BACnet Browser
Test Sequencer

User’s Manual

SIEMENS

Version: 1.5

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1 General information

1.1 BACnet

BACnet is a communications protocol for building automation and control networks. It is an ASHRAE, ANSI, and ISO standard protocol. BACnet was designed to allow communication of building automation and control systems for applications such as heating, ventilating, and air-conditioning control, lighting control, access control, and fire detection systems and their associated equipment. The BACnet protocol provides mechanisms for computerized building automation devices to exchange information, regardless of the particular building service they perform.

1.2 BACnet Browser

The BACnet browser is a tool that has been developed as an aid to confirm BACnet/IP communications on a network. It can be used with 3rd Party devices to discover BACnet addresses. It can also be used to adjust BACnet object properties.

1.3 Test Sequencer

Test Sequencer is a tool embedded within BACnet Browser, which enables testing BACnet Network by loading scripts delivered in XML format. The scripts can be designed in MS Excel and easily converted to XML format. All devices in the BACnet Network can be tested according to designed script.

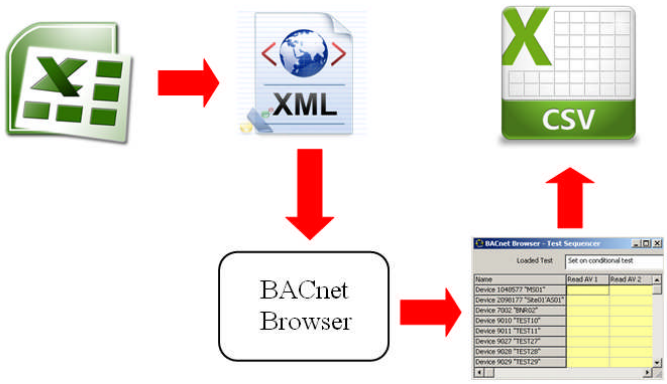


Figure 1. Test Sequencer Operation

The test results can be exported and saved in CSV representation. Test Sequencer is useful tool for system testing especially while commissioning a system.

1.4 BACnet Network

Any BACnet devices, connected to the same BACnet Network are able to exchange data values. Desigo PX uses three forms of BACnet communications, BACnet on LON, BACnet on IP (Ethernet) and BACnet MSTP. BACnet Browser enables access to all devices available on the network using IP router. Moreover, all BACnet objects can be easily modified and adjusted according to user preferences.

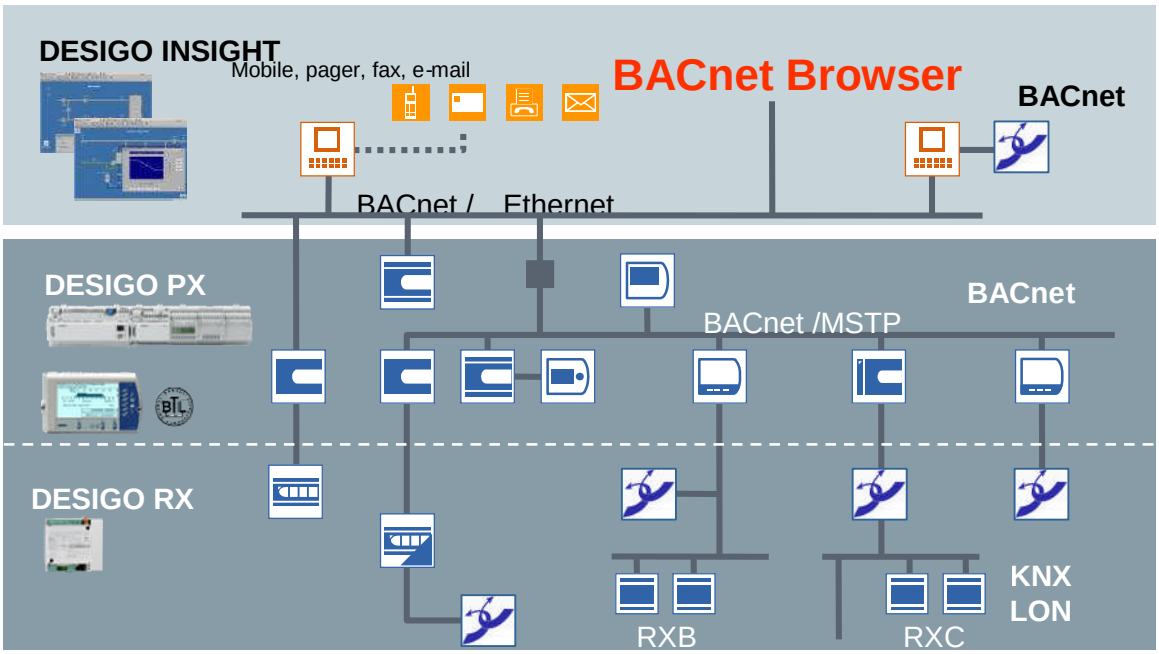


Figure 2. Example BACNet Network

2 Installation

Open *BACnetBrowser_v2.0_Setup.exe* and install BACnet Browser on PC by following installation instructions. Once it is finished open BACnet Browser and register the product. In the main toolbar go to "Help" and "Registration". This tool is free issued. Once this is installed on a PC an Installation code is produced. This code must be e-mailed to cpstechsupport.sbt.uk@siemens.com in order for a Registration Code to be generated to activate the tool. Once registration is successful, the registration window will indicate that BACnet Browser is registered.

