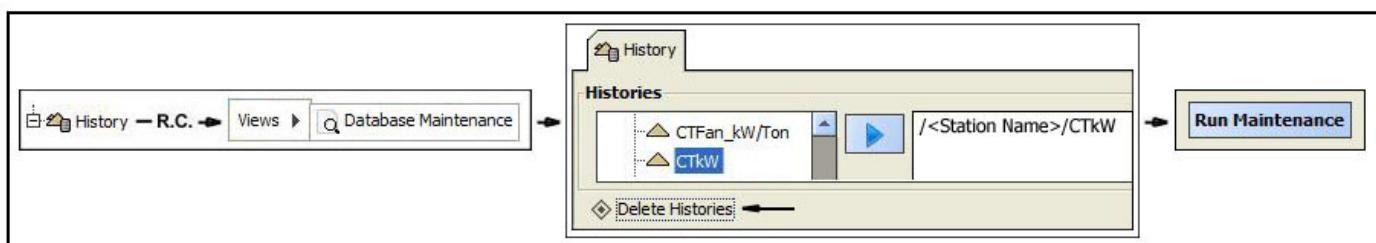
Note: you can also bring up a chart by right-clicking on the point's History Extension (eg, Live History Chart)  
Other History Views: History Table, Collection Table, History Summary View, History Editor (see User Guide).

To export to a .csv file, right-click in the middle of the chart and chose the 'Export\_Data' selection.

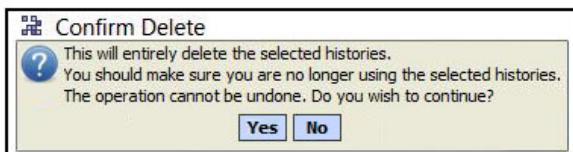
On the Button Bar, locate the Save Chart button, click to save (.px file). File is located in the 'Files', then 'Px' folder.

## To Remove Histories

1. Right-click the 'History' node under 'Station'.
2. Views > 'Database Maintenance'.
3. Highlight the appropriate histories to be deleted (left pane).
4. Click the  $\Rightarrow$  button.
5. Histories should appear in the right pane.
6. Select 'Delete Histories' (bottom).
7. Click 'Run Maintenance'.



8. Warning message will appear.



9. Select 'Yes' to remove histories. Wait for 'Command Successful' message.

### 3 – ARKIVE

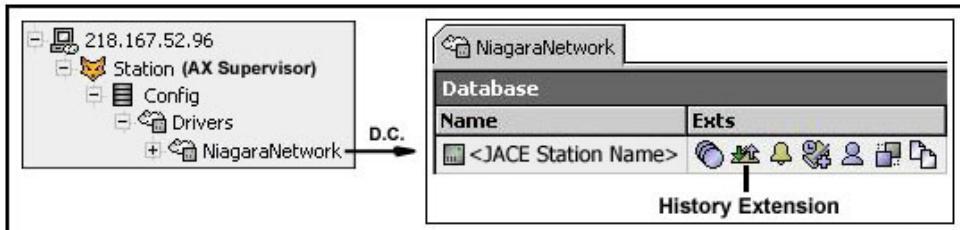
#### Importing Histories from the JACE to the AX Supervisor

Before uploading history files to the AX Supervisor, the files must exist in the JACE Station 'History' folder (see Section 2–Store).

It is recommended to discover history points directly from the AX Supervisor host (faster service). If you're at a remote PC, use the WIN Remote Desktop Connection service to connect to the AX Supervisor PC (host).

1. Connect to the AX Supervisor Station.

2. Open Config > Drivers.



3. Open the Supervisor Niagara Network (double-click on 'NiagaraNetwork').

4. Locate the JACE Station.

5. Open the JACE's 'Niagara History Import Manager' (double-click on the History Ext. icon)

6. Click 'Discover'.

    1. Discovery Pane: open the History folder (slowly click the '+'). Wait until the points appear.

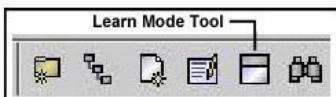
    2. Select the all the required history points (scrolling is slow).

7. Click 'Add'.

    1. Select the history points in the Add box. OK. (wait).

    2. Set the Execution Time to 'Interval'. Set the Interval time to the appropriate value (eg, 30 minutes).

8. Click the 'Learn' icon to remove the 'Discover' pane (upper).



9. Select all the history points in the 'Database' pane (lower).

10. Click 'Arkive' (one-time event). Wait. (creates a project folder in the AX Supervisor's History folder)

11. 'On Demand Poll Enabled' should change to 'True'.

12. Verify the history files.

Database		
Name	History Id	Status
Remote_AuditHistory	^AuditHistory	{ok}
Remote_CDWPBV	^CDWPBV	{ok}
Remote_CDWP1Failed	^CDWP1Failed	{ok}
Remote_CDWP1OK	^CDWP1OK	{ok}



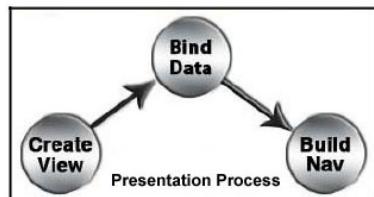
## Px GRAPHICS

Technical Document: Niagara AX-3.x User Guide, Ch. 6

Custom graphical views are defined with a Px file (Presentation XML), a special XML file that describes the graphical components. Px files can be any collection of components, up to a complete database.

A single Px file may be used as part of one or more Px views. Since the bindings within a Px file are always resolved relative to the current ORD, you can reuse the same Px file across multiple components by specifying binding with *relative* ORDs.

### PRESENTATION PROCESS

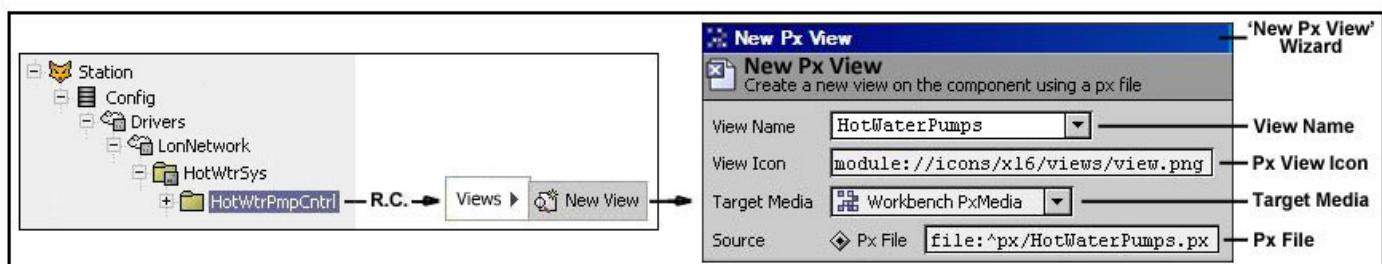


#### 1. CREATE VIEW

##### Create 'New View' Graphic

The 'New View' feature enables easier graphic development by creating a Px view that relates to an object (eg, controller, control strategy folder). A new slot is created for that object which links to a Px file (the Px file is stored in the Station/Files/Px folder).

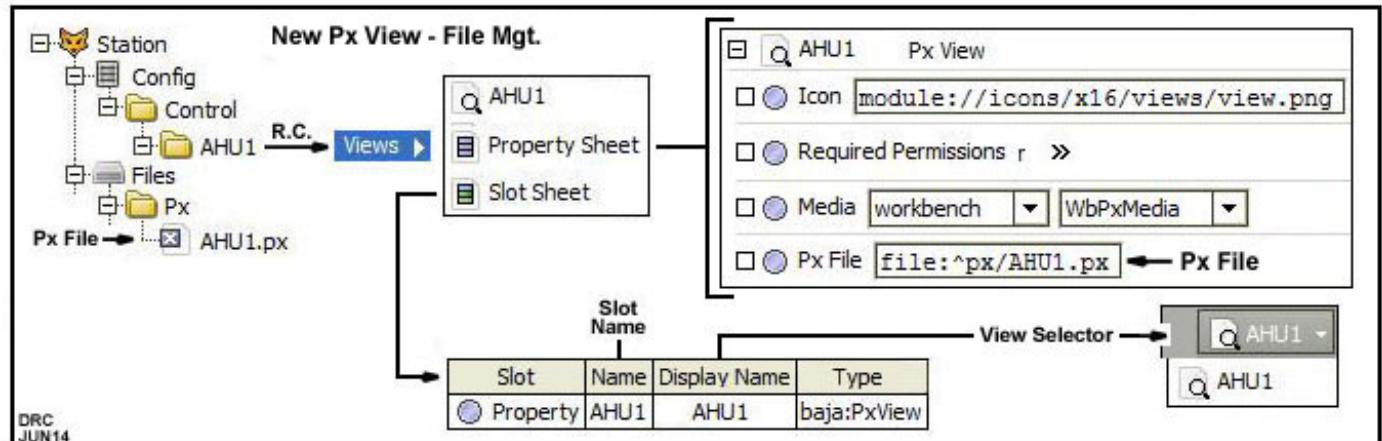
1. Highlight the control folder (or controller) that the graphics apply to.
2. Right-click > Views > New View. The 'New Px View' wizard should appear.



