BACnet Controller Integration Technical Bulletin

Building Technologies & Solutions

www.johnsoncontrols.com

2021-02-05

LIT-1201531

Release 11.0

Contents

Introduction

This document describes how BACnet® controllers, both those from Johnson Controls and third-party suppliers, are integrated into the Metasys system through the NAE, NCE, SNE, and SNC series network engines, OAS series Open Application Server, or ODS series Open Data Server all hereafter referred to as supervisory devices. This capability provides two major functions:

- First, this BACnet integration allows the objects within BACnet controllers to be interfaced with the Site Management Portal.
- Second, this BACnet integration enables the supported supervisory controllers to provide supervisory control and monitoring functions for objects integrated from connected BACnet controllers. BACnet controllers can integrate with a supervisory controller using either BACnet/IP or MS/TP communications.

Note: In this document, all NCE25, NAE35, and NAE45 content relates to Release 9.0.8. NAE55/NAE85/LCS85 are supported at Release 11.0. All SNE and SNC content relates to 11.0.

The functions provided by the supervisory controllers for BACnet controllers are similar to those provided to integrated N2 and LonTalk® controllers. The major difference is that the supervisory controller behaves as a BACnet gateway to the non-BACnet controllers, converting their data into BACnet objects that reside within the supervisory controller. For integrated BACnet controllers, the supervisory controller provides BACnet mapper objects, which supplement the standard BACnet object data of the integrated controllers with additional attributes needed to perform the workstation and building controller functions within the Metasys system. This document describes those additional attributes.

Note: The term supervisory controller is used throughout this document to refer to the variants of controllers that support BACnet controller integration, including NAE, NCE, SNE, and SNC series network engines, the OAS series Open Application Server, and the ODS series Open Data Server.

Summary of changes

Updated Metasys Release references to 11.0 throughout the document.

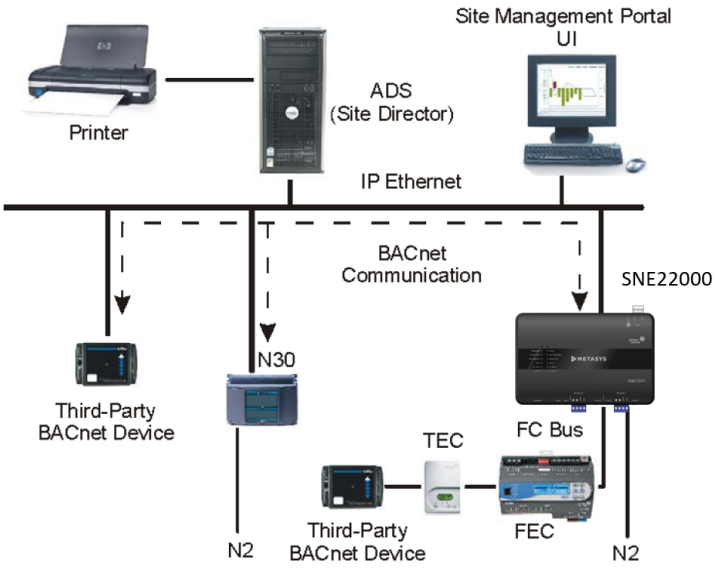
BACnet Controller Integration overview

As a BACnet integrator, the supervisory controller monitors and supervises a network of BACnet devices and acts as a BACnet operator workstation for all integrated controllers. Data is presented to the operator through the Site Management Portal UI of the supervisory controller. Other BACnet devices on the network can read from and write to the BACnet objects within the supervisory controller.

BACnet Integration

The BACnet Integration allows the integration of BACnet devices into the *Metasys* system. Figure 1 shows an example of this type of configuration. As shown, third-party BACnet devices can reside on the IP Network and on the MS/TP Field Bus.

Figure 1: BACnet system integration configuration example



Two software objects in the supervisory controllers enable integration to BACnet controllers:

- The BACnet IP Integration supports the connection of BACnet/IP devices.
- The Field Bus MSTP Integration supports the connection of BACnet MS/TP devices via a local Field Bus or a Remote Field Bus connection. Field Bus integrations on trunk 1 and 2 are exposed as BACnet Network Port objects.

The supervisory controller, with the Site Management Portal as its UI, serves as a BACnet workstation on which to view and command standard BACnet objects in BACnet devices. It maps the BACnet system data to create integrated objects to use in Metasys system applications, and to use in features such as interlocking and demand limit/load rolling.

By using the BACnet Integration and Field Bus Integration in a supervisory controller, you can map the desired BACnet devices and objects.

Notes:

- BACnet devices that auto-discover the objects in a supervisory controller, such as a third-party BACnet workstation, identifies the mapper objects, not the actual BACnet objects in the field devices. The mapper objects have all the same standard attribute values of the original objects of the integrated devices, except for the BACoid, for which the mapper object has a unique number that is different from that of the original object. The Device Objects themselves of the integrated devices do not have mapper objects. Thus, the BACnet device recognizes the supervisory controller as a single device with a large collection of all the integrated standard objects that are mapped from the integrated devices. FX products are treated as third-party devices on the BACnet integrations.
- The BACnet devices can discover MS/TP field devices and objects by enabling the BACnet/IP to MS/TP routing feature in the NAE. See the Configuring a Network Engine as a BACnet/IP to MS/TP Router section.

  ➽ **Important:** BACnet routing can greatly increase the amount of message traffic on the MS/TP bus. This can, in turn, cause a major reduction in performance. Refer to the *Adjusting NAE network sensitivity* section in the *NAE Commissioning Guide (LIT-1201519)* for ways to improve performance by adjusting network parameters.

BACnet Integration/Field Bus Integration object

In most instances, the supervisory controller has a BACnet integration. Use the BACnet Integration to configure the parameters for BACnet integration in the supervisory controller that is monitoring BACnet/IP devices. For more information about the BACnet Integration object, including attributes and commands, refer to the *Object Help* in the *Metasys SMP Help (LIT-1201793)*.

Note: NxE/SNx's can only have one BACnet/IP Integration.

Use the Field Bus MSTP Integration to connect BACnet MS/TP devices to a supervisory controller. The specific model of supervisory controller must either have an available RS-485 communication connection or use the remote field bus integration if the MS/TP devices are accessible through a BACnet/IP to MS/TP router. In this case, the router provides the RS-485 communication instead of the supervisory controller.

Note: Make sure you map field devices under a remote field bus to only one supervisory controller. If you map the same remote controllers to multiple supervisors, these devices may cycle online and offline and you may experience slow startup performance. For more background on the remote field bus, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

The BACnet Integration object offers four views, while the Field Bus Integration object adds a fifth view:

- Focus view
- Diagnostics view
- Engineering view
- Summary view
- Hardware view (Field Bus integration only)

Note: Only the focus view is available during offline configuration with the SCT.

Focus view

The focus view contains basic user data including the name of the object and the device name of the host supervisory controller for the BACnet integration object.

Diagnostics view

The diagnostics view displays BACnet protocol diagnostic properties for troubleshooting purposes.

Note: This view is not available during offline configuration with the SCT.

Engineering view

The engineering view of the BACnet Integration allows scanning the entire IP network to discover and view data in BACnet devices that are connected on the network, whereas the Field Bus object's engineering view shows the devices connected to the corresponding MS/TP bus. Advanced users (with the appropriate access authority) use this view to see and change data in BACnet devices directly, whether or not the objects have been integrated to the supervisory controller. A user can then view and command many more BACnet devices than just those that have been integrated and are visible in the Site Management Portal All Items navigation tree.

The engineering view contains the Integration Tree and Integration View panels. The Integration Tree panel contains a list of known BACnet devices and their objects that are connected to the supervisory controller. The Integration View panel displays the details about the BACnet device or objects selected in the Integration Tree.

After you create a new BACnet Integration or Field Bus Integration, the Integration Tree is empty until you add the BACnet devices by using auto discovery.

Note: This view is not available for offline configuration with the SCT.

Summary view

The Summary view shows a list of all mapped devices and the current values of key data about each device.

Note: This view is not available for offline configuration with the SCT.

Hardware view (Field Bus integration only)

The hardware view shows the Field bus trunk number, baud rate and network address.

BACnet Integration and Field Bus Integration Auto Discovery filtering

When you map BACnet/IP devices or Field Bus integration devices using auto discovery, the list of devices may become so long that it is difficult to find a device in the list. You can use a number of attributes in the Advanced Focus view to filter your view and make the list more manageable. You can configure this filtering using a collection of attributes located on the Advanced Focus view of the BACnet integration object or Field Bus Integration object.

When devices are discovered, the discovery list displays the devices previously mapped by default. Additional devices are then added as they are discovered.

BACnet Integration Auto Discovery filters

- **Device Discovery Range**—This attribute is a list of filters arranged so that a device that matches any of the list entries displays in the Auto Discovery list. The default attribute value is no entries, which allows all reachable devices to be discovered. Each list entry has the following parts:

  - Broadcast Type - This entry filters the scope of the device discovery process at a BACnet network level. This entry has three options:

    - Local - Discovers devices only on the local BACnet/IP network (network number zero [0] is defined by BACnet as the local network).
    - Remote - Discovers devices only on a particular BACnet network that must be specified.
    - Global - Discovers devices on all BACnet networks that are reachable (network number 65535 is defined by BACnet as the global broadcast network number).

  - Network Number - The network number can only be entered when the Broadcast Type is set to Remote.
  - Device Instance Low Limit - Each BACnet device is required to have a unique instance number at a site. The Device Instance Low Limit value specifies the lowest device instance number discovered on a network. The range for this value is 0 to 4194303. A device with an instance number zero is not discovered when using this filter.
  - Device Instance High Limit - The Device Instance High Limit value specifies the highest device instance number discovered on a network. The range for this value is 1 to 4194303 and must be at least one number greater than the Device Instance Low Limit. A device cannot have an instance number higher than the range limit.

- **Preserve Discovered Devices**—This attribute determines whether devices discovered during a previous Auto Discovery operation are preserved during subsequent Auto Discovery operations. If the attribute is set to True, devices previously discovered are preserved. If the attribute is set to False, then devices previously discovered are not preserved. By default, this attribute is set to True.

  Set the attribute to True to collect an inclusive list of devices by performing discovery multiple times with different filter settings.

  Set the attribute to False to narrow the discovery list to the current filter settings.
- **Discover All As General BACnet Device**— If the attribute is set to True, the BACnet/IP integration allows for the discovery of JCI supervisory controllers. On both IP and MS/TP integrations the devices are discovered as general BACnet devices rather than JCI Family BACnet devices and this prevents you from using JCI enhanced BACnet features. However, setting the attribute to False does not prevent the discovery of JCI IP field devices as JCI IP field devices are always discovered on the BACnet/IP integration.

ⓘ **Note:** If you change the attribute after running Auto Discovery, we recommend you restart the supervisory controller when configuration is complete.

- **Requested Vendor ID**—The BACnet Vendor ID is a numerical value assigned to the vendor of the device. By default, this attribute is empty (or at zero), allowing all vendors to be discovered. If a number other than zero is entered, only devices with a matching vendor ID display in the discovery list. BACnet maintains a list of vendor IDs at http://www.bacnet.org.
- **Page Size**—This attribute filter applies only to point object discovery within a single device, and limits the number of displayed objects to a quantity within the display capability of the Site Management Portal (SMP) UI. When the page size reaches the limit, click Restart on the object discovery list to move to the next page. If you click Restart on the last page of the discovery list, the object discovery runs again and produces a new page 1. The range of point objects displayed per page is 10 to 1,000.

Field Bus Integration Auto Discovery filters

Field Bus integrations are associated with a particular BACnet network number. During Auto Discovery, only devices connected directly to that particular BACnet network are discovered. A device is classified as either a General BACnet Device or as a JCI Family BACnet Device. General BACnet Devices are managed using standard BACnet services and properties. JCI Family BACnet Devices are managed using enhanced BACnet services and include proprietary properties in order to improve performance and to display additional details about the device and its objects. Devices that are not JCI Family devices are always managed as General BACnet Devices.

- **Discover All As General BACnet Device**—This attribute determines whether a Johnson Controls Device in the FEC/FAC/VMA or CGM/CVM series family is classified as a JCI BACnet Device or as a General BACnet Device. By default, this attribute is set to False, and classifies the device as JCI BACnet Devices so that performance is optimized and proprietary properties display. When this attribute changes, any previous discovery information clears and Auto Discovery must run again.

  ⓘ **Note:** If you change the attribute after running Auto Discovery, we recommend you restart the NxE when configuration is complete.
- **Requested Vendor ID**—The BACnet Vendor ID is a numerical value assigned to the vendor of the device. By default, this attribute is empty (or at zero), allowing all vendors to be discovered. If a number other than zero is entered, only General BACnet Devices with matching vendor IDs display in the discovery list. JCI BACnet devices always display on the discovery list. BACnet maintains a list of vendor IDs at http://www.bacnet.org.

BACnet object support

The Metasys system integrates and exposes objects as standard BACnet object types. The user configures and enables the BACnet Integration and Field Bus Integration feature in the supervisory controllers.

The Metasys system supports a subset of standard BACnet object types, but does not support integration of any proprietary object types in other BACnet devices. Of the supported standard BACnet objects, only the required and optional properties are viewable for non Metasys Series controllers (referred to as General BACnet Device in this document); proprietary properties are not supported.

The following list of BACnet object types are both those supported in the Metasys supervisory controllers for BACnet/Field Bus integration, and those exposed as BACnet objects to third-party BACnet devices that discover the supervisory controller. Refer to the *Object Dictionary* in online *Help* or the *Network Engine Protocol Implementation Conformance Statement Technical Bulletin (LIT-1201532)* for further details on objects supported.

➤ **Important:** Electric Demand Control, Electric Demand Monitoring, and Generator Load Control objects are intended for use only in Japan.

- Accumulator
- Analog Input (AI)
- Analog Output (AO)
- Analog Value (AV)
- Averaging

ⓘ **Note:** Averaging objects created in the NAE appear as extensions to the object that the average is associated with. When exposed to a third-party BACnet device, the extension appears as its own BACnet Averaging object.

- Binary Input (BI)
- Binary Output (BO)
- Binary Value (BV)
- Bitstring Value (ODS only)
- Calendar
- Characterstring Value
- Command
- Date Pattern Value (ODS only)
- Date Time Pattern Value (ODS only)
- Date Time Value (ODS only)
- Date Value (ODS only)
- Device (only the NAE/NCE/SNE/SNC exposes the Device object)
- Event Enrollment
- Electric Demand Control
- Electric Demand Monitoring
- File
- Generator Load Control
- Group

- Integer Value
- Large Analog Value (ODS only)
- Life Safety Point
- Life Safety Zone
- Load Control
- Loop
- Multistate Input (MI)
- Multistate Output (MO)
- Multistate Value (MV)
- Notification Class (Notification)
- Octet String Value (ODS only)
- Positive Integer Value
- Program (the *Metasys* Control System object qualifies as a BACnet Program object)
- Pulse Converter
- Schedule
- Time Pattern Value (ODS only)
- Time Value (ODS only)
- Trend

Note: Trend objects created in the supervisory controllers appear as extensions to the object that the trend is associated with. When exposed to a third-party BACnet device, the extension appears as its own BACnet Trend object.

- Trend Log Multiple

In the network engine, all mapped field points, including those on the N2 Bus, LonWorks® trunk as well as all field bus and BACnet integrated points are exposed as the corresponding BACnet objects types (AI, AO, BI, BO, MSI and so on) to third party BACnet devices. By default, the network engines do not allow routing messages to MS/TP devices connected to a network engine field bus. If you do enable routing, third party devices can map devices and their points connected to the local field buses.

Important: Do not enable routing during normal operation on NCE25, NAE35 or NAE45 series network engines as the increased traffic will likely increase offline/online event reporting.

