BrightCore BACnet Lookout   V2.2 Product Family

BrightCore BACnet Lookout

User Guide – Essential, Standard and Extended

v.2.2

BACnet Lookout was tested against VTS-3.5.5, WAGO devices, Loytec devices, Contemporary Controls BAS Router, SCADA Engine's device simulator, Open source BACnet Stack and other devices.

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1. Introduction

System Requirements

- Intel© Pentium 4 or a similar Processor

- 512 MB RAM

- 10 MB of free HD space

Operating System

BrightCore BACnet Lookout was tested and working with the following operating systems

- Microsoft Windows XP

- Microsoft Windows Vista

- Microsoft Windows 7

BrightCore BACnet Lookout is the newest addition to our BrightCore line of products. It is an easy-to-use tool which enables you to scan, discover and generally manage your BACnet networks.

BACnet Lookout is not just an ordinary BACnet explorer through which you can monitor or read properties. It also enables you to build your specified property monitor and COV lists and later save or load them back in to the program. You can detect alarm and event states on specified devices through GetAlarmSummary and GetEventInfo BACnet services and list them in user friendly and easy-to-read format. It also enables you to export your BACnet network to EDE format and use it later in your own product or application.

BACnet Lookout
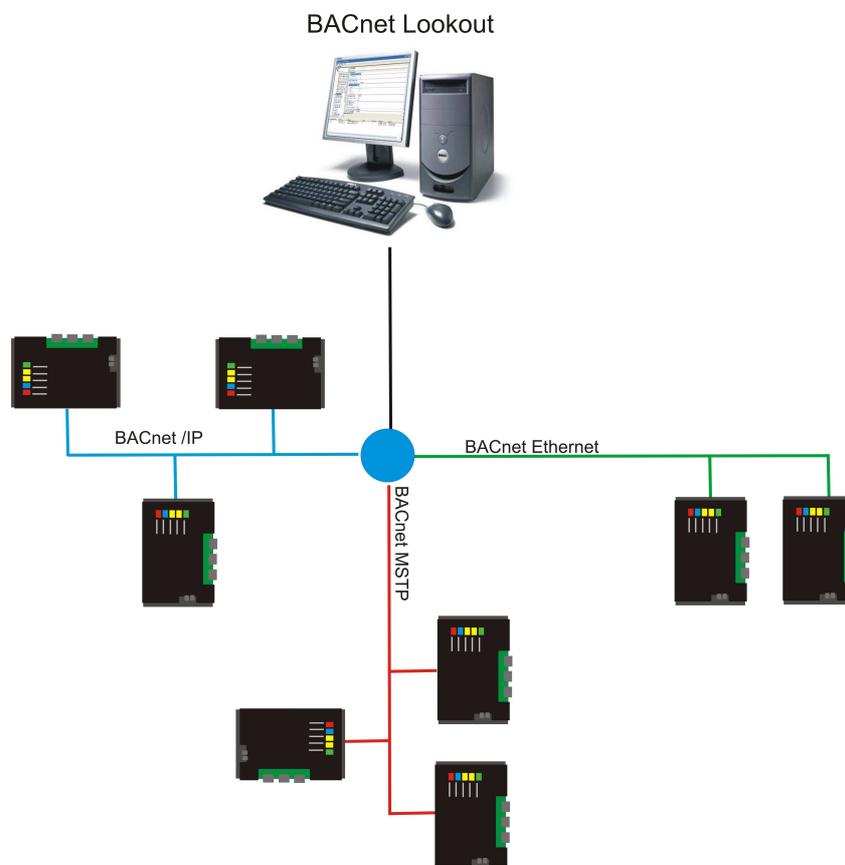
BACnet /IP

BACnet Ethernet

BACnet MSTP

Figure 1. Overview of BACnet Lookout communication

2. Setup

Start the installation by double clicking the "BrightCore BACnet Lookout setup.exe"
You must accept EULA license agreement before continuing.

Figure 2. EULA

You will be prompted to select destination folder (Figure 3.)

NOTE: The install target directory must have reading and writing rights for the current logged user.
    If you don't have such rights, contact your system administrator.
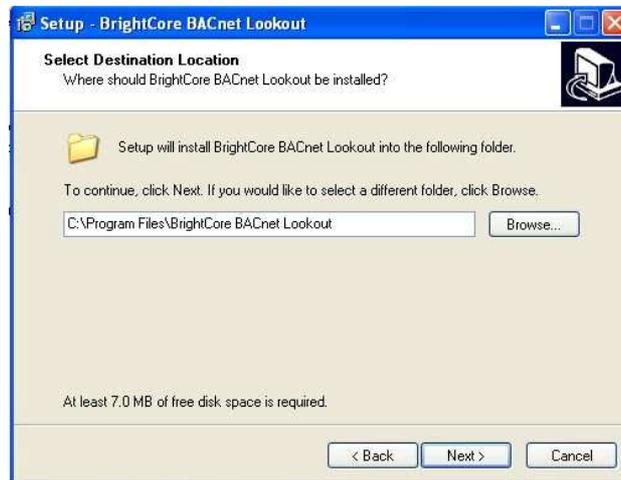
Figure 3. Setup, step 1

Select the destination folder and click "Next" button.

You can also create a Start Menu folder by disabling "Don't create a Start Menu folder"
(see Figure 4.). Click "Next" to continue.

Figure 4.   Setup, step 2

Select if you want to create a desktop icon and Quick Launch icon.
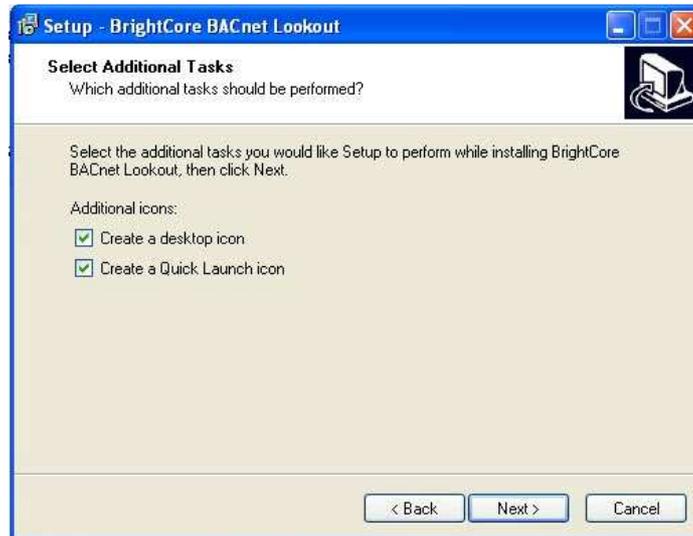

