AleoBlue BACnet Gateway

Integration guide

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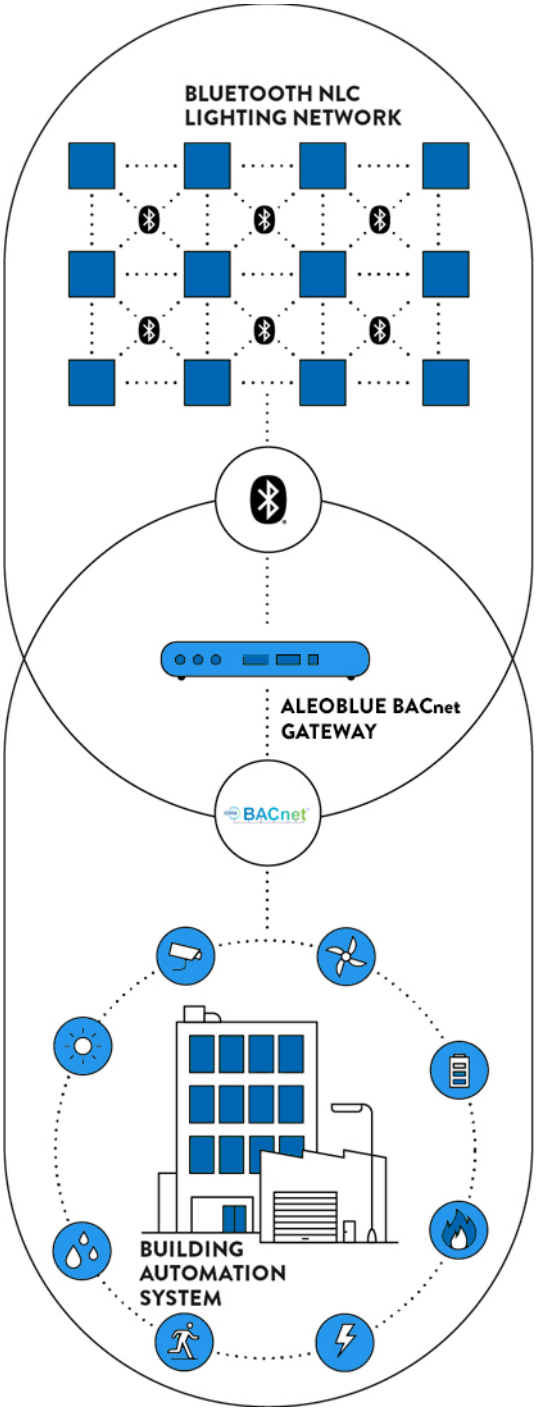

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ALEO LIGHTING, INC
10988 Bloomfield Ave, Santa Fe Springs, CA 90670

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1. Overview

The AleoBlue BACnet Gateway is a device that connects a Bluetooth® NLC lighting system to a Building Management System (BMS) using the BACnet/IP protocol. It provides bidirectional communication between the wireless lighting network and the BACnet system by exposing lighting-related data as readable BACnet objects and lighting control points as writable BACnet objects.

Through this object model, a BACnet client can monitor states of the lighting system and control lighting behavior. Writing to BACnet output objects triggers the transmission of Bluetooth Mesh control messages that directly affect luminaire behavior within the lighting network.

From the lighting system perspective, the gateway is a standard Bluetooth Mesh node that listens to mesh traffic and sends control messages when commanded.

From the BACnet perspective, the gateway behaves as a BACnet Application Specific Controller (B-ASC) that hosts a fixed set of BACnet objects representing the state and control points of the lighting system.

The gateway operates strictly on-premise and cannot be connected to the internet. Communication with the lighting system occurs over Bluetooth Mesh, while communication with the BMS occurs over Ethernet using BACnet/IP protocol. These two domains are fully isolated and are bridged only within the gateway.

The gateway uses a group-centric integration model (zone-centric from the Bluetooth NLC perspective). Lighting zones defined using AleoBlue Commissioning tools are mapped to BACnet objects that represent aggregated zone-level state and control, including occupancy, energy usage, light level, and scene recall. Individual luminaires are not exposed as controllable BACnet objects. However, the gateway may expose device-level health status objects for diagnostics and maintenance.

