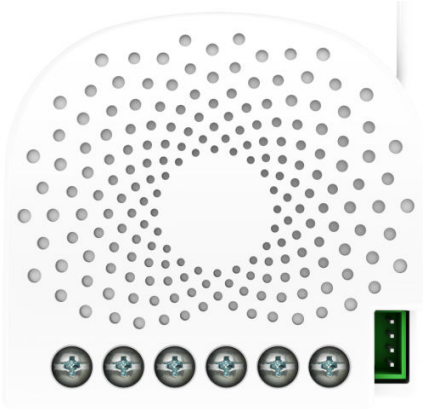
Aeon Labs Nano Dimmer

(Z-Wave Nano Dimmer)



Change history

Revision	Date	Change Description
1	08/10/2016	Initial draft.
2	10/20/2016	Update
3	10/28/2016	Update
4	10/31/2016	Update
5	11/01/2016	Update
6	12/07/2016	Update
7	12/13/2016	Update
8	02/27/2017	Update
9	06/01/2017	Update
10	11/30/2017	Update
11	3/6/2018	Update
12	3/19/2018	Update
13	10/9/2018	Update

Aeon Labs Nano Dimmer
Engineering Specifications and Advanced Functions for Developers

Aeon Labs Nano Dimmer is a Z-Wave multilevel switch device based on Z-Wave enhanced 232 slave library V6.51.10.
You can use it to control (on/off/dim) of any kinds of bulbs. It supports a variety of installations of wiring connection, such as the 2-wire, 3-wire connection and so on.
It 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 Nano Dimmer is a security Z-Wave plus device, so a security enabled controller is needed for take full advantage of all functionally for the Nano Dimmer. It also supports the Over The Air (OTA) feature for the product's firmware upgrade.
As soon as Nano Dimmer is removed from a Z-Wave network, it will be restored into default factory setting.

1. Library and Command Classes

1.1 SDK: 6.51.10

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 Network	Included Secure Network
Node Info Frame	COMMAND_CLASS_ZWAVEPLUS_INFO V2 COMMAND_CLASS_SWITCH_BINARY COMMAND_CLASS_SWITCH_MULTILEVEL V2 COMMAND_CLASS_METER V3 COMMAND_CLASS_SWITCH_ALL V1 COMMAND_CLASS_CONFIGURATION V1 COMMAND_CLASS_ASSOCIATION_GRP_INFO V1 COMMAND_CLASS_ASSOCIATION V2 COMMAND_CLASS_SCENE_ACTUATOR_CONF V1 COMMAND_CLASS_SCENE_ACTIVATION V1 COMMAND_CLASS_NOTIFICATION V4 COMMAND_CLASS_MANUFACTURER_SPECIFIC V2 COMMAND_CLASS_VERSION V2 COMMAND_CLASS_FIRMWARE_UPDATE_MD V3 COMMAND_CLASS_POWERLEVEL V1 COMMAND_CLASS_CLOCK V1 COMMAND_CLASS_DEVICE_RESET_LOCALLY V1 COMMAND_CLASS_MARK V1 COMMAND_CLASS_HAIL V1	COMMAND_CLASS_ZWAVEPLUS_INFO V2 COMMAND_CLASS_SECURITY V1 COMMAND_CLASS_DEVICE_RESET_LOCALLY V1 COMMAND_CLASS_MARK V1 COMMAND_CLASS_HAIL V1
Security Command Supported Report Frame	-	COMMAND_CLASS_ASSOCIATION_GRP_INFO V1 COMMAND_CLASS_SWITCH_BINARY COMMAND_CLASS_SWITCH_MULTILEVEL V2 COMMAND_CLASS_SWITCH_ALL V1 COMMAND_CLASS_METER V3 COMMAND_CLASS_VERSION V2 COMMAND_CLASS_MANUFACTURER_SPECIFIC V2 COMMAND_CLASS_CONFIGURATION V1 COMMAND_CLASS_ASSOCIATION V2 COMMAND_CLASS_SCENE_ACTUATOR_CONF V1 COMMAND_CLASS_SCENE_ACTIVATION V1

		COMMAND_CLASS_NOTIFICATION V4 COMMAND_CLASS_POWERLEVEL V1 COMMAND_CLASS_CLOCK V1 COMMAND_CLASS_FIRMWARE_UPDATE_MD V3

2. Technical specifications

Operating distance: Up to 300 feet/100 meters outdoors.

