ICC

INDUSTRIAL CONTROL COMMUNICATIONS, INC.

BACnet/IP Client Driver Manual

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1 BACnet/IP Client

1.1 Overview

This driver supports the BACnet/IP client protocol. Some notes of interest are:

- The driver supports reading and writing the present value property of BACnet objects residing in other devices on the network.

- The APDU Timeout, Number of APDU Retries, and Max Master properties of the Device object are writeable over the BACnet network.

- Requests are fully configurable through service objects. Up to 100 service objects can be created, targeting up to 32 unique destination device instances.

- Supported BACnet objects include:
    - Analog input (AI), output (AO) and value (AV)
    - Binary input (BI), output (BO) and value (BV)
    - Multi-state input (MSI), output (MSO) and value (MSV)

- Whenever a node is added to the project, its BACnet device object is always present and must be properly configured.

- Analog and multi-state objects are mapped in the database as either an 8-bit, 16-bit, or 32-bit value, depending on the data type selected. This means that each analog object in a service object consumes one, two, or four database addresses, respectively. For example, if a service object's starting analog output instance is "1", the number of instances is "5", the database address is "100", and the data type is "32-bit Unsigned", then AO1 through AO5 will be mapped at database addresses 100 through 119 (AO1 is mapped at address 100 through 103, AO2 is mapped at address 104 through 107, and so on).

- Binary objects are mapped on a bit-by-bit basis in the database starting with the least significant bit of the database byte. For example, if a service object's starting binary output instance is "1", the number of instances is "12", and the database address is "240", then BO1 through BO8 will be mapped to bit 0 through bit 7, respectively, at address 240, and BO9 through BO12 will be mapped to bit 0 through bit 3, respectively, at address 241. The remaining 4 bits in the byte at address 241 are unused.

1.2 Client Settings

UDP Port
Specifies the UDP port that the driver will use for BACnet communications. Enter a value between 1…65535 (0x0…0xFFFF).

APDU Timeout
Sets the time in milliseconds that the driver will wait for a response from a device after sending a request.

Number of APDU Retries
Sets the number of times that the driver will retry a request when a response is not received.

Scan Rate

This is the time in milliseconds the driver will wait between sending requests. This is a useful feature to reduce overall network utilization, or for certain devices or infrastructure components (such as radio modems) that may not be capable of sustaining the maximum packet rates that the driver is capable of producing. The start time for this delay is taken with respect to the moment at which the driver is capable of sending the next packet (due to either reception or timeout of the previous request). If no additional time is required, setting this field to 0 instructs the driver to send its next request packet as soon as possible.

1.3 Node Settings

There are no node settings. A node is simply a container for service objects.

1.4 Device Object Settings

A Device Object is automatically added to every node, and cannot be removed. The Device Object contains several configurable fields that must be appropriately set for each device residing on a BACnet network.

The BACnet/IP BBMD driver, BACnet/IP client driver and BACnet/IP server driver all include mandatory device object definitions. When more than one of these drivers is executing on a single device, only one of these device object definitions is used as the overall device object instance. The hierarchy used to determine which device object definition is used in a multiple-driver scenario is as follows:

1. BACnet/IP client driver device object (highest priority)
2. BACnet/IP server driver device object
3. BACnet/IP BBMD driver device object (lowest priority)

Device Name

Defines the node's name. The device name must be unique across the entire BACnet network. Enter a string of between 1 and 32 characters in length.

Instance Number

Defines the node's instance number. The instance number must be unique across the entire BACnet network. Enter a value between 0…4194302 (0x0…0x3FFFFE).

1.5 Service Object Settings

A variety of different service object types are available. Each type targets a different class of BACnet object. For each service object, the driver will continually read the present value of the defined BACnet object within the service object from the designated device, storing the value(s) in the database (if the read function is enabled). When data in the database changes where the BACnet objects are mapped, a write request is generated to the designated device notifying it of

the changed present value(s) of the BACnet object(s) (if the write function is available and enabled).

1.5.1   Analog Input Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the targeted data type, as well as the number of items to be accessed.