3. Complete the fields in the New Px View wizard:

1. View Name: Create custom graphic name.
  2. View Icon: (default: view.png)
  3. Target Media: (default: Workbench Px Media)
  4. Source: Px File name (automatically copies View Name).
4. OK (px file is created; resides in Files/Px folder)
  5. Canvas Pane appears. Set the canvas properties (see next page).
  6. Add static images and dynamic objects (see Bind Data section).
  7. Double-click on 'New View' folder and graphic will appear.

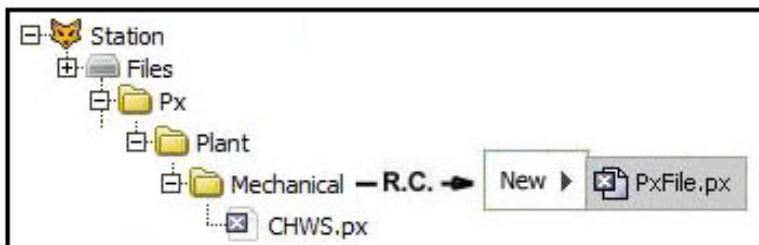
Use Slot sheet to update or remove New View. Use Property Sheet to update Px View Icon, Px file name.



## Create Px File Graphic

A new PxFile creates the Px graphic file without any links to an object.

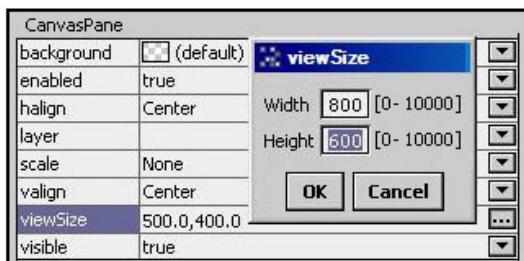
1. Open Station > Files.
2. Create sub-folder directory for file organization (optional).
3. Right-click the 'Px' folder or appropriate sub-folder.
4. Select 'New' > 'PxFile.px'.
5. Name the Px file. OK.



6. Open the Px file (double-click).
7. Switch to Canvas Edit Mode (see Px Editor). Set the canvas properties.
8. Add static images and dynamic objects (see Bind Data section).

## Set the Canvas Pane Properties

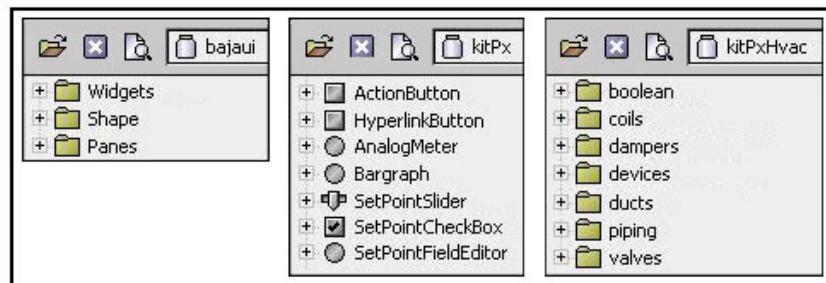
1. Double-click an empty area in the canvas.
2. Background: (default), solid color or image.
3. Enabled: True
4. ViewSize: W: 800, H:600 (typical)



Graphic files supported on Px graphics are: gif, ief, jpeg, jpg, jpe, tiff, tif, png, pnm, pbm, ppm, ras, rgb, xbm, xpm, xwd.

## Px Palettes

After the Px view is created, graphic visualizations (user interfaces) known as 'widgets' are added to the canvas pane. Widgets are found in three palettes: 1) bajau, 2) kitPx, 3) kitPxHvac



Note: the 'Make Widget Wizard' does not appear when you drag a widget object from a palette to the canvas.

## Panes

Panes are containers for widgets (pg. 6-13)

1. Canvas Pane - used for absolute positioning.
2. Boarder Pane - to wrap one widget and provide margin, border and padding.
3. Edge Pane - supports five children: top, bottom, left, right, center.
4. Grid Pane - widgets are laid out in columns and rows.
5. Split Pane – 2 widgets with a movable divider between them.
6. Tabbed Pane - Supports multiple widgets; only one is currently selected using a set of tabs.
7. Scroll Pane – permits viewing a widget that is larger than its boundaries (uses scroll bars).
8. Report Pane - Supports headers and footers in report PDFs. Allows its content to span multiple pages, and allows each page to have a common logo as well as a page number and timestamp.

## Px Editor

The Px Editor is activated by the 'Toggle Px View-Edit Mode' button on the button bar. To add objects to the Canvas Pane you must be in the Px Editor mode. Switch to the Px View mode to view the graphic.

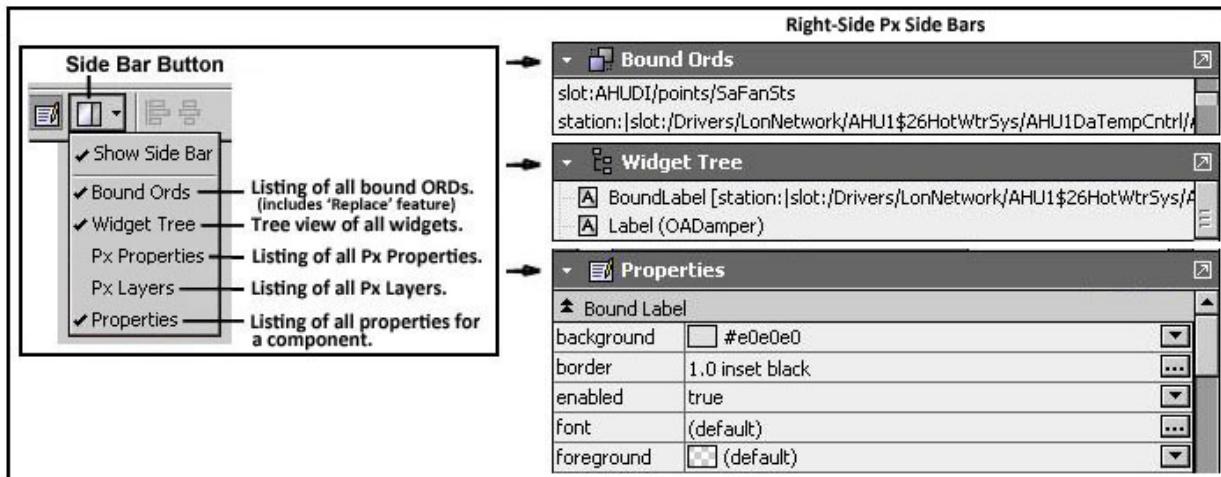


## Show Side Bar

The 'Show Side Bar' is a collection of Px side bars that are useful in editing Px graphics. The Px side bars are shown on the right side of the workbench. The Show Side Bar can be opened with the menu bar or tool bar.

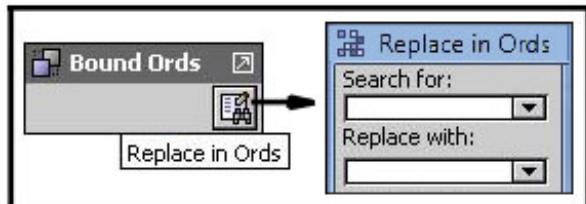
Tool Bar: (see illustration)

Menu Bar: Windows > Side Bars > Show Side Bar



## Bound Ords Side Bar: 'Replace in Ords'

To modify multiple ORDs, use the 'Replace in Ords' feature. One example is to replace the Station name of all the px objects.

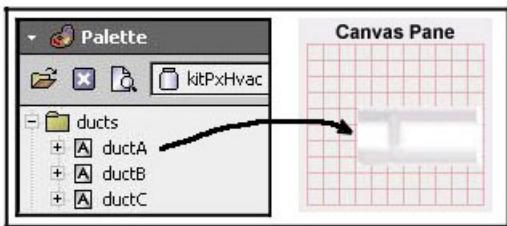


## **Adding Static Images**

The following example illustrates how to add 'static' images to images to the canvas (not linked to an ORD).

### Adding a Duct to the Graphic

1. Switch to the Px Editor mode.
2. Open the 'kitPxHvac' palette.
3. From the 'ducts' folder drag a duct object onto the canvas pane.
4. Position the duct (don't resize it).



### Add Px View to a Slot

1. Open the 'Slot View' of the object.
2. Right-click > 'Add Slot'
- 3a. Name: Set Name.
- 3b. Type: Baja, PxView
4. Open the Property Sheet of the object.
5. Set the 'Px File' path.
6. Reorder the slot, as required (Slot View).