The gateway does not execute lighting logic. All lighting behavior, including scenes, scheduling, or automation rules is configured using AleoBlue Commissioning tools, and cannot be modified through the gateway.

2. BACnet objects, instance IDs, and allocation model

The AleoBlue BACnet Gateway exposes lighting system data and control points as standard BACnet objects. Each object is defined by its Object Type (Device, Network Port, Analog Input, Analog Output, Binary Input, Multi-State Input, Multi-State Output, Structured View) and a unique Object Instance ID. Together, these form the BACnet object identifier.

The BACnet object model exposed by the gateway is derived from the commissioned lighting topology. Any change to the lighting system requires regeneration of the BACnet Gateway configuration file in the AleoBlue web app and deployment of the updated configuration file to the gateway. Such changes include creating or deleting zones, adding or removing devices, moving devices between zones, renaming elements, and changing scenarios or settings.

Until the updated configuration is applied, the BACnet objects exposed may no longer reflect the actual lighting system, and BACnet clients may reference outdated objects. For reliable BMS integration, finalize the lighting topology using AleoBlue Commissioning tools before BACnet object mapping and update the gateway configuration after any topology changes.

Control interactions include predefined zone-level functions: Group Scene Recall objects trigger commissioned scenes, and Group Light Level Set objects define the target light level within a zone. Monitoring objects exposed by the gateway are read-only and reflect the current state of the lighting system. Device-level objects provide health and diagnostic information.

The gateway reserves a range of 2000 Object Instance IDs in the gateway's BACnet object space starting from the Base Object Instance selected during configuration. This range allows a topology of up to 100 zones and 200 devices. Selecting the Base Object Instance must be coordinated with the BMS integrator to prevent Object Instance ID collisions with other BACnet devices on the same BACnet network. Only a subset of these IDs is instantiated as active BACnet objects.

Within each function-specific range, Object Instance IDs are assigned sequentially in ascending order according to zone commissioning date. If fewer zones are configured than the maximum supported, only the Object Instance IDs assigned to those zones are instantiated, and the remaining IDs in the range remain unused.

Changing the Base Object Instance renumbers all BACnet objects and requires remapping in the BMS.

The gateway supports BACnet Change of Value (COV) reporting for applicable objects, and updates are sent to subscribed BACnet clients.

Detailed object definitions are provided in the *SGW-105 AleoBlue BACnet PICS* document for the gateway.

2.1 Fixed gateway-level objects (offsets 0–99)

18 fixed gateway-level Object Instance IDs are instantiated as active BACnet objects. The remaining offsets are reserved for future use, which preserves stable Object Instance numbering and allows future extensions without affecting existing BACnet mappings.

These objects are independent of zones and devices and define the fixed gateway footprint. They are always present, regardless of the lighting topology.

2.1.1 Device and network objects

- Offset **0** – Device
  Represents the AleoBlue BACnet Gateway as a BACnet device. Required by the BACnet standard and used for discovery, identification, and basic device management.
- Offset **1** – Network Port
  Represents the BACnet/IP network interface of the gateway, including IP addressing mode (DHCP or static) and BACnet/IP communication parameters.

2.1.2 Gateway status and diagnostics

- Offset **50** – Gateway Status (Structured View)
  Acts as a logical container for gateway-related diagnostic and status information.
- Offset **51** – UART TX (Analog Input)
  Counts the number of messages transmitted from the BACnet application to the Bluetooth radio.
- Offset **52** – UART RX (Analog Input)
  Counts the number of messages received by the BACnet application from the Bluetooth radio.
- Offset **53** – MESH TX (Analog Input)
  Counts the number of Bluetooth Mesh messages transmitted by the radio.
- Offset **54** – MESH RX (Analog Input)
  Counts the number of Bluetooth Mesh messages received by the radio.
- Offset **55** – Firmware Status (Analog Input)
  Exposes the gateway firmware status:
  - Firmware unprovisioned
  - Firmware unprovisioned in attention state
  - Firmware provisioned but not in a mesh range (no MESH RX activity)
  - Firmware provisioned and in a mesh range (MESH RX activity)
  - Firmware provisioned in attention state and in a mesh range (MESH RX activity)

2.1.3 Structured view objects for group functions and topology

Structured view objects provide navigation entry points for group-level functions and the lighting topology. They do not represent measured or controllable values but enable BACnet clients to discover and browse related zone-level objects within a structured hierarchy.