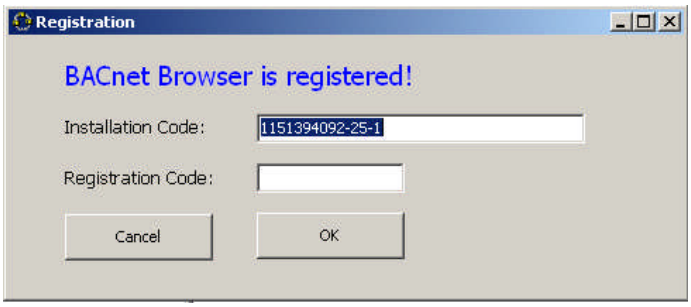


Figure 3. BACnet Browser Registration

3 BACnet Browser configuration

Before you start working on BACnet Browser it is required to configure the network. Go to "File", "Settings" and Select IP addresses of the computer to obtain communication with BACnet (Figure 4).

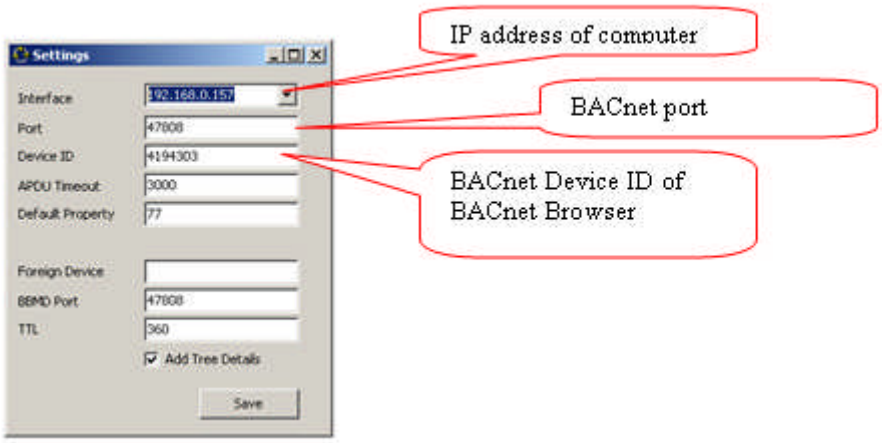


Figure 4. BACnet Browser IP Settings

Expand the "File" menu in the main toolbar and click "Send Who-Is". All available BACnet networks will be displayed (Figure 5). Next by double click on chosen network expand list and all available devices in the chosen network will be displayed.

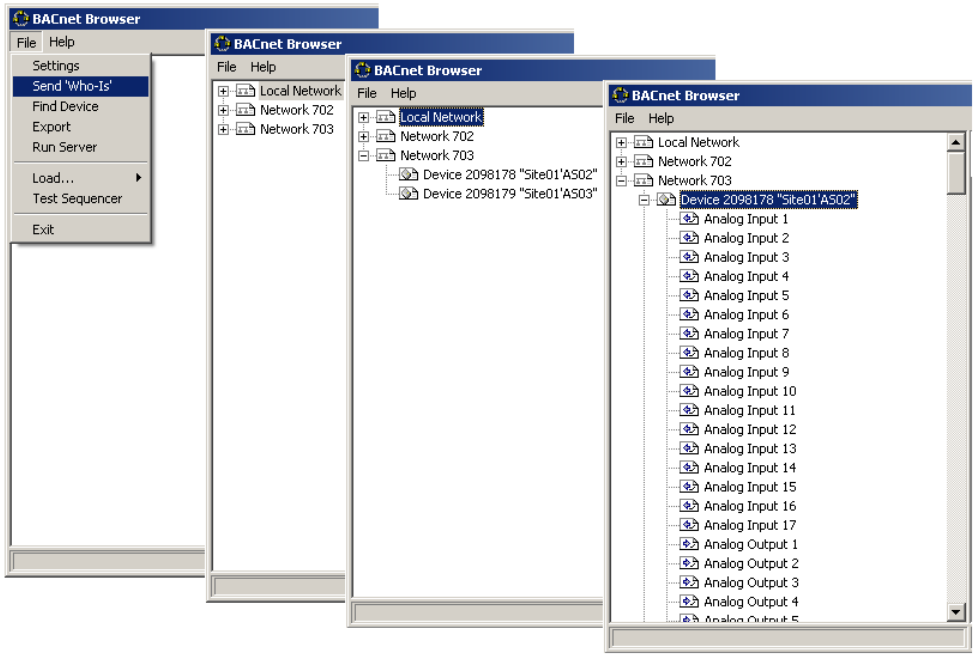


Figure 5. BACnet Browser Configuration

Repeat the same steps with "Devices" in order to access to device inputs, outputs, etc.

See example Analog Input 1 (Figure.6).