See Enabling the routing mode.

Unique device object identifiers

Each BACnet device object at a site must have a unique instance number and name. The BACnet device object instance number and name are assigned in the field as part of the installation configuration. When assigning instance numbers and names to device objects at a site, we recommend maintaining a list of devices and their assigned BACnet device object unique instance numbers and names.

Items in the Navigation tree on the SMP UI

When an object appears in the Navigation tree that represents an object located in other devices, it is called an integrated (mapped) BACnet object. The integrated BACnet object has a new BACnet ID that is different from the ID of the physical BACnet object being mapped.

BACnet objects that appear in the Navigation tree on the Site Management Portal UI can be used as object references to other objects on the Metasys site (for example, scheduling, trend study, and DL/LR), allowing the integrated object to be referenced as any other Metasys system object.

Discovered BACnet/IP and MS/TP devices are not automatically added to the Navigation tree. The following rules apply when adding BACnet device objects and BACnet objects to the Navigation tree.

Add the:

- BACnet/IP device under the BACnet Integration object, or BACnet MS/TP device under the Field Bus Integration object
- Folder (container) objects under the BACnet device to group BACnet objects within a BACnet device

ⓘ **Note:** Adding folder objects is optional. For the easiest reference, put more important information points in the root directory and other information points into folders.

- BACnet objects directly under a BACnet device, or in folders under a BACnet device

When you select an integrated BACnet object from the navigation tree, the Focus view displays the BACnet properties in an available panel of the UI.

While most of the properties are directly inherited from the actual BACnet object in the integrated device, the mapped object in the NAE may have additional or different properties.

Commands

Only those *Metasys* system commands that can be implemented by a standard BACnet service are supported on an integrated BACnet object. Some BACnet objects support commands that are handled by writing to the remote BACnet object's properties.

The following table lists the commands that are available for each of the BACnet object types that are supported in the supervisory controller for BACnet/Field Bus integration.

Table 1: Command name table

Command Name	Override/ Override Release	Temp Override	Temp Out of Service	In and Out of Service	Sync Field Device Times	Reset Field Device	Adjust	State N, or Set State	Release	Release All	Route	Enable and Disable Alarms	Preset Value	Add/Remove Recipient	Clear and Execute	Rediscover Text Strings	Restore Controller States Text	Program Changes	Shed
Accumulator				X								X	X						
Analog Input (AI)			X	X								X							
Analog Output (AO)	X	X		X			X		X	X		X							
Analog Value(AV)	X	X					X		X	X		X							
Averaging																			

Table 1: Command name table

Command Name	Override/ Override Release	Temp Override	Temp Out of Service	In and Out of Service	Sync Field Device Times	Reset Field Device	Adjust	State N, or Set State	Release	Release All	Route	Enable and Disable Alarms	Preset Value	Add/Remove Recipient	Clear and Execute	Rediscover Text Strings	Restore Controller States Text	Program Changes	Shed
BACnet Character String Value	X	X					X		X	X		X							
BACnet Electric Demand Control (EDC)				X								X							
BACnet Electric Demand Monitoring (EDM)				X								X							
BACnet Generator Load Control (GLC)				X								X							
BACnet Integer Value	X	X					X		X	X		X							
BACnet Positive Integer Value	X	X					X		X	X		X							
Binary Input (BI)			X	X								X					X		
Binary Output (BO)	X	X		X				X	X	X		X					X		
Binary Value (BV)	X	X						X	X	X		X					X		
BitString Value[1]	X	X					X		X	X		X							
Calendar																			
Command								X									X		
Date Pattern Value[1]	X	X					X		X	X									

Table 1: Command name table

Command Name	Override/ Override Release	Temp Override	Temp Out of Service	In and Out of Service	Sync Field Device Times	Reset Field Device	Adjust	State N, or Set State	Release	Release All	Route	Enable and Disable Alarms	Preset Value	Add/Remove Recipient	Clear and Execute	Rediscover Text Strings	Restore Controller States Text	Program Changes	Shed
Date Time Pattern Value[1]	X	X					X		X	X									
Date Time Value[1]	X	X					X		X	X									
Date Value[1]	X	X					X		X	X									
Device					X	X										X			
Electric Demand Control				X								X	X						
Electric Demand Monitoring				X								X	X						
Event Enrollment (EEO)																			
Generator Load Control				X								X	X						
Group																			
Large Analog Value	X	X					X		X	X		X							
Life Safety Point (LSP)				X								X							
Life Safety Zone (LSZ)				X								X							
Load Control												X					X		X
Loop				X			X					X							
Multistate Input (MI)			X	X								X					X		
Multistate Output (MO)	X	X		X				X	X	X		X					X		

Table 1: Command name table

Command Name	Override/ Override Release	Temp Override	Temp Out of Service	In and Out of Service	Sync Field Device Times	Reset Field Device	Adjust	State N, or Set State	Release	Release All	Route	Enable and Disable Alarms	Preset Value	Add/Remove Recipient	Clear and Execute	Rediscover Text Strings	Restore Controller States Text	Program Changes	Shed
Multistate Value (MV)	X	X						X	X	X		X					X		
Notification Class (NCO)														X					
Octet String Value[1]	X	X					X		X	X									
Program																		X	
Pulse Converter				X								X							
Schedule				X															
Time Pattern Value[1]	X	X					X		X	X									
Time Value[1]	X	X					X		X	X									
Trend			X								X				X				
Trend Log Multiple											X				X				

1 Applicable to ODS only

Operation for most of these commands can be found in *Metasys SMP Help (LIT-1201793)*. The following command operations are unique to the BACnet integration:

- **Restore Controller States Text:** For objects supporting the States Text attribute, if the User Selected States Text attribute is true, the object's States Text is no longer synchronized with the States Text, Action Text, Active/Inactive, or Shed Level Description property. Use the Restore Controller States Text to set User Selected States Text to false. The field point's States Text attribute is then updated to match the remote object's **States Text** property.

ⓘ **Note:** If the dictionary cannot be updated to match the field device, the **States Text Error Status** attribute indicates the cause of the error.

- **State N:** The State N Command is used by the Command object to write the Present Value attribute by selecting a state. The first state in the drop-down box indicates No Action, and the remainder of the states indicate an Action from the Action array. If you choose to define your own custom enumeration set for this object, be sure to enter **No Action** for the first entry.

- **Add Recipient and Remove Recipient for the Notification Object:** Use this command to add or remove the parent supervisory device as a notification recipient for the selected Notification object.
- **Adjust:** For the Loop object, the Adjust command writes the Setpoint attribute.
- **Out of Service and Temporary Out of Service:** If you want to write and make reliable Present Value, first select an out of service or temporary out of service command to the input object, then set the Value before issuing the command. Objects that include this functionality include Accumulator, AI, BI, MSI, Pulse Converter, and Schedule mappers.

Alarming

The supervisory controller accepts alarms from BACnet devices if those devices have a Notification Class object with the supervisory controller specified as a recipient for the alarms, and if the sources of the alarms are mapped as integrated BACnet objects.

The remote BACnet device notification class object has a destination Process ID for each recipient entry. By default, the supervisory controller accepts alarms for all valid Process ID values. For each supervisory controller, you can filter alarms and accept only those matching specific Process IDs. The supervisory controller's device object contains an attribute under the BACnet section of the Focus tab called Process Id List. Adding Process ID values to this attribute tells the supervisory controller to only accept alarms matching those Process IDs values. There are two special cases that tell the supervisory controller to accept alarms for any Process ID: if the list is empty (which is the default) or if the list contains a Process ID of 0.

You can also configure the supervisory controller's Notification Class objects to send alarms to remote BACnet devices. The *Metasys* system audit trail then records the Alarm acknowledgments from the BACnet device.

Performance considerations for third-party BACnet devices

Network performance can degrade when you add third-party devices on the same IP network or MS/TP trunk if those devices do not meet the **Required** recommendations in Table 2. Actual job experience has shown as few as five devices can create significant performance issues; although other variables can affect performance, such as the number of objects per device. To improve network performance, we recommend that third-party devices also meet the **Highly Desired** recommendations in Table 2.

Table 2: Third-Party BACnet Device Performance Recommendations

MS/TP Trunk, IP Network, and BACnet Services		Recommendation
Devices On MS/TP Trunk	MS/TP Master Device	Required
	At least 38,400 bps	Highly Desired
	Application Layer Protocol Data Unit (APDU) size 480 bytes	Desired
	APDU size >200	Highly Desired
	Segmentation on MS/TP	Desired
Devices On IP Network	Segmentation on IP devices	Highly Desired
	Minimum APDU size 1024	Highly Desired

Table 2: Third-Party BACnet Device Performance Recommendations

MS/TP Trunk, IP Network, and BACnet Services		Recommendation
BACnet Services	Conform at a minimum to BACnet Version 1 Revision 4 specification	Protocol revision 15 or higher is desired.
	Device supports a minimum of a B-SA profile or a B-SS profile.	Required
	BACnet listed or Certified	Highly Desired
	+ Read Property Multiple, Execute	Highly Desired
	+ Subscribe COV, Execute	Highly Desired
	+ Write Property Multiple, Execute	Highly Desired

Exposing network engine data to M-Series Workstations

To allow the M-Series Workstation or third-party BACnet devices to interface to network engine devices, you must follow specific guidelines when configuring the network engine.

All network engine objects that are exposed as BACnet standard objects can be accessed from other BACnet devices and the M3 Workstation or M5 Workstation software.

ⓘ **Note:** The network engine must be configured to expose General BACnet Device controllers to other third-party BACnet devices, such as a workstation. For example, for an M-Series workstation to recognize the objects in a network engine that are mapped from a TEC controller, the network engine's device object's **BACnet Integrated Objects** attribute in the network tab must be set to Include in **Object List.**

For information on configuring the network engine, refer to the *Metasys SMP Help (LIT-1201793)*.

For M-Series Workstations, configure the network engine with the following considerations. These considerations may or may not apply to other third-party BACnet devices. Consult the documentation for the third-party BACnet device for more information.

- Use ASCII text strings for BACnet Encoding Type in the Site object.
- Make the network engine Item Reference as short as possible because the network engine Item Reference is used as the basis for building up the BACnet OLE for Process Controls tag name in the M-Series Workstations.
- Enable BACnet Intrinsic Alarming or set up Event Enrollment Alarming, including BACnet event notification (Notification Class objects), in the network engine for all objects that should report event messages to M-Alarm.
- Do not set up a domain name for the network engine's Device Object. Setting up a domain name causes name changes for every NAE point object, making them unavailable to the M-Series Workstation.
- For the standard M-Series workstations, use only supported enumeration sets, or the data does not appear correctly. For the list of enumeration sets, refer to the *Metasys® System Enumeration Sets Technical Bulletin (LIT-12011361)*.
- The safest alternative is to use the **States** set for the attributes that need enumerations.

- The generic integration object (GIO) is not a BACnet standard object. Do not use the GIO for network engine objects accessed by other BACnet devices or the M-Series Workstation. Use standard analog and binary objects for interfacing points from the network engine to other BACnet devices or the M-Series Workstation.
- If more than one network engine device is interfaced to the M5 Workstation or M3 Workstation, and if these interfaced devices need to exchange information between each other, the network engines must be set up as a *Metasys* system site, with one NAE defined as the Site Director.

Table 3 details the versions of the network engine that the M-Series Workstation can interface. This table does not apply to the M3 integral and M5i workstations available in Europe.

Table 3: Supported network engine models and firmware revisions

Order codes	Product description	Firmware version
MS-NAE5510-x **MS-NAE5511-x**	*Metasys* NAE with two FC Buses	Release 1.0 or later
MS-NAE5520-x **MS-NAE5521-x**	*Metasys* NAE with two FC Buses and one LonWorks bus	Release 1.1 or later

ⓘ **Note:** Starting at R10.0, NxE55-1 versions are not supported.

Supported network engine objects

ⓘ **Note:** The M-Series Workstation Interface to the network engine supports access to the network engine objects listed in the following table, with the exception of the Averaging object extension.

Table 4: Supported supervisory controller objects

Analog Value (AV)	Binary Output[1]
Binary Value (BV)	Multistate Input[1]
Event Enrollment (EEO)	Multistate Output[1]
Interlock	Notification Class
Multiple Command	Accumulator object
Analog Input[1]	Trend Log object extension[2]
Analog Output[1]	Totalization object extension[2]
Binary Input[1]	Averaging object extension[2]

1 With N2 or LonWorks Hardware Tab (points can be interfaced from N2 devices as well as LonWorks devices).
2 Object extensions appear as a separate object within third-party BACnet devices.

Objects from the following devices are **not** available to the M-Series Workstation:

- NIE55
- ADS
- ADX
- ODS

- OAS

Exposing data as standard BACnet objects to other BACnet devices

Observe the following considerations when configuring the supervisory controller to third-party BACnet devices:

- For BACnet Encoding Type in the Site object, specify a text string format that is supported by the other BACnet Devices (either ISO 10646 [UTF-8}, ISO 10646 [UCS-2], or Microsoft® double-byte character sets [DBCS] code page 932 [Japanese Shift JIS]). For older BACnet equipment, ANSI X3.4 [ASCII] is still supported.

ⓘ **Note:** Starting at Release 10.1, UTF-8 is the default. The recommendation is to use UTF-8 unless other devices do not support it. This is not a per engine setting and impacts all engines on the site.

- For mapped objects that do not support intrinsic reporting at the remote device, enable BACnet Intrinsic Alarming or set up Event Enrollment Alarming, including BACnet Notification Class objects, for all NAE/SNx objects that should report event messages to other BACnet workstations.
- The Generic Integration Object (GIO) is not a BACnet standard object. **Do not use the GIO for NAE/SNx objects interfaced by BACnet devices.** Use standard analog and binary NAE objects instead.

Adjusting the poll rate for third-party BACnet devices

The device's poll rate governs how frequently a third-party BACnet device communicates with the supervisory controller. A too fast poll rate may adversely affect the performance of the supervisory controller. By increasing the number of seconds the network engine waits before flagging a field device as offline, you can minimize the number of false offline reports. Three different sensitivity options, each with a different set of values, are available: high, medium, and low. The default setting for all network engines upgraded to Release 10.0 is medium. For further information on poll rate, refer to the section *Adjusting NAE network sensitivity* in the *NAE Commissioning Guide (LIT-1201519)*.

ⓘ **Note:** The supervisory controller supports client Change of Value (COV) subscription, which reduces the need for polling. The remote BACnet device must be capable of executing COV subscription to take advantage of this service.

Configuring a Network Engine as a BACnet/IP to MS/TP Router

In its default configuration, third-party BACnet/IP devices can only see the integrated BACnet objects of the network engine. If the BACnet Routing mode is set to Enabled in the network engine, then other BACnet devices on the IP network are able to communicate directly with BACnet MS/TP devices. See Enabling the routing mode.

ⓘ **Note:** In most cases, enabling routing is not recommended.

Auto-Created States Text

In addition to the standard enumeration sets (which define the text displayed for each state of a Binary and Multistate object) provided with the Metasys system, Auto-Created States Text can be automatically added when a non-Johnson Controls device or select Johnson Controls-labeled

BACnet device is discovered and added to a supervisory controller. An Auto-Created States Text can be automatically assigned to the States Text field of a mapped object.

The BACnet State_Text property is read when an online supervisory controller discovers BACnet objects (BI, BO, BV, MSI, MSO, and MSV), and when a user views the object. When the value of the integrated point's States Text attribute is updated and the user-selected states attribute is false, the Metasys system checks to see if the BACnet State_Text property associated with the object matches a standard enumeration set used with Metasys States Text. Existing Auto-Created States Text are also checked.

