

Basic Lightness Controller NLC Profile

Bluetooth® Profile Specification

- **Version:** v1.0.1
- **Version Date:** 2024-10-01
- **Prepared By:** Mesh Working Group

Abstract

The Basic Lightness Controller NLC Profile specifies the requirements for a product acting as a sensor-driven luminaire controller supporting basic use cases in a Bluetooth mesh system.



Version History

Version Number	Date (yyyy-mm-dd)	Comments
v1.0	2023-09-12	Adopted by the Bluetooth SIG Board of Directors.
v1.0.1	2024-10-01	Adopted by the Bluetooth SIG Board of Directors.

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1 Introduction

The occupancy status or light level reported by occupancy and ambient light sensors can be used to turn off or dim down the lights to save energy when rooms are unoccupied or when daylight is sufficient.

The Basic Lightness Controller NLC Profile specifies the requirements for a networked lighting control (NLC) product acting as a luminaire controller in a Bluetooth mesh system. The Basic Lightness Controller NLC Profile standardizes the use cases and implementation patterns of luminaire controllers to help improve interoperability and performance of systems based on Bluetooth mesh, such as networked lighting control systems.

A common use case for the Basic Lightness Controller NLC Profile is a luminaire reacting to information published by occupancy and/or ambient light sensors as well as reacting to override events (e.g., manually dimming/brightening the lights or turning them on/off) in networked lighting control systems.

A device implementing the Basic Lightness Controller role may drive the light output directly (e.g., when integrated into an LED driver) or indirectly (e.g., by interacting with the LED driver over a Digital Addressable Lighting Interface (DALI) bus; see [9]).

1.1 Change History

This section summarizes changes at a moderate level of detail and should not be considered representative of every change made.

1.1.1 Changes from v1.0 to v1.0.1

Section	Errata
3.4: Performance	25030
5: References	24814, 25367

Table 1.1: Errata incorporated in v1.0.1

1.2 Language

1.2.1 Language conventions

In the development of a specification, the Bluetooth SIG has established the following conventions for use of the terms “shall”, “shall not”, “should”, “should not”, “may”, “must”, and “can”. In this Bluetooth specification, the terms in Table 1.1 have the specific meanings given in that table, irrespective of other meanings that exist.

Term	Definition
shall	—used to express what is required by the specification and is to be implemented exactly as written without deviation
shall not	—used to express what is forbidden by the specification
should	—used to express what is recommended by the specification without forbidding anything



Term	Definition
should not	—used to indicate that something is discouraged but not forbidden by the specification
may	—used to indicate something that is permissible within the limits of the specification
must	—used to indicate either: <ol style="list-style-type: none"> 1. an indisputable statement of fact that is always true regardless of the circumstances 2. an implication or natural consequence if a separately-stated requirement is followed
can	—used to express a statement of possibility or capability

Table 1.2: Language conventions terms and definitions

1.2.1.1 Implementation alternatives

When specification content indicates that there are multiple alternatives to satisfy specification requirements, if one alternative is explained or illustrated in an example it is not intended to limit other alternatives that the specification requirements permit.

1.2.1.2 Discrepancies

It is the goal of Bluetooth SIG that specifications are clear, unambiguous, and do not contain discrepancies. However, members can report any perceived discrepancy by filing an erratum and can request a test case waiver as appropriate.

1.2.2 Reserved for Future Use

Where a field in a packet, Protocol Data Unit (PDU), or other data structure is described as "Reserved for Future Use" (irrespective of whether in uppercase or lowercase), the device creating the structure shall set its value to zero unless otherwise specified. Any device receiving or interpreting the structure shall ignore that field; in particular, it shall not reject the structure because of the value of the field.

Where a field, parameter, or other variable object can take a range of values, and some values are described as "Reserved for Future Use," a device sending the object shall not set the object to those values. A device receiving an object with such a value should reject it, and any data structure containing it, as being erroneous; however, this does not apply in a context where the object is described as being ignored or it is specified to ignore unrecognized values.