### Adding Text to the Graphic

1. Right-click on the Canvas Pane. Select 'New' > Text Block
2. Add Label text and formatting properties.

### Multiple Object Drag

Select objects in specific order & drag to canvas.

### Fine Mouse Movement

Hold down 'Ctrl' key.

### To Lock a Px Object

1. Select the 'Locked' option in the Px Layers palette Status column (locked objects cannot be edited). Use 'Side Bar' button.

## 2. BIND DATA

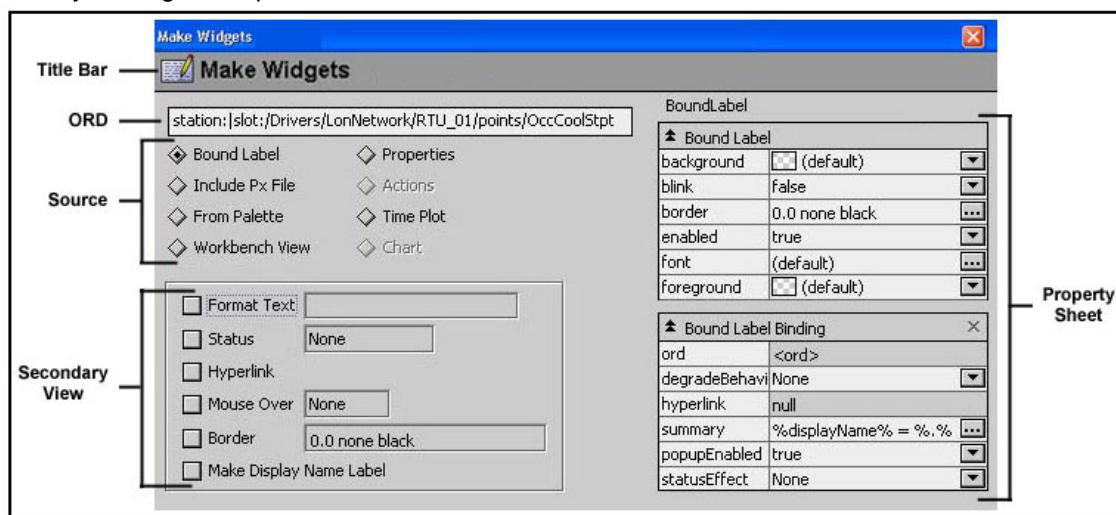
Widgets are animated by binding the widget's properties with an object's ORD (data source). Data values can be text (On/Off), a number (72F), or it can be an animated image (rotating fan, moving dampers).

Types of bindings:

Binding	Overview
Bound Label	Connects a value to a widget. Most common binding.
Field Editor	Connects a field editor component to an object. Field editors are built with widgets like buttons, text field and check boxes.
Value	Connects a value that is typically under a component. Value bindings support features such as real-time graphics, mouse-over and right-click actions.
Action	Invokes an action on the binding target component when an event is fired by the parent widget. Example of actions include: 'active', 'inactive', 'override'.
Setpoint	To display and modify a setpoint value.
Popup	To display a Px view in a 'popup' window.
Table	Connects table data in a bounded table. Table binding can bind to any 'collection' using a BQL, SQL or History ORD binding.
Spectrum	To animate a widget's brush color property.
Spectrum Setpoint	To animate the midColor properties (used in conjunction with a spectrum binding).

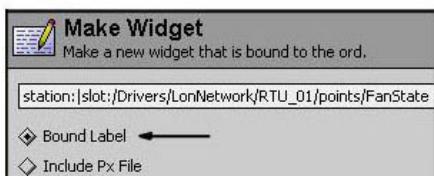
### Make Widget Wizard

The Make Widget Wizard is a guide that assists in binding Widgets and the data source. It automatically displays when you drag a component onto the Px Editor canvas.

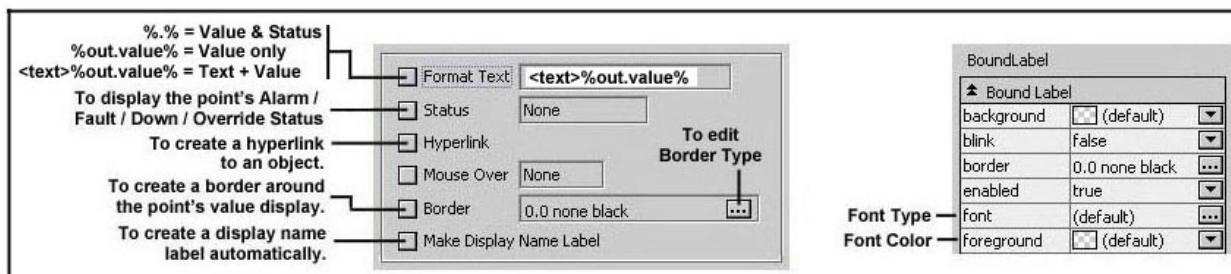


### Add a Point to the Graphic

1. Expand the view of the 'Points' folder (NAV side bar).
2. Drag the point onto the PX editor view. ('Make Widget Wizard' should appear)
3. Select 'Bound Label' as the Widget type (associates the point value with a text display).



- 5a. Set the text formats, status, borders, etc. accordingly. Click the OK button.



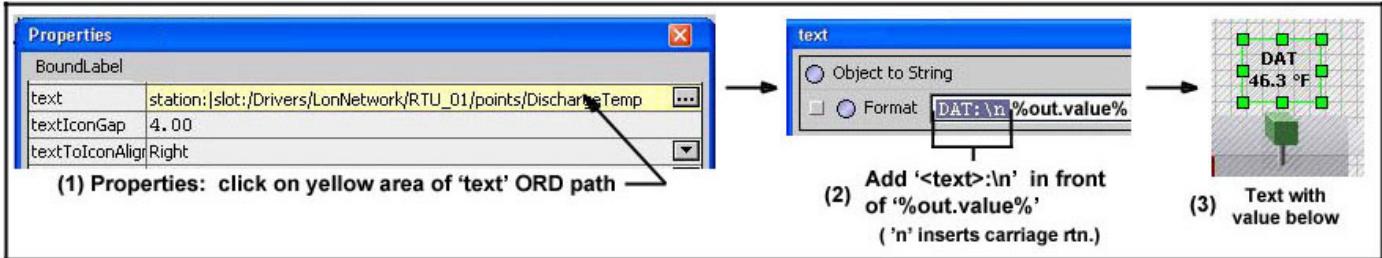
## Add Point to a Graphic Cont.)

5b. To add text with the value (with no status)

1. Format Text: <text>%out.value% or <text>:\n%out.value% (includes carriage return).

2. Uncheck "Make Display Name Label".

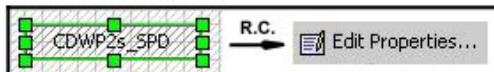
5c. To add text to the data value:



## Modify a Point ORD to another Point ORD

1. Highlight the point.

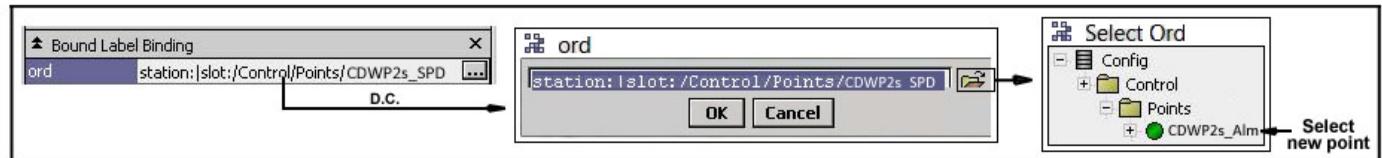
2. Right-click > Edit Properties.



3. Bound Label Binding: double-click the ORD path.

4. ORD box: select the Folder icon.

5. Select Ord box: locate and select the new point.

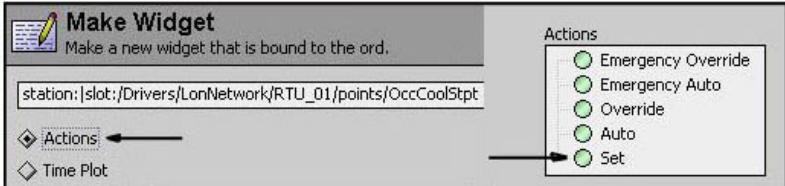


## Setting up an 'Action' for a SetPoint value

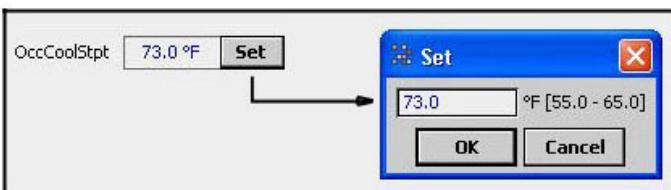
1. Drag the setpoint point onto the Px editor view. ('Make Widget Wizard' should appear)

2. Select 'Actions' as the Widget type.

3. Select 'Set' as the Action type. Click the OK button.

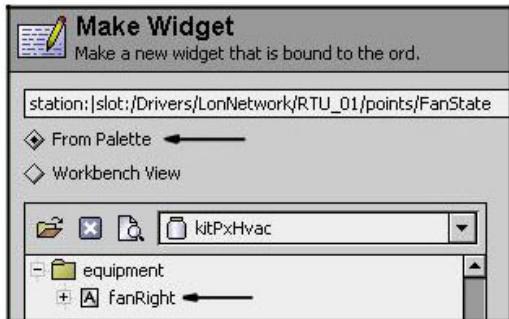


4. Move the Set button to the right of the setpoint display.



### Add a Dynamic Object to the Graphic

1. Drag the dynamic point onto the Px Editor (eg, FanState). ('Make Widget Wizard' should appear)
2. Select 'From Palette' as the Widget type.
- 3a. Open the 'kitPx Hvac' palette.
- 3b. Open the 'Equipment' folder. Select 'FanRight' (fan example). Click the OK button to create the fan.



