S4 BACnet N2 Integration User Guide

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S4 BACnet N2 Integration
User Guide

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S4 BACnet N2 Integration Basic Information

Introduction

The S4 BACnet N2 Integration is delivered as a network appliance hosted on a SuperLogics Embedded PC Model SL-EB-LL6412J-S17. The S4IS application is installed on the system before shipment. System commissioning and configuration is performed through the web-based user interface.

S4IS products offer very sophisticated integrations while keeping the master system integrator, or end user, experience clean and intuitive. The S4IS application handles the details of interfacing with the Metasys® headend, and the configuration wizard locates all N2 objects and publishes them to BACnet IP. All configuration information and data gathered is persistently stored in our SQL database.

The product excels at the protocol conversion and gateway functionality needed for everyday operation. It goes way beyond what typical gateway applications offer by automating as much of the integration process as is practical and offering extensive monitoring and management of the upstream and downstream protocols and of the integration process itself.

Each N2 device, with its associated points and properties, is published as an emulated BACnet IP device. Any BACnet-enabled client application can interact with these devices as if they were native BACnet devices.

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Gateway Overview

General information about the S4 BACnet N2 Integration product can be found in the product brochure S4 BACnet N2 Integration.

Details about unpacking and physically installing your S4 BACnet N2 Integration product can be found in document S4 BACnet N2 Integration Getting Started.

After all connections are completed, power up the system and launch your preferred browser, pointing it to the IP address of the system. The first time the system is accessed, you will be prompted to create an account.
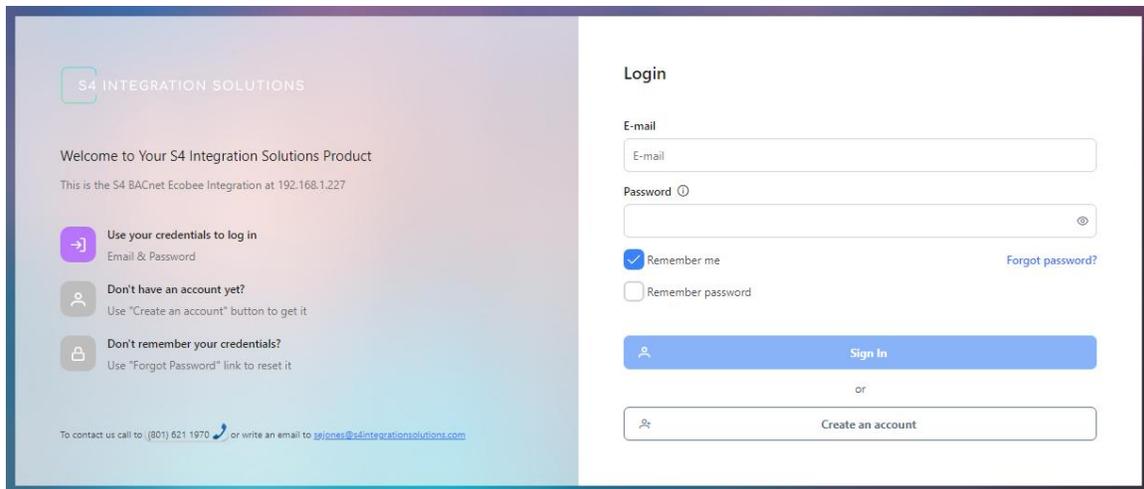
This account will be the primary user and administrator of the system. Continue to sign in using these credentials. When your login is complete, the system will walk you through several pages of Startup Wizard options where you can select your desired operational properties.

Also available on the login page are licensing information, version information, access to create and save system logs, backup and restore functionality, and the ability to reset the database (with assistance from S4IS).

System Architecture

The system is hosted on an Ubuntu Linux operating system. This provides a high level of hardware portability, the ability to implement security best practices, and a well-supported programming environment that facilitates both system development and support activities.

A SQL database is central to the system implementation. It contains all system configuration options not managed directly by the OS, our template catalog, and all device and point details. This includes point values, point level fault and reliability status, and all point attributes including the BACnet priority array. This optimizes system performance, ensures that system operation remains constant, and that values and properties are persistent even across system reboots.