- **Offset 90** – Group Light Level Status (Structured View)
- **Offset 91** – Group Ambient Light Level (Structured View)
- **Offset 92** – Group LightOn Status (Structured View)
- **Offset 93** – Group Light Level Set (Structured View)
- **Offset 94** – Group Scene Recall (Structured View)
- **Offset 95** – Group Occupancy Status (Structured View)
- **Offset 96** – Group Energy Use (Structured View)
- **Offset 97** – Group Health Status (Structured View)
- **Offset 98** – Area Name (Structured View)
  Represents the Area controlled by the gateway and contains Mesh Topology Information for zones.
- **Offset 99** – Project Name (Structured View)
  Represents the Project containing the Area and is the top-level entry point to the lighting topology exposed by the gateway.

2.2 Zone-based group function objects (offsets 100–899)

Zone-based group function Object Instance IDs are allocated in function-specific ranges. Each range spans 100 offsets and corresponds to a specific BACnet Object Type and function. Each zone instantiates up to one object per function within the corresponding range. The total number of instantiated objects depends on the number of configured zones.

- Offset **100–199** – Group Health Status (Multi-State Input)
- Offset **200–299** – Group Occupancy Status (Binary Input)
- Offset **300–399** – Group Energy Use (Analog Input)
- Offset **400–499** – Group Scene Recall (Multi-State Output)
- Offset **500–599** – Group Ambient Light Level (Analog Input)
- Offset **600–699** – Group LightOn Status (Binary Input)
- Offset **700–799** – Group Light Level Set (Analog Output)
- Offset **800–899** – Group Light Level Status (Analog Input)

2.3 Zone name objects (offsets 1400–1499)

- Offset **1400–1499** – Zone Name (Structured View)
  Each Zone Name object represents a single zone in the BACnet structural hierarchy.

2.4 Device-level health status objects (offsets 1500–1699)

- Offset **1500–1699** – Device Health Status (Multi-State Input)
  Each device is represented by a **Device Health Status** object. This enables the BMS to monitor the health of individual luminaires or controllers, although control and automation remain zone-based.

3. BACnet object naming

The AleoBlue BACnet Gateway uses a deterministic, human-readable naming scheme to make BACnet objects self-descriptive within the lighting system topology by indicating the gateway, project, area, zone, optionally device, and associated function.

Object names are provided for readability and diagnostics only and must not be used as stable identifiers. All BMS integration, binding, and control logic must use Object Instance ID and Object Type. Object names may change if project, area, zone, or device names are modified, while Object Instance IDs remain the same as long as the Base Object Instance and topology are unchanged.

For reliable BMS integration, do not use object names as primary identifiers.

Group-level objects

Group-level (zone-based) objects use the following naming format:
`APPLICATION_GROUP_ID@GW_NAME/PROJECT_NAME/AREA_NAME/ZONE_NAME/OBJECT_FUNCTION`

Example:
`Lighting_G000@BACnet_GW_0/Office/Floor_1/Corridor/Group_Health_Status`

Device-level objects

Device-level objects use the following naming format:
`APPLICATION_GROUP_ID_DEVICE_ID@GW_NAME/PROJECT_NAME/AREA_NAME/ZONE_NAME/DEVICE_NAME/OBJECT_FUNCTION`

Example:
`Lighting_G000_D000@BACnet_GW_0/Office/Floor_1/Corridor/Device_c345/Device_Health_Status`

The following table defines the components used in the object naming scheme.

