

## 2080sc-BAC BACNet Utilities Notes (v2.1)

Access Level: Everyone

### Question:

How can I test the 2080sc-BAC module using the BACNet utilities?

### Answer:

The BACNet utilities allow using a Windows PC on the same network as the 2080sc-BAC module access to the BACnet Objects for reading and writing data.

The BACNet utilities are available for download at:

<https://www.spectrumcontrols.com/products/2080-micro800/2080sc-bac/>

For these examples, the 2080sc-BAC module is configured with a device instance of 200121, and a LAN type of BACnet/IP at 192.168.2.92 with the default UDP port 0xBAC0:

Device	Instance: 200121 * Name: Spectrum BACNET1 *
LAN	LAN Type: <input checked="" type="radio"/> BACnet/IP <input type="radio"/> MS/TP UDP Port: 0x BAC0 * IP Address: 192 . 168 . 2 . 92 Subnet Mask: 255 . 255 . 255 . 0 Gateway: 192 . 168 . 2 . 1

### Using the BACnet Whols service:

**BACwi** [device-instance] or [device-instance-min] [device-instance-max]

BACwi -1 means send a Who-Is request to all devices on the current network and report the results in a table.

```
C:\BACnet\Bin>bacwi -1
host: sciwin7-AF2 at 192.168.2.98
IP Address: 192.168.2.98
IP Broadcast Address: 255.255.255.255
UDP Port: 0xBAC0 [47808]
BVLIC: Sent Original-Broadcast-NPDU.
BVLIC: Received Original-Broadcast-NPDU.
BVLIC: Received Original-Broadcast-NPDU.
Received I-Am Request from 200121, MAC = 192.168.2.92.186.192
BVLIC: Received Original-Broadcast-NPDU.
Received I-Am Request from 408, MAC = 192.168.2.93.186.192
;Device  MAC                               SNET  SADR                               APDU
;-----
200121  C0:A8:02:5C:BA:C0  0      0                               1476
408     C0:A8:02:5D:BA:C0  0      0                               1476
;
; Total Devices: 2
```

In the above example, the host PC is on the network at 192.168.2.98 and is making a request using the default UDP port 0xBAC0 which is decimal 47808. Two devices respond with an I-Am response, the first one is device 200121 (the 2080sc-BAC module configured for BACnet/IP at 192.168.2.92). The second I-Am response is from device 408, a BACnet router at 192.168.2.93. The table lists the device-instance, MAC address, the Source Network values, the Source Address values (if any), and the length of the APDU (Application Layer Protocol Data Units) which is the packet on the BACnet network. When the device resides on BACnet/IP (ethernet) the APDU can be up to 1476 bytes. On an MS/TP network the length won't be higher than 480.

Finally, the BACwi command reports the total number of devices found that are listed in the table.

BACwi 200121 means send a Who-Is request to device 200121 on the current network and report the results in a table.

```
C:\BACnet\Bin>bacwi 200121
host: sciwin7-AF2 at 192.168.2.98
IP Address: 192.168.2.98
IP Broadcast Address: 255.255.255.255
UDP Port: 0xBAC0 [47808]
BVLIC: Sent Original-Broadcast-NPDU.
BVLIC: Received Original-Broadcast-NPDU.
BVLIC: Received Original-Broadcast-NPDU.
Received I-Am Request from 200121, MAC = 192.168.2.92.186.192
;Device   MAC                               SNET   SADR                               APDU
;-----
; 200121  C0:A8:02:5C:BA:C0           0       0                               1476
;
; Total Devices: 1
```

### Using the BACnet ReadProperty service:

**BACrp** [device-instance] [object-type] [object-instance] [property]

**device-instance:** This unique address number identifies a specific device on the BACnet network. The instance number of the 2080sc-BAC module is configured on the System Configuration tab of the module web page.

Device	Instance: <input type="text" value="200121"/> ★ Name: <input type="text" value="Spectrum BACNET1"/> ★
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**object-type:** The 2080sc-BAC module supports 4 readable IO BACnet object types. Object type is defined as AI=0, AO=1, BI=3, BO=4. Each object type supports a variety of properties. The 4 IO types all support the present value property which has a type identifier of 85. When the BACnet master wants to read the present value of an analog input, the object type of interest is 0. When the BACnet master wants to read the present value of a binary input, the object type of interest is 3.

**object-instance:** This is the object instance number of the object being read. The 2080sc-BAC module supports 64 BACnet object instances for each IO object type and the valid range is from 0 to 63. There can be a total of 64 of each of the 4 IO object types, so 64 analog input objects, 64 analog output objects, etc.

**property:** Each of the 4 IO BACnet object types have a list of properties specific to that type. For the 2080sc-BAC module, most properties are read-only. The present value property is always read/write and has a value of 85. On the analog input and output object types the data type is REAL, and on the binary input and output object types the data type is BACnetBinaryPV which is essentially a Boolean with a response of inactive (0) or active (1).

