# Aeon Labs LED Bulb

(Z-Wave LED Bulb)

**Change History**

| Revision | Date | Change Description |
|---|---|---|
| 1 | 03/24/2015 | Initial draft. |
| 2 | 07/06/2015 | Update |
| 3 | 04/25/2016 | Update to V1.05 |
| 4 | 06/20/2016 | Update |
| | | |

**Aeon Labs LED Bulb**
**Engineering Specifications and Advanced Functions for Developers**

Aeon Labs LED Bulb is a switch multilevel device based on Z-wave enhanced 232 slave library of V6.51.06.
Its bulb has the Smart RGB LEDs in, which can be used for adding colour to your home, the bulb has 5 main colour channels available for you to adjust: Red, Green, Blue, Warm white and Cold white. You can configure its indication colour according to your favour.
LED Bulb can be included and operated in any Z-Wave network with other Z-Wave certified devices from other manufacturers and/or other applications. All non-battery operated nodes within the network will act as repeaters regardless of vendor to increase reliability of the network.
The LED Bulb is a security Z-Wave device, so a security enabled controller is needed for take full advantage of all functionally for the LED Bulb. It also supports the Over The Air (OTA) feature for the product's firmware upgrade.

## 1. Library and Command Classes

### 1.1 SDK: 6.51.06

### 1.2 Library

- Basic Device Class: BASIC_TYPE_ROUTING_SLAVE
- Generic Device class: GENERIC_TYPE_SWITCH_MULTILEVEL
- Specific Device Class: SPECIFIC_TYPE_POWER_SWITCH_MULTILEVEL

### 1.3 Commands Class

| | Included Non-Secure | Included Secure |
|---|---|---|
| Node Info Frame | COMMAND_CLASS_ZWAVEPLUS_INFO V2<br>COMMAND_CLASS_SWITCH_MULTILEVEL V2<br>COMMAND_CLASS_SWITCH_COLOR V1<br>COMMAND_CLASS_SWITCH_ALL V1<br>COMMAND_CLASS_SCENE_ACTUATOR_CONF V1<br>COMMAND_CLASS_SCENE_ACTIVATION V1<br>COMMAND_CLASS_CONFIGURATION V1<br>COMMAND_CLASS_ASSOCIATION_GRP_INFO V1<br>COMMAND_CLASS_ASSOCIATION V2<br>COMMAND_CLASS_MANUFACTURER_SPECIFIC V2<br>COMMAND_CLASS_VERSION V2<br>COMMAND_CLASS_FIRMWARE_UPDATE_MD V2<br>COMMAND_CLASS_POWERLEVEL V1<br>COMMAND_CLASS_SECURITY V1<br>COMMAND_CLASS_DEVICE_RESET_LOCALLY V1<br>COMMAND_CLASS_MARK V1<br>COMMAND_CLASS_HAIL V1 | COMMAND_CLASS_ZWAVEPLUS_INFO V2<br>COMMAND_CLASS_VERSION V2<br>COMMAND_CLASS_MANUFACTURER_SPECIFIC V2<br>COMMAND_CLASS_SECURITY V1<br>COMMAND_CLASS_DEVICE_RESET_LOCALLY V1<br>COMMAND_CLASS_MARK V1<br>COMMAND_CLASS_HAIL V1 |
| Security | - | COMMAND_CLASS_SWITCH_MULTILEVEL V2<br>COMMAND_CLASS_SWITCH_COLOR V1 |

| | | |
|---|---|---|
| Command Supported Report Frame | | COMMAND_CLASS_SWITCH_ALL V1<br>COMMAND_CLASS_SCENE_ACTUATOR_CONF V1<br>COMMAND_CLASS_SCENE_ACTIVATION V1<br>COMMAND_CLASS_CONFIGURATION V1<br>COMMAND_CLASS_ASSOCIATION_GRP_INFO V1<br>COMMAND_CLASS_ASSOCIATION V2<br>COMMAND_CLASS_MANUFACTURER_SPECIFIC V2<br>COMMAND_CLASS_VERSION V2<br>COMMAND_CLASS_FIRMWARE_UPDATE_MD V2<br>COMMAND_CLASS_POWERLEVEL V1<br>COMMAND_CLASS_DEVICE_RESET_LOCALLY V1<br>COMMAND_CLASS_HAIL V1 |

## 2. Technical Specifications

Model number: ZW098.