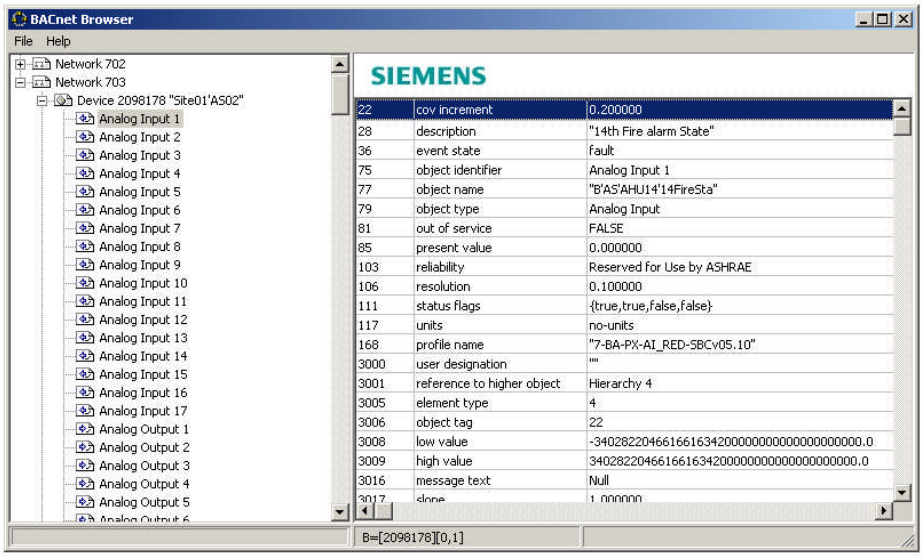


Figure 6. BACnet Analog Input 1

4 Test Setup

4.1 Create Test

BACnet Browser provides unique functionality to design and execute various tests useful while commissioning a system. Testing operations are carried out in Test Sequencer which is the tool embedded within BACnet Browser.

BACnet test can be easily designed in MS Excel and translated to XML format. There seven main fields which are crucial while designing the test. These are:

Sid	number of the action
Name	description of the action
Read	subscribe value to variable
Format	display format
Test	logical condition
Write	send value out to network
Sleep	delay

Each script can have row/device specific 6 local variables: A, B, C, X, Y, Z and 2 global test wide variables: G1, G2. All variables are mainly used for "read" and "write" functions, but also can be used to store values, reset, etc. See example script in Figure 7. (next page).

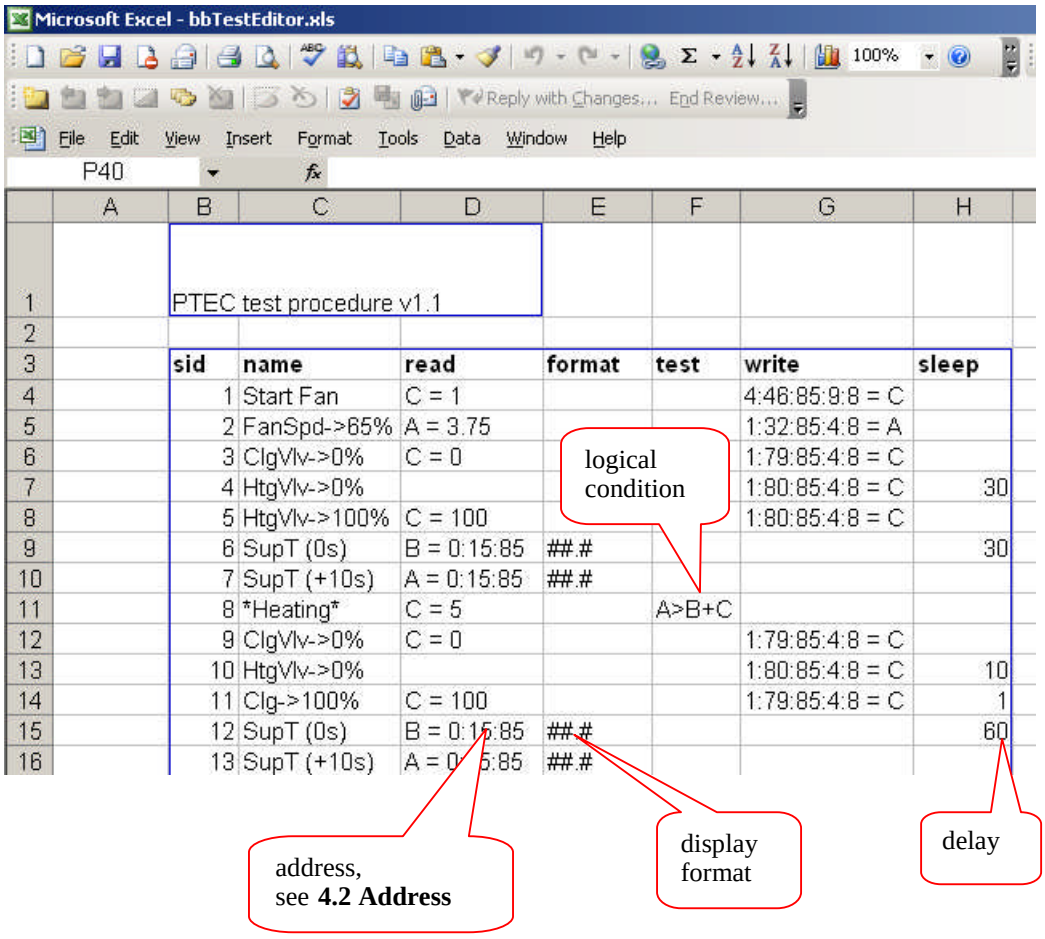


Figure 7. Example XLS Script

4.2 Address

Once creating XLS script, the BACnet Browser uses a simple address representation. It is denoted by numbers separated by single colons.

