BACnet Device Simulator User's Manual

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Contents

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Introduction

The SCADA Engine BACnet Device Simulator is a client that provides creating and simulating BACnet Devices and Objects to test the functionality of the BACnet network.

The BACnet Device Simulator allows creating a new network or opening an existing network. Then it allows adding, removing devices, objects in to the network according to the user requirements. In addition, it supports user to save the network or export it in to a file.

Also, BACnet Device Simulator acts as a global simulator which simulates all the devices. All the devices and all the object types of a device are simulated while the BACnet Device Simulator is running.

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Installation

This chapter describes how to install the SCADA BACnet Device Simulator onto your PC. It is important that you check the System Requirements section before following the installation section for a step by step guide to the installation process.

System Requirements

The minimum hardware requirements for the BACnet Device Simulator are:

- Intel® Pentium® 4 Processor
- 512 MB RAM
- 20 GB hard drive

The SCADA Engine BACnet Device Simulator can be used with the following operating systems:

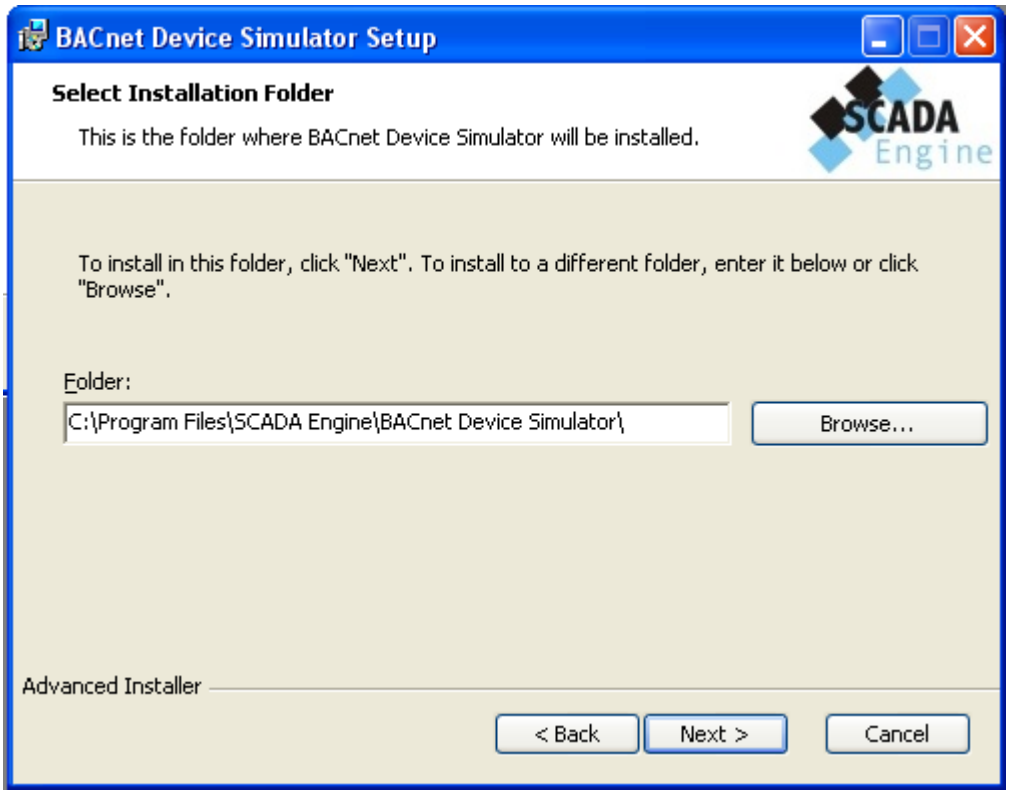
- Microsoft Windows XP
- Microsoft Windows 2003 Server
- Microsoft Windows 2000
- Microsoft Windows Vista

Install

Log onto the system as Administrator before running the installation program, it cannot be installed under a limited user account.

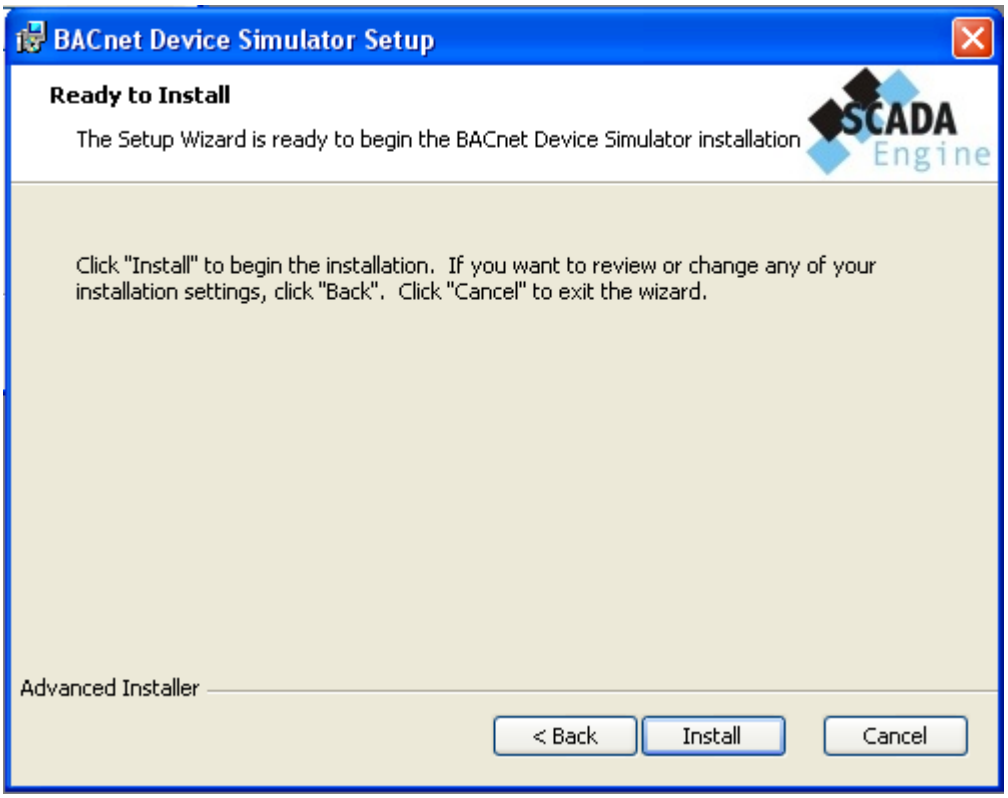
1. Place the SCADA Engine BACnet Device Simulator CD into the CD drive, or double click on the ***BACnetDeviceSimulator.msi*** program.
2. The Windows Installer will start and you should see the following screen.

3. Click the Next Button to select the installation folder.

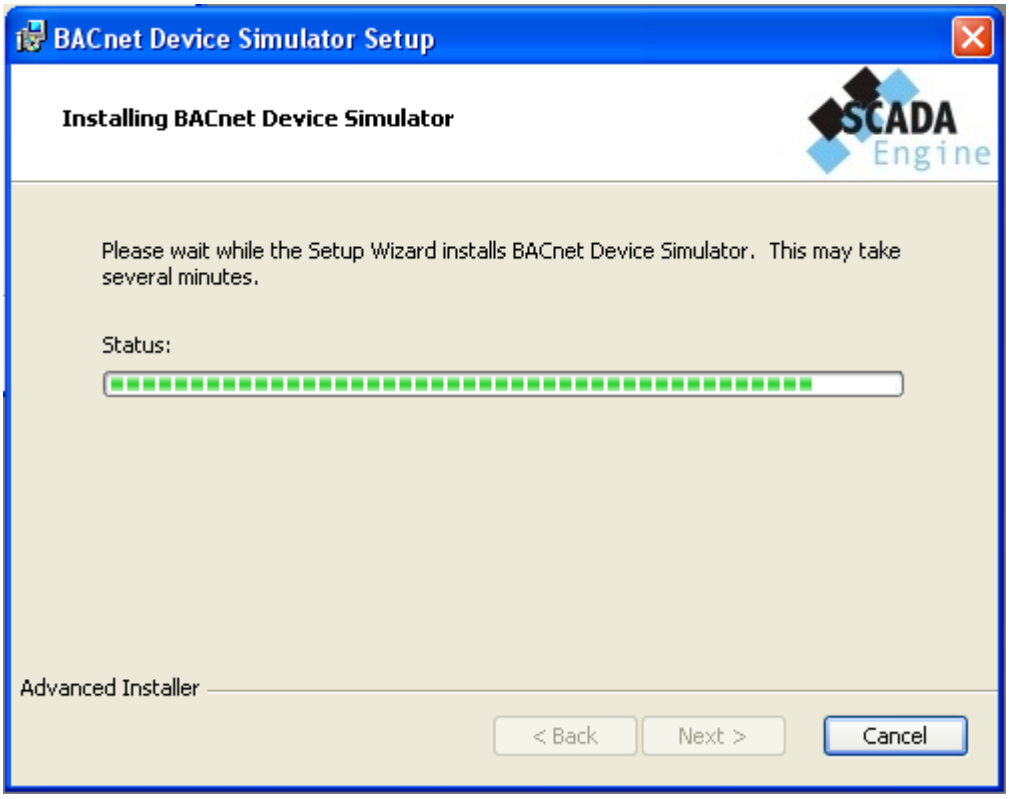


Browse for a new Installation folder or keep the default location.

4. Click next Button. You will be displayed the “Ready to Install” dialog.



5. Click the Install button and it will display the progress of the installation.



6. Once the installation is completed you will be displayed the following dialog. Click Finish Button to exit the wizard.

Installed Files

The program files are installed by default into the C:\Program Files\SCADA Engine\BACnet Device Simulator directory on the hard drive. The list below lists all of the files installed into this location.

- BACnAPI.dll
- BACnCSharp.dll
- BACnCSWrap.dll
- BACnetPropertyGrid.dll
- scada_engine.lic
- simulator.exe

Application Data

Application data is stored onto the hard drive into the C:\Documents and Settings\All Users\Application Data\SCADA Engine\BACnet Device Simulator directory for Windows 2000, 2003 and XP. It is stored into C:\ProgramData\SCADA Engine\BACnet Device Simulator for Vista.

Uninstall

To remove the BACnet Device Simulator, go to the Control Panel and select Add/Remove programs. Locate the entry for the BACnet Device Simulator and remove it.

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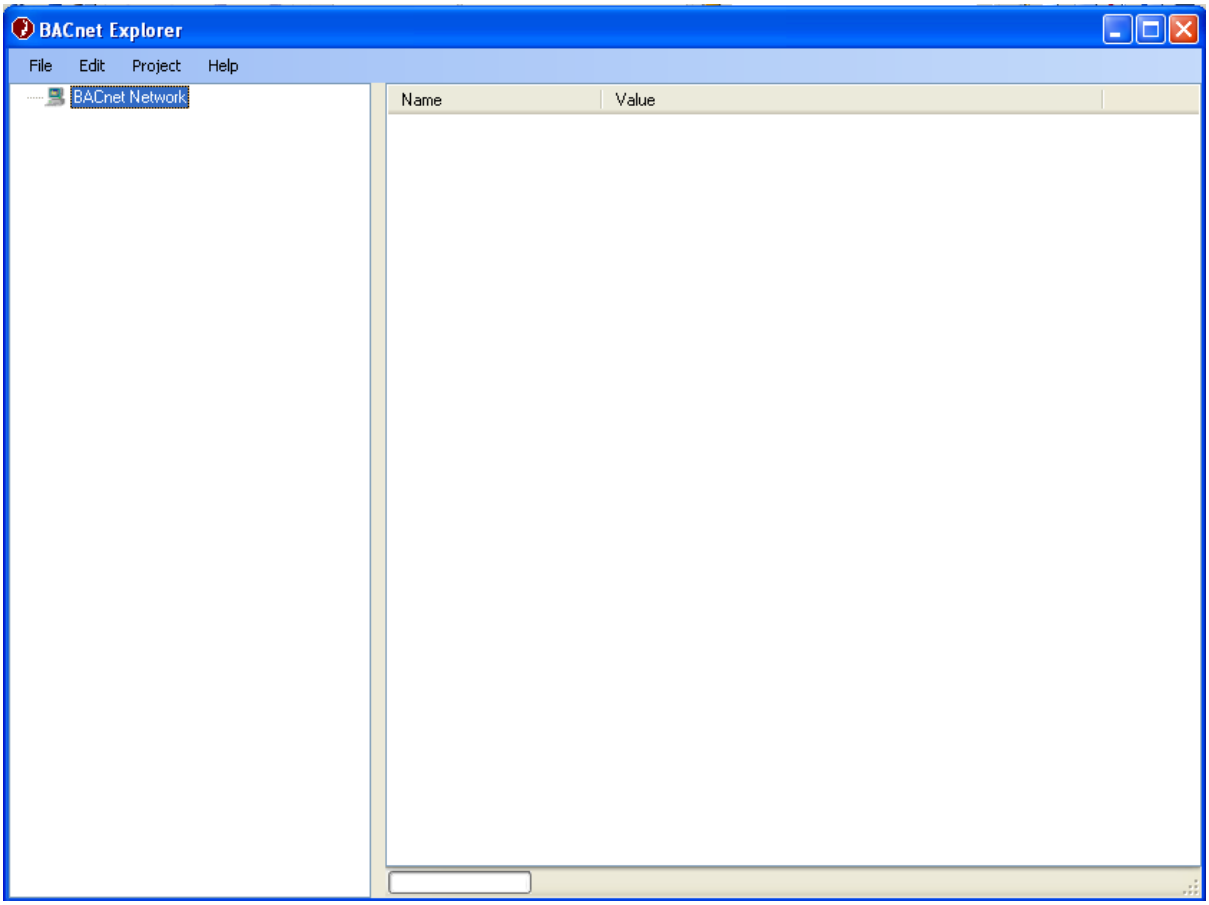
Getting Started