The SCADA Engine BACnet stack is utilized in the S4 Integration Solutions products.

A Scanner – Poller task is continually running to periodically update all points in the database at the frequency determined by the properties selected in the system Startup Wizard. This makes point details immediately available to BACnet client applications and makes the system immune to small disruptions in TCP/IP service.

The Scanner ensures that the S4IS UI, BACnet, and the Metasys system are synchronized. As the configuration gets larger this polling process could take a considerable amount of time so values published in the S4 UI or BACnet may lag the Metasys system.

For any point that supports the BACnet priority array mechanism this value is saved in the Relinquish Default property. For points that do not support the priority array, the read value will be written to the point's present value. More information on support for the BACnet priority array will be provided in a later section.

A resolver task processes each request from BACnet or the UI, gathers the requested data from the database if it has not expired, and returns it to the requesting interface. If the data has expired (another configurable parameter), it requests an update from the N2 field device before returning the value.

The system contains a log file to track all transactions and error conditions. This is accessible via the UI and remotely for support personnel.

System performance and monitoring statistics are built into the system and are available through the UI.
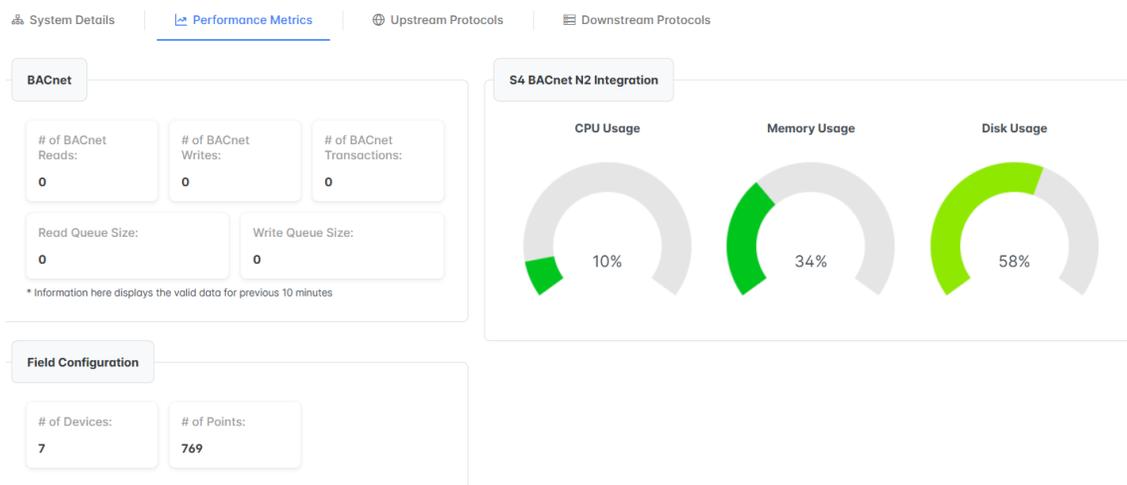
Device level performance statistics are published to BACnet along with the point details from the N2 device to facilitate trend logging, alarming, or display in the BACnet operator workstation.

Most properties and point details contain an **(i)** icon in the UI. Hovering over this icon will display a tooltip for the item.

Startup Wizard

All sections of the startup wizard must be completed before the system will go into production operation. If you cancel the Startup Wizard anywhere during the process the database will be reset any you will need to start the process over.

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Ethernet TCP/IP Properties

The first set of properties are the TCP/IP settings for the system Ethernet interface. These are standard TCP/IP properties. We assume that the user is versed in this technology so we will not detail each property here.

By default, systems are delivered with automatically assigned IP addresses. However, you can request special configurations when ordering the system, or update them through the UI during or after installation.

1	2	3	4	5
TCP/IPv4 Network Settings	Upstream Protocols	Downstream Protocols	Other	Discovery

TCP/IP V4 Network Settings

Hostname ⓘ	s4n2Dev
DHCP Enabled ⓘ	🔵
IP Address ⓘ	192.168.1.125
Subnet Mask ⓘ	255.255.255.0
DNS Server ⓘ	192.168.1.1
Default Gateway ⓘ	192.168.1.1

If you are installing multiple S4 BACnet N2 Integration systems, be sure to update the Hostname to a unique value that identifies this system as you install each system.

