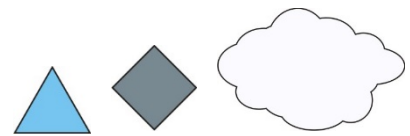




## The BACnetIP Driver

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The BACnetIP driver allows North to interface with a wide range of equipment supporting BACnet. The driver provides operator interface functions to display and adjust values from other BACnet devices, and a controller profile to provide values to a BACnet display. Available for Commander and ObSys.

This document relates to BACnetIP driver version 3.1

Please read the *Commander Manual* or *ObSys Manual* alongside this document, available from [www.northbt.com](http://www.northbt.com)

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# Compatibility with the BACnet System

The BACnetIP driver allows North to interface with a wide range of equipment supporting BACnet. The driver conforms to the BACnet Application Specific Controller, and partially conforms to the BACnet Operator Display device profiles.

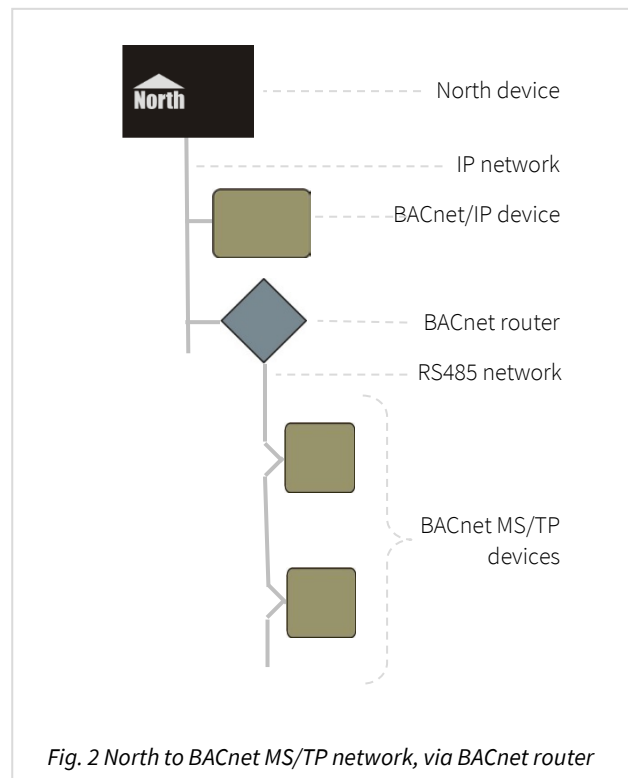
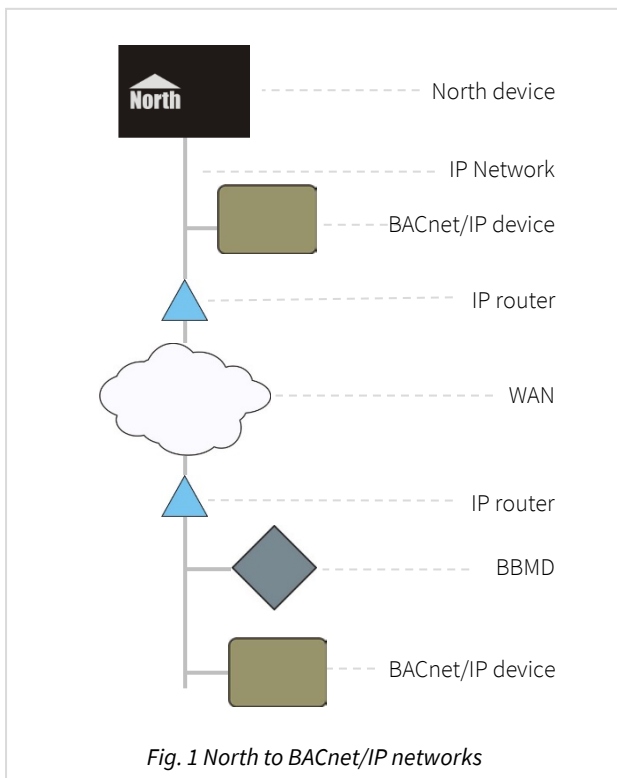
BACnet is an international, European, and American standard for data communication in building automation and control networks – BS EN ISO 16484-5 and ANSI/ASHRAE 135.

The standard defines object-orientated communications between building automation components; describing input, output and control elements, along with their properties and states. The standard also specifies the services used to read and write these elements.

BACnet uses a client-server model. The BACnetIP driver is capable of both requesting values from server devices (i.e. controllers), and providing values from Essential Data and Extra Data within the North device when requested by a client device (i.e. workstation).

The driver connects to an IP network, and is capable of accessing multiple BACnet/IP devices on this local network (Fig. 1). If BACnet/IP devices are located on another network segment, then BACnet broadcast management devices (BBMD) may be required.

BACnet is available over different physical layers including MS/TP (RS485), Point-to-Point (RS232), Ethernet, ARCNET, and LonTalk. To connect with these devices, a BACnet router is required (Fig. 2).



## Equipment

Many different types of BACnet equipment are compatible with the driver, including: HVAC, thermostat, lighting, fire alarm, security, and access control systems.

Equipment is available from many different manufacturers, including: ABB, Alerton, Automated Logic, Cylon, Daikin, Delta Controls, Honeywell, Schneider, Siemens, Trane, Trend Controls, JCI, plus many more.

# Values

The BACnetIP driver is capable of both requesting values from a BACnet controller, and providing values when requested by a BACnet workstation.

## Values available from a BACnet Controller

Depending on the type of equipment, typically values from the following BACnet object types are available:

- Accumulator
- Analog Input
- Analog Output
- Analog Value
- Averaging
- Binary Input
- Binary Lighting Output
- Binary Output
- Binary Value
- Bit String Value
- Calendar
- Channel
- Character String Value
- Command
- Date Pattern Value
- Date Time Pattern
- Date Time Value
- Date Value
- Device
- Large Analog Value
- Lighting Output
- Load Control
- Loop
- Multi-state Input
- Multi-state Output
- Multi-state Value
- Octet String Value
- Positive Integer Value
- Program
- Pulse Counter
- Schedule
- Time Pattern Value
- Time Value
- Timer

To check a BACnet device’s compatibility. Read the manufacturers’ protocol implementation conformance statement (PICS) for information on the BACnet object types and interoperability building blocks (BIBBs) supported. A controller-type device supports data sharing BIBBs ending ‘B’.

## Values available to a BACnet Workstation

The driver presents values from the North device’s Essential Data and Extra Data as BACnet objects, accessible to any device on the BACnet network. Essential Data contains 640 values on Commander, and 1280 values on ObSys. If necessary, start the Extra Data driver (which requires an interface licence) for an additional 1024 values. Access to these values can be controlled by configuring privilege levels within the driver.

Depending on their configuration, values from Essential Data and Extra Data are presented as the following BACnet object types:

| Essential/Extra Data Configuration |    |                |               |            |
|------------------------------------|----|----------------|---------------|------------|
| BACnet Object Type                 |    | Object Type    | Remote Action | Adjustable |
| <b>Analog Input</b>                | 0  | Num or Float   | Read          | No         |
| <b>Analog Output</b>               | 1  | Num or Float   | Write         | Yes        |
| <b>Analog Value</b>                | 2  | Num or Float   | None ‡        | Any ‡      |
| <b>Binary Input</b>                | 3  | NoYes or OffOn | Read          | No         |
| <b>Binary Output</b>               | 4  | NoYes or OffOn | Write         | Yes        |
| <b>Binary Value</b>                | 5  | NoYes or OffOn | None ‡        | Any ‡      |
| <b>Multi-state Input</b>           | 13 | ENum           | Read          | No         |
| <b>Multi-state Output</b>          | 14 | ENum           | Write         | Yes        |
| <b>Multi-state Value</b>           | 19 | ENum           | None ‡        | Any ‡      |

‡ BACnet Value object types are presented from Essential/Extra Data when the remote action and adjustable settings do not match those of the BACnet Input or Output object types. E.g. a read remote action and adjustable.

Object instance numbers in the range 1...1280 are from Essential Data, and 2001...3024 are from Extra Data.

## PIC Statement

A protocol implementation conformance statement (PICS) is available at the end of this document, describing the BACnet objects and BACnet interoperability building blocks (BIBBs) supported by North devices.

## Prerequisites

All BACnet devices must be configured with a unique address on the network – set by the BACnet instance number. North devices are configured with a default address in the range 33000, plus the last part of the IP address.

The BACnetIP driver requires Essential Data v3.0 (build 01/09/2015) or later.

## BACnet and IP Sub-networks

BACnet uses broadcast messages that will not easily travel between different IP sub-networks. If you are connecting devices across different sub-networks, then a BACnet Broadcast Management Device (BBMD) will be required for each sub-network.

The BBMD receives broadcast messages on one sub-network, and then re-sends the message to other BBMDs for broadcast onto their network segment.

The BACnetIP driver can register as a Foreign Device with compatible BBMDs. This allows the driver to sit on its own sub-network and use a BBMD on a remote network to receive broadcast messages.

BBMD functions are often available within some BACnet controllers, or a BACnet router.

## BACnet Routers

The BACnetIP driver connects directly to an IP network, and supports BACnet/IP (Annex J).

BACnet is also available on devices supporting different physical layers. These include MS/TP (RS485), Point-to-Point (RS232), Ethernet, ARCNET, and LonTalk.

To connect with devices supporting a different physical layer, a BACnet router is required.

Two different BACnet routers are available from North – a BACnet/IP to MS/TP router (order code MISC/BACIP/MSTP), and a BACnet router supporting common physical layers (order code MISC/BACROUTER).

# Using the Driver

On ObSys and Commander, the BACnetIP driver is pre-installed. On all of these North devices, you can use the driver to create an interface to a BACnet/IP network. Once started, you will need to set up the driver before it can communicate with the BACnet system.

The BACnetIP driver uses zero licence units.

## Starting the Interface

- 📖 To start an interface using the BACnetIP driver, follow these steps:
  - **Start Engineering** your North device using ObSys
  - Navigate to **Configuration, Interfaces**, and set a unused **Interface** to 'BACnetIP' to start the particular interface
  - Navigate to the top-level of your North device, then rescan it

The driver setup object (Mc), labelled **BACnet/IP Interface**, should now be available.

## Setting up the Driver

- 📖 To set up the driver, follow these steps:
  - Navigate to the **BACnet/IP Interface** object (Mc). For example, if you started interface 1 with the driver earlier, then the object reference will be 'M1'
  - Check the **BACnet Device Instance** object (BI) value is a unique address on the BACnet inter-network
  - On multi-homed devices, check the **Current IP Address** object (CIA) is using the correct IP network. If required, set the **Preferred IP Address** object (IA) to a different available IP address

## Checking Communications

You can check the interface is communicating by reading the **BACnet Operational** object (DS). A value of 'yes' indicates the driver has opened a BACnet/IP port at the IP address indicated. If the value is 'no', then check that no other BACnet software is running.

The **Database Objects Available** object (EDC) indicates the maximum values available to a BACnet workstation from Essential and Extra Data.

Scan the **BACnet System** to discover other BACnet devices on the network.

# Object Specifications

Once an interface is started, one or more extra objects become available within the top-level object of the device. As with all North objects, each of these extra objects may contain sub-objects, (and each of these may contain sub-objects, and so on) - the whole object structure being a multi-layer hierarchy. It is possible to navigate around the objects using the ObSys Engineering Software.

An example of a reference to an object in a different device: the IP network object contains

Each object is specified below, along with its sub-objects.

## Example Object Reference

An example of a reference to an object in the same device: the BACnet/IP network (S1) contains a BACnet device at instance 150 (D150), which contains a value found in Analog Value 1 (AV1.V). Therefore, the complete object reference is 'S1.D150.AV1.V'.

An example of a reference to an object in a different device: the IP network object (IP) contains Default Commander object (CDIP), which contains the object above (S1.D150.AV1.V) – therefore the complete object reference is 'IP.CDIP.S1.D150.AV1.V'.

## Device Top-Level Objects

When an interface is started using the BACnet/IP driver, the objects below become available within the top-level object of the device. For example, if interface 1 is started, then the object references 'M1' and 'S1' become available.

| Description   | Reference | Type   |
|---|-----------|--|
| <b>BACnet/IP Interface</b><br>Set up the BACnetIP driver, started on interface <i>c</i> ( <i>c</i> is the interface number) | Mc        | Fixed Container:<br>On the Commander platform this will be<br><i>[CDM v20\BACnetIP v31]</i><br>On the ObSys platform this will be<br><i>[OSM v20\BACnetIP v31]</i> |
| <b>BACnet Network</b><br>Access BACnet system connected to interface <i>c</i> ( <i>c</i> is the interface number)           | Sc        | Variable Container:<br><i>[BACnetIP v31]</i>   |



# BACnet/IP Interface

Object Type: [OSM v20\BACnetIP v31]

Object Type: [CDM v20\BACnetIP v31]

The BACnet/IP Interface contains the following objects:

| Description  | Reference | Type   |
|--|-----------|--|
| <b>System Label</b><br>Label displayed when scanning the system  | DL        | Obj\Text: 20chars; Adjustable  |
| <b>BACnet Operational</b><br>Indicates if the BACnet/IP port is open. A value of 'No' indicates a problem, this could be caused by another application opening the BACnet/IP port, a BACnet device instance of 0, or an invalid IP address                                 | DS        | Obj\NoYes  |
| <b>BACnet Device Instance</b><br>The address on the BACnet network, from which it can be referenced by other devices. This number must be unique across the entire BACnet inter-network  | BI        | Obj\Num; Adjustable; Range: 1...4194303<br>On initialization, set to 33000 + last part of IP address   |
| <b>Current IP Address</b><br>IP address currently opened by the driver   | CIA       | Obj\IP   |
| <b>Preferred IP Address</b><br>If multiple IP networks are available, set which available IP address to use  | IA        | Obj\IP; Adjustable   |
| <b>BACnet Port Number</b><br>BACnet/IP devices on the same LAN must use the same UDP port number   | PN        | Obj\Num; Adjustable; Range: 0...65535<br>Set to 47808 (0xBAC0) by default  |
| <b>APDU Segment Timeout (ms)</b><br>In order to achieve reliable communication, it is recommended that the APDU timeouts of all interconnecting devices should contain the same value. These values may also be configured by devices on the BACnet network                | ST        | Obj\Num; Adjustable; Range: 500...60000<br>Set to 2000ms by default  |
| <b>APDU Timeout (ms)</b><br>It is recommended that an APDU timeout less than 4000ms is specified. See also note for APDU Segment Timeout   | AT        | Obj\Num; Adjustable; Range: 500...60000<br>Set to 3000ms by default  |
| <b>Device Communication</b><br>Use to temporarily disable BACnet communication   | DC        | Obj\Enum; Adjustable; Range: 0...2<br>Values: 0=Enabled, 1=Disable all Communication, 2=Disable client (outbound) requests   |
| <b>Access Password</b><br>The access password is used to restrict access to the BACnetIP driver from devices using the BACnet ReinitializeDevice and DeviceCommunicationControl services. Devices using these services will need to include the password as specified here | PSW       | Obj\Text: max 20 chars; Adjustable   |
| <b>Default Character Encoding</b><br>When writing a character string property to a device, or when a BACnet device reads a property from the driver, the value is encoded using the character encoding specified.  | CE        | Obj\Enum; Range: 0...5; Adjustable<br>Values: 0=UTF-8 (recommended), 5=ISO 8859-1<br>On the ObServer platform, character encoding using the following are also supported:<br>1=IBM/Microsoft DBCS, 4=UCS-2 |
| <b>Show Unsupported Objects</b><br>When scanning a device, show unsupported BACnet object types  | SU        | Obj\NoYes; Adjustable  |

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Database Objects Available</b><br>Count of maximum objects available from Essential Data and Extra Data.   | EDC       | Obj\Num  |
| <b>Database Privilege Levels</b><br>Configure privilege levels to control read and adjust access to Essential Data and Extra Data from a BACnet workstation | S         | Fixed Container:<br>On the Commander platform this will be <i>[CDM v20\BACnetIP v31\Security]</i><br>On the ObSys platform this will be <i>[OSM v20\BACnetIP v31\Security]</i> |
| <b>Foreign Device</b><br>Configure options for driver to register with a BBMD, on multi-network installations   | FD        | Fixed Container:<br>On the Commander platform this will be <i>[CDM v20\BACnetIP v31\Foreign]</i><br>On the ObSys platform this will be <i>[OSM v20\BACnetIP v31\Foreign]</i>   |
| <b>Static Device List</b><br>If a BACnet device does not support auto-discovery, then its address can be entered here                                       | SD        | Fixed Container:<br>On the Commander platform this will be <i>[CDM v20\BACnetIP v31\Static]</i><br>On the ObSys platform this will be <i>[OSM v20\BACnetIP v31\Static]</i>     |

# Database Privilege Levels

Object Type: [CDM v20\BACnetIP v31\Security]

Object Type: [OSM v20\BACnetIP v31\Security]

## Security Areas and Levels

Within the North security model, there are eight security areas. Security areas could be actual areas in a building, but are normally functional areas – for example, ‘environmental control’ and ‘North engineering’ areas would allow a user to have different privileges in controlling set points and engineering Commanders.