Figure 5. Setup, step 3,

Press "Next" button.
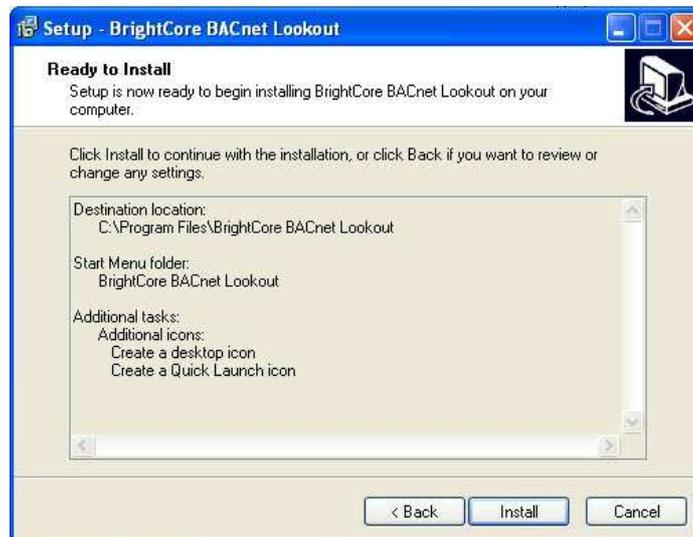

Figure 6. Setup, step 4

Confirm your options by pressing "Install" button.
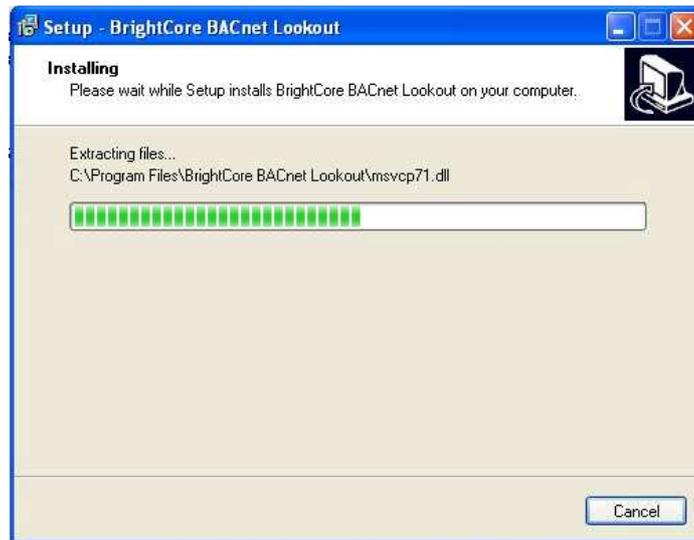
Figure 7. Installing

Complete the installation process by pressing "Finish" button. If you enabled automatic launch of BACnet lookout, application will start as soon as you click "Finish" button.

Figure 8.   Setup, step 5.

3. Licensing and Register options

After initial launch BACnet Lookout will notify you of days left in the trial run. If you purchased the application, copy-paste the Registration Number and send it to licensing@brightcore.biz along with your full name and company from a valid e-mail address.

Figure 9. Licensing and Register Options

After receiving your unlock code click on the Register tab or a button and input your username and Unlock code into their respective fields.

Figure 10. Register Window

4. User Interface
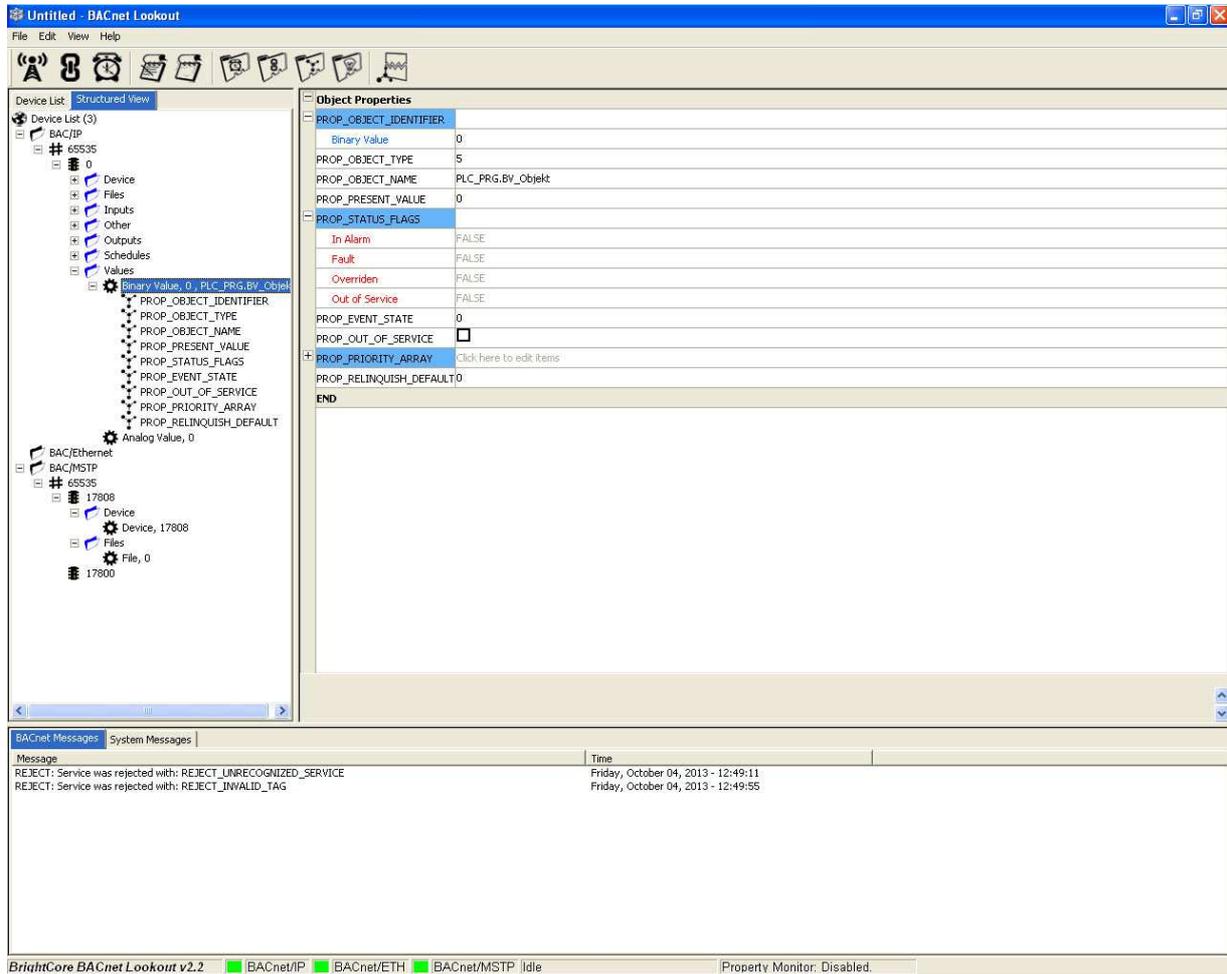
Figure 11. BACnet Lookout User Interface

BACnet Lookout user interface main sections.