Some examples follow of how to read a property of the object-type from the device-instance (the assigned node) on the network.

### Read present value:

To read the present value of AI1 at device 200121:

```
bacrp 200121 0 1 85
{param 1} - 200121. This is a module instance number.
{param 2} - 0. This is the object type, defined as AI=0, AO=1, BI=3, BO=4.
{param 3} - 1. This is the object instance (AnalogInput 1).
{param 4} - 85. This is the property. (85=present value).
```

Response:

```

C:\BACnet\Bin>bacrp 200121 0 1 85
host: sciwin7-AF2 at 192.168.2.98
IP Address: 192.168.2.98
IP Broadcast Address: 255.255.255.255
UDP Port: 0xBAC0 [47808]
BVLC: Sent Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Received Original-Unicast-NPDU.
80.800003

```

In the above example, the host PC is on the network at 192.168.2.98 and is making a request to read property 85 of object type 0 object instance 1 from device instance 200121 using the default UDP port 0xBAC0 which is decimal 47808. The response from 200121 is 80.800003.

To read the present value property (85) of BI4 at device 200121:

```

bacwp 200121 3 4 85
{param 1} - 123. This is a module instance number.
{param 2} - 1. This is the object type, defined as AI=0, AO=1, BI=3, BO=4.
{param 3} - 4. This is the object instance (BinaryInput 4).
{param 4} - 85. This is the property. (85=present value).

```

Response:

```

C:\BACnet\Bin>bacrp 200121 3 4 85
host: sciwin7-AF2 at 192.168.2.98
IP Address: 192.168.2.98
IP Broadcast Address: 255.255.255.255
UDP Port: 0xBAC0 [47808]
BVLC: Sent Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Received Original-Unicast-NPDU.
inactive

```

In the above example, the host PC is on the network at 192.168.2.98 and is making a request to read property 85 of object type 3 object instance 4 from device instance 200121 using the default UDP port 0xBAC0 which is decimal 47808. The response from 200121 is inactive or 0.

To read the Object Name property (77) of BI4 at device 200121:

```

C:\BACnet\Bin>bacrp 200121 3 4 77
host: sciwin7-AF2 at 192.168.2.98
IP Address: 192.168.2.98
IP Broadcast Address: 255.255.255.255
UDP Port: 0xBAC0 [47808]
BVLC: Sent Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Received Original-Unicast-NPDU.
"Tower_HAND1"

```

The Object Name property has a data type of CharacterString.

Looking at the tag setup screen for this BAC module, the object name is on the BACnet side of the screen, is an object type BinaryInput, has an object ID = 4 and is false, or inactive.

System Configuration

Tag Setup

Tags

PLC			BACnet		
Tag Name	Data Type	Attribute	Object Name	Object Type	Object ID Present Value
Temp_Chiller	REAL	Read	Temp_Chiller1	AnalogInput	0 95.559998
Temp_Tower	REAL	Read	Temp_Tower1	AnalogInput	1 84.400002
Temp_Ambient	REAL	Read	Temp_Ambient1	AnalogInput	2 83.000000
Temp_Floor	REAL	Read	Temp_Floor1	AnalogInput	3 72.280998
Humidity_Ambient	REAL	Read	Humidity_Ambient1	AnalogInput	4 0.000000
Temp_SP	REAL	Write	Temp_SP1	AnalogOutput	0 0.000000
Fan_Speed	DINT	Write	Fan_Speed1	AnalogOutput	1 0.000000
Pump_Speed	DINT	Write	Pump_Speed1	AnalogOutput	2 0.000000
Tower_FLT	BOOL	Read	Tower_FLT1	BinaryInput	0 false
Chiller_FLT	BOOL	Read	Chiller_FLT1	BinaryInput	1 false
Occupied	BOOL	Read	Occupied_1	BinaryInput	2 false
Tower_AUTO	BOOL	Read	Tower_AUTO1	BinaryInput	3 false
Tower_HAND	BOOL	Read	Tower_HAND1	BinaryInput	4 false
INTO_BW	BOOL	Read	IntoBackWash	BinaryInput	5 false
Floor_Enable	BOOL	Write	Floor_Enable1	BinaryOutput	0 false
Floor_Heat	BOOL	Write	Floor_Heat1	BinaryOutput	1 false
Floor_Cool	BOOL	Write	Floor_Cool1	BinaryOutput	2 false

### Using the BACnet WriteProperty service:

**BACwp** [device-instance] [object-type] [object-instance] [property] [priority] [index] [tag value] [tag value...]

**device-instance:** This unique address number identifies a specific device on the BACnet network. The instance number of the 2080sc-BAC module is configured on the System Configuration tab of the module web page.

Device

Instance:

200121

★

Name:

Spectrum BACNET1

★

**object-type:** The 2080sc-BAC module supports 5 BACNet object types. Object type is defined as AI=0, AO=1, BI=3 and BO=4. Each object type supports a variety of properties. The 4 IO types all support the present value property which has a type identifier of 85. When the BACNet master wants to write the present value of an analog input, the object type of interest is 0. When the BACNet master wants to write the present value of a binary input, the object type of interest is 3.