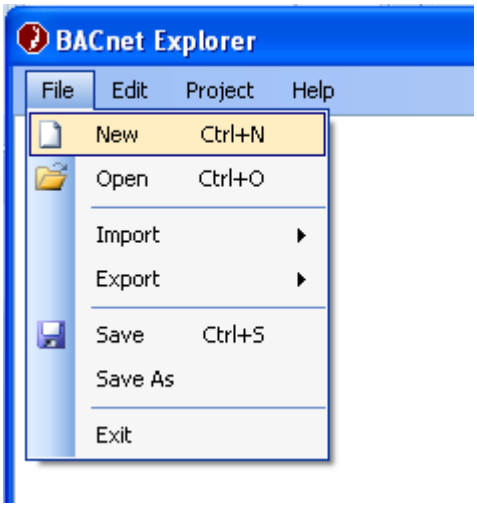
This section contains a tutorial with a step by step walk through all the functionalities of the BACnet Device Simulator.

Start the BACnet Device Simulator

From the Start Menu select "***SCADA Engine -> BACnet Device Simulator -> BACnet Device Simulator***" to start the SCADA BACnet Device Simulator. You will see the following screen when you start it for the first time.

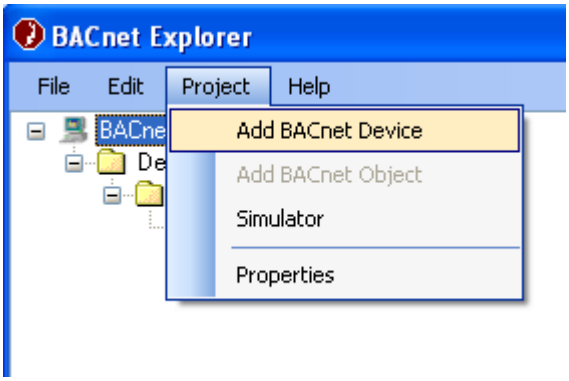


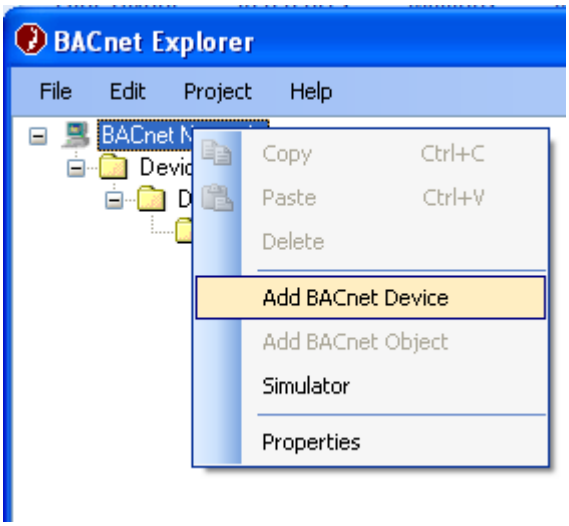
After you started the BACnet Device Simulator you can create a new network using the ***File -> New*** Menu.



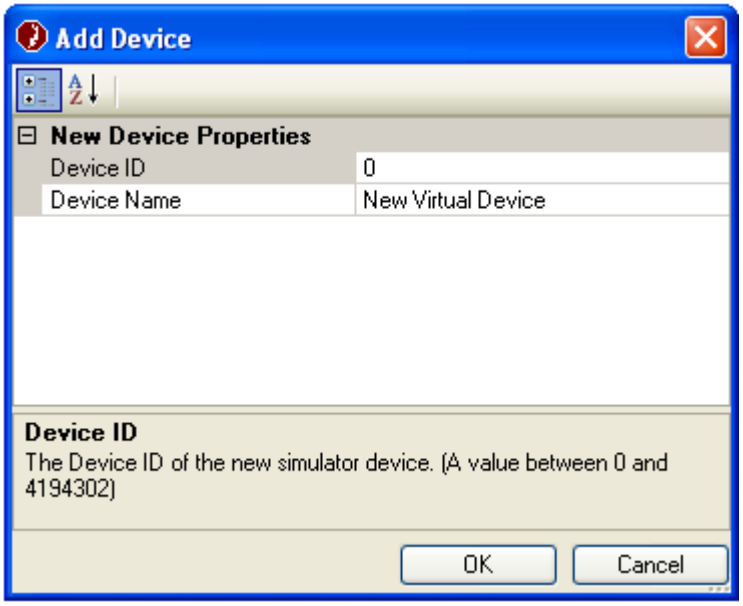
Add BACnet device

You can add devices to your network using the ***Project -> Add BACnet Device*** menu or Add ***BACnet Device*** Menu in the popup menu appears, when you click on the network explorer panel.



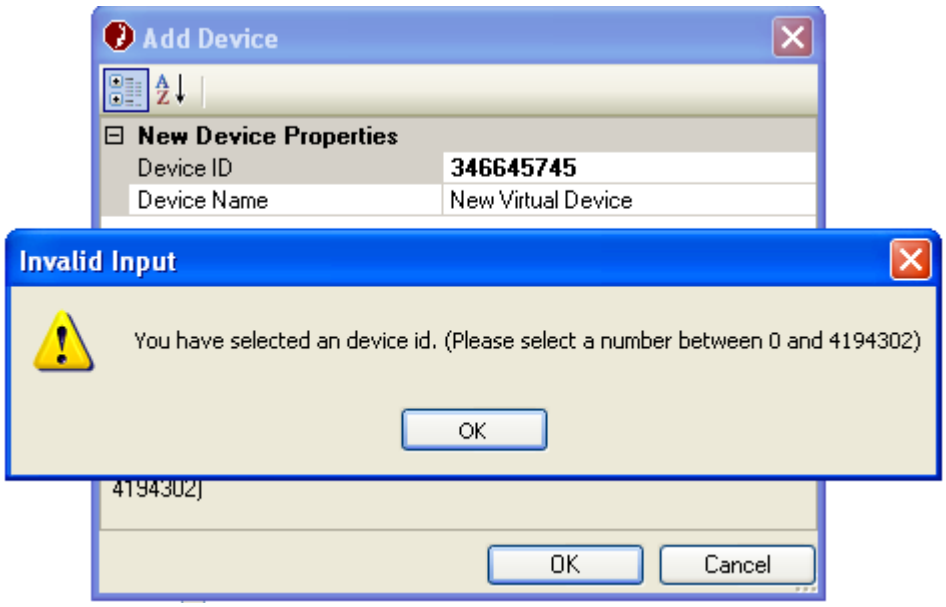


When you click on the Add Network Device, you will get the following dialog.

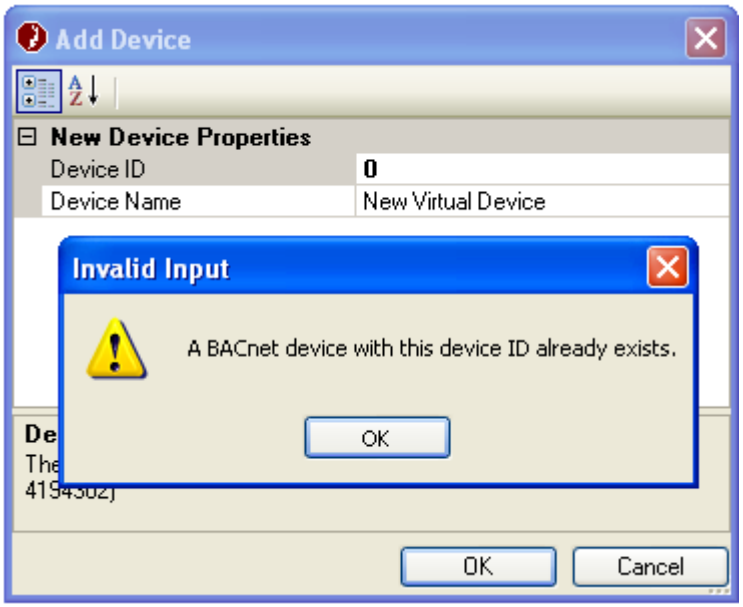


You have to specify the Device ID and a name for the device. The device ID displayed is the next possible device ID. Users can change it as they need.

Device ID must be between 0 and 4194302. If user specifies an invalid ID it will display the following error message.

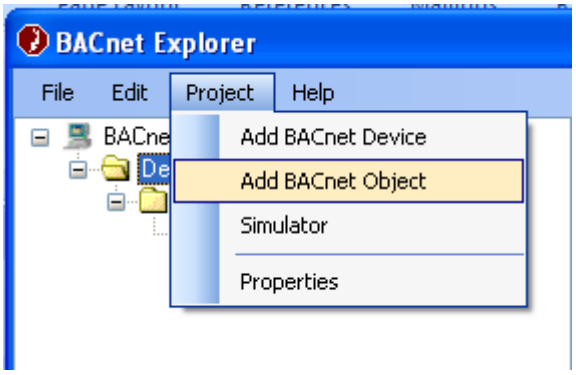


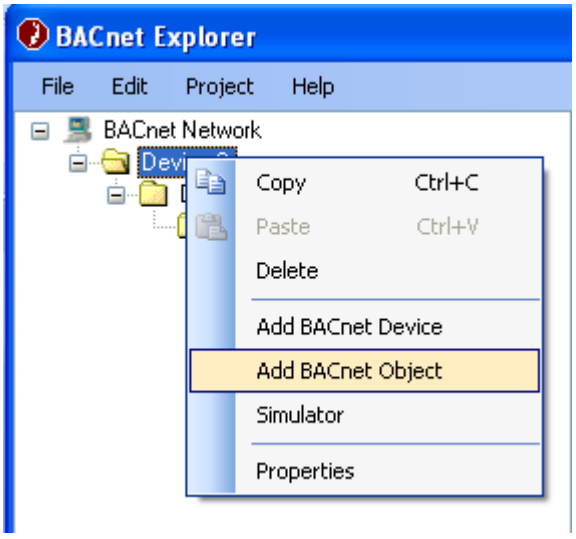
If user enters an existing device ID, it will display the following error.



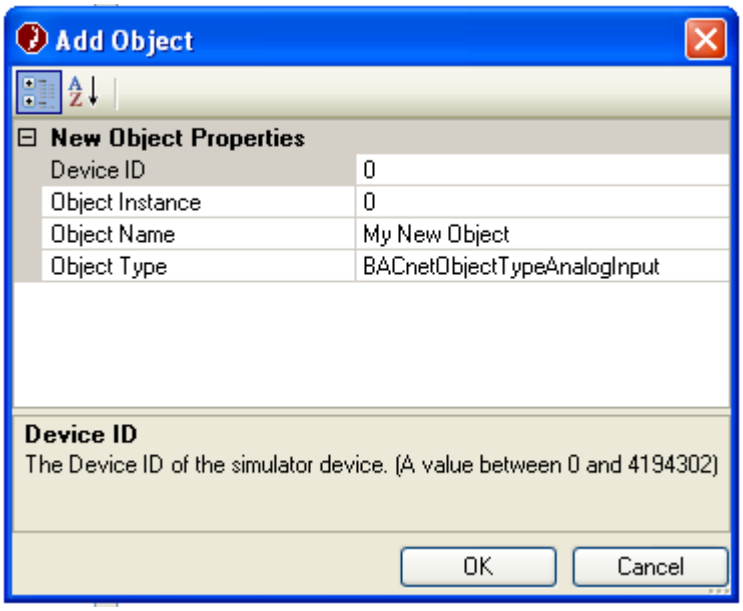
Add BACnet Object

Users can add BACnet objects to the selected device using the ***Project -> Add BACnet Object*** or ***Add BACnet Object*** in the popup menu which appears when you right click on the left tree panel.