Input: 120V~, 60Hz. (USA Version)
230V~, 50Hz. (EU, AU, CN Version)
230V~, 60Hz. (BR version)

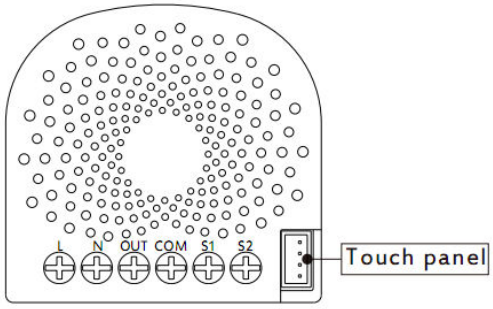
Output: 120V~, 60Hz, Max 1.2A. (USA Version)
230V~, 50Hz, Max 1.2A. (EU Version)
230V~, 50Hz, Max 1.2A. (CN Version)
230V~, 50Hz, Max 1.2A. (AU Version)
230V~, 60Hz, Max 1.2A. (BR Version)

Operating temperature: 0℃ to 40℃.

Relative humidity: 8% to 80%.

3. Familiarize yourself with your Dimmer

3.1 Interface



Notes for the wire connection ports:

L – Power input for live

N – Power input for neutral

OUT – Output for load

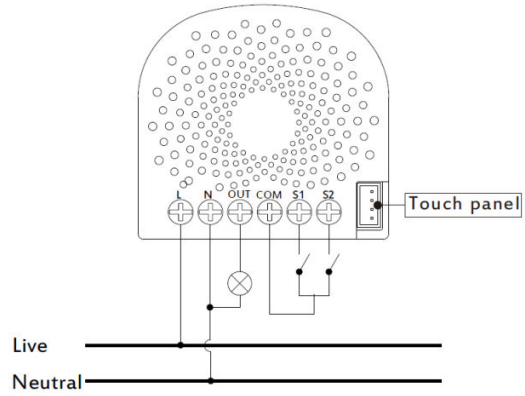
COM – Common port for all External switches (S1 and S2)

S1 – External switch 1 control for load

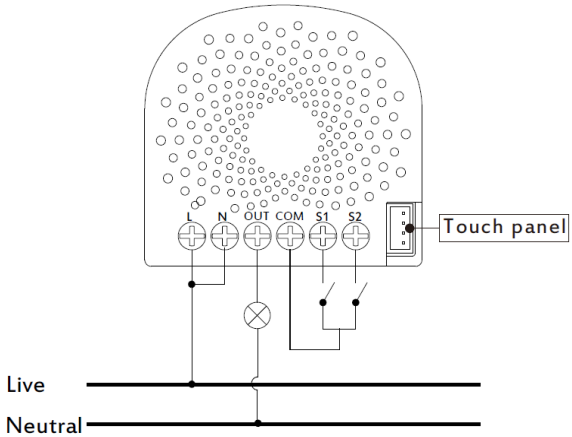
S2 – External switch 2 control for load

3.2 Wire connection

a. 3-Wire connection



b. 2-Wire connection



4. All functions of each trigger

4.1 Function of Action Button

Since Nano Dimmer supports multiple NIFs, the non-security NIF can be sent out via pressing the Action Button one time, the security NIF can be sent out via pressing the Action Button 2 times.

Trigger	Description
Press one time	1. Send out non-security Node Info frame (the node info list doesn't contain Security CC). 2. Add Nano Dimmer into a Z-Wave network: 1. Power on your Dimmer, the RGB LED will be colorful gradient status. 2. Turn the primary controller into inclusion mode (If you don't know how to do this, refer to its manual). 3. Press the Action button.