Address = a:b:c:d:e, where **a,b,c,d** and **e** are numbers

The first three numbers **a:b:c** are associated with "read" command and additional requirement of **d:e** in order to correctly define a "write" command.

Address have different representation based on the object types. It varies depending if it is Analog Input/Output, Analog Value, Binary Input/Output or Binary Value.

Table.1 lists the value of "**a**" required to define the main Object types.

Object Type	Address "a"
Analog Input	0
Analog Output	1
Analog Value	2
Binary Input	3
Binary Output	4
Binary Value	5

Table 1. Object Type Address "a"

The second position in signal address "**b**" indicates the object instance number.

Object Instance	Address "a:b"
Analog Input **4**	0:**4**
Analog Output **1**	1:**1**
Analog Value **2**	2:**2**
Binary Input **4**	3:**4**
Binary Output **1**	4:**1**
Binary Value **11**	5:**11**

Table 2. Object Instance Address "b"

The third number in the BACnet address "**c**" indicates specific object property. See various objects in Figure 8. For example, the "present value" has number "**85**".

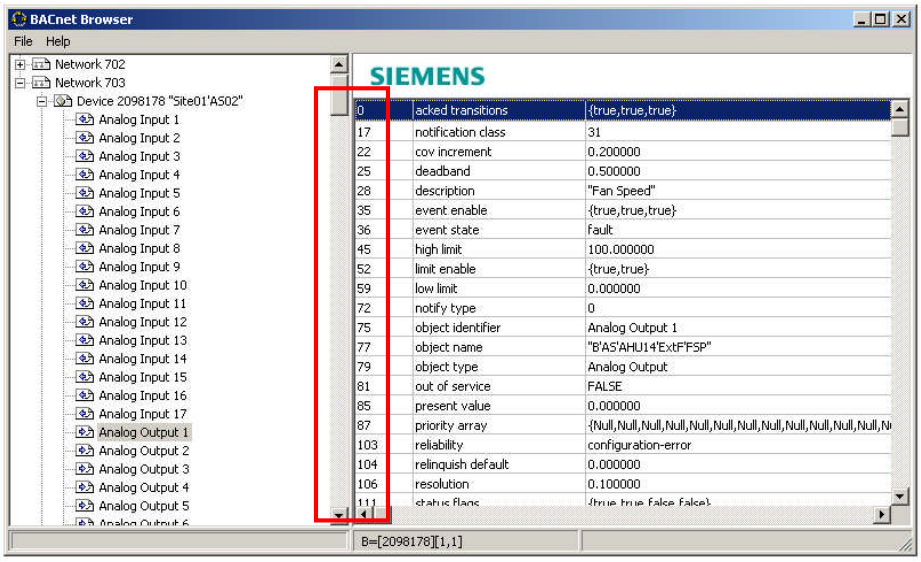


Figure 8. Property Code "**c**"

There is also an alternative method to address an objects present value. It can be done directly by assigning object name to the address, example

Address = B'GBM'MonthlyBiomassTarget

In order to 'write' to an object it is important to set the "Tag" and "Priority" parameters, these are indicated by "**d**" and "**e**", respectively. The priority parameter is particularly important if the object has a priority array property. To access to priority array in the BACnet Browser double click on object "87 – priority array".