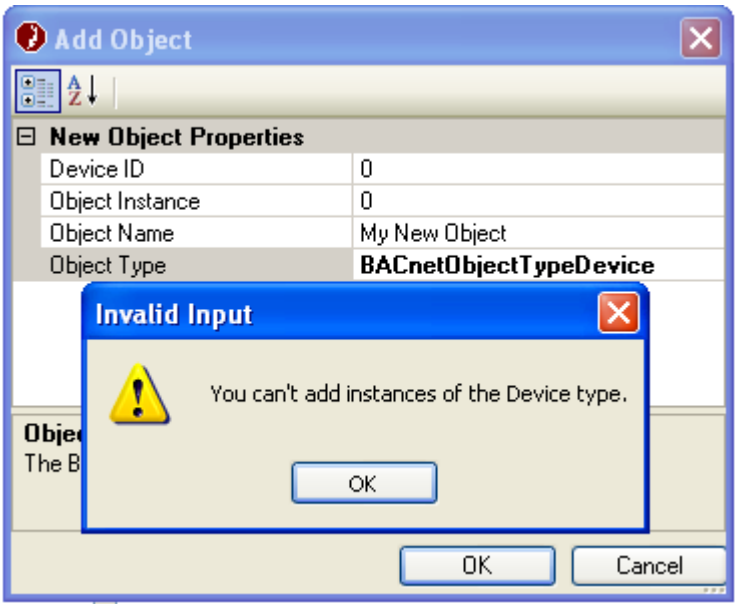
When you click on the Add BACnet Object it will display the following dialog.



User has to specify the Device ID, Object Instance, Object Name and Object Type. Next possible Device ID, next Object Instance ID, Default object name and the selected object type will be displayed as the default values in the dialog. Users can change these values as they require.

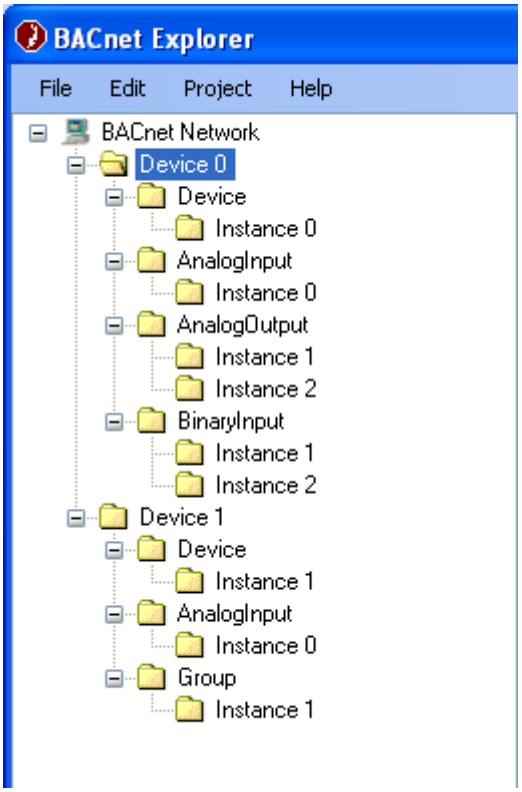
Device ID and the Instance ID should be between 0 and 4194302. Object Type can be any of the available BACnet object types except the BACnetObjectTypeDevice.

If user selects the BACnetObjectTypeDevice, it will display the following error message.



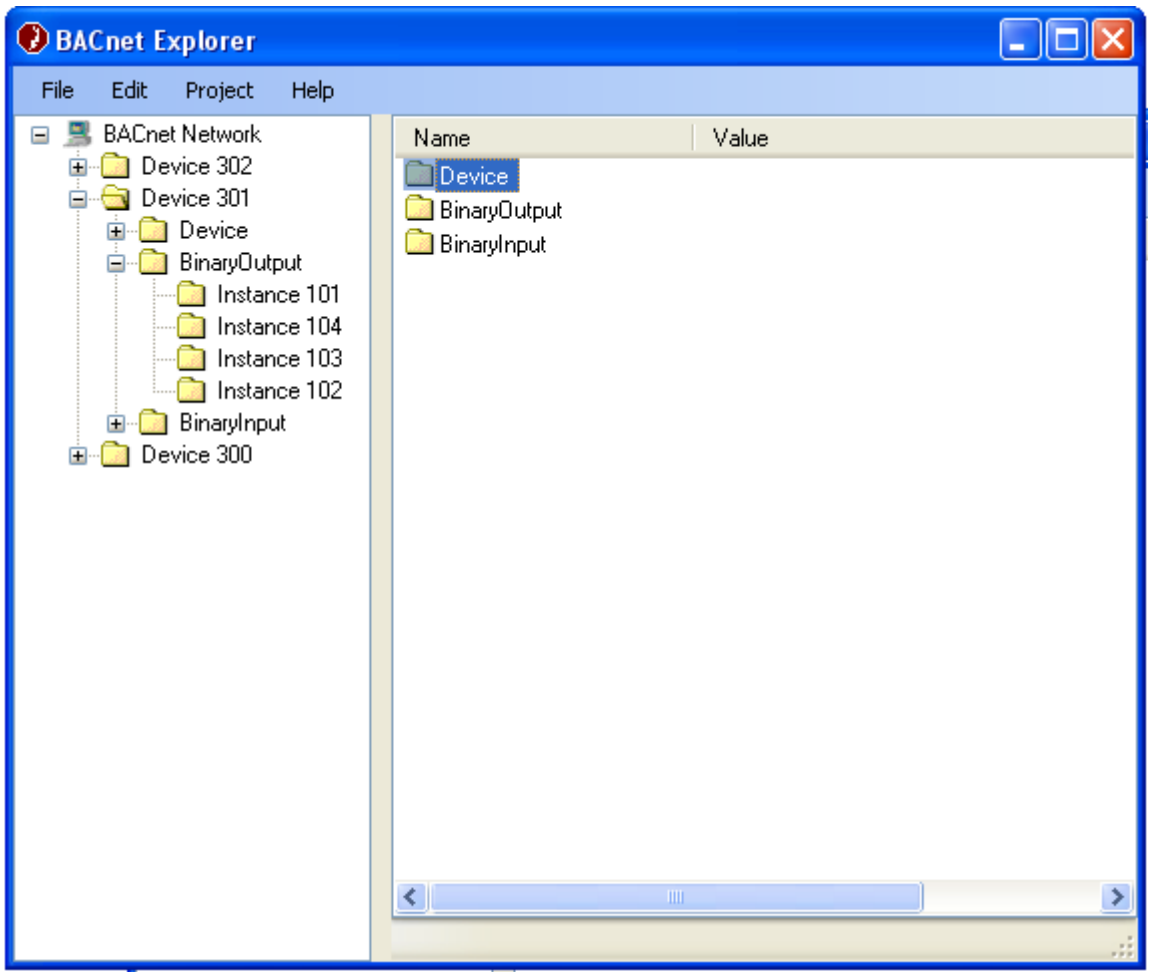
If you are creating a new object of an existing object type, new object instance will be added under the existing object type folder. If it is a new object type, folder corresponds to the new object type will be created and an instance will be created under the newly created folder.

The devices, object types and instances hierarchy will be displayed like below.

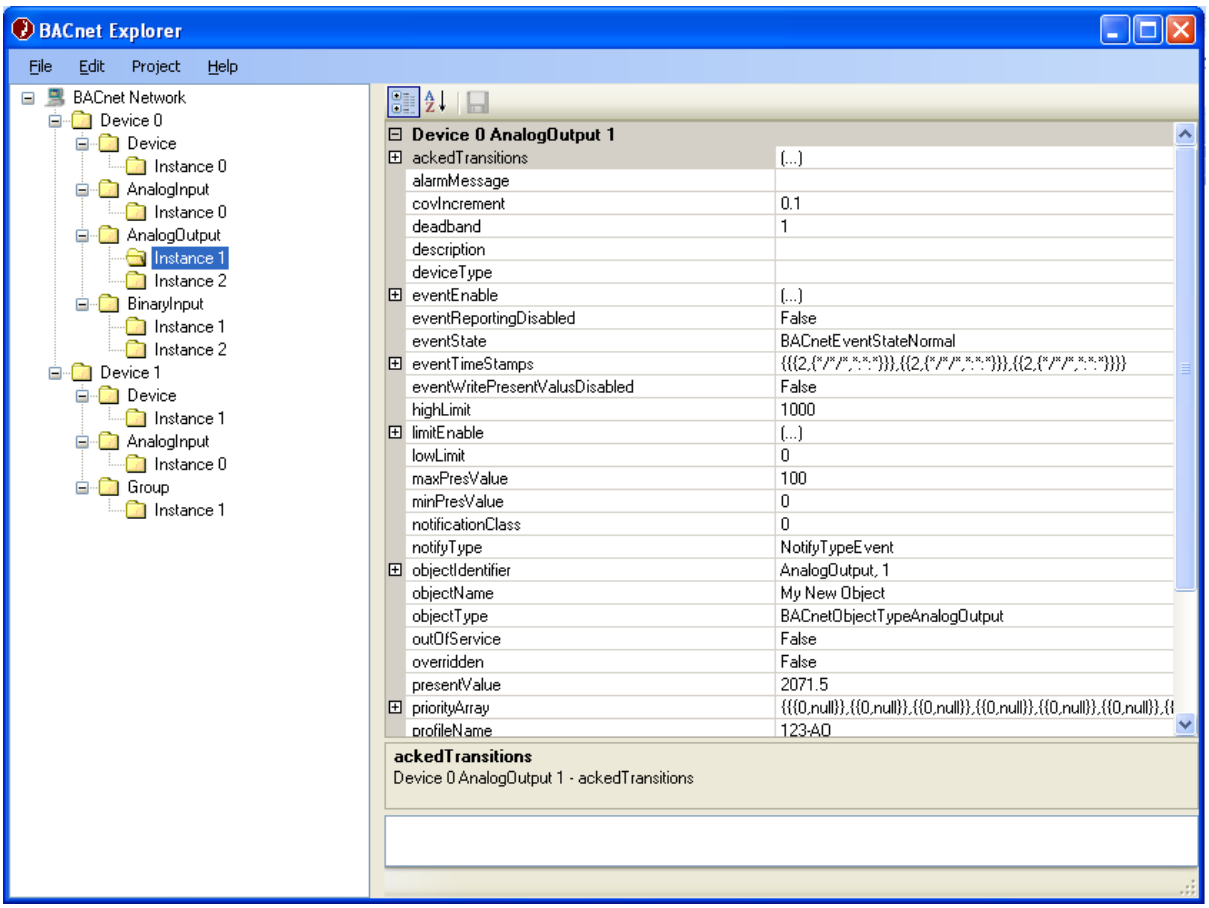


When you select a device, object type or an instance, details of the particular item will be displayed on the right hand pane.

If user selects the BACnet Network (root level) on the left hand tree, all the devices belongs to the network will be displayed on the right hand pane. If the selected item is a device, object types of that devices and if it is an object type, the instances of that object type will be displayed on the right had side. Also users can navigate further down by clicking the particular item in the right hand pane.



If you select an instance on the left hand tree panel or click on the instance name on the right hand panel, details of that instance will be displayed in the right hand panel.

