



S4 BACnet ecobee Integration User Guide

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S4 BACnet ecobee Integration

Basic Information

Summary

The S4 BACnet ecobee Integration is delivered as a network appliance hosted on a SuperLogics Embedded PC Model SL-EB-J6412-H-2LAN. The S4 application is installed on the system before shipment. System commissioning and configuration is performed through the web-based user interface.

S4 products offer very sophisticated integrations while keeping the master system integrator, or end user, experience clean and intuitive. The S4 application handles the details of interfacing with the ecobee SmartBuildings service utilizing the customer provided ecobee Client ID and Client Secret credentials. All configuration information and data gathered from the ecobee service is persistently stored in our SQL database.

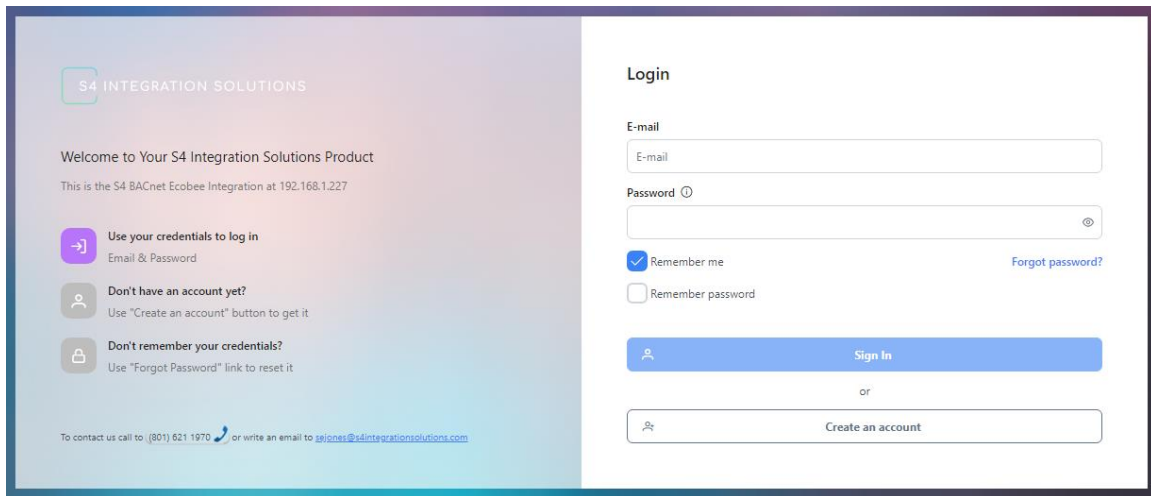
Each ecobee defined building and thermostat, with associated data and properties, is published as an emulated BACnet/IP device. Any BACnet-enabled client application can interact with these devices as if they were native BACnet devices.

Gateway Overview

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

Details about unpacking and physically installing your S4 BACnet ecobee Integration product can be found in document **S4 BACnet ecobee 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 setup wizard options where you can select your desired operational properties.

System Configuration

The first set of properties are the TCP/IP settings for the system Ethernet interface. By default systems are delivered with automatically assigned IP addresses. However, you can request special configurations when ordering the system.

Ethernet TCP/IP Properties

Setup your system now using Startup Wizard

1 TCP/IP v4 Network Settings 2 Upstream Protocols 3 Downstream Protocols 4 Discovery

TCP/IP V4 Network Settings

Hostname ⓘ	<input type="text" value="S4Ecobee"/>
DHCP Enabled ⓘ	<input checked="" type="checkbox"/>
IP Address ⓘ	<input type="text" value="192.168.1.227"/>
Subnet Mask ⓘ	<input type="text" value="255.255.255.0"/>
DNS Server ⓘ	<input type="text" value="192.168.1.1"/>
Default Gateway ⓘ	<input type="text" value="192.168.1.1"/>

Moving on to the Next screen you will be asked to select your BACnet properties. We assume that anyone using this product is proficient in BACnet and we will not provide a BACnet tutorial in this document.

BACnet Properties

Setup your system now using Startup Wizard

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

BACnet Protocol

Segmentation Settings

APDU Max Length (bytes) 1476

APDU Retries 3

APDU Segment Timeout (milliseconds) 2,000

APDU Timeout (milliseconds) 4,000

Segmentation Supported Not Supported

Router Settings

IP Port Number 47,808

Router Network Number 1

Virtual Network Number 1,000

Router Device ID 1

I-AM Message Pacing (milliseconds) 1,000

Field BACnet Priority 16

Other Settings

S4 Router Installation Address 123 Anystreet, City, State, Zip

Additional Description

Cancel
Back
Next

Segmentation is not supported by the S4 system so that setting is not changeable

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

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.