Typically, a user is assigned a privilege level in each of the eight areas. The level is in the range zero to seven, seven being the most powerful. When a user wishes to pass a door, his/her privilege level in the door’s area is checked against the minimum required for that area – and then either allowed to pass, or rejected.

The engineer must decide the use of the eight areas. The engineer must also decide the power of the privilege levels. Most systems use only a few levels per area: 0=None, 1=Guest, 2=User, 7=Administrator.

As an example, imagine a page of values in Essential Data. The page needs a user to have a minimum privilege level of 2 in area 1 before it can be viewed. The page is available in a Web browser that checks users with a security database. User A has privilege level 7 in area 1 – she can view the page. User B has privilege level 5 in area 1 – he can also view the page. User C has privilege level 1 in area 1 – she cannot view the page.

The example continues: within this page of values in Essential Data is a temperature set point object. Users need a minimum privilege level of 6 in area 1 to adjust it – therefore User A can adjust the set point, but User B cannot.

## Specifying Access Security

Essential Data and Extra Data have Access Security objects to control who can view a page, and who can adjust an adjustable object.

Each Access Security object has a two-digit value. Each controls the access to a particular feature - such as viewing the page, or adjusting the value. The two-digit value is made up of the area digit (1-8), followed by the minimum privilege level (1-7) – for example, if the minimum privilege level is 6 in area 2, then the two digit value is 26. If the value is 00, then no security checks are made.

## BACnet/IP Driver

The Database Privilege Levels object contains a privilege level for each of the eight security areas, representing a virtual user. The BACnetIP driver uses these to control access to Essential Data and Extra Data when reading or adjusting a value.

| Description  | Reference | Type                              |
|--|-----------|-----------------------------------|
| <b>Privilege Level in Area x</b><br>The area, x, can be in the range 1...8 | Px        | Obj\Num; Adjustable; Range: 0...7 |

# Foreign Device

Object Type: [CDM v20\BACnetIP v31\Foreign]

Object Type: [OSM v20\BACnetIP v31\Foreign]

The BACnet/IP protocol uses IP broadcast messages. As most routers do not pass broadcast messages between sub-networks, a BACnet broadcast management device (BBMD) is required on each sub-network to perform this function.

If a BBMD is available on the same sub-network as the North device, then no configuration is required. The BBMD will automatically re-transmit broadcast messages.

If a BBMD is only available on a remote network, then configure that BBMD's IP address here and enable foreign device registration. The driver will then register with the BBMD so that it can communicate across sub-networks.

| Description                               | Reference | Type                                   |
|---|-----------|--|
| <b>Enable foreign device registration</b> | E         | Obj\NoYes; Adjustable                  |
| <b>BBMD Server IP Address</b>             | SIP       | Obj\IP; Adjustable                     |
| <b>Registration Lifetime (secs)</b>       | TTL       | Obj\Num: 30...32400 (9hrs); Adjustable |

## Static Device List

Object Type: *[CDM v20\BACnetIP v31\Static]*

Object Type: *[OSM v20\BACnetIP v31\Static]*

Certain BACnet devices, such as MS/TP slaves, do not respond to Who-Is device discovery messages. The static device list provides a mechanism to manually enter a BACnet device's address.

| Description  | Reference | Type   |
|--|-----------|--|
| <b>Only Scan Static Devices</b><br>Stops device discovery and only lists static devices when scanning the BACnet network object                                  | OS        | Obj\NoYes; Adjustable  |
| <b>Alias <i>a</i></b><br>The alias, <i>a</i> , is in the range 1...20. Enter details for a static device, including BACnet instance, IP address, and MAC address | <i>Aa</i> | Fixed Container:<br>On the Commander platform this will be <i>[CDM v20\BACnetIP v31\Static\Alias]</i><br>On the ObSys platform this will be <i>[OSM v20\BACnetIP v31\Static\Alias]</i> |

## Static Device Alias

Object Type: *[CDM v20\BACnetIP v31\Static\Alias]*

Object Type: *[OSM v20\BACnetIP v31\Static\Alias]*

A BACnet device's address and basic communication parameters.

| Description  | Reference | Type   |
|--|-----------|--|
| <b>BACnet Device Instance</b>  | BI        | Obj\Num; Adjustable; Range: 1...4194303  |
| <b>IP Address</b><br>IP address of the device, or BACnet router  | IA        | Obj\IP; Adjustable   |
| <b>IP Port Number</b><br>BACnet UDP port number of the device. If set '0', then driver's BACnet Port Number will be used | PN        | Obj\Num; Adjustable; Range: 0...65535  |
| <b>Network Number</b><br>BACnet network number. Set to '0' if on the same BACnet/IP network                              | N         | Obj\Num: 0...65534; Adjustable   |
| <b>MAC Address</b><br>Dependent on the network layer. For MS/TP networks a 1 byte address                                | MAC       | Obj\Text (hex value); Adjustable   |
| <b>Maximum APDU Length</b><br>Set to match the value reported in the device Information object                           | AL        | Obj\Num: 50, 128, 206, 480, 1024, 1476 ;Adjustable   |
| <b>Segmentation Supported</b><br>Set to match the value reported in the device Information object                        | SEG       | Obj\Enum; Range: 0...3; Adjustable<br>Values: 0=None, 1=Transmit only, 2=Receive only, 3=Both (transmit/receive) |

# BACnet Network

Object Type: *[BACnetIP v31]*

The BACnet network is a network of devices supporting the BACnet standard. It includes devices on the connected BACnet/IP network, and devices on different inter-connected networks including BACnet MS/TP, Point-to-Point, Ethernet, ARCNET, etc.

The BACnet network contains the following objects:

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Device Name</b><br>The BACnet device number, $x$ , is in the range 1...4194303   | $Dx$      | Variable container:<br><i>[BACnetIP v31\Dev]</i> |
| <b>Network <math>a</math></b><br>Network of devices available via a BACnet router. The BACnet network number, $a$ , is in the range 1...65534.<br>This is used to present devices by network. The network reference is optional, and can be omitted from the full object reference. | $Na$      | Variable container:<br><i>[BACnetIP v31]</i>     |
| <b>Broadcast Date &amp; Time</b><br>Update all devices with the current date and time   | BT        | Obj\NoYes; Adjustable only                       |

# BACnet Device

Object Type: *[BACnetIP v31\Dev]*

The driver supports the following type of BACnet objects from a device. Scan the device to discover the BACnet objects available.

The object instance number, *x*, for the following objects is dependent upon engineering within the device.

| Description                        | Reference | Type   |
|------------------------------------|-----------|--|
| <b>Device Information</b>          | I         | Fixed container:<br><i>[BACnetIP v31\PIC]</i>        |
| <b>Network Port name</b>           | NETx      | Fixed container:<br><i>[BACnetIP v31\NetPort]</i>    |
| <b>Analog Input name</b>           | AIx       | Fixed container:<br><i>[BACnetIP v31\AnIn]</i>       |
| <b>Analog Output name</b>          | AOx       | Fixed container:<br><i>[BACnetIP v31\AnOut]</i>      |
| <b>Analog Value name</b>           | AVx       | Fixed container:<br><i>[BACnetIP v31\AnVal]</i>      |
| <b>Binary Input name</b>           | BIx       | Fixed container:<br><i>[BACnetIP v31\BinIn]</i>      |
| <b>Binary Output name</b>          | BOx       | Fixed container:<br><i>[BACnetIP v31\BinOut]</i>     |
| <b>Binary Value name</b>           | BVx       | Fixed container:<br><i>[BACnetIP v31\BinVal]</i>     |
| <b>Calendar name</b>               | CALx      | Fixed container:<br><i>[BACnetIP v31\Calendar]</i>   |
| <b>Command name</b>                | CMDx      | Fixed container:<br><i>[BACnetIP v31\Command]</i>    |
| <b>Event Enrolment name</b>        | EEx       | Fixed container:<br><i>[BACnetIP v31\EvtEnr]</i>     |
| <b>Loop name</b>                   | LPx       | Fixed container:<br><i>[BACnetIP v31\Loop]</i>       |
| <b>Multi-State Input name</b>      | Mix       | Fixed container:<br><i>[BACnetIP v31\MultiIn]</i>    |
| <b>Multi-State Output name</b>     | MOx       | Fixed container:<br><i>[BACnetIP v31\MultiOut]</i>   |
| <b>Program name</b>                | PRGx      | Fixed container:<br><i>[BACnetIP v31\Program]</i>    |
| <b>Schedule name</b>               | SCx       | Fixed container:<br><i>[BACnetIP v31\Schedule]</i>   |
| <b>Averaging name</b>              | AVGx      | Fixed container:<br><i>[BACnetIP v31\Avg]</i>        |
| <b>Multi-State Value name</b>      | MVx       | Fixed container:<br><i>[BACnetIP v31\MultiVal]</i>   |
| <b>Accumulator name</b>            | ACCx      | Fixed container:<br><i>[BACnetIP v31\Acc]</i>        |
| <b>Pulse Converter name</b>        | PCTx      | Fixed container:<br><i>[BACnetIP v31\Pulse]</i>      |
| <b>Load Control name</b>           | LDCx      | Fixed container:<br><i>[BACnetIP v31\Load]</i>       |
| <b>Timer name</b>                  | TMRx      | Fixed container:<br><i>[BACnetIP v31\Timer]</i>      |
| <b>Bit String Value name</b>       | BSVx      | Fixed container:<br><i>[BACnetIP v31\BitStrVal]</i>  |
| <b>Character String Value name</b> | CSVx      | Fixed container:<br><i>[BACnetIP v31\CharStrVal]</i> |

| <b>Description</b>                  | <b>Reference</b> | <b>Type</b>                                    |
|-------------------------------------|------------------|--|
| <b>Date Pattern name</b>            | DPVx             | Fixed container:<br>[BACnetIP v31\DatePat]     |
| <b>Date Value name</b>              | DVx              | Fixed container:<br>[BACnetIP v31\DateVal]     |
| <b>Date Time Pattern Value name</b> | DTPx             | Fixed container:<br>[BACnetIP v31\DateTimePat] |
| <b>Date Time Value name</b>         | DTVx             | Fixed container:<br>[BACnetIP v31\DateTimeVal] |
| <b>Integer Value name</b>           | IVx              | Fixed container:<br>[BACnetIP v31\IntVal]      |
| <b>Large Analog Value name</b>      | AVLx             | Fixed container:<br>[BACnetIP v31\AnValLg]     |
| <b>Octet String Value name</b>      | OSVx             | Fixed container:<br>[BACnetIP v31\OctStrVal]   |
| <b>Positive Integer Value name</b>  | IVPx             | Fixed container:<br>[BACnetIP v31\IntValPos]   |
| <b>Time Pattern Value name</b>      | TPVx             | Fixed container:<br>[BACnetIP v31\TimePat]     |
| <b>Time Value name</b>              | TVx              | Fixed container:<br>[BACnetIP v31\TimeVal]     |
| <b>Channel name</b>                 | DCx              | Fixed container:<br>[BACnetIP v31\Channel]     |
| <b>Lighting Output name</b>         | LOAx             | Fixed container:<br>[BACnetIP v31\LtgOut]      |
| <b>Binary Lighting Output name</b>  | LOBx             | Fixed container:<br>[BACnetIP v31\LtgOutBin]   |
| <b>Unsupported Object Type</b>      | yx               | Fixed container:<br>[BACnetIP v31\Unknown]     |



# Device Information

Object Type: *[BACnetIP v31\PIC]*

Device Information contains a summary of the device's BACnet capabilities. Support for some objects is optional.

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Name</b>   | N         | Obj\Text   |
| <b>Location</b>   | R58       | Obj\Text   |
| <b>Description</b>  | D         | Obj\Text; Adjustable   |
| <b>System Status</b>  | S         | Obj\Enum; Range: 0...5<br>Values: 0=Operational, 1=Operational (read-only), 3=Download in progress, 4=Non-operational, 5=Backup in progress  |
| <b>Reinitialize Device</b>  | RST       | Obj\Enum; Range: 0...1; Adjustable-only<br>Values: 0=Cold start, 1=Warm start, 7=Activate changes<br>Some devices require an optional password. This should be included when adjusting the value in the format '<restart-type> <password>' |
| <b>Local Date</b>   | LD        | Obj\Date   |
| <b>Local Time</b>   | LT        | Obj\Time   |
| <b>Date &amp; Time</b><br>Use to set the date and time in the device  | TIME      | Obj\DateTime; Adjustable   |
| <b>Vendor Name</b>  | R121      | Obj\Text   |
| <b>Vendor ID</b><br>A list of BACnet vendor identifiers is available from <a href="http://www.bacnet.org">www.bacnet.org</a>  | R120      | Obj\Num; Range: 0...65535  |
| <b>Model Name</b>   | R70       | Obj\Text   |
| <b>Serial Number</b>  | R372      | Obj\Text   |
| <b>Firmware Version</b>   | R44       | Obj\Text   |
| <b>Software Version</b>   | R12       | Obj\Text   |
| <b>Database Revision</b>  | R155      | Obj\Num; Range: 0...255  |
| <b>Total Objects</b>  | R76.E0    | Obj\Num  |
| <b>BACnet Version</b>   | R98       | Obj\Num  |
| <b>BACnet Revision</b>  | R139      | Obj\Num  |
| <b>Segmentation Supported</b>   | R107      | Obj\Enum; Range: 0...3<br>Values: 0=Both (transmit/receive), 1=Transmit only, 2=Receive only, 3=None   |
| <b>Maximum Segments Supported</b>   | R167      | Obj\Num  |
| <b>Maximum APDU Length</b>  | R62       | Obj\Num; Range: 50...1476  |
| <b>APDU Timeout (ms)</b><br>In order to achieve reliable communication, it is recommended that the APDU timeouts of all interconnecting devices should contain the same value         | R11.U     | Obj\Num; Adjustable; Range: 3000...10000   |
| <b>APDU Segment Timeout (ms)</b><br>In order to achieve reliable communication, it is recommended that the APDU timeouts of all interconnecting devices should contain the same value | R10.U     | Obj\Num; Adjustable; Range: 2000...10000   |
| <b>APDU Retries</b>   | R73.U     | Obj\Num; Adjustable; Range: 0...99   |
| <b>Services Supported</b><br>Indicates which standard protocol services are executed by this device   | R97       | Fixed container:<br><i>[BACnetIP v31\PIC\Svc]</i>  |
| <b>Object Types Supported</b><br>Indicates which standard object types can be present in this device  | R96       | Fixed container:<br><i>[BACnetIP v31\PIC\Obj]</i>  |

# BACnet Services Supported

Object Type: [BACnetIP v31\PIC\Svc]