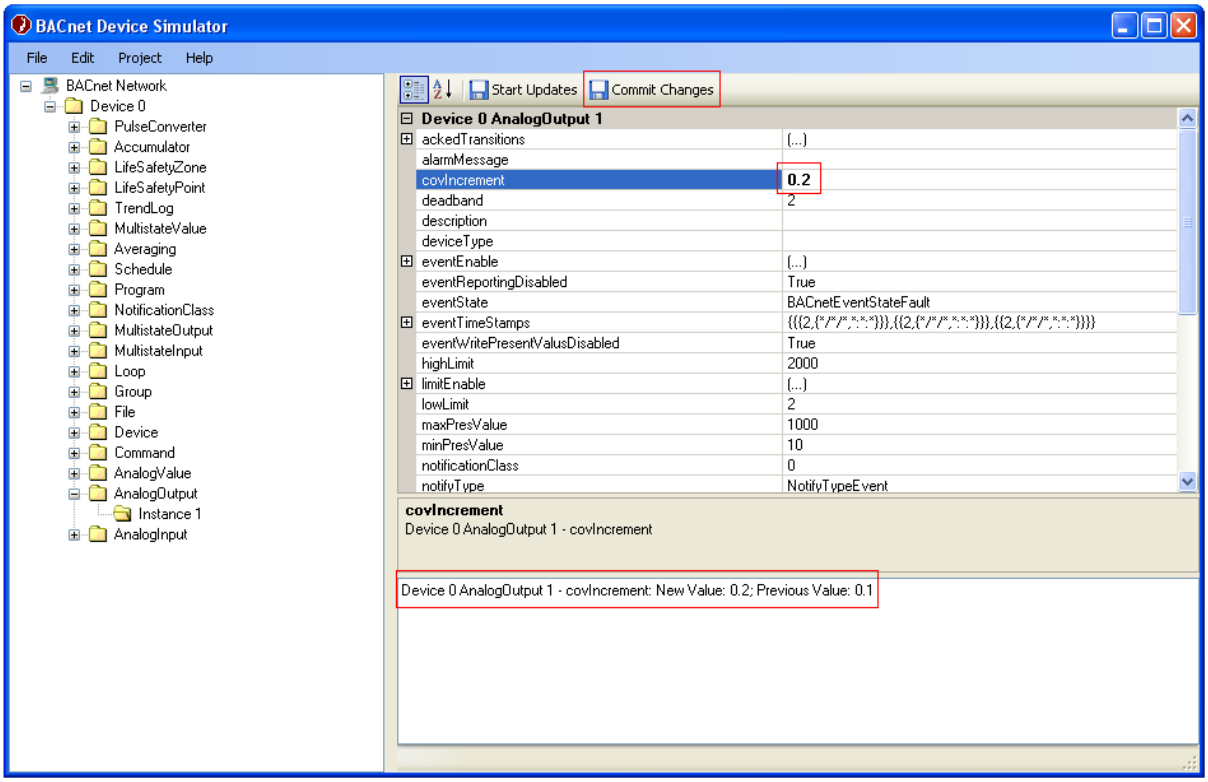


Update Object Properties

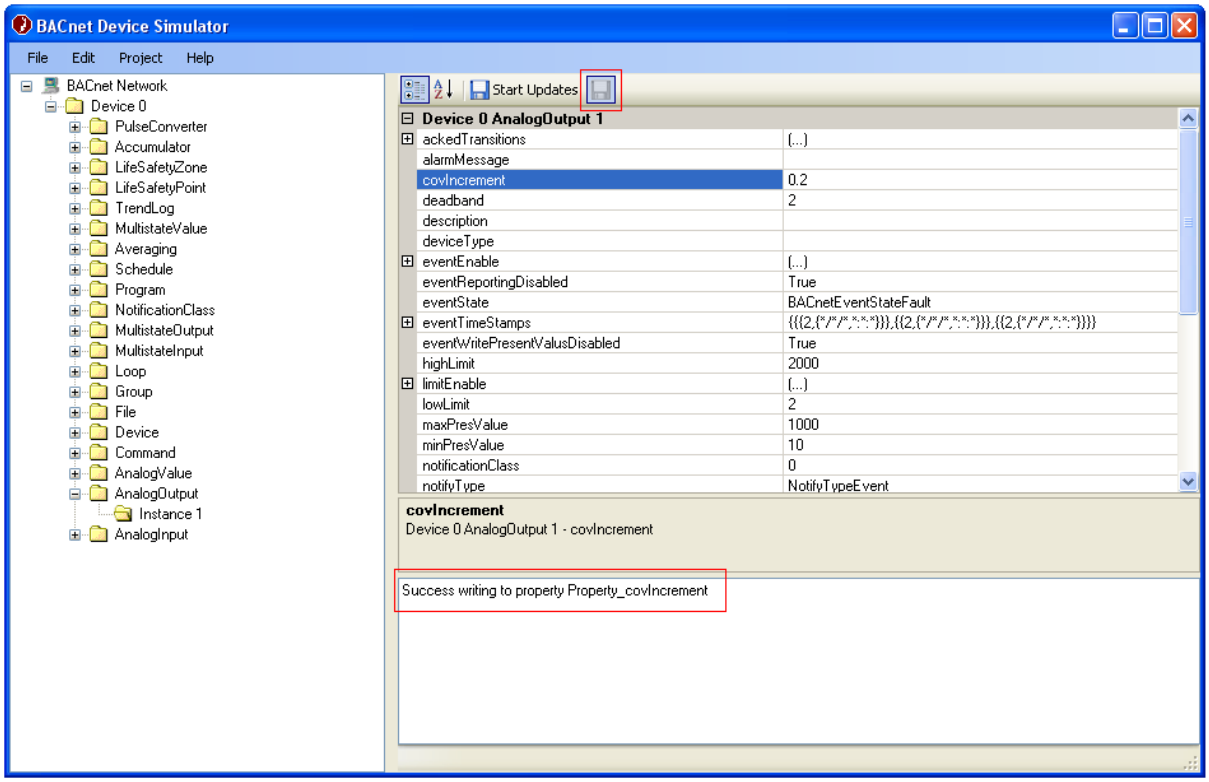
Users can update the object property values by clicking on the particular property value in the property grid. The value can have different value formats such as simple value, selection from a collection of values, array, choices, etc. The method of displaying and updating the value depends on the value format.

Updating a property with a simple value format

Select the corresponding value field in the right column of the property grid and simply edit the value to the required value and press enter. The changes will be displayed below the grid. Also, the “Commit Changes” button will appear at the top.

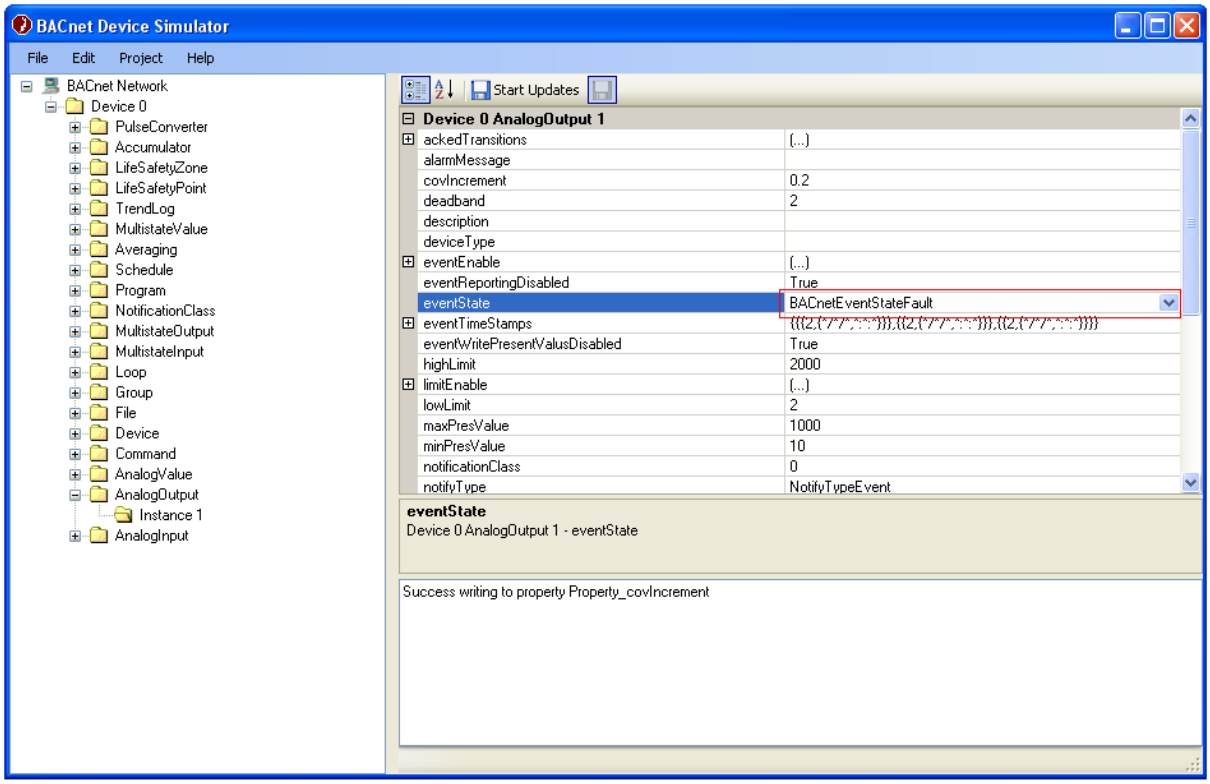


Then click on the “Commit Changes” button, which will update the server with the updated property value. The status of the updating is displayed at the bottom panel and “Commit Changes” button get disabled.

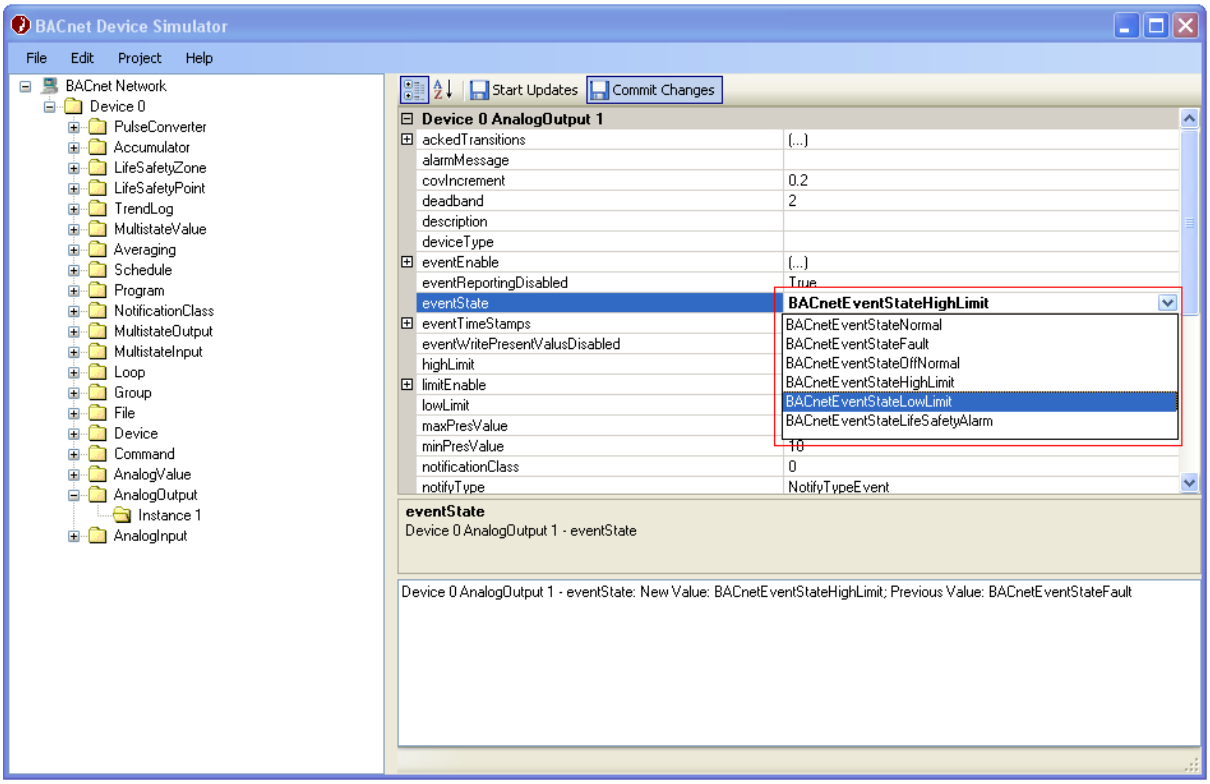


Updating a property value with a selection

Click on the property value that you want to update. If it is a selection property, the cell will become a selection box and it will display an arrow at the end.

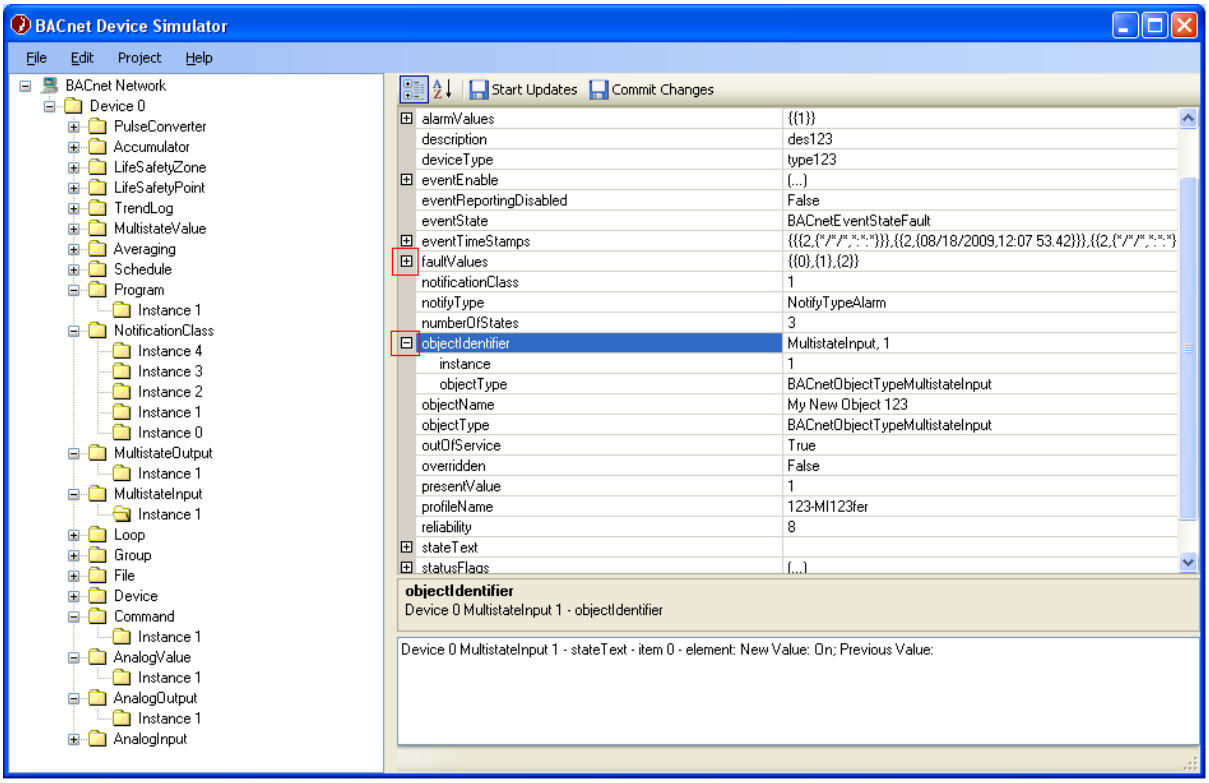


When you click on the array it will display a list of available options. You have to select one of them and commit changes similar to the way that mentioned under updating a property with a simple value.