Field BACnet Priority is one of the methods utilized to ensure that the ecobee service, the S4 system, and BACnet stay synchronized for any point that supports the BACnet priority array mechanism. This property is fixed at priority 16. Every read that is performed against the ecobee API is entered into the priority array at priority 16. 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.

Note that most properties and points contain an (i) icon in the UI. Hovering over this icon will display a tooltip for the item.

BACnet Integration

The S4 BACnet ecobee Integration supports bi-directional access to building and thermostat 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 ecobee Integration Protocol Implementation Conformance Statement (PICS) document available on the S4 website.

The final page of properties are related to the Downstream Protocol. In this product that is the ecobee API. To complete this section, you will need the Client ID and Client Secret provided for the building owner's ecobee SmartBuildings account before the process can move forward.

Integration to 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 and to compensate for the ecobee SmartBuildings API policy of last one in wins. Without supporting algorithms in the S4 system this would allow occupants to defeat client applications needing to issue deterministic and persistent commands to the thermostats using either the physical thermostat or smart phone applications.

BACnet clients are not aware of the details of the Ecobee thermostats or SmartBuildings API. Conversely, Ecobee devices are not aware of any of the details of the BACnet protocol.

Synchronizing Values

The integration from Ecobee to BACnet clients fully supports the BACnet priority array mechanism. All Ecobee point reads by the S4 system will enter the received value into



the priority array at priority 16. This guarantees that the S4 system, the Ecobee SmartBuildings Service, and BACnet will always be in sync.

Persistent Values

A critical S4 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 higher than 16 the S4 algorithms will interrogate the priority array with every read to the ecobee API. If a higher priority value exists in the priority array that value will immediately be written back to the ecobee API, forcing that value to be persistent and override any value manually entered on the ecobee thermostat or smart phone application. When the higher priority entry is relinquished, physical thermostat operation returns to normal.

Non-Commandable Points

BACnet physical input object types BI, AI, and MSI do not support priority arrays. For these object types the value read from the API will always be written to the point present value attribute. The BACnet Out Of Service mechanism can also be utilized in conjunction with BACnet write operations to override the value of these input 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. If this is not done under conditions of frequent errors the Niagara Fox protocol recovery and retry algorithms could cause all points to go stale.

ecobee Properties

Setup your system now using Startup Wizard

1 2 3 4

TCP/IPv4 Network Settings Upstream Protocols **Downstream Protocols** Discovery

Ecobee Settings

Maximum Alert Count ⓘ	<input type="text" value="10"/>	↑ ↓
Client ID ⓘ	<input type="password"/>	👁
Client Secret ⓘ	<input type="password"/>	👁
Initial BACnet ID ⓘ	<input type="text" value="100,000"/>	↑ ↓
Response Timeout (seconds) ⓘ	<input type="text" value="5"/>	↑ ↓

Cancel Back Next

For security reasons after you enter these fields they will be hidden from a casual user's view and require a password to be displayed.

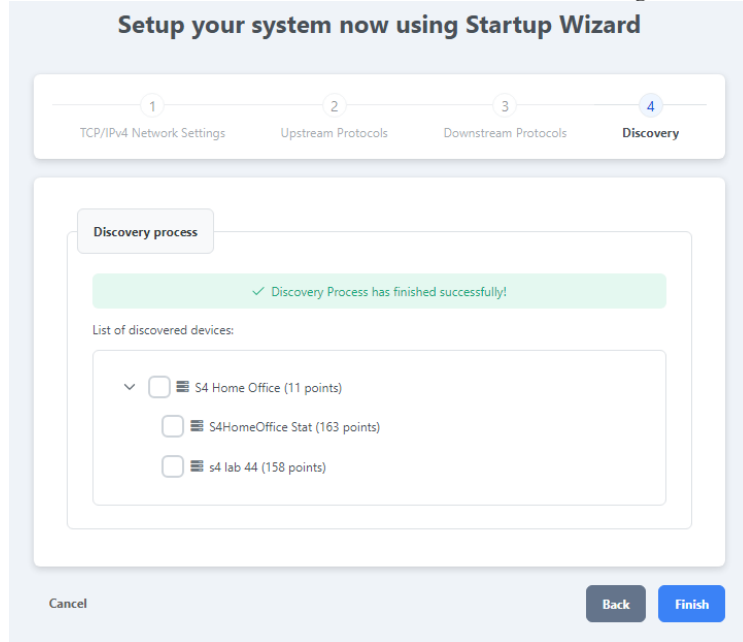
ecobee Integration

As described earlier, S4 uses the public ecobee commercial APIs associated with their SmartBuildings service to interact with thermostats subscribed to the service. If you need more details about the APIs and how they relate to your building and thermostats, please visit <https://docs.sb.ecobee.com/docs>.