The BACnet Services Supported indicates which standard protocol services are executed by the remote BACnet device's protocol implementation.

| Description                                  | Reference | Type      |
|--|-----------|-----------|
| <b>Acknowledge Alarm</b>                     | B0        | Obj\NoYes |
| <b>Confirmed COV Notification</b>            | B1        | Obj\NoYes |
| <b>Confirmed COV Notification Multiple</b>   | B42       | Obj\NoYes |
| <b>Confirmed Event Notification</b>          | B2        | Obj\NoYes |
| <b>Get Alarm Summary</b>                     | B3        | Obj\NoYes |
| <b>Get Enrolment Summary</b>                 | B4        | Obj\NoYes |
| <b>Get Event Information</b>                 | B39       | Obj\NoYes |
| <b>Life Safety Operation</b>                 | B37       | Obj\NoYes |
| <b>Subscribe COV</b>                         | B5        | Obj\NoYes |
| <b>Subscribe COV Property</b>                | B38       | Obj\NoYes |
| <b>Subscribe COV Property Multiple</b>       | B41       | Obj\NoYes |
| <b>Atomic Read File</b>                      | B6        | Obj\NoYes |
| <b>Atomic Write File</b>                     | B7        | Obj\NoYes |
| <b>Add List Element</b>                      | B8        | Obj\NoYes |
| <b>Remove List Element</b>                   | B9        | Obj\NoYes |
| <b>Create Object</b>                         | B10       | Obj\NoYes |
| <b>Delete Object</b>                         | B11       | Obj\NoYes |
| <b>Read Property</b>                         | B12       | Obj\NoYes |
| <b>Read Property Multiple</b>                | B14       | Obj\NoYes |
| <b>Read Range</b>                            | B35       | Obj\NoYes |
| <b>Write Group</b>                           | B40       | Obj\NoYes |
| <b>Write Property</b>                        | B15       | Obj\NoYes |
| <b>Write Property Multiple</b>               | B16       | Obj\NoYes |
| <b>Device Communication Control</b>          | B17       | Obj\NoYes |
| <b>Confirmed Private Transfer</b>            | B18       | Obj\NoYes |
| <b>Confirmed Text Message</b>                | B19       | Obj\NoYes |
| <b>Reinitialize Device</b>                   | B20       | Obj\NoYes |
| <b>Virtual Terminal Open</b>                 | B21       | Obj\NoYes |
| <b>Virtual Terminal Close</b>                | B22       | Obj\NoYes |
| <b>Virtual Terminal Data</b>                 | B23       | Obj\NoYes |
| <b>I-Am</b>                                  | B26       | Obj\NoYes |
| <b>I-Have</b>                                | B27       | Obj\NoYes |
| <b>Unconfirmed COV Notification</b>          | B28       | Obj\NoYes |
| <b>Unconfirmed COV Notification Multiple</b> | B43       | Obj\NoYes |
| <b>Unconfirmed Event Notification</b>        | B29       | Obj\NoYes |
| <b>Unconfirmed Private Transfer</b>          | B30       | Obj\NoYes |
| <b>Unconfirmed Text Message</b>              | B31       | Obj\NoYes |
| <b>Time Synchronisation</b>                  | B32       | Obj\NoYes |
| <b>UTC Time Synchronisation</b>              | B36       | Obj\NoYes |
| <b>Who-Has</b>                               | B33       | Obj\NoYes |
| <b>Who-Is</b>                                | B34       | Obj\NoYes |

# BACnet Objects Types Supported

Object Type: [BACnetIP v31\PIC\Obj]

The BACnet Object Types Supported indicates which standard object types can be present in the BACnet device's protocol implementation.

| Description                    | Reference | Type      |
|--------------------------------|-----------|-----------|
| <b>Access Credential</b>       | B32       | Obj\NoYes |
| <b>Access Door</b>             | B30       | Obj\NoYes |
| <b>Access Point</b>            | B33       | Obj\NoYes |
| <b>Access Rights</b>           | B34       | Obj\NoYes |
| <b>Access User</b>             | B35       | Obj\NoYes |
| <b>Access Zone</b>             | B36       | Obj\NoYes |
| <b>Accumulator</b>             | B23       | Obj\NoYes |
| <b>Alert Enrolment</b>         | B52       | Obj\NoYes |
| <b>Analog Input</b>            | B0        | Obj\NoYes |
| <b>Analog Output</b>           | B1        | Obj\NoYes |
| <b>Analog Value</b>            | B2        | Obj\NoYes |
| <b>Averaging</b>               | B18       | Obj\NoYes |
| <b>Binary Input</b>            | B3        | Obj\NoYes |
| <b>Binary Output</b>           | B4        | Obj\NoYes |
| <b>Binary Value</b>            | B5        | Obj\NoYes |
| <b>Bit String Value</b>        | B39       | Obj\NoYes |
| <b>Calendar</b>                | B6        | Obj\NoYes |
| <b>Channel</b>                 | B53       | Obj\NoYes |
| <b>Character String Value</b>  | B40       | Obj\NoYes |
| <b>Command</b>                 | B7        | Obj\NoYes |
| <b>Credential Data Input</b>   | B37       | Obj\NoYes |
| <b>Date Pattern Value</b>      | B41       | Obj\NoYes |
| <b>Date Value</b>              | B42       | Obj\NoYes |
| <b>Date Time Pattern Value</b> | B43       | Obj\NoYes |
| <b>Date Time Value</b>         | B44       | Obj\NoYes |
| <b>Device</b>                  | B8        | Obj\NoYes |
| <b>Elevator Group</b>          | B57       | Obj\NoYes |
| <b>Escalator</b>               | B58       | Obj\NoYes |
| <b>Event Enrolment</b>         | B9        | Obj\NoYes |
| <b>Event Log</b>               | B25       | Obj\NoYes |
| <b>File</b>                    | B10       | Obj\NoYes |
| <b>Global Group</b>            | B26       | Obj\NoYes |
| <b>Group</b>                   | B11       | Obj\NoYes |
| <b>Integer Value</b>           | B45       | Obj\NoYes |
| <b>Large Analog Value</b>      | B46       | Obj\NoYes |
| <b>Life Safety Point</b>       | B21       | Obj\NoYes |
| <b>Life Safety Zone</b>        | B22       | Obj\NoYes |
| <b>Lift</b>                    | B59       | Obj\NoYes |
| <b>Lighting Output</b>         | B54       | Obj\NoYes |
| <b>Load Control</b>            | B28       | Obj\NoYes |
| <b>Loop</b>                    | B12       | Obj\NoYes |
| <b>Multi-state Input</b>       | B13       | Obj\NoYes |
| <b>Multi-state Output</b>      | B14       | Obj\NoYes |
| <b>Multi-state Value</b>       | B19       | Obj\NoYes |
| <b>Network Port</b>            | B56       | Obj\NoYes |
| <b>Network Security</b>        | B38       | Obj\NoYes |
| <b>Notification Class</b>      | B15       | Obj\NoYes |
| <b>Notification Forwarder</b>  | B51       | Obj\NoYes |
| <b>Octet String Value</b>      | B47       | Obj\NoYes |

| Description                   | Reference | Type      |
|-------------------------------|-----------|-----------|
| <b>Positive Integer Value</b> | B48       | Obj\NoYes |
| <b>Program</b>                | B16       | Obj\NoYes |
| <b>Pulse Converter</b>        | B24       | Obj\NoYes |
| <b>Schedule</b>               | B17       | Obj\NoYes |
| <b>Structured View</b>        | B29       | Obj\NoYes |
| <b>Time Pattern Value</b>     | B49       | Obj\NoYes |
| <b>Time Value</b>             | B50       | Obj\NoYes |
| <b>Timer</b>                  | B31       | Obj\NoYes |
| <b>Trend Log</b>              | B20       | Obj\NoYes |
| <b>Trend Log Multiple</b>     | B27       | Obj\NoYes |

# Network Port

Object Type: [BACnetIP v31\NetPort]

Network Port provides access to the configuration and properties of network ports of a device.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b>   | N             | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text; Adjustable  |
| <b>Status Flag <i>b</i></b><br>Health of the analogue input. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 3=Out of Service | SF.B <i>b</i> | Obj\NoYes   |
| <b>Reliability</b><br>Indicates if the network port and connected network are reliable.<br>Device support for this object is optional                                   | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault, 17= Activation, 18=DHCP, 19=FD reg, 20=AutoNeg, 21=Restart |
| <b>Out of Service</b><br>Indicates if the network port is not in service disabling all communications through it  | US            | Obj\NoYes; Adjustable   |
| <b>Network Type</b><br>Type of network the port object is representing  | R427          | Obj\Enum: 0...10<br>Values: 0=Ethernet, 1=ARCNET, 2=MSTP, 3=PTP, 4=LonTalk, 5=IPv4, 6=ZigBee, 7=Virtual, 9=IPv6, 10=Serial  |
| <b>Protocol Level</b>   | R482          | Obj\Enum: 0...3<br>Values: 0=Physical, 1=Protocol, 2=BACnet App, 3=Non-BACnet App   |
| <b>Reference Port</b><br>Device support for this object is optional   | R483          | Obj\Num   |
| <b>Network Number</b>   | R425          | Obj\Num: 0...65534  |
| <b>Network Number Quality</b>   | R426          | Obj\Enum: 0...3<br>Values: 0=Unknown, 1=Learned, 2=Learned-Configured, 3=Configured   |
| <b>Changes Pending</b><br>Indicates configuration settings have been changed. A Reinitialize Device is required.  | R416          | Obj\NoYes   |
| <b>Command</b><br>Perform an action on the network port.<br>Device support for this object is optional  | CMD           | Obj\Enum: 0...7; Adjustable<br>Values: 0=Idle, 1=Discard changes, 2=Renew FD registration, 3=Discover slaves, 4=Renew DHCP, 5=Start Auto Negotiation, 6=Disconnect, 7=Restart port  |
| <b>BACnet MAC Address</b><br>BACnet MAC address used on this network.<br>For IPv4, typically 4-octet IP followed by 2-octet UDP port                                    | R423.m        | Obj\Text (hex value)  |
| <b>APDU Length</b>  | R399          | Obj\Num: 0...1476   |
| <b>Link Speed (bps)</b>   | R420.R        | Obj\Float; Adjustable (if auto-negotiate is 'Off')<br>'0' = unknown   |
| <b>Link Speed Auto-negotiate</b><br>Indicates if device automatically determines link speed. Device support for this object is optional                                 | R422.S        | Obj\OffOn; Adjustable   |
| <b>Network Interface Name</b><br>Device support for this object is optional   | R424.C        | Obj\Text; Adjustable  |
| <b>BACnet/IP Mode</b>   | R408.A        | Obj\Enum; Adjustable<br>Values: 0=Normal, 1=Foreign, 2=BBMD   |
| <b>IP Address</b>   | R400.Yi       | Obj\IP; Adjustable  |

| Description   | Reference | Type   |
|---|-----------|--|
| <b>BACnet/IP UDP Port</b>   | R412.U    | Obj\Num; Adjustable                                |
| <b>IP Subnet Mask</b>   | R411.Yi   | Obj\IP; Adjustable                                 |
| <b>IP Default Gateway</b>   | R401.Yi   | Obj\IP; Adjustable                                 |
| <b>BACnet/IP Multicast Address</b>  | R409.Yi   | Obj\IP; Adjustable<br>'0.0.0.0' indicates not used |
| <b>DNS Server IP</b>  | R406.E1i  | Obj\IP<br>'0.0.0.0' indicates unknown or not used  |
| <b>DHCP Enable</b><br>Indicates network is configured via DHCP  | R402.S    | Obj\NoYes; Adjustable                              |
| <b>DHCP Lease Time (s)</b><br>Device support for this object is optional  | R403      | Obj\Num<br>'0' indicates unknown                   |
| <b>DHCP Lease Time Remaining (s)</b><br>Device support for this object is optional  | R404      | Obj\Num  |
| <b>DHCP Server IP</b><br>Device support for this object is optional   | R405.i    | Obj\IP<br>'0.0.0.0' indicates unknown              |
| <b>BACnet/IP NAT Traversal</b><br>Device support for this object is optional  | R410.S    | Obj\NoYes; Adjustable                              |
| <b>BACnet/IP Global Address</b><br>IP address and port. Device support for this object is optional  | R407      | Obj\Text   |
| <b>BBMD Accept FD Registration</b><br>For BBMD devices, indicates foreign device registrations are accepted. Device support for this object is optional | R413.S    | Obj\NoYes; Adjustable                              |
| <b>FD BBMD Address</b><br>IP address and port that FD's can register. Device support for this object is optional  | R418      | Obj\Text   |
| <b>FD Subscription Lifetime (s)</b><br>Time a foreign device remains registered. Device support for this object is optional                             | R419.U    | Obj\Num; Adjustable                                |
| <b>MSTP Max Master</b><br>Support for this object required by MS/TP devices only  | R64.U     | Obj\Num; Adjustable                                |
| <b>MSTP Max Info Frames</b><br>Support for this object required by MS/TP devices only   | R63.U     | Obj\Num: 1...255; Adjustable                       |
| <b>MSTP Slave Proxy Enable</b><br>Support for this object required by MS/TP devices only  | R172.S    | Obj\NoYes; Adjustable                              |

# Analog Input

Object Type: [BACnetIP v31\AnIn]

The Analog Input object represents the externally visible characteristics of an analogue input.

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text   |
| <b>Present Value</b><br>Current value of the analogue input   | V         | Obj\Float; Adjustable (only when the object is 'Out-of-Service')   |
| <b>Units</b>  | U         | Obj\Text   |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text   |
| <b>Device Type</b><br>Description of the physical device connected to the analogue input.<br>Device support for this object is optional   | DT        | Obj\Text   |
| <b>Status Flag <i>b</i></b><br>Health of the analogue input. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF.Bb     | Obj\NoYes  |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety  |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 1=No Sensor, 2=Over range, 3=Under range, 4=Open loop, 5=Short loop, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault |
| <b>Out of Service</b><br>Indicates if the input is not in service decoupling the Present Value from the physical input  | US        | Obj\NoYes; Adjustable  |
| <b>Value Resolution</b><br>Smallest recognizable change in value.<br>Device support for this object is optional   | VR        | Obj\Float  |
| <b>Value High</b><br>Maximum value that can be obtained from Present Value. Device support for this object is optional  | VH        | Obj\Float  |
| <b>Value Low</b><br>Minimum value that can be obtained from Present Value. Device support for this object is optional   | VL        | Obj\Float  |
| <b>Alarm High</b><br>Device support for this object is optional   | AH        | Obj\Float; Adjustable  |
| <b>Alarm Low</b><br>Device support for this object is optional  | AL        | Obj\Float; Adjustable  |

# Analog Output

Object Type: *[BACnetIP v31\AnOut]*

The Analog Output object represents the externally visible characteristics of an analogue output.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Float; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’   |
| <b>Value Table</b><br>Priority array table containing the value for each priority   | VT            | Fixed container:<br><i>[BACnetIP v31\AnOut\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: ‘[NULL]’, 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used   | DV            | Obj\Float; Adjustable   |
| <b>Units</b>  | U             | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Device Type</b><br>Description of the physical device connected to the analogue output.<br>Device support for this object is optional  | DT            | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the analogue output. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service  | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 4=Open loop, 5=Short loop, 6=No output, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault |
| <b>Out of service</b><br>Indicates if the output is not in service, decoupling the Present Value from the physical output   | US            | Obj\NoYes; Adjustable   |
| <b>Value Resolution</b><br>Smallest recognizable change in value.<br>Device support for this object is optional   | VR            | Obj\Float   |



| Description  | Reference | Type                  |
|--|-----------|-----------------------|
| <b>Value High</b><br>Maximum value that can be obtained from Present Value. Device support for this object is optional | VH        | Obj\Float             |
| <b>Value Low</b><br>Minimum value that can be obtained from Present Value. Device support for this object is optional  | VL        | Obj\Float             |
| <b>Alarm High</b><br>Device support for this object is optional  | AH        | Obj\Float; Adjustable |
| <b>Alarm Low</b><br>Device support for this object is optional   | AL        | Obj\Float; Adjustable |

# Analog Value

Object Type: *[BACnetIP v31\AnVal]*

The Analog Value object represents the externally visible characteristics of an analogue value. An analogue value is a control system parameter in the memory of the BACnet device.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Float; Adjustable<br>To release or clear a value for a priority, set the value to " or '[NULL]'   |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\AnVal\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Float; Adjustable   |
| <b>Units</b>  | U             | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the analogue value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF. <i>Bb</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device  | US            | Obj\NoYes; Adjustable   |
| <b>Value Resolution</b><br>Smallest recognizable change in value.<br>Device support for this object is optional   | VR            | Obj\Float   |

|  |    |                       |
|--|----|-----------------------|
| <b>Value High</b><br>Maximum value that can be obtained from Present Value. Device support for this object is optional | VH | Obj\Float             |
| <b>Value Low</b><br>Minimum value that can be obtained from Present Value. Device support for this object is optional  | VL | Obj\Float             |
| <b>Alarm High</b><br>Device support for this object is optional  | AH | Obj\Float; Adjustable |
| <b>Alarm Low</b><br>Device support for this object is optional   | AL | Obj\Float; Adjustable |

# Binary Input

Object Type: [BACnetIP v31\BinIn]

The Binary Input object represents the externally visible characteristics of a binary input. A binary input is a physical device or hardware input that can be in one of two states – ‘off’ or ‘on’. A typical use of a binary input is to indicate whether a particular piece of mechanical equipment, such as a fan or pump, is running or idle. The state ‘on’ corresponds to the situation when the equipment is on or running, and ‘off’ corresponds to the situation when the equipment is off or idle.

