# Daintree Controls Software (DCS) BACnet® integration guide

## About this guide

**Daintree Control Software (DCS)** is for networked controls projects and serves as the interface for commissioning and start-up, management of controls strategies, visualization of energy and space usage, as well as troubleshooting and diagnostics of the networked controls system.

DCS can control a building's lighting as well as collecting data from sensors. Using DCS, you can

- commission and configure a building's operation, including defining schedules, through the DCS web-based interface
- allow third-party applications to set schedules and retrieve historical events (e.g. occupancy and light change states) through RESTful web APIs
- integrate with third-party Building Management Systems (BMS) by configuring BACnet settings through DCS

This document describes BACnet capabilities available through DCS and provides the information you need to integrate the two systems.

## Before you begin

This guide assumes that technical personnel performing the integration are familiar with BACnet and building automation control systems.

You can find our contact details at Daintree.Support@curentlighting.com if you need help with your BACnet integration.

BACnet configuration done through the DCS interface can be done in advance (before arriving at the site and installing WACs and other hardware). It can also be done at the site as part of the commissioning process.

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# Configuring BACnet integration through DCS

For more detailed information about how BACnet integration is handled through the Daintree Controls Software, please refer to the BACnet model description that follows these instructions.

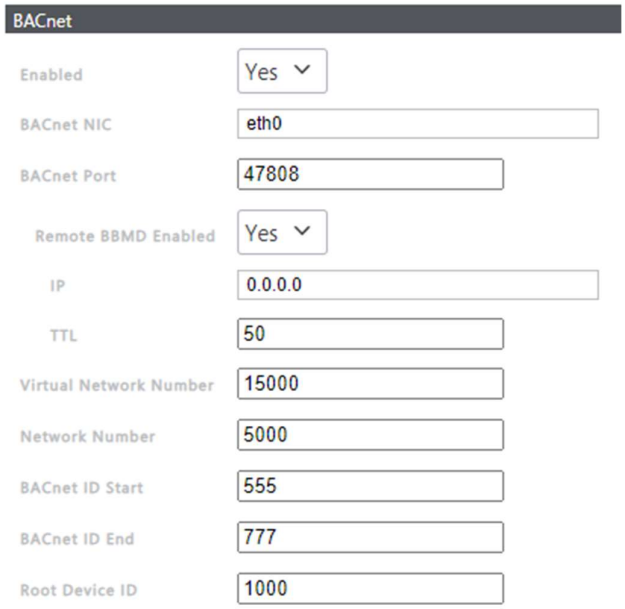
## Adding a BACnet-enabled WAC (gateway) to a site

The following provides a high-level overview of these steps. For more detail, please refer to the *Daintree Controls Software Commissioning Quick Start Guide*.

1. From the DCS menu, select **Configure** > **Sites**.
2. Select **(All Sites)** from the sites drop-down list at the top of the page.
3. Click the **ADD SITE** button and enter the details for your site.
4. From the menu, select **Configure** > **Gateway**.
5. Click the **ADD GATEWAY** button and type a name for the gateway.
6. Click the **SAVE** button to add the gateway to your site.

## Configuring BACnet integration

1. Click the **Edit** icon.
2. Add other gateway details as required. Then scroll down to the **BACnet** settings, to integrate DCS with your existing Building Management System (BMS).