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

As soon as your ecobee credentials are verified the system will automatically discover all buildings and their associated thermostats in the SmartBuildings service and display them for your review.



Select the devices you want integrated to BACnet and click the Finish Button. System configuration is completed 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.

System Architecture Overview

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 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 setup wizard. This makes point details immediately available to BACnet client applications and makes the system immune to small disruptions in Internet service.

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 ecobee API 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 both through the UI and published to BACnet to facilitate trend logging or display in the BACnet graphical user interface.

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.

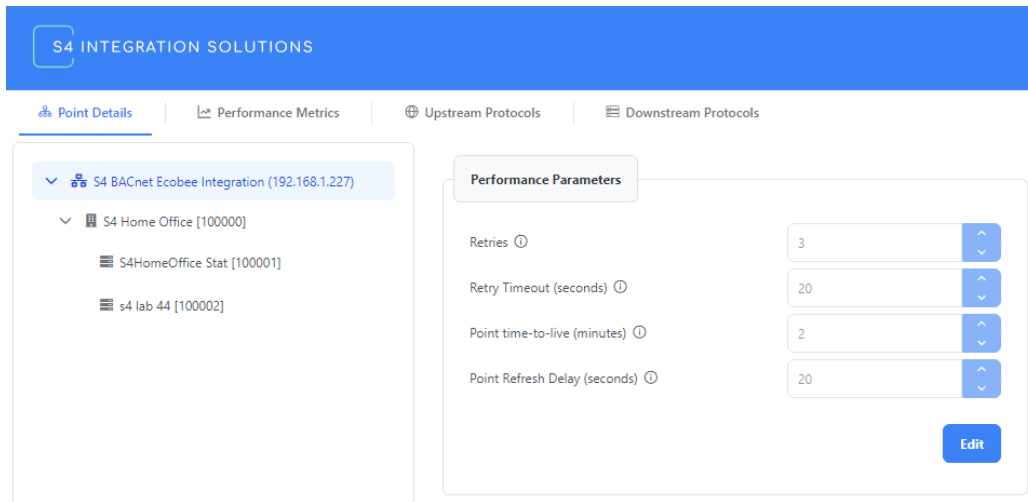
Port 5095 is used by the S4 application.

Port 5800 is used for the backend to UI communication.

Port 80 is used for user access to the web server based UI

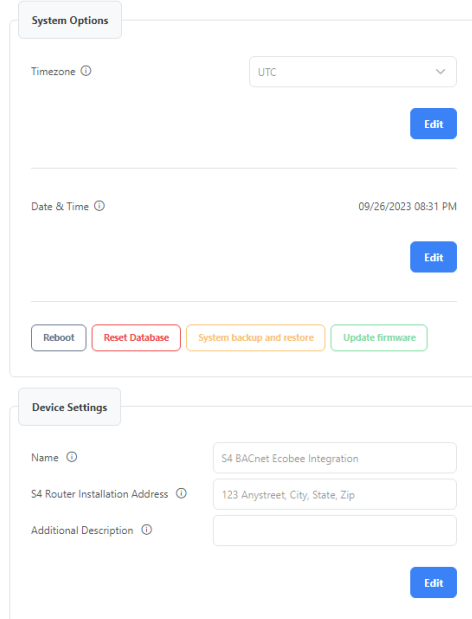
System Production Operation

This is the UI as seen when the system initiates production operation. The top-level items take you back to the properties configured during system setup, enabling you to modify your selections 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.



Building and Thermostat Nodes

Each item in the tree below this provides details for a building or thermostat subscribed to the ecobee SmartBuildings service.

Name	Data Source	Data Type	Access Rights	BACnet OID	Point Status	Present Value	Current Command Priority
Building_ID	ecobee//buildingid	Characterstring/Value	read	CS1	●	"64402c5e4a205002a54004"	
Building_Name	ecobee//buildingname	Characterstring/Value	write	CS2	●	"S4 Home Office"	16
Building_Address	ecobee//buildingaddress	Characterstring/Value	write	CS3	●	"1090 E 4600 S"	16
Building_City	ecobee//buildingcity	Characterstring/Value	write	CS4	●	"Ogden"	16

Point Details

Point lists and details are defined by S4 templates. Refer to **S4 Integration Solutions Template Design** for assistance in defining or modifying templates. 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.

Set Present Value

Relinquish

Present Value

Ogden

Priority

8 - Manual Operator

Cancel Save

BACnet properties, including Point Status, are displayed along with the point value. If any faults or reliabilities 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 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.



Contact

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Happy Integrating!