### Modify the Rotation of Damper Blades

Issue: 'dampersH' or 'dampersV' move in the wrong direction ('kitPxHVAC' palette > 'dampers' folder).

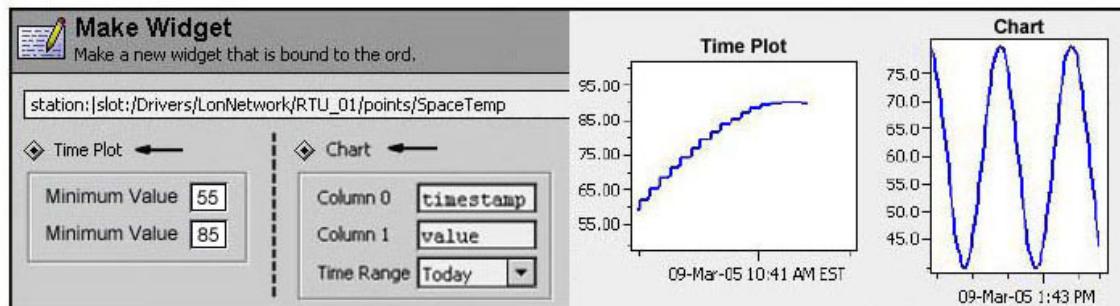
Resolve: modify the picture file order.

1. Right-click the damper object. Choose 'Edit' Properties.
2. In the Edit window click the yellow slot to open its properties.
- Five (5) .gif files will appear. 0-20% is linked to 'H1', 20-40% is linked 'H2', up to '80-100% linked to 'H5'.
3. Click the 'H1' ORD path to open the editor. Change to 'H5'. Continue the process until the order is reversed.
4. Right-click the screen and choose 'New', then 'Label'. Create a new damper name.



### To add a Time or Chart Plot to the Graphic

1. Drag the point onto the PX editor view. ('Make Widget Wizard' should appear)
2. Select 'Time Plot' or 'Chart Plot' as the Widget type.
- 3a. For the Time Plot enter the min. and max. values (Y-axis of the Time Plot)
- 3b. For the Chart Plot enter the value source for column 0 and 1. Select the Time Range.



4. Edit the widget properties (header, line, fonts) using the Widget Tree and Px Properties side bars (see 'Show Side Bar' in section 1-Create View).

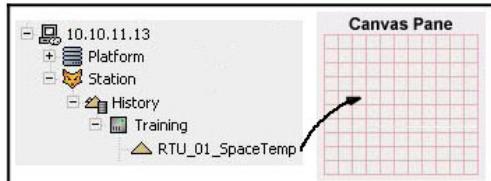
### Create a Hyperlink to a Schedule

1. Drag the schedule from the NAV side bar on to the Px Editor. ('Make Widget Wizard' should appear)
2. Select 'Bound Label' as the Widget type.
3. In the Format Text, remove the B-format text (%out.value%) and type in 'Click to See Schedule'.
4. Check the 'Hyperlink' checkbox. Click OK.

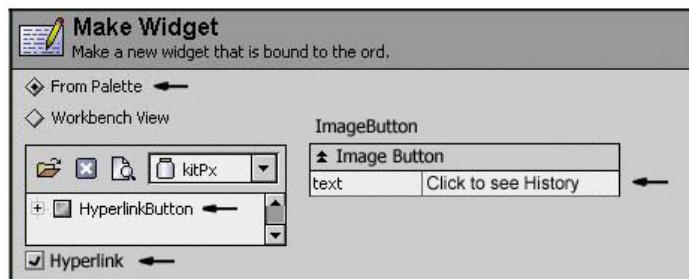


### Create a Hyperlink Button to the Space Temperature History File

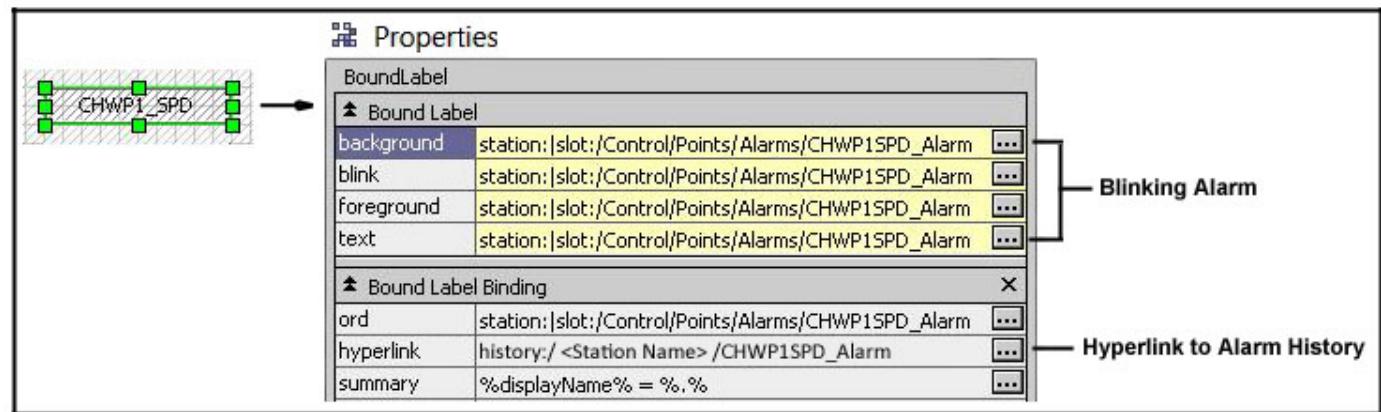
1. Drag the space temp history file (Station 'History' folder) on to the Px Editor. ('Make Widget Wizard' should appear)



2. Select 'From Palette' as the Widget type.
3. Open the 'kitPx' palette, select the 'Hyperlink Button' widget.
4. Click the 'Hyperlink' checkbox at the bottom of the Wizard.
5. In the 'Text' slot type in 'Click to See History'. Click OK.



### Create an Alarm History Hyperlink



### To Display the Current User

A) Create a String Constant

1. Right-click the 'Points' folder.
2. Choose 'New' > open the 'kitControl' object.
3. Select Constants.
4. Add a 'StringConstant' to the Points folder.
5. Name the constant 'CurrentUser'

B) Add the String Constant to the Px View.

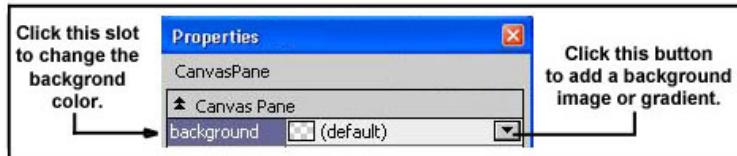
1. From the NAV side bar, drag the 'CurrentUser' on to the Px Editor.
2. Select 'Bound Label' as the Widget type.
3. Set the Format Text slot to read: Current user signed on is\n%user()%
4. Click OK. Edit the size as needed.

### To Display the Backup Service

1. Locate the BackupService (Station > Config > BackupService).
2. R.C. 'BackupService' > Views > New Views
3. Name the new view (eg, 'Backup')
4. Drag the BackupService object onto the editing window of the new view.
5. 'Make Widget Wizard' appears.
6. Choose Workbench View > Backup Manager.
7. Stretch the Backup Manager widget to fit the grid view size (use green handles).
8. Run the PX view (click the Toggle View Edit Mode button).
9. Click the new 'Backup' button on the PX view to backup the station.

### Modify the Canvas Background Color

1. Double-click the white space on the Px Editor.
2. The Properties editor for the Canvas Pane should open.



### Relativize ORD

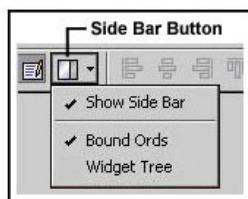
Px Widgets are bound to the data sources using an ORD. ORDs can be absolute or relative.