Component	Description
`APPLICATION`	Application domain exposed by the gateway. It is always set to `Lighting`.
`GROUP_ID`	Identifier assigned by the gateway during configuration based on the zone creation date within the area. Represented as `G` followed by a sequential, zero-padded, three-digit number (for example, `G000`, `G001`).
`DEVICE_ID`	Identifier assigned by the gateway during configuration, based on zone creation date and, within each zone, on device commissioning date. Represented as `D` followed by a sequential, zero-padded, three-digit number (for example, `D000`, `D001`).
`GW_NAME`	Name of the BACnet Gateway device as defined in AleoBlue Commissioning. Spaces and URI-reserved characters are replaced with underscores (‘_’).

Component	Description
`PROJECT_NAME/AREA_NAME/ZONE_NAME`	Topology path within the project. These names are taken directly from AleoBlue Commissioning and reflect the logical project structure. Spaces and URI-reserved characters are replaced with underscores ('_').
`DEVICE_NAME`	Name of the luminaire or controller as defined in AleoBlue Commissioning. Spaces and URI-reserved characters are replaced with underscores ('_').
`OBJECT_FUNCTION`	For **group-level objects**, this element indicates a supported group function (for example, `Group_Health_Status`). The set of valid object functions is fixed and corresponds to the group-level BACnet objects supported by the gateway. For **device-level objects**, this element indicates a supported device function (for example, `Device_Health_Status`). Spaces and URI-reserved characters are replaced with underscores ('_').

4. Object allocation example

This section shows how the AleoBlue BACnet Gateway allocates BACnet Object Instance IDs in a real installation and how they translate into BACnet addresses and human-readable names.

This example assumes that all supported group-level and device-level functions are enabled.

The network configuration used in this example is as follows:

Number of AleoBlue BACnet Gateways	1
Number of areas	1
Number of zones	3
Number of devices	15 (5 per zone)
Base Object Instance ID	10000
Object Instance ID range	10000–11999

From the BACnet system perspective, the gateway reserves Object Instance IDs 10000–11999. Within this range, 60 Object Instance IDs are instantiated as active objects:

- 18 fixed gateway-level objects
- 24 zone-based group function objects (3 zones × 8 group functions)
- 3 zone name objects (3 zones)
- 15 device-level health status objects (15 devices)

As described in the BACnet object naming section, the following naming formats are used for group-level and device-level objects:

```
APPLICATION_GROUP_ID@GW_NAME/PROJECT_NAME/AREA_NAME/ZONE_NAME/OBJECT_FUNCTION
APPLICATION_GROUP_ID_DEVICE_ID@GW_NAME/PROJECT_NAME/AREA_NAME/ZONE_NAME/DEVICE_NAME/OBJECT_FUNCTION
```

The components of these naming formats are as follows:

`APPLICATION`	`Lighting`
`GW_NAME`	`BACnet_GW_0`
`PROJECT_NAME`	`Office`
`AREA_NAME`	`Floor_1`

`ZONE_NAME`	`Zone_A`
	`Zone_B`
	`Zone_C`

`GROUP_ID` (assigned based on zone creation date)	`G000` for `Zone_A`
	`G001` for `Zone_B`
	`G002` for `Zone_C`

DEVICE_ID (assigned based on zone creation date and, within each zone, by device commissioning date)	D000, D001, D002, D003, D004 for devices in Zone_A (oldest zone) D005, D006, D007, D008, D009 for devices in Zone_B D010, D011, D012, D013, D014 for devices in Zone_C (newest zone)

4.1 Fixed gateway-level objects (offsets 0–99; instance IDs reserved 10000–10099)

- 10000 (offset 0) – Device object
- 10001 (offset 1) – Network Port object
- 10050 (offset 50) – Gateway Status (Structured View)
- 10051 (offset 51) – UART TX (Analog Input)
- 10052 (offset 52) – UART RX (Analog Input)
- 10053 (offset 53) – MESH TX (Analog Input)
- 10054 (offset 54) – MESH RX (Analog Input)
- 10055 (offset 55) – Firmware Status (Analog Input)
- 10090 (offset 90) – Group Light Level Status (Structured View)
- 10091 (offset 91) – Group Ambient Light Level (Structured View)
- 10092 (offset 92) – Group LightOn Status (Structured View)
- 10093 (offset 93) – Group Light Level Set (Structured View)
- 10094 (offset 94) – Group Scene Recall (Structured View)
- 10095 (offset 95) – Group Occupancy Status (Structured View)
- 10096 (offset 96) – Group Energy Use (Structured View)
- 10097 (offset 97) – Group Health Status (Structured View)
- 10098 (offset 98) – Area Name (Structured View)
- 10099 (offset 99) – Project Name (Structured View)