Bulb holder type: E26 for USA version, B22/E27 for EU/AU version.

Max operating power: 9W.

Max standby power: 0.7W.

Operating temperature: 0℃ to 40℃.

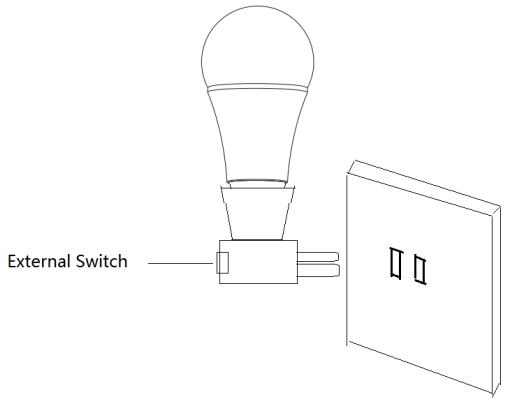
Relative humidity: 8% to 80%.

Operating distance: Up to 500 feet/150 metres outdoors.

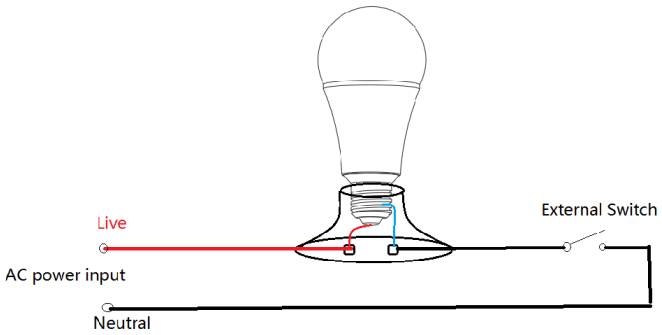
## 3. Familiarize Yourself with Your LED Bulb

### 3.1 Interface

## 4. Inclusion/Exclusion of LED Bulb




**Or**




| Button Action | Operation Steps |
|---|---|
| Press the External switch to turn off (Keep it in "OFF" state for 2 seconds) the Bulb and then turn it on. | **Add the Bulb into the Z-Wave network:**<br>1. Let your Z-Wave controller into add/inclusion mode.<br>2. Implement the Button Action, the bulb will send out a Node info without Security CC in command class list (*Non-security inclusion*).<br>3. If the inclusion is successful, its RGB LED will be solid when you turn the Bulb on, Otherwise, please repeat the steps above. |
| Keep the external switch in "ON" state and then press the External switch to turn off the Bulb and then | **Add the Bulb into the Z-Wave network:**<br>1. Let your Z-Wave controller into add/inclusion mode.<br>2. Implement the Button Action, the bulb will send out a Node info that contains Security CC in the command class list (*Security inclusion*).<br>4. If the inclusion is successful, its bulb will be solid when you turn the LED Bulb on. Otherwise, please repeat the process above.<br>**Remove LED Bulb from Z-Wave network:** |

| | |
|---|---|
| **turn on it, repeat it 3 times continuously within 1.5 seconds.** | 1. Power on your LED Bulb as above the wire diagrams.<br>2. Let the primary controller into exclusion mode (If you don't know how to do this, please refer to its manual).<br>3. Turn off the LED Bulb and then turn on it, repeat the operation 3 times within 2 seconds via pressing the external switch.<br>4. If the exclusion is failed, please repeat the process from step 2.<br>**Note:** If LED Bulb has been successfully excluded from your Z-Wave network, the LED Bulb will change to orange colour for 2 seconds before changing to white. If the exclusion was unsuccessful, the LED Bulb will blink orange for 3 seconds before changing to red colour for 2 seconds. |