Absolute ORD: station:|slot:/Logic/Campus/Building/AirHandler/DaTemp

The absolute ORD points to the location of an object relative to the station. In this case, the absolute path ensures that the data that is displayed always resolves to a single component that represents DaTemp within a specific air handler that serves on particular building.

Equivalent ORD after Relativized: slot: DaTemp

ORDs can be relativized by using the Bound ORDs side bar pane:



### To Reuse a Px Views

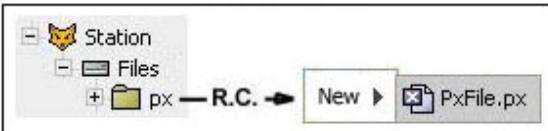
1. Make the Px view generic (eg, remove specific plant name labels)
2. Drag the controller onto the Px Editor.
3. Select 'Bound Label' as the Widget type.
4. Change the Format Text setting to %name%.
5. Switch to the Px view. It should match the name of the controller.

### To Duplicate Controller Px View

1. Open the Px Editor. (note the ORDs displayed in the upper right corner of the editing window. These are the Absolute ORDs).
2. Click the 'Relativize ORDs' button. Click OK.
3. Duplicate the controller. Display the Px view of the Points folder in the new controller. Verify the controller name.
4. Right-click the another controller that does not have a Px view.
5. Select View > New View.
6. Select the px file name created earlier.
7. When prompted, select 'Reuse' and click OK.

### Using a JPG or GIF File as a Background Image and Linking Px Views

1. In the Files folder of the Station, right-click the Px folder.
2. Choose New > PxFile.px



3. Open the Properties of the canvas pane. Set the view size to 800 x 600.
4. Set the background image to use a .gif file (eg, floorplan).
5. Add the controller's Space Temperature as a Bound Label with no display name to the view.
6. Double-click the space temp display on the view to open the properties editor. Locate the 'Hyperlink' slot. Open the Component Chooser and browser to the controller. Select the controller and close the window by clicking the OK button(s). Run the graphic and click the space temp point.
7. Open the controller's Px Editor. Right-click in an appropriate place on the editing window, choose New, then Label.
8. Open the Properties view of the new label. Type in 'Floor Plan' as the text. Modify the font color, size as needed.
9. In the upper right corner of the property view of the label, click 'Add Binding' button. Add a Value Binding to the object. Note the value binding has a 'Hyperlink' slot. Configure this slot to the FloorPlan.px file in the Files folder in the station.
10. Run the graphic and test the hyperlink
11. Backup the Station.

### **3<sup>rd</sup> Party Tridium Graphics Service**

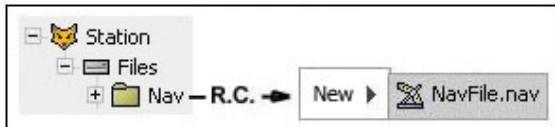
- 1) Alper Uzmezler.
- Web Site: [www.bassg.com](http://www.bassg.com)

### 3. BUILD NAV

The NAV file is a special xml file that resides on the file system - not in the Station database. Many NAV files can be created, but a client can only display one NAV file at any time. The NAV file is user-specific, so when a user logs into a Station, a unique NAV tree can be displayed (see section 3-Station - User Account).

#### To Create a NAV File

1. Open the 'Files' folder.
2. Highlight the Nav folder (or create a custom folder).
3. Right-click > New > NavFile.nav.



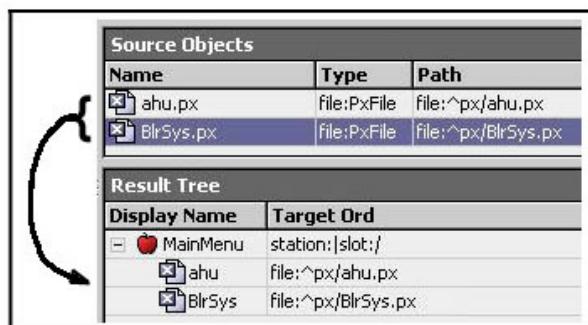
4. Name the Nav file.
3. Open the Nav File Editor (double-click the new Nav file)
4. Double-click the 'Home' slot to open the Edit window.



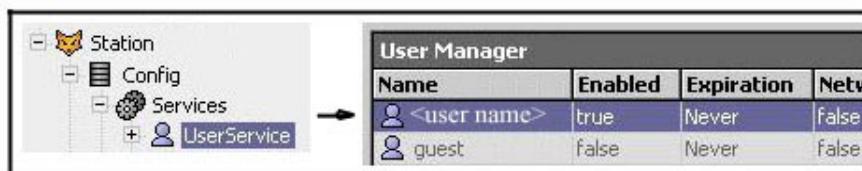
5. Modify the 'Display Name' (eg, 'MainMenu') and the Nav tree icon as required.
6. Click the 'Show Files' button (bottom).