Toolbar and system menu

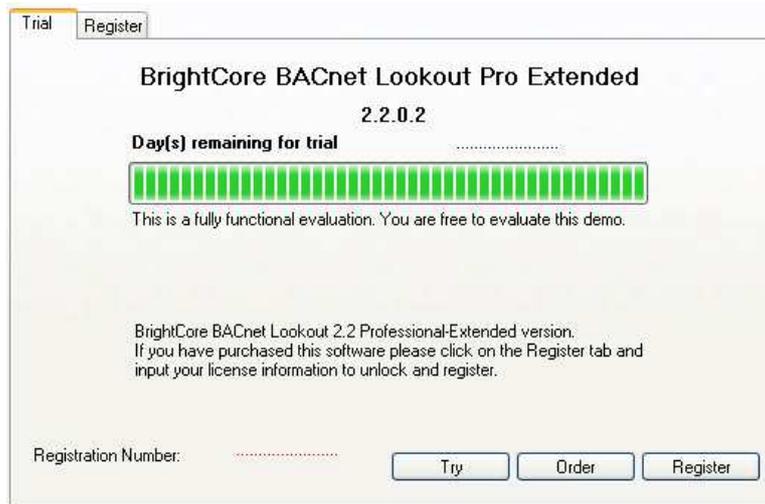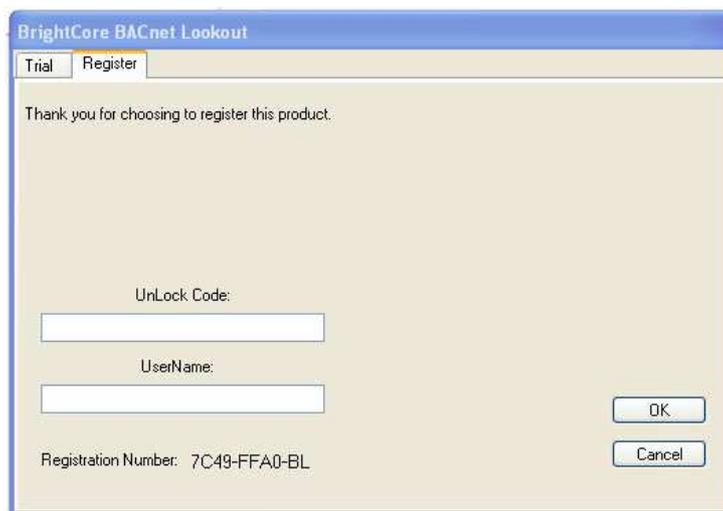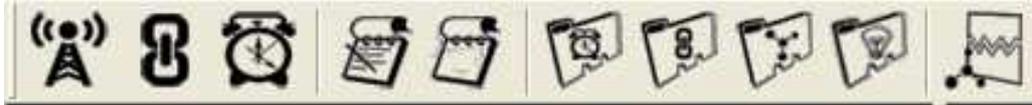Toolbar and system menu are the main methods of communication and management with the BACnet systems. Every option enables in one way or another to communicate and gather information on the BACnet device.

The options are in order:

   Who Is BACnet service. - Scan and discover the BACnet network.

   Subscribe to property COV. – Receive the change of property value.

   Get Alarm Summary BACnet Service. – Receive and view the device list of alarm states.

   Write Property BACnet Service. – Writes one or more BACnet properties.

   Empty Write List. – Undo the changes made.

   Show Alarm Summary List. – View device list of alarm states.

   Show COV List. View received COV list.

   Show Monitor Property List. – View the monitored property list.

   Property Stress Test

Device Tree List

Figure 12. Simple and structured view device list.

Device Tree List

Device Tree Lists consists of 2 different tree views accessible by click the Tab Buttons above them. They are simple and structured device Trees.

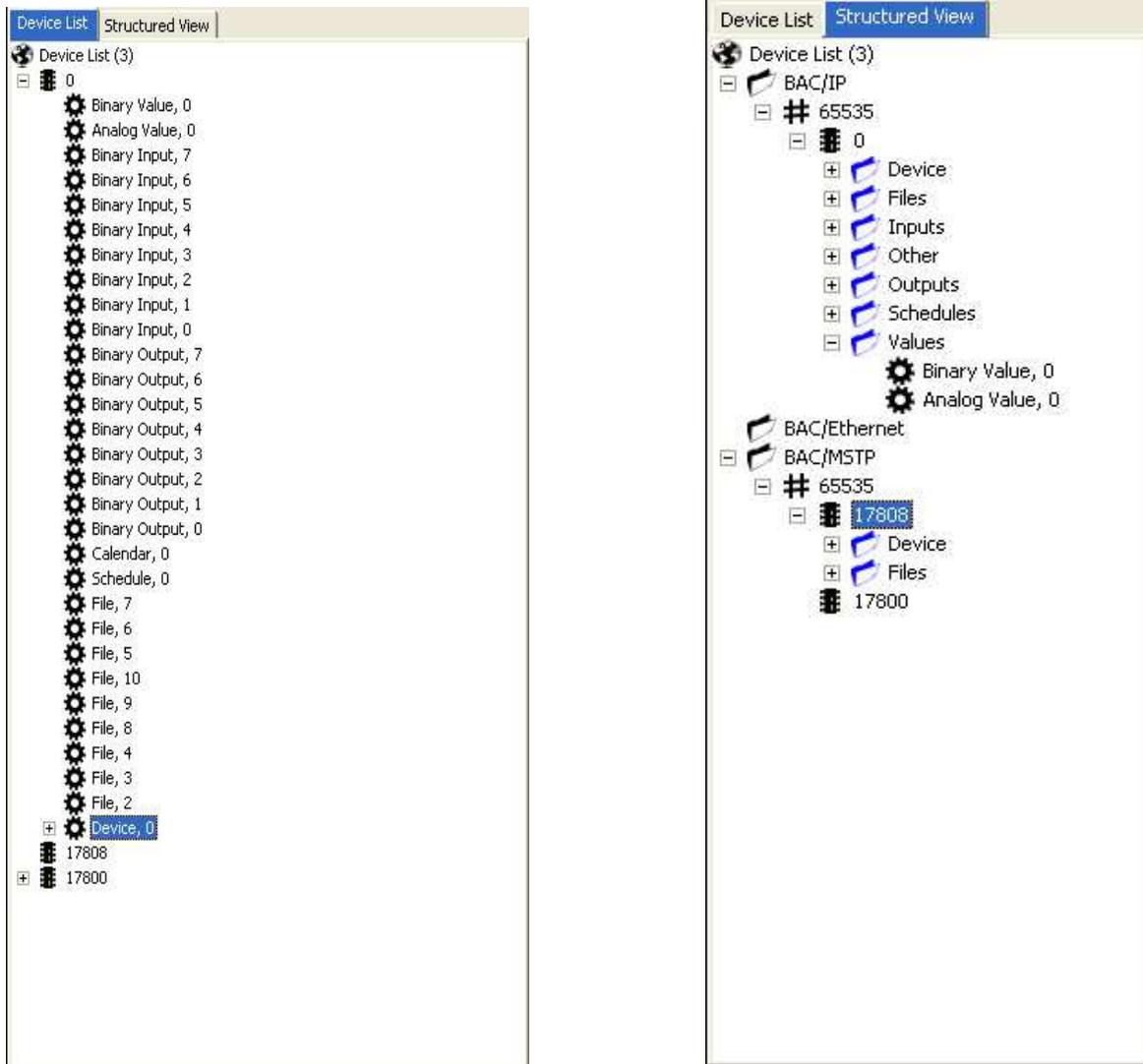This 2 device tree lists will always have the same devices shown but using the structured tree view will organize the device list by its Data Link Layer, Network number and Object type.