When a field value is a bit field, unassigned bits can be marked as Reserved for Future Use and shall be set to 0. Implementations that receive a message that contains a Reserved for Future Use bit that is set to 1 shall process the message as if that bit was set to 0, except where specified otherwise.

The acronym RFU is equivalent to Reserved for Future Use.

1.2.3 Prohibited

When a field value is an enumeration, unassigned values can be marked as "Prohibited." These values shall never be used by an implementation, and any message received that includes a Prohibited value shall be ignored and shall not be processed and shall not be responded to.

Where a field, parameter, or other variable object can take a range of values, and some values are described as "Prohibited," devices shall not set the object to any of those Prohibited values. A device

receiving an object with such a value should reject it, and any data structure containing it, as being erroneous.

“Prohibited” is never abbreviated.

1.3 Table requirements

Requirements in this specification are defined as "Mandatory" (M), "Optional" (O), "Excluded" (X), "Not Applicable" (N/A), or "Conditional" (C.n). Conditional statements (C.n) are listed directly below the table in which they appear.

1.4 Conformance

Each capability of this specification shall be supported in the specified manner. This specification may provide options for design flexibility, because, for example, some products do not implement every portion of the specification. For each implementation option that is supported, it shall be supported as specified.

2 Configuration

2.1 Identification

The Basic Lightness Controller NLC Profile shall be identified by the «Basic Lightness Controller» mesh profile UUID (see [3]) in Composition Data Page 2 (see [1]).

2.2 NLC profile relationships

A device implementing the Basic Lightness Controller NLC Profile interacts with devices implementing the following NLC profiles:

- The Occupancy Sensor NLC Profile [4] as defined in Mesh Model [2] Section 6.5.1.7.1, “Receiving a Sensor Status message”, and shown in Figure 2.1.
- The Ambient Light Sensor NLC Profile [5] as defined in Mesh Model [2] Section 6.5.1.7.1, “Receiving a Sensor Status message”, and shown in Figure 2.1.
- The Dimming Control NLC Profile [6] as defined in Mesh Model [2] Sections 3.3.2.2.3, “Receiving Generic Delta Set / Generic Delta Set Unacknowledged messages” and 3.3.2.2.4, “Receiving Generic Move Set / Generic Move Set Unacknowledged messages”. The messages are received by the Generic Level Server model, which has states bound to the Light Lightness Level Server model, which has states bound to the Light LC Server model. This is shown in Figure 2.1.
- The Basic Scene Selector NLC Profile [7] as defined in Mesh Model [2] Section 6.5.1.3, “Scene Store and Scene Recall behavior”, and shown in Figure 2.1.