## 5. Special Rule of Each Command

### 5.1 Basic Command Class

Basic Set = 255 maps to Multilevel Switch Set = 255

Basic Set = 0 maps to Multilevel Switch Set = 0

Basic Set = 1-99 maps to Multilevel Switch Set = 1-99

Basic Get/Report maps to Multilevel Switch Get/Report

### 5.2 Z-Wave Plus Info Report

| Parameter | Value |
|---|---|
| Z-Wave Plus Version | 1 |
| Role Type | 5 (ZWAVEPLUS_INFO_REPORT_ROLE_TYPE_SLAVE_ALWAYS_ON) |
| Node Type | 0 (ZWAVEPLUS_INFO_REPORT_NODE_TYPE_ZWAVEPLUS_NODE) |
| Installer Icon Type | 0x0600 (ICON_TYPE_GENERIC_LIGHT_DIMMER_SWITCH) |
| User Icon Type | 0x0600 (ICON_TYPE_GENERIC_LIGHT_DIMMER_SWITCH) |

### 5.3 Manufacturer Specific Report

| Parameter | Value (hex) |
|---|---|
| Manufacturer ID 1 | 0x00 |
| Manufacturer ID 2 | 0x86 |
| Product Type ID 1 | EU=0x00, US=0x01, AU=0x02, JP=0x0A |
| Product Type ID 2 | 0x03 |
| Product ID 1 | 0x00 |
| Product ID 2 | 0x62 |

### 5.4 Association Command Class

The LED Bulb supports 2 association groups and can add max 5 nodes for each group.

| Association | Nodes | Send | Send commands |
|---|---|---|---|

| Group | | Mode | |
|---|---|---|---|
| Group 1 | 0 | N/A | N/A |
| | 1 | Single Cast | When the state of LED Bulb (turn on/off the bulb) is changed:<br>1, Set Configuration parameter 80 to 0: Reserved (Default).<br>2, Set Configuration parameter 80 to 1: Send Hail CC.<br>3. Set Configuration parameter 80 to 2: Send the Basic Report. |
| | [2,5] | | |
| Group 2 | 0 | N/A | N/A |
| | [1,5] | Single Cast | Forward the Basic Set, Switch Binary Set, Switch Multilevel Start Level Change, Switch Multilevel Stop Level Change, Switch Multilevel Set, Scene Activation Set to associated nodes in Group 2 when the LED Bulb receives the Basic Set, Switch Binary Set, Switch Multilevel Start Level Change, Switch Multilevel Stop Level Change, Switch Multilevel Set, Scene Activation Set commands from the main controller. |

### 5.5 Association Group Info Command Class

#### 5.5.1 Association Group Info Report Command Class

Profile: General: NA (Profile MSB=00, Profile LSB=01)

#### 5.5.2 Association Group Name Report Command Class

Group 1：Lifeline

Group 2：Retransmit

### 5.6 Scene Actuator Conf Command Class

The LED Bulb supports max 255 Scene IDs.

The Scene Actuator Conf Set command is effective, when only Level>=0 and Level<0x64 or Level=0xff, otherwise, it will be ignored.

The Scene Actuator Configuration Get Command is used to request the settings for a given scene, if scene ID is not setting, it will be ignored. If Scene ID =0, then the LED Bulb will report currently the activated scene settings. If the currently activated scene settings do not exist, the LED Bulb will reports Level = currently load status and Dimming Duration=0

### 5.7 Scene Activation Set Command Class

The Scene Activation Set Command is effective, when only Level>=0 and Level<0x64 or Level=0xff, otherwise, it will be ignored. If the requested Scene ID is not configured, it will be ignored too.

### 5.8 Switch Color Set Command Class

| Priority | Capability ID | Color |
|---|---|---|

| | | |
|---|---|---|
| 1 (Highest) | 0 | Warm white |
| 2 | 1 | Cold white |
| 3 (lowest) | 2、3、4 | R、G、B |

**Note:** White color LED and RGB LED will not light up at the same time, so the software makes the following processing. When you want to activate the current RGB color, the color value of higher priority should be set to 0.

For example: The warm white is the highest priority, when it is configured to 0, the Cold white or RGB color configuration values can be activated. Otherwise, the bulb is always be activated by warm white.