	4. If the inclusion is success, the LED will be solid. Otherwise, the LED will remain colorful gradient status, in which you need to repeat the process from step 2. 3. Remove Nano Dimmer from a Z-Wave network: 1. Power on the Dimmer, the LED will remain solid state. 2. Turn the primary controller into remove mode (If you don't know how to do this, refer to its manual). 3. Press the Action button. 4. If the remove is successful, the LED will be colorful gradient status. If the LED still be solid, please repeat the process from step 2.
Quick Press 2 times	1. Send out security Node Info frame (the node info list contains Security CC). 2. Add Nano Dimmer into a Z-Wave network: 1. Power on the Dimmer, the LED will be colorful gradient status. 2. Turn the primary controller into inclusion mode (If you don't know how to do this, refer to its manual). 3. Press the Action Button 2 times continuously. 4. If the inclusion is success, the LED will be solid. Otherwise, the LED will remain colorful gradient status, in which you need to repeat the process from step 2. 3. Remove Nano Dimmer from a Z-Wave network: 1. Power on the Nano Dimmer, the LED will be solid. 2. Turn the primary controller into remove mode (If you don't know how to do this, refer to its manual). 3. Press the Action button. 4. If the remove is success, the LED will be colorful gradient status. If the LED still be solid, please repeat the process from step 2.
Quick press 4 times	Activate the automatic identification mode for external switch S1. The blue LED will fast blink to indicate the Nano Dimmer is in this mode. *Note:* When the Nano Dimmer enters this mode, toggle the external switch S1 once and wait 2 seconds for the Dimmer to detect the external switch type of S1.
Quick press 6 times	Activate the automatic identification mode for external switch S2. The green LED will fast blink to indicate the Nano Dimmer is in this mode. *Note:* When the Nano Dimmer enters this mode, toggle the external switch S2 once and wait 2 seconds for the Dimmer to detect the external switch type of S2.
Press and hold 6 seconds	Enter RF power level test mode. The Nano Dimmer will start sending NOP power messages to the Controller/gateway and its LED flashes purple, finally report the test result to controller/gateway.
Press and hold 20 seconds	Reset Nano Dimmer to factory default: 1. Make sure the Nano Dimmer has been connected to the power supply. 2. Press and hold the Action Button for 20 seconds, the green LED will be on for 2 seconds and then remain colorful gradient status, which indicates the reset is success, otherwise please repeat the step. Note: 1, This procedure should only be used when the primary controller is missing or inoperable. 2, Reset Nano Dimmer to factory default settings will:

	a), exclude the Nano Dimmer from Z-Wave network; b), delete the Association setting, power measure value, Scene Configuration settings and restore the Configuration settings to their defaults.

4.2 Function of External Switch

Network state	Triggering	Function	LED state
Out of network	Change the switch state once within 1 second via S1/S2	Toggle On/Off. Send non-security NIF.	Blink
	Change the switch state 2 times with 1 second via S1/S2	Send security NIF.	Blink
In network	Change the switch state once within 1 second via S1/S2	Toggle On/Off.	Solid
	Change the switch state 2 times within 1 second via S1/S2	Send NIF.	Solid

4.3 RGB LED indication when Nano Dimmer is in Energy Mode

	RGB indication	Status
RGB LED	Green	Output load is in small wattage range. US version，the range of load wattage is [0W, 48W) AU version， the range of load wattage is [0W, 92W) EU version， the range of load wattage is [0W, 92W)
	Yellow	Output load is in big wattage range. US version，the range of load wattage is [48W, 96W) AU version，the range of load wattage is [92W, 184W) EU version，the range of load wattage is [92W, 184W)
	Red	Output load is in warning wattage range. US version， the range of load wattage is [96W,144W) AU version， the range of load wattage is [184W, 276W) EU version， the range of load wattage is [184W, 276W)

4.4 RGB LED indication when Nano Dimmer is in RF Power level test mode

	RGB indication	Status
RGB LED	Purple LED fast blink	Enter into the wireless power level test mode
	Green LED is switched to ON state for 2 seconds	wireless power level is good
	Yellow LED is switched to ON state for 2 seconds	wireless power level is acceptable but latency can occur
	Red LED is switched to ON state f or 2 seconds	wireless power level is insufficient

5. Special rule of each command

5.1 Z-Wave Plus Info Report Command Class

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)

5.2 Basic Command Class

Basic Set=0x01-0x63 maps Multilevel Switch Set=0x01-0x63, dim ON output load to the brightness of 1% - 99%.

Basic Set=0xFF maps Multilevel Switch Set=0xFF, dim ON output load.

Basic Set=0x00 maps Multilevel Switch Set=0x00, dim OFF output load.

Basic Get/Report maps Multilevel Switch Get/Report.