Both Tree Views contain the list of discovered BACnet devices on the BACnet network. It is also a control part of the application meaning all services and options presented in the Toolbar or System menu work in combination with the Device Tree List.

Toolbar and System menu options works only when an appropriate device, object or a property is selected in the Device Tree List.

Device Tree List is also designed around fast Object/Property discovery. Double clicking the Object/Property will automatically discover member objects of the device or properties of the object.

Objects and properties are automatically discovered using ReadProperty or ReadPropertyMultiple BACnet services without bothering the operator with intrinsic BACnet options.

Additionally, when the application detects that the property "PROPERTY_OBJECT_NAME" is discovered it will automatically put the name by the object instance in the Device Tree List as seen in example on the left: "Device , 1 , New Virtual Device 1" depending whether or not this option is chosen in the settings.

Property Value List

Figure 13. Property Value List

Property Value List is the heart of the BACnet Lookout.

Every object property of selected BACnet device or object is automatically displayed in this list each time the selection changed in Device Tree List.
Properties are presented in the user friendly format so the operator can change it as fast as clicking the mouse button.

Example.
We want to change the Bit 0 of PROP_EVENT_ENABLE from value 0 to 1. We can do that just by clicking the checkbox value next to the Bit[0]. After that we change PROP_BUFFER_SIZE from 10 to 20 and press enter.
It is as simple as that.

But it is important to mention that although it appears property values are now changed, they still need to be written to the BACnet device. Clicking the "Write Property BACnet Service" option in the Toolbar will actually write the values to the selected BACnet device.

System Information

BACnet and system message window tabs are the operators window on what happens with the application or the device. These messages are separated by BACnet and System tabs and as they state, they will convey BACnet or System specific messages.

Some samples of BACnet specific messages would be failure to write property or acknowledgement of write, unknown service error or similar messages.

System specific messages convey the information important to operator concerning the inner working of the application. System specific errors will be shown here. For instance APDU data of some BACnet message was not coded properly or the format of some property was not set.

Below the System Message window is a System Information bar. The bar shows current system information.
- Current BACnet Lookout version
- Link Layer Protocols currently in use
- Current device ID of incremental scan.
- Information about Property Monitor system with the time remaining until next property scan when Property Monitor is enabled.

5. Configuring BACnet Lookout

Before any work can be done it's necessary to configure the application to the system.

Click on the **Edit** menu and select the **Settings** option. The configuration window will appear.
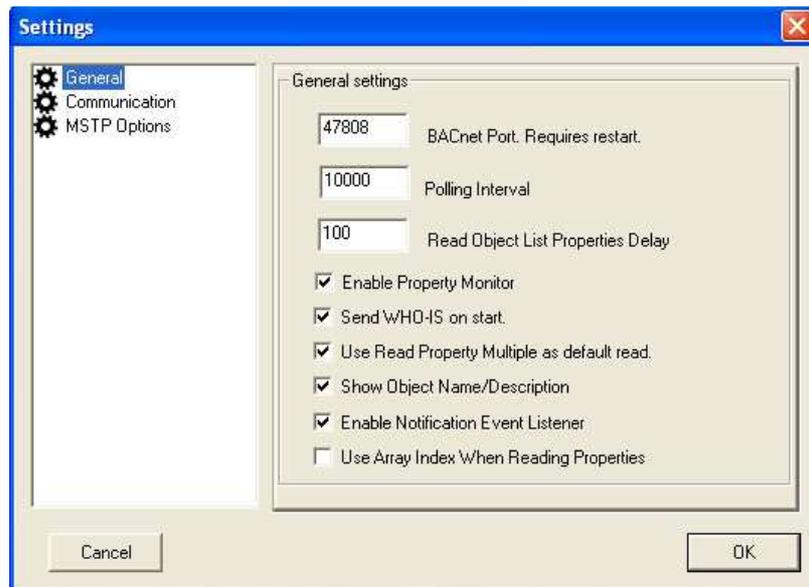
Figure 15. General Settings

General settings.

- Read Object List Properties Delay.

    - While BACnet Lookout offers a fast Object/Property Discovery by double clicking there's always a possibility that device has hundreds if not thousands of object. Clicking through all of them to find a specific one or simply to have them all discovered can be a pretty time consuming task. BACnet Lookout offers automatic scan of selected device object list by one click. This option controls the how fast each object is scanned. The delay is presented in milliseconds.

- Polling Interval.

    - BACnet Lookout also can be configured to scan different properties by inserting them in to the internal Property Monitor List. This option controls a time delay between each property scan. Time delay is presented in milliseconds.

- BACnet Port.

    - Not every device operates on the same port number. Although the industry standard BACnet port is 47808 (convenient hexadecimal BAC0) engineers and system engineers can decide to change the port of the device for whatever reason. This option allows operators to scan BACnet networks working on a different port. **This option requires application restart.**

- Enable Property Monitor.

    - Enables or disables internal Property Monitor.

- Send Who-Is on start.

    - This option is automatically enabled when application is started for the first time. It scans the network for BACnet devices automatically each time the application is run and also at each new project. Operators may choose to disable this option when building their own user networks where only specific devices are present.

- Use Read Property Multiple as default read.

    - Device Tree List offers a quick-object/property scan by double clicking on the object /property and it uses ReadPropertyMultiple BACnet service by default. This is convenient because it discovers every property currently present in the BACnet object. Including unknown and proprietary properties. But not all devices support ReadPropertyMultiple BACnet service. Disabling this option will force BACnet Lookout to use ReadProperty BACnet service as a default read service. This will also scan object properties, but only the standard object properties and proprietary properties will have to be added manually by operator and then saved as a specific device project to avoid having to repeat the process.

- Show Object Name/Description.

    - When dealing with hundreds of BACnet devices or objects it is often useful to have a device or object name beside only type and instance. Enabling this option will name the device/object in the Device Tree List each time the application detects that object name or description property was discovered.

- Enable Notification Event Listener.

    - This option will force the application to register and monitor Notification Events issues from the device.

- Use Array Index When Scanning Properties

    - This option will force the application to read properties by its array index. Use it when the object list is too big and device doesn't support segmentation.
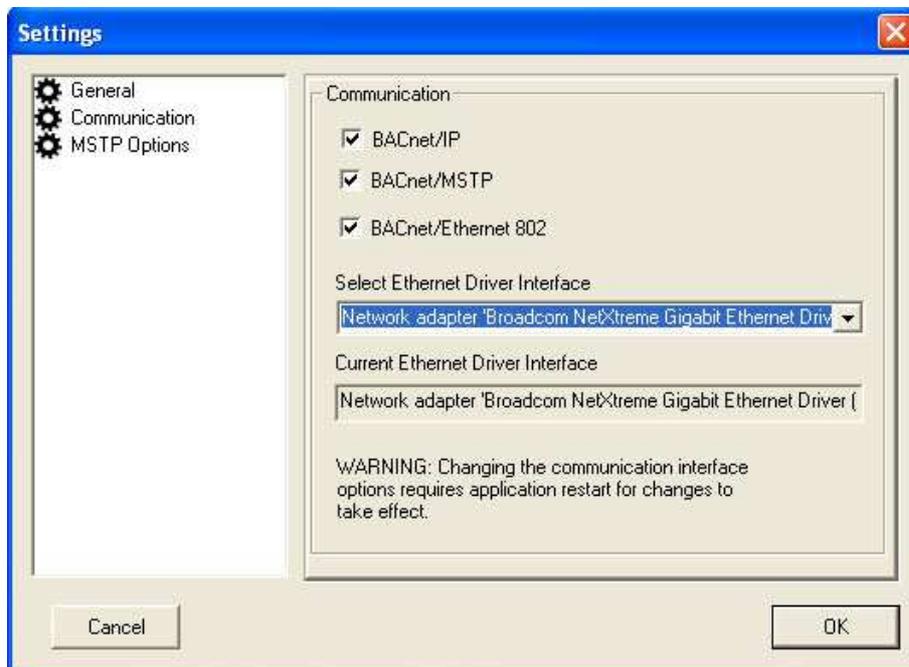
Figure16. Communication Options