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text   |
| <b>Present Value</b><br>Current value of the binary input   | V         | Obj\OffOn; Adjustable (only when the object is ‘Out-of-Service’)   |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text   |
| <b>Device Type</b><br>Description of the physical device connected to the binary input.<br>Device support for this object is optional   | DT        | Obj\Text   |
| <b>Status Flag <i>b</i></b><br>Health of the binary input. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF.Bb     | Obj\NoYes  |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES        | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety  |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS        | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 1=No Sensor, 2=Over range, 3=Under range, 4=Open loop, 5=Short loop, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault |
| <b>Out of Service</b><br>Indicates if the input is not in service decoupling the Present Value from the physical input  | US        | Obj\NoYes; Adjustable  |
| <b>Polarity Reversed</b>  | P         | Obj\NoYes  |
| <b>Off State Text</b><br>Device support for this object is optional   | FL        | Obj\Text   |
| <b>On State Text</b><br>Device support for this object is optional  | TL        | Obj\Text   |

# Binary Output

Object Type: [BACnetIP v31\BinOut]

The Binary Output object represents the externally visible characteristics of a binary output. A binary output is a physical device or hardware input that can be in one of two states – ‘off’ or ‘on’. A typical use of a binary output is to switch a particular piece of mechanical equipment, such as a fan or pump, on or off. The state ‘on’ corresponds to the situation when the equipment is on or running, and ‘off’ corresponds to the situation when the equipment is off or idle.

| Description   | Reference | Type  |
|---|-----------|---|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.Pp      | Obj\OffOn; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’   |
| <b>Value Table</b><br>Priority array table containing the value for each priority   | VT        | Fixed container:<br>[BACnetIP v31\BinOut\ValTable]  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP        | Obj\Num: ‘[NULL]’, 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used   | DV        | Obj\OffOn; Adjustable   |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text  |
| <b>Device Type</b><br>Description of the physical device connected to the binary output.<br>Device support for this object is optional  | DT        | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the binary output. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service  | SF.Bb     | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 4=Open loop, 5=Short loop, 6=No output, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault |
| <b>Out of service</b><br>Indicates if the output is not in service, decoupling the Present Value from the physical output   | US        | Obj\NoYes; Adjustable   |
| <b>Polarity Reversed</b>  | P         | Obj\NoYes   |

| Description   | Reference | Type     |
|---|-----------|----------|
| <b>Off State Text</b><br>Device support for this object is optional | FL        | Obj\Text |
| <b>On State Text</b><br>Device support for this object is optional  | TL        | Obj\Text |

# Binary Value

Object Type: *[BACnetIP v31\BinVal]*

The Binary Value object represents the externally visible characteristics of a binary value. A binary value is a control system parameter residing in the memory of the BACnet device. This parameter may assume only one of two distinct states – ‘off’ or ‘on’.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\OffOn; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’   |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\BinVal\ValTable]</i>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: ‘[NULL]’, 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\OffOn; Adjustable   |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the binary value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device  | US            | Obj\NoYes; Adjustable   |
| <b>Off State Text</b><br>Device support for this object is optional   | FL            | Obj\Text  |
| <b>On State Text</b><br>Device support for this object is optional  | TL            | Obj\Text  |

# Calendar

Object Type: [BACnetIP v31\Calendar]

The Calendar object is used to describe a list of calendar dates, which might be thought of as holidays, special events, or simply a list of dates.

| Description  | Reference             | Type  |
|--|-----------------------|---|
| <b>Name</b><br>Unique object name within the device  | N                     | Obj\Text  |
| <b>Present Value</b><br>Indicates 'on' if the current date is in the date list, and 'off' if it is not | V                     | Obj\OffOn   |
| <b>Description</b><br>Device support for this object is optional                                       | D                     | Obj\Text  |
| <b>Date List (all)</b><br>List of dates. Each date contains a period type and period – see below       | R23                   | Obj\Text; Adjustable<br>A list of dates in the format '{type period} ...'   |
| <b>Date <i>d</i> – Type</b><br>Period type for date <i>d</i> . <i>d</i> is in the range 1...5          | R23.V( <i>d</i> *2)-1 | Obj\Enum; Adjustable<br>Values: 0=Date, 1=Date range, 2=Month-week-day, 4=Delete entry  |
| <b>Date <i>d</i> – Period</b><br>Period for date <i>d</i> . <i>d</i> is in the range 1...5             | R23.V( <i>d</i> *2)   | Type depends on Period Type; Adjustable<br><b>Date</b><br>Obj\Date: 'dd/mm/yy'<br><b>Date range</b><br>Obj\Text: 'dd/mm/yy- dd/mm/yy' (see note 1)<br><b>Month-week-day</b><br>Obj\Text: 'm,w,d' (see note 2) |

## Notes

1. Date range specifies a range of dates, or date pattern in the format 'dd/mm/yy-dd/mm/yy':
  - dd – Day-of-month 1...31, 32=last day, 33=odd days, 34=even days, 41..47=Mondays...Sundays, 99=any
  - mm – Month 1...12, 13=odd months, 14=even months, 99=any
  - yy – Year 00...79=2000...2079, 99=any.
2. Month-week-day, specifies a reoccurring date pattern in the format 'm,w,d':
  - m – Month 1...12, 13=odd months, 14=even months, 255=any
  - w – Week-of-month 1...5=1<sup>st</sup>-5<sup>th</sup> week, 6=last 7 days, 7...9=penultimate 7 days, etc, 255=any
  - d – Day-of-week 1..7=Mondays...Sundays, 255=any.



# Command

Object Type: [BACnetIP v31\Cmd]

The Command object represents the externally visible characteristics of a multi-action command procedure. A command is used to write a set of values to a group of BACnet object properties, based on the action code written to the Present Value.

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text   |
| <b>Present Value</b><br>Indicates which action to take or has already been taken. Set the value to the action number to trigger   | V         | Obj\Num: 0...maximum actions; Adjustable   |
| <b>In Process</b><br>Indicates that the Command object has begun processing a sequence of actions   | R47       | Obj\NoYes  |
| <b>All Writes Successful</b><br>Once the actions have completed and In Process is set to 'no', this value indicates if all of the value writes in the action have succeeded | R9        | Obj\NoYes  |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text   |
| <b>Status Flag <i>b</i></b><br>Health of the command. Status Flag, <i>b</i> , is a number in the range 0...1, where:<br>0=In Alarm, 1=In Fault                              | SF.Bb     | Obj\NoYes  |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety  |
| <b>Reliability</b><br>Indicates whether the object is properly configured and is able to if the Present Value is reliable.<br>Device support for this object is optional    | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail, 23=Faults listed, 24=Referenced object fault |
| <b>Maximum Actions</b>  | R2.E0     | Obj\Num  |
| <b>Action <i>n</i> Text</b><br>Text description of the action. Where <i>n</i> is in the range 1 to maximum actions.<br>Device support for this object is optional           | R3.En     | Obj\Text   |

# Event Enrolment

Object Type: [BACnetIP v31\EvtEnr]

The Event Enrolment object represents and contains the information required for algorithmic reporting of events.

Although this object is accessible, note that the BACnetIP driver does not currently support BACnet alarm and event management services.

| Description  | Reference | Type   |
|--|-----------|--|
| <b>Name</b><br>Unique object name within the device  | N         | Obj\Text   |
| <b>Event Type</b><br>Indicates the type of event algorithm used  | R37       | Obj\Enum<br>Values: 0=Change of bitstring, 1=Change of state, 2=Change of value, 3=Cmd failure, 4=Floating limit, 5=Out-of-range 8=Change of life safety, 9=Extended, 10=Buffer-ready, 11=Unsigned range, 13=Access event, 14=Double out-of-range, 15=Signed out-of-range, 16=Unsigned out-of-range , 17=Change of character string, 18=Change of status flags, 19=Change of reliability, 20=None, 21=Change of discrete value, 22=Change of timer |
| <b>Notify Type</b><br>Indicates whether the notifications generated by the object should be events or alarms   | R72       | Obj\Enum<br>Values: 0=Alarm, 1=Event, 2=Ack Notification   |
| <b>Event Parameters</b><br>Determines the algorithm used to monitor the referenced object and provides the parameter values needed for this event algorithm                                  | R83       | Obj\Text   |
| <b>Object Property Reference</b><br>Designates the particular object and property reference by the event enrolment   | R78       | Obj\Text   |
| <b>Description</b><br>Device support for this object is optional   | D         | Obj\Text   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it   | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety  |
| <b>Event Enable <i>b</i></b><br>Enable and disable the distribution of <i>b</i> notifications. <i>b</i> , is a number in the range 0...2, where:<br>0=To off-normal, 1=To fault, 2=To normal | R35.Bb    | Obj\OffOn  |
| <b>Acked Transitions <i>b</i></b><br>Indicates the acknowledgement state for <i>b</i> events. <i>b</i> , is a number in the range 0...2, where:<br>0=To off-normal, 1=To fault, 2=To normal  | R0.Bb     | Obj\NoYes  |
| <b>Notification Class</b><br>Instance of the notification class object to use for event-notification distribution  | R17       | Obj\Num  |
| <b>Status Flag <i>b</i></b><br>Health of the event enrolment. Status Flag, <i>b</i> , is a number in the range 0...1, where:<br>0=In Alarm, 1=In Fault                                       | SF.Bb     | Obj\NoYes  |

| Description   | Reference | Type  |
|---|-----------|---|
| <p><b>Reliability</b><br/> Indicates the reliability of the event enrolment object to perform its monitoring function, in addition to the reliability of the monitored object</p> | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail, 14=Monitored object fault |

# Loop

Object Type: [BACnetIP v31\Loop]

The Loop object represents the externally visible characteristics of any form of feedback control loop.

| Description   | Reference | Type  |
|---|-----------|---|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text  |
| <b>Present Value</b><br>Indicates the current output value from the loop algorithm in Output Units  | V         | Obj\Float; Adjustable   |
| <b>Output Units</b><br>Engineering units for the output   | R82.u     | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the loop. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF.Bb     | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 1=No Sensor, 2=Over range, 3=Under range, 4=Open loop, 5=Short loop, 6=No output, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault, 15=Tripped, 16=Lamp failure, 17=Activation fail, 18=Renew DHCP fail, 19=Renew FD registration fail, 20=Restart auto-neg fail, 21=Restart fail, 22=Proprietary cmd fail, 23=Faults listed, 24=Referenced object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device  | US        | Obj\NoYes; Adjustable   |
| <b>Update Interval (ms)</b><br>Interval at which the loop algorithm updates the output (Present Value).<br>Device support for this object is optional                             | R118.U    | Obj\Num; Adjustable   |
| <b>Manipulated Variable Reference</b><br>The output (Present Value) of the control loop is written to this BACnet object reference, typically an analogue output                  | R60       | Obj\Text  |
| <b>Priority for Writing</b><br>Priority to use when writing the output value to the Manipulated Variable Reference  | R88.U     | Obj\Num: 1...16; Adjustable   |
| <b>Controlled Variable Reference</b><br>The BACnet object reference used to set the Controlled Variable Value, typically an analogue input  | R19       | Obj\Text  |
| <b>Controlled Variable Value</b><br>The control loop compares the controlled Variable Value with the Setpoint to determine the error  | R21.R     | Obj\Float   |

| Description  | Reference | Type                                    |
|--|-----------|---|
| <b>Controlled Variable Units</b><br>Engineering units of the Controlled Variable Value   | R20.u     | Obj\Text                                |
| <b>Setpoint Reference</b><br>Optional BACnet object reference to obtain setpoint value   | R109      | Obj\Text                                |
| <b>Setpoint</b><br>Value of the loop setpoint  | R108.R    | Obj\Float; Adjustable                   |
| <b>Action</b><br>Determines whether loop is direct or reverse acting   | R2        | Obj\Enum<br>Values: 0=Direct, 1=Reverse |
| <b>Proportional Constant</b><br>Value of the proportional gain used by the loop algorithm. Device support for this object is optional        | R93.R     | Obj\Float; Adjustable                   |
| <b>Proportional Constant Units</b><br>Engineering units of the Proportional Constant. Device support for this object is optional             | R94.u     | Obj\Text                                |
| <b>Integral Constant</b><br>Value of the integral gain used by the loop algorithm. Device support for this object is optional                | R49.R     | Obj\Float; Adjustable                   |
| <b>Integral Constant Units</b><br>Engineering units of the Integral Constant. Device support for this object is optional                     | R50.u     | Obj\Text                                |
| <b>Derivative Constant</b><br>Value of the derivative gain used by the loop algorithm. Device support for this object is optional            | R26.R     | Obj\Float; Adjustable                   |
| <b>Derivative Constant Units</b><br>Engineering units of the Derivative Constant. Device support for this object is optional                 | R27.u     | Obj\Text                                |
| <b>Bias</b><br>Bias value used by the loop algorithm, expressed in Output Units. Device support for this object is optional                  | R14.R     | Obj\Float; Adjustable                   |
| <b>Maximum Output</b><br>Maximum value of the Present Value as limited by the PID loop algorithm. Device support for this object is optional | R61.R     | Obj\Float; Adjustable                   |
| <b>Minimum Output</b><br>Minimum value of the Present Value as limited by the PID loop algorithm. Device support for this object is optional | R68.R     | Obj\Float; Adjustable                   |

# Multi-State Input

Object Type: [BACnetIP v31\MultiIn]

The Multi-State Input object represents the result of an algorithmic process within the BACnet device. The Present Value is an integer representing the state, with state text describing each state value.

| Description  | Reference | Type   |
|--|-----------|--|
| <b>Name</b><br>Unique object name within the device  | N         | Obj\Text   |
| <b>Present Value</b><br>Current value of the multi-state input   | V         | Obj\Num; Range 1...number of states; Adjustable (only when the object is 'Out-of-Service')   |
| <b>Description</b><br>Device support for this object is optional   | D         | Obj\Text   |
| <b>Device Type</b><br>Description of the physical device connected to the multi-state input.<br>Device support for this object is optional   | DT        | Obj\Text   |
| <b>Status Flag <i>b</i></b><br>Health of the multi-state input. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF.Bb     | Obj\NoYes  |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it   | ES        | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety  |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional  | RS        | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 1=No Sensor, 2=Over range, 3=Under range, 4=Open loop, 5=Short loop, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail |
| <b>Out of Service</b><br>Indicates if the input is not in service decoupling the Present Value from the physical input   | US        | Obj\NoYes; Adjustable  |
| <b>Number of States</b>  | NS        | Obj\Num  |
| <b>State <i>n</i> Text</b><br>Text description of the state value.<br>The state number, <i>n</i> , is in the range 1...number of states.<br>Device support for this object is optional         | A.En      | Obj\Text   |