5.3 Association Command Class

Nano Dimmer supports 4 association groups and Max 5 nodes for every group.

Association Group	Nodes	Send Mode	Send commands
Group 1	[1,5]	Single Cast	When the load state of Nano Dimmer (on/off/dim the load) is cha nged: 1. Set Configuration parameter 80 to 0: Send Nothing (Default). 2. Set Configuration parameter 80 to 1: Send Hail CC. 3. Set Configuration parameter 80 to 2: Send the Basic Report. 4. Set Configuration parameter 80 to 3: Send Hail CC when using the manual switch to change the load state. 5. Set Configuration parameter 80 to 4: Send Switch Multilevel Report.
Group 2	[1,5]	Single Cast	Forward the Basic Set, Switch Binary Set, Switch Multilevel Start Level Change, Switch Multilevel Stop Level Change, Switch Multilevel Set, Switch all to the associated nodes in Group 2 when the Nano Dimmer receives the Basic Set, Switch Binary Set, Switch Multilevel Start Level Change, Switch Multilevel Stop Level Change, Switch Multilevel Set, Switch all commands from main controller. (E.g. Send/forward Basic Set to control the other nodes in association Group 2)
Group 3	[1,5]	Single Cast	Send Basic Set (configured by parameter 0x51) to the associated nodes in Group 3 when the external switch S1 is operated. *Note:* The Switch Mode of external switch S1 should be identified successfully, which means that the value of Configuration parameter 0x78 should be non-zero, then the Basic Set can be sent to the associated nodes in Group 3 via triggering the S1 switch.

Group 4	[1,5]	Single Cast	Send Basic Set (configured by parameter 0x52) to the associated nodes in Group 4 when the external switch S2 is operated. *Note:* The Switch Mode of external switch S2 should be identified successfully, which means that the value of Configuration parameter 0x79 should be non-zero, then the Basic Set can be sent to the associated nodes in Group 3 via triggering the S2 switch.

5.4 Association Group Info Command Class

5.4.1 Association Group Info Report Command Class

Profile: General: NA (Profile MSB=0, Profile LSB=1)

Group 1：01 01 00 00 01 00 00 00

Group 2：01 02 00 00 00 00 00 00

Group 3：01 03 00 20 01 00 00 00

Group 4：01 04 00 20 02 00 00 00

5.4.2 Association Group Name Report Command Class

Group 1: Lifeline

Group 2: Retransmit

Group 3: Control Key1

Group 4: Control Key2

5.4.3 Association Group Command List Report

Group 1:

Command List Report: 5A 01 26 03 20 03 82 01 71 05.

COMMAND_CLASS_BASIC	BASIC_ REPORT
COMMAND_CLASS_HAIL	HAIL
COMMAND_CLASS_ SWITCH _MULTILEVEL	SWITCH _MULTILEVEL_REPORT
COMMAND_CLASS_NOTIFICATION_V4	NOTIFICATION_REPORT_V4
COMMAND_CLASS_DEVICE_RESET_LOCALLY	DEVICE_RESET_LOCALLY_NOTIFICATION

Group 2:

Command List Report: 25 01 20 01 27 04 27 05 26 04 26 05 26 01 2B 01.

COMMAND_CLASS_SWITCH_BINARY	SWITCH_BINARY_SET
COMMAND_CLASS_BASIC	BASIC_SET
COMMAND_CLASS_SWITCH_ALL	SWITCH_ALL_ON
COMMAND_CLASS_SWITCH_ALL	SWITCH_ALL_OFF
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_START_LEVEL_CHANGE
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_STOP_LEVEL_CHANGE
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_SET
COMMAND_CLASS_SCENE_ACTIVATION	SCENE_ACTIVATION_SET

Group 3:

Command List Report: 20 01 26 01 26 04 26 05

COMMAND_CLASS_BASIC	BASIC_SET

COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_SET
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_START_LEVEL_CHANGE
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_STOP_LEVEL_CHANGE

Group 4:
Command List Report: 20 01 26 01 26 04 26 05

COMMAND_CLASS_BASIC	BASIC_SET
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_SET
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_START_LEVEL_CHANGE
COMMAND_CLASS_SWITCH_MULTILEVEL	SWITCH_MULTILEVEL_STOP_LEVEL_CHANGE

5.5 Manufacturer Specific Report

Parameter	Value
Manufacturer ID 1	US/EU/AU=0x00 CN=0x01
Manufacturer ID 2	US/EU/AU=0x86 CN=0x6A
Product Type ID 1	EU=0x00, US=0x01, AU=0x02 CN=0x1D (29)
Product Type ID 2	0x03
Product ID 1	0x00
Product ID 2	0x6F

5.6 Multilevel Switch Command Class

The Multilevel Switch CC is used to change the state/brightness level of output load.

