# BACnet IP (Annex J) Device Driver Guide

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# 1. Summary - BwBACnetJ driver

There are multiple ways to implement the BACnet protocol. This document describes BACnet using the Internet Protocol stack (sometimes called BACnet IP). This driver complies with the J Annex of the BACnet standard; hence, the name, BACnetJ, for the driver.

To implement this driver you will need:

#### **BACnetJ device driver from Broadwin.**

These consist of BwBACnetJ#.dll located in drive:\Webaccess\Node\ And BwBacDrvJ.dll in drive:\Webaccess\Node\driver

### WebAccess Version 7 candidate dated Sept 23 2009 or later or the

BwBACnetJ.DLL and BwBACnetJ#.dll dated Sept 17 2009, or later.

#### **BACnet Browser**

WebAccess does not have a 'Self-Discovery" feature that will allow you to browse devices and tags. The object instance number is used as the tag's address in WebAccess; this is easily determined from a BACnet browser, usually supplied by the BACnet equipment manufacturer, but also from third party companies (for example Cimmetrics). The Cimmetrics BACnet Explorer (the purchased version or demo version) or Cimmetrics OPC Server (the demo version works great) can provide you with the Instance Number of each device, the Object Type (AI, AO, AV, BI. BO BV, etc) and Instance Number for each tag that you want to read. But don't install these on the SCADA node, they will interfere with WebAccess SCADA node communications to the BACnet devices.

Warning – The Cimmetrics BACstac runs as a service and will interfere with (intercept) BACnet communications with the Webaccess SCADA node software. It is recommended to not install Cimmetrics BACnet browser on the SCADA node (use another PC instead). You should uninstall the Cimmetric BACstac from the SCADA node. Similarly you should uninstall any other communications service that would intercept the BACnet communications. And you can not run another BACnet communications program while the SCADA node is running; they will interfere with each other.

#### **IP Address and UDP Port** used by the BACnet Device(s).

The steps to implement this BACnetJ driver, in brief, are:

- Ensure the BwBacDrvJ.dll is located in drive:\Webaccess\Node\driver and that BwBACnetJ#.dll is located in drive:\Webaccess\Node\. If not, obtain them from Broadwin and copy them to drive:\Webaccess\Node\driver on the Project Node and drive:\Webaccess\Node\driver on the SCADA node.
- 2. Uninstall or disable any other BACnet communications services on the SCADA node computer.
- 3. Create a Project, Node in Project Manager

- 4. Create a TCP/IP Port on SCADA node
- 5. Create a BACnetJ Device. There are two methods to address a BACnet Device:
  - a. For a pure BACnet IP device with no MSTP connection to the device.b. For a device on an MSTP (serial) network connected to a Ethernet/IP Gateway
- 6. For a pure BACnet IP device configure the:
  - a. **IP Address** of the Device
  - b. The **UDP Port** used by the BACnet protocol (typically 47808).
  - c. The **Device Instance Number**. (You may need to use the BACnet browser, on a second PC, to discover the Instance Number).
  - d. The **Max Read Property** (0 = Read 70 tags each poll, 1 = Read 1 tag per poll, 2 = Read 2 tags each poll, etc.).
- 7. For a an MSTP device connected to a BACnet IP gateway configure the:
  - a. **IP Address** of the Device
  - b. The **UDP Port** used by the BACnet protocol (typically 47808).
  - c. The Device Address using the format NetworkNumber.MACaddress (You may need to use the BACnet browser, on a second PC, to discover the Network number and MAC address). The mac address is in decimal (not Hex).
  - d. Leave Device instance number as 0.
  - e. The **Max Read Property** (0 = Read 70 tags each poll, 1 = Read 1 tag per poll, 2 = Read 2 tags each poll, etc.).
- 8. Use the BACnet browser (on another PC) to browse tags and discover their name, object type and Instance Number.
- 9. Create Tags that match the Object Type, Instance Number and the objectidentifier that you want to read and/or write (typically 85)

### **1.1.1** Tag Address

The BACnetJ device driver in WebAccess uses a simple address scheme, Object Type Number.Instance Number. Object-Identifier Number

Analog Inputs are 0.InstanceNo.85 (for example, the address of the first instance of an AI is 0.1.85 )