Moving on to the Next screen you will be asked to select your Upstream Network properties (both N2 and BACnet).

Upstream N2 Properties

Status - This property can have one of two settings: Normal or No Upstream.

After the system is in production a third option will be available Pass-Through Mode. When Pass-Through mode is selected Metasys configuration and commissioning utilities attached to this interface will have exclusive access to the downstream N2 bus. Transactions originating on BACnet, the S4 UI, or internally generated N2 traffic will be suppressed.

Field BACnet Write Priority - Priority array settings used to synchronize N2 Write transactions from the Upstream N2 interface.

Field BACnet Override Priority - Priority array settings used to synchronize N2 Override transactions from the Upstream N2 interface.

N2 communications settings are not changeable but are provided for documentation purposes.

N2 Protocol	
⚙ Upstream Settings	
Status	Normal Mode
Field BACnet Write Priority	14
Field BACnet Override Priority	8
⟳ Serial Settings	
Baudrate	9600
Parity	None

BACnet Properties

We assume that anyone using this product is proficient in BACnet and we will not provide a BACnet tutorial in this document.

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APDU settings should match the corresponding settings in your BACnet client.

Segmentation is not supported by the current version S4IS system. That setting is not changeable.

Under the Router Settings section, you can customize the BACnet settings for the BACnet router functionality of the system

IP Port Number – User configurable TCP/UDP port number where BACnet transactions are published.

Router Network Number – The S4IS device is a BACnet device so it needs to be assigned to a BACnet network number. This would typically be the BACnet network being utilized as the backbone for your BACnet environment.

Virtual Network Number – This is the BACnet virtual network hosted on the S4IS device. All discovered N2 devices will be published as BACnet IP devices under this network.

Router Device ID – Like any BACnet device the S4IS device needs to be assigned as unique BACnet device ID.

I-Am Message Pacing - The BACnet standard allows a device to send an I-AM announcement either asynchronously or as a response to a Who-Is request. I-AM Message Pacing inserts a user configurable delay between each I-AM transaction to protect network infrastructure devices from getting flooded by broadcast messages.

RPM – Read Property Multiple is enabled by default and can be disabled if desired by the installer.

WPM – is not supported in this version of the S4IS device. This setting cannot be changed.

Under the Other Settings section you can enter a physical address where the unit is being installed and an optional additional description. These values will be published to BACnet.

The next page of properties is related to the Downstream Protocol. In this product that is predefined as the legacy JCI Metasys N2 protocol.

Downstream N2 Properties

Initial BACnet ID – This property is utilized by the Startup Wizard discovery process to assign BACnet device ids to each published device. The first device is created using the specified ID. Each subsequent device is assigned a sequential ID. The system will validate that the ID is unique before assigning it and take appropriate action to find the next available unassigned device ID if necessary.
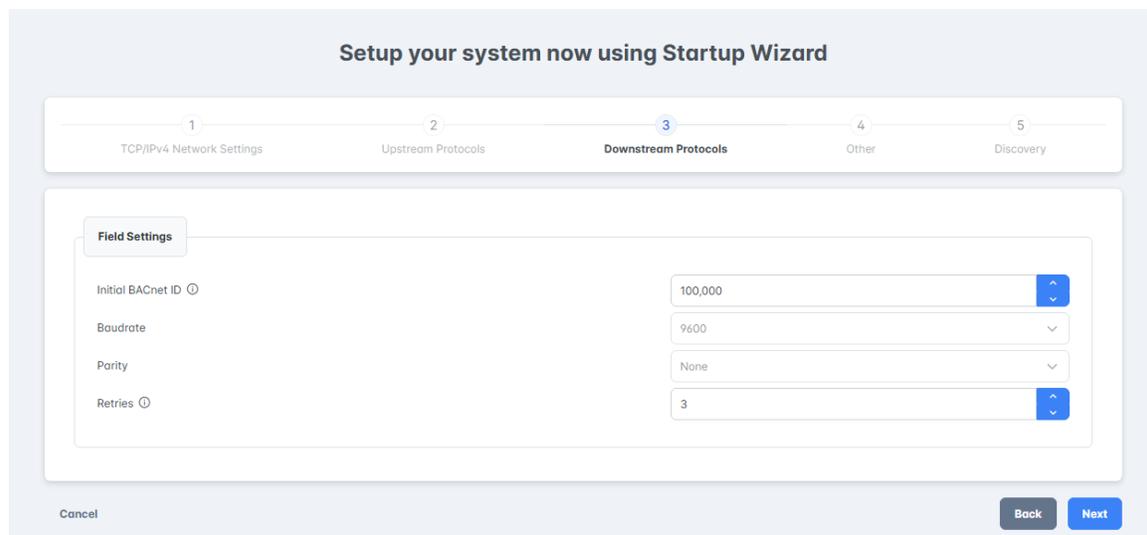
Serial communication properties for the N2 bus are fixed so they are displayed here for documentation purposes.