If a match occurs, the Metasys system automatically assigns the matching States Text value to the object. If no match occurs, the Metasys system automatically creates and assigns a new enumeration set. All new sets added at each supervisory controller are copied to the Site Director. New States Text added have the following limitations:

- 1,000 new enumeration sets maximum
- 260 Kb memory for all sets
- For any multi-value BACnet object (MSI, MSO, MSV), the number of states can be between 2 and 500, with a maximum of 60 characters for any one state. Using the Command window, you can only manually select from the first 32 states.
- Auto-Created States Text can only be automatically assigned to one object and cannot be edited using the Metasy system.
- Auto-Created States Text is saved in the Site Director, and cached in the other devices.
- The Rediscover Text Strings device level command allows you to reset the States Text across an entire Metasys supervisory device; It rediscovers text strings from all the mapped BACnet objects.

Table 5: Auto-Created Enumeration Sets Usage by Metasys Product

Metasys Product	Uses Auto-Created Enumeration Sets	Makes Changes to Auto-Created Enumeration Sets
Metasys Advanced Reporting System with Energy Essentials	Yes	Yes
ADS/ADX/ODS/OAS	Yes	Yes
NAE, NCE, SNE, SNC	Yes	Yes
SCT, SCT Simulation	Yes	No
CCT	No	No

Auto-Created Enumeration Sets are not translatable and do not appear in the dictionary viewer tool. They are local to the site where they are defined.

➤ **Important:** When using Auto-Created Enumeration Sets, you must upload the Site Director first, then the network engine where you mapped the object. If you download from SCT, download the Site Director first, and then the network engine. You must do the procedure in this order, or the enumeration set text files do not match, and the state values are not indicated correctly.

For Binary Values and Multistate Variables, Auto-Created States Text is indicated by an asterisk at the beginning of the States Text value, as shown in Figure 2.

➤ **Important:** If you edit an Auto-Created States Text value to choose a standard enumeration set, you lose the option to reselect the Auto-Created Enumeration Set. To restore the Auto-Created Enumeration Set, you can execute the Restore Controller States Text or use the Rediscover Text Strings supervisory device level command to reset all of the mapped objects.

Figure 2: Auto-Created Text For Binary Value

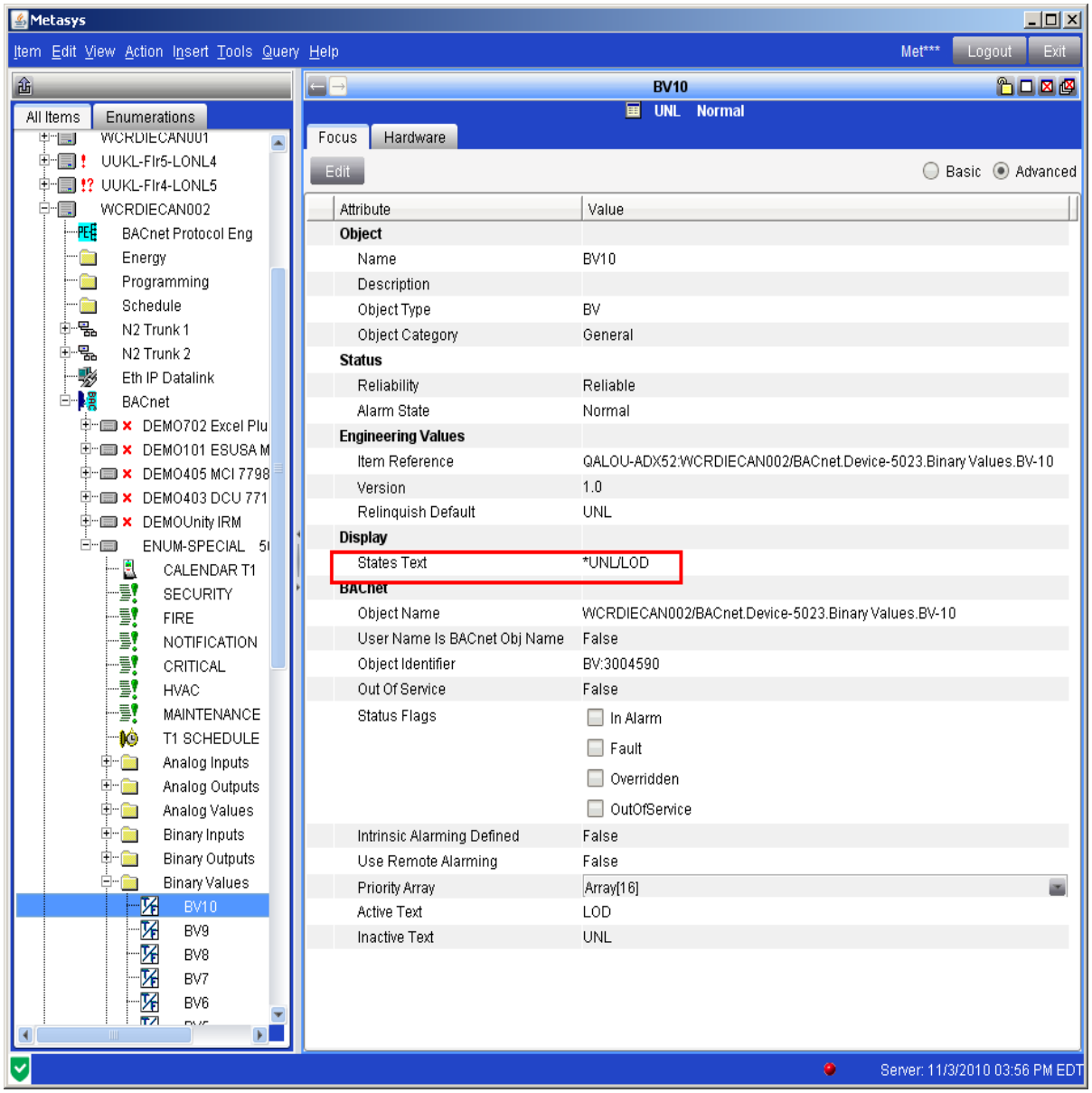
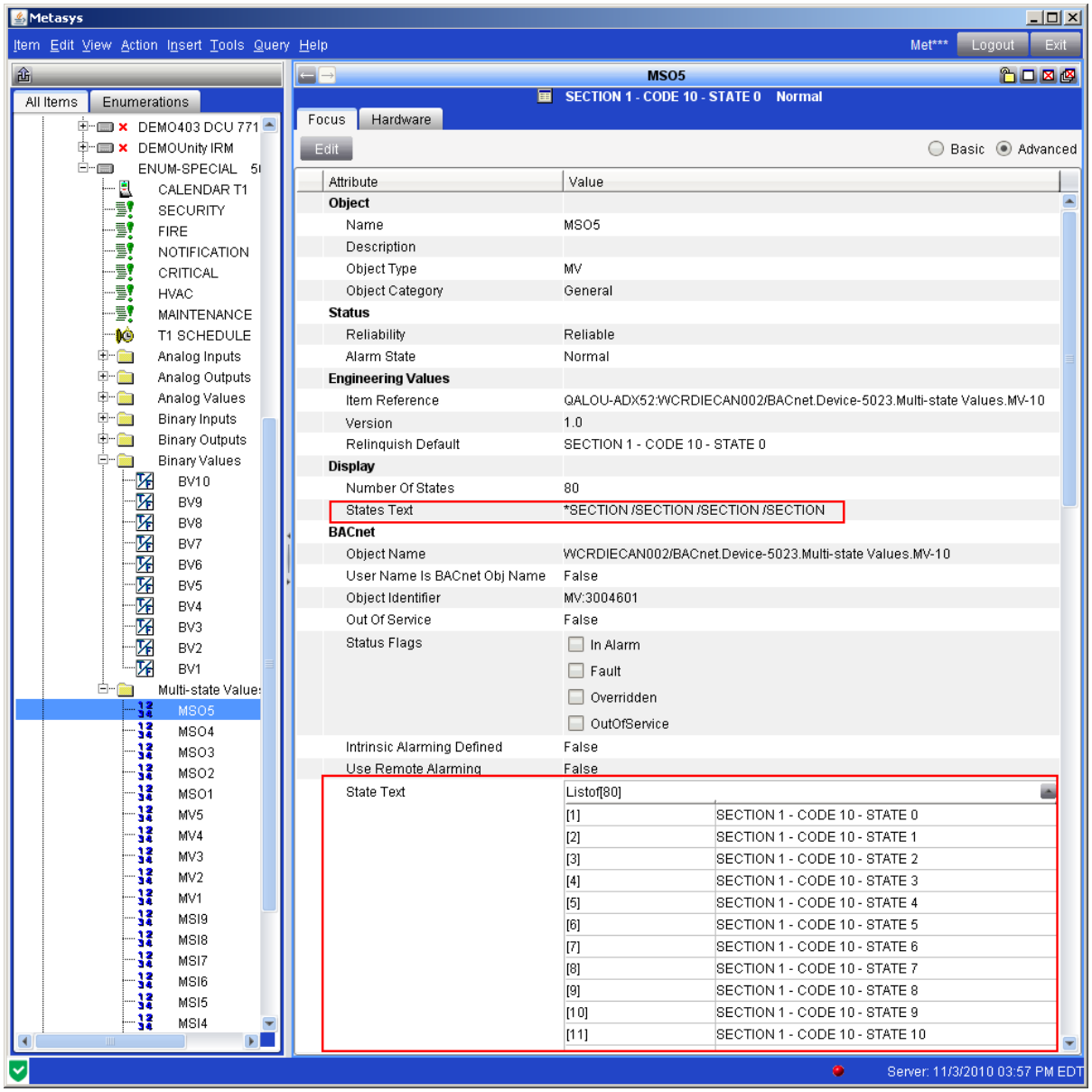


Figure 3: Auto-Created Text for Multistate Variable Objects



After a multi-value BACnet object from a third-party device is mapped to Metasys, in a rare instance the SMP UI might display its enumeration set ID with the current value of the object (for example, **1031:10 (text not found) Normal**). The first number in this example (1031) is the enumeration set ID and the second number is the enumeration value counting from 0. If you see the current value of the object represented in this manner, either the UserDictionary on the site is out of sync or the number of states property at the third party device has changed. To resolve, perform a Rediscover Text Strings command at the network engine to which the third-party device reports. This action flushes the locally saved auto-discovered text and updates all objects with the current text.

Detailed procedures

Connecting to BACnet devices

To connect and integrate BACnet devices into the Metasys system, connect the BACnet devices to the same IP network as the supervisory controller used for the BACnet system integration.

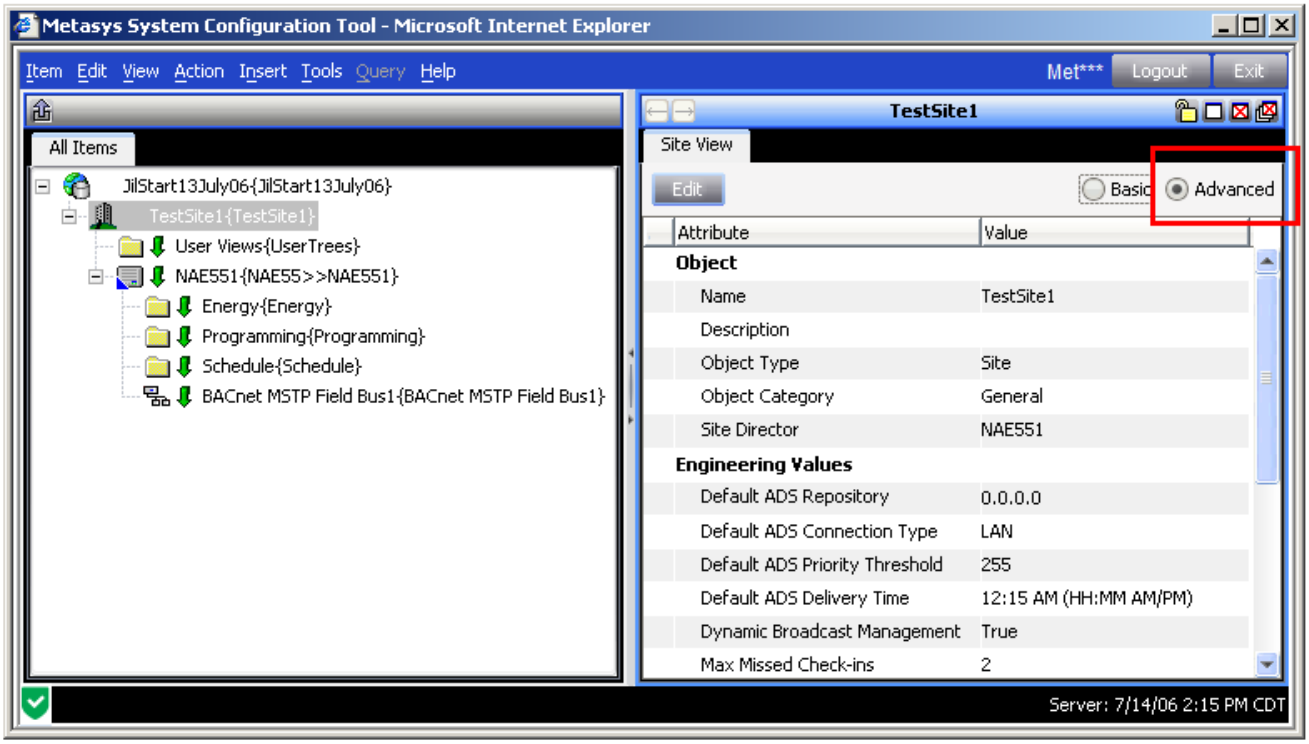
The devices must have the same BACnet Network Address and BACnet/IP Port number (UDP port) as assigned to the supervisory controller to which the device is to be integrated. These values can be seen in the NAE Focus tab.

Exposing BACnet information

About this task:

1. Log in to the supervisory controller or open an archive database in the SCT.
2. Right-click the Site Object and select **View**. The **Site View** screen appears.