# Multi-State Output

Object Type: *[BACnetIP v31\MultiOut]*

The Multi-State Output object represents the desired state of one or more physical outputs. The present value is an integer representing the state, with state text describing each state value.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Num; Adjustable<br>To release or clear a value for a priority, set the value to " or '[NULL]'   |
| <b>Value Table</b><br>Priority array table containing the value for each priority   | VT            | Fixed container:<br><i>[BACnetIP v31\MultiOut\ValTable]</i>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used   | DV            | Obj\Num; Adjustable   |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Device Type</b><br>Description of the physical device connected to the multi-state output.<br>Device support for this object is optional   | DT            | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the multi-state output. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 4=Open loop, 5=Short loop, 6=No output, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault, 15=Tripped |
| <b>Out of service</b><br>Indicates if the output is not in service, decoupling the Present Value from the physical output   | US            | Obj\NoYes; Adjustable   |
| <b>Number of States</b><br>Number of states the Present Value may have  | NS            | Obj\Num   |

| Description   | Reference | Type     |
|---|-----------|----------|
| <p><b>State <math>n</math> Text</b><br/> Text description of the state value.<br/> The state number, <math>n</math>, is in the range<br/> 1...number of states.<br/> Device support for this object is optional</p> | A.En      | Obj\Text |



# Program

Object Type: [BACnetIP v31\Prog]

The Program object represents the externally visible characteristics of an application program.

| Description   | Reference | Type  |
|---|-----------|---|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text  |
| <b>Program State</b><br>Current logical state of the process executing the application program  | R92       | Obj\Enum: 0...5<br>Values: 0=Idle, 1=Loading, 2=Running, 3=Waiting, 4=Halted, 5=Unloading   |
| <b>Program Change</b><br>Request a change to the operating state  | R90.A     | Obj\Enum: 0...5; Adjustable<br>Values: 0=Ready (for change request), 1=Load, 2=Run, 3=Halt, 4=Restart, 5=Unload   |
| <b>Reason for Halt</b><br>If the program encounters an error that causes execution to halt, this property indicates the reason why the process was halted. Device support for this object is optional | R100      | Obj\Enum: 0...4<br>Values: 0=Normal, 1=Load fail, 2=Internal, 3=Program, 4=Other  |
| <b>Description of Halt</b><br>Used to describe why the program has been halted. Device support for this object is optional  | R29       | Obj\Text  |
| <b>Program Location</b><br>Used by the application program to indicate its location within the program code. Device support for this object is optional   | R91       | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text  |
| <b>Instance of</b><br>Local name of the application program being executed. Device support for this object is optional  | R48       | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the program. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service                  | SF.Bb     | Obj\NoYes   |
| <b>Reliability</b><br>Indicates if the object properties or the process executing the application program are reliable. Device support for this object is optional                                    | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 1=No Sensor, 2=Over range, 3=Under range, 4=Open loop, 5=Short loop, 6=No output, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault, 15=Tripped, 16=Lamp failure, 17=Activation fail, 18=Renew DHCP fail, 19=Renew FD registration fail, 20=Restart auto-neg fail, 21=Restart fail, 22=Proprietary cmd fail, 23=Faults listed, 24=Referenced object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device  | US        | Obj\NoYes; Adjustable   |

# Schedule

Object Type: [BACnetIP v31\Schedule]

The Schedule object describes a periodic schedule that may occur during a range of dates, with optional exceptions.

Schedules are divided into days, of which there are two types: normal days within a week and exception days. Both types of days can specify scheduling events for either the full day or portions of a day, and a priority mechanism defines which scheduled event is in control at any given time.

The current state of the Schedule object is represented by the Present Value, which is normally calculated using the time-value pairs from the weekly schedule and exception schedule, with a Default Value for use when no schedules are in effect.

A schedule's value could contain any primitive BACnet data type – such as real, boolean, unsigned, integer, enumerated, or null. Consult the BACnet device's documentation for actual data types supported by the schedule. When adjusting the Day Schedule, Exception Schedule, or Schedule Default then specify the data type to use.

| Description   | Reference | Type  |
|---|-----------|---|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text  |
| <b>Present Value</b><br>Current value of the schedule   | V         | Obj\Text  |
| <b>Effective Period</b><br>Range of dates within which the schedule is active   | R32.Dr    | Obj\Text; Adjustable<br>Format: 'dd/mm/yy-dd/mm/yy'<br>where:<br>dd Day of month - 1...31, 32=last day, 33=odd days, 34=even days, 41..47=Mondays...Sundays, 99=any<br>mm Month - 1...12, 13=odd months, 14=even months, 99=any<br>yy Year - 00...79=2000...2079, 99=any. |
| <b>Day <i>n</i> Schedule</b><br>Weekly schedule containing a list of time-value pairs, for one day of the week.<br><i>n</i> is the day of week, where: 1=Monday, 2=Tuesday, 3=Wednesday, 4=Thursday, 5=Friday, 6=Saturday, 7=Sunday<br>When adjusting the profile, value data-type, <i>t</i> , can be 'R'=Real/float, 'S'=Boolean, 'U'=Unsigned, 'I'=Integer, 'A'=Enumerated. | WP.Ent    | Obj\Profile; Adjustable   |
| <b>Schedule Default</b><br>When no scheduled values is in effect, this default value is used.<br>When adjusting, value data-type, <i>t</i> , can be 'R'=Real/float, 'S'=Boolean, 'U'=Unsigned, 'I'=Integer, 'A'=Enumerated.   | R174.t    | Obj\Float; Adjustable   |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the schedule. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.Bb     | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Device support for this object is optional  | ES        | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |

| Description   | Reference    | Type   |
|---|--------------|--|
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS           | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail, 24=Referenced object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device  | US           | Obj\NoYes; Adjustable  |
| <b>Exceptions in use</b><br>Device support for this object is optional  | XP.E0        | Obj\Num  |
| <b>Exception Schedules – t value</b><br>Exception events that take precedence over the day's schedule.<br>When adjusting the profile, a value data-type, <i>t</i> , is required: 'R'=Real/float, 'S'=Boolean, 'U'=Unsigned, 'I'=Integer, 'A'=Enumerated<br>Device support for this object is optional | XP. <i>t</i> | Fixed container:<br><i>[BACnetIP v31\Schedule\Exceptions]</i>  |

## Exception Schedules

Object Type: *[BACnetIP v31\Schedule\Exceptions]*

A list of Exception Schedules that takes precedence over the day's schedule.

| Description  | Reference | Type   |
|--|-----------|--|
| <b>Exception Schedule <i>n</i></b><br>List of exception events that takes precedence over the day's schedule.<br>The exception number, <i>n</i> , is in the range 1...255. | <i>En</i> | Fixed container:<br><i>[BACnetIP v31\Schedule\Exception]</i> |

# Exception Schedule

Object Type: [BACnetIP v31\Schedule\Exception]

The Exception Schedule contains an exception profile that takes precedence over the day's schedule.

An exception schedule can be accessed as a single composite value with the format 'type|period|profile|priority' by excluding the 'Vx' object reference. For example 'S1.D150.SC1.XP.E1'

| Description  | Reference | Type  |
|--|-----------|---|
| <b>Period Type</b><br>Select the period value used   | V1        | Obj\ENum; Adjustable<br>Values: 0=Date, 1=Date range, 2=Month-week-day, 3=BACnet object, 4=Delete entry   |
| <b>Period</b><br>Period this exception is active   | V2        | Type depends on Period Type; Adjustable<br><b>Date</b><br>Obj\Date: 'dd/mm/yy'<br><b>Date range</b><br>Obj\Text: 'dd/mm/yy- dd/mm/yy' (see note 1)<br><b>Month-week-day</b><br>Obj\Text: 'm,w,d' (see note 2)<br><b>BACnet object</b><br>Obj\Text: 'CALx', referencing calendar object in same device |
| <b>Profile</b><br>A list of date-value pairs for the exception schedule's profile.                                     | V3t       | Obj\Profile; Adjustable   |
| <b>Priority</b><br>Importance of this exception, relative to others. With priority '1' the highest and '16' the lowest | V4        | Obj\Num: 1...16; Adjustable   |

## Notes

1. Date range specifies a range of dates, or date pattern in the format 'dd/mm/yy-dd/mm/yy':

*dd* – Day-of-month 1...31, 32=last day, 33=odd days, 34=even days,  
 41..47=Mondays...Sundays, 99=any  
*mm* – Month 1...12, 13=odd months, 14=even months, 99=any  
*yy* – Year 00...79=2000...2079, 99=any.

2. Month-week-day, specifies a reoccurring date pattern in the format 'm,w,d':

*m* – Month 1...12, 13=odd months, 14=even months, 255=any  
*w* – Week-of-month 1...5=1<sup>st</sup>-5<sup>th</sup> week, 6=last 7 days, 7...9=penultimate 7 days, etc, 255=any  
*d* – Day-of-week 1..7=Mondays...Sundays, 255=any.

# Averaging

Object Type: [BACnetIP v31\Avg]

The Averaging object represents the externally visible characteristics of a value that is sampled periodically over a specified time interval. The Averaging object records the minimum, maximum and average value over the interval.

The Averaging object shall use a ‘sliding window’ technique that maintains a buffer of *n* samples distributed over the specified interval. Every (time interval/*n*) seconds a new sample is recorded displacing the oldest sample from the buffer. At this time, the minimum, maximum and average are recalculated. The buffer shall maintain an indication for each sample that permits the average calculation and minimum/maximum algorithm to determine the number of valid samples in the buffer.

| Description   | Reference | Type                                 |
|---|-----------|--------------------------------------|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text                             |
| <b>Minimum Value</b><br>Lowest value within the buffer window for the most recent window samples, or valid samples  | R136      | Obj\Float                            |
| <b>Minimum Value Timestamp</b><br>Date and time that the minimum value was sampled. Device support for this object is optional                                      | R150      | Obj\DateTime                         |
| <b>Average Value</b><br>Mean average value within the buffer window for the most recent window samples, or valid samples  | R125      | Obj\Float                            |
| <b>Variance Value</b><br>Variance value within the buffer window for the most recent window samples, or valid samples<br>Device support for this object is optional | R151      | Obj\Float                            |
| <b>Maximum Value</b><br>Highest value within the buffer window for the most recent window samples, or valid samples   | R135      | Obj\Float                            |
| <b>Maximum Value Timestamp</b><br>Date and time that the Maximum Value was sampled. Device support for this object is optional                                      | R149      | Obj\DateTime                         |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text                             |
| <b>Attempted Samples</b><br>Number of samples that have been attempted to be collected for the buffer window  | R124.U    | Obj\Num; Adjustable (value ‘0’ only) |
| <b>Valid Samples</b><br>Number of samples that have been successfully collected for the buffer window   | R146      | Obj\Num                              |
| <b>Window Interval (s)</b><br>Period of time over which the minimum, maximum and average are calculated   | R147.U    | Obj\Num:0...3600; Adjustable         |
| <b>Window Samples</b><br>Number of samples to be taken during the period specified by Window Interval   | R148.U    | Obj\Num: 1...15; Adjustable          |

# Multi-State Value

Object Type: *[BACnetIP v31\MultiVal]*

The Multi-State Value object represents the externally visible characteristics of a multi-state value. This is a control system parameter residing in the memory of the BACnet device.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Num; Adjustable<br>To release or clear a value for a priority, set the value to " or '[NULL]'                           |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\MultiVal\ValTable]</i>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, this value is used.<br>Device support for this object is only required if present value is adjustable   | DV            | Obj\Num; Adjustable   |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the multi-state value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service  | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety                 |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional  | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device  | US            | Obj\NoYes; Adjustable   |
| <b>Number of States</b><br>Number of states the Present Value may have  | NS            | Obj\Num   |

| Description  | Reference | Type     |
|--|-----------|----------|
| <b>State e Text</b><br>Text description of the state value.<br>The state number, e, is in the range<br>1...number of states.<br>Device support for this object is optional | A.Ee      | Obj\Text |

# Accumulator

Object Type: [BACnetIP v31\Acc]

The Accumulator object represents the externally visible characteristics of a device that indicates measurements made by counting pulses.

| Description  | Reference | Type   |
|--|-----------|--|
| <b>Name</b><br>Unique object name within the device  | N         | Obj\Text   |
| <b>Present Value</b><br>Count of the input pulses, prescaled if Prescale is present, acquired since the value was last set in Value Set  | V         | Obj\Num: 0...value high; Adjustable (only when the object is 'Out-of-Service') |
| <b>Scale (x)</b><br>Conversion factor to be multiplied with the Present Value to provide a value in engineering units.<br>Scaling is performed in one of two ways. If this object has a value then use present value x scale                           | R187.RH0  | Obj\Float  |
| <b>Scale (10<sup>^</sup>)</b><br>Conversion factor to be multiplied with the Present Value to provide a value in engineering units<br>Scaling is performed in one of two ways. If this object has a value then use present value x 10 <sup>scale</sup> | R187.IH1  | Obj\Num  |
| <b>Units</b><br>Engineering units of value when multiplied by Scale  | U         | Obj\Text   |
| <b>Prescale (mult,div)</b><br>Coefficients used for converting pulse signals into Present Value.<br>Device support for this object is optional   | R185      | Obj\Text<br>Format: <i>multiplier modulo-divide</i>                            |
| <b>Value Change Time</b><br>Date and time of the most recent change to Value Before Change or Value Set.<br>Device support for this object is optional   | R192      | Obj\DateTime   |
| <b>Value Before Change</b><br>Value of Present Value just prior to changing Value Set.<br>Device support for this object is optional   | R190.U    | Obj\Num; Adjustable  |
| <b>Value Set</b><br>Value of Present Value just after changing Value Set.<br>Device support for this object is optional  | R191.U    | Obj\Num; Adjustable  |
| <b>Pulse Rate</b><br>Number of input pulses received during the most recent Limit Monitoring Interval.<br>Device support for this object is optional   | R186.U    | Obj\Num; Adjustable (only when the object is 'Out-of-Service')                 |
| <b>Limit Monitoring Interval (s)</b><br>Monitoring period to determine the Pulse Rate.<br>Device support for this object is optional   | R182.U    | Obj\Num; Adjustable  |
| <b>Description</b><br>Device support for this object is optional   | D         | Obj\Text   |



| Description  | Reference | Type   |
|--|-----------|--|
| <b>Device Type</b><br>Description of the physical device represented by the accumulator.<br>Device support for this object is optional   | DT        | Obj\Text   |
| <b>Status Flag <i>b</i></b><br>Health of the accumulator. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF.Bb     | Obj\NoYes  |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it   | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety  |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional  | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 2=Over range, 3=Under range, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail, 14=Monitored object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device   | US        | Obj\NoYes; Adjustable  |
| <b>Value High</b><br>Maximum value that can be obtained from Present Value. Device support for this object is optional   | VH        | Obj\Float  |
| <b>Alarm High</b><br>Device support for this object is optional  | AH        | Obj\Float; Adjustable  |
| <b>Alarm Low</b><br>Device support for this object is optional   | AL        | Obj\Float; Adjustable  |

# Pulse Converter

Object Type: [BACnetIP v31\Pulse]

The BACnet Pulse Converter object represents a process where ongoing measurements represented by pulses or counts, such as electric power or water usage, are monitored over a time interval for applications such as peak load management.

The object might represent a physical input or it might acquire the data from the BACnet Accumulator object, representing an input in the same device as the BACnet Pulse Converter object.