**object-instance:** This is the object instance number of the object being read. The 2080sc-BAC module supports 64 BACNet object instances for each IO object type and the valid range is from 0 to 63. There can be a total of 64 of each of the 4 IO object types, so 64 analog input objects, 64 analog output objects, etc.

**property:** Each of the 4 IO BACNet object types have a list of properties specific to that type. For the 2080sc-BAC module, most properties are read-only. Present value is the only read/write property for the 4 IO types and has a property value of 85. On the analog input and output object types the data type is REAL, and on the binary input and output object types the data type is BACnetBinaryPV which is essentially a Boolean with a command of inactive (0) or active (1).

**priority:** This parameter is used for setting the priority of the write. If Priority 0 is given, no priority is sent. The BACnet standard states that the value is written at the lowest priority (16) if the object property supports priorities when no priority is sent.

**index:** This integer parameter is the index number of an array. If the property is an array, individual elements can be written to if supported. Use -1 for a single property write. The 2080sc-BAC module does not support arrays.

**tag:** Tag is the integer value of the data type of the value that you are writing. For example, if you were writing a REAL value, you would use a tag of 4. Context tags are created using two tags in a row. The context tag is preceded by a C. Ctag tag. C2 4 creates a context 2 tagged REAL.

Tag Number	NULL (0)
	Boolean (1)
	Unsigned Integer (2)
	Integer (3)
	Real (4)
	String (7)
	Enumerated (9)

**value:** The value is an ASCII representation of some type of data that you are writing. It is encoded using the tag information provided. For example, if you were writing a REAL value of 100.1, you would use 100.1 as the value.

To write a present value of 100.1 to AO2 at device 200121 at priority 12, do this:

```
bacwp 200121 1 2 85 12 -1 4 100.1
```

{param 1} - 200121. This is the module instance number.  
 {param 2} - 1. This is the object type. Object type is defined as AI=0, AO=1, BI=3, BO=4.  
 {param 3} - 2. This is the object instance.  
 {param 4} - 85. This is the property (85=present value).  
 {param 5} - 12. This is the priority.  
 {param 6} - -1. This is the index. Use -1 for a single property write.  
 {param 7} - 4. Value type. Use 4 for AO (REAL=4 datatype).  
 {param 8} - 100.1 Value. This is the actual value to be written to the tag.

After writing a present value of 100.0 to AO7 at device 200121, it would be best to read the present value to verify the change has been made.

To write a present value of 1 to BO2 at device 200121 at priority 15, do this:

```
bacwp 200121 4 2 85 15 -1 9 1
```

{param 1} - 200121. This is the module instance number.  
 {param 2} - 4. This is the object type. Object type is defined as AI=0, AO=1, BI=3, BO=4.  
 {param 3} - 2. This is the object instance.  
 {param 4} - 85. This is the property (85=present value).  
 {param 5} - 15. This is the priority.  
 {param 6} - -1. This is the index. Use -1 for a single property write.  
 {param 7} - 9. Value type. Use 9 for BO.  
 {param 8} - 1. Value. This is the actual value to be written to the tag.

After writing a present value of 1 to BO2 at device 200121, it would be best to read the present value to verify the change has been made.

### Using the BACnet ReadPropertyMultiple service:

**BACrpm** [device-instance] [object-type] [object-instance] [property]

**device-instance:** This unique address number identifies a specific device on the BACnet network. The instance number of the 2080sc-BAC module is configured on the System Configuration tab of the module web page.

Device	Instance: <input type="text" value="200121"/> ★	Name: <input type="text" value="Spectrum BACNET1"/> ★
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**object-type:** The 2080sc-BAC module's 5<sup>th</sup> object type besides the 4 IO types, is Device, object type = 8.

**object-instance:** This is the object instance number of the object being read. The 2080sc-BAC module Device object instance is the same as the device instance, because it is the only one.

**property:** The Device BACNet object type has a list of properties specific to that type. For the 2080sc-BAC module, most properties are read-only. The Object\_Name property has a type identifier of 77. Some read only properties such as the Object\_Name can be changed from the System Configuration tab of the 2080sc-BAC module webpage.

Some examples follow of how to read a property from the device.

To read the Object Name property (77) of the device 200121:

```
C:\BACnet\Bin>bacrpm 200121 8 200121 77
host: sciwin7-AF2 at 192.168.2.98
IP Address: 192.168.2.98
IP Broadcast Address: 255.255.255.255
UDP Port: 0xBAC0 [47808]
BVLC: Sent Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Received Original-Broadcast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Sent Original-Unicast-NPDU.
BVLC: Received Original-Unicast-NPDU.
Device #200121
{
    object-name: "Spectrum BACNET1"
}
```

The Object Name property has a data type of CharacterString.