Retries – This is the number of times the system will try to access a N2 device if errors occur during the read, write, override, or release N2 transactions.

The final page of the Startup Wizard allows you to select time zone, date and time options. These default to Auto Detect but can be manually assigned if appropriate Internet services cannot be reached by the system.
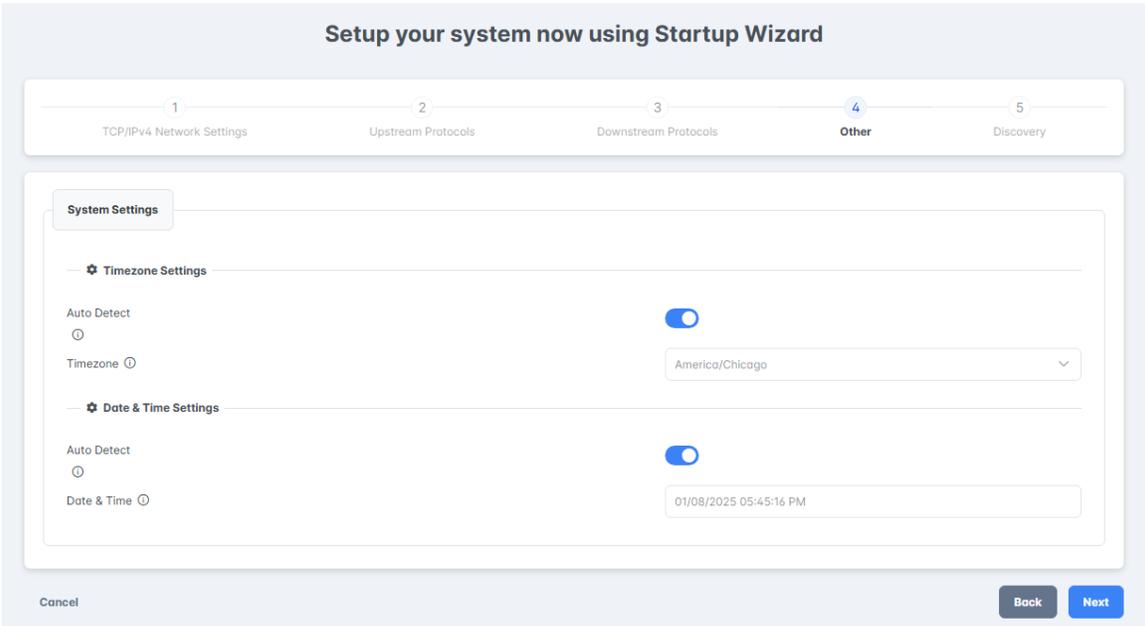
This completes the information gathering phase of the Setup Wizard. The wizard now walks you through auto discovery, BACnet object generation, and creation of the S4 system database.