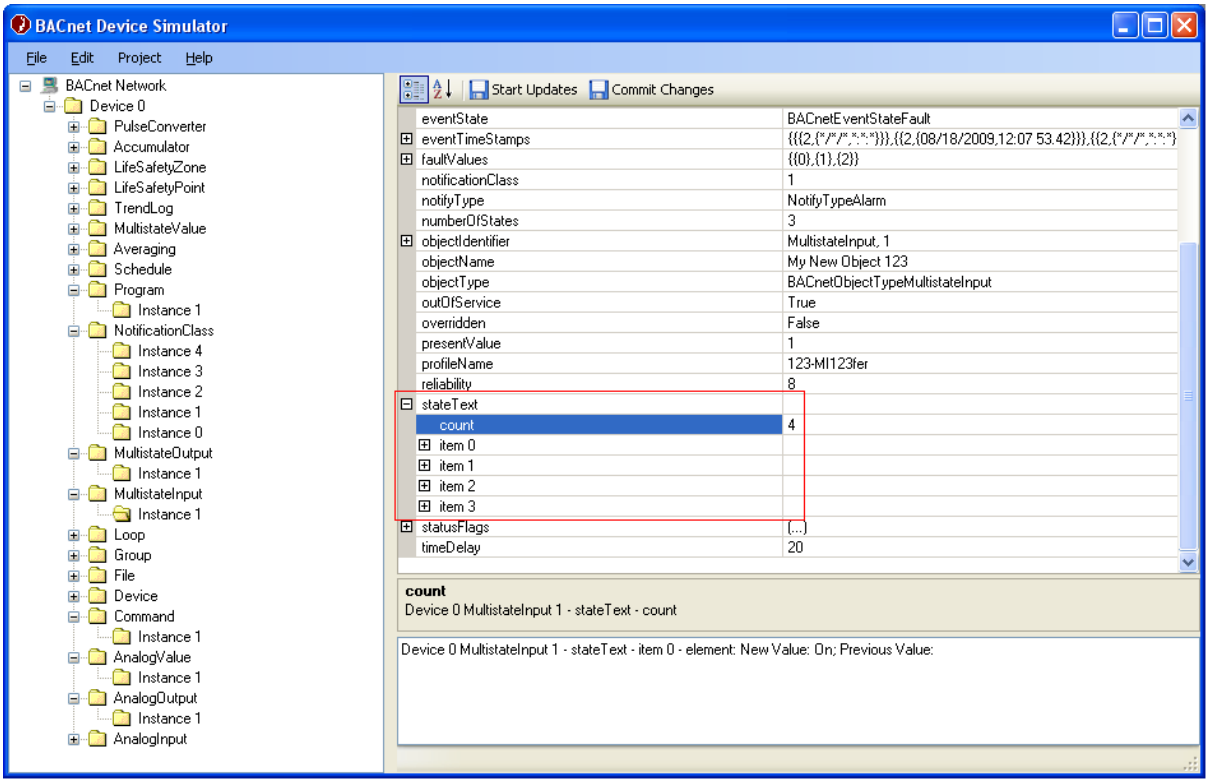
Updating a property with a value collection

If the property is a collection of values, it will display an expandable button (+) at the beginning of the property name. Users can expand and see the values of the sub properties and update them.



If the sub properties are simple values or selection values you can update them in a similar manner to the previous two sections.

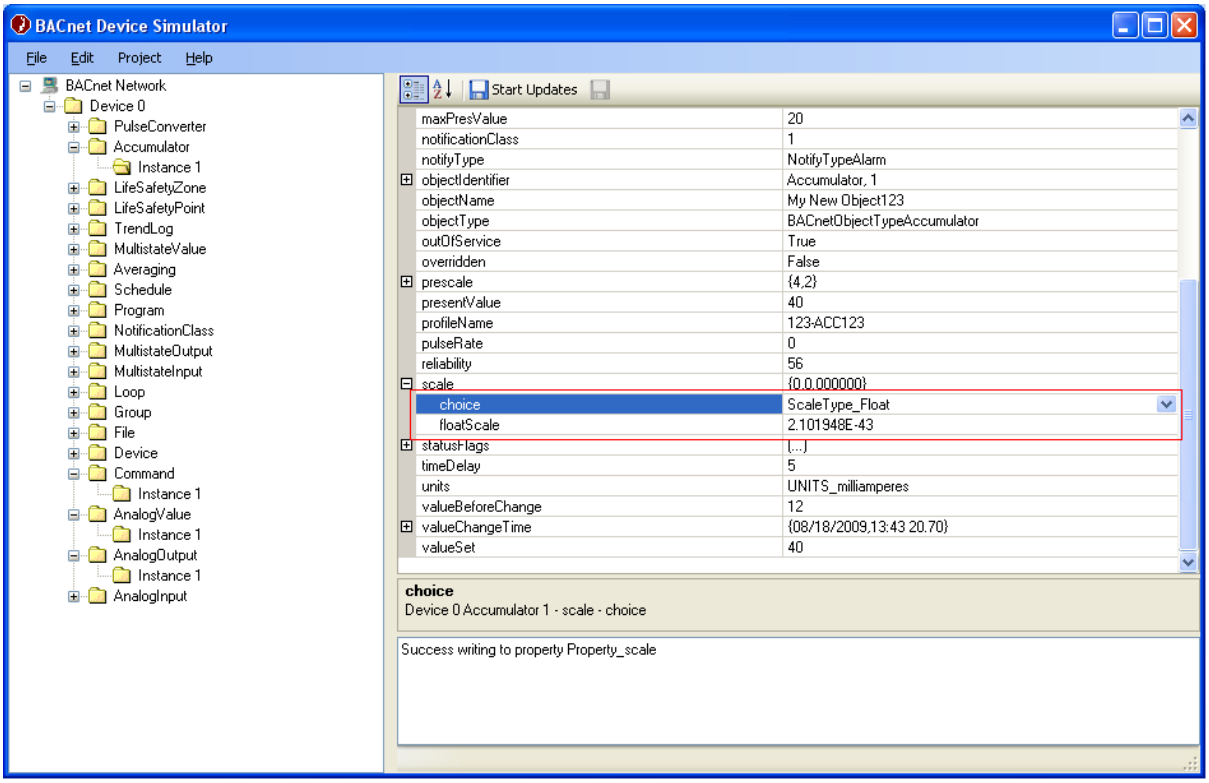
Sometimes, the collection can hold an array of elements. Users can specify the number of elements using the “count” property and it will add the specified number of sub items to the collection.

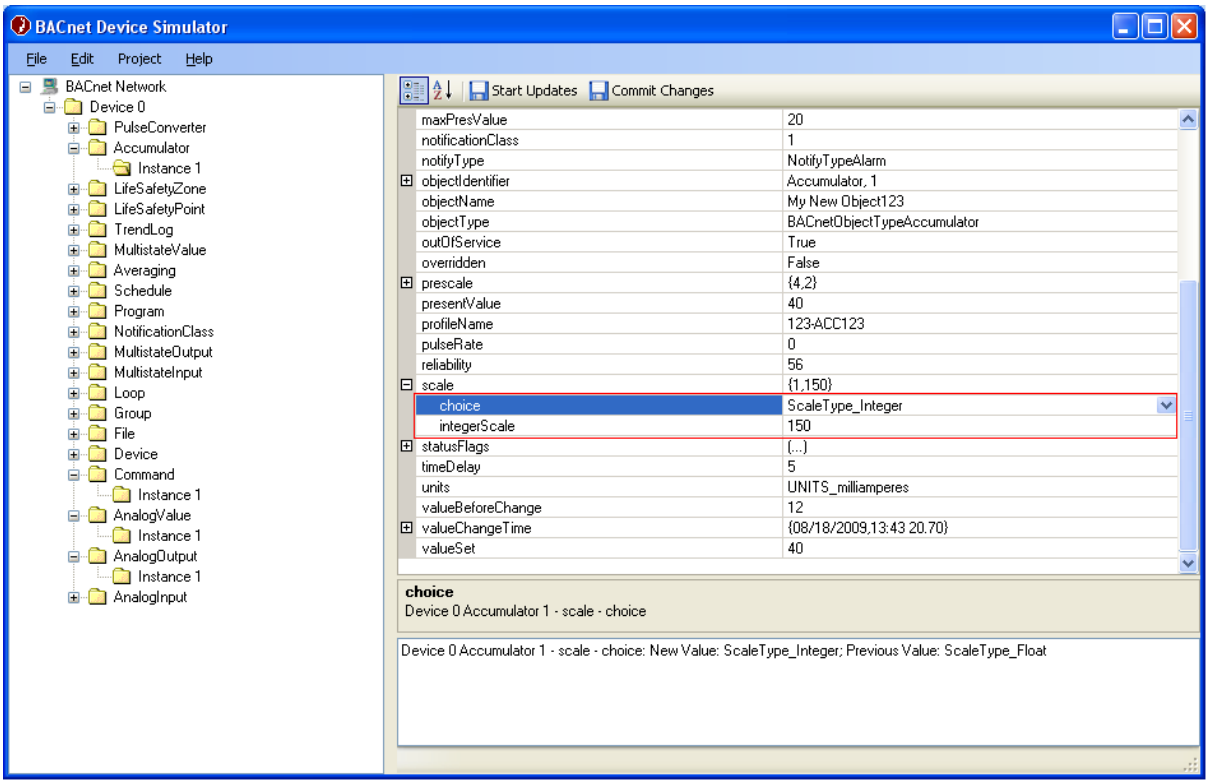


After that you can change the properties of sub items and click on the “Commit Changes” button to update the server.

Updating a property value with a choice

Some of the property values are choice values, which means that the displayed sub properties get changed based on the user’s selection. The “choice” is a selection property from which you can select a value and based on that the other available sub properties get changed.


BACnet Device Simulator
File Edit Project Help
BACnet Network
Device 0
PulseConverter
Accumulator
Instance 1
LifeSafetyZone
LifeSafetyPoint
TrendLog
MultistateValue
Averaging
Schedule
Program
NotificationClass
MultistateOutput
MultistateInput
Loop
Group
File
Device
Command
Instance 1
AnalogValue
Instance 1
AnalogOutput
Instance 1
AnalogInput
Start Updates
maxPresValue 20
notificationClass 1
notifyType NotifyTypeAlarm
objectIdentifier Accumulator, 1
objectName My New Object123
objectType BACnetObjectTypeAccumulator
outOfService True
overridden False
prescale {4,2}
presentValue 40
profileName 123-ACC123
pulseRate 0
reliability 56
scale {0.0.000000}
choice ScaleType_Float
floatScale 2.101948E-43
statusFlags {...}
timeDelay 5
units UNITS_milliamperes
valueBeforeChange 12
valueChangeTime {08/18/2009,13:43 20.70}
valueSet 40
choice
Device 0 Accumulator 1 - scale - choice
Success writing to property Property_scale