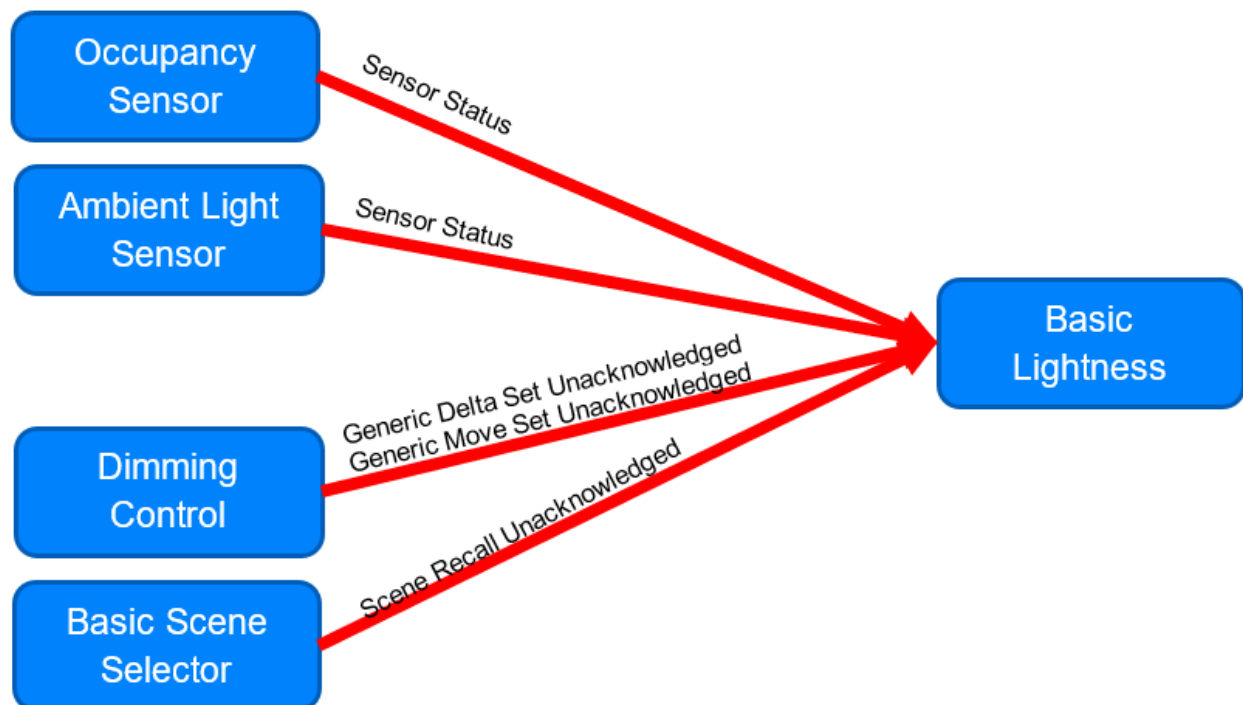


Figure 2.1: Interaction of a Basic Lightness Controller with other NLC profiles

Note: See Section 6.2.2 in [2] and Section 9 in [8] for a broader discussion on lighting control scenarios using occupancy and ambient light sensors.

2.3 Concurrency limitations and restrictions

There are no concurrency limitations or restrictions imposed by this specification.

2.4 Topology limitations and restrictions

There are no topology limitations or restrictions imposed by this specification.

2.5 Bluetooth specification release compatibility

This specification is compatible with Mesh Protocol Version 1.1 [\[1\]](#) and Mesh Model Version 1.1 [\[2\]](#).

2.6 Mesh Protocol dependencies

This specification requires implementation of all mandatory requirements for an unprovisioned device and a node described in the Mesh Protocol specification [\[1\]](#).

3 Requirements and recommendations

The Basic Lightness Controller NLC Profile specifies the following requirements and recommendations.

3.1 Provisioning

The following requirements are related to provisioning:

- The PB-GATT provisioning bearer shall be supported. See Section 5.2.2 in [1].
- Either the device «Complete Local Name» advertising data (AD) type or the device «Shortened Local Name» AD type shall be included in scan response data when advertising the Mesh Provisioning Service. See Section 7.1.2.2.1 in [1].
- Visual attention indication for all instances of the Attention Timer shall be supported. The visual attention indication may be shared among multiple instances of the Attention Timer. See Section 4.2.10 in [1].

3.2 Bearers

The following requirements are related to bearers:

- The advertising bearer shall be supported. See Section 3.3.1 in [1].
- The Generic Attribute Profile (GATT) bearer shall be supported in the GATT Bearer Server role. See Section 3.3.2 in [1].

3.3 Features

The following requirements are related to features:

- The Relay feature shall be supported. See Section 3.4.6.1 in [1].
- The Proxy feature shall be supported. See Section 3.4.6.2 in [1].

3.4 Performance

The following requirements are related to performance:

- At least two network keys shall be supported. See Section 3.9.6.3 in [1].
- At least three application keys shall be supported. See Section 3.9.6.2 in [1].
- At least three application keys shall be supported by the Model to AppKey List state for each model instance that uses application keys. See Section 4.2.7 in [1].
- At least 255 entries in the replay protection list shall be supported. See Section 4.2.2.1 in [1].
- The Light LC Server model shall support a subscription list size of at least 32 items. See Section 4.2.3 in [1].
- At least 8 entries per connection in the proxy filter list shall be supported. See Section 6.4 in [1].
- At least 64 entries in the network message cache shall be supported. See Section 3.4.6.5 in [1].