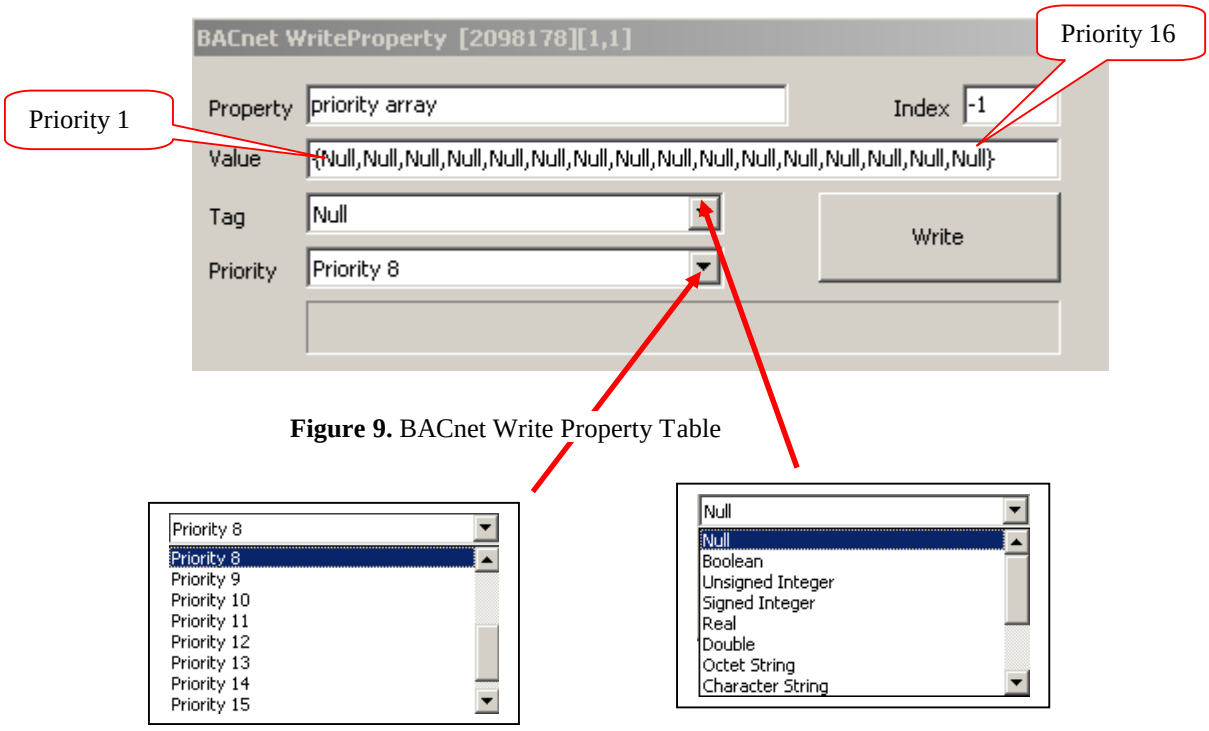


Figure 9. BACnet Write Property Table

Priority is crucial for output operation; it allows multiple control inputs to be defined for an output, with the priority mechanism determining which input determines the output value. BACnet Browser specifies optional object properties to support command prioritization. The Priority Array property consists of 16 entries, corresponding to BACnet's 16 command priorities (Figure 9.). A value with a priority of 16 possesses the lowest priority in the array and is overridden by all other values (e.g. scheduler, safety function). Thus giving any action lowest priority, the action will continuously proceeded until it is not released. For example, it can be fire operation and as long as it is not released any other action will not be undertaken. Example full BACnet addresses is shown in Table 3.

Signal	a	b	c	d	e	full address a:b:c:d:e
Analog Input 4	0	4	4			0:4:4
Analog Output 1	1	1	3	0	8	1:1:3:0:8
Analog Value 2	2	2	2			2:2:2
Binary Input 4	3	4	3			3:4:3
Binary Output 1	4	1	1	9	3	4:1:1:9:3
Binary Value 11	5	11	1			5:11:1

Table 3. Example Addresses

4.3 Logical Conditions

Logical condition have crucial role while carrying out BACnet tests. Basic mathematical operations are incorporated to evaluate logic conditions within test and based on obtained result to proceed Test Sequencer operations. The detail Test Sequencer Operation is described in Section 4.5 "Load Test". Example test conditions for Test Sequencer operations are as follows:

A = B	check if variable "A" ad "B" are equal, where B incorporates tolerance factor C, thus effectively A = B (±C)
A > B + C	check if "A" is greater then sum of "B" and "C"
A < B - C	check if "A" is less then subtraction of "C" from "B"
G1 = A	check if variable "G1" ad "A" are equal, where A incorporates tolerance factor C, thus effectively G1 = A (±C)
G2 = B	check if variable "G2" ad "B" are equal, where B incorporates tolerance factor C, thus effectively G2 = B (±C)

4.4 Export to XML

Once the test is created using MS Excel, it can be exported into an XML file and loaded to Test Sequencer. To do that left click on spread sheet, go to "XML" and "Export".

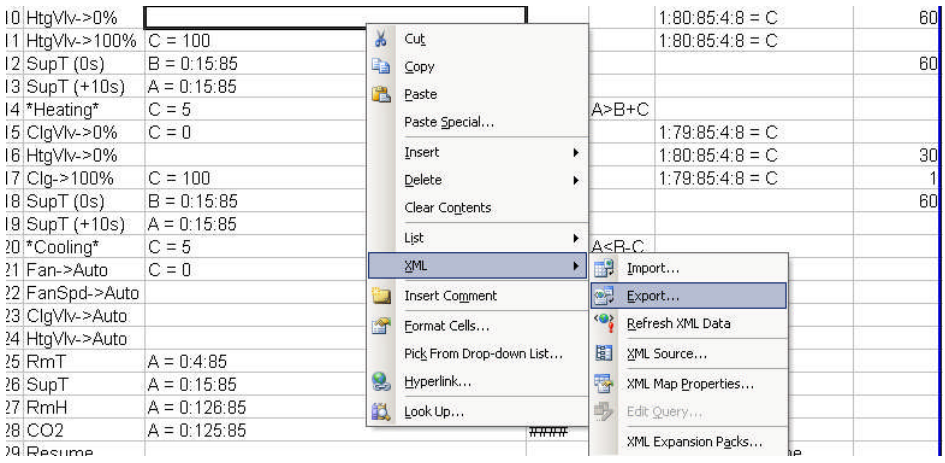


Figure10. Export to XML

You will be asked to specify location where you want to save your XML file. Specify location and confirm choice by clicking "Export" button.