5.7 Notification Command Class

Notification Types		Notification Events	
Power Management	0x08	Over-current detected	0x06
Heat Alarm	0x04	Overheat detected	0x02

5.8 Configuration 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
0x03 (3)	Current Overload Protection. Output Load will be turned off automatically after 30 seconds and if the current overrun 1.5A. 0 = Disabled, 1 = Enabled	1	1
0x04 (4)	Overheat protection. Output Load will be turned off automatically after 30 seconds and if the temperature of product inside exceeds 100 ℃. 0 = Disabled, 1 = Enabled	0	1
0x14 (20)	Configure the output status after re-power on it. 0 = Last status, 1 = Always on, 2 = Always off	0	1
0x50 (80)	To set which notification would be sent to the associated devices (Group 1) when the state of Nano Dimmer's load is changed. 0 = Send Nothing, 1 = Send Hail CC, 2 = Send Basic CC report. 3 = Send Multilevel Switch report 4 = Send Hail CC when using the manual switch to change the load state.	0	1
0x51 (81)	To set which notification would be sent to the associated nodes in association group 3 when using the external switch 1 to switch the loads. 0 = Send Nothing 1 = Basic Set CC. 2 = Switch Multilevel Set	1	1
0x52 (82)	To set which notification would be sent to the associated nodes in association group 4 when using the external switch 2 to switch the loads. 0 = Send Nothing 1 = Basic Set CC. 2 = Switch Multilevel Set	1	1
0x53 (83)	Set the LED indication state. 0 = Energy mode. The LED will follow the status (on/off). 1 = Momentary indicate mode. When the state of Switch's load changed, The LED will follow the status (on/off) of its load, but the LED will turn off after 5 seconds if there is no any switch action. 2 = Night light mode. The LED will remain the state that is set via the Multilevel Switch Set CC.	0	1

0x54 (84)	Set the ON/OFF time of the LED when it is in Night light mode. Value1 = ON (hour) Value2 = ON (minute) Value3 = OFF (hour) Value4 = OFF (minute)	Value1 = 0x12 Value2=0x00 Value3=0x08 Value4=0x00	4
0x55 (85)	State appointment 1: Set the ON time of output load. Value1 = 0, disable or =non zero, enable (day, bit0 - bit6 represent Mon to Sun). Value2 = ON (hour) Value3 = ON (minute) Value4 = ON (brightness level)	Value1=00 Value2=18 Value3=00 Value4=99	4
0x56 (86)	State appointment 2: Set the ON time of output load. Value1 = 0, disable or = non zero, enable (day, bit0 - bit6 represent Mon to Sun). Value2 = ON (hour) Value3 = ON (minute) Value4 = ON (brightness level)	Value1=00 Value2=23 Value3=00 Value4=00	4
0x5A (90)	Enables/disables parameter 91 and 92 below: 1 = enabled 0 = disabled.	0	1
0x5B (91)	The value here represents minimum change in wattage (in terms of wattage) for a REPORT to be sent (Valid values 0-60000).	25 (W)	2
0x5C (92)	The value here represents minimum change in wattage percent (in terms of percentage) for a REPORT to be sent (Valid values 0-100).	5 (%)	1
0x64 (100)	Set 101-103 to default.	N/A	1
0x65 (101)	Which reports need to send in Report group 1 (See flags in table below).	0x00 00 00 00	4
0x66 (102)	Which reports need to send in Report group 2 (See flags in table below).	0x00 00 00 00	4
0x67 (103)	Which reports need to send in Report group 3 (See flags in table below).	0x00 00 00 00	4
0x6E (110)	Set 111-113 to default.	N/A	1
0x6F (111)	The time interval of sending Report group 1 (Valid values 0x01-0x7FFFFFFF).	0x00 00 00 03	4
0x70 (112)	The time interval of sending Report group 2 (Valid values 0x01-0x7FFFFFFF).	0x00 00 02 58	4
0x71 (113)	The time interval of sending Report group 3 (Valid values 0x01-0x7FFFFFFF).	0x00 00 02 58	4