- BACnet/IP

  - Standard BACnet/IP communication link layer. Enable this option for devices communication through BACnet/IP communication protocol.

- BACnet/Ethernet 802

  - Not all devices can communicate in BACnet/IP protocol and some devices can only receive and transmit packets in somewhat older Ethernet802 communication protocol. Although BACnet/IP and BACnet/Ethernet802 both communicate on the same network layer, the BACnet messages are fundamentally different. BACnet Lookout also offers a way to communicate with those kind of devices.

  - To set up the Ethernet interface select it from **Ethernet Drives Interface drop-down list.** When **Current Ethernet Driver Interface shows** the selection click OK. **This option requires application restart**.

- BACnet /MSTP (**Standard and extended versions**) Enable this option to find devices operating on MSTP RS485 protocol.
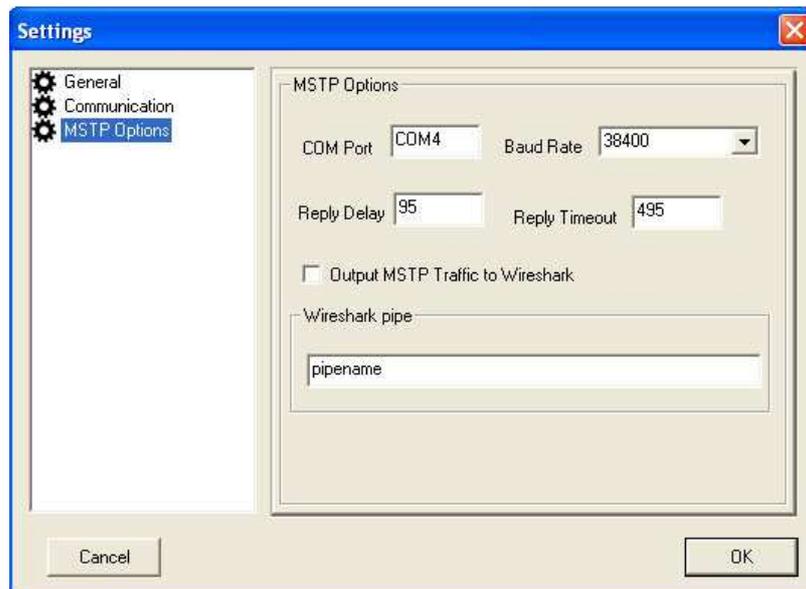
Figure 17. MSTP Settings

MSTP Options are standard RS485 wire configuration options. Reply Delay and Reply timeout control how long in milliseconds the application will wait until it receives the answer from the device.

Output MSTP Traffic to Wireshark (**Extended Version only**) will enable you see MSTP BACnet traffic as regular packets in Wireshark. You need to enter the pipe name and create the same pipe in wireshark.

To do this start Wireshark and click on the Capture menu and select Interfaces option. Click the options button and then click Manage Interfaces button. Click the new button and enter the pipe name.

Pipe name must be written in this format: "\\.\pipe\pipename". Where pipename is the same as the one you specified in BACnet Lookout. Click on save and close. You should see this window.
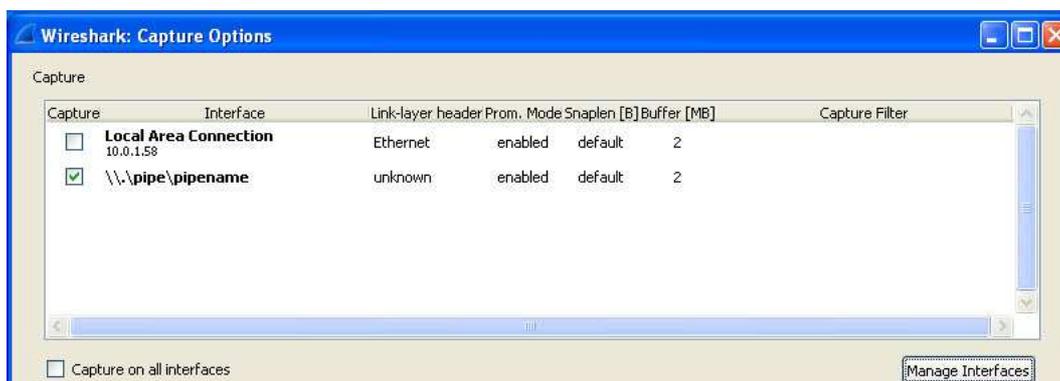
6. Using BACnet Lookout

Discovering BACnet Device List

The first thing any operator will want to do is to discover BACnet network.
Usually the application will always send a default WHO-IS service every time it starts but sometimes the operator can decide to disable that option and manually scan the network. Be it to create a new network project or just to scan the specific device range.

To manually scan the BACnet network go to the **Edit** menu and select the **Settings** option. Now disable the **Send WHO-IS on start option**. Click OK and go to the **File** menu and select **New** option. When prompted with saving the project, click NO.

Empty project will appear. And now the Device Tree List will be empty.

Click on the **Who-Is Network Scan** option in the Toolbar menu represented by the transmitting radio tower icon.
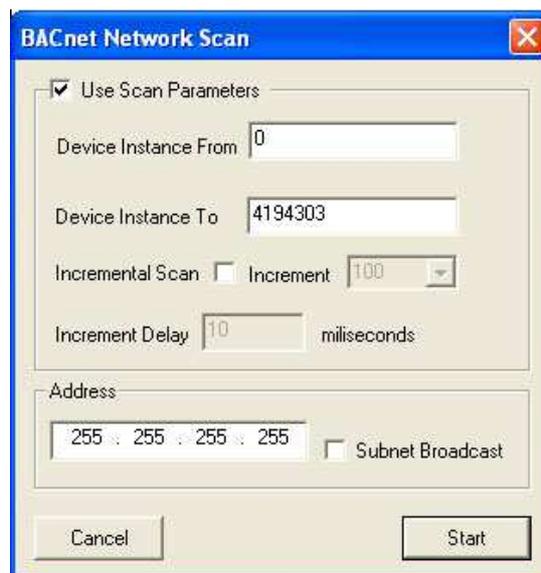
Figure 18. Who Is selection window

On the window shown in the Figure 17, input desired IP network, device scan range and click **Start**.