Analog Outputs are 1.InstanceNo.85 (for example the address is 1.1.85)

Analog Values are 2.InstanceNo.85 (for example, address: 2.1.85)

Binary Inputs are 3.InstanceNo.85 (for example, address: 0.1.85)

Binary Outputs are 4.InstanceNo.85 (for example, address: 1.1.85)

Binary Values are 5.InstanceNo.85 (for example, address: 2.1.85)

If there are multiple BACnet devices, it is recommended to configure unique instance numbers for the objects. (For example 1.70001.85, 1.80001.85, etc.) Having the object instance number repeatedly used in multiple devices (for example all devices having an object 1.1.85) can give false readings.

To read the Present Value of Tags, some examples of Addresses are:

Tag	Address
AI_1	0.1.85
AI_2	0.2.85
AI_3	0.3.85
AI_4	0.4.85
AO_1	1.1.85
AO_2	1.2.85
AO_3	1.3.85
AO_4	1.4.85
AV_1	2.1.85
AV_2	2.2.85
AV_3	2.3.85
AV_4	2.4.85
BI_1	3.1.85
BI_2	3.2.85
BI_3	3.3.85
BI_4	3.4.85
BO_1	4.1.85
BO_2	4.2.85
BO_3	4.3.85
BO_4	4.4.85
BV_1	5.1.85
BV_2	5.2.85
BV_3	5.3.85
BO_4	5.4.85

# **2. Example: BACnetJ**

This is an Example using the Delta Controls VAV Air controller and an Aleron IP/MSTP gateway/bridge.

```
WebAccess SCADA Node

↑

Internet Protocol

↓

Alerton BCM-ETH

↑

Serial MSTP

↑

Delta VAV controllers
```

## 2.1 Use a BACnet Browser to get device Instance Numbers

Most manufacturers provide a BACnet browser or configuration tool. You should run it on another PC (not the SCADA node) to discover instance number of the Device and tags.

The Cimmetrics BACnet browser example below uses the Global Broadcast Who Is to discover the devices.

🕶 Untitled - Cime	trics BACnet Explorer	
File Edit View Hel;	p	
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	Global broadcast Who-is	DblClick
Local Net	Re-discover on existing netwo Add Network	orks
-	Rename	F2

Figure - BACnet browser discovering devices with Global Broadcast Who-is

TUntitled - Cimetrics BACnet Ex	plorer
File Edit View Help	
📔 🚅 📃 👗 🖻 🛍 🙋 ?🗜	2
E Global Internetwork	Name:
🗄 🌱 Hocal Network	
	Value:
	Property Name Property Value
Device 507122	Network Properties
	This Network     OK       Network number:     5071       Cancel

Figure - BACnet browser reading properties of IP Gateway with Device Instance Number of the Gateway and the Network number of the connected MSTP devices. (5071)

T Untitled - Cimetrics BACnet Ex	plorer
File Edit View Help	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2
Hat Global Internetwork     Hat Global Internetwork     Hat Global Network	Name: Value:
	Property Name Property Value
<u>a</u>	Device Properties
	Set Device     OK       Device ID:     507122
	Address Cancel
	Network number: 5071 MAC address: 17 (hexadecimal)

Figure – Bacnet Explorer reading properties of MSTP device to see MAC address (here in Hex, but web access uses decimal 17 Hex = 23 decimal).

Note that WebAccess expects the Device Instance Number, Network Number and MAC address in decimal. An convenient tool to convert Hexadecimal to Decimal is the Calculator in windows. Select View -> Scientific. Select the HEX button. Enter the number. Select the DEC button to convert the HEX number to Decimal.