4.5 Load Test

Load any test stored in XML format to Test Sequencer. Right click on "File", expand list, go to "Load" and "Test Configuration" (Figure 11.) Next, go to directory with XML file location and load test (Figure 12).

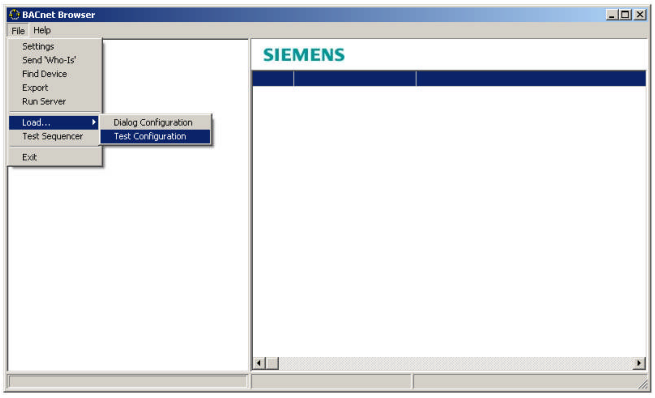


Figure 11. Load Test

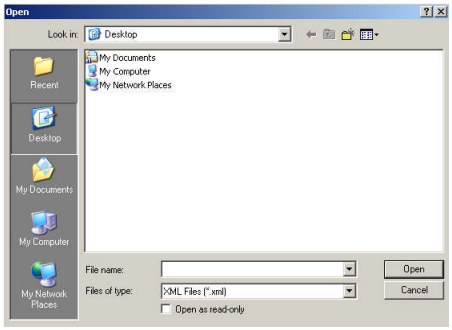


Figure 12. Load XML file

Once test is loaded, highlight all devices which you want to be tested, then left click on "File" and go to "Test Sequencer".

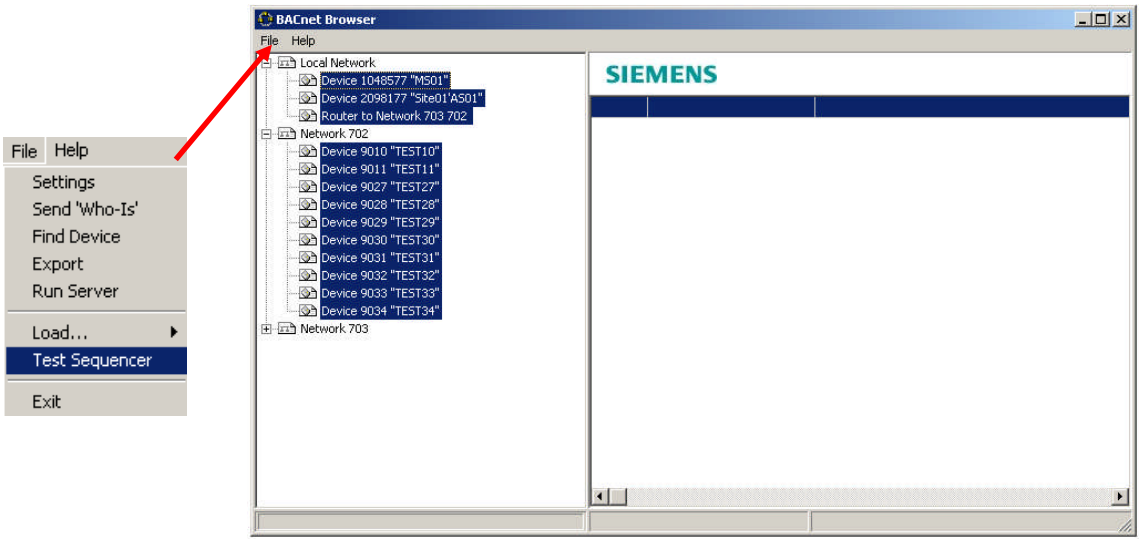
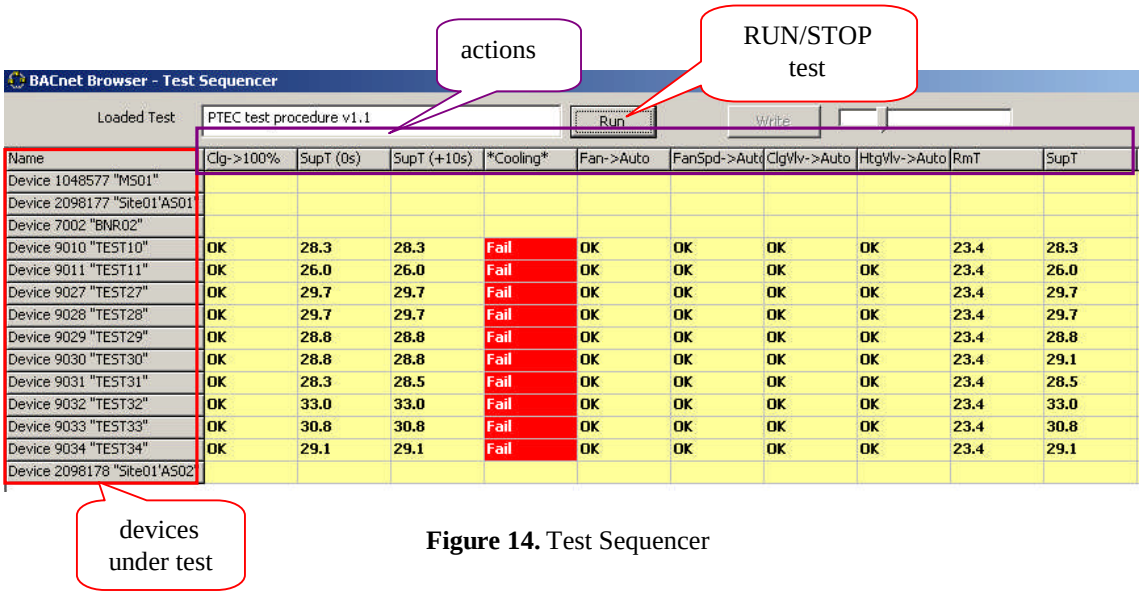