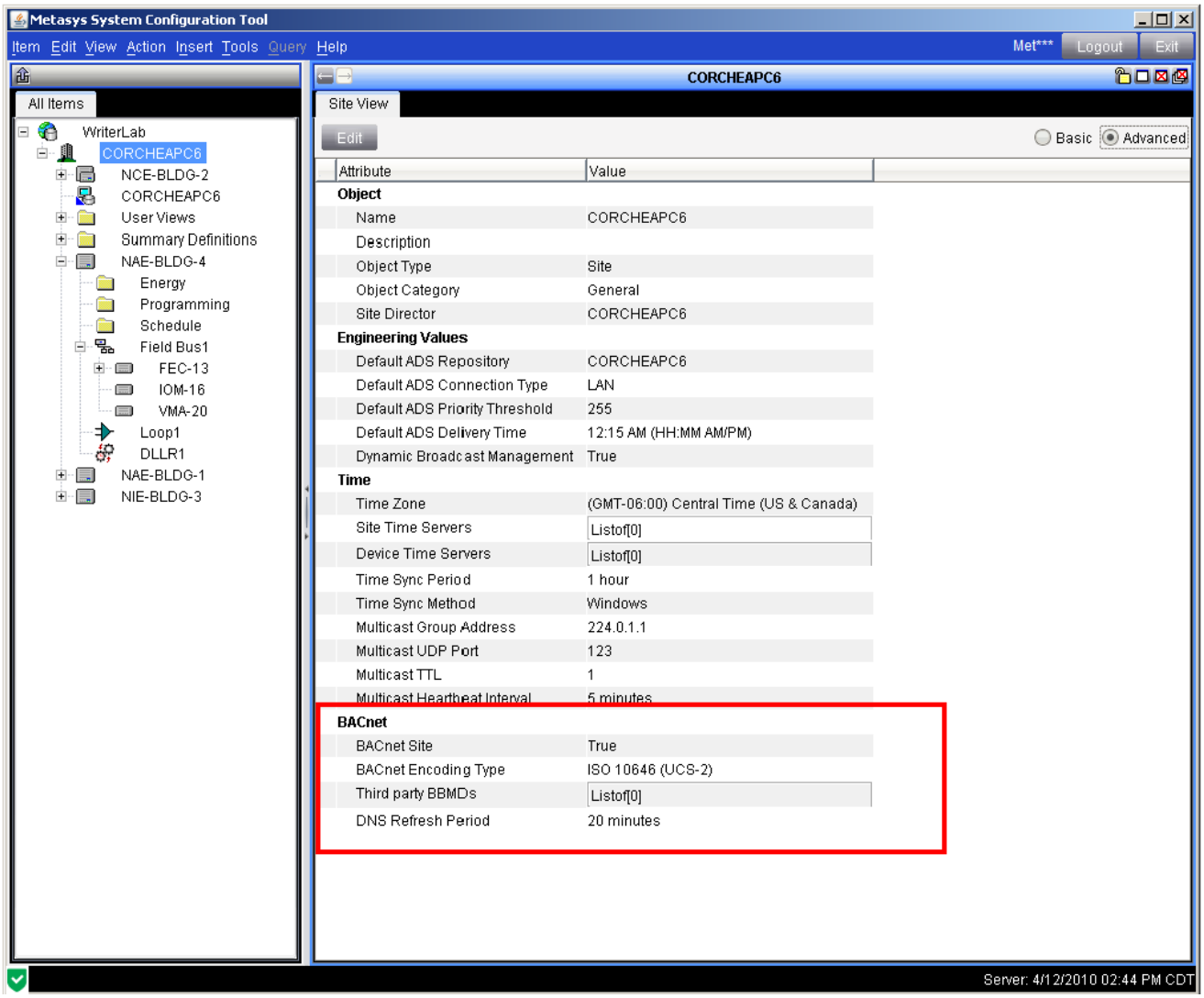
Figure 4: Site view screen



3. On the right side of the Site View screen, click **Advanced**.
4. Click **Edit** on the left side of the **Site View** screen and scroll down to the **BACnet** section (Figure 5).

   ⓘ **Note:** The BACnet section is visible only when the **Advanced** option is selected.

Figure 5: BACnet section enabled in site view



5. Set the **BACnet Site** field to **True** and set the **BACnet Encoding Type** for the encoding used by the BACnet devices.

   Note: The default **BACnet Encoding Type** is UTF-8. Many BACnet devices, including the N30 Supervisory Controller, use ASCII for the BACnet Encoding Type. When connecting to an N30 Network, choose **ANSI X3.4 (US_ASCII)** for the **BACnet Encoding Type**. Many devices supplied in Japan use Microsoft DBCS code page 932 (Japanese Shift JIS). If connecting to another BACnet device, verify the **BACnet Encoding Type** with the manufacturer or supplier of the device. Selection of the wrong BACnet Encoding Type can result in unaccepted entries of text at the BACnet device, such as failed BACnet object descriptions and alarm acknowledgments from the *Metasys* system UI.

   Note: The UTF-8 BACnet Encoding Type is also compatible with ASCII as long as extended characters (for example, Çä╣ß) are not used with ASCII devices.

6. Click **Save**. The NAE is now enabled to work with BACnet networks.

Adding a BACnet Integration object

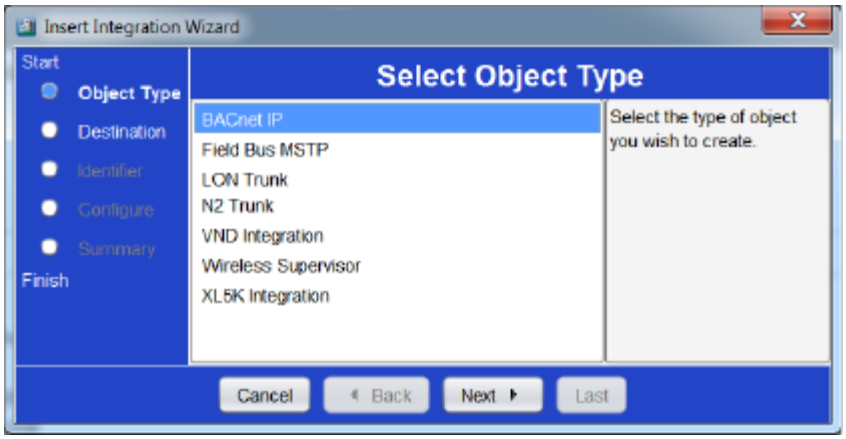
About this task:

The following process is applicable to online configuration in the Site Management Portal UI or offline configuration in the SCT. These procedures assume both an online configuration and a connection between the NAE and the same network as the BACnet system or the integrating devices.
The SCT contains no **Engineering** or **Diagnostics** views, as these are online features. In addition, to use Auto Discovery, the system must be online and connected to a BACnet network of devices.

ⓘ **Note:** At startup of the supervisory controller, the BACnet Integration binds with the BACnet OID and uses the IP address from that bind. If you move a device to a different subnet, change the IP address of the device, or change the device's BACnet OID, you must restart the supervisory controller to bind the BACnet OID with the new IP address.

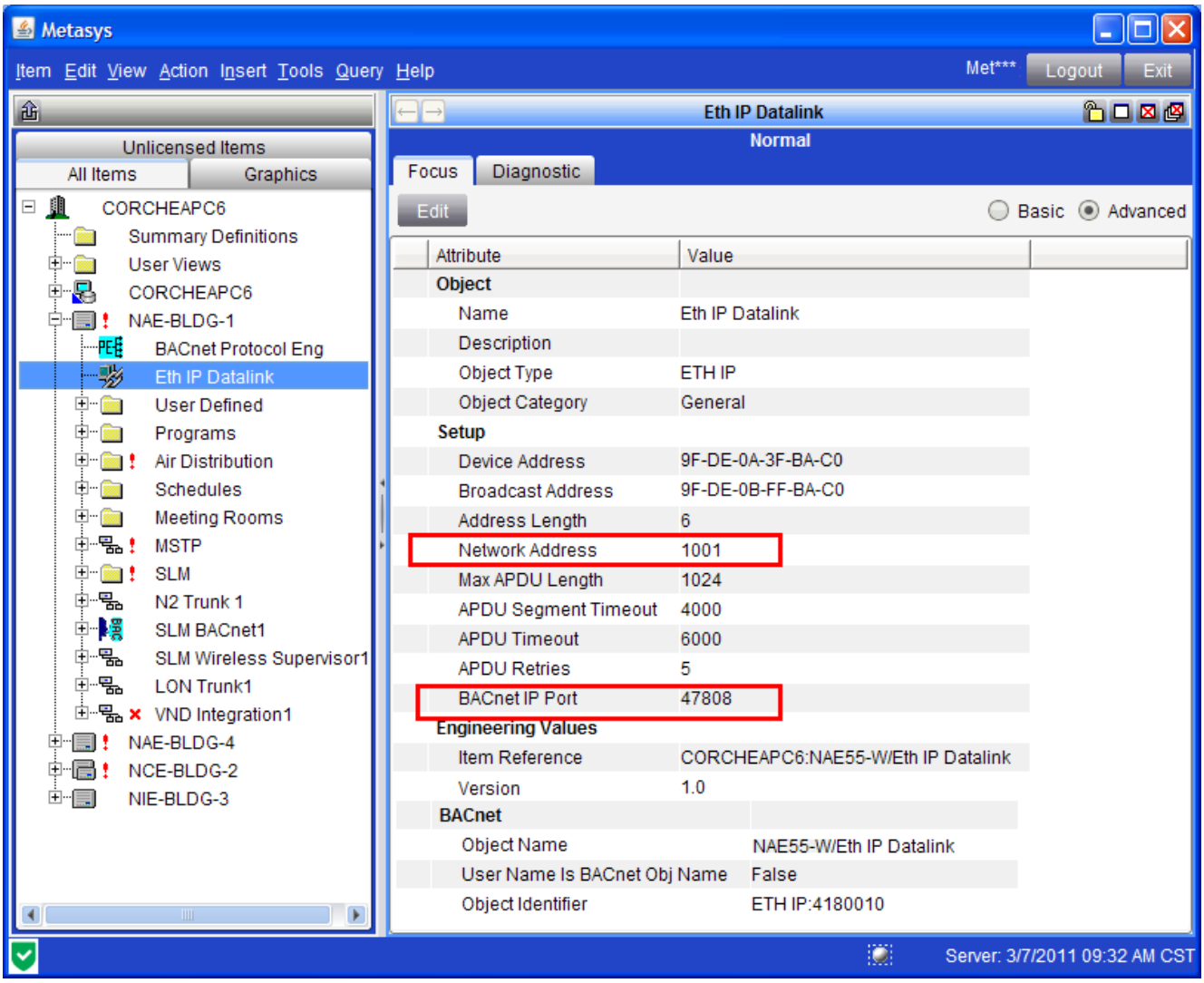
1. On the Insert menu, select **Integration**. The **Insert Integration Wizard**, **Select Object Type** screen appears.

Figure 6: Insert Integration Wizard (Select Object Type)



2. Select **BACnet IP** and click **Next**. The **Destination** screen appears.
3. Select the NAE/SNx to which to add the BACnet Integration object. After selecting the device, click **Next**. The **Identifier** screen appears.
4. Enter a unique name for the BACnet network of devices to integrate and click **Next**. The **Configuration** screen appears.
5. In most cases, accept the default Configuration parameters. (Refer to the BACnet Integration object in *Metasys SMP Help (LIT-1201793)* for a complete definition of the parameters.) Click **Next** to accept the defaults. The **Summary** screen appears.
6. To change anything, click **Back**. If the Summary looks acceptable, click **Finish** to create the BACnet Integration object. You can now add extensions to the new object.
7. Add extensions as desired and click **Done** when finished. The Wizard closes.

Figure 7: Ethernet IP Datalink Integration



8. After adding a BACnet Integration object, map the BACnet devices on the network to the NAE. Verify that the network address and port for this integration match the devices you are adding to this integration. See Figure 7.

Mapping BACnet/IP Devices using Auto Discovery

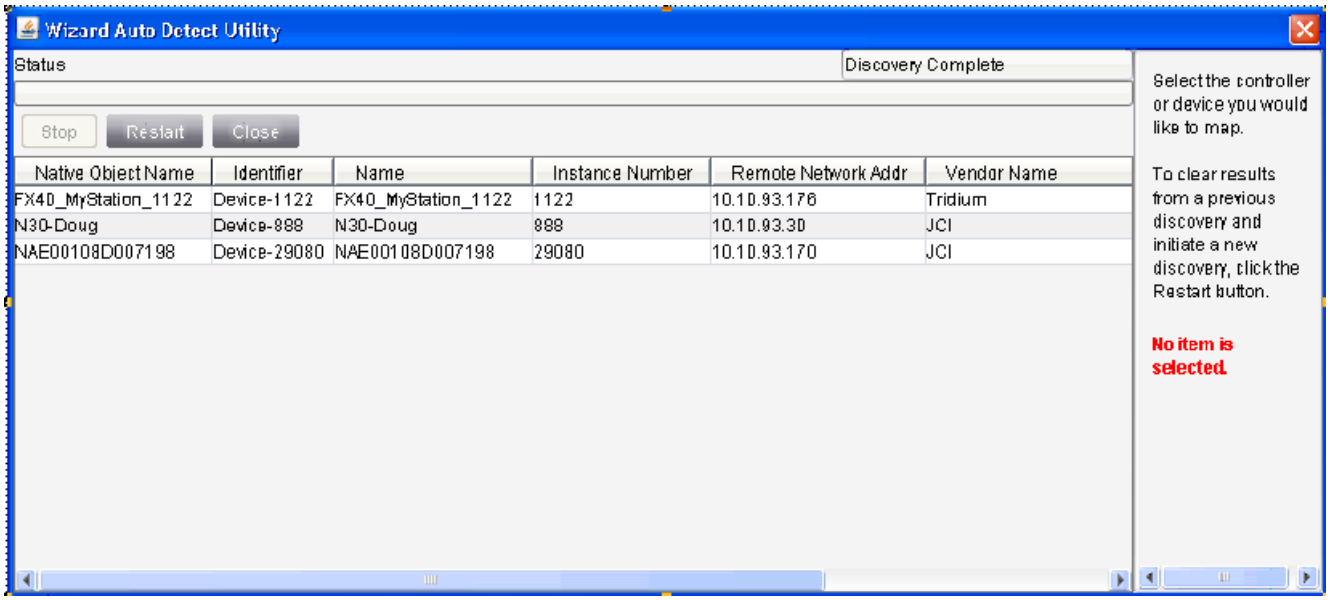
About this task:

1. Select the BACnet Integration object within the supervisory controller.
2. On the **Insert** menu, select **Field Device**. The **Insert Field Device Wizard, Destination** screen appears. Select the BACnet Integration item and click **Next**. The **Insert Field Device Wizard**, **Select Definition Mode** screen appears.

   ⓘ **Note:** If no BACnet Integration object appears, follow the procedures in Adding a BACnet Integration object.
3. Select **Assisted** and click the **Invoke Auto Discovery** bar. The **Wizard Auto Detect Utility** starts. If auto discovery has not already been performed, it begins immediately. If the **Wizard Auto Detect Utility** does not start automatically, click **Restart**.

Note: The supervisory controller must be online with the devices on the BACnet/IP network to use Auto Discovery. When Auto Discovery is complete, a list of discovered devices appears.

Figure 8: Auto Detect Utility screen



4. Select a device from the list to start the item creation process for that device.
5. Follow the wizard's prompts. At the configuration screen of the BACnet device, the **Instance Number**, **Name**, and **Item Reference** fields fill in automatically with the auto-discovered data from the BACnet device. The **Item Reference** comes from the remote device **BACnet Object Identifier**, and the **Name** defaults to the **BACnet Object Name** of the BACnet device object. The NAE Navigation Tree uses the **Name**. Change the **Name** field manually, if desired, by clicking the **Edit** button. The **BACnet Object Name** in the device is not changed.
6. Complete the **Insert Field Device** screens by accepting the defaults. The **Add Extensions Wizard** starts.
7. Add extensions by clicking **New** for the desired extension and completing the wizard prompts that appear.

   Note: Adding extensions to attributes of the BACnet device is uncommon so most users can skip this step.
8. When finished adding extensions, click **Done**. The **Insert Field Points Wizard** starts.
9. Go to Mapping BACnet Field Points using Auto Discovery or Mapping BACnet Field Points manually.

Mapping BACnet/IP devices manually

1. Select the BACnet Integration object within the supervisory controller.
2. On the **Insert** menu, select **Field Device**. The **Insert Field Device Wizard, Destination** screen appears. Select the BACnet Integration item and click **Next**.

   Note: If no BACnet Integration object appears, follow the procedures in Adding a BACnet Integration object.
3. Select **Manual** and click **Next**.

4. Follow the wizard's prompts. At the configuration screen of the BACnet device:

   - Fill in the **Instance Number** manually.
   - Fill in the **Name** field manually if the default data for the BACnet device is not satisfactory.

     The Navigation Tree uses the field device name. Change the **Name** field manually, if desired, by clicking the **Name** field. The BACnet Object Name in the device is not changed.

5. Complete the **Insert Field Device** screens by accepting the defaults. The **Add Extensions Wizard** starts.
6. Add extensions by clicking **New** for the desired extension and completing the wizard prompts that appear.
7. When finished adding extensions, click **Done**. The **Insert Field Points Wizard** starts.

   ⓘ **Note:** If no BACnet Integration object appears, follow the procedures in Adding a BACnet Integration object.

