



## **SP-101**

Smart energy plug in  
switch

## **User Manual**



[www.airlive.com](http://www.airlive.com)



## Copyright & Disclaimer

No part of this publication may be reproduced in any form or by any means, whether electronic, mechanical, photocopying, or recording without the written consent of OvisLink Corp.

OvisLink Corp. has made the best effort to ensure the accuracy of the information in this user's guide. However, we are not liable for the inaccuracies or errors in this guide. Please use with caution. All information is subject to change without notice

This product contains some codes from GPL. In compliance with GPL agreement, AirLive will publish the GPL codes on our website. Please go to [www.airlive.com](http://www.airlive.com) and go to the "Support->GPL" menu to download source code.

All Trademarks are properties of their respective holders.



## FCC Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

## Warning

1. Plug out to disconnect from power supply; Do not plug in line.
2. Do not exceed the max rating

## Disposal



This marking indicates that this product should not be disposed with other household wastes throughout the EU. To prevent possible harm to the environment or human health from uncontrolled waste disposal, recycle it responsibly to promote the sustainable reuse of material resources. To return your used device, please use the return and collection systems or contact the retailer where the product was purchased. They can take this product for environmental safe recycling.

## Table of Contents

<b>1. Overview.....</b>	<b>2</b>
1.1 Adding to Z-Wave™ Network .....	2
1.2 LED Indication .....	4
1.3 Choosing a Suitable Location .....	4
1.4 Installation .....	4
1.5 Programming .....	5
1.6 Troubleshooting .....	11
1.7 Specifications.....	12

# 1

## Overview



This plug-in ON/OFF switch is a security enabled wireless switch, based on Z-Wave Plus technology. Z-Wave Plus™ enabled devices displaying the Z-Wave Plus™ logo can also be used with it regardless of the manufacturer, and can also be used in other manufacturer's Z-Wave™ enabled networks. Remote On/Off control of the connected load is possible with other manufacturer's wireless Controller. Each switch is designed to act as a repeater. Repeaters will re-transmit the RF signal to ensure that the signal is received by its intended destination by routing the signal around obstacles and radio dead spots. Because plug supports Security Command Class, it can learn with Secured controller. Its functionality and supported command classes is identical when included as a secure and non-secure device.

This plug-in ON/OFF switch is able to detect instance wattage (3000W/230Vac) (13Ampere) and overload current (14.5A with resistive load) of connected lights or appliances. When detecting overload state, the Switch will be disabled and its On/Off button will be lockout of which LED will flash quickly. However, unplug and reconnect the switch will reset its overload condition to normal status.

### 1.1 Adding to Z-Wave™ Network

In the front casing, there is an On/Off button with LED indicator which is used to toggle switch on and off or carry out inclusion, exclusion, reset or association. When first power is applied, its LED flashes on and off alternately and repeatedly at 0.5 second intervals. It implies that it has not been assigned a node ID and start auto inclusion.

### 1.1.1. Auto Inclusion

The function of auto inclusion will be executed as long as the switch does not have Node ID and just plug the switch into a wall outlet.

**Note:** Auto inclusion timeout is 2 minute during which the node information of explorer frame will be emitted once several seconds. Unlike “inclusion” function as shown in the table below, the execution of auto inclusion is free from pressing the On/Off button on the Switch.

The table below lists an operation summary of basic Z-Wave functions. Please refer to the instructions for your Z-Wave™ Certificated Primary Controller to access the Setup function, and to include/exclude/associate devices.

Function	Description	Annotation
No node ID	The Z-Wave Controller does not allocate a node ID to the Switch.	LED 2-second on, 2-second off
Inclusion	1. Put your Z-Wave controller into inclusion mode by following the instructions provided by the controller manufacturer.	
	2. Pressing On/Off button three times within 2 seconds will enter inclusion mode.	
Exclusion	1. Put your Z-Wave controller into exclusion mode by following the instructions provided by the controller manufacturer.	
	2. Pressing On/Off button three times within 2 seconds will enter exclusion mode.	
	Node ID has been excluded.	
Reset	1. Pressing On/Off button three times within 2 seconds will enter inclusion mode.	Use this procedure only in the event that the primary controller is lost or otherwise inoperable.
	2. Within 1 second, press On/Off button again for 5 seconds.	
	3. IDs are excluded.	LED 0.5s On, 0.5s Off (Enter auto inclusion)
Association	1. The Plug is an always listening Z-Wave device, so associations may be added or removed by a controller at any time.	