Figure 13 Launch Test Sequencer

Next, BACnet Browser will navigate you to BACnet Browser – Test Sequencer. At this stage, the test is ready to be run. As test progresses, thus results can be followed from the beginning till the end. On the left had side of Test Sequencer Window are devices taking part in test are displayed, while the top bar contains information with all action which are going to be taken during particular test. Actions are executed from left to right, column by column and row by row. Only actions designed previously in XLS file

(Figure 14) and loaded can be carried out. Moreover, each test can be stopped any time and reactivated by pressing RUN/STOP button, see Test Sequencer (Figure 14).



Name	Clg->100%	SupT (0s)	SupT (+10s)	*Cooling*	Fan->Auto	FanSpd->Auto	ClgVlv->Auto	HtgVlv->Auto	RmT	SupT
Device 1048577 "MS01"										
Device 2098177 "Site01'AS01"										
Device 7002 "BNR02"										
Device 9010 "TEST10"	OK	28.3	28.3	Fail	OK	OK	OK	OK	23.4	28.3
Device 9011 "TEST11"	OK	26.0	26.0	Fail	OK	OK	OK	OK	23.4	26.0
Device 9027 "TEST27"	OK	29.7	29.7	Fail	OK	OK	OK	OK	23.4	29.7
Device 9028 "TEST28"	OK	29.7	29.7	Fail	OK	OK	OK	OK	23.4	29.7
Device 9029 "TEST29"	OK	28.8	28.8	Fail	OK	OK	OK	OK	23.4	28.8
Device 9030 "TEST30"	OK	28.8	28.8	Fail	OK	OK	OK	OK	23.4	29.1
Device 9031 "TEST31"	OK	28.3	28.5	Fail	OK	OK	OK	OK	23.4	28.5
Device 9032 "TEST32"	OK	33.0	33.0	Fail	OK	OK	OK	OK	23.4	33.0
Device 9033 "TEST33"	OK	30.8	30.8	Fail	OK	OK	OK	OK	23.4	30.8
Device 9034 "TEST34"	OK	29.1	29.1	Fail	OK	OK	OK	OK	23.4	29.1
Device 2098178 "Site01'AS02"										

Figure 14. Test Sequencer

Test Sequencer executes steps based on specification provided in XML file. Steps are carried out from left to right, row after row. Once test is started, the Test Sequencer reads values specified in "read" column and assign them to one of the variable (A, B, C, X, Y, Z, G1, G2). Next, it verifies the format type, if specified by designer and proceed to logical operation. During the logical operation "test", the logical conditions are evaluated. If logical condition is failed, Test Sequencer ignores "write" command, goes straight to sleep operation and executes it. However, if logical test is passed, Test Sequencer executes "write" command. Once "write" command is carried out, Test Sequencer proceeds sleep operation. It is only applicable if there is any delay specified. Once finish "sleep" command, Test Sequencer terminates its operation. The Test sequencer operation is summarized in Figure 14.