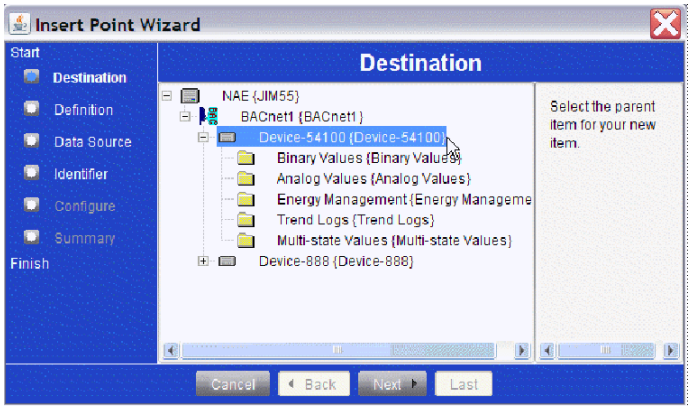
8. Go to Mapping BACnet Field Points using Auto Discovery or Mapping BACnet Field Points manually.

Mapping BACnet Field Points using Auto Discovery

About this task:
Once one or more BACnet devices are configured, add BACnet field points that are mapped to BACnet objects in the BACnet device.
The supervisory controller must be online with the devices on the BACnet/IP network to use Auto Discovery. For mapping points offline, see Mapping BACnet Field Points manually.

1. On the **Insert** menu, select **Field Points**. The **Insert Point Wizard, Destination** screen appears.

Figure 9: Insert Point Wizard (Destination)



The **Insert Field Points Wizard** starts automatically after inserting a **Field Device**. Because it selects the newly added device as the destination, the wizard opens to the **Select Definition Mode** screen bypassing the **Destination** screen.
Add BACnet devices during the Mapping BACnet Field Points using Auto Discovery procedure. To view the selectable devices, click the plus sign next to the BACnet Integration object to open the list of mapped BACnet devices.

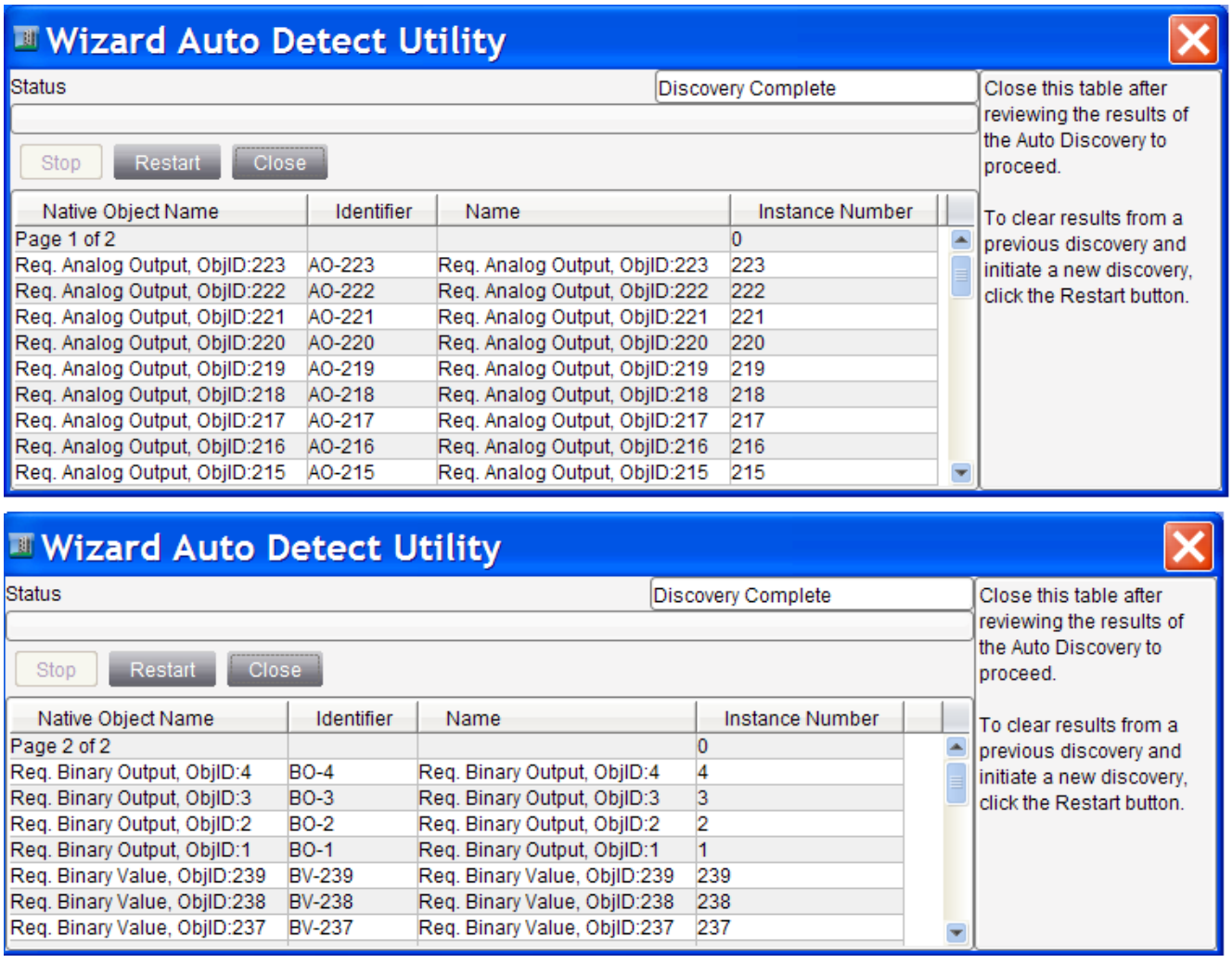
2. Select the BACnet device to which objects are to be integrated and click **Next.** The **Insert Point Wizard, Select Definition Mode** screen appears.

3. Click **Assisted** and then click **Invoke Auto Discovery**. The **Wizard Auto Detect Utility** starts. If an auto discovery has not already run, it begins immediately. If the **Wizard Auto Detect Utility** fails to start automatically, click **Restart**.

   When Auto Discovery finishes, a list of discovered BACnet objects appears. The fields automatically fill in with the auto discovered data from the BACnet device. The Native Object Name is the BACnet Object Name in the device.

   ⓘ **Note:** If the total number of discovered points exceeds the limit, then the returned discovery indicates Page 1 of X, where X is the total number of pages. A restart increments the page and displays the next set of discovered points. Each completion of the point mapping process also increments the page. After the last page, the point mapping process begins again at Page 1.

Figure 10: Auto Detect Utility screen

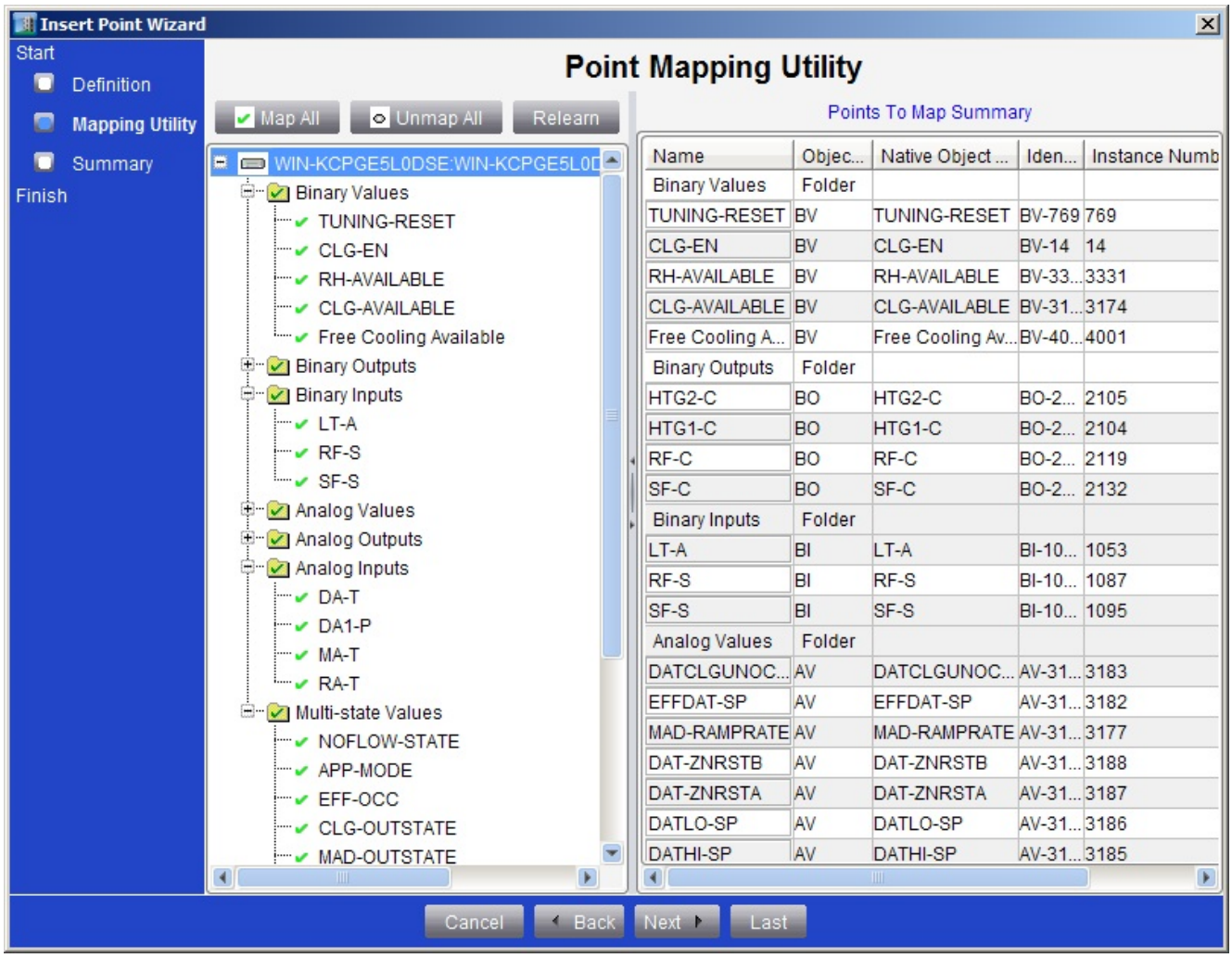


   The **Identifier** derives from the remote device BACnet Object Identifier and indicates both the object type and instance number. The Name defaults to the Native BACnet Object Name; you can change the Name field during the configuration process if desired. The Name appears in the navigation tree. The BACnet Object Name in the device is unchanged. The Instance Number comes from the BACnet Object Identifier.

4. Close the window by clicking the **X** in the upper-right corner of the screen.

5. When the auto discovery window is closed, the point mapping utility dialog box appears as shown in Figure 11. The **Assisted Identity/Configure** screen appears. Use this screen to select which points to map from the BACnet device.

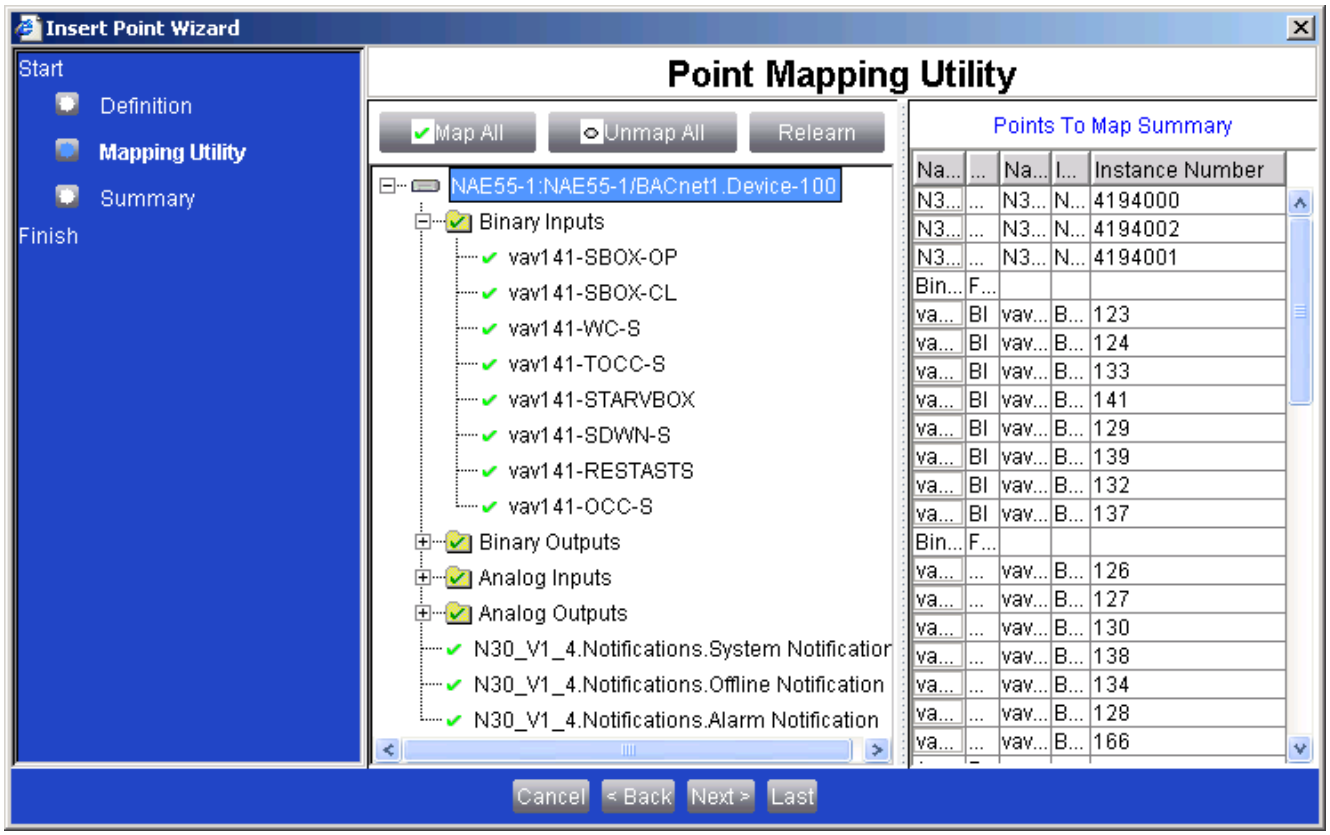
Figure 11: (Part 1 of 2) Insert Point Wizard (Assisted Identity/Configuration)



6. Select points individually by double-clicking on them, or use the Map All function. When an item is selected to be mapped, a green check mark appears next to it, and the right side of the screen displays a summary of the mapping items. A blue check mark represents an item that has been previously mapped.

   ⓘ **Note:** Deselecting a folder in the tree does not deselect the objects under the folder. Use this feature if the objects should appear directly under the controller in the navigation tree. **Map All** is not recommended. Mapping objects that you do not need will impact performance.

Figure 12: (Part 2 of 2) Insert Point Wizard (Assisted Identity/Configuration)



7. After selecting all the points to map, click **Next**. The **Insert Point Wizard** summary screen appears.
8. Review the **Summary** screen and click **Finish**.

Mapping BACnet Field Points manually

After adding a BACnet device, add BACnet Field Points mapped to BACnet objects in the BACnet device, if desired.