Alternately you may want to do the incremental network scan. This will allow you to scan the network in a specified device range but instead issuing one huge WHO-IS service, issue a lot of smaller services in the same range but with smaller increment.

For example, doing an incremental scan in a device instance range 0-1000000 with increment of 100 would look like this: WHO-IS 0-100, WHO-IS 100-200, WHO-IS 200-300 etc.

If the scan was successful, a list of devices will now display in the Device Tree List.

Discovering BACnet Object List

There are two ways to find objects and properties of listed devices.
First one is to just double click on the device listed and BACnet lookout will automatically initiate a ReadProperty BACnet service. It will simply ask the parent device for its list of objects. And then will automatically construct the object list in the Device Tree List.

It is important to note here that sometimes the engineers can make a mistake and create hundreds of object on the same device but do not check the device's segmentation options. This can result in an error when trying to construct the object list. We ask the device for an object list and receive "Segmentation Not Supported Error".

This can be countered by enabling "Use Array Index When Reading Properties" option in the General Settings dialog window.
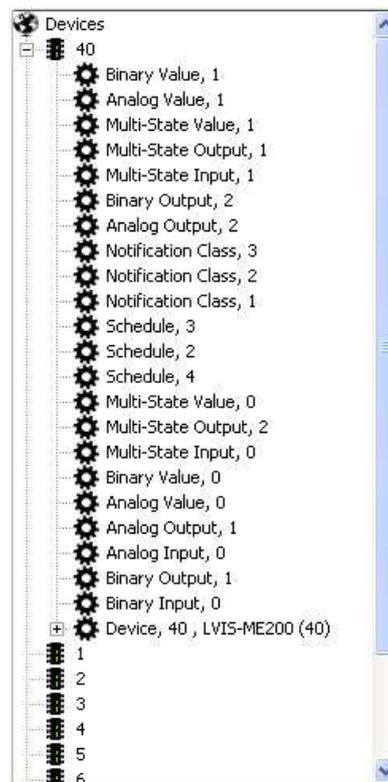
Figure 19. Device Object List

Discovering BACnet Object Properties

After successfully reading its object list, object properties can be read the same way, by double clicking BACnet object.

BACnet Lookout by default uses ReadPropertyMultiple BACnet service when reading properties of selected BACnet object. This is convenient because not only is it extremely fast and bandwidth efficient, it also discovers every property currently present in the BACnet object including, unknown and proprietary properties.

But not all devices support ReadPropertyMultiple BACnet service. Sometime when device doesn't support ReadPropertyMultiple BACnet service it is required to scan the properties using ReadProperty service.

This will also scan the object properties but unknown and proprietary properties will be excluded from the list. Operator can then use BACnet Lookout internal **Add Property** option to manually add proprietary properties.

Right click on the selected BACnet object and choose **Add Property** option from the drop down menu.
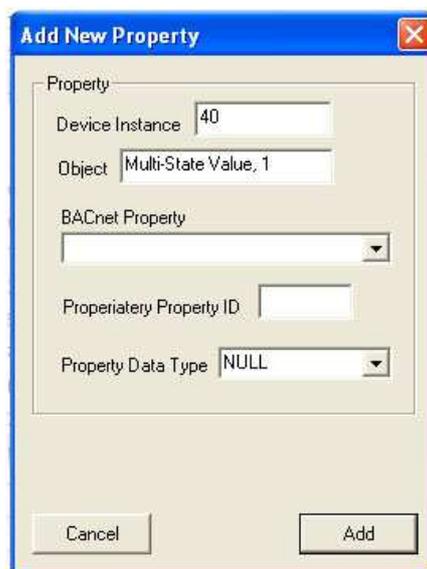

Figure 20. Add New Property Window

If proprietary property input window is empty chosen BACnet standard property will be added to the selected object. If property input window has a number, choose a property data type and click **Add** button.

Newly created property will then be added to the object's property list. Operator can then double click on the property to retrieve its value.

Changing Property Value and working with the Property List

Every object property of selected BACnet device or object is automatically displayed in this list each time the selection changed in Device Tree List.
Properties are presented in the user friendly format so the operator can change it as fast as clicking the mouse button.

Figure 21. Property List

Properties in the property list are represented in two different ways. There are simple properties representing only the basic and one-click-edit values, such as integer, text, float… And the array properties, such as supported services, supported types, bit values and others.
The third type representations are complex properties such as week days, object references and such.

In addition to writing simple properties there are more complex properties that can't be changed by simple line change. This are complex properties and BACnet Lookout will show an appropriate popup window for each property type that will enable the value change.

This properties can be recognized by the text line in the property list saying "Click here to edit items".
It is important to note here that not all complex properties can be changed as some complex properties are read-only properties and other depends on the device configuration.
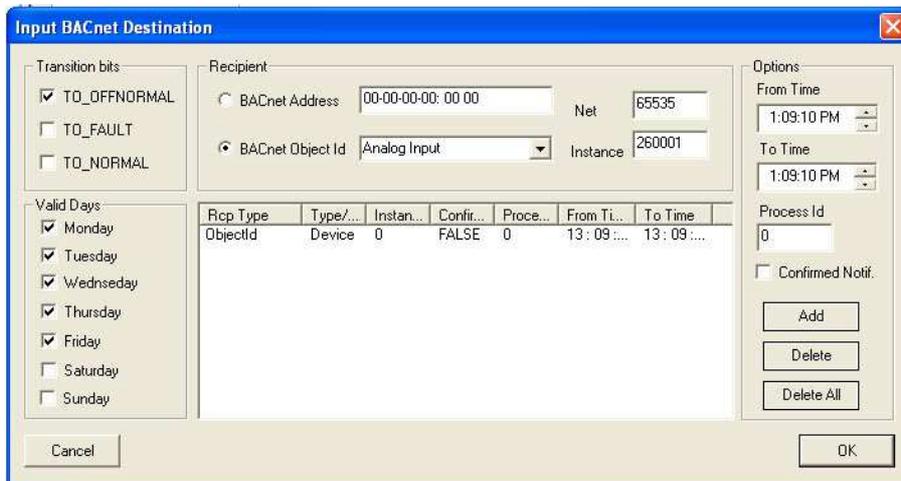
 Below are some examples of complex property windows.