The Present Value can be adjusted at any time by writing to Adjust Value, which causes Count to be adjusted, and the Present Value recalculated from Count.

| Description  | Reference     | Type  |
|--|---------------|---|
| <b>Name</b><br>Unique object name within the device  | N             | Obj\Text  |
| <b>Present Value</b><br>Accumulated value of input being measured. It is calculated by multiplying the Count by the Scale Factor   | V             | Obj\Float; Adjustable (only when the object is 'Out-of-Service')  |
| <b>Units</b><br>Engineering units of value when multiplied by Scale Factor   | U             | Obj\Text  |
| <b>Input Reference</b><br>BACnet object reference of the actual input to be measured.<br>Device support for this object is optional  | R181          | Obj\Text  |
| <b>Scale Factor</b><br>Conversion factor for calculating the Present Value to provide a value in engineering units   | R188.R        | Obj\Float   |
| <b>Adjust Value</b><br>Adjust the Present Value (and Count) by this amount   | R176.R        | Obj\Float: -100.00...100.00; Adjustable   |
| <b>Count</b><br>Count of input pulses from input   | R177          | Obj\Num   |
| <b>Update Time</b><br>Date and time of the most recent change to Count   | R192          | Obj\DateTime  |
| <b>Count Change Time</b><br>Date and time of the most recent change to Adjust Value  | R192          | Obj\DateTime  |
| <b>Count Before Change</b><br>Value of count just prior to changing Adjust Value   | R190.U        | Obj\Num   |
| <b>Description</b><br>Device support for this object is optional   | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the pulse converter. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF. <i>Bb</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it   | ES            | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |

| Description  | Reference | Type   |
|--|-----------|--|
| <b>Reliability</b><br>Indicates if the Present Value and Count are reliable.<br>Device support for this object is optional | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 2=Over range, 3=Under range, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail, 14=Monitored object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device           | US        | Obj\NoYes; Adjustable  |
| <b>Alarm High</b><br>Device support for this object is optional  | AH        | Obj\Float; Adjustable  |
| <b>Alarm Low</b><br>Device support for this object is optional   | AL        | Obj\Float; Adjustable  |

# Load Control

Object Type: [BACnetIP v31\Load]

The Load Control object represents the externally visible characteristics of a mechanism for controlling load requirements. A BACnet device can use a Load Control object to allow external control over the shedding of a load that it controls.

| Description   | Reference | Type  |
|---|-----------|---|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text  |
| <b>Present Value</b><br>Current load shedding state   | V         | Obj\Enum<br>Values: 0=Inactive, 1=Pending, 2=Compliant, 3=Non-Compliant |
| <b>State Description</b><br>Additional description of the shed state of the load control object.<br>Device support for this object is optional  | R222      | Obj\Text  |
| <b>Requested Shed Level</b><br>Desired load shedding. This value is available in one of three formats, <i>f</i> :<br>'UH0'=Percentage (%) of Full Duty,<br>'UH1'=Shed Level,<br>'RH2'=Amount to reduce power (kW)   | R218.f    | Obj\Float; Adjustable   |
| <b>Start Time</b><br>Start of the duty window in which the load controlled must be compliant with the Requested Shed Level  | R142.t    | Obj\DateTime; Adjustable  |
| <b>Shed Duration (min)</b><br>Duration of the load shed action, starting at Start Time  | R219.U    | Obj\Num; Adjustable   |
| <b>Duty Window (min)</b><br>Time window used for load shed accounting   | R213.U    | Obj\Num; Adjustable   |
| <b>Enable</b><br>Indicates and controls whether the load control object is available to provide load shed requests  | R133.S    | Obj\NoYes; Adjustable   |
| <b>Full Duty Baseline (kW)</b><br>Baseline power consumption for the sheddable load controlled.<br>Device support for this object is optional   | R215.R    | Obj\Float; Adjustable   |
| <b>Expected Shed Level</b><br>Amount of power the load control expects to be able to shed. This value is available in one of three formats, <i>f</i> :<br>'UH0'=Percentage (%) of Full Duty,<br>'UH1'=Shed Level,<br>'RH2'=Amount to reduce power (kW)        | R214.f    | Obj\Float   |
| <b>Actual Shed Level</b><br>Actual amount of power being shed in response to a load shed request. This value is available in one of three formats, <i>f</i> :<br>'UH0'=Percentage (%) of Full Duty,<br>'UH1'=Shed Level,<br>'RH2'=Amount to reduce power (kW) | R212.f    | Obj\Float   |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text  |

| Description   | Reference        | Type  |
|---|------------------|---|
| <b>Status Flag <i>b</i></b><br>Health of the load control. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF.B <i>b</i>    | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it  | ES               | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety                       |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional  | RS               | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail, 14=Monitored object fault |
| <b>Number of Shed Levels</b><br>Number of shed levels available, used when specifying a level for Requested Shed Level, Expected Shed Level, and Actual Shed Level                        | R221.E0          | Obj\Num   |
| <b>Shed Level <i>n</i> Value</b><br>Shed level for shed level choice <i>n</i> . Where <i>n</i> is in the range 1...number of shed levels  | R221.U <i>En</i> | Obj\Num; Adjustable   |
| <b>Shed Level <i>n</i> Label</b><br>Description of action to take for shed level choice <i>n</i>  | R220. <i>En</i>  | Obj\Text  |

# Timer

Object Type: [BACnetIP v31\Timer]

The Timer object represents the externally visible characteristics of a countdown timer.

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text   |
| <b>Present Value (ms)</b><br>When Timer State is 'Running', this indicates the remaining time.<br>Set value to '0' to stop the timer, or a timeout value to start the timer running | V         | Obj\Num: 0, value low...value high; Adjustable   |
| <b>Timer State</b><br>Current state of the timer. To clear the timer, set to 'idle'.  | R398.A    | Obj\Enum; Adjustable<br>Values: 0=Idle, 1=Running, 2=Expired   |
| <b>Timer Running</b><br>Indicates the timer is in the 'Running' state. Set value to 'yes' to start or 'no' to stop the timer  | R397.S    | Obj\NoYes; Adjustable  |
| <b>Update Time</b><br>Date and time of the last transition of the timer state. Device support for this object is optional   | R189      | Obj\DateTime   |
| <b>Last State Change</b><br>Last transition the timer state machine performed. Device support for this object is optional   | R395      | Obj\Enum<br>Values: 0=None, 1=Idle to Running, 2=Running to Idle, 3=Running to Running, 4=Running to Expired, 5=Forced to Expired, 6=Expired to Idle, 7=Expired to Running |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text   |
| <b>Status Flag b</b><br>Health of the timer. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 3=Out of Service                             | SF.Bb     | Obj\NoYes  |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety  |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional  | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail   |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional                               | US        | Obj\NoYes; Adjustable  |
| <b>Expiration Time</b><br>Date and time when the timer will expire, or has expired. Device support for this object is optional  | R270      | Obj\DateTime   |
| <b>Initial Timeout (ms)</b><br>Initial duration to count down when the timer last transitioned to 'Running'. Device support for this object is optional                             | R394      | Obj\Num  |
| <b>Default Timeout (ms)</b><br>Default timeout used when setting Timer Running. Device support for this object is optional  | R393.U    | Obj\Num: value low...value high; Adjustable  |
| <b>Value Resolution (ms)</b>  | VR        | Obj\Num  |

| Description   | Reference | Type   |
|---|-----------|--|
| Resolution of the timer in milliseconds.<br>Device support for this object is optional  |           |  |
| <b>Value High (ms)</b><br>Maximum initial timeout value. Device support for this object is optional   | VH        | Obj\Num  |
| <b>Value Low (ms)</b><br>Minimum initial timeout value. Device support for this object is optional  | VL        | Obj\Num  |
| <b>State Change Value (n)</b><br>Value to be written to the referenced properties when a change of the timer state occurs.<br>State change, <i>n</i> , is in the range 1...7, where: 1=Idle to Running, 2=Running to Idle, 3=Running to Running, 4=Running to Expired, 5=Forced to Expired, 6=Expired to Idle, 7=Expired to Running | R396.En   | Fixed container:<br><i>[BACnetIP v31\Timer\StateVal]</i> |

## Timer State Change Value

Object Type: *[BACnetIP v31\Timer\StateVal]*

The State Value Change object contains the value written when the timer changes to a particular state.

The value may contain any one of the following data types:

| Description  | Reference | Type                     |
|--|-----------|--------------------------|
| <b>Value - Null</b>  | N         | Obj\Text; Adjustable     |
| <b>Value - Boolean</b>   | S         | Obj\OffOn; Adjustable    |
| <b>Value - Unsigned</b>  | U         | Obj\Num; Adjustable      |
| <b>Value - Integer</b>   | I         | Obj\Float; Adjustable    |
| <b>Value - Real</b>  | R         | Obj\Float; Adjustable    |
| <b>Value - Double</b>  | F         | Obj\Text; Adjustable     |
| <b>Value - Octet String</b>  | Y         | Obj\Text; Adjustable     |
| <b>Value - Char String</b>   | C         | Obj\Text; Adjustable     |
| <b>Value - Bit String</b>  | B         | Obj\Text; Adjustable     |
| <b>Value - Enumerated</b>  | A         | Obj\Num; Adjustable      |
| <b>Value - Date</b>  | D         | Obj\Date; Adjustable     |
| <b>Value - Time</b>  | T         | Obj\Text; Adjustable     |
| <b>Value - Date &amp; Time</b>   | tH2       | Obj\DateTime; Adjustable |
| <b>Value - No Value</b><br>No value shall be written when the change of timer state occurs | NH0       | Obj\Text; Adjustable     |

# Bit String Value

Object Type: *[BACnetIP v31\BitStrVal]*

The Bit String Value object represents the externally visible characteristics of a named data value in a BACnet device.

A bit string is a series of '0' and '1' characters. The first character of the variable length string is bit 0, followed by bit 1, etc. For example, '1001010111100010'.

| Description  | Reference     | Type  |
|--|---------------|---|
| <b>Name</b><br>Unique object name within the device  | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information.<br>See note 1. | V.P <i>p</i>  | Obj\Text; Adjustable<br>To release or clear a value for a priority, set the value to "" or '[NULL]'         |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable<br>See note 1.   | VT            | Fixed container:<br><i>[BACnetIP v31\BitStrVal\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional  | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable   | DV            | Obj\Text; Adjustable  |
| <b>Description</b><br>Device support for this object is optional   | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the bit string value. Status Flag, <i>b</i> , is a number in the range 0...3, where: 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF. <i>Bb</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional  | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional  | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional  | US            | Obj\NoYes; Adjustable   |



| Description  | Reference        | Type     |
|--|------------------|----------|
| <b>Bits supported</b><br>Number of bits in string. Device support for this object is optional  | BL.E0            | Obj\Num  |
| <b>Bit <i>n</i> Text</b><br>Description of bit <i>n</i> , where <i>n</i> is in the range 0..64. Device support for this object is optional | BL.E <i>n</i> +1 | Obj\Text |

## Notes

1. When reading the value, additional decode options are available. Append the object reference with 'B*x*' to read the individual bit *x*. Append with 'w' to read the first 16-bits as an integer in the range 0..65535

# Character String Value

Object Type: *[BACnetIP v31\CharStrVal]*

The Character String Value object represents the externally visible characteristics of a named data value in a BACnet device.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Text; Adjustable<br>To release or clear a value for a priority, set the value to " or '[NULL]'          |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\CharStrVal\ValTable]</i>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Text; Adjustable  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the char string value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service  | SF. <i>Bb</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES            | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional  | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional   | US            | Obj\NoYes; Adjustable   |

# Date Pattern Value

Object Type: *[BACnetIP v31\DatePat]*

The Date Pattern Value object represents the externally visible characteristics of a named data value in a BACnet device.

Date Pattern objects represent multiple recurring dates based on rules defined by the pattern of individual fields of the date, some of which can be special values like ‘even months’, or ‘don't care’, which matches any value in that field. Examples of possibilities would be: ‘every Thursday in May of any year’, or ‘every day in May 2009’.

In this object, Date values have the format ‘*dd/mm/yy*’, where:

*dd* Day of month - 1...31, 32=last day, 33=odd days, 34=even days, 41..47=Mondays...Sundays, 99=any  
*mm* Month - 1...12, 13=odd months, 14=even months, 99=any  
*yy* Year - 00...79=2000...2079, 99=any.

| Description   | Reference | Type  |
|---|-----------|---|
| <b>Name</b><br>Unique object name within the device   | N         | Obj\Text  |
| <b>Present Value - Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.Pp      | Obj\Date; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’          |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT        | Fixed container:<br><i>[BACnetIP v31\DatePat\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP        | Obj\Num: ‘[NULL]’, 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV        | Obj\Date; Adjustable  |
| <b>Description</b><br>Device support for this object is optional  | D         | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the date pattern value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.Bb     | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional                                       | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional | US        | Obj\NoYes; Adjustable  |

# Date Value

Object Type: *[BACnetIP v31\DateVal]*

The Date Value object represents the externally visible characteristics of a named data value in a BACnet device. A BACnet device can use a Date Value object to make any kind of date data value accessible to other BACnet devices.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Date; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’          |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\DateVal\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: ‘[NULL]’, 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Date; Adjustable  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the date value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional   | US            | Obj\NoYes; Adjustable   |

# Date Time Pattern Value

Object Type: *[BACnetIP v31\DateTimePat]*

The Date Time Pattern Value object represents the externally visible characteristics of a named data value in a BACnet device.

Date Time Pattern objects can be used to represent multiple recurring dates and times based on rules defined by the pattern of individual fields of the date and time, some of which can be special values like ‘even months’, or ‘don't care’, which matches any value in that field. Examples of possibilities would be: ‘11:00 every Thursday in any June’, or ‘every day in May 2009’.