7. Drag the appropriate Px files from the 'Source Objects' pane to the 'Result Tree' pane.

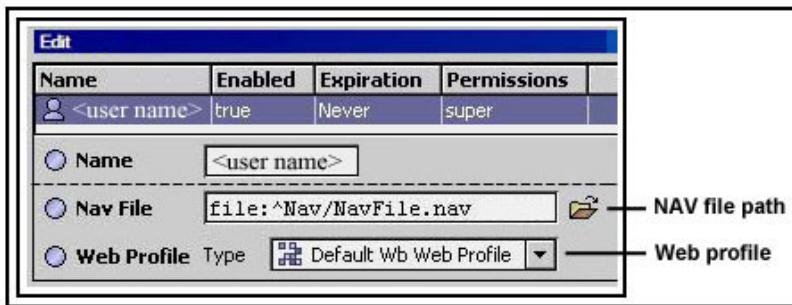


8. Select the User Account.

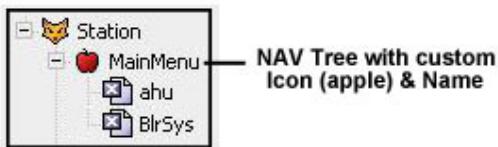


## Create NAV file Cont.)

9. Set the NAV file path and the Web Profile in the User Account (click the folder to browse).



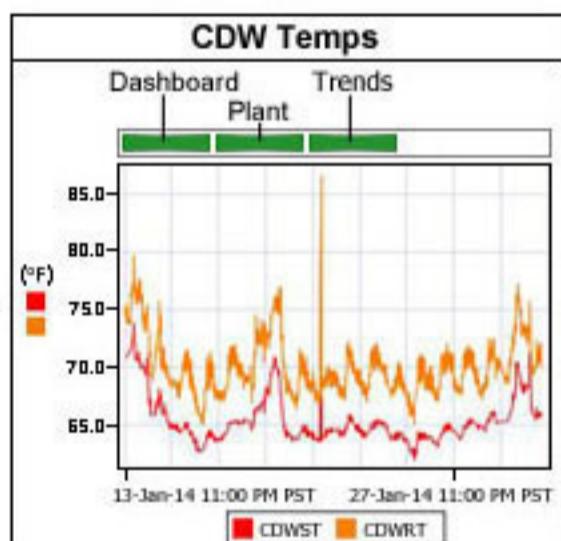
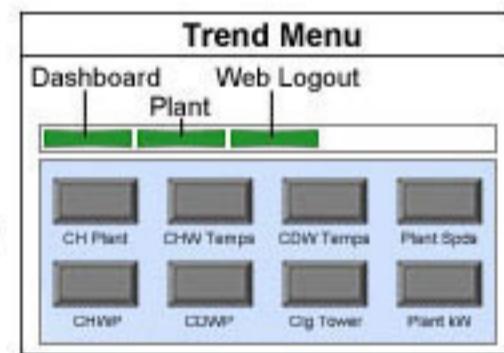
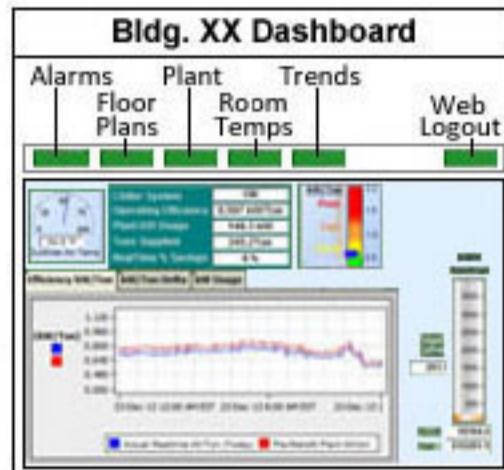
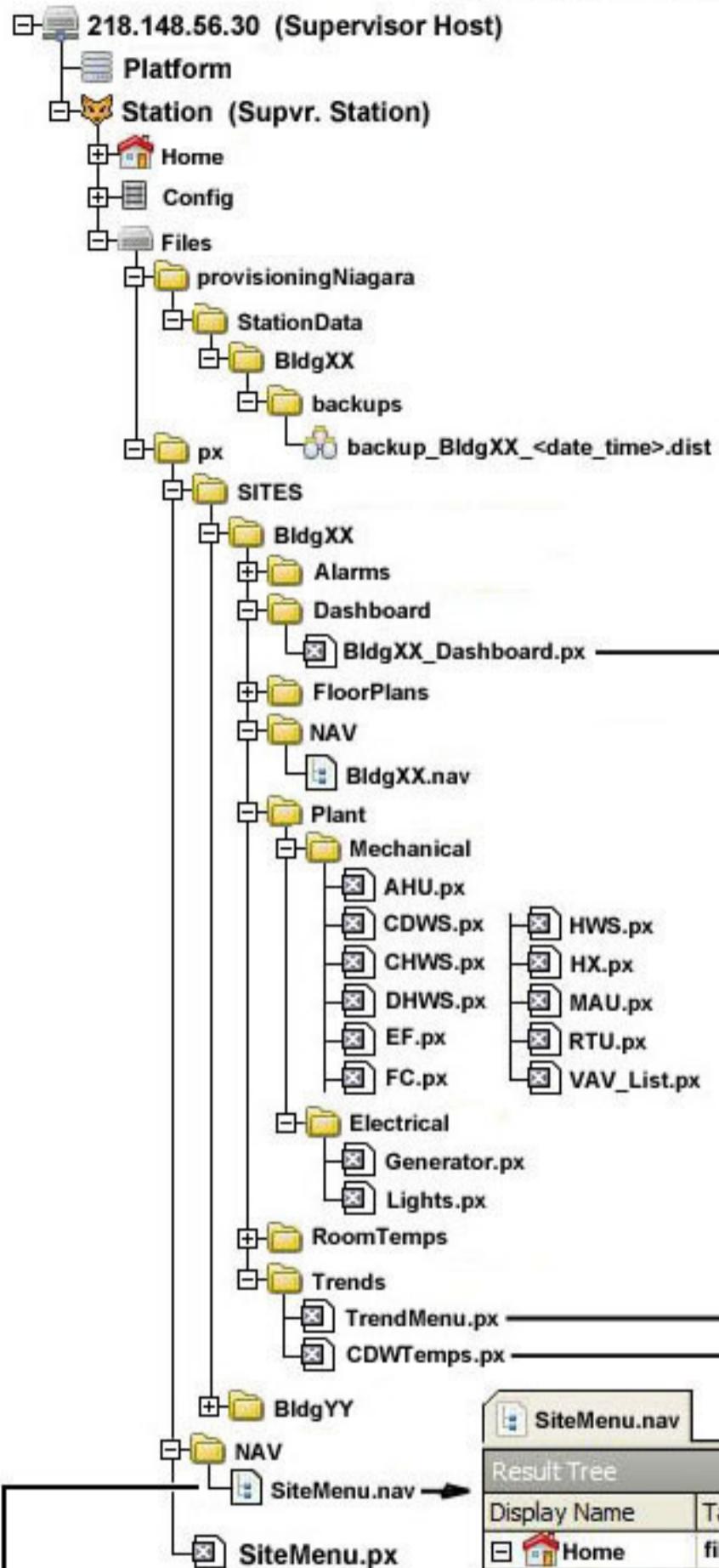
10. Final NAV tree result.



## **Nav File Editor**

1. Right-click on the Nav File
2. View > Nav File Editor.

## AX Supervisor Px File Overview

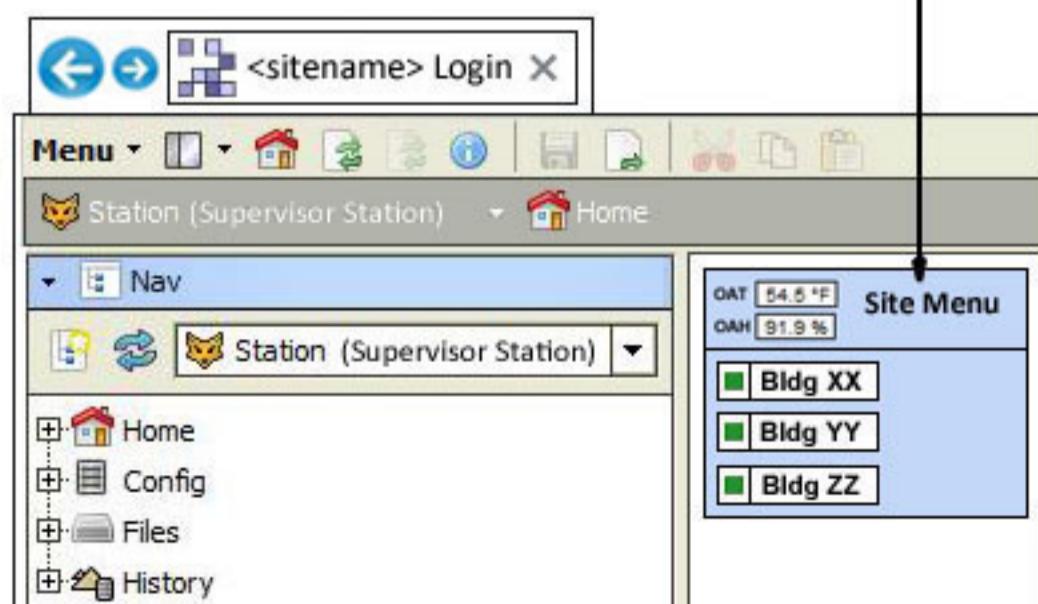


### Browser Log-in

http://<AX Supv. IP addr.>/login

Supervisor Station Login

Username: \_\_\_\_\_  
Password: \_\_\_\_\_



### Supervisor Station: User Account

Name	Enabled	Expiration	Per
<user name>	true	Never	super
<input type="radio"/> Name	<user name>		
<input type="radio"/> Nav File	file: ^NAV/SiteMenu.nav		
<input type="radio"/> Web Profile	Default Wb Web Profile		

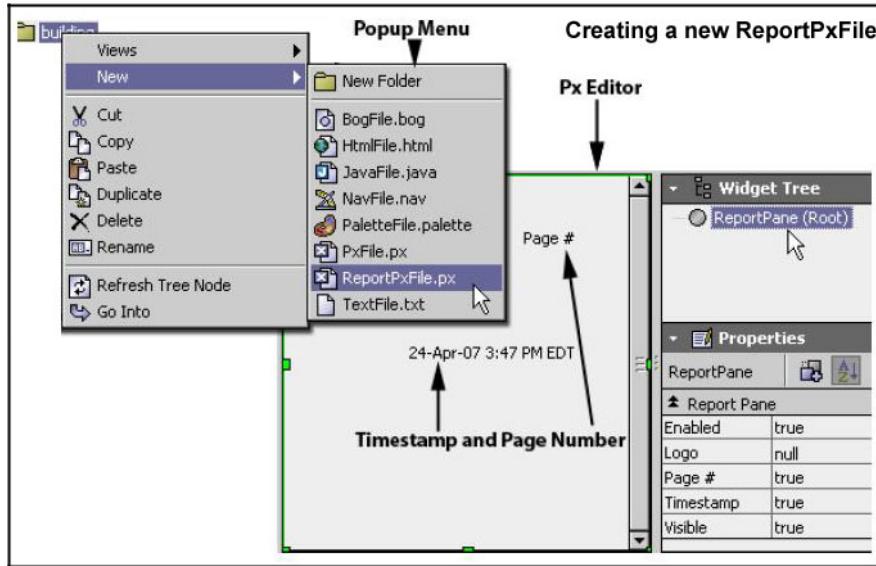
## REPORTING

Technical Documents: Niagara AX-3.6 User Guide, 6-56 (pg.230). Niagara Engineering Notes "Sample Reports Using BQL and Bound Tables".

The Reporting function permits the delivery of data to online views and to printed pages. The report service and the report export feature permits the scheduling and distribution of reports by email.

### ReportPx File

A ReportPx file is a regular Px file that has been “pre-loaded” with a ReportPane widget.