3.5 Models

The following requirements are related to models:

- The Light LC Server model shall be supported. See Section 6.5.1 in [2].
- At least one instance of the Scene Server model shall be supported. See Section 5.3.3 in [2].
- The first instance of the Scene Server model shall be present on an element with an address not higher than the address of the element on which the Light Lightness Server model is present.
- If additional instances of the Scene Server model are present, they shall be present on an element with an address higher than the address of the element on which the Light LC Server model is present.
- If the Light CTL Temperature Server model (see Section 6.4.4 in [2]), or the Light HSL Hue Server model (see Section 6.4.7 in [2]), or the Light HSL Saturation Server model (see Section 6.4.8 in [2]) are present:
 - The Light CTL Temperature Server model, the Light HSL Hue Server model, and the Light HSL Saturation Server model should be present on an element with an address higher than the address of the element on which the Light LC Server model is present.
 - An instance of the Scene Server model should be present on an element with an address higher than the address of the element on which the Light LC Server model is present.

3.6 Combinations of NLC profiles

The following requirements are related to combinations of the Basic Lightness Controller NLC Profile and combinations with other NLC profiles (see [3]):

- When multiple instances of the Basic Lightness Controller NLC Profile are combined on a device, the number of entries in the replay protection list on the device shall be at least the number of entries in the replay protection list required by the Basic Lightness Controller NLC Profile. See Section 4.2.2.1 in [1].
- When the Basic Lightness Controller NLC Profile is combined with other NLC profiles on a device, the number of entries in the replay protection list on the device shall be at least the highest required minimum number of entries among the NLC profiles. See Section 4.2.2.1 in [1].
- When multiple instances of the Basic Lightness Controller NLC Profile are combined on a device, the device shall support at least the minimum number of network keys defined for the Basic Lightness Controller NLC Profile. See Section 3.9.6.3 in [1].
- When the Basic Lightness Controller NLC Profile is combined with other NLC profiles on a device, the device shall support at least the highest minimum number of network keys defined among the NLC profiles. See Section 3.9.6.3 in [1].
- When multiple instances of the Basic Lightness Controller NLC Profile are combined on a device, the device shall support at least the minimum number of application keys defined for the Basic Lightness Controller NLC Profile. See Section 3.9.6.2 in [1].
- When the Basic Lightness Controller NLC Profile is combined with other NLC profiles on a device, the device shall support at least the highest minimum number of application keys defined among the NLC profiles. See Section 3.9.6.2 in [1].
- When multiple instances of the Basic Lightness Controller NLC Profile are combined on a device, the presence of the required models must satisfy the requirements related to models, as specified in Section 3.5, for each instance of the Basic Lightness Controller NLC Profile.

3.7 Recommendations

Implementers should consider the following recommendations:

- If a blinking sequence on power-up in the unprovisioned state is supported, then it should be the Unprovisioned Blinking Sequence defined by the DiiA Part 341 specification [\[9\]](#).
- If a reset to factory default settings is supported, then a manual reset (i.e., physical interaction with the device) should be supported.

4 Acronyms and abbreviations

Acronym/Abbreviation	Meaning
AD	advertising data
DALI	Digital Addressable Lighting Interface
GATT	Generic Attribute Profile
NLC	networked lighting control
PDU	Protocol Data Unit
RFU	Reserved for Future Use

Table 4.1: Acronyms and abbreviations

5 References

- [1] Mesh Protocol Specification, Version 1.1 or later
- [2] Mesh Model Specification, Version 1.1 or later
- [3] Bluetooth SIG Assigned Numbers, <https://www.bluetooth.com/specifications/assigned-numbers>
- [4] Occupancy Sensor NLC Profile, Version 1.0 or later
- [5] Ambient Light Sensor NLC Profile, Version 1.0 or later
- [6] Dimming Control NLC Profile, Version 1.0 or later
- [7] Basic Scene Selector NLC Profile, Version 1.0 or later
- [8] Building a Sensor-Driven Lighting Control System Based on Bluetooth Mesh – Bluetooth White Paper, Version 1.0
- [9] Digital Illumination Interface Alliance (DiiA), “Part 341 – Bluetooth Mesh to DALI Gateway”, <https://www.dali-alliance.org/specifications/download.html>