## 2.2 Configure TCP/IP Port on SCADA node

The SCADA node needs use an IP address with the same subnet of the BACnet Gateway or device, if the BACnet Gateway uses a Private or Local Area network. (which maybe different than IP address used by clients to access the SCADA node). The SCADA node can have multiple IP networks assigned to a single NIC (for example a Public IP like 67.94.27.177 and a local LAN (private IP) like 192.168.1.177). You assign this in the Microsoft Windows Local Area Connections Properties using the Advanced button.

ettings DNS WINS	Options	
P add <u>r</u> esses		
IP address	Subnet mask	
67.94.27.177 192.168.1.177	255.255.255.0 255.255.255.0	
<u>A</u>	id <u>E</u> dit Remo <u>v</u> e	
Default gateways:		
Gateway	Metric	
67.94.27.1	Automatic	
Ag	dd Edit Remove	
Automatic metric		
Interface metric;		

Windows Local Area Connections Properties - Advanced

Ensure there are no other BACnet communications services running. While your are in the Local Area Connections, look for other BACnet Communications services and un-install them. Some Network Monitors will also interfere with BACnet communications and should be uninstalled. If the SCADA node fails to communicate, you should come back an un-install these Network monitors as well.

General Advanced						
Connect using:						
Broadcom 440x 10/100 Integrated Cc						
This c <u>o</u> nnection uses	the following items:					
Cimetrics BACstac(TM) Standard Edition v4.0 Protocol     S     S     Network Monitor Driver     Internet Protocol (TCP/IP)						
<	100	>				
		No. 1 market 1				
I <u>n</u> stall	<u>U</u> ninstall	P <u>r</u> operties				
Install Description Transmission Contro wide area network p across diverse inter	Uninstall of Protocol/Internet Pro protocol that provides connected networks.	P <u>roperties</u>				
Install Description Transmission Contro wide area network p across diverse inter Show icon in notific Notify me when this	Uninstall of Protocol/Internet Pro protocol that provides connected networks. cation area when conr s connection has limite	Properties				

The Cimetrics BACstac will interfere with WebAccess BACnet communications and should be removed!

## 2.3 Configure TCP/IP Port in WebAccess Project Manager

In the WebAccess Project Manager create a TCP/IP Communications Port on the SCADA node.

🖉 Comport : 7 - Windows Internet Explorer					
🚱 💿 🔻 🚺 http://64.55.156.4/broadWeb/bwMain.asp?pos=project&ProjIdbw=1& 🗹 🗲 🔀 Live Search					
🖕 Favorites 👍 🎉 Suggested Sites 🕶 🔊 Web Slice Gallery 🕶					
🥨 Comport : 7					
BroadWin WebAccess Project Manager <u>Quick Start</u> Help Hom					
Project / Node	Comport Property Delete Ad	ld Device			
LiveDemo 🔨	Comport : LiveDemo • S	CADAnode1 • 7			
SCADAnode1	Interface Name	TCPIP			
Port3 (tcpip) = Port4 (api)	Comport Number	7			
BlockTags	Description	Description			
Port6 (api) Port7 (topip)	Scan time	30 Second			
AlertonBCM	TimeOut	6000 MilliSecond			
	nineout	ouu miinsecona			
Acc Point	Retry count	3			
Calc Point	Auto Recover Time	60 Second			
Const Point	Backup Port Number	0			
Device Type					
<u>A101</u>					
ABPLC5					
			net		

Note that an MSTP (serial device) may require longer TimeOut and slower scan than a pure BACnet IP device.

## 2.4 Create a pure BACnet IP Device in WebAccess

🖉 Device : AlertonBCM - Windows Internet Explorer					
💽 🕞 💌 👹 http://64.55.156.4/broadWeb/bwMain.asp?pos=project&ProjI			idbw=1& 🔽 😽 🕻	🗙 🔊 Live Search	P -
🖕 Favorites 👍 🏉 Suggested Sites 👻 🔊 Web Slice Gallery 👻					
W Device : AlertonBCM			<u>ن</u>	🔹 🔝 🖃 🖶 🍷 Page 🔹 Safety 🕶 To	ols • 🔞 • 👋
BroadWin WebAccess Project Manager Quick Start Help H					ne Logout
Project / Node		Delete Add Tag Add Block			^
LiveDemo	^	Device	e Property	[Cancel] Submit	
SCADAnode I Dort3 (tcpip)		Device Name	AlertonBCM		
Port4 (api)		Description	Alerton Bacnet	Control Module	
Diock lags		Unit Number	0		
Dort7 (tcpip)		Device Type	BwBacNetJ 🗸		
VLC 22		Primary	IP Address	192.168.1.90	
D <u>VLC_7</u>			Port Number	47808	
Calc Point			Device Address	if other than Unit Number	er
Caic Point			IP Address		
System Point		Secondary	Port Number		
Device Type		coondary			
ABPLC5		Synchronize Time at/Ex. 22:50:00):	01-00-00		
ABSLC5		Device Decederat (1 AM Time (concerd)	01.00.00	Delline Quele i	
ACEFAM3 ADAM4K		Device Broadcast (I Amj Time (second)	U		
ADAM5K		Device Instance # :	507	Max Property/ Request : 30	
ADAM5KE	~		[Cancel]	Submit	~
	>	<			
Done				🌍 Internet 🛛 🖓 👻	