Auto Discovery and Database Generation
Select the devices you want integrated to BACnet and click the Finish Button.
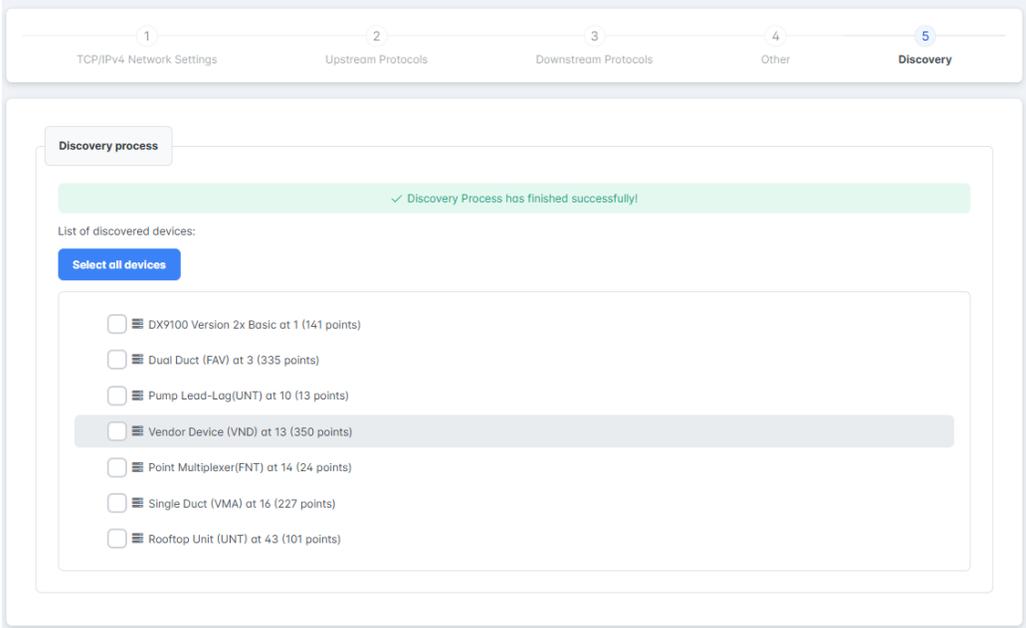
System configuration is complete and publishing to BACnet is initiated. This event is announced to BACnet by sending out a BACnet I-AM Router to Network transaction.

Note: The system will reject any BACnet requests while the System Setup wizard is running.

Please be advised that the S4 system has a lot of work to do to prepare for publishing to BACnet. In large configurations this could take 10 minutes, or longer.

During this process the correct Device Template is selected from our on-board catalog and associated with each device. Device Templates contain BACnet point mapping for each device along with all associated properties.

Please review the point mapping for each device to make sure it is correct. Manual intervention may be required for DX9100 devices, VND devices, Metasys Integrator devices, and CIG devices.

Templates may be edited to prune unneeded points, modify point properties, designate points as Critical, or other customization required to meet the needs of your project.

BACnet Integration

The S4 BACnet N2 Integration supports bi-directional access to field device data by any client following the BACnet protocol as defined by ASHRAE SSPC 135 https://bacnet.org/.

All supported BACnet properties and services are defined in the S4 BACnet N2 Integration Protocol Implementation Conformance Statement (PICS) document available on the S4 website.

Integration with the BACnet Priority Array

Commandable Points
All commandable BACnet points contain a 16-level priority array. The S4 integration fully supports the priority array and provides application specific extensions to guarantee the integrity of the integration. BACnet clients are not aware of the details of the N2 protocol. Conversely, N2 devices are not aware of any of the details of the BACnet protocol.

Synchronizing Values
The integration from N2 to BACnet clients fully supports the BACnet priority array mechanism. All N2 points are read on a repeatperiodic schedule by our Scanner process, and the value is entered into the priority array Relinquish Default entry. This guarantees that the S4 system, the N2 master, and BACnet will always be in sync.

Persistent Values
A S4IS extension to the priority array is support for persistent commands. This is critical for value added applications like Demand-Response. If a commandable point is written at a priority, the S4 algorithms will interrogate the priority array with every read to the N2 bus. If a higher priority value exists in the priority array that value will immediately be written back to the N2 bus, forcing that value to be persistent and override any value commanded at a lower priority. When the higher priority entry is relinquished, point operation returns to normal.

Metasys Supervisory Controller Integration
The Upstream N2 interface enables co-existence of the legacy supervisory controller with the new BACnet OWS, Global controller, or value-added applications.

BACnet Priority Array Integration
The priority of write or override transactions was defined in the Setup Wizard and is configurable through the UI.