3. Select **Yes** to enable BACnet integration.

4. Enter the following values to configure your integration:

| | |
|---|---|
| BACnet NIC | The ID of the Ethernet interface that the WAC BACnet server runs on. If the WAC60 is connected to the site's network through its built-in ethernet then "eth0" should be used. If the WAC60 is connected to the site's network through a USB-to-ethernet adapter, then "eth2" should be used. |
| BACnet Port | The hex value of the UDP port the BACnet server is running on (default value is 47808). |
| Remote BBMD Enabled | Select Yes if the BACnet server is in a different subnet from the rest of the BACnet network where a BBMD device resides. |
| Remote BBMD IP | If set to a valid IP, the BACnet server will try to register with the BBMD device provided the network routing has been set up. If left as the default 0.0.0.0, the BACnet server will not use the BBMD registration functionality. |
| Remote BBMD TTL | Time-To-Live for BBMD registration. The default value is 300 seconds. This parameter applies only if the BBMD IP is not 0.0.0.0. |
| Virtual Network Number | BACnet Virtual Network number for the virtual network of zones exposed by the WAC BACnet server to a BACnet client.<br>Note: If there are multiple BACnet servers (for example, if there are multiple WACs installed in the building) each BACnet server should use a unique virtual network number. |
| Network Number | The network number for the WAC's root device.<br>Note: Its common for all BACnet devices on the same IP subnet to use the same network number. Therefore, most of the time each WAC in a site will have the same network number. |
| BACnet ID Start | This is the starting BACnet instance ID. The starting number is used for the WAC BACnet server itself. Subsequent numbers are used for zones exposed by the server.<br>Note: That the range from start to end cannot overlap any other BACnet device in your BACnet network. |
| BACnet ID End | Ending number for BACnet instance ID. Make sure the start-to-end range can accommodate all the physical and virtual devices. |
| Root Device ID | Auto generate the root device ID from the gateway's MAC address. |

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# BACnet model

DCS provides controls and sensing capabilities through **Wireless Area Controllers (WACs)**, wireless devices and Modbus devices.

Each WAC can control individual devices and also groups of devices (zones) that need to be managed and controlled together. Each WAC also runs its own BACnet server. It has one main routing entity referred to as the **WAC Root Device**, and one or more virtual BACnet devices to represent each zone that has been configured through DCS.

## WAC Root Device

The WAC Root Device comprises all properties that relate to the entire WAC.

| | Type | Instance | Write? | Command? | COV? | Units | Range |
|---|---|---|---|---|---|---|---|
| **<WAC Name>** | Device | | No | No | No | | |
| | Text name if configured in Daintree Controls Software; otherwise the WAC's MAC address. | | | | | | |
| **Firmware Version** | Character String Value | 1 | No | No | No | | |
| | Version of the software applications and operating system installed on the WAC. | | | | | | |
| **Server Connection Status** | Multi-state Value | 1 | No | No | Yes | | 1-2 |
| | Is the connection between the WAC and the configuration sever working properly?<br>1 = Connection Up<br>2 = Connection Down | | | | | | |
| **ZigBee Network Status** | Multi-state Value | 2 | No | No | Yes | | 1-2 |
| | Is the WAC's ZigBee Network running?<br>1 = ZigBee Network Up<br>2 = ZigBee Network Down | | | | | | |
| **Demand Response** | Multi-state Value | 3 | Yes | Yes | Yes | | 1-4 |
| | Is a Demand Response (DR) event active?<br>1 = DR inactive<br>2 = Low severity DR event<br>3 = Medium severity DR event<br>4 = High severity DR event | | | | | | |
| **Accumulated Lighting Energy** | Analog Value | 1 | Yes | No | Yes | kWh | |
| | Total energy usage for all lighting zones managed by this WAC.<br>Write any value to reset the energy accumulation. | | | | | | |

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## Lighting Zone Device

Lighting zone devices comprise all (virtual) devices that are assigned to lighting zones through the Daintree Controls Software (DCS) commissioning tool.

Note that DCS light zones can contain both luminaires and control devices (e.g. switches and sensors).