### 5.9 Configuration Set Command Class

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Command Class = COMMAND_CLASS_CONFIGURATION | | | | | | | |
| Command = CONFIGURATION_SET | | | | | | | |
| Parameter Number | | | | | | | |
| Default | Reserved | | | | Size | | |
| Configuration Value 1(MSB) | | | | | | | |
| Configuration Value 2 | | | | | | | |
| ..... | | | | | | | |
| Configuration Value n(LSB) | | | | | | | |

Parameter Number Definitions (8 bit):

| Parameter Number Hex / Decimal | Description | Default Value | Size |
|---|---|---|---|
| 0x14 (20) | The Bulb's state after re-power on it.<br>0 = The last state before re-power on.<br>1 = Always On.<br>2 = Always Off. | 1 | 1 |
| 0x20 (32) | Enable/disable to send out a report when the color is changed.<br>0 = Disable.<br>1 = Hail CC.<br>Others = Ignore. | 0 | 1 |

| | | | |
|---|---|---|---|
| 0x21 (33) | Get the Bulb's color value.<br>Value 1 = Reserved.<br>Value 2 = Red color value.<br>Value 3 = Green color value.<br>Value 4 = Blue color value.<br>*Note:* This parameter is a get-only parameter. | - | 4 |
| 0x22 (34) | Enable/disable the function of using External Switch to turn on/off the bulb.<br>0 = Disable.<br>1 = Enable.<br>Others = Ignore. | 0 | 1 |
| 0x23 (35) | Enable/disable the function of using External Switch to changes the bulb's color.<br>0 = Disable.<br>1 = Enable.<br>Others = Ignore. | 1 | 1 |
| 0x24 (36) | Reboot/save/exit Colorful mode.<br>0 = Un-reboot Colorful mode.<br>1 = Reboot Colorful mode.<br>2 = Exit Colorful mode.<br>3 = Save the current Colorful mode value and then to be exited.<br>*Note:* This parameter is a set-only parameter. | - | 1 |
| 0x25 (37) | Colorful mode configuration.<br>(See the below table) | 0x09630000 | 4 |
| 0x26 (38) | Change speed:<br>Value 1: the speed from OFF to ON.<br>Value 2: the speed from ON to OFF.<br>Value 3: pause time of ON.<br>Value 4: pause time of OFF. | 0x03000300 | 4 |
| 0x27 (39) | Color index configuration when the bulb is in Multi color mode.<br>(See the below table) | 0x87654321 | 4 |
| 0x50 (80) | Enable to send notifications to associated devices (Group 1) when the state of LED Bulb is changed.<br>0 = Nothing.<br>1 = Hail CC.<br>2 = Basic CC report. | 1 (US version)<br>2(other version) | 1 |

| | | | |
|---|---|---|---|
| 0x70 (112) | Dimmer mode:<br>0 = Parabolic curve.<br>1 = Index curve.<br>2 = (Parabolic + Index)/2.<br>3 = Linear. | 0 | 1 |
| 0xFC (252) | Enable/disable Lock Configuration (0 =disable, 1 = enable).<br>Value = 0, the setting of configuration parameters is allowed.<br>Value = 1, all configuration parameters cannot be set (Locked). | 0 | 1 |
| 0xFF (255) | 1, Value = 0x55555555、Default = 1、Size = 4.<br>Reset to factory default settings and removed from the z-wave network | N/A | 4 |
| | 2, Value = 0、Default = 1、Size = 1.<br>Reset all configuration parameters to factory default settings | N/A | 1 |

Parameter 37 [4 byte] will set the Bulb into different modes:

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Value 1 (MSB) | Color Transition Style | | Color Change Speed Option | | | Color Display Cycle | | |
| Value 2 | Brightness | | | | | | | |
| Value 3 | Cycle Count | | | | | | | |
| Value 4 (LSB) | Time Base of Color Change Speed | | Color Change Speed Level | | | | | |