BACnet Device Simulator
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MultistateValue
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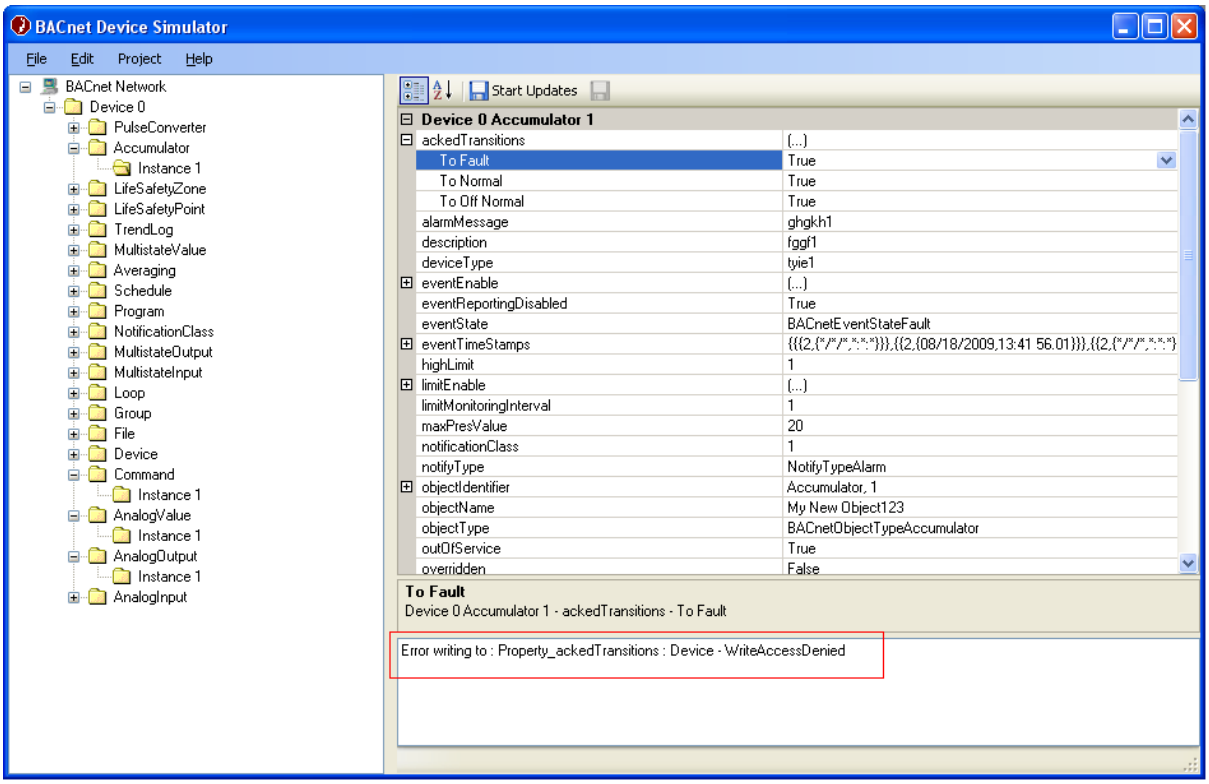
Schedule
Program
NotificationClass
MultistateOutput
MultistateInput
Loop
Group
File
Device
Command
Instance 1
AnalogValue
Instance 1
AnalogOutput
Instance 1
AnalogInput
Start Updates
Commit Changes
maxPresValue 20
notificationClass 1
notifyType NotifyTypeAlarm
objectIdentifier Accumulator, 1
objectName My New Object123
objectType BACnetObjectTypeAccumulator
outOfService True
overridden False
prescale {4,2}
presentValue 40
profileName 123-ACC123
pulseRate 0
reliability 56
scale {1,150}
choice ScaleType_Integer
integerScale 150
statusFlags {...}
timeDelay 5
units UNITS_milliamperes
valueBeforeChange 12
valueChangeTime {08/18/2009,13:43 20.70}
valueSet 40
choice
Device 0 Accumulator 1 - scale - choice
Device 0 Accumulator 1 - scale - choice: New Value: ScaleType_Integer; Previous Value: ScaleType_Float

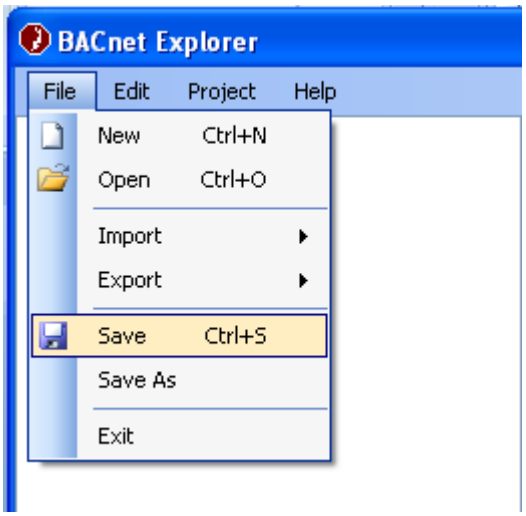
Non updatable properties

Some properties are not allowed to be updated by the users. When a user tries to update such a property it will display an error message below the property grid and the value will be reverted back to the original value.

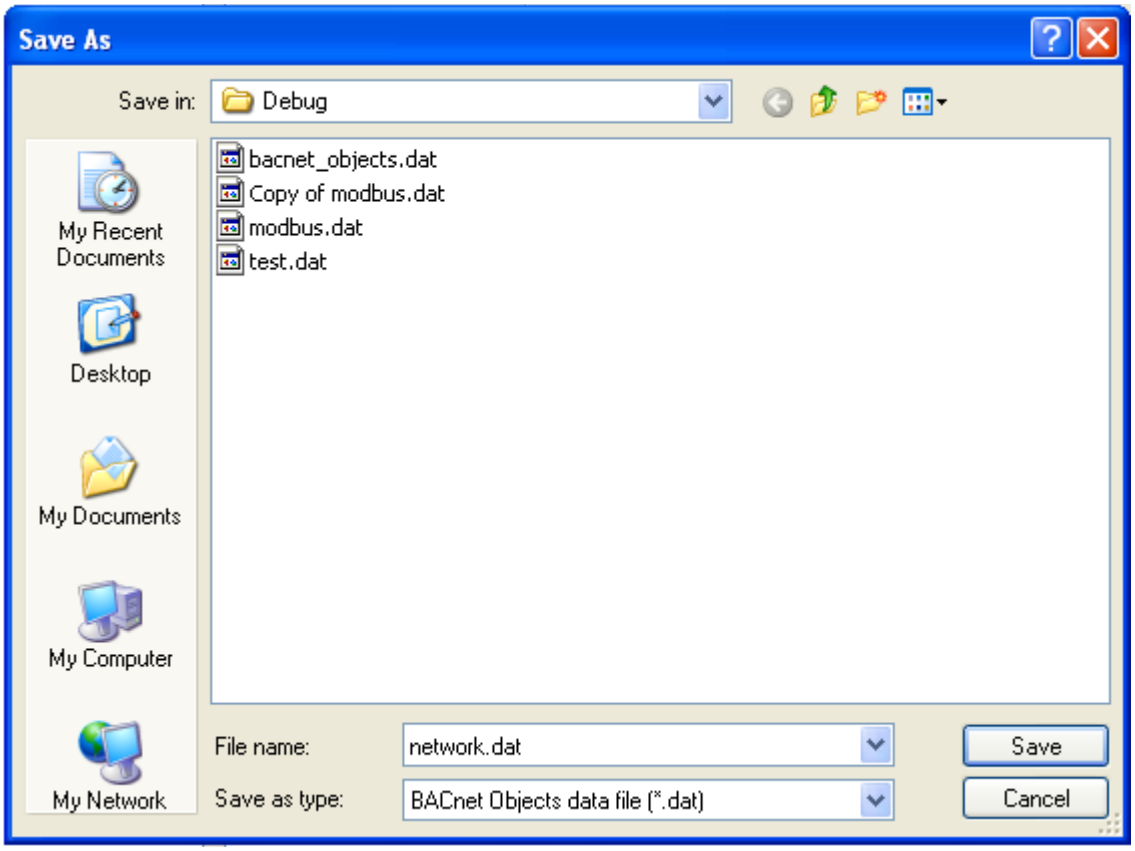


Saving the Network

Users can save the network into a .dat file by clicking the ***File->Save*** menu or ***File->Save As*** menu.

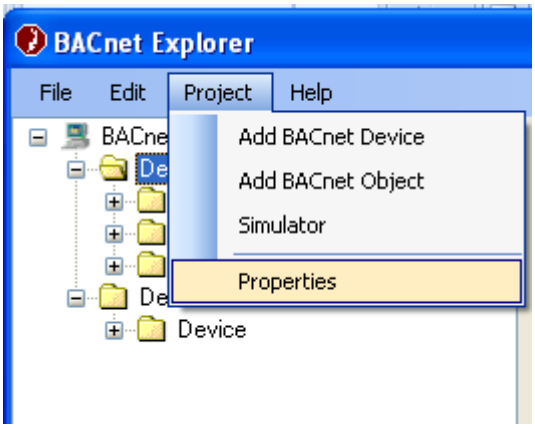


When you click on one of the above menus, File Save dialog will be appeared and users can specify the file name and the location for the new file. The network will be saved as a .dat file.

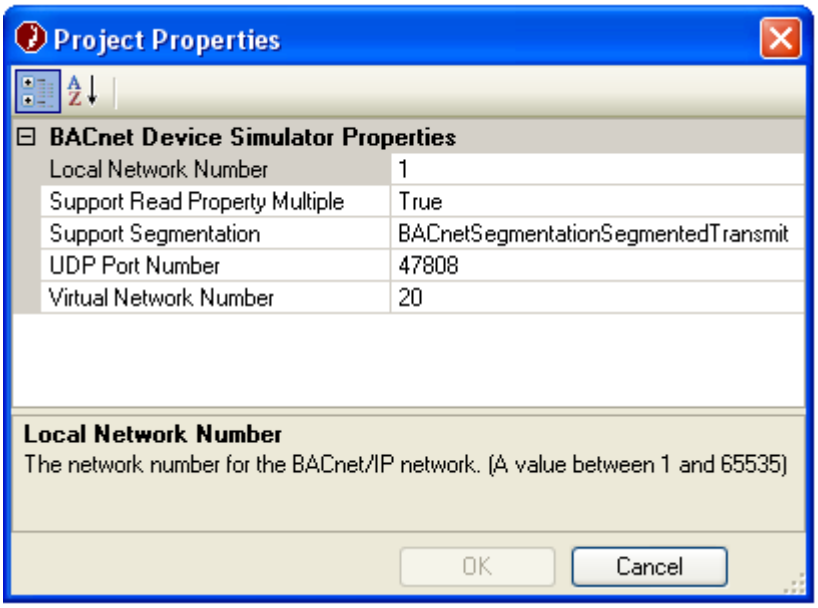


Project properties

Users can set the project properties using the ***Project -> Properties*** menu.



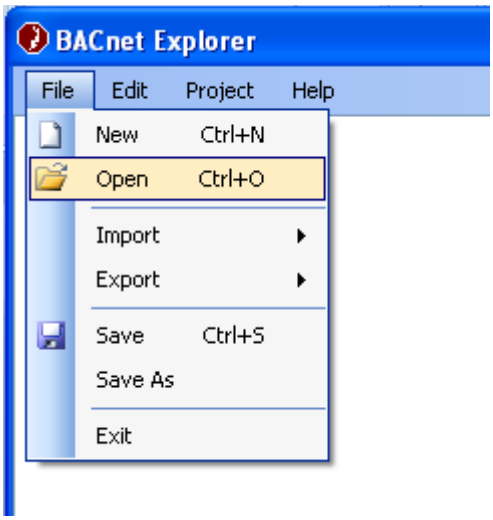
When you click on the properties menu, the following dialog will be displayed.



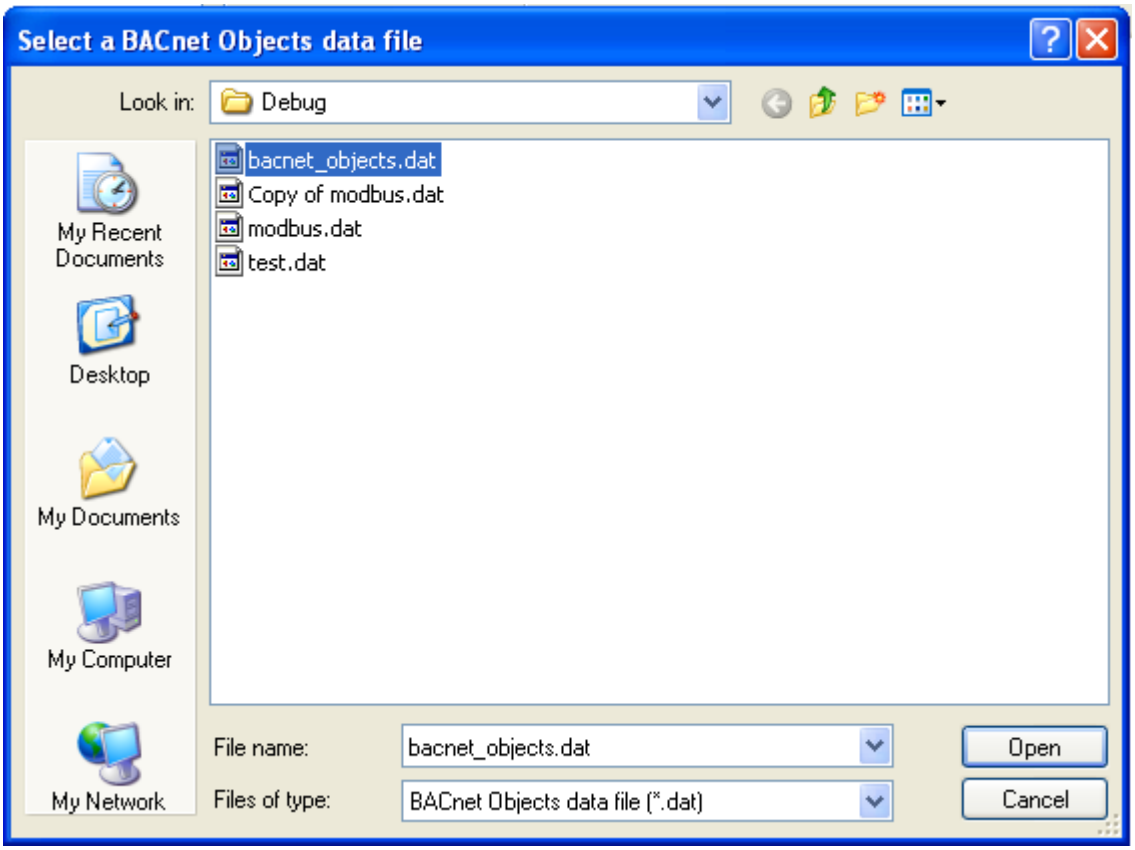
You have to specify the Local Network Number, UDP Port Number, Virtual Network Number, Support Read Property Multiple, Support Segmentation and Press OK button. Then the network properties will be updated.