1. On the **Insert Menu**, select **Field Points**. The **Insert Point Wizard, Destination** screen appears (Figure 9).

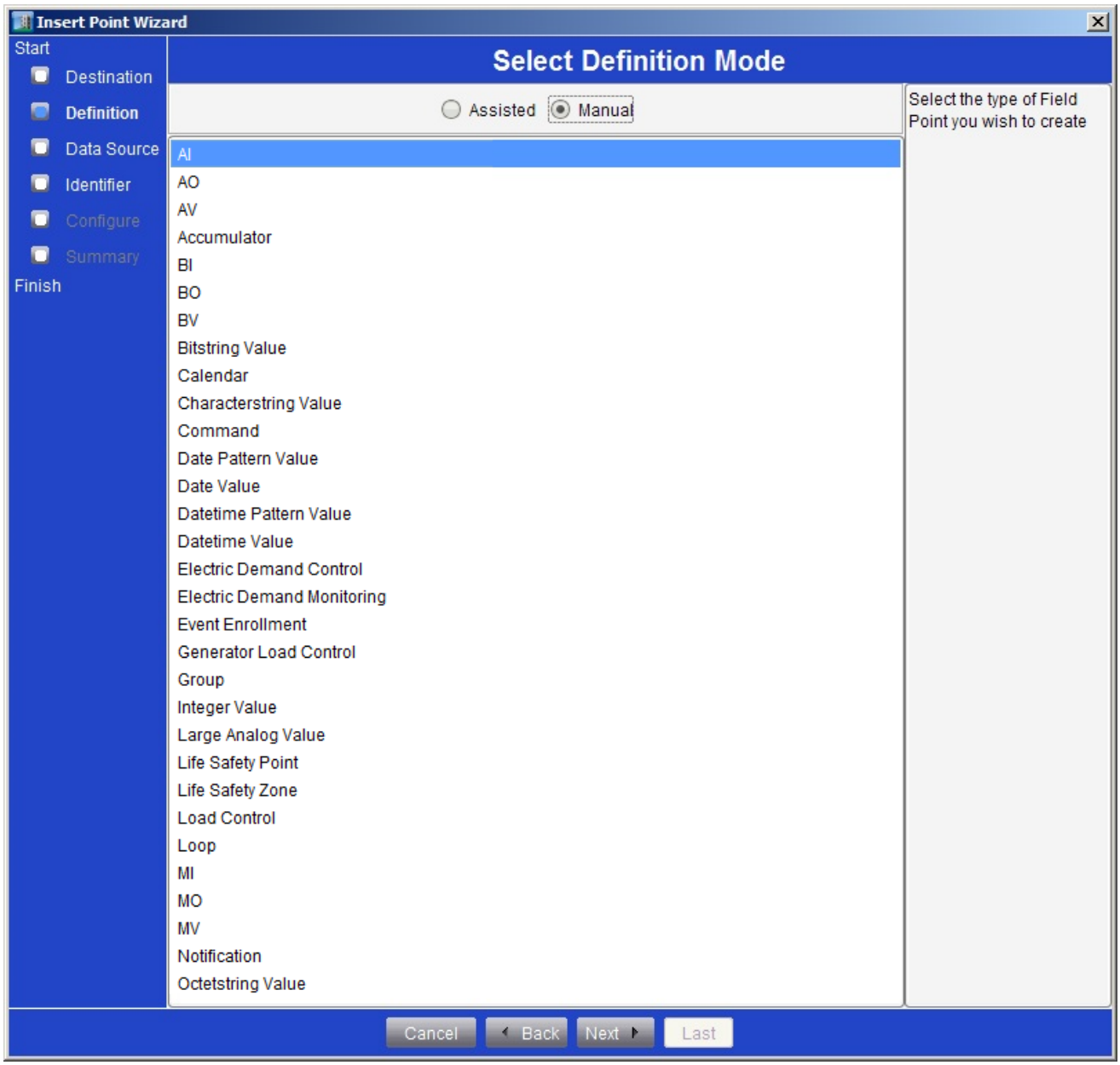
   The **Insert Field Points Wizard** starts automatically after inserting a Field Device. Because it selects the newly added device as the destination, the wizard opens to the **Select Definition Mode** screen, bypassing the **Destination** screen.

2. Select the BACnet device from which to map the points and click **Next**. The **Insert Point Wizard, Select Definition Mode** screen appears.

   ⓘ **Note:** Add BACnet devices during the Mapping BACnet/IP Devices using Auto Discovery procedure in this document. If the screen displays no selectable device, click the plus sign next to the BACnet Integration object to open the list of mapped BACnet devices.

3. Select **Manual** point definition; the screen changes to the manual mode with a list of point object types to add.

Figure 13: Insert Point Wizard (Select Definition Mode)



Distinguish the **Manual** point definition from the **Assisted** point definition by the list of steps on the left side of the screen. The **Manual** definition display adds a **Data Source** step and separates the **Identify** and **Configure** steps.

4. Select the type of point to create and click **Next**. The remaining steps of the **Insert Point Wizard** - manual mode are listed in the following table.

Table 6: Insert Point Wizard - manual mode screens

Screen	Purpose
Select the Data Source	Enter the Instance Number associated with the point you are mapping.
Identifier	Allows entry of a unique name for each mapped field point.
Configure	Allows field point configuration. Click **Advanced** to see the BACnet object identifier. Be sure to fill in the Instance Number on the **Hardware** tab of the **Configuration** screen and to match the configuration to the Instance Number of the BACnet Object Identifier in the host BACnet device.
Summary	Provides a summary of the entered information. Click **Back** to make any corrections.

5. Click **Finish**.

Using the Relearn feature

About this task:
The Relearn feature uses Auto Discovery and requires that the supervisory controller be online with the BACnet network to discover Field Devices and Field Points.

1. Select the BACnet Integration object from the Navigation tree.
2. Click the **Engineering** tab and click the **Relearn** button that appears below the tab.
3. Discovery begins automatically and finds all new BACnet devices on the network. After Discovery, the new devices appear in the Integration Tree and in the Integration View.
4. When Discovery is complete, close the **Auto Discovery** box.

Using the Engineering view to View and Edit Device Attributes (BACnet Properties)

About this task:
When online with a BACnet device, use the Engineering view of the BACnet Integration object to View and Edit Device Attributes (known as properties in BACnet terms). Act on these devices whether or not the BACnet devices have been mapped to the Navigation tree.

1. Right-click the BACnet Integration object on the Navigation tree and select **View**. The BACnet Integration object appears.
2. Click the **Engineering** tab, and navigate to either a field device or a field point in the **Integration Tree**.
3. Double-click the selected field device or field point. The **Details** screen for the selected field device or object appears.
4. Click **Edit**. The editable fields from this screen appear in a box with a heavy line border.

   The BACnet device displays only the required and optional attributes of the BACnet point object. Vendor-specific proprietary attributes do not appear.
   For attributes that support a command priority, such as the Present Value of an Analog Output (AO), the BACnet device displays the active value and priority. To change a

value, enter an equal or higher priority. Clearing the value at the specified priority releases this priority and displays the value for the next highest priority.

5. Make the desired changes and click **Save**.

Field Bus Integration object — detailed procedures

Adding BACnet MS/TP (Field Bus) Integrations

1. On the **Insert** menu, click **Integration**. The **Insert Integration Wizard** starts.
2. Follow the prompts to configure the integration using the information in the following table.

Table 7: Insert Integration Wizard

Screen	Purpose
Object Type	Select the type of integration, Field Bus MSTP.
Destination	Select the network engine that connects to the integrating trunk.
Identifier	Type a unique name for the trunk. Each integration under a device requires a unique name. By default, the name of the newly entered object has a number appended to keep it unique; therefore, if adding a BACnet MS/TP trunk to a device for the first time, the default name is Field Bus.[1]
Configure[2]	Configure information about the integration such as trunk number[3] and a brief description.[1] **Note:** If BACnet routing is enabled for this network engine, the Network Address on the Hardware tab must be unique from all other Field Bus and BACnet/IP network addresses on the site.
Summary	View the basic parameters of the integration just added.

1 The local MS/TP trunks are 1 and 2. Some supervisory products support two MS/TP trunks. Numbers greater then 2 are for a remote field bus. When selecting or adding a second BACnet MS/TP trunk, change the default trunk number (which is 1) on the **Hardware** tab to 2 and change the Network Address to a value not already used on the network engine, typically one greater than the default value.

2 Typically, use the default values for Baud Rate Selection and Network Address. Change the Network Address if the activity at the site also includes integrating third-party BACnet networks into the network engine. If BACnet routing is enabled for this network engine, the Network Address on the **Hardware** tab must be unique from all other network addresses on the site.

3 Trunk numbers 1 and 2 are used for local directly wired BACnet MS/TP trunks. Trunks that communicate through the BACnet IP connection to a BACnet/IP to MS/TP router (which provides the MS/TP wiring connection) use higher trunk numbers between 3 and 20. You must configure the router with an MS/TP network address number that is unique from all other network address numbers on the site. You must set the BACnet network address of the field bus to match the BACnet MS/TP network address number of the router. The BACnet/IP network address of the router must match the BACnet/IP network address of the NxE. In addition, one or more BBMDs may be required to allow BACnet/IP broadcast messages to reach the router. For more information on field bus capacity and quantity limits, refer to *Metasys® SMP Help (LIT-1201793)*.

3. Click **Finish**.

Manually adding BACnet MS/TP (Field Bus) Field Devices (online or offline)

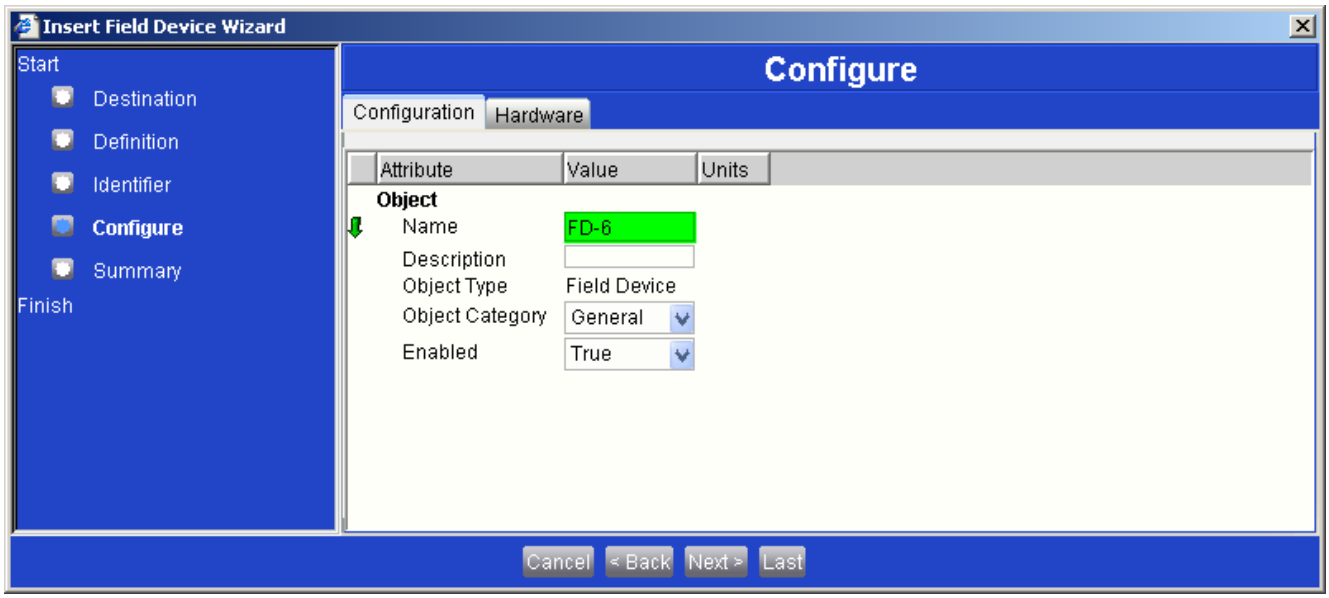
About this task:
Use the **Insert Field Device Wizard** to manually add BACnet MS/TP (field bus) field devices, whether the system is online or offline.

1. On the **Insert** menu, click **Field Device**. The **Insert Field Device Wizard** starts.
2. Select the trunk to which the field device is connected and click Next. The **Insert Field Device Wizard Select Definition Mode** screen appears.
3. Click **Manual**. You are then prompted to select the class of device (JCI Family BACnet Device or General BACnet Device).

   ⓘ **Note:** When using the SCT, the **Assisted** option appears dimmed because that method is unavailable when the system is offline. When devices and objects are added in SCT, mapper instance numbers are not assigned. The Supervisory Device assigns instance numbers to mapper objects when archive is loaded. If you add devices or objects in SCT, upload the Supervisory Device back into SCT to capture mapper instance numbers. Failure to upload could result in conditions where mapper instance numbers could change.
4. For JCI Family BACnet Device, select a BACnet MS/TP address for the new device. All BACnet MS/TP addresses in the list are available because the address list updates each time a new controller object is created. After choosing a BACnet MS/TP address, click **Next**. Auto Discovery is available only for online field devices. See the Adding BACnet MS/TP Field Devices online using Auto Discovery section in this document.

   ⓘ **Note:** With JCI Family BACnet Device selected, you are prompted to enter the MAC Address, which is the physical hardware address of the device as determined by its address switch settings. With **General BACnet Device** selected, you must enter the BACnet Instance Number, which is determined by software settings in the device. This value is entered on the **Hardware** tab of the **Identifier** screen of the Wizard.
5. Click **Next**. The **Insert Field Device Wizard Identifier** screen appears.
6. Choose a unique name (within the parent object) for the new controller object and click **Next**. The **Insert Field Device Wizard Configure** screen appears. The fields of the **Configure** screen have default data based on the previous information entered. This information includes the object type and naming parameters of the new controller just created.

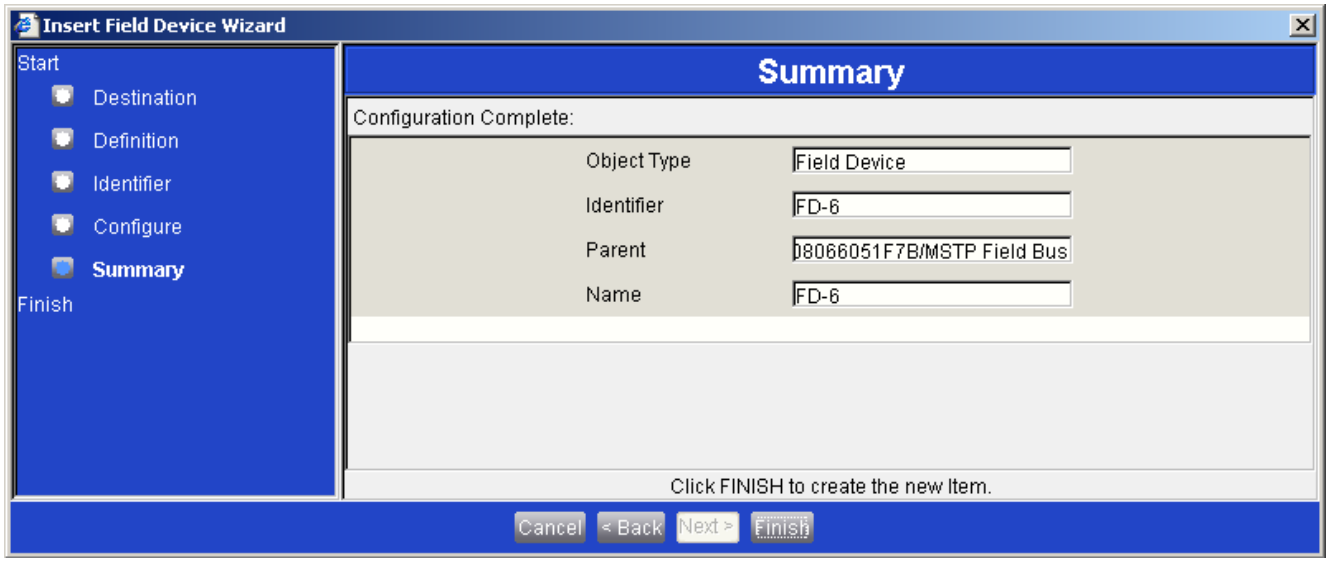
Figure 14: Insert Field Device Wizard (Configure screen)



When using the **Manual** device definition, the default name is always FD plus an incremental number for field devices. The incremental number provides a suggested name that is unique within the context of the parent object, in this case a BACnet MS/TP (field bus) integration.