Data Type

Specifies how the value will be stored in the database for each BACnet object in this service object. This defines how many bytes will be allocated, whether the value should be treated as signed or unsigned, and whether the value should be interpreted as an integer or a floating point number. Select the desired data type from this dropdown menu.

Multiplier

The amount that associated network values are scaled by prior to being stored into the database or after being retrieved from the database. Upon retrieval from the database, raw data is multiplied by the multiplier to produce a network value (to be sent to the device). Similarly, network values (read from the device) are divided by the multiplier before being stored into the database.

Read Present Value

This checkbox is always checked, which indicates that reading is always enabled for this type of service object.

1.5.2   Analog Output Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the targeted data type, as well as the number of items to be accessed.

Data Type

Specifies how the value will be stored in the database for each BACnet object in this service object. This defines how many bytes will be allocated, whether the value should be treated as signed or unsigned, and whether the value should be interpreted as an integer or a floating point number. Select the desired data type from this dropdown menu.

Multiplier

The amount that associated network values are scaled by prior to being stored into the database or after being retrieved from the database. Upon retrieval from the database, raw data is multiplied by the multiplier to produce a network value (to be sent to the device). Similarly, network values (read from the device) are divided by the multiplier before being stored into the database.

Read Present Value

Check this checkbox to enable reading (the service object will continuously read from the remote device unless a pending write exists).

Write Present Value

Check this checkbox to enable writing (when values encompassed by this service object change in the internal database, these changes will be written down to the targeted remote device).

Write Priority

This field is enabled only when the "Write Present Value" checkbox is checked. Defines the priority associated with writes for this service object. Select the desired priority from the dropdown menu.

1.5.3 Analog Value Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the targeted data type, as well as the number of items to be accessed.

Data Type

Specifies how the value will be stored in the database for each BACnet object in this service object. This defines how many bytes will be allocated, whether the value should be treated as signed or unsigned, and whether the value should be interpreted as an integer or a floating point number. Select the desired data type from this dropdown menu.

Multiplier

The amount that associated network values are scaled by prior to being stored into the database or after being retrieved from the database. Upon retrieval from the database, raw data is multiplied by the multiplier to produce a network value (to be sent to the device). Similarly, network values (read from the device) are divided by the multiplier before being stored into the database.

Read Present Value

Check this checkbox to enable reading (the service object will continuously read from the remote device unless a pending write exists).

Write Present Value

Check this checkbox to enable writing (when values encompassed by this service object change in the internal database, these changes will be written down to the targeted remote device).

Write Priority

This field is enabled only when the "Write Present Value" checkbox is checked. Defines the priority associated with writes for this service object. Select the desired priority from the dropdown menu.

1.5.4 Binary Input Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the number of items to be accessed.

Data Type

Fixed at "1 Bit".

Read Present Value

This checkbox is always checked, which indicates that reading is always enabled for this type of service object.

1.5.5 Binary Output Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

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Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the number of items to be accessed.

Data Type

Fixed at "1 Bit".

Read Present Value

Check this checkbox to enable reading (the service object will continuously read from the remote device unless a pending write exists).

Write Present Value

Check this checkbox to enable writing (when values encompassed by this service object change in the internal database, these changes will be written down to the targeted remote device).

Write Priority

This field is enabled only when the "Write Present Value" checkbox is checked. Defines the priority associated with writes for this service object. Select the desired priority from the dropdown menu.

1.5.6 Binary Value Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the number of items to be accessed.

Data Type

Fixed at "1 Bit".

Read Present Value

Check this checkbox to enable reading (the service object will continuously read from the remote device unless a pending write exists).

Write Present Value

Check this checkbox to enable writing (when values encompassed by this service object change in the internal database, these changes will be written down to the targeted remote device).

Write Priority

This field is enabled only when the "Write Present Value" checkbox is checked. Defines the priority associated with writes for this service object. Select the desired priority from the dropdown menu.

1.5.7   Multi-state Input Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the targeted data type, as well as the number of items to be accessed.

Data Type

Specifies how the present value will be stored in the database for each BACnet object in this service object. This defines how many bytes will be allocated for the value. Select the desired data type from this dropdown menu.