Figure – Device Property of BACnet Gateway

For a pure BACnet IP device configure the:

- a. **IP Address** of the Device
- b. The **UDP Port** used by the BACnet protocol (typically 47808).
- c. Leave the Device Address blank.
- d. The **Device Instance Number**. (You may need to use the BACnet browser, on a second PC, to discover the Instance Number).
- e. The **Max Read Property** (0 = Read 70 tags each poll, 1= Read 1 tag per poll, 2= Read 2 tags each poll, etc.). Typically an MSTP device is limited to a small number of bytes. An Alerton VLC 550 controller can only respond with a message of 128 bytes, which corresponds to about 7 or 8 tags. An Alerton Gateway can respond with 1460 bytes, which corresponds to about 30 tags. Unfortunately, WebAccess uses a deterministic request size based generated at download. So, you will probably have to experiment with your devices to determine the Max Read Property size (in tag count).
- f. Optionally configure **the Synchronize Time** to some other time of Day.

g. If COV (Change of Value) reporting is enabled in the device, configure the **Device broadcast I AM** to the frequency the device transmits it's I AM. COV means the device responds only when there is a change of value and the I AM is used to mark the device as good. If use I AM broadcast, and the I AM message is not received within the period, the device will be marked as failed.

If you are not using COV, then leave I AM Time = 0.

h. Optionally change the **Polling cycle**. Polling Cycle = 1 means the device is polled at the Scan time. Polling Cycle =2 means the device is polled at 2\*scan time. Polling Cycle essentially slows down how often a device is polled, allow other devices to be polled more frequently.

## 2.5 Create a MSTP BACnet Device in WebAccess

If there are MSTP devices connected to the BACnet IP device, create these using the BACnet IP Gateway's IP address, but the NetworkNumber.MACaddress in the Device Address. Leave the Device Instance number blank.

🖉 Device : VLC_22 - Windows Internet Explorer				
🔆 🗢 🗸 🚳 http://64.55.156	.4/broadWeb/bwMain.asp?pos=project&ProjI	dbw=1& 💙 🗲 >	🖌 ಶ Live Search	P •
🚖 Favorites 🛛 🚖 🏉 Suggested :	Sites 🔻 🙋 Web Slice Gallery 👻			
WDevice : VLC_22		🟠 -	🔊 - 🖃 🖶 - Bag	e + Safety + Tools + 🕢 + 🏾 💙
BroadWin WebAccess Project Manager Ouick Start Help Home L				
Project / Node	<u>Delete</u> Add Tag Add Block			<u> </u>
	Device	Property	[Cancel] Subm	it
SCADAnode1 Port3 (tcpip)	Device Name	VLC_22		
Dort4 (api)	Description	V Local Controle	er 22 mac 16	
Block Lags	Unit Number	2		
Port7 (tcpip)	Device Type	BwBacNetJ 💌		
AlertonBCM		IP Address	192.168.1.90	
<u>VLC_7</u>	Primary	Port Number	47808	
Calo Point	· · · · · · · · · · · · · · · · · · ·	Device Address	5071.23 if other	than Unit Number
Const Point		IP Address		
System Point	Secondary	Port Number		
Device Type	Occondary	Device Address		
ABPLC5	Synchronize Time at/Ex. 23:50:00):	01-00-00		
ABSLC5	Device President II AMI Time (second)	01.00.00	Balling Cycle :	4
ADAM4K	Device Broadcast (i AM) Time (second)	0	Polling Cycle.	-
ADAM5K	Device Instance # :	U	max Property/ Request :	/
		[Cancel]	Submit	×
	<	ш		>
http://64.55.156.4/broadWeb/device/d	levPg.asp?cid=28&did=28&dt=BwBacNet		😜 Internet	