7. Click **Next**. The **Insert Field Device Wizard, Summary** screen appears.

Figure 15: Insert Field Device (Summary screen)



8. If satisfied with the Summary, click **Finish** (otherwise, click **Back** and correct any problems).
9. Add extensions to the newly created controller object, if needed. See Adding extensions to an object for more information.

Adding BACnet MS/TP Field Devices online using Auto Discovery

About this task:
When logged in to a network engine through the Metasys system, you can automatically discover field devices. SCT does not support the Auto Discovery process. However, with SCT you can upload devices discovered on the network and added to the NAE database for archive and editing.

1. On the **Insert** menu, select **Field Device**. The **Insert Field Device Wizard Destination** screen appears.
2. Select the BACnet MS/TP trunk to map the field devices to and click **Next**. The **Select Definition Mode** screen appears.

   The Assisted Mode and Invoke Auto Discovery options are not available from the SCT. Upload any relevant online-generated information to an archive database in the SCT.
3. Click **Invoke Auto Discovery**. The Auto Detect Utility starts.
4. After Auto Discovery is complete, select the device to map. If the device is already mapped, a notification message appears. If the device is not mapped, the **Insert Field Device Identifier** screen appears.
5. Enter a unique identifier for the device and click **Next**. The **Insert Field Device Wizard Configure** screen appears.
6. Click **Next**. The **Insert Field Device Summary** screen appears.
7. If the Summary is satisfactory, click **Finish** (otherwise, click **Back** and correct any problems). This action creates the object and enables the process for adding extensions to the new controller object. See Adding extensions to an object for more information.
8. After adding all discovered devices, use the SCT to upload the NAE database to an archive database in the SCT.

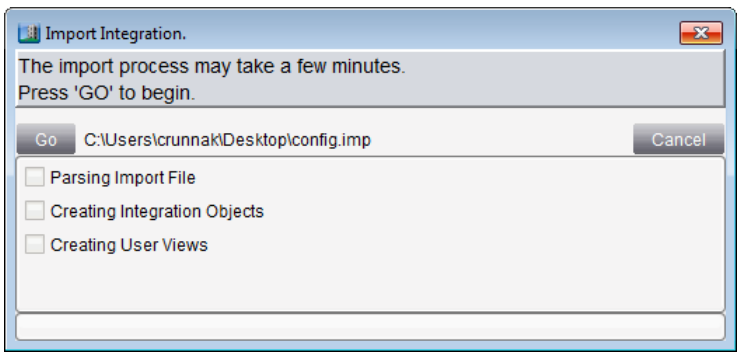
   Note: See Troubleshooting (BACnet Trend Logs cannot be discovered) if the auto discovery fails to find third-party Trend Log objects.

Adding BACnet Devices to the BACnet and MSTP Integrations using the Import Integration Wizard

About this task:

1. On the navigation tree, click the integration you want to add a device to.
2. On the **Action** menu, select **Import Integration**. The Open files screen appears.
3. Locate and select the import file that matches the integration. Then click **Open**. The **Import Integration** screen appears.

Figure 16: Import Integration Screen



4. Click **Go**. The Import Integration starts.
5. After the Import Integration is complete, a notification message appears.
   If the import file does not match the integration, an **Alert** notice appears.
6. Click **OK**. Repeat this process for each device you want to add.

Adding extensions to an object

About this task:
Add trend, totalization, alarm, load, and averaging extensions to increase the functionality of a field device or field point object.
After creating a field device object or a field point object, the **Extension Wizard** automatically starts (skip to Step 3).

1. Select an object.
2. On the Action menu, select **Show Extensions**. The **Extension Wizard** starts.
3. Click **New** in the row next to the desired type of extension. Follow the prompts on the Wizard that appears. See Adding a Trend Extension, Adding a Totalization Extension, or Adding an Alarm Extension for more information.
4. Follow the prompts to configure the extension and click **Finish** when done. The **Extension Wizard** appears with the new extension listed in the appropriate row.
5. Click **Done** after adding the needed extensions. If the **Extension Wizard** launches automatically after creating the new field device object, the **Field Device Extension** screen opens next.
6. Add field points under the newly created controller object by clicking **New** in the **Field Points** panel of the **Field Device Extension Wizard**. See Manually adding BACnet MS/TP (Field Bus) Field Devices (online or offline) for instructions on adding BACnet MS/TP points.

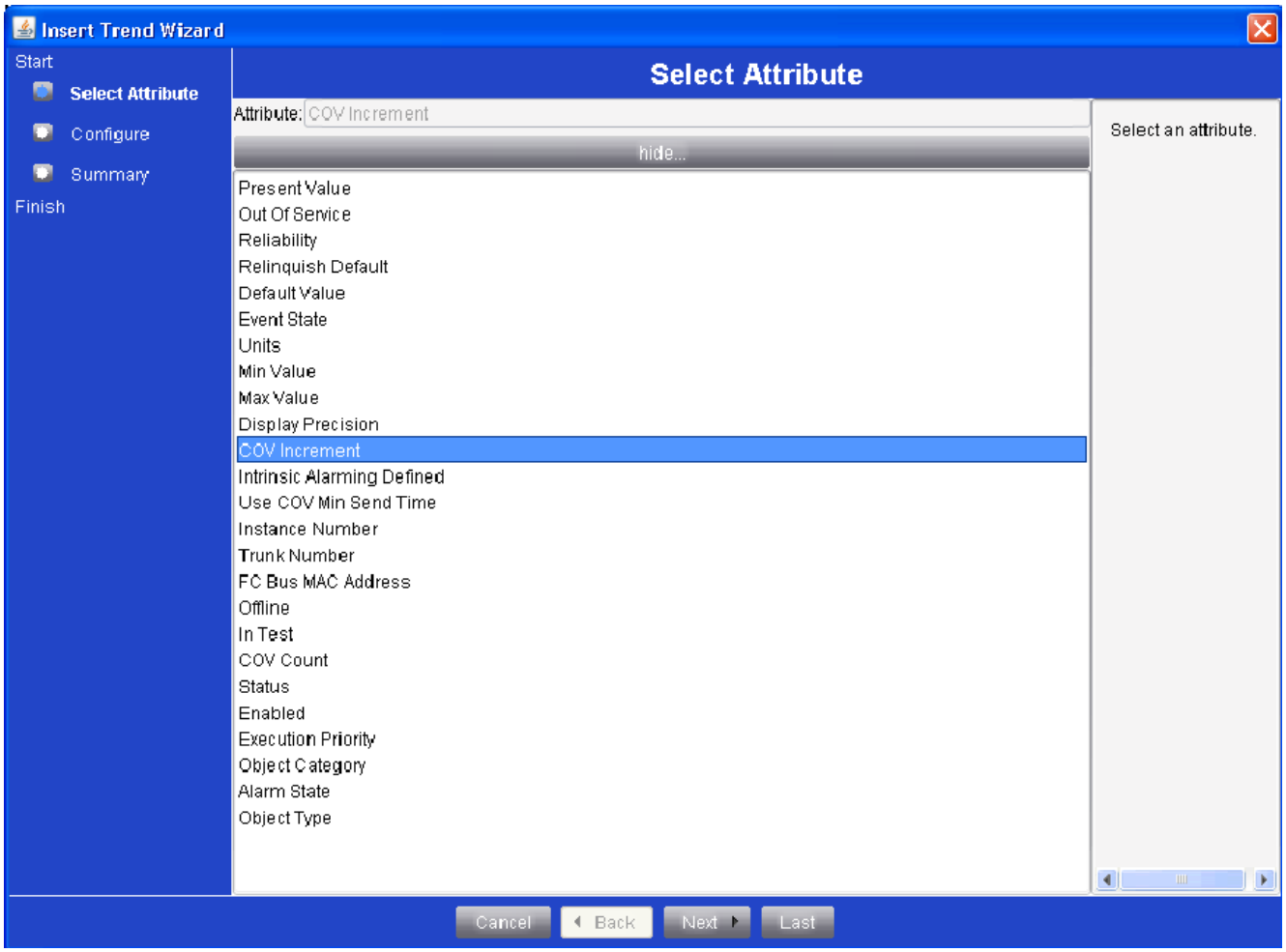
Adding a Trend Extension

About this task:
Adding trend extensions to objects allows the user to collect historical data for one or more attributes of an object. Afterwards, view that data or forward the data to a Metasys Application Server for long-term storage. Use Trend Study to view Trend extensions from multiple items at the same time.

1. In the **Extensions Wizard**, click **New** in the **Trend** row. The **Insert Trend Wizard Select Attribute** screen appears.

   The trended attribute defaults to **Present Value**. To trend a different attribute, click **other**. The attribute list appears.

Figure 17: Insert Trend Wizard (Select Attribute Screen)



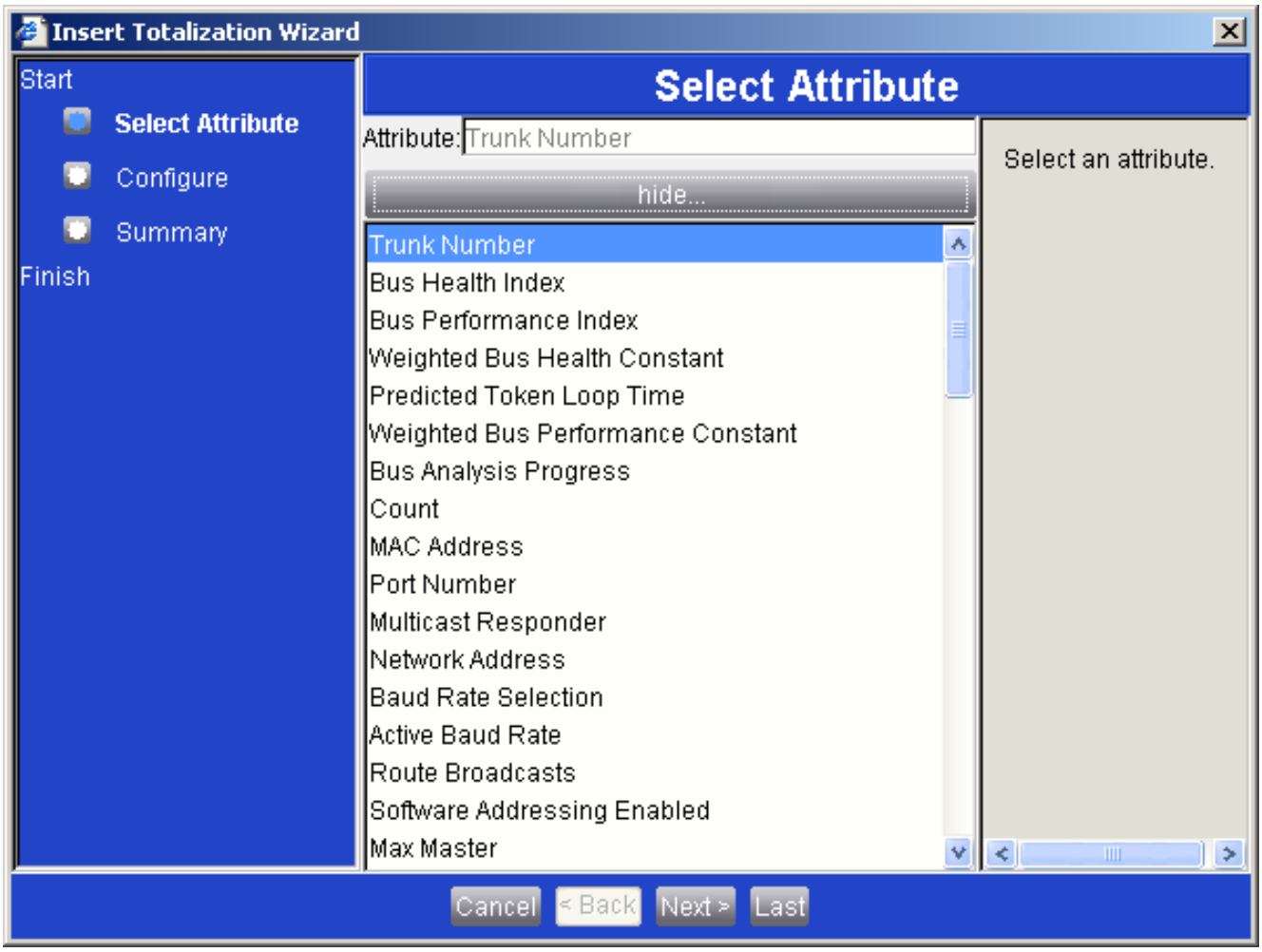
2. Select an attribute and follow the prompts in the Wizard to complete the addition of a Trend Extension.
3. Click **Finish**. The **Extensions Wizard** appears with the new attribute listed under Trend.

Adding a Totalization Extension

About this task:

1. In the **Extensions Wizard**, click **New** in the **Totalization** row. The **Insert Totalization Wizard Select Attribute** screen appears.

Figure 18: Insert Totalization Wizard (Select Attribute Screen)



2. Select an object in the top of the screen and an attribute in the bottom and click **Next**.
   ⓘ **Note:** Click **other** to display a list of available attributes.
3. Select **Totalization type** from the available options on the right (if available).
4. Follow the prompts in the Wizard to complete the addition of a Totalization Extension.
5. Click **Finish**. The **Extensions Wizard** appears with the new attribute listed under the **Totalization** tab.

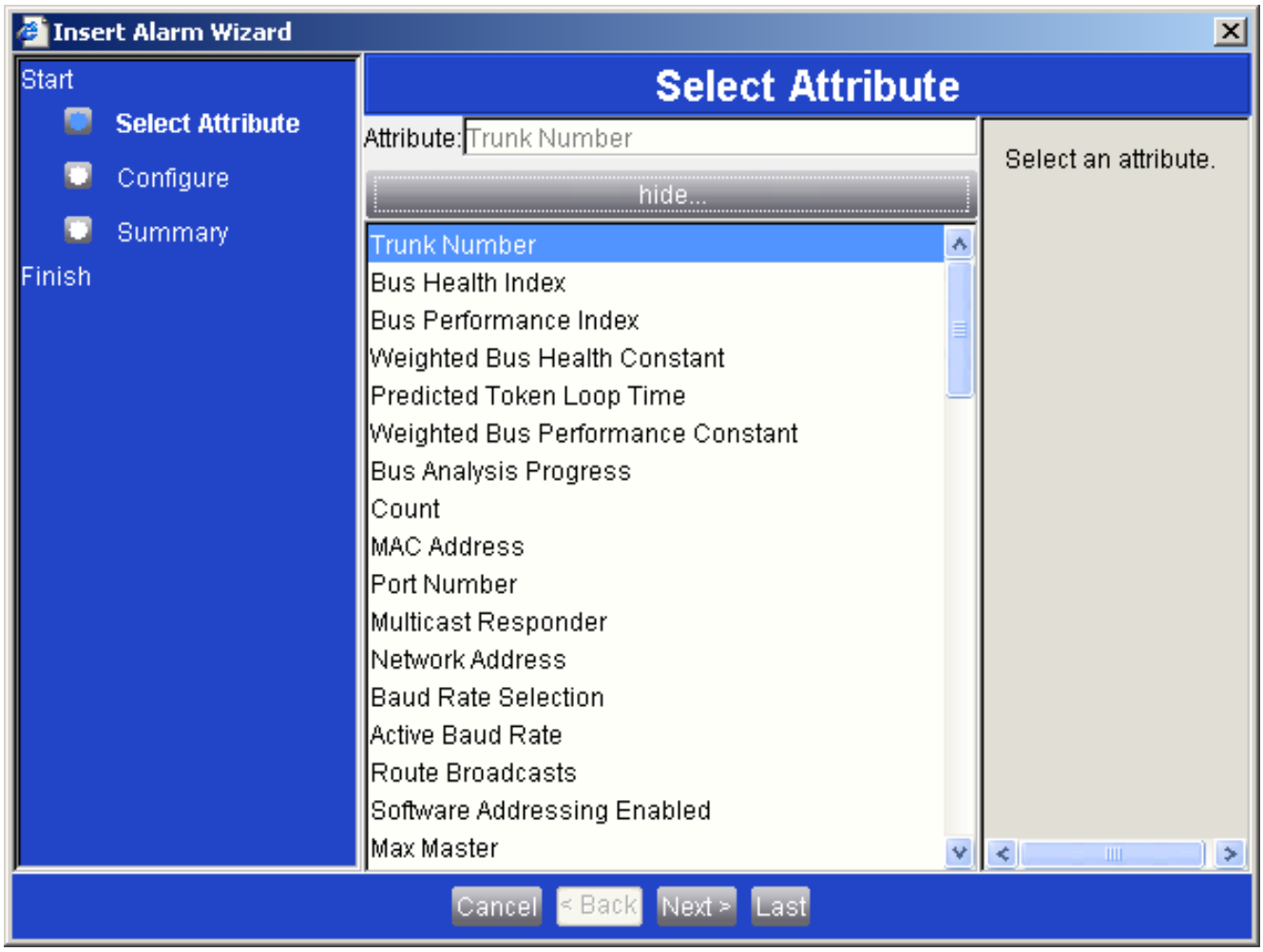
Adding an Alarm Extension

About this task:

ⓘ **Note:** To add a BACnet intrinsic alarm, refer to the *M-Series Workstation Interface to the NAE Application Note (LIT-1201655)*.