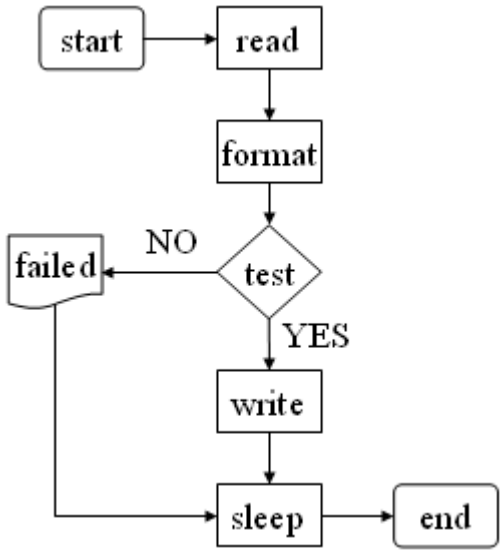
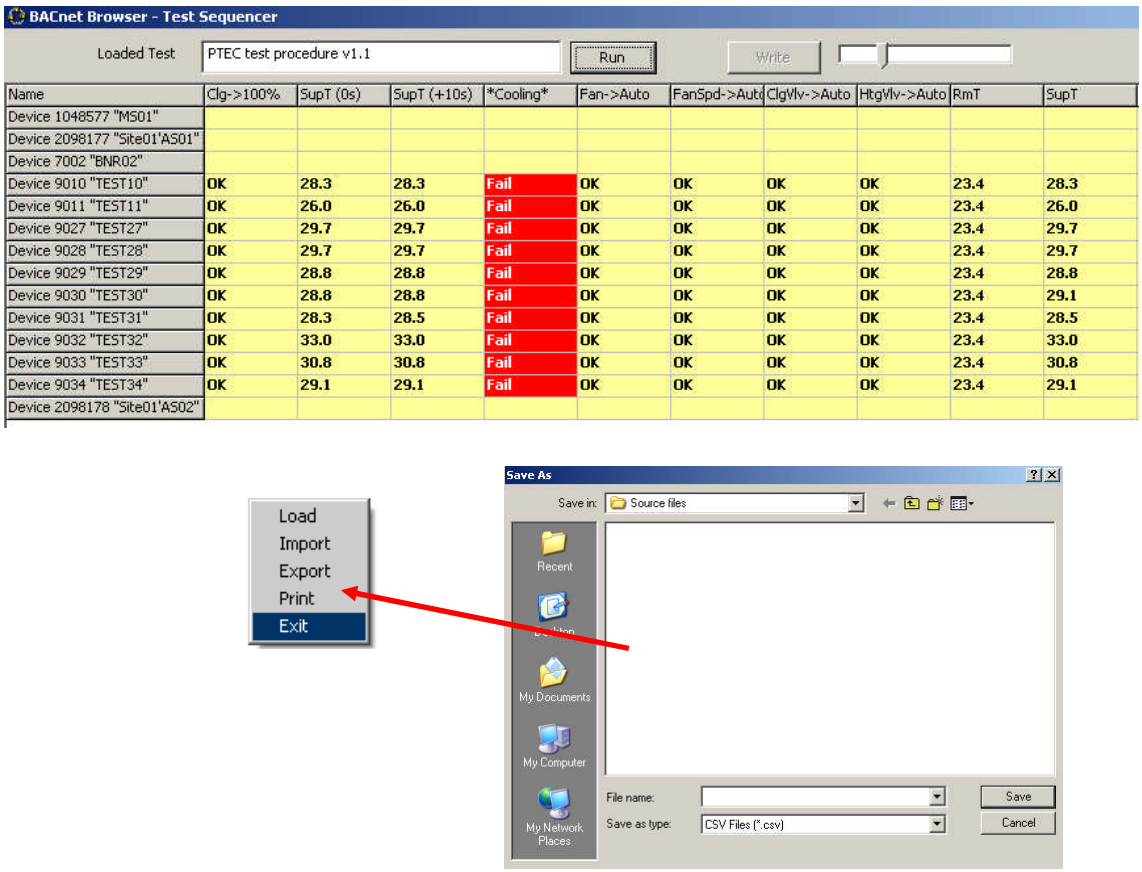


Figure 5 . Test Sequencer operation

4.6 Export Test

When test is finished, results can be analysed, exported and saved in CSV format.



Name	Clg->100%	SupT (0s)	SupT (+10s)	*Cooling*	Fan->Auto	FanSpd->Auto	ClgVlv->Auto	HtgVlv->Auto	RmT	SupT
Device 1048577 "MS01"										
Device 2098177 "Site01'AS01"										
Device 7002 "BNR02"										
Device 9010 "TEST10"	OK	28.3	28.3	Fail	OK	OK	OK	OK	23.4	28.3
Device 9011 "TEST11"	OK	26.0	26.0	Fail	OK	OK	OK	OK	23.4	26.0
Device 9027 "TEST27"	OK	29.7	29.7	Fail	OK	OK	OK	OK	23.4	29.7
Device 9028 "TEST28"	OK	29.7	29.7	Fail	OK	OK	OK	OK	23.4	29.7
Device 9029 "TEST29"	OK	28.8	28.8	Fail	OK	OK	OK	OK	23.4	28.8
Device 9030 "TEST30"	OK	28.8	28.8	Fail	OK	OK	OK	OK	23.4	29.1
Device 9031 "TEST31"	OK	28.3	28.5	Fail	OK	OK	OK	OK	23.4	28.5
Device 9032 "TEST32"	OK	33.0	33.0	Fail	OK	OK	OK	OK	23.4	33.0
Device 9033 "TEST33"	OK	30.8	30.8	Fail	OK	OK	OK	OK	23.4	30.8
Device 9034 "TEST34"	OK	29.1	29.1	Fail	OK	OK	OK	OK	23.4	29.1
Device 2098178 "Site01'AS02"										

Figure 6. Test Sequencer Export