0x78 (120)	Configure the external switch mode for S1. 0 = Unidentified mode. 1 = 2-state switch mode. 2 = 3-way switch mode. 3 = momentary switch button mode. 4 = Enter automatic identification mode. Note: When the mode is determined, this mode value will not be reset after exclusion.	0	1
0x79 (121)	Configure the external switch mode for S2. 0 = Unidentified mode. 1 = 2-state switch mode. 2 = 3-way switch mode. 3 = momentary switch button mode. 4 = Enter automatic identification mode. Note: When the mode is determined, this mode value will not be reset after exclusion.	0	1
0x7B (123)	Set the control destination for external switch S1 1 = control the output loads of itself. 2 = control the other nodes. 3 = control the output loads of itself and other nodes.	3	1
0x7C (124)	Set the control destination for external switchS2 1 = control the output loads of itself. 2 = control the other nodes. 3 = control the output loads of itself and other nodes.	3	1
0x7D (125)	Set the default dimming rate.	3	1
0x80 (128)	Get the current working mode 0 = unknown 1 = 2-wire mode (No neutral wire) 2 = 3-wire mode Note: 1. This parameter is a Get-only parameter. 2. When the mode is determined, this mode value will not be reset after exclusion.	0	1
0x81 (129)	Set the dimming principle 0 = Trailing edge mode 1 = Leading edge mode Note: When the mode is determined, this mode value will not be reset after exclusion.	1	1

0x82 (130)	To get what type of load the Dimmer is connected to. 0 = Unknown 1 = Resistive load 2 = Capacitive load 3 = Inductive load Note: 1. This parameter is a Get-only parameter. 2. When the load type is determined, this type value will not be reset after exclusion.	0	1
0x83 (131)	Set the min brightness level that the load can reach to. Note: When the level is determined, this level value will not be reset after exclusion.	0	1
0x84 (132)	Set the max brightness level that the load can reach to. Note: When the level is determined, this level value will not be reset after exclusion.	99	1
0xF7 (247)	Set the working way for S1/S2 when the Switch mode is 2 state switch mode. Bit 0 =0, S1 is a toggle switch. Bit 0 =1, S1 is an On/Off switch, the out load state and S1 switch state would be in sync when using S1 to control the output load. Bit 1 =0, S2 is a toggle switch. Bit 1 =1, S2 is an On/Off switch, the out load state and S2 switch state would be in sync when using S2 to control the output load. Bit 2- Bit 7, reserved.	0	1
0xF8 (248)	Set the function of S1/S2. Bit 0 = 0, the function of sending NIF is disabled. Bit 0 = 1, the function of sending NIF is enabled. Bit 1 = 0, the function of entering RF power level test mode is disabled. Bit 1 = 1, the function of entering RF power level test mode is enabled. Bit 2 = 0, the function of factory reset is disabled. Bit 2 = 1, the function of factory reset is enabled. Bit 3- Bit 6 = reserved. Bit 7 = 0, the setting for Bit 0 –Bit 2 are ineffective. Bit 7 = 1, the setting for Bit 0 –Bit 2 are effective.	131	1
0xF9 (249)	Set the recognition way of load 0 = Never recognize the load when power on. 1 = Only recognize once when first power on. 2 = Recognize the load once power on.	1	1
0xFC (252)	Lock/unlock configuration parameters 0 = Unlock, 1 = Lock.	0	1

0xFF (255)	1, Value=0x55555555、Default=1、Size=4 Reset to factory default setting and removed from the z-wave network	N/A	4
	2, Value=0、Default=1、Size=1 Reset all configuration parameters to factory default setting	N/A	1

Configuration Values for parameter 101-103：

	7	6	5	4	3	2	1	0
configuration Value 1(MSB)	Reserved							
configuration Value 2	Reserved							
configuration Value 3	Reserved							
configuration Value 4(LSB)	Reserved	Reserved	Reserved	Reserved	Meter REPORT (**kWh**)	Meter REPORT (**Watt**)	Meter REPORT (**A**)	Meter REPORT (**V**)