Figure 22. Changing the destination property of the Notification Class Object.
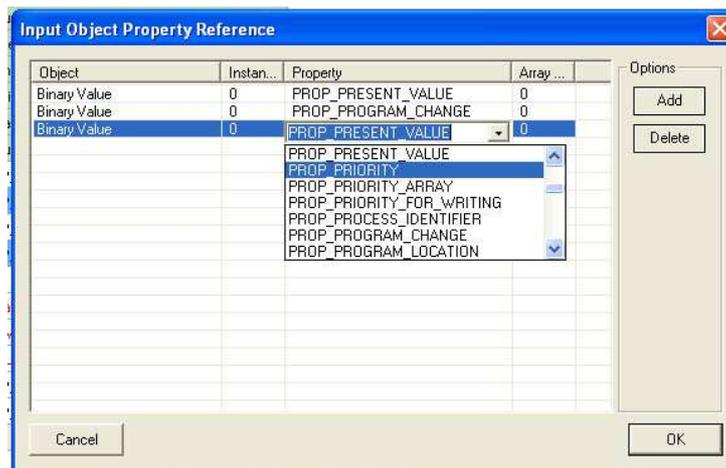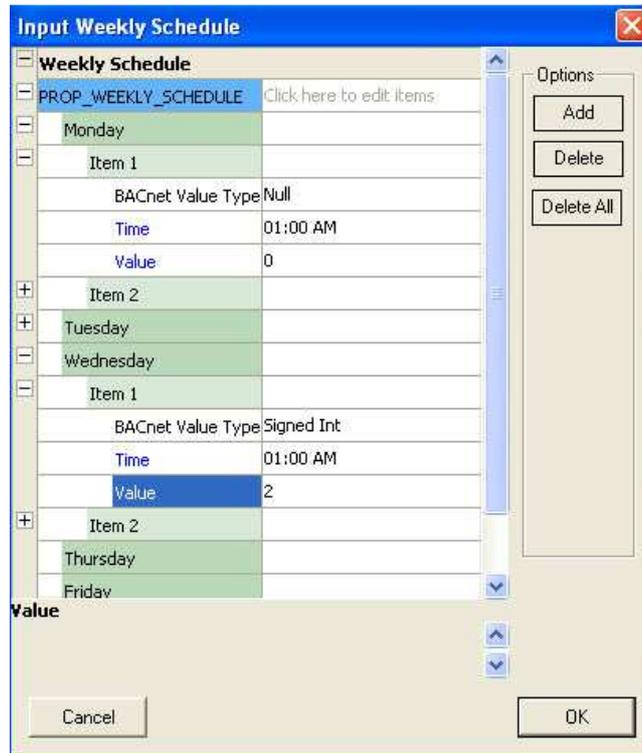

Figure 23. Object Property Reference.

Figure 24. Weekly Schedule property.

It is important to mention that although it appears property values are now changed, they still need to be written to the BACnet device. Clicking the "**Write Property BACnet Service**" option in the Toolbar will actually write the values to the selected BACnet device.
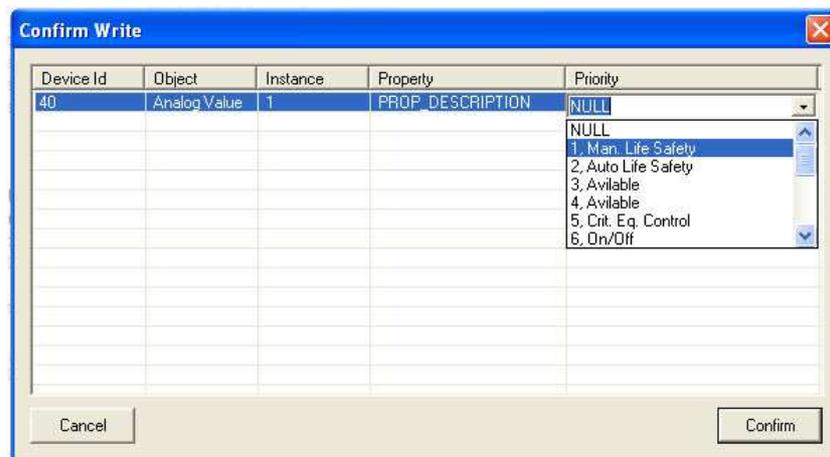
Figure 25. Write Confirmation Window

Clicking the **Write Property BACnet Service** button will prompt the operator with the window displayed in the figure 21.

Each changed property will be displayed on this list enabling the operator to change the priority of each write command.
Clicking the **Confirm** button will then try to write each property in the list using the BACnet WriteProperty service. But not all of the properties in the device can be changed. Some will be Read-Only and some will be device-specific Read-Only properties.

If the write command fails for specific properties, System Messages window will display an appropriate BACnet error-class and error-type.

7. BACnet Services

BrightCore BACnet Lookout supports several BACnet services.

- Read Property*
- Read Property*
- Write Property*
- Get Alarm Summary
- Subscribe COV Property
- Create Object (**Standard and Extended Versions**)
- Delete Object(**Standard and Extended Versions**)
- Time Synchronization
- Time Synchronization UTC
- Read Broadcast Distribution Table (**Extended Version**)
- Write Broadcast Distribution Table (**Extended Version**)
- Register Foreign Device Object (**Extended Version**)
- Read Foreign Device Table (**Extended Version**)
- Write Foreign Device Table (**Extended Version**)
- Delete Foreign Device Table Entry (**Extended Version**)

* This services are incorporated in to the application functionality and cannot be accessed directly.

Get Alarm Summary

The GetAlarmSummary service is used by a client BACnet-user to obtain a summary of "active alarms." The term "active alarm" refers to BACnet standard objects that have an Event_State property whose value is not equal to NORMAL and a Notify_Type property whose value is ALARM.

To receive the list of active alarms, BACnet device must support GetAllarmSummary service.

When request is initiated the list of active alarms will display in the Alarm Summary List property window.

The list is color-coded for easier reading and is as follows:

Alarm: Number   - List of Alarm Summaries for a specific device.
Alarm Summary: number – 1…n Alarm summaries for specific device.
OID - Object type, Object instance of object in alarm state.
Event State - Event state of offending object.
Transition Bits – Transition Bits of offending object.

Subscribe COV Property

The SubscribeCOVProperty service is used by a COV-client to subscribe for the receipt of notifications of changes that may occur to the properties of a particular object. Any object may optionally support COV reporting. If a standard object provides COV reporting, then changes of value of subscribed-to properties of the object, in some cases based on programmable increments, trigger COV notifications to be sent to one or more subscriber clients. Typically, COV notifications are sent to supervisory programs in BACnet client devices or to operators or logging devices.

To Initiate a COV subscription, right-click on the property and under Services menu choose SubscribeCOVProperty option. The following dialog will appear.
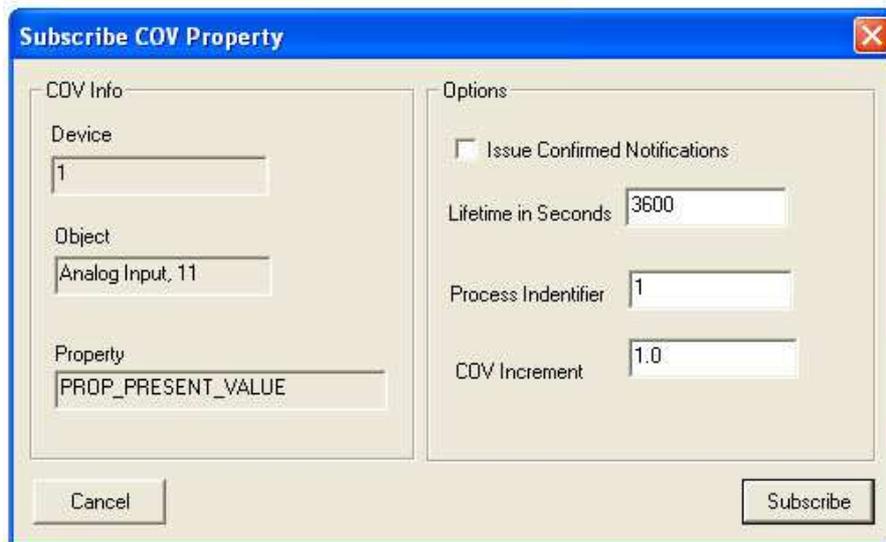
Figure 26. Subscribe COV Property

Issue Confirmed Notification option tells the COV server device weather to automatically re-subscribe to the property if the change occurs in the device or lifetime expires.