Offset by One

When enabled, this option automatically offsets the object's present value property by one compared to the object's value in the database. This option is useful when mapping a multi-state object to an enumeration that starts at zero, as zero is an invalid value for a multi-state object's present value property.

The effect of the "Offset by One" field when reading: After the present value property of a multi-state object on a BACnet server is read, the network value is decremented by one before being stored into the device's database.

Read Present Value

This checkbox is always checked, which indicates that reading is always enabled for this type of service object.

1.5.8   Multi-state Output Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the targeted data type, as well as the number of items to be accessed.

Data Type

Specifies how the present value will be stored in the database for each BACnet object in this service object. This defines how many bytes will be allocated for the value. Select the desired data type from this dropdown menu.

Offset by One

When enabled, this option automatically offsets the object's present value property by one compared to the object's value in the database. This option is useful when mapping a multi-state object to an enumeration that starts at zero, as zero is an invalid value for a multi-state object's present value property.

The effect of the "Offset by One" field when writing: Before the present value property of a multi-state object on a BACnet server is written, the raw data retrieved from the device's database is incremented by one to produce a network value.

The effect of the "Offset by One" field when reading: After the present value property of a multi-state object on a BACnet server is read, the network value is decremented by one before being stored into the device's database.

Read Present Value

Check this checkbox to enable reading (the service object will continuously read from the remote device unless a pending write exists).

Write Present Value

Check this checkbox to enable writing (when values encompassed by this service object change in the internal database, these changes will be written down to the targeted remote device).

Write Priority

This field is enabled only when the "Write Present Value" checkbox is checked. Defines the priority associated with writes for this service object. Select the desired priority from the dropdown menu.

1.5.9   Multi-state Value Service Object Settings

Description

This 32-character (max) field is strictly for user reference: it is not used at any time by the driver.

Destination Device Instance

Defines the destination device instance of the BACnet device the driver will send requests to for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Start Instance

Defines the starting instance number for a range of BACnet objects for this service object. Enter a value between 0…4194302 (0x0…0x3FFFFE).

Number of Instances

Defines the number of BACnet objects to be targeted by this service object. Enter a value of 1 or more.

Database Address

Defines the database address where the first BACnet object value of this service object will be mapped. The configuration studio will not allow entry of a starting database address that will cause the service object to run past the end of the database. The highest valid database address, therefore, will depend on the targeted data type, as well as the number of items to be accessed.

Data Type

Specifies how the present value will be stored in the database for each BACnet object in this service object. This defines how many bytes will be allocated for the value. Select the desired data type from this dropdown menu.

Offset by One

When enabled, this option automatically offsets the object's present value property by one compared to the object's value in the database. This option is useful when mapping a multi-state object to an enumeration that starts at zero, as zero is an invalid value for a multi-state object's present value property.

The effect of the "Offset by One" field when writing: Before the present value property of a multi-state object on a BACnet server is written, the raw data retrieved from the device's database is incremented by one to produce a network value.

The effect of the "Offset by One" field when reading: After the present value property of a multi-state object on a BACnet server is read, the network value is decremented by one before being stored into the device's database.

Read Present Value

Check this checkbox to enable reading (the service object will continuously read from the remote device unless a pending write exists).

Write Present Value

Check this checkbox to enable writing (when values encompassed by this service object change in the internal database, these changes will be written down to the targeted remote device).

Write Priority

This field is enabled only when the "Write Present Value" checkbox is checked. Defines the priority associated with writes for this service object. Select the desired priority from the dropdown menu.

1.6   Relinquish Priority Trigger

Each commandable service object, i.e. Output and Value service objects, can optionally include a relinquish priority trigger to relinquish a previously written value. The trigger is assigned to a byte in the database. When a write is detected at this database address, the trigger value is reset to 0, and a relinquish priority request is sent to all objects defined in the service object.

Trigger Address

Specifies the database address to use to trigger the relinquish priority request.

1.7   Diagnostics Object

Each service object can optionally include a diagnostics object for debugging and diagnostics.

Diagnostics Database Address

Enter the database address at which to store the diagnostics information.

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