Critical Points
Points marked Critical are scanned at a faster rate than normal points. This property is controlled by the device template which can be edited by the installer.

The exact scan rate will be determined by the total volume of points, the volume of N2 transactions generated by the supervisory controller, and the number of BACnet transactions being generated by all sources.

Passthrough Mode
The Upstream N2 interface is a virtualization of the N2 bus. In a typical installation the Metasys supervisory controller would be connected to this interface. After the Metasys supervisory controller is disconnected, this interface can be utilized by the Metasys configuration and commissioning utilities HVAC Pro, GX9100, and others. Upload and download functions of these utilities require that you put the interface into Pass-Through mode through the UI to avoid conflicting transactions on the N2 bus.

Non-Commandable Points
BACnet physical input object types BI, AI, and MSI and character object types do not support priority arrays. For these object types, the value read from the N2 bus will always be written to the point present value attribute. The BACnet Out-Of-Service mechanism can also be used in conjunction with BACnet write operations to override the value of these points.

BACnet Best Practices

Best practices dictate that you adjust the APDU Segment Timeout and the APDU Timeout settings to match those settings in your BACnet client.

For Tridium (and Niagara derivatives) best practices indicate that Read Property Multiple (RPM) and Write Property Multiple (WPM) should be disabled. Otherwise, under conditions of frequent errors, the Niagara Fox protocol recovery and retry algorithms could cause all points to go stale.

Security

Only ports needed for proper operation of the S4 application are open.

 SSH (Port 22), FTP (Ports 20-21), Telnet (Port 23), etc. are disabled by default (these may be needed for remote support so eventually they will be configurable.)

Port 47808 is the standard BACnet port. This is configurable as specified in the BACnet standard.
Port 5095 is used by the S4 application.
Port 5800 is used for the backend to UI communication.
Port 80 is used for user access to the web server-based UI

Licensing

The S4 N2 Integration is a licensed product. It will be a perpetual license with the option for an annual support contract. The appropriate license will be installed in the system as a part of the S4 system build and Q/A test process prior to shipment.

The following actions will be taken if a system is unlicensed.

For 1 to 30 days, a message will be displayed in the UI saying "Your license has expired, please contact S4 immediately to prevent any interruption of services at sejones@s4integrationsolutions.com.".

For 31 to 60 days, you will not be able to login to the S4 UI and a pop-up window will be displayed saying "Your license has expired, please contact S4 immediately at sejones@s4integrationsolutions.com."

After 61 days, the lockout of the S4 UI will continue, and the system will append "S4 License Expired" to the device name in BACnet. For example, if the device name is "Lobby", this will change to "Lobby S4 License Expired".

If the number of licensed devices is exceeded a message will be displayed in the UI saying "Your licensed number of devices has been exceeded, please contact S4 immediately to order additional licenses at sejones@s4integrationsolutions.com.". The system will append "S4 License Exceeded" to the device name in BACnet.

Licensing status can be seen on the system login page. There are also links here to retrieve your hardware ID and to install a new license.

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System Production Operation

This is the UI as seen when the system initiates production operation. The top-level items enable you to modify your selections made in the Setup Wizard at any time.