| | Type | Instance | Write? | Command? | COV? | Units | Range |
|---|---|---|---|---|---|---|---|
| **<Zone Name>** | Device | | No | No | No | | |
| | Text name as configured through the DCS application. | | | | | | |
| **Light Level CMD** | Analog Value | 1 | Yes | Yes | Yes | % | 1-100 |
| | Point that a supervisory controller can use to control the light level of this zone.<br>Internal controls write to this point at priority 7. To affect the light level a priority of six or higher should be used. | | | | | | |
| **Minimum Level** | Analog Value | 2 | Yes | No | Yes | % | 0-100 |
| | Minimum dimming level that lights controlled by this zone can be set to.<br>Other control parameters cannot set the Light Level to a value less than this.<br>Default value = 0.<br><br>Note: A non-zero setting does not prevent the lights from being turned off. | | | | | | |
| **Maximum Level** | Analog Value | 3 | Yes | No | Yes | % | 0-100 |
| | Maximum dimming level that lights controlled by this zone can be set to.<br>Other control parameters cannot set the Light Level to a value higher than this.<br>Default value = 100. | | | | | | |
| **Occupied Level** | Analog Value | 4 | Yes | No | Yes | % | 0=100 |
| | Light Level set when the space is being controlled by occupancy (e.g. Auto On)<br>and an unoccupied to occupied transition is detected.<br>Default value = 100. | | | | | | |
| **Unoccupied Level** | Analog Value | 5 | Yes | No | Yes | % | 0-100 |
| | Light Level set when the space is being controlled by vacancy (e.g. Auto Off)<br>and an occupied to unoccupied transition has been detected.<br>Default value = 10. | | | | | | |
| **Off Delay** | Analog Value | 6 | Yes | No | Yes | seconds | 0-1800 |
| | The time delay from when all occupancy sensors associated with the zone report<br>unoccupied until the zone's occupancy state transitions to unoccupied.<br>Default value of 900 (i.e. 15 minutes). | | | | | | |
| **On Transition Time** | Analog Value | 7 | Yes | No | Yes | seconds | 0-6000 |
| | Time it takes for the light level to transition from the current level<br>when lights are turned on or space becomes occupied.<br>With the default value of 0 the lights will change level as quickly as possible. | | | | | | |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Off Transition Time** | Analog Value | 8 | Yes | No | Yes | seconds | 0-6000 |
| | Time it takes for the light level to transition from the current level when lights are turned off or the space becomes unoccupied. With the default value of 0 the lights will change level as quickly as possible. | | | | | | |
| **Accumulated Lighting Energy** | Analog Value | 9 | No | No | Yes | kWh | |
| | Total energy usage for this zone. Write any value to reset the energy accumulation. | | | | | | |
| **People Count** | Analog Value | 10 | No | No | Yes | | |
| | Only present if at least one people counter has been associated with the zone. Reports to the total (sum) of the value returned by all people counters associated with the zone. | | | | | | |
| **Ambient Light Level** | Analog Value | 11 | No | No | Yes | lux | |
| | Only present if at least one photo sensor has been associated with the zone. Average value reported by photo sensors associated with the zone. | | | | | | |
| **Fault** | Multi-state Value | 1 | No | No | Yes | | 1-3 |
| | Faults codes associated with this zone:<br>1 - Normal operation<br>2 - Communication failure with associated device<br>3 - Invalid configuration | | | | | | |
| **Control Strategy** | Multi-state Value | 2 | Yes | No | Yes | | 1-5 |
| | Mode of operation:<br>1 - Manual control<br>2 - Auto On / Auto Off<br>3 - Manual On / Auto Off<br>4 - Auto On / Manual Off<br>5 - Timed On | | | | | | |
| **Devices in alarm** | Character String Value | 1 | No | No | Yes | | |
| | Comma separated list of device IDs (IEEE address) associated with this zone that have a communications fault. | | | | | | |
| **Occupied** | Binary Value | 1 | No | No | Yes | | |
| | Only present if at least one occupancy sensor has been associated with the zone. Reports as 'occupied' if **any** of the occupancy sensors associated with the zone report occupied.<br>False – unoccupied<br>True - occupied | | | | | | |

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## Sensor Zone Device

Sensor zone devices comprise all (virtual) devices that are assigned to sensor zones through the Daintree Controls Software (DCS) commissioning tool.

Note that DCS sensor zones can contain only control devices (e.g. switches and sensors).