#### For a an MSTP device connected to a BACnet IP gateway configure the:

- a. **IP Address** of the Device
- b. The **UDP Port** used by the BACnet protocol (typically 47808).
- c. The **Device Address** using the format **NetworkNumber.MACaddress** (You may need to use the BACnet browser, on a second PC, to discover the Network number and MAC address). The mac address is in decimal (not Hex). This MAC address is often set using toggle/dip switches on the MSTP device. Note that the MAC Address and device instance number are not always the same.
- d. Leave **Device instance** number as 0.
- e. Typically an MSTP device is limited to a small number of bytes. An Alerton VLC 550 controller can only respond with a message of 128 bytes, which corresponds to about 7 or 8 tags. An Alerton Gateway can respond with 1460 bytes, which corresponds to about 30 tags. Unfortunately, WebAccess uses a deterministic request size based generated at download. So, you will probably have to experiment with your devices to determine the Max Read Property size (in tag count).
- f. Optionally configure **the Synchronize Time** to some other time of Day.
- g. If COV (Change of Value) reporting is enabled in the device, configure the **Device broadcast I AM** to the frequency the device transmits it's I AM. COV means the device responds only when there is a change of value and the I AM is used to mark the device as good. If use I AM broadcast, and the I AM message is not received within the period, the device will be marked as failed.

If you are not using COV, then leave I AM Time = 0.

 h. Optionally change the **Polling cycle**. Polling Cycle = 1 means the device is polled at the Scan time. Polling Cycle =2 means the device is polled at 2\*scan time. Polling Cycle essentially slows down how often a device is polled, allow other devices to be polled more frequently.

## 2.6 Create Tags in BACnetJ Device

There are at least 6 parameters in the BACnetJ driver, AI, AO, AV, BI, BO, and BV. These correspond to the most commonly read "present value" of properties in BACnet devices.

- 1. Select a parameter type that matches the property you are to read.
- 2. Enter a tag name.
- 3. Modify the address to include the instance number of the property (i.e. change 0.InstanceNo.85 to 0.1.85).

🤄 Tag : VLC22_AIO - Windows Internet Explorer					
🕥 🗢 🧭 http://64.55.156.	4/broadWeb/bwMain.asp?pos=project&ProjIdb	bw=1&ProjName=LiveDe 💙 😽 🗶 ಶ Live Search			
🖕 Favorites 🛛 🍰 🖉 Suggested Sites 👻 🖉 Web Slice Gallery 👻					
👹 Tag : VLC22_AIO		🏠 🔹 🔝 🕤 🖃 🖶 👻 Bage 🔹 Safety 🔹 Tools 🔹 🔞 👻			
	BroadWin WebAccess Proje	ct Manager Quick Start Help Home Logout			
	•				
	<u>Taq Property</u> <u>Delete</u>	<u>^</u>			
Project / Node	Tag : LiveDemo • SCADAnode	1 • 7 • VLC _22 • VLC22_AI0			
SCADAnode1	- Tag Type	Point (analog)			
Dort3 (tcpip)	Tag Name				
BlockTags	Tag Name				
Port6 (api)	Description	Analog Input Object I ypelvo=0 PresentValue=85			
Dert7 (tcpip)	Scan Type	Constant Scan			
	Address	0.0.85			
VLC22 AIO	Conversion Code	AUTO			
VLC22 AI1	Start hit	0			
VLC22 AI10 VLC22 AI11	otar br				
VLC22 AI12	Length	16			
VLC22 AI13	Signal Reverse	No			
VLC22 AI14	Scaling Type	No Scale			
VLC22 AI15 VLC22 AI2	Scaling factor 1	0			
VLC22 AI3					
VLC22 AI4	Scaling factor 2	0			
VLC22 AI5	Log Data	No			
VLC22 AIO VLC22 AI7	Data Log Dead Band	3 %			
VLC22 AI8	Write Action Log	Vec			
<u>VLC22_A00</u>	P IOI				
VLC22 A01	Read Only	res			
	Keep Previous Value	No			
Done		😜 Internet			