You will find Performance Metrics throughout the UI providing insight into the health of the system and the efficiency of the integration.
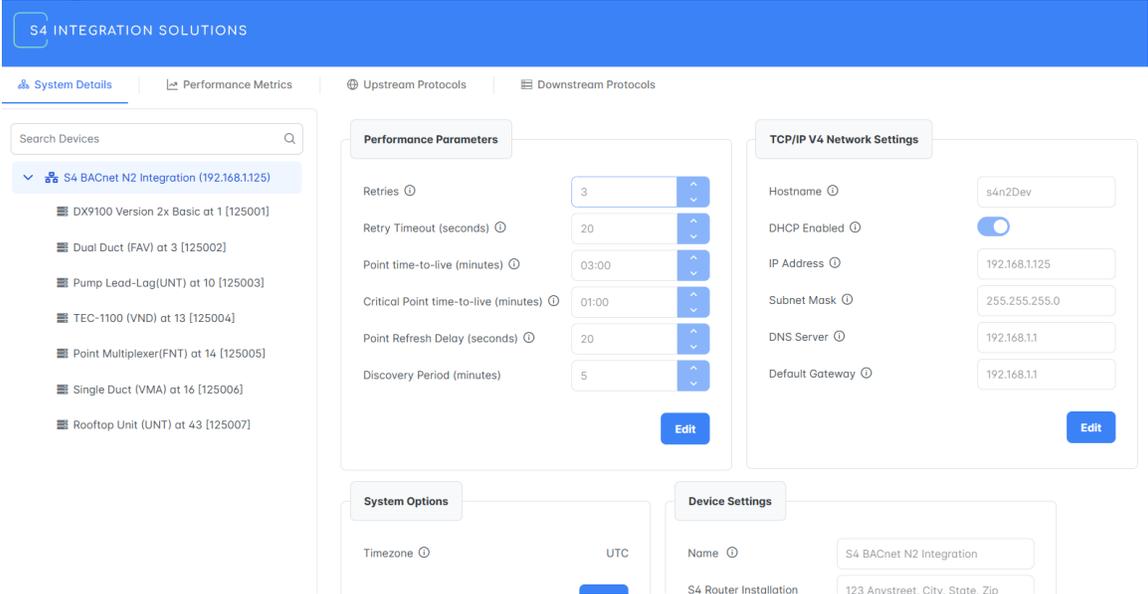
The S4 System Node

The first item in the navigation pane is always the S4 system itself. This provides the ability to change any operational parameters and initiate administrative functions.

Performance Parameters

Retries ⓘ	3
Retry Timeout (seconds) ⓘ	20
Point time-to-live (minutes) ⓘ	03:00
Critical Point time-to-live (minutes) ⓘ	01:00
Point Refresh Delay (seconds) ⓘ	20
Discovery Period (minutes) ⓘ	5

Edit

TCP/IP V4 Network Settings

Hostname ⓘ	s4n2Dev
DHCP Enabled ⓘ	(toggle on)
IP Address ⓘ	192.168.1.125
Subnet Mask ⓘ	255.255.255.0
DNS Server ⓘ	192.168.1.1
Default Gateway ⓘ	192.168.1.1

Edit

System Options

Auto Detect ⓘ	(toggle off)
Timezone ⓘ	America/Denver

Edit

Auto Detect ⓘ	(toggle on)
Date & Time ⓘ	12/27/2024 01:14 PM

Edit

Reboot   Reset Database   System logs
System backup and restore   Update firmware

Device Settings

Name ⓘ	S4 BACnet N2 Integration
S4 Router Installation Address ⓘ	123 Anystreet, City, State, Zip
Additional Description ⓘ	

Edit

Reset Database

This function will reset the system to its pre-configuration status so that the setup process can start over. This is a protected function that can have adverse side effects. You will need to contact S4IS to request the current password to invoke this function as well as a discussion about what to expect after the process is completed.

Reboot

At any time that the S4 system restarts the following process will be followed.
- The S4 SQL database will be validated.
- Communication with the N2 field bus will be restored.
- Publishing to BACnet will be restored. Please be advised that the S4 system has a lot of work to do to prepare for publishing to

BACnet. In large configurations this could take 10 minutes, or longer.

System Logs
All transactions, property changes, and user administration actions are logged to the system SQL database. This item can be used to export an existing log file so that it can be sent to S4IS for analysis or to manually initiate the creation of a log file.

System Backup and Restore
System backup and restore functions can be initiated through this button. Application configuration and the SQL database is backed up or restored with this function. The operating system is not included in this backup.

Update Firmware
If it becomes necessary to update the system firmware for any reason S4IS will transmit an update package to you typically as an email attachment. This button will walk you through selecting the update package file and applying it to the system. As a failsafe method of updating system firmware the update package can be placed on a USB thumb drive and inserted into the system. Rebooting the system will apply the update