In this object, DateTime values have the format ‘*dd/mm/yy|hh:mm:ss*’, where:

- dd* Day of month - 1...31, 32=last day, 33=odd days, 34=even days, 41..47=Monday...Sundays, 99=any
- mm* Month - 1...12, 13=odd months, 14=even months, 99=any
- yy* Year - 00...79=2000...2079, 99=any
- hh* Hour - 00...23, 99=any
- mm* Minutes - 00...59, 99=any
- ss* Seconds - 00...59, 99=any

| Description   | Reference    | Type   |
|---|--------------|--|
| <b>Name</b><br>Unique object name within the device   | N            | Obj\Text   |
| <b>Present Value - Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i> | Obj\DateTime; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’ |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT           | Fixed container:<br><i>[BACnetIP v31\DateTimePat\ValTable]</i>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP           | Obj\Num: ‘[NULL]’, 1...16  |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV           | Obj\DateTime; Adjustable   |
| <b>Is UTC</b><br>Indicates if Present Value contains a UTC date and time. Support for this object is optional   | R344         | Obj\NoYes  |
| <b>Reliability Evaluation Inhibit</b><br>Indicates if reliability-evaluation is disabled (‘yes’). Support for this object is optional   | R357         | Obj\NoYes  |
| <b>Description</b><br>Device support for this object is optional  | D            | Obj\Text   |

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Status Flag <i>b</i></b><br>Health of the date time pattern value.<br>Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES            | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional  | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional   | US            | Obj\NoYes; Adjustable   |

# Date Time Value

Object Type: *[BACnetIP v31\DateTimeVal]*

The Date Time Pattern Value object represents the externally visible characteristics of a named data value in a BACnet device. A BACnet device can use a DateTime Value object to make any kind of datetime data value accessible to other BACnet devices.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value - Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\DateTime; Adjustable<br>To release or clear a value for a priority, set the value to '' or '[NULL]'     |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\DateTimeVal\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\DateTime; Adjustable  |
| <b>Is UTC</b><br>Indicates if Present Value contains a UTC date and time. Support for this object is optional   | R344          | Obj\NoYes   |
| <b>Reliability Evaluation Inhibit</b><br>Indicates if reliability-evaluation is disabled ('yes'). Support for this object is optional   | R357          | Obj\NoYes   |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the date time value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service  | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES            | Obj\ENUM; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENUM; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |



| Description   | Reference | Type                  |
|---|-----------|-----------------------|
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional | US        | Obj\NoYes; Adjustable |

# Integer Value

Object Type: *[BACnetIP v31\IntVal]*

The Integer Value object represents the externally visible characteristics of a named data value in a BACnet device. A BACnet device can use an Integer Value object to make any kind of signed integer data value accessible to other BACnet devices.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value - Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Float; Adjustable<br>To release or clear a value for a priority, set the value to '' or '[NULL]'        |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\IntVal\ValTable]</i>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Float; Adjustable   |
| <b>Units</b>  | U             | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the integer value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service  | SF. <i>Bb</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Device support for this object is optional  | ES            | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional  | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Device support for this object is optional  | US            | Obj\NoYes; Adjustable   |

| Description  | Reference | Type                  |
|--|-----------|-----------------------|
| <b>Value Resolution</b><br>Smallest recognizable change in value.<br>Device support for this object is optional        | VR        | Obj\Float             |
| <b>Value High</b><br>Maximum value that can be obtained from Present Value. Device support for this object is optional | VH        | Obj\Float             |
| <b>Value Low</b><br>Minimum value that can be obtained from Present Value. Device support for this object is optional  | VL        | Obj\Float             |
| <b>Alarm High</b><br>Device support for this object is optional  | AH        | Obj\Float; Adjustable |
| <b>Alarm Low</b><br>Device support for this object is optional   | AL        | Obj\Float; Adjustable |

# Large Analog Value

Object Type: *[BACnetIP v31\AnValLg]*

The Large Analog Value object represents the externally visible characteristics of a named data value in a BACnet device. A BACnet device can use a Large Analog Value object to make any kind of double-precision data value accessible to other BACnet devices.

| Description  | Reference | Type  |
|--|-----------|---|
| <b>Name</b><br>Unique object name within the device  | N         | Obj\Text  |
| <b>Present Value - Priority p</b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information.<br>See note 1 regarding 64-bit values | V.Pp      | Obj\Text; Adjustable<br>To release or clear a value for a priority, set the value to '' or '[NULL]'   |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable.<br>See note 1 regarding 64-bit values   | VT        | Fixed container:<br><i>[BACnetIP v31\AnValLg\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional  | VP        | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable.  | DV        | Obj\Float; Adjustable   |
| <b>Units</b>   | U         | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional   | D         | Obj\Text  |
| <b>Status Flag b</b><br>Health of the large analogue value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.Bb     | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it   | ES        | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional  | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device   | US        | Obj\NoYes; Adjustable   |

| Description  | Reference | Type                 |
|--|-----------|----------------------|
| <b>Value Resolution</b><br>Smallest recognizable change in value.<br>Device support for this object is optional        | VR        | Obj\Text             |
| <b>Value High</b><br>Maximum value that can be obtained from Present Value. Device support for this object is optional | VH        | Obj\Text             |
| <b>Value Low</b><br>Minimum value that can be obtained from Present Value. Device support for this object is optional  | VL        | Obj\Text             |
| <b>Alarm High</b><br>Device support for this object is optional  | AH        | Obj\Text; Adjustable |
| <b>Alarm Low</b><br>Device support for this object is optional   | AL        | Obj\Text; Adjustable |

## Notes

1. 64-bit values can contain up to 20 significant figures. Numbers this size are ok for displaying to a user, but may be too large to perform accurate maths functions. These values can be read in blocks of six significant figures by appending the object reference with a block number. Block 1 reads the six least significant figures, block 2 the next six significant figures, etc.  
For example, if object 'V' reads the 64-bit value '674407370955.1615', then object 'V.F1' will read the least six significant figures '55.1615', object 'V.F2' the value '073709', and object 'V.F3' the value '6744'.

Floating point numbers are formatted to four decimal places.

# Octet String Value

Object Type: *[BACnetIP v31\OctStrVal]*

The Octet String Value object represents the externally visible characteristics of a named data value in a BACnet device.

An octet string is a series of hex values, with each two hex characters representing a byte (or 8-bit value). For example, '16A20534' represents the bytes 22, 162, 5, and 52.

| Description  | Reference     | Type  |
|--|---------------|---|
| <b>Name</b><br>Unique object name within the device  | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information.<br>See note 1. | V.P <i>p</i>  | Obj\Text; Adjustable<br>To release or clear a value for a priority, set the value to " or '[NULL]'          |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable<br>See note 1.   | VT            | Fixed container:<br><i>[BACnetIP v31\OctStrVal\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional  | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable   | DV            | Obj\Text; Adjustable  |
| <b>Description</b><br>Device support for this object is optional   | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the octet string value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>1=In Fault, 2=Value Overridden, 3=Out of Service  | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional  | ES            | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional  | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional  | US            | Obj\NoYes; Adjustable   |

## Notes

1. Additional formatting options are available for an octet string value. Append the object reference with 'i' to format as a decimal dot delimited (.) number for an IP address, e.g. '127.0.0.1'. Append with 'm' to format as a hexadecimal colon delimited (:) number for a MAC address, e.g. 'AB:01:23:45:67'.

# Positive Integer Value

Object Type: *[BACnetIP v31\IntValPos]*

The Positive Integer Value object represents the externally visible characteristics of a named data value in a BACnet device. A BACnet device can use a Positive Integer Value object to make any kind of unsigned data value accessible to other BACnet devices.

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Num; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’           |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\IntValPos\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: ‘[NULL]’, 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Num; Adjustable   |
| <b>Units</b>  | U             | Obj\Text  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the positive integer value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Device support for this object is optional  | ES            | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional  | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Device support for this object is optional  | US            | Obj\NoYes; Adjustable   |



| Description  | Reference | Type                |
|--|-----------|---------------------|
| <b>Value Resolution</b><br>Smallest recognizable change in value.<br>Device support for this object is optional        | VR        | Obj\Num             |
| <b>Value High</b><br>Maximum value that can be obtained from Present Value. Device support for this object is optional | VH        | Obj\Num             |
| <b>Value Low</b><br>Minimum value that can be obtained from Present Value. Device support for this object is optional  | VL        | Obj\Num             |
| <b>Alarm High</b><br>Device support for this object is optional  | AH        | Obj\Num; Adjustable |
| <b>Alarm Low</b><br>Device support for this object is optional   | AL        | Obj\Num; Adjustable |

# Time Pattern Value

Object Type: *[BACnetIP v31\TimePat]*

The Time Pattern Value object represents the externally visible characteristics of a named data value in a BACnet device. A BACnet device can use a Time Pattern Value object to make any kind of time data value accessible to other BACnet devices

Time Pattern objects can be used to represent multiple recurring times based on rules defined by the pattern of individual fields of the time, some of which can be special values like ‘don't care’, which matches any value in that field. Examples of possibilities would be: ‘every minute of the 11 o'clock hour of the day’, or ‘the thirteenth minute of any hour’.

In this object, Time values have the format ‘*hh:mm:ss*’, where:

*hh* Hours – 00...23, 99=any

*mm* Minutes – 00...59, 99=any

*ss* Seconds – 00...59, 99=any

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Text; Adjustable<br>To release or clear a value for a priority, set the value to “ or ‘[NULL]’          |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\TimePat\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: ‘[NULL]’, 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Text; Adjustable  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the time pattern value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional                                       | RS        | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional | US        | Obj\NoYes; Adjustable  |

# Time Value

Object Type: *[BACnetIP v31\TimeVal]*

The Time Value object represents the externally visible characteristics of a named data value in a BACnet device. A BACnet device can use a Time Value object to make any kind of time data value accessible to other BACnet devices

| Description   | Reference     | Type  |
|---|---------------|---|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text  |
| <b>Present Value - Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Text; Adjustable<br>To release or clear a value for a priority, set the value to '' or '[NULL]'         |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\TimeVal\ValTable]</i>  |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16   |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Text; Adjustable  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the time value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>0=In Alarm, 1=In Fault, 2=Value Overridden, 3=Out of Service   | SF.B <i>b</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional   | ES            | Obj\ENum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail      |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional   | US            | Obj\NoYes; Adjustable   |

# Channel

Object Type: *[BACnetIP v31\Channel]*

The Channel object is used to forward a single received value to a collection of object properties. The collection of object properties may include any combination of BACnet object types, as well as properties of different data types.

| Description  | Reference     | Type  |
|--|---------------|---|
| <b>Name</b><br>Unique object name within the device  | N             | Obj\Text  |
| <b>Present Value</b><br>Value most recently written. To set value, access Present Value by type  | V             | Obj\Text  |
| <b>Present Value (adjust)</b><br>Set value for distribution, specifying the data type.<br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. | V.P <i>p</i>  | Fixed container:<br><i>[BACnetIP v31\Channel\Vals]</i>  |
| <b>Last Priority</b><br>Priority at which the Present Value was last set   | R369          | Obj\Num: 1...16   |
| <b>Write Status</b><br>Channel object's status to distribute the Present Value   | R370          | Obj\Enum<br>Values: 0=None, 1=Idle, 2=In Progress, 3=Successful, 4=Failed   |
| <b>Description</b><br>Device support for this object is optional   | D             | Obj\Text  |
| <b>Status Flag <i>b</i></b><br>Health of the channel. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>1=In Fault, 2=Value Overridden, 3=Out of Service   | SF. <i>Bb</i> | Obj\NoYes   |
| <b>Event State</b><br>Indicates if the object has an active event state associated with it. Support for this object is optional  | ES            | Obj\Enum; Range: 0...5<br>Values: 0=Normal, 1=Fault, 2=Off-normal, 3=High limit, 4=Low limit, 5=Life safety   |
| <b>Reliability</b><br>Indicates if the Present Value is reliable. Device support for this object is optional   | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 7=Unreliable, 8=Process error, 10=Config error, 12=Comms fail, 13=Member fault, 24=Referenced object fault |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device. Support for this object is optional  | US            | Obj\NoYes; Adjustable   |

## Channel Value (adjust)

Object Type: [BACnetIP v31\Channel\Vals]

The Present Value is adjusted by specifying a data type with the value.

The value may contain any one of the following data types:

| Description                 | Reference | Type                  |
|-----------------------------|-----------|-----------------------|
| <b>Value - Null</b>         | N         | Obj\Text; Adjustable  |
| <b>Value - Boolean</b>      | S         | Obj\OffOn; Adjustable |
| <b>Value - Unsigned</b>     | U         | Obj\Num; Adjustable   |
| <b>Value - Integer</b>      | I         | Obj\Float; Adjustable |
| <b>Value - Real</b>         | R         | Obj\Float; Adjustable |
| <b>Value - Double</b>       | F         | Obj\Text; Adjustable  |
| <b>Value - Octet String</b> | Y         | Obj\Text; Adjustable  |
| <b>Value - Char String</b>  | C         | Obj\Text; Adjustable  |
| <b>Value - Bit String</b>   | B         | Obj\Text; Adjustable  |
| <b>Value - Enumerated</b>   | A         | Obj\Num; Adjustable   |
| <b>Value - Date</b>         | D         | Obj\Date; Adjustable  |
| <b>Value - Time</b>         | T         | Obj\Text; Adjustable  |
| <b>Value - Object</b>       | O         | Obj\Text; Adjustable  |

# Lighting Output

Object Type: *[BACnetIP v31\LtgOut]*

The Lighting Output object represents the externally visible characteristics of a lighting output. The lighting output is analogue.

| Description   | Reference     | Type   |
|---|---------------|--|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text   |
| <b>Present Value (%) – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\Float: 0...100.0; Adjustable<br>To release or clear a value for a priority, set the value to " or '[NULL]'.<br>Values <0 perform a special function:<br>-1 = equivalent to the WARN command<br>-2 = equivalent to the WARN_RELINQUISH command<br>-3 = equivalent to the WARN_OFF command |
| <b>Tracking Value</b><br>Indicates the value at which the physical lighting output is being controlled. When In Progress is 'Idle' Tracking Value shall equal Present Value   | R164          | Obj\Float: 0...100.0   |
| <b>In Progress</b><br>Indicates processes that may cause Tracking Value and Present Value to differ   | R378          | Obj\Enum<br>Values: 0=Idle, 1=Fade Active, 2=Ramp Active, 3=Not Controlled, 4=Other  |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><a href="#">[BACnetIP v31\LtgOut\ValTable]</a>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16  |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\Float; Adjustable  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text   |
| <b>Status Flag <i>b</i></b><br>Health of the lighting output value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>1=In Fault, 2=Value Overridden, 3=Out of Service  | SF.B <i>b</i> | Obj\NoYes  |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\Enum; Range: 0...24<br>Values: 0=Ok, 4=Open loop, 5=Short loop, 6=No output, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault, 16=Lamp failure   |

| Description   | Reference | Type   |
|---|-----------|--|
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device                                    | US        | Obj\NoYes; Adjustable                                  |
| <b>Blink Warn Enable</b><br>Indicates if a WARN, WARN_RELINQUISH, or WARN_OFF command is executed when written                                      | R373      | Obj\OffOn  |
| <b>Egress Time (s)</b><br>Time the lighting is held at its current level before relinquishing to 0% following a WARN_RELINQUISH or WARN_OFF command | R377.U    | Obj\Num: 0...3600; Adjustable                          |
| <b>Egress Active</b><br>Indicates if the egress time is in effect following a command   | R386      | Obj\NoYes  |
| <b>Default Fade Time (ms)</b><br>Amount of time over which changes to Present Value are reflected in the Tracking Value                             | R374.U    | Obj\Num: 100...86400000 (1 day); Adjustable            |
| <b>Default Ramp Rate (%/s)</b><br>Rate at which changes to Present Value are reflected in the Tracking Value  | R375.R    | Obj\Float: 0.1...100; Adjustable                       |
| <b>Default Step Increment (%)</b><br>Amount to be added to the Tracking Value when a command doesn't include a step-increment value                 | R376.R    | Obj\Float: 0.1...100; Adjustable                       |
| <b>Transition</b><br>How a change in Present Value transitions from current to target level. Support for this object is optional                    | R385.A    | Obj\Enum; Adjustable<br>Values: 0=None, 1=Fade, 2=Ramp |
| <b>Feedback Value (%)</b><br>Actual value of the physical lighting output. Support for this object is optional                                      | R40       | Obj\Float: 0...100.0                                   |
| <b>Power (kW)</b><br>Power consumption of the load when light level is 100%. Support for this object is optional                                    | R384      | Obj\Float  |
| <b>Instantaneous Power (kW)</b><br>Power consumption of the load at this moment. Support for this object is optional                                | R379      | Obj\Float  |
| <b>Minimum Actual Value (%)</b><br>Physical output level that corresponds to a Present Value of 1.0%. Support for this object is optional           | R383.R    | Obj\Float: 1...100.0; Adjustable                       |
| <b>Maximum Actual Value (%)</b><br>Physical output level that corresponds to a Present Value of 100.0%. Support for this object is optional         | R382.R    | Obj\Float: 1...100.0; Adjustable                       |
| <b>Lighting Command Default Priority</b>  | R381      | Obj\Num: 0...16  |



# Binary Lighting Output

Object Type: *[BACnetIP v31\LtgOutBin]*

The Binary Lighting Output object represents the externally visible characteristics of a binary lighting output.