Opening an existing Network

Users can open an already saved .dat file using the ***File -> Open*** menu.



When you clicked on the Open button file open dialog will be displayed and user can select the file that needs to be opened.

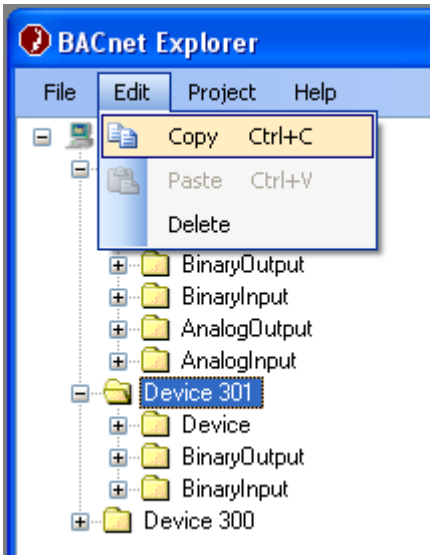


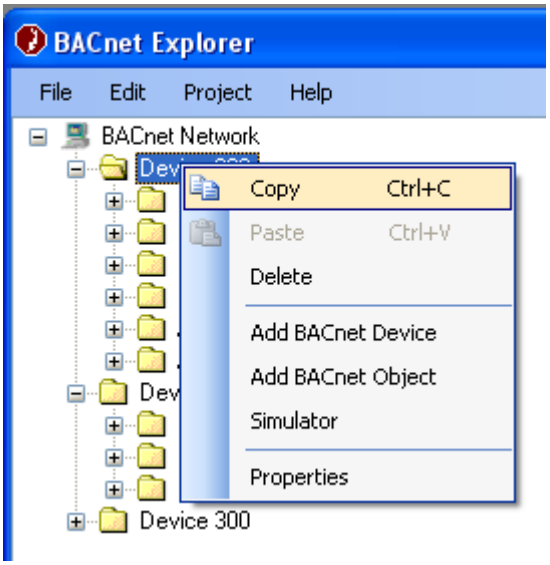
When the file is opened, the opened network will be displayed in the BACnet Device Simulator.

Copy / Paste network objects

Users can copy and paste the network devices, object types or instances in the network.

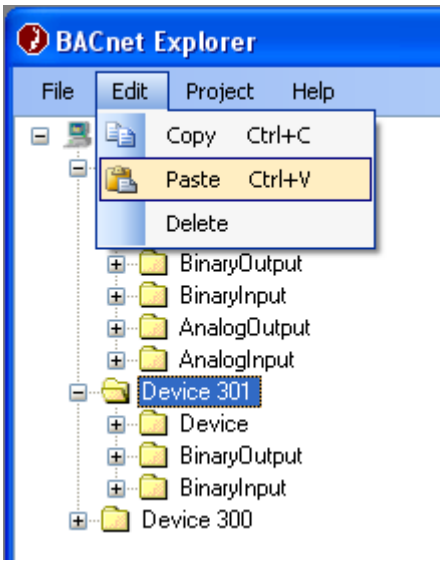
Users can copy the corresponding object by using the ***Edit->Copy*** menu or ***Copy*** menu in the popup menu (Which appears when you right click on the left tree panel).

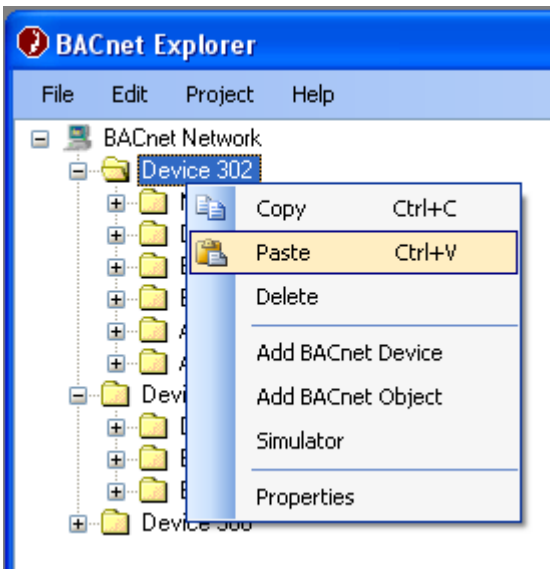




If user selects at the device level, all the object types and instances under the device will be copied. If user selects at the object type level all the instances under that device will be copied and if it is the instance level, only the instance details will be copied.

After user copying a network object, users can paste it to the network using the ***Edit -> Paste*** menu or ***Paste*** menu in the popup menu.





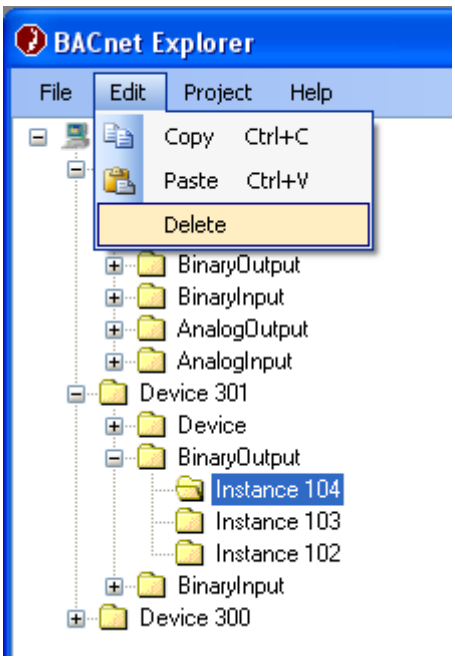
Pasting operation depends on where user needs to paste the copied item.

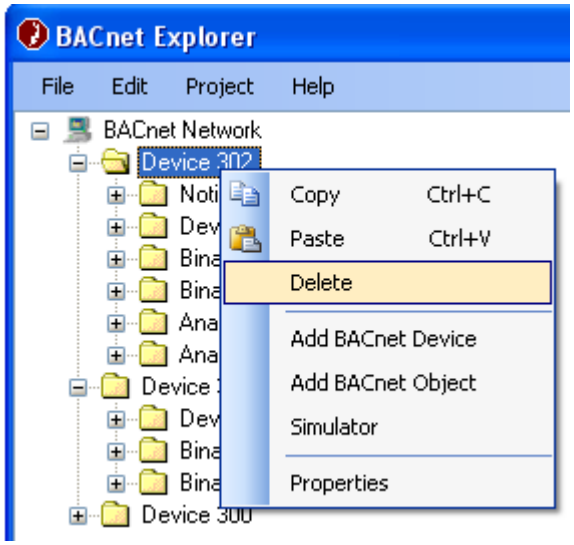
If user select to paste at the root level (by selecting the BACnet Network node), copied item will be pasted as a new device with the copied content. If user selects a particular device node, object type node or an instance node, copied item will be pasted under the selected device.

In detail, if the copied item is a device, then all the object types and instances are pasted under the selected device, if copied item is an object type or an instance, then all the copied instances or the copied instance will be pasted under the corresponding object type of the selected device.

Delete Network Object

Users can delete network objects using the ***Edit-> Delete*** menu or ***Delete*** menu item in the popup menu.

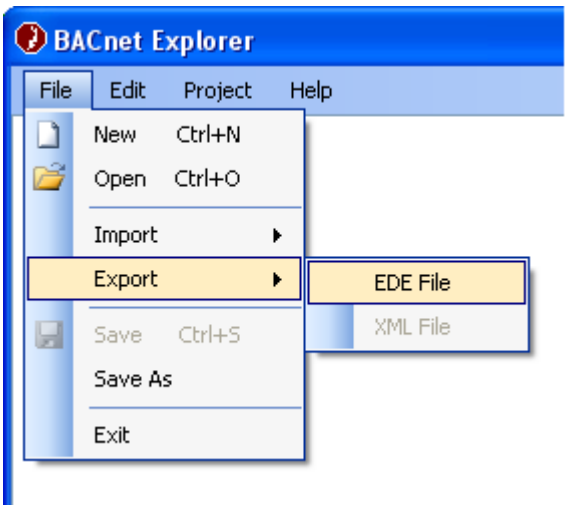




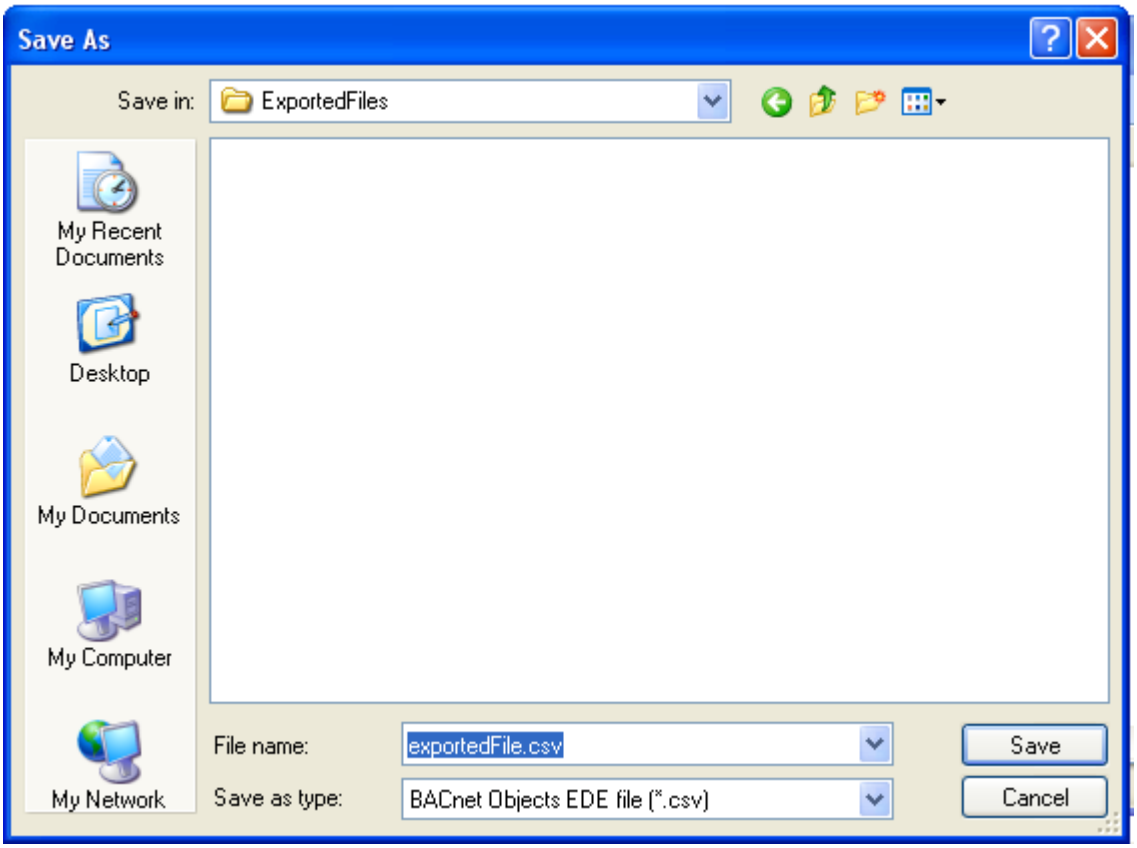
If user selects at the device level, all the objects and instances of that device will be deleted. If user selects at object level or instance level only the corresponding object type or the instances will be deleted.

Exporting the Network

Users can export the network to an EDE file using the ***File ->Export -> EDE File*** menu.