	Or If your controller requires to have the Plug send a 'node information frame' or NIF for associations, then pressing the On/Off button three times within 2 seconds will cause the Plug to send its NIF.	
	2. There are only one group for the switch	
※ Including a node ID allocated by Z-Wave Controller means inclusion. Excluding a node ID allocated by Z-Wave Controller means exclusion. ※ Failed or success in including/excluding the node ID can be viewed from the Z-Wave Controller.		

## 1.2 LED Indication

To distinguish what mode the switch is in, view from the LED for identification. The color of LED could be blue 、cyan 、green 、orange 、pink or red, it represents the power consumption from light to heavy.

State Type	LED Indication
Normal	Under normal operation, toggle On/Off button between On and Off. When pressing On, LED lights up, whereas Off, LED is off.
No node ID	Under normal operation, when the Switch has not been allocated a node ID, the LED flashes on and off alternately at 2-second intervals. By pressing On/Off button, it will stop flashing temporarily.
Learning	When Plug is in learning mode, LED flashes on and off alternately and repeatedly at 0.5 second intervals.
Overload	When overload state occurs, the Switch is disabled of which LED flashes on and off alternately at 0.2 second intervals. Overload state can be cleared by unplugging and reconnecting the Switch to the wall outlet.

## 1.3 Choosing a Suitable Location

1. Do not locate the Switch facing direct sunlight, humid or dusty place.
2. The suitable ambient temperature for the Switch is 0°C~40°C.
3. Do not locate the Switch where exists combustible substances or any source of heat, e.g. fires, radiators, boiler etc.
4. After putting it into use, the body of Switch will become a little bit hot of which phenomenon is normal.

## 1.4 Installation

1. Plug this On/Off Switch into a wall outlet near the load to be controlled.
2. Plug the load into the Switch. Make sure the load to be controlled cannot exceed 13A.
3. Press the button or switch on the load to the ON position.
4. To manually turn ON the Switch, press and release the On/Off button. The LED will turn ON, and the load plugged into the Switch will also turn ON.
5. To manually turn OFF the Switch, simply press and release the On/Off button. The LED will turn OFF and the load plugged into the Switch will also turn OFF.

## 1.5 Programming

### 1.5.1. Basic Command Class/Bi

#### 1.5.1.1. BASIC\_GET / BINARY\_SWITCH\_GET

Upon receipt of the following commands from a Z-Wave Controller, the Switch will report its On/Off state to the node asked.

Basic Get Command: [Command Class Basic, Basic Get]
Basic Report Command: Report OFF: [ <b>Command Class Basic, Basic Report, Value = 0(0x00)</b> ] Report ON:[ <b>Command Class Basic, Basic Report, Value = 255(0xFF)</b> ]

Binary Switch Get Command:[ <b>Command Class Switch Binary, Switch Binary Get</b> ]
Binary Switch Report Command: Report OFF:[ <b>Command Class Switch Binary, Switch Binary Report, Value= 0(0x00)</b> ] Report ON:[ <b>Command Class Switch Binary, Switch Binary Report, Value = 255(0xFF)</b> ]

#### 1.5.1.2. BASIC\_SET / SWITCH\_BINARY\_SET

Upon receipt of the following commands from a Z-Wave Controller, the load attached to the Switch will turn on or off.

[ <b>Command Class Basic, Basic Set, Value = 1~99,255(0xFF)</b> ]: the load attached to the Switch turns on.
[ <b>Command Class Basic, Basic Set, Value = 0(0x00)</b> ]: the load attached to the Switch turns off.
[ <b>Command Class Switch Binary, Switch Binary Set, Value = 1~99, (255)0xFF</b> ]: the load attached to the Switch turns on.
[ <b>Command Class Switch Binary, Switch Binary Set, Value = 0(0x00)</b> ]: the load attached to the Switch turns off.