4.2 Zone-based group function objects (offsets 100–899; instance IDs reserved 10100–10899)

For each supported group-level function, the gateway allocates one BACnet object per zone within a dedicated offset range. Each range can accommodate up to 100 zones. In this example, there are three zones, so only the first three Object Instance IDs in each range are used.

4.2.1 Group Health Status objects (offsets 100-199)

```
Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_Health_Status (10100)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_Health_Status (10101)
Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_Health_Status (10102)
```

4.2.2 Group Occupancy Status objects (offsets 200-299)

```
Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_Occupancy_Status (10200)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_Occupancy_Status (10201)
Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_Occupancy_Status (10202)
```

4.2.3 Group Energy Use objects (offsets 300-399)

```
Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_Energy_Use (10300)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_Energy_Use (10301)
Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_Energy_Use (10302)
```

4.2.4 Group Scene Recall objects (offsets 400-499)

```
Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_Scene_Recall (10400)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_Scene_Recall (10401)
```

Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_Scene_Recall (10402)

4.2.5 Group Ambient Light Level objects (offsets 500-599)

Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_Ambient_Light_Level (10500)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_Ambient_Light_Level (10501)
Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_Ambient_Light_Level (10502)

4.2.6 Group LightOn Status objects (offsets 600-699)

Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_LightOn_Status (10600)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_LightOn_Status (10601)
Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_LightOn_Status (10602)

4.2.7 Group Light Level Set objects (offsets 700-799)

Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_Light_Level_Set (10700)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_Light_Level_Set (10701)
Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_Light_Level_Set (10702)

4.2.8 Group Light Level Status objects (offsets 800-899)

Lighting_G000@BACnet_GW_0/Office/Floor_1/Zone_A/Group_Light_Level_Status (10800)
Lighting_G001@BACnet_GW_0/Office/Floor_1/Zone_B/Group_Light_Level_Status (10801)
Lighting_G002@BACnet_GW_0/Office/Floor_1/Zone_C/Group_Light_Level_Status (10802)

4.3 Zone name objects (offsets 1400–1499; instance IDs reserved 11400–11499)

Lighting_G000@Zone_A (11400)
Lighting_G001@Zone_B (11401)
Lighting_G002@Zone_C (11402)

4.4 Device-level health status objects (offsets 1500–1699; instance IDs reserved 11500–11699)

Lighting_G000_D000@BACnet_GW_0/Office/Floor_1/Zone_A/Device_01/Device_Health_Status (11500)
Lighting_G000_D001@BACnet_GW_0/Office/Floor_1/Zone_A/Device_02/Device_Health_Status (11501)
Lighting_G000_D002@BACnet_GW_0/Office/Floor_1/Zone_A/Device_03/Device_Health_Status (11502)
Lighting_G000_D003@BACnet_GW_0/Office/Floor_1/Zone_A/Device_04/Device_Health_Status (11503)
Lighting_G000_D004@BACnet_GW_0/Office/Floor_1/Zone_A/Device_05/Device_Health_Status (11504)
Lighting_G001_D005@BACnet_GW_0/Office/Floor_1/Zone_B/Device_06/Device_Health_Status (11505)
Lighting_G001_D006@BACnet_GW_0/Office/Floor_1/Zone_B/Device_07/Device_Health_Status (11506)
Lighting_G001_D007@BACnet_GW_0/Office/Floor_1/Zone_B/Device_08/Device_Health_Status (11507)
Lighting_G001_D008@BACnet_GW_0/Office/Floor_1/Zone_B/Device_09/Device_Health_Status (11508)
Lighting_G001_D009@BACnet_GW_0/Office/Floor_1/Zone_B/Device_10/Device_Health_Status (11509)
Lighting_G002_D010@BACnet_GW_0/Office/Floor_1/Zone_C/Device_11/Device_Health_Status (11510)
Lighting_G002_D011@BACnet_GW_0/Office/Floor_1/Zone_C/Device_12/Device_Health_Status (11511)
Lighting_G002_D012@BACnet_GW_0/Office/Floor_1/Zone_C/Device_13/Device_Health_Status (11512)
Lighting_G002_D013@BACnet_GW_0/Office/Floor_1/Zone_C/Device_14/Device_Health_Status (11513)

```
Lighting_G002_D014@BACnet_GW_0/Office/Floor_1/Zone_C/Device_15/Device_Health_Status (11514)
```