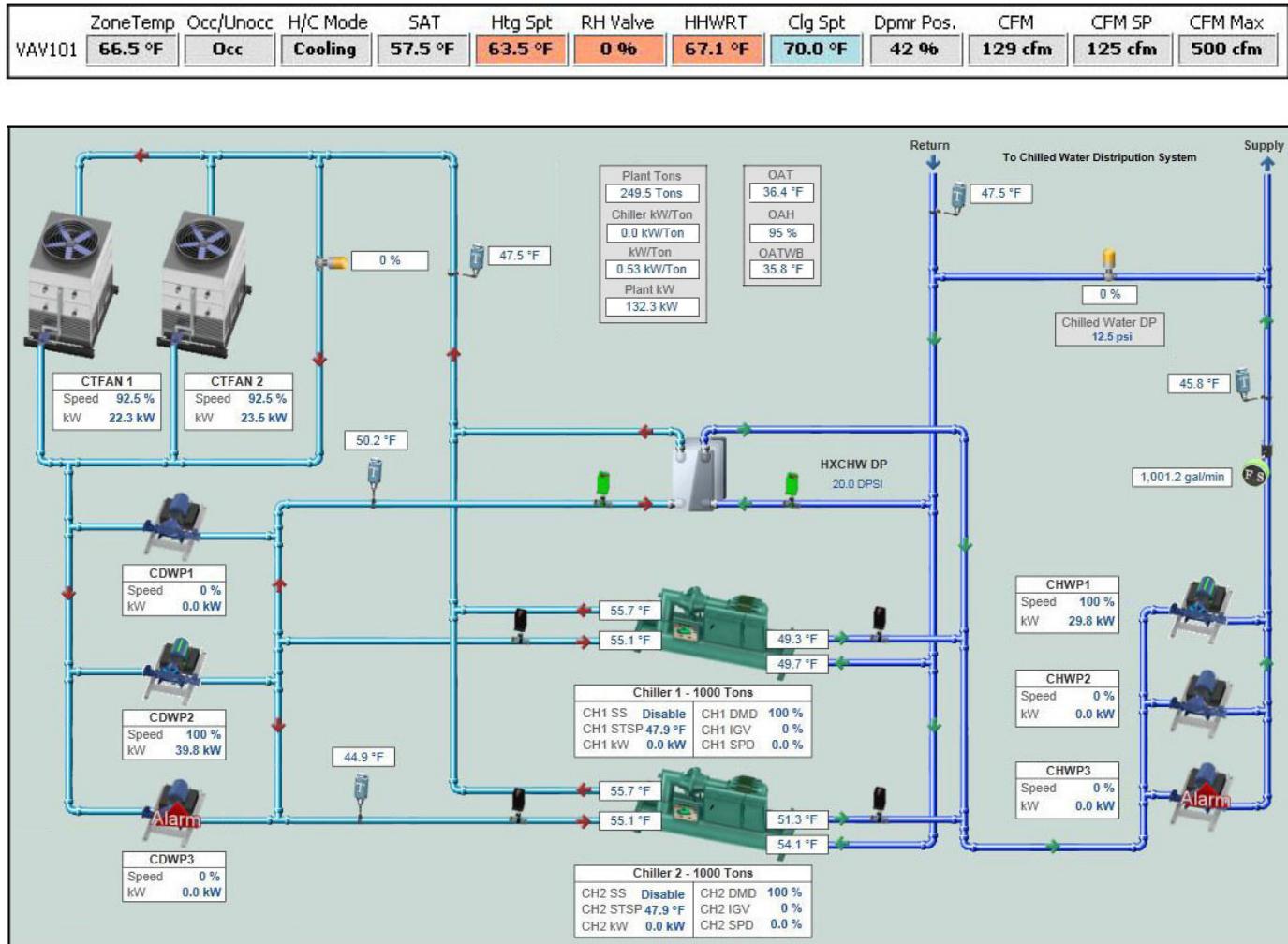
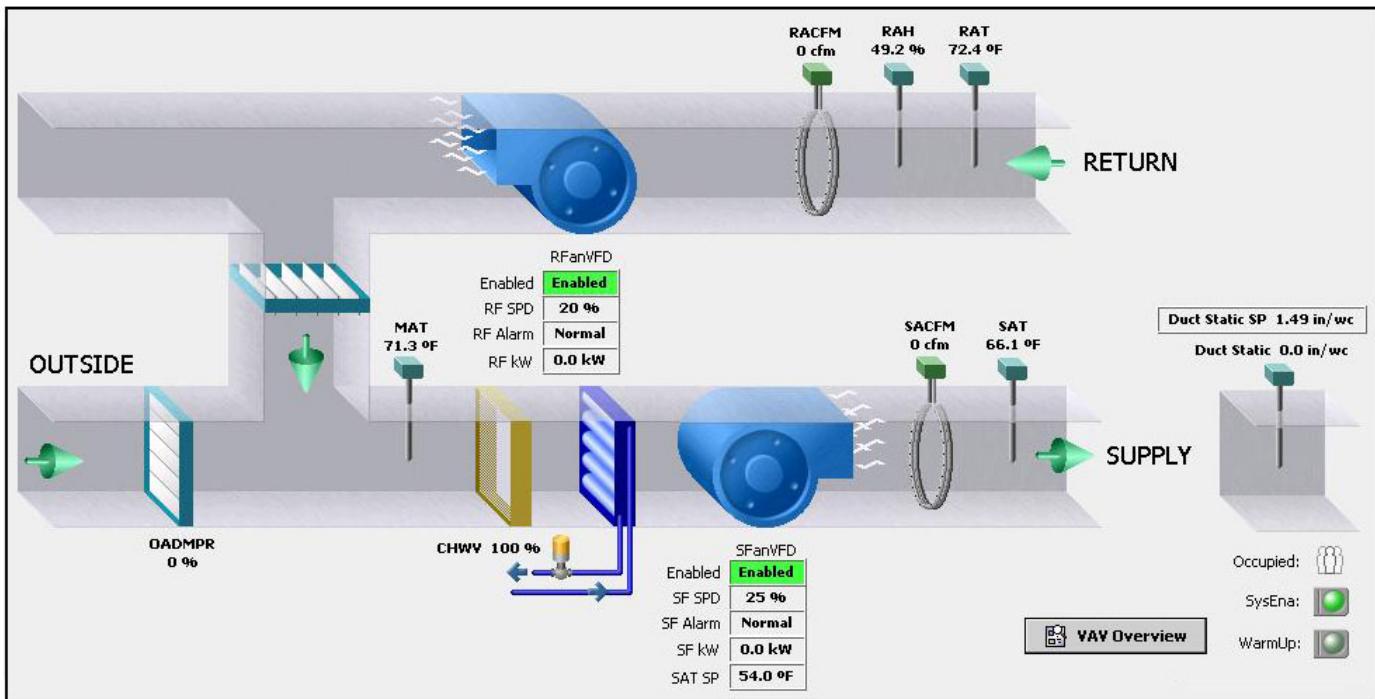


For more information on creating customized report graphics, refer to the Niagara Engineering Notes document "Sample Reports Using BQL and Bound Tables".

### Grid Table

Grid Tables are useful in presenting VAV parameters. See Niagara AX-3.x User Guide, 6-60 (Component Grid).

## Plant Samples





## JACE – Java Application Control Engine

A JACE (Java Application Control Engine) is a headless, embedded platform (host). While running on a Flash file system (QNX O/S), a JACE client/server platform runs a Station (JVM) and a daemon process, but not workbench. It includes integrated control, alarming, scheduling, data logging and web serving capabilities.

Tridium is an OEM technology company that retails to other control manufacturers. There is no 'Tridium' branded JACE. All JACE's are rebranded by other controls manufacturers: Vykon, Honeywell, JCI, Distech, etc.

A JACE controller can be connected to in three (3) ways:

1. Workbench
2. AX Supervisor (or other Station)
3. Web Browser

When shipped from the factory a JACE-4/5 series controller *does not* contain a JAVA Virtual Machine (JVM), software modules, lexicons, license, Stations. JACE-3/6 series controller *does* include a core Niagara software load and a Tridium certificate, but not all the items needed.

The 'Commissioning Wizard' is used for the *initial* Niagara Installation and startup of a JACE controller. A new JACE must be installed with the core software (distribution file). The Commissioning Wizard is only available in a remote JACE connection, not in a local host connection.

### JACE Factory IP Address

The factory-assigned IP address is in the following range:

$n$  = the last numeral in the JACE's serial number. (Default subnet mask: 255.255.255.0)

JACE-2/6: 192.168.1.12 $n$  (primary LAN1 port, 'LAN2' port is disabled).

JACE-4/5: 192.168.1.14 $n$

To find the IP address of an existing JACE see 'Determining the IP address of a WEB Controller'.

### Factory Platform Credentials

The factory-assigned daemon (administrator) credentials are:

Username: tridium  
Password: niagara

Commissioning is the process to prepare a new JACE to run a Station or to upgrade a JACE's Baja Version. It will delete an existing Station in the JACE. Version rule: a JACE should only connect to a Station at the same version.

JACE saves to flash – don't write to flash too much (E<sup>2</sup>PROM memory wears down). To minimize the risk of corruption with a full flash disk:

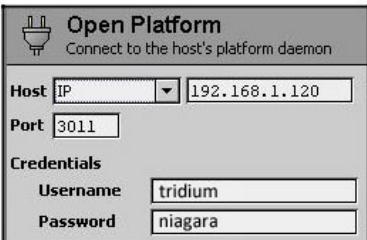
- 1) reduce the default station backup count from 3 to 0. To change the count: Config > Services > PlatformServices property sheet: "Station Auto-Save Version to Keep".
- 2) keep free disk space greater than 1MB. Disk usage can be view in the PlatformServices property sheet or with a platform connectin to the JACE via the Platform Administration view.