1. In the **Extensions Wizard**, click **New** in the **Alarm** row. The **Insert Alarm Wizard Select Attribute** screen appears.

Figure 19: Insert Alarm Wizard (Select Attribute Screen)



2. **Next**.

   ⓘ **Note:** Click **other** to display a list of available attributes. Select an object in the top of the screen and an attribute in the bottom of the screen and click

3. Follow the prompts in the Wizard to complete the addition of an Alarm Extension.
4. Click **Finish**Select an object in the top of the screen and an attribute in the bottom of the. The **Extensions Wizard** appears with the new attribute listed under the **Alarm** tab.

Adding a Load Extension

About this task:

1. In the **Extensions Wizard**, click **New** in the **Load** row. The **Insert Load Wizard Select Attribute** screen appears.
2. Select an object in the top of the screen and an attribute in the bottom of the screen and click **Next**.

   ⓘ **Note:** Click **other** to display a list of available attributes.

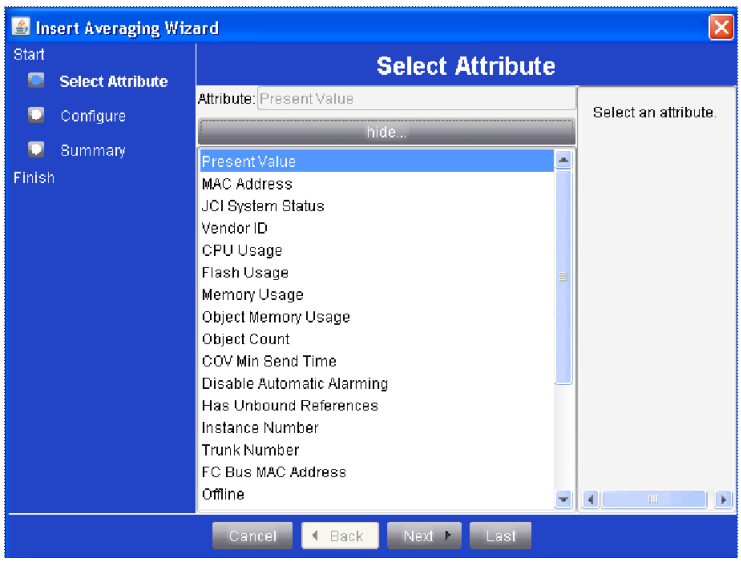
3. Follow the prompts in the Wizard to complete the addition of a Load Extension.
4. Click **Finish**. The **Extensions Wizard** appears with the new attribute listed under **Load**.

Adding an Averaging Extension

About this task:

1. In the **Extensions Wizard**, click **New** in the **Averaging** row. The **Insert Averaging Wizard Select Attribute** screen appears.

Figure 20: Insert Averaging Wizard (Select Attribute Screen)



2. Select an object in the top of the screen and an attribute in the bottom of the screen and click **Next**.

   ⓘ **Note:** Click **other** to display a list of available attributes.

3. Follow the prompts in the Wizard to complete the addition of an Averaging Extension.
4. Click **Finish**. The **Extensions Wizard** appears with the new attribute listed under **Averaging**.

Deleting extensions from an object

About this task:

1. Select a **field device** or a **field point** that contains the extensions to delete.
2. On the **Action** menu, select **Show Extensions**. The **Extension Wizard** starts.
3. Select the check boxes next to the extensions you want to delete.
4. Click **Delete** for each extension.

   Clicking **Delete** in any extension row deletes only the checked extensions in that row. For example, in the Extension Wizard, click both **Resource Delete** and **Alarm Delete** to delete both checked extensions.

5. Click **Done** when finished.

Copying extensions to a Field Device or Field Point (offline only)

About this task:

1. Select a field device or a field point that contains the extensions to copy.
2. On the **Action** menu, click **Show Extensions**. The **Extension Wizard** starts.

3. Select the check boxes for the extensions that you want to copy and click **Copy Checked Extensions** at the bottom of the Wizard.
4. Click **Done**.
5. In the Navigation Tree, select the desired field device or field point destination.
6. On the **Edit** menu, click **Paste**. This adds the copied extensions to the selected field device or field point.
7. Drag the field device or field point to the Display frame (on the right) to verify that the new extensions are correct.

Enabling the routing mode

Normally, third-party BACnet/IP field devices only view mapper objects in the supervisory controller, which are representations of the real BACnet objects in the integrated third-party BACnet field devices. Because the mapper objects are representations the supervisory device keeps updated, no extra network traffic is added to third-party BACnet field devices. Enable the routing mode at the supervisory controller only if you need to communicate directly with the third-party BACnet field devices, such as when you are reprogramming from the third party's engineering workstation, to directly pass BACnet messages from the workstation through the supervisory controller to the third-party BACnet field devices.

BACnet routing considerations

BACnet routing is a technique by which data on one physical Data Link layer is passed to and from another physical Data Link layer. In the case of the network engine, this BACnet routing occurs when data is passed from the IP side of the device to the MS/TP side of the device.

If routing is disabled, the network engine provides an indirect (or proxy) method of obtaining the data on its MS/TP network when a request is made from another device on the IP side of the device. With routing enabled, the network engine may no longer need detailed knowledge of the types of devices and services that reside on its MS/TP network–it simply passes the data request from one link to the next and back again with as little interference as possible. This passing of information benefits those third-party vendors that have the need to directly access devices on the network engine's MS/TP network using tools from the IP network side.

ⓘ **Note:** On a homogenous (or near-homogeneous) Johnson Controls network, you do not need to enable routing. Enabling routing requires the entire site to follow strict BACnet rules so the consequences should be fully understood beforehand.

The routing function of the network engine is disabled by default. Routing can be enabled by setting the Routing Mode attribute on the Network tab of the Device object view to Enabled. You can disable routing by setting the Routing Mode attribute to Disabled. Restarting the network engine is not required when routing is enabled or disabled.

The Enable without Broadcasts setting of the Routing Mode attribute is used to reduce the network traffic caused by enabling routing on an MS/TP network. If this option is used, it is difficult for third-party devices outside the network to discover any devices on a routed network using this setting because they rely on broadcast data for discovery. Because the data capacity of Ethernet IP is much higher than that of MS/TP, special care must be taken to avoid overloading the MS/TP bus when routing is enabled.

All integrated points are visible in the network engine by default, including General BACnet Devices. A third-party device can view the entire list of integrated points by requesting the Object List of the network engine. This request is part of the BACnet communication protocol used to help discover objects on other BACnet devices.

If you want to have access to third-party integrated points within the network engine, there is a benefit to interfacing with mapped MS/TP points in the network engine rather than directly with the objects in each MS/TP device. The network engine acts as a high-speed proxy for all data requests within its domain, which ensures the best performance. This is the default behavior for the network engine and eliminates the need for enabling routing on the network engine. Routing should only be enabled if existing third-party tool configurations cannot support any other method.

When routing is enabled, device configurations must follow more strict setup rules, and configurations that may have previously worked in non-routing situations may no longer work. The same setup rules apply for systems with routing enabled and static IP networks.

Notes:

- Once routing is enabled on the network engine, all device identifiers within each device must be unique across all routed networks, and all network address numbers must be unique across all routed networks.
- Be sure you have good reason before you enable routing. For example, if BACnet rules are not followed when routing is enabled, performance and intermittent issues could result. Or, if a third-party device exists or is added in the future, considerable work may be required to allow the device to work.

The BACnet Broadcast Receive Rate, BACnet Routed Messages Rate, MS/TP Broadcast Transmit Rate, MS/TP Broadcast Receive Rate, and Net Routed Messages attributes allow you to diagnose an overloaded network.

Related documentation

The following table lists documents related to *Metasys* system and BACnet® protocol.

Table 8: Related documentation

For information on:	See Document
Installing the NxE55	*NAE55/NIE55 Installation Instructions (Part No. 24-10051-43)*
Installing the NxE35 and NxE45	*NAE35/NAE45 Installation Instructions (Part No. 24-10050-6)*
Installing the SNC	*SNC Network Engine Installation Instructions (Part No. 24-10143-01892)*
Installing the SNE	*SNE Network Engine Installation Instructions (Part No. 24-10143-01647)*
Installing the NCE	*NCE25 Installation Instructions (Part No. 24-10143-63)*
Overview of BACnet and MS/TP Field Bus Controllers	*Metasys System Field Equipment Controllers and Related Products Product Bulletin (LIT-12011042)*
Setting up Databases	*Metasys SCT Help (LIT-12011964)*
Configuring the NAE and NCE	*NAE Commissioning Guide (LIT-1201519)*
Understanding the Metasys System	*Metasys System Configuration Guide (LIT-12011832)* *SNE Commissioning Guide (LIT-12013352)* *SNC Commissioning Guide (LIT-12013295)* *NAE85 Commissioning Guide (LIT-12011044)*

Table 8: Related documentation

For information on:	See Document
Using the Metasys System and Metasys System Supported Objects and Commands	*Metasys Site Management Portal Help (LIT-1201793)*
NAE Protocol Implementation Conformance Statement (PICS)/BACnet Interoperability Building Blocks (BIBBs)	*NAE/NCE Protocol Implementation Conformance Statement (LIT-1201532)*
SNE/SNC Protocol Implementation Conformance Statement (PICS)	*SNE/SNC Protocol Implementation Conformance Statement (LIT- 12013355*
BACnet Information	American National Standards Institute/ American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 135-2019 at protocol revision 18
Supported Enumeration Sets When Using the Metasys System with a Third-Party BACnet Workstation or Controller	*Metasys System Enumeration Sets Technical Bulletin (LIT-12011361)*
Acronyms and Terms	*Metasys System Extended Architecture Glossary Technical Bulletin (LIT-1201612)*
Remote Field Bus	*MS/TP Communications Bus Technical Bulletin (LIT-12011034)*
Open Data Server	*ODS Commissioning Guide (LIT-12011944)*
Open Application Server	*Open Application Server (OAS) Commissioning Guide (LIT-12013243)*

Troubleshooting

BACnet System Integration troubleshooting guide

Use the information in Table 9 to assist in diagnosing and solving possible BACnet System Integration problems.

Table 9: BACnet System Integration Troubleshooting Guide

Symptom	Cause	Solutions
Field devices appear to periodically cycle online and offline to the network engine as reported on the Site Management Portal UI. However, the field devices may actually be online the entire time	The network engine is too busy with some other tasks, misses a token pass, and is dropped from the token loop. By the time the engine rejoins the token loop, the engine has already flagged its field devices as offline.	Refer to the section *Adjusting NAE network sensitivity* in the *NAE Commissioning Guide (LIT-1201519)*.

Table 9: BACnet System Integration Troubleshooting Guide

Symptom	Cause	Solutions
Auto discovery fails to find all devices.	—	Verify that the supervisory controller's Network Address and BACnet IP Port match that of the integrating IP-based BACnet devices. In the Device object **Focus** view, select **Advanced** to view the BACnet IP Port address.
		If the BACnet device is on the MS/TP Field Bus, verify that the Network Address defined under the **Hardware** tab of the MS/TP Field Bus is correct.
		Verify that no network devices have duplicated Object Identifiers. In accordance with the BACnet specification, the BACnet Object Identifier for each device on the entire network must be unique. After performing a Relearn, view the Duplicate Device Identifiers attribute of the BACnet Integration object (**Diagnostic** view). Any duplicates found on the network are listed. ⓘ **Note:** Duplicates of VMA1930 and FAC4911 devices will be included in list of discovered devices.
		Verify that the BACnet Object Identifier of the supervisory controller itself does not conflict with that of the BACnet devices being integrated. The BACnet Object Identifier appears in the **Focus** view after selecting **Advanced**.
		When Dynamic Broadcast Managment is enabled at the Site Director: If the BACnet device is on a different IP network segment from any supervisory controller, specify a BACnet Broadcast Management Device (BBMD) for its segment. Add the device IP of a BBMD device in that segment to the third-party BBMD attribute of the Site object. When Dynamic Broadcast Management is disabled at the Site Director: Add all of the specified BBMD devices to the BBMD list of each JCI supervisory, field controller, or third party BBMD device. With Release 11.0 Metasys supervisory devices, you can enter either an IP address or a host name.
		Verify that the BACnet device supports the Who-Is BACnet service. Auto discovery requires the support of this service.

Table 9: BACnet System Integration Troubleshooting Guide

Symptom	Cause	Solutions
A BACnet device goes offline and fails to come back online.	A change of the BACnet device IP address.	At startup of the supervisory controller, the BACnet Integration binds with the BACnet Object Identifier (OID) and uses the IP address from that bind. If you move a device to a different subnet, or change the IP address of the device, you must restart the NxE to bind the OID with the new IP address.
BACnet Trend Logs cannot be discovered.	The third-party Trend Log object does not support BACnet **Logging Type** (property 197) and returns an **Unknown_ Property** error when read.	Manually add the third-party Trend Log object to show the trend log attributes, and display the views and log data graph properly. See Adding a Trend Extension.
Attempts to write string attributes (such as Description) or if alarm acknowledgments from the SMP UI are not seen at the BACnet device.	Encoding type may be incorrect.	Verify that the BACnet Encoding Type specified in the Site matches the encoding that the BACnet devices are using: ANSI X3.4 (US-ASCII), ISO 10646 (UTF-8), ISO 10646 (UCS-2), or Microsoft DBCS Code Page 932. ⓘ **Note:** The UTF-8 BACnet Encoding Type is also compatible with ASCII as long as extended characters (for example, Ç, ä, ╣, and ß) are not used with ASCII devices.
Time sync or UTC time sync messages are not accepted.	—	The network engine accepts BACnet time sync messages only if no Simple Network Time Protocol (SNTP) server is defined for that network engine. If the device is a Site Director, do not enable (leave blank) the Site Time Servers attribute of the Site object. or If the device is not a Site Director, do not enable (leave blank) the Device Time Servers attribute of the Site object. or If the Time sync or UTC time sync message does not contain a specific time as required by BACnet (for example, message has wild card values), it is not accepted.

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This product is covered by a limited warranty, details of which can be found at www.johnsoncontrols.com/buildingswarranty.

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