**Color Display Cycle (4 bits)**

The Color Display Cycle field can have the following values corresponding to 4 different modes:

| Colour Display Cycle | Description |
|---|---|
| 0 | Inactive (keep the current configuration values) |
| 1 | Rainbow Mode(red, orange, yellow, green, cyan, blue, violet, pinkish) |
| 2 | Multi Color Mode(colors cycle between selected colors) |
| 3 | Random Mode |

| | |
|---|---|
| 4 | Single Color Mode |
| 5 to 15 | Reserved |

**Single Color Mode:** The Bulb will be solid/ blinking with one color in this mode.

**Rainbow Mode:** The Bulb has 8 colors to display and will change through a range of colors (Red→Orange→Yellow→Green→Cyan→Blue→Violet→pinkish).

**Multi Color Mode:** The Bulb can change between multiple colors according to the color index which is configurable through configuration parameter 39, see the configuration table of parameter 39 below.

**Random Mode:** The Bulb's color will be displayed randomly.

### Color Transition Style (2 bits)

The following values correspond to 3 different transition styles between colors:

| Dim Style | Description |
|---|---|
| 0 | Smooth Color Transition. |
| 1 | Fade Out Fade In Transition. |

### Brightness (8 bits)

| Level | Description |
|---|---|
| 1 to 99 | 1 = Min level. 99 = Max level. |
| 0 or 255 | Inactive (keep the current configuration values) |

### Cycle Count (8 bits)

The Cycle Count is used to define the number of repetitions/cycles displayed by your LED Bulb in Color Display Cycle before stopping.

| Cycle Count | Description |
|---|---|
| 0 | Unlimited |
| 1 to 254 | Total number of repetitions/cycles before stopping. |
| 255 | Inactive (keep the current configuration values). |

Note: The process of the first color change to the last color is regarded as a cycle.

For example:

When the Bulb is in Rainbow mode, the color change from red to pink (Red→Orange→Yellow→Green→Cyan→Blue→Purple→Pink), going through the colors is regarded as 1 cycle.

### Time Base of Colour Change Speed (3 bits)

This function would be used when the Color Transition Style is set to Fade out/in.

| Time Base | Description |
|---|---|
| 0 | Time base is 1s. |
| 1 | Time base is 10ms. |
| 2 | Time base is 100ms. |

I

### Colour Change Speed Level (5 bits)

This function would be used when the Color Transition Style is set to Fade out/in.

| Level | Description |
|---|---|
| 0 | Constant speed |
| 1 to 30 | Accelerate/decelerate speed from the level 1 to 30. |
| 31 | Inactive (keep the current configuration values) |

Parameter 39 [4 byte] can be used to set the 8 colour index when the Bulb is in Multi color mode.

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Value1 (MSB) | Index 1 | | | | Index 2 | | | |
| Value2 | Index 3 | | | | Index 4 | | | |
| Value3 | Index 5 | | | | Index 6 | | | |
| Value4 (LSB) | Index 7 | | | | Index 8 | | | |

Colour component id:

| ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Colour | Red | Orange | Yellow | Green | Cyan | Blue | Violet | Pinkish |

The color will be changed form index 1 to index 8 circularly when your bulb is in Multi color mode.

For example:

If you set the parameter 39 to 305135616 (0x12300000 in hexadecimal, which means the Index 1=1(Red), the Index 2=2(Orange) and the Index 3=3(Yellow)), the color will be changed from Blue to Violet and then Violet to Pinkish (Red→Orange→Yellow).

When your Bulb is in Single Colour Mode and the Fade Out Fade In transition style, the parameter 39 would be used to set the RGB value.

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| **Value1 (MSB)** | Red value | | | | | | | |
| **Value2** | Green value | | | | | | | |
| **Value3** | Blue value | | | | | | | |
| **Value4 (LSB)** | Reserved | | | | | | | |

When your Bulb is in Random Mode, the parameter 39 would be used to set the random seed, then your bulb will automatically generate random colours to be displayed according to the random seed you set.

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| **Value1 (MSB)** | Random seed value | | | | | | | |
| **Value2** | | | | | | | | |
| **Value3** | | | | | | | | |
| **Value4 (LSB)** | | | | | | | | |