### 1.5.2. Z-Wave's Groups (Association Command Class Version 2)

The Switch can be set to send reports to associated Z-Wave devices. It supports one association group with one node support for Grouping 1. For group 1, the Switch will report its latest status to Z-Wave Controller.



Grouping 1 includes, SWITCH\_BINARY\_REPORT, METER\_REPORT, ALARM\_REPORT.

#### 1.5.2.1. Auto report to Grouping 1 (Maximum Node 1)

##### 1.5.2.1.1. On/Off Event Report

When “on” or “off” state has been changed, it will send Binary Switch Report to the node of Grouping 1.

##### Binary Switch Report

**ON:[Command Class Switch Binary, Switch Binary Report, Value =255(0xFF)]**  
**OFF:[Command Class Switch Binary, Switch Binary Report, Value =0(0x00)]**

##### 1.5.2.1.2. Instant Power Consumption vary over 5% report

When the power consumption of load vary over 5%, it will send Meter report to the nodes of Grouping 1.

##### Meter Report Command:

**[Command Class Meter , Meter Report , Rate Type = 0x01 , Meter Type =0x01 , Precision = 1 , Scale = 0x02 , Size = 4 , Meter Value(W) ]**

##### 1.5.2.1.3. Overload alarm report

When Plug detects the current is more than 14.5A, it will send Alarm Report to Group 1 node.

##### The content of Alarm Report

##### Alarm report command:

**[Command Class Alarm, Alarm\_Report, Alarm Type = 0x08, Alarm Level =0xFF]**

#### 1.5.2.2. Response to Meter Get Command

The Switch will report its (1) instant Power Consumption (Watt) or (2) accumulated power consumption(KWH) or (3) AC load Voltage (V) or (4) AC load current ( I ) (5) load power factor (PF) to Z-Wave Controller after receive the Meter Get Command from Z-Wave Controller.

##### 1.5.2.2.1. Instant Power Consumption (Watt) of Switch

When receiving Meter Get Command, it will report Meter Report Command to the node.

**Meter Get Command: [Command Class Meter, Meter Get, Scale =0x02(W) ]**

##### Meter Report Command:

**[Command Class Meter , Meter Report , Rate Type = 0x01 , Meter Type =0x01 , Precision = 1 , Scale = 0x02 , Size = 4 , Meter Value(W) ]**

##### Example:

Meter Value 1 = 0x00 (W)

Meter Value 2 = 0x00 (W)

Meter Value 3 = 0x03 (W)

Meter Value 4 = 0xEA (W)

Meter (W) = Meter Value 3 \*256 + Meter Value 4 = 100.2W

#### 1.5.2.2.2. Accumulated Power Consumption (KW/h)

When receiving Meter Get Command, it will report Meter Report Command to the node.

Meter Get Command:

**[Command Class Meter, Meter Get, Scale = 0x00 KW/h]**

Meter Report Command:

**[Command Class Meter , Meter Report , Rate Type = 0x01 , Meter Type =0x01 , Precision = 2 , Scale = 0x00 , Size = 4 , Meter Value (KWh)]**

Example:

Scale = 0x00 (KWh)

Precision = 2

Size = 4 Bytes (KW/h)

Meter Value 1 = 0x00(KWh)

Meter Value 2 = 0x01(KWh)

Meter Value 3 = 0x38(KWh)

Meter Value 4 = 0xA3 (KWh)

Accumulated power consumption (KW/h) = (Meter Value 2\*65536) + (Meter Value 3\*256) + (Meter Value 4) = 800.35 (KW/h)

#### 1.5.2.2.3. Clearing accumulated power consumption

Whenever re-start counting the accumulated power consumption is needed, you can use Meter Reset Command to clear it.

Meter Reset Command: **[Command Class Meter, Meter Reset]**

#### 1.5.2.2.4. AC load Voltage (V)

When receiving Meter Get Command, it will report Meter Report Command to the node.