N2 Device Nodes
Each N2 device discovered is displayed below the S4 Router node. Selecting an N2 device opens its point list and properties.
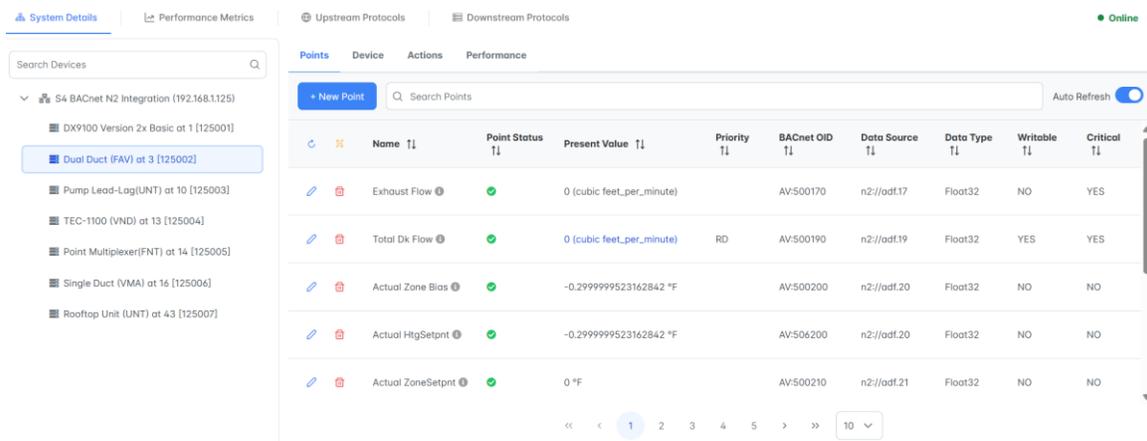
Device specific actions, administrative functions, and performance stats can be viewed by selecting the appropriate tabs.

Point Details

Point lists and details are defined by S4 device templates. Refer to S4 Integration Solutions Template Design for assistance in defining or modifying templates. This document contains S4IS intellectual property and must be requested by contacting S4IS.

Any BACnet properties of a point can be modified by editing the associated template.

The Present Value of any writable point can be changed by clicking on the value displayed. A pop-up will assist you with completing the transaction.

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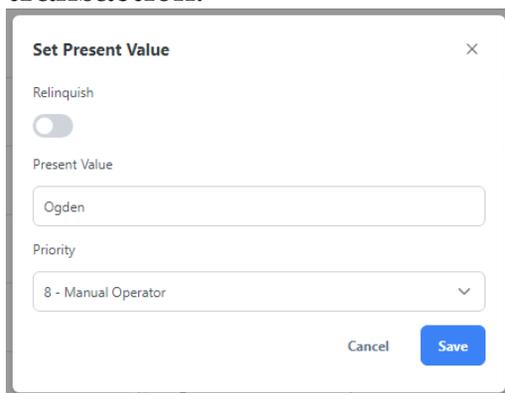
BACnet properties, including Point Status, are displayed along with the point value. If any faults or reliabilitity errors are detected, this field will be displayed in red. Hovering over the field will provide more details.

Navigating Point Details

As a master system integrator or end user you will spend most of your time in Point Details. The system provides additional navigation aids by providing a free text search function and by enabling you to sort the data points by any column.

Once system installation and integration is complete, the S4 UI will become a reference tool for monitoring system performance and troubleshooting. The primary interface used to access or update data provided by the system will be BACnet.

Upstream Protocols
Selecting this tab displays the properties selected during the Setup Wizard and allows you to modify these properties in the operational system. Note that in some cases this will require a system reboot to apply changes you select.

Downstream Protocols
Selecting this tab displays the properties selected during the Setup Wizard and allows you to modify these properties in the operational system. Note that in some cases this will require a system reboot to apply changes you select.

Device Template Library
The downstream Protocols tab contains a function that was not required for system setup but is necessary for maintenance and support of Device Templates. Earlier sections discussed the operation and functionality provided by device templates. The Export button allows you to select and export templates. The

exported template is in .CSV format and may be edited using Excel or a text editor. The Import button allows you import either new or edited templates. After a template is imported the system will recommend devices that it is compatible with and allow you to choose what devices to associate that template with.

Summary

This document provided an introduction to the S4 BACnet N2 Integration and is intended to be used as a training and reference document. The system UI is intuitive so after your introduction to the system it is hoped that you very seldom need to come back to this document.

Contact

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Happy Integrating!