| Description   | Reference     | Type   |
|---|---------------|--|
| <b>Name</b><br>Unique object name within the device   | N             | Obj\Text   |
| <b>Present Value – Priority <i>p</i></b><br>Within a BACnet device, the present value is stored in a priority array table. Various applications can send a new value to the object, along with a priority. From this table, the value with the highest priority becomes the current value.<br>On adjusting the value a priority, <i>p</i> , is required in the range 1 (high) to 16 (low). If not specified, 8 (manual) is used. On reading, the priority is ignored and the highest priority value returned.<br>See <i>Value Table</i> for more information. | V.P <i>p</i>  | Obj\ENum: 0...5; Adjustable<br>To release or clear a value for a priority, set the value to " or '[NULL]'.<br>Values: Off, On, Warn, Warn-off, Warn-relinquish, Stop   |
| <b>Value Table</b><br>Priority array table containing the value for each priority<br>Device support for this object is only required if present value is adjustable   | VT            | Fixed container:<br><i>[BACnetIP v31\LtgOutBin\ValTable]</i>   |
| <b>Command Priority</b><br>Current active value priority. Support for this object is optional   | VP            | Obj\Num: '[NULL]', 1...16  |
| <b>Default Value</b><br>When there are no values in the priority array, the default value is used.<br>Device support for this object is only required if present value is adjustable  | DV            | Obj\OffOn; Adjustable  |
| <b>Description</b><br>Device support for this object is optional  | D             | Obj\Text   |
| <b>Status Flag <i>b</i></b><br>Health of the lighting output value. Status Flag, <i>b</i> , is a number in the range 0...3, where:<br>1=In Fault, 2=Value Overridden, 3=Out of Service  | SF.B <i>b</i> | Obj\NoYes  |
| <b>Reliability</b><br>Indicates if the Present Value is reliable.<br>Device support for this object is optional   | RS            | Obj\ENum; Range: 0...24<br>Values: 0=Ok, 4=Open loop, 5=Short loop, 6=No output, 7=Unreliable, 8=Process error, 9=Multi-state fault, 10=Config error, 12=Comms fail, 13=Member fault, 14=Monitored object fault, 16=Lamp failure |
| <b>Out of Service</b><br>Indicates if the value is prevented from being modified by software local to the device  | US            | Obj\NoYes; Adjustable  |
| <b>Blink Warn Enable</b><br>Indicates if a WARN, WARN_RELINQUISH, or WARN_OFF command is executed when written  | R373          | Obj\NoYes  |

| Description  | Reference | Type                                    |
|--|-----------|---|
| <b>Egress Time (s)</b><br>Time the lighting is held at its current level before turning off following a WARN_RELINQUISH or WARN_OFF command            | R377.U    | Obj\Num: 0...3600; Adjustable           |
| <b>Egress Active</b><br>Indicates if the egress time is in effect following a command  | R386      | Obj\NoYes                               |
| <b>Feedback Value</b><br>Actual value of the physical lighting output. Support for this object is optional   | R40       | Obj\OffOn                               |
| <b>Power (kW)</b><br>Power consumption of the load when light level is on. Support for this object is optional   | R384      | Obj\Float                               |
| <b>Polarity Reversed</b><br>Support for this object is optional  | P         | Obj\NoYes; Adjustable                   |
| <b>Elapsed Active Time (s)</b><br>Number of seconds the Present Value has had the value 'on' since the last reset. Support for this object is optional | R33.U     | Obj\Num; Adjustable<br>Set '0' to reset |
| <b>Active Time Last Reset</b><br>Date & time the Elapsed Active Time was reset. Support for this object is optional                                    | R114      | Obj\DateTime                            |
| <b>Strike Count</b><br>Number of times the Present Value has transitioned from 'off' to 'on'. Support for this object is optional                      | R391.U    | Obj\Num; Adjustable<br>Set '0' to reset |
| <b>Strike Count Last Reset</b><br>Date & time the Strike Count was reset. Support for this object is optional  | R392      | Obj\DateTime                            |

## Value Table

Object Type: [BACnetIP v31\AnOut\ValTable]  
 Object Type: [BACnetIP v31\AnVal\ValTable]  
 Object Type: [BACnetIP v31\BinOut\ValTable]  
 Object Type: [BACnetIP v31\BinVal\ValTable]  
 Object Type: [BACnetIP v31\MultiOut\ValTable]  
 Object Type: [BACnetIP v31\MultiVal\ValTable]  
 Object Type: [BACnetIP v31\BitStrVal\ValTable]  
 Object Type: [BACnetIP v31\CharStrVal\ValTable]  
 Object Type: [BACnetIP v31\DatePat\ValTable]  
 Object Type: [BACnetIP v31\DateVal\ValTable]  
 Object Type: [BACnetIP v31\DateTimePat\ValTable]  
 Object Type: [BACnetIP v31\DateTimeVal\ValTable]  
 Object Type: [BACnetIP v31\IntVal\ValTable]  
 Object Type: [BACnetIP v31\AnValLg\ValTable]  
 Object Type: [BACnetIP v31\OctStrVal\ValTable]  
 Object Type: [BACnetIP v31\IntValPos\ValTable]  
 Object Type: [BACnetIP v31\TimePat\ValTable]  
 Object Type: [BACnetIP v31\TimeVal\ValTable]  
 Object Type: [BACnetIP v31\LtgOut\ValTable]  
 Object Type: [BACnetIP v31\LtgOutBin\ValTable]

A Value Table is a BACnet priority array, containing a read-only list of prioritized commands.

For BACnet objects that have an adjustable value, values are prioritized based on a fixed number of priorities that are assigned to the application issuing the command. The priority ranges from 1 (highest) to 16 (lowest).

An object stores a priority array containing either a value or a null for each priority. The highest priority value becomes the Present Value for the object.

Applications adjusting an object's value are assigned one of the 16 possible priority levels. The following are standard priorities; however, the assignment of most priorities is site dependent:

| Priority | Application                |
|----------|----------------------------|
| 1        | Manual Life Safety         |
| 2        | Automatic Life Safety      |
| 3        | Available                  |
| 4        | Available                  |
| 5        | Critical Equipment Control |
| 6        | Minimum On/Off             |
| 7        | available                  |
| 8        | Manual Operator            |
| 9        |                            |
| ...      | available                  |
| 16       |                            |

Other applications that need prioritization include temperature override, demand lighting, optimum stop/start, duty cycling, and scheduling. The relative priorities of these applications may vary from site to site and are not standardized. For interoperability at any particular site, the only requirement is that all devices implement the same priority scheme.

| Description   | Reference | Type  |
|---|-----------|---|
| <b>Value - Priority <math>p</math></b><br>The priority, $p$ , is in the range 1...16. See table above | $Ep$      | Depends on BACnet object, will match Present Value type |

# Unsupported Object

Object Type: *[BACnetIP v31\Unknown]*

This BACnet object type is unsupported by the driver.

| Description   | Reference | Type     |
|---|-----------|----------|
| <b>Name</b><br>Unique object name within the device | N         | Obj\Text |

# BACnet Protocol Implementation Conformance Statement (PICS)

|                              |   |                   |          |                          |    |
|------------------------------|---|-------------------|----------|--------------------------|----|
| Date                         | September 10, 2019  |                   |          |                          |    |
| Vendor Name                  | North Building Technologies Ltd.                          |                   |          |                          |    |
| Product Name                 | ObServer BACnetIP Interface, Commander BACnetIP Interface |                   |          |                          |    |
| Product Model Number         | BACnetIP OSM, BACnetIP CDM                                |                   |          |                          |    |
| Application Software Version | BACnetIP v3.1   | Firmware Revision | OSM v2.0 | BACnet Protocol Revision | 19 |

## Product Description

ObSys software and Commander controllers can work stand-alone or together, becoming part of a larger control or monitoring solution.

The BACnet/IP interface can retrieve and modify the values of BACnet objects from other devices, in addition to providing and allowing the modification of its own BACnet objects.

The interface can work as a gateway, using the North Essential Data and Extra Data modules to collect values from any of the attached systems and presenting them as BACnet objects.

## BACnet Standardized Device Profile (Annex L)

- BACnet Cross-Domain Advanced Operator Workstation (B-XAWS)
- BACnet Advanced Operator Workstation (B-AWS)
- BACnet Operator Workstation (B-OWS)
- BACnet Operator Display (B-OD)
- BACnet Advanced Life Safety Workstation (B-ALSWS)
- BACnet Life Safety Workstation (B-LSWS)
- BACnet Life Safety Annunciator Panel (B-LSAP)
- BACnet Advanced Access Control Workstation (B-AACWS)
- BACnet Access Control Workstation (B-ACWS)
- BACnet Access Control Security Display (B-ACSD)
- BACnet Building Controller (B-BC)
- BACnet Advanced Application Controller (B-AAC)
- BACnet Application Specific Controller (B-ASC)
- BACnet Smart Actuator (B-SA)
- BACnet Smart Sensor (B-SS)
- BACnet Advanced Life Safety Controller (B-ALSC)
- BACnet Life Safety Controller (B-LSC)
- BACnet Advanced Access Control Controller (B-AACC)
- BACnet Access Control Controller (B-ACC)
- BACnet Router (B-RTR)
- BACnet Gateway (B-GW)
- BACnet Broadcast Management Device (B-BBMD)
- BACnet Access Control Door Controller (B-ACDC)
- BACnet Access Control Credential Reader (B-ACCR)

## BACnet Interoperability Building Blocks Supported (Annex K)

BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. The services are described in terms of an 'A' and a 'B' device. Both of these devices are nodes on a BACnet inter-network. In most cases 'A' will act as the user of data (like an operator display) and the 'B' device will be the provider of this data (like a controller).

| BIBB Name  | Designation |
|--|-------------|
| Data Sharing – ReadProperty – A                      | DS-RP-A     |
| Data Sharing – ReadProperty – B                      | DS-RP-B     |
| Data Sharing – ReadPropertyMultiple – A              | DS-RPM-A    |
| Data Sharing – WriteProperty – A                     | DS-WP-A     |
| Data Sharing – WriteProperty – B                     | DS-WP-B     |
| Data Sharing – View – A                              | DS-V-A      |
| Data Sharing – Modify – A                            | DS-M-A      |
| Scheduling – View and Modify – A                     | SCHEM-VM-A  |
| Scheduling – Weekly Schedule – A                     | SCHEM-WS-A  |
| Device Management – Dynamic Device Binding – A       | DM-DDB-A    |
| Device Management – Dynamic Device Binding – B       | DM-DDB-B    |
| Device Management – Dynamic Object Binding – B       | DM-DOB-B    |
| Device Management – DeviceCommunicationControl – B   | DM-DCC-B    |
| Device Management – Time Synchronization – A         | DM-TS-A     |
| Device Management – Time Synchronization – B         | DM-TS-B     |
| Device Management – ReinitializeDevice – A           | DM-RD-A     |
| Device Management – ReinitializeDevice – B           | DM-RD-B     |
| Device Management – Automatic Network Mapping – A    | DM-ANM-A    |
| Device Management – Automatic Device Mapping – A     | DM-ADM-A    |
| Network Management – Foreign Device Registration – A | NM-FDR-A    |
| Gateway – Embedded Objects – B                       | GW-EO-B     |

## Segmentation Capability

- Able to transmit segmented messages      Window Size: 1
- Able to receive segmented messages      Window Size: 1

## Standard Object Types Supported

| Object Type        | Optional Properties Supported  | Writable Properties Supported                   |
|--------------------|--|---|
| Analog Input       | Description, Reliability, Min Pres Value, Max Pres Value, Resolution |   |
| Analog Output      | Description, Reliability, Min Pres Value, Max Pres Value, Resolution | Present Value                                   |
| Analog Value       | Description, Reliability, Min Pres Value, Max Pres Value, Resolution | Present Value                                   |
| Binary Input       | Description, Reliability, Inactive Text, Active Text                 |   |
| Binary Output      | Description, Reliability, Inactive Text, Active Text                 | Present Value                                   |
| Binary Value       | Description, Reliability, Inactive Text, Active Text                 | Present Value                                   |
| Device             | Description, Serial Number   | APDU Segment Timeout, APDU Timeout, Description |
| Multi-state Input  | Description, Reliability, State Text                                 |   |
| Multi-state Output | Description, Reliability, State Text                                 | Present Value                                   |
| Multi-state Value  | Description, Reliability, State Text                                 | Present Value                                   |
| Network Port       | Description  |   |

This device does not support the dynamic creation or deletion of objects via BACnet.

## Data Link Layer Options

- ARCNET (ATA 878.1), 2.5 Mb. (Clause 8)
- ARCNET (ATA 878.1), EIA-485 (Clause 8)
- BACnet IP, (Annex J)
- BACnet IP, (Annex J), BACnet Broadcast Management Device (BBMD)
- BACnet IP, (Annex J), Network Address Translation (NAT Traversal)
- BACnet IPv6, (Annex U)
- BACnet IPv6, (Annex U), BACnet Broadcast Management Device (BBMD)
- BACnet/ZigBee (Annex O)
- Ethernet, ISO 8802-3 (Clause 7)
- LonTalk, ISO/IEC 14908.1 (Clause 11)
- MS/TP master (Clause 9)
- MS/TP slave (Clause 9)
- Point-To-Point, EIA 232 (Clause 10)
- Point-To-Point, modem, (Clause 10)
- Other:

## Device Address Binding

Is static device binding supported?     Yes                     No  
(necessary for two-way communication with MS/TP slaves and certain other devices)

## Networking Options

- Router, Clause 6
- Annex H, BACnet Tunneling Router over IP

## Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

- ISO 10646 (UTF-8)                     IBM/Microsoft DBCS \*                     ISO 8859-1
- ISO 10646 (UCS-2) \*                     ISO 10646 (UCS-4)

\* Character set supported on the ObServer platform only.

## Gateway Options

This device collects values from non-BACnet systems and maps them as BACnet objects in a single device.

North Interface Technology supports thousands of different third-party systems. Visit [www.northbt.com/go/drivers](http://www.northbt.com/go/drivers) for the latest driver list.

## Network Security Options

- Non-secure Device – is capable of operating without BACnet Network Security

# Driver Versions

| Version | Build Date | Details   |
|---------|------------|---|
| 1.0     | 14/08/2006 | Driver released based on BACnet v12   |
| 2.0     | 01/03/2009 | Changes in IP address driver uses now detected, link to Essential Data added for client device support, UTF-8 encoding added, and reworked internal driver operation  |
| 2.1     | 01/07/2011 | Driver released on Commander platform   |
| 2.1     | 25/04/2012 | Multistate values are now base 1 as per the BACnet standard, and not 0. Essential Data ENum values translated to this range.  |
| 2.1     | 18/01/2013 | Commander support for ISO 8859-1 added, "?" now returned if character set not supported   |
| 2.1     | 24/01/2014 | On Commander platform, BVLC_FORWARD messages from BBMD replied to wrong IP address.<br>Objects now include Essential Data object label in addition to 'Px.Ox' reference.<br>Enforce Essential Data write inhibit field when writing from BACnet.<br>Clear BACnet device address table on restart.   |
| 3.0     | 01/09/2015 | Updated to support Essential Data v3.0 and Extra Data driver.   |
| 3.1     | 31/05/2018 | Updated to be compliant with revision 19 of the BACnet standard.<br>Expanded the capabilities of the BACnet client. Adding support for more BACnet object types, including schedule and calendars, etc (see BIBBs DS-V-A and MS-M-A).<br>Added new objects for decoding parsing values.<br>Added static device binding.<br>Added loopback, to read local device objects.  |
| 3.1     | 30/07/2018 | Improvements to scanning large BACnet networks. Including reduced global broadcasts, increased address cache size, and increased device timeout.  |
| 3.1     | 19/10/2018 | Added support for driver to reply to devices that use a different UDP port number. Static Device List will wipe on updating to this version.  |
| 3.1     | 24/01/2019 | Resolve issue when reading very long Description on a BACnet object.<br>On Commander platform, added scanning of own device.  |
| 3.1     | 01/10/2020 | Increased checking of corrupt incoming messages.<br>Server operation: Corrected reading the priority array for multi-state object types (Enum values start at 1, not 0).<br>Server operation: Fixed device identifier returning 16-bit value when reading the driver device object's object identifier.<br>Increased cache of BACnet device addresses.<br>Scanning the interface sends Whols on first rather than last object, WholsRouter sent on last object. |

## Next Steps...

If you require help, contact support on 01273 694422 or visit [www.northbt.com/support](http://www.northbt.com/support)



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