To cancel the subscription, uncheck Issue Confirmed Notifications and enter 0 at the Lifetime option.

COV Notification List

Figure 27. COV Notification List

Create/Delete BACnet object

The CreateObject and DeleteObject services are used by a client BACnet-user to create or delete a new instance of an object. This service may be used to create or delete instances of both standard and vendor specific objects. The standard object types supported by this service are specified in the target device PICS file.
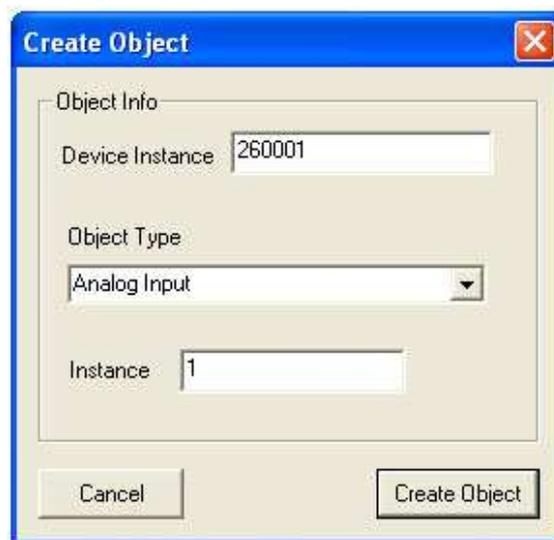

Figure 28. Create Object

Time Synchronization and UTCTimeSynchronization services.

The TimeSynchronization and UTCTimeSynchronization services are used by a requesting BACnet-user to notify a remote devices of the correct current time so that they may synchronize their internal clocks with one another.

9. Tests

As of 2.0.1.5 version BACnet Lookout supports Device Stress tests. (**Standard and Extended Version**)

Read Property Stress Test

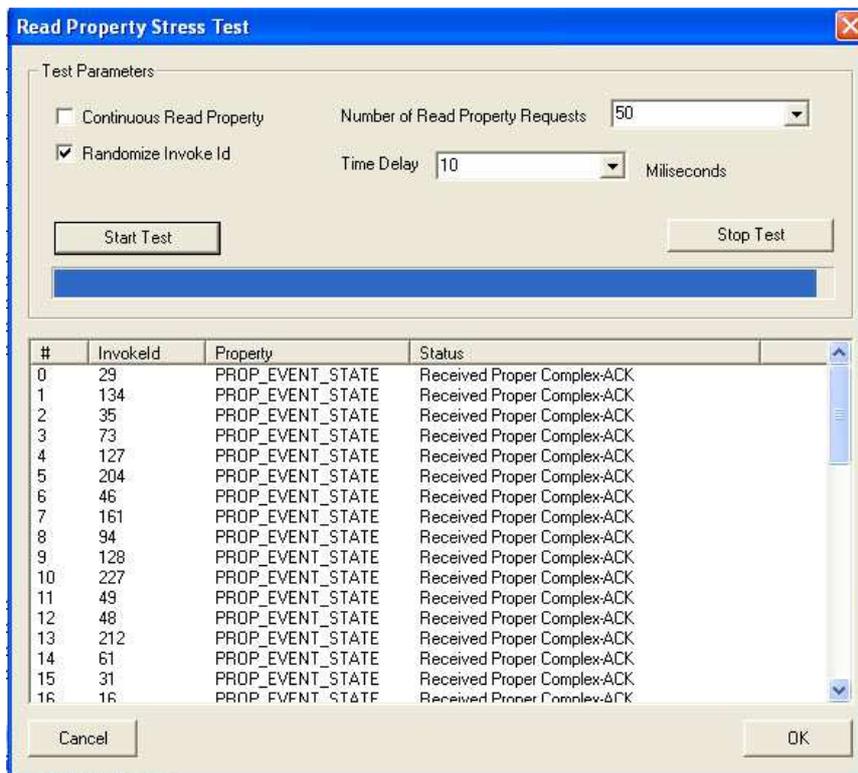<p align="center">Figure 29. Read Property Stress Test Window</p>

Read Property Test is designed to enable few of the common tests normal BACnet device should support.

To test the property, right click on the property in the Device Tree to open up a context menu and then select "Test->Stress Tests->ReadProperty" option or select the property and click the Read Property Test button in the Toolbar. This will bring up the window shown on Figure 24.

9. Features

Objects supported (all properties in listed objects supported).

Objects	Read	Write
Analog Input	✓	✓
Analog Output	✓	✓
Averaging	✓	✓
Binary Input	✓	✓
Binary Output	✓	✓
Binary Value	✓	✓
Command	✓	✓
Device	✓	✓
File	✓	✓
Group	✓	✓
Life Safety Point	✓	✓
Life Safety Zone	✓	✓
Loop	✓	✓
Multi State Input	✓	✓
Multi State Output	✓	✓
Multi State Value	✓	✓
Pulse Converter	✓	✓
Notification Class	✓	✓
Program	✓	✓
Calendar	✓	✓
Event Enrollment	✓	✓
Schedule	✓	✓
Trend Log	✓	✓
Structured View	✓	✓
Load Control	✓	✓
Trend Log Multiple	✓	✓
Access Door	✓	✓
Event Log	✓	✓

Here is the list of supported features for BACnet Lookout V2.2

Application	BrightCore Bacnet Lookout Essential 2.2 P/N BBLe-1	BrightCore Bacnet Lookout Standard 2.2 P/N BBLs-2	BrightCore Bacnet Lookout Extended 2.2 P/N BBLx-3
Discover Objects	✅	✅	✅
Discover Properties	✅	✅	✅
Read Property	✅	✅	✅
Write Property	✅	✅	✅
BACnet/IP communication Data Link	✅	✅	✅
Property Monitor	✅	✅	✅
Alarm Summary List	✅	✅	✅
Event Summary List	✅	✅	✅
Subscribe COV Property	✅	✅	✅
Import EDE	✅	✅	✅
Export EDE	✅	✅	✅
IEEE 802.3 Ethernet communication Data Link	✅	✅	✅
Time Synchronization	✅	✅	✅
Structured Device List	✅	✅	✅
UTC Time Synchronization	✅	✅	✅
BACnet/MSTP Data Link Layer	❌	✅	✅
Create Object	❌	✅	✅
Delete Object	❌	✅	✅
Property Stress Test	❌	✅	✅
Read Broadcast Table	❌	❌	✅
Write Broadcast Table	❌	❌	✅
Register Foreign Device	❌	❌	✅
Read Foreign Device Table	❌	❌	✅
Delete Foreign Device Entry	❌	❌	✅
Analyze MSTP Traffic	❌	❌	✅

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