### Platform Connection to a New JACE Out of the Box

1. Set the static IP of the notebook (PC).
  1. Control Panel > Network & Sharing Center.
  2. 'Change Adapter Settings' (left pane).
  3. 'Local Area Connection'.
  4. Networking Tab > highlight 'Internet Protocol Version 4' > Properties.
  5. Select 'Use the following IP Address'.
  6. Set the IP Address to 192.168.1.xxx (xxx is different than JACE's last octet).
  7. Set the Subnet Mask to 255.255.255.0.
  6. Verify the notebook's new IP address (command line: ipconfig).
2. Connect the notebook (PC) to the JACE (LAN1) via Ethernet cable.
3. Power up the JACE. Verify the yellow 'Beat' LED.
4. Ping the JACE to verify IP connectivity.
5. Launch AX Workbench.

## Platform Connection to a New JACE Out of the Box Cont.)

### 6a. Menu Bar: File > Open > Open Platform (http)



6b. Enter the IP address of the factory JACE (192.168.1.12n or 14n). n = the last numeral in the JACE's s/n.

6c. Enter the default Credentials:

    Username: tridium

    Password: niagara

7. The 'Platform' icon should be active.



8. Commissioning the JACE is performed with the 'Platform Administration' tool (see next section).

## **Commissioning the JACE**

Technical Document: JACE Niagara AX Install & Startup Guide

1. Close all running Station(s) on the PC.

2. Make a Platform connection to the JACE. Open the 'Platform Administration'.

3a. Select 'Commissioning'. Commissioning Wizard appears.

3b. Typical box selection includes:

'Request or install software licenses'

'Set module content filter level'

'Install/upgrade core software from distribution files'

'Install/upgrade modules'

'Sync with my local system date and time'

3c. Optional box selection include:

'Install station from the local computer'

'Configure TCP/IP network settings'

'Install lexicons to support additional languages'

'Configure platform daemon authentication'



4. Next.

5. Select 'Install on or more licenses from files'.

6. Next. If prompted to install a certificate, check the box.



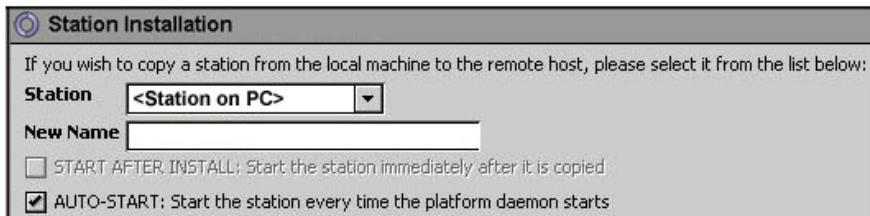
7. Set the Module Content Filter Level to "UI + Runtime" (important).

(note: installing the entire jar (doc + ui + runtime) will use excessive memory on the JACE)

8. Next.

## Commissioning the JACE Cont.)

9. Station Installation. A Station can be installed during the Commission process or later with 'Station Copier'. Select the Station to be installed on the JACE from the local machine (an existing Station on the JACE will be deleted). Select "Auto-Start" (starts the Station when the platform daemon starts; leave unchecked if testing Station code).



10. Next.

11. Station Installation: select "Copy every file in the station directory and its subdirectories".

12. Next.

13. Software Installation. Select the required software modules. Typical modules include 'Kitcontrol', 'KitPxHvac', 'PxEditor', 'Report', 'Weather', 'TimeSync'. Modules to run drivers include: 'Bacnet', 'Lonworks', 'ndio'. Additional software modules can be added later with Software Manager.

Software	Installed Version	Avail. Version	
backup	-	Tridium 3.6.31	<a href="#">Install software required by station (Tridium 3.6.31)</a>
driver	-	Tridium 3.6.31	<a href="#">Install software required by station (Tridium 3.6.31)</a>
history	-	Tridium 3.6.31	<a href="#">Install software required by station (Tridium 3.6.31)</a>

14. Next.

15. Distribution File Installation. "The core software is already up-to-date: Nre-config-npm2xx-etfs512".

16. Next.

17. Platform Daemon Authentication

User Name:

Password:

18. Next.

19. Commissioning: review the Final List of Changes.

20. Click 'Finish'.

21. Commissioning Process:

- Stop Running Applications
- Install files to remote Host
- Update System date/time/time zone
- Update TCP/IP (if selected)
- Update Operating System
- Reboot

22. "Commissioning Complete" (process will take a few minutes).

23. Close.

## **JACE Licensing**

Licensing a drivera (eg, Lonworks) is similar to licensing the AX Workbench for the local PC (see section 'Basic Steps-Installing AX', License Registration). The Host ID of the JACE begins with 'QNX'.

Checkout

1. Platform details: Platform Administration > View Details. Check JVM, memory, modules, licenses, s/n, etc.
2. License details: License Details > Highlight 'Vyon.license' > click 'View' button (bottom).

## **Set the JACE Time**

1. Connect to the Platform of the JACE (see 'Platform' Section).
2. Open 'Platform Administration'.
3. Set the Local Date, Time & Time Zone.

## Determining the IP address of a WEB Controller

Prerequisites:

H/W: USB-to-Serial Adapter<sup>1</sup>, Null-modem serial cable, Ethernet cable, 15VDC Power Supply.

S/W: Putty (WIN7 Terminal Emulation program).

### Acquire Address

- 1a. Connect the USB to Serial Adapter to the notebook.
- 1b. Control Panel: Device Manager > Ports.
- 1c. Determine the COM # of the serial adapter (install the driver if necessary).
- 1d. Set the parameters: 115200, 8 data bits, no parity, 1 stop bit.
2. Connect the USB Serial Adapter to the JACE (requires a null-model cable).
- 3a. Launch Putty.
- 3b. Set: 1) Connection Type (Serial), 2) Serial Line (COM #), 3) Speed (115200).
- 3c. Click 'Open' (idle terminal screen should appear).
4. Remove the JACE cover and set the top jumper pin to 'Serial Shell'
5. Power the JACE (green 'Status' LED should be ON, 'Beat' amber LED should flash).
6. Let the JACE bootup. Press ESC to select the Boot Options:
  1. Reset Default Username & Password.
  2. Skip device scan.
  3. Skip network initialization.
  4. Skip Wi-Fi initialization.
  5. Skip starting GPRS daemon.
  6. Skip starting Photon.
  7. Skip starting NTP daemon.
  8. Enable NTP daemon debugging.
  9. Skip starting Niagara daemon.
7. "Press ESC to restore factory default username and password"... (perform if necessary to change login account).
8. View the IP address in the "TCP/IP Network Status" section.
9. To enter System Shell Menu (optional):
  1. Login: <tridium> (default username)
  2. Password: <Niagara> (default password)
  3. NPM6 System Shell Menu:
    1. Update System Time
    2. Update Network Settings
    3. Ping Host
    4. Enable/Disable Ftp
    5. Enable/Disable Telnet
    6. Update Platform Account
    7. Reboot
    - L. Logout
10. End Putty session.
11. Remove power & the serial cable.
12. Set top jumper to 'Normal Operation'.

### Test JACE IP Address

1. Set the notebook's static IP address. The 1st three octets must be similar to the JACE (ie, 192.168.1.x).
2. Power the JACE.
3. Connect an ethernet cable between the notebook and the JACE's LAN1 port (green 'PRI' status should be ON).
4. Ping the JACE.

---

<sup>1</sup> Tripp-Lite, Keyspan, mdl. USA-19HS.

## To Restore a JACE

1. Remote Host: Platform > Platform Administrator > Distribution File Installer.

Another way: Config > Services > Backup Services > Backup Manager (can setup to run automatically).

## Clean the Distribution File

'Clean the Distribution file' of the JACE = Equivalent to formatting the hard drive. Wipes out the Niagara Workbench version.

## Java Heap

Java heap is the memory used to run the program in the java virtual machine. To free up heap: remove some components from the station, less devices, less logic, less schedules. Histories do not use much extra heap for more data stored, but each additional history extension does. Best to add extra memory to the JACE.

The best way to remove the yellow heap error is to reboot the JACE.

## Garbage Collection

Good to set up "garbage collection" on the JACE. Helps minimize traffic congestion (also check poll rate).

## JACE Models

JACE Model	I/O Type	Mounting
JACE-300, -600	Attachable I/O Modules	DIN-rail, screw mountable
JACE-403	On-Board I/O	Wall Mount
JACE-545	No on-board I/O	Wall Mount

Datasheets: [www.tridium.com/cs/library/ax\\_library.com](http://www.tridium.com/cs/library/ax_library.com)

## [Preventative Maintenance]

1) Replace the JACE batteries every ~3 years.

## [Troubleshooting]

Issue: Ok to directly connect to the JACE (via laptop). No traffic to JACE when installed on the facility network.

Resolve: check if crossover cable is required.