5. Integration workflow and responsibilities

This section defines the integration workflow between lighting configuration, gateway setup, and BMS integration. It specifies the required sequence of actions and the responsibilities at each stage.

5.1 Lighting system preparation

Before commissioning the BACnet Gateway, complete lighting system commissioning in AleoBlue Commissioning.

All luminaires, sensors, and controllers must be added to zones in the project and fully configured. This includes defining scenes, schedules, occupancy behavior, daylight control, and other required lighting settings.

Verify correct operation in the field before proceeding.

Do not commission or configure the gateway until the lighting configuration is finalized and validated.

5.2 Gateway commissioning and configuration

Commission the gateway into the Bluetooth Mesh network using the AleoBlue mobile app.

Generate the gateway configuration file in the AleoBlue web app. During this step, define:

- Base Object Instance
- BACnet/IP network parameters

Selection of the Base Object Instance must be coordinated with the BMS integrator to prevent Object Instance ID conflicts on the BACnet network.

Transfer the generated configuration file to the gateway using a FAT32-formatted USB drive, then power-cycle the gateway to apply it.

Applying a configuration replaces the existing configuration and regenerates the BACnet object model according to the project topology at the time the configuration file was generated.

The detailed gateway commissioning procedure is described in the *SGW-104 AleoBlue BACnet Gateway user manual*.

5.3 BACnet object validation and verification

After configuration, use a BACnet/IP client (for example, YABE) to identify the gateway on the network and review the exposed object list within the configured Object Instance range. Make sure that Object Instance IDs align with the configured Base Object Instance and expected offset ranges.

Verify:

- The presence of the Device object and Network Port object
- That group-level objects are created for each configured zone
- That structured view objects reflect the expected topology
- That monitored values (occupancy, energy use, light level, and health status) update consistently with observed lighting behavior
- That scene recall and light level set commands produce the expected zone response

Complete functional verification before integrating with the production BMS.

5.4 BMS mapping and integration

Map BACnet objects into the BMS according to project requirements.

All BMS integration must rely exclusively on Object Type and Object Instance ID. Object names must not be used as identifiers.

Use Change of Value (COV) subscriptions where applicable.

The BMS must not replicate or override lighting logic defined in AleoBlue Commissioning and must interact with the system only through exposed BACnet objects.

5.5 Handling lighting system changes and reconfiguration

Any change to the lighting project requires regeneration and redeployment of the gateway configuration file.

After such changes:

1. Generate a new configuration file in the AleoBlue web app.
2. Transfer the file to the gateway using a FAT32-formatted USB drive.
3. Power-cycle the gateway to apply the updated configuration.

If the configuration is not updated after project changes, BACnet clients may see outdated objects or an object model that no longer reflects the current system structure.

Such changes invalidate existing BMS bindings.

Coordinate topology changes and Base Object Instance modifications with the BMS integrator to prevent integration conflicts.

6. Document revisions

Revision	Date	Editor	Changes
1.1	16 March 2026	GM	Corrected the examples in the Zone name objects section.
1.0	5 March 2026	GM	Initial revision.

Contact information

Support: Business development:	**AleoBlue.support@aleolighting.com** **Support2@aleolighting.com**
For more information please visit:	**www.AleoBlue.com**
Our offices: **Aleo Lighting + Controls** 10988 Bloomfield Ave Santa Fe Springs, CA 90670	