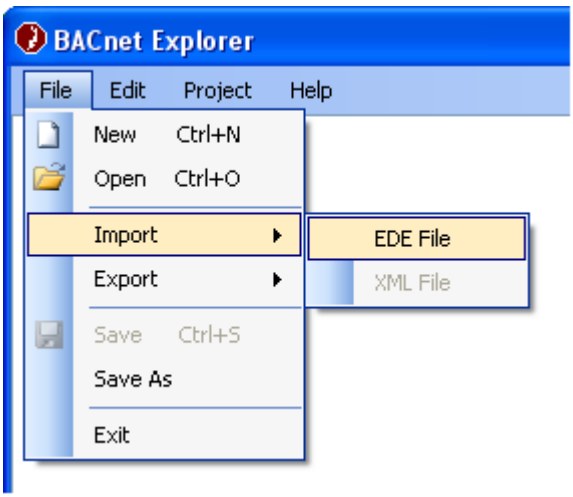


When you click on the menu, Save As dialog will be displayed and in that you can specify the file location and a file name for the new file. File will be saved as a .csv file.



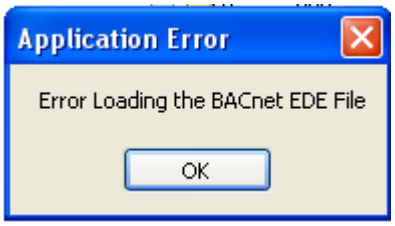
Importing a network

You can import an EDE file using the File->Import->EDE File Menu.



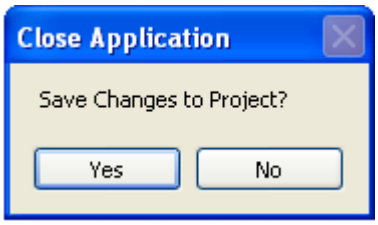
When you click on the menu, imported network will be loaded in to the explorer and displayed.

If there is an error in loading or error in the file format, it will display the following error.



Closing the application

When you press the windows close button you will be asked whether you need to save the existing changes (if there are any unsaved changes).



If user select the 'YES' option, file save dialog will be displayed and user can specify the location and the file name (similar to when user clicks the SAVE button).

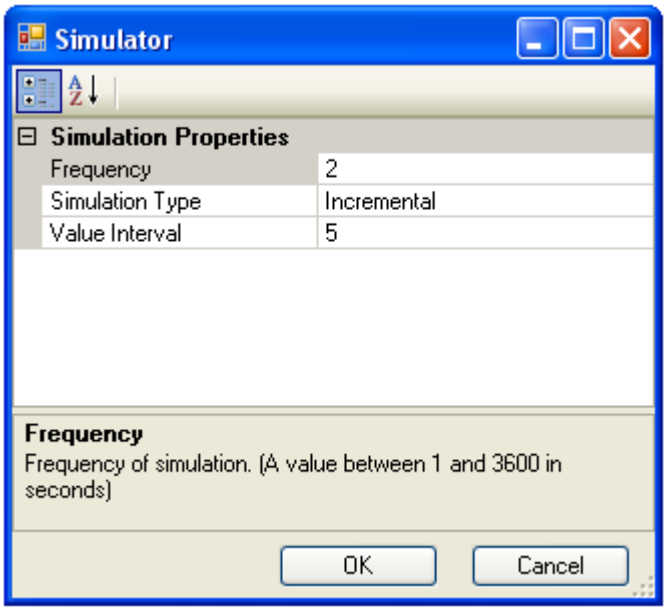
If there are no changes made, BACnet Device Simulator will be directly closed.

Simulator

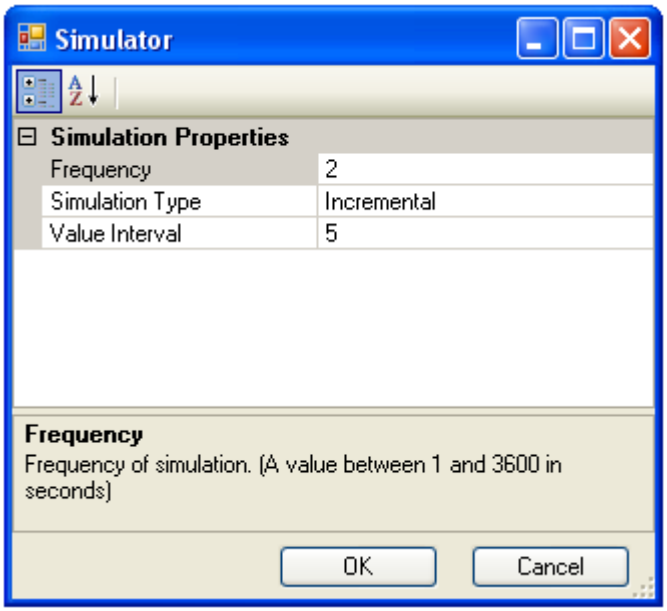
BACnet Device Simulator acts as a global simulator which runs all the time during the BACnet Device Simulator and which simulates all the instances of all the internal devices.

Simulator will be stated automatically when the BACnet Device Simulator starts and will be stopped only when BACnet Device Simulator exits.

Users can change the simulator settings using the ***Project -> Simulator*** menu.



Then the user will be displayed the following simulation settings dialog.



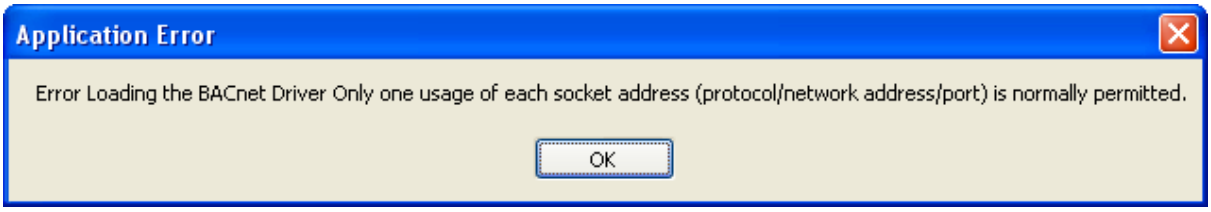
Users can specify the simulation frequency, simulation type and the value interval for the simulation (value interval is needed only for the incremental simulation type).

Available simulation types are Incremental, Random, Sinusoidal and Ramp. Incremental simulation will gradually increase the value of the present value of all the instances by an amount equal to the value interval, in each time interval equal to the simulation frequency.

Random simulation will randomly set the value of the present value of all the instances. In Sinusoidal simulation present value of all the instances will be set according to the Sin function, and in Ramp simulation present value will be set according to the Ramp function.

Troubleshooting

When you are starting the BACnet Device Simulator you might be displayed the following error message.



This error message indicates that there are some other BACnet application is running in the machine at that time.

To resolve this issue you need to shut down the other application and open the BACnet Device Simulator again.

Protocol Implementation Conformance Statement

Products

Product	Model Number	Protocol Revision	Software Version	Firmware Version
BACnet Device Simulator	SE-SIM	135-1995b (4)	2.0.0	2.0.0

Date Tested: 6 August 2009

Vendor Information

SCADA Engine
4A Hartnett Close.
Mulgrave 3170,
Australia
www.scadaengine.com

Product Description

The SCADA Engine BACnet Device Simulator is used to simulate 1 or more BACnet Devices.

BACnet Standardized Device Profile

Product	Device Profile	Tested
SE-SIM	BACnet Application Specific Controller (B-ASC)	

Supported BIBBs

Product	Supported BIBBs	BIBB Name	
SE-SIM	DS-RP-A	Data Sharing-ReadProperty-A	
	DS-RP-B	Data Sharing-ReadProperty-B	
	DS-RPM-A	Data Sharing-ReadPropertyMultiple-A	
	DS-RPM-B	Data Sharing-ReadPropertyMultiple-B	
	DS-WP-A	Data Sharing-WriteProperty-A	
	DS-WP-B	Data Sharing-WriteProperty-B	
	DS-WPM-A	Data Sharing-WritePropertyMultiple-A	
	DS-WPM-B	Data Sharing-WritePropertyMultiple-B	
	DS-COV-A	Data Sharing-COV-A	
	DS-COV-B	Data Sharing-COV-B	
	DS-COVP-A	Data Sharing-COVP-A	
	DS-COVP-B	Data Sharing-COVP-B	
	DS-COVU-A	Data Sharing-COV-Unsolicited-A	
	DS-COVU-B	Data Sharing-COV-Unsolicited-B	
	SCHED-A	Scheduling-A	
	SCHED-I-B	Scheduling-Internal-B	
	SCHED-E-B	Scheduling-External-A	
	T-VMT-A	Trending-Viewing and Modifying Trends-A	
	T-VMT-I-B	Trending-Viewing and Modifying Trends-Internal-B	
	T-VMT-E-B	Trending-Viewing and Modifying Trends-External-B	
	T-ATR-A	Trending-Automated Trend Retrieval-A	

Product	Supported BIBBs	BIBB Name	
	T-ATR-B	Trending-Automated Trend Retrieval-B	
	NM-CE-A	Network Management-Connection Establishment-A	
	NM-CE-B	Network Management-Connection Establishment-B	
	AE-N-A	Alarm and Event-Notification-A	
	AE-N-I-B	Alarm and Event-Notification Internal-B	
	AE-N-E-B	Alarm and Event-Notification External-B	
	AE-ACK-A	Alarm and Event-ACK-A	
	AE-ACK-B	Alarm and Event-ACK-B	
	AE-ASUM-A	Alarm and Event-Alarm Summary-A	
	AE-ASUM-B	Alarm and Event-Alarm Summary-B	
	AE-ESUM-A	Alarm and Event-Enrollment Summary-A	
	AE-ESUM-B	Alarm and Event-Enrollment Summary-B	
	AE-INFO-A	Alarm and Event-Information-A	
	AE-INFO-B	Alarm and Event-Information-B	
	AE-LS-A	Alarm and Event-LifeSafety-A	
	AE-LS-B	Alarm and Event-LifeSafety-B	
	DM-RD-A	Device Management-ReinitializeDevice-A	
	DM-RD-B	Device Management-ReinitializeDevice-B	
	DM-DDB-A	Device Management-Dynamic Device Binding-A	
	DM-DDB-B	Device Management-Dynamic Device Binding-B	
	DM-DOB-A	Device Management-Dynamic Object Binding-A	

Product	Supported BIBBs	BIBB Name	
	DM-DOB-B	Device Management-Dynamic Object Binding-B	
	DM-DCC-A	Device Management-DeviceCommunicationControl-A	
	DM-DCC-B	Device Management-DeviceCommunicationControl-B	
	DM-PT-A	Device Management-Private Transfer-A	
	DM-PT-B	Device Management-Private Transfer-B	
	DM-TM-A	Device Management-Text Message-A	
	DM-TM-B	Device Management-Text Message-B	
	DM-TS-A	Device Management-TimeSynchronization-A	
	DM-TS-B	Device Management-TimeSynchronization-B	
	DM-UTC-A	Device Management-UTCTimeSynchronization-A	
	DM-UTC-B	Device Management-UTCTimeSynchronization-B	
	DM-LM-A	Device Management-List Manipulation-A	
	DM-LM-B	Device Management-List Manipulation-B	
	DM-OCD-A	Device Management-Object Creation and Deletion-A	
	DM-OCD-B	Device Management- Object Creation and Deletion -B	

Standard Object Types Supported

Product	Object Type	Creatable	Deletable	Tested
SE-SIM	Analog Input	Yes	Yes	
	Analog Output	Yes	Yes	
	Analog Value	Yes	Yes	
	Binary Input	Yes	Yes	
	Binary Output	Yes	Yes	
	Binary Value	Yes	Yes	
	Calendar	Yes	Yes	
	Device	No	No	
	Event Enrollment	Yes	Yes	
	File	Yes	Yes	
	Loop	Yes	Yes	
	Multi-state Value	Yes	Yes	
	Notification Class	Yes	Yes	
	Program	Yes	Yes	
	Schedule	Yes	Yes	
	Trend Log	Yes	Yes	
	LifeSafetyPoint	Yes	Yes	
	LifeSafetyZone	Yes	Yes	
	Accumulator	Yes	Yes	
	PulseConverter	Yes	Yes	

Data Link Layer Options

Product	Data Link	Options	Tested
SE-SIM	BACnet/IP (Annex J)	Can communicate as a Direct BACnet/IP device. Can register as a Foreign BACnet/IP device.	

Segmentation Capability

Product	Segmentation Type	Supported	Window Size (MS/TP product limited to 1)	Tested
SE-SIM	Able to transmit segmented messages	Yes	Configurable	
	Able to receive segmented messages	Yes	Configurable	

Device Address Binding

Product	Static Binding Supported	Tested
SE-SIM	Yes	

Networking Options

Product	Router Option	Options	Tested
SE-SIM			

Character Sets

Product	Character Sets supported	
SE-SIM	ANSI X3.4	
	IBM Microsoft DBCS	
	ISO 8859-1	