The points available within any given sensor zone device instance depend on what wireless devices have been mapped to that zone. For example, in a zone that contains nothing but occupancy sensors, only the Occupied point will be present in the virtual device.

| | Type | Instance | Write? | Command? | COV? | Units | Range |
|---|---|---|---|---|---|---|---|
| **<Zone Name>** | Device | | No | No | No | | |
| | Text name as configured through the DCS application. | | | | | | |
| **People Count** | Analog Value | 1 | No | No | Yes | | |
| | Only present if at least one people counter has been associated with the zone.<br>Reports to the total (sum) of the value returned by all people counters associated with the zone. | | | | | | |
| **Ambient Light Level** | Analog Value | 2 | No | No | Yes | lux | |
| | Only present if at least one photo sensor has been associated with the zone.<br>Average value reported by photo sensors associated with the zone. | | | | | | |
| **Temperature** | Analog Value | 3 | No | No | Yes | degree C | |
| | Only present if at least one temperature sensor has been associated with the zone.<br>Average value reported by temperature sensors associated with the zone. | | | | | | |
| **Fault** | Multi-state Value | 1 | No | No | Yes | | 1-3 |
| | This point is always present.<br>Faults codes associated with this zone:<br>1 - Normal operation<br>2 - Communication failure with associated device<br>3 - Invalid configuration | | | | | | |
| **Devices in alarm** | Character String Value | 1 | No | No | Yes | | |
| | This point is always present.<br>Comma separated list of device IDs (IEEE address) associated with this zone<br>that have a communications fault. | | | | | | |
| **Occupied** | Binary Value | 1 | No | No | Yes | | |
| | Only present if at least one occupancy sensor has been associated with the zone.<br>Reports as 'occupied' if **any** of the occupancy sensors associated with the zone report occupied.<br>False – unoccupied<br>True - occupied | | | | | | |

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## BACnet interoperability

The WAC BACnet server supports the following BACnet standard interoperability features:

| Property | Details |
|---|---|
| **BACnet version** | ANSI/ASHRAE 135-2016 specifically revision 19 and all relevant errata |
| **Data Link Layer Options** | BACnet/IP (IPv4); supporting BBMD and foreign device registration.<br>Uses the default BACnet/IP UDP port of 47808 (0xBAC0). |
| **Segmentation** | Supported |
| **Routing** | The WAC BACnet server routes between a physical BACnet/IP (IPv4) network and a virtual network. The address lengths of the virtual devices are 3-bytes. |
| **BACnet Device Profile** | The WAC BACnet server will behave as a B-GW router supporting GW-VN-B to a virtual network of B-ASC type profile server devices. |
| **BACnet BIBBs** | The following specific BIBBs shall be supported per their relevant definitions in BACnet for both the router and virtual devices:<br>• **DS-RP-B, DS-RPM-B, DS-WP-B, DS-WPM-B**<br>Act as a server that can execute Read/Write single or Read/Write multiple properties<br>• **DM-DDB-B, DM-DOB-B**<br>Dynamic device and object binding. Initiate I-Am in response to Who-Is, and I-Have in response to Who-Has<br>• **DM-DCC-B, DM-RD-B**<br>DeviceCommunicationControl and Reinit Device server<br>• **DS-COV-B**<br>Act as a server that accepts COV subscriptions and can initiate COVNotifications<br>• **AE-N-I-B, AE-ACK-B, AE-INFO-B**<br>Act as a server that can detect various alarm conditions and can report them using Confirmed and UnconfirmedEventNotifications |

## Interactions with controls from other DCS subsystems

The following DCS subsystems can modify the lighting zone state and configuration settings:

| Subsystem | Modifiable properties |
|---|---|
| **WAC's scheduler (as configured via UI or API)** | Any properties in this document listed as being Write? (writeable) or Command? (commandable) |
| **Manual override from user interface** | Light Level CMD |
| **Manual override from RESTful API** | Light Level CMD |
| **BACnet supervisory controller** | Any properties in this document listed as being Write? (writeable) or Command? (commandable) |

- For any writeable property that is not commandable, the value used by the WAC is taken from whichever sub-system last wrote to the property.
- For properties that are both writeable and commandable, the value of the property is taken from whichever subsystem wrote with the highest priority.
- All WAC subsystems write with a priority level of 7. To affect changes a priority of six or higher should be used.