Meter Get Command: **[Command Class Meter, Meter Get, Scale =0x04(V)]**

Meter Report Command:

**[Command Class Meter , Meter Report , Rate Type = 0x01 , Meter Type =0x01 , Precision = 1 , Scale = 0x04 , Size = 2 , Meter Value(V)]**

Example:

Scale = 0x04 (V)

Precision = 1

Size = 2 (2 Bytes of V)

Meter Value 1 = 0x09(V)

Meter Value 2 = 0x01(V)

AC load Voltage = (Meter Value 1\*256) + (Meter Value 2) = 230.5 (V)

#### 1.5.2.2.5. AC load current (I)

When receiving Meter Get Command, it will report Meter Report Command to the node.

Meter Get Command:  
**[Command Class Meter, Meter Get, Scale =0x05(I)]**

Meter Report Command:  
**[Command Class Meter , Meter Report , Rate Type = 0x01 , Meter Type =0x01 , Precision = 2 , Scale = 0x05 , Size = 2 , Meter Value(I)]**

Example:

Scale = 0x05 (I)

Precision = 2

Size = 2 (2 Bytes of I)

Meter Value 1 = 0x01(I)

Meter Value 2 = 0x21(I)

AC load current = (Meter Value 1\*256) + (Meter Value 2) = 2.89 (A)

#### 1.5.2.2.6. load power factor (PF)

When receiving Meter Get Command, it will report Meter Report Command to the node.

Meter Get Command: **[Command Class Meter, Meter Get, Scale =0x06(PF)]**

Meter Report Command:  
**[Command Class Meter , Meter Report , Rate Type = 0x01 , Meter Type =0x01 , Precision = 2 , Scale = 0x06 , Size = 1 Bytes , Meter Value(PF)]**

Example:

Scale = 0x06 (PF)

Precision = 2

Size = 1 (1 Byte of PF)

Meter Value 1 = 0x63(PF) (It means that the load power factor is 0.99)

### 1.5.3. Z-Wave's Configuration

Configuration Parameter	Function	Size (Byte)	Value	Unit	Default	Description
1	Watt Meter Report Period	2	0x01-0x7FFF	5s	720	720*5s=3600s=1 hour
2	KWH Meter Report Period	2	0x01-0x7FFF	10min	6	6*10min=1 hour
3	Threshold of current for Load caution	2	10-1100	0.01A	1100	1100*0.01A = 11A
4	Threshold of	2	1-10000	1KWh	10000	

	KWh for Load caution					
5	Restore switch state mode	1	0-2		1	0: Switch off 1: Last switch state 2 : Switch on
6	Mode of Switch Off function	1	0-1		1	1.: Disable 2.: Enable
7	LED indication mode	1	1-3		1	1 : Show switch state 2 : Show night mode 3 : One flash mode
8	Auto off timer	2	0-0x7FFF	1s	0	0 : Disable auto off function 1-0x7FFF : 1s ~32767s
9	RF off com-mand mode	1	0-3		0	0 : Switch off 1 : Ignore 2 : Switch toggle 3 : Switch on

#### 1.5.3.1. Watt Meter Report Period

If the setting is configured for 1hour (set value =720), the Plug will report its instant power consumption every 1 hour to Group1 node. The maximum interval to report its instant power consumption is 45 hours ( $5s \times 32767 / 3600 = 45hr$ ).

#### 1.5.3.2. KWH Meter Report Period

If the setting is configured for 1hour (set value =6), the Plug will report its Accumulated Power Consumption (KW/h) every 1 hour to Group1 node. The maximum interval to report its Accumulated Power Consumption (KW/h) is 227.55 days ( $10min \times 32767 / 1440 = 227.55$  days).

#### 1.5.3.3. Threshold of current for Load Caution

This is a warning when the current of load over the preset threshold value, if the setting value is 1300, when the load current of Relay1 over this value, Plug will send current meter report to warn the Group1 node, the Range of the setting value is from 10 to 1300, and the default value is 1300.

#### 1.5.3.4. Threshold of KWh for Load Caution

This is a warning when the KWh of load over the preset threshold value, If the setting value is 10000, when the Accumulated Power Consumption of Relay1 over this value, Plug will send KWH meter report to warn the Group1 node, minimum value is 1KWh and default value is 10000 kWh.

#### 1.5.3.5. Restore switch state mode

Whenever the AC power return from lost, Plug will restore the switch state which could be

SWITCH OFF \ LAST SWITCH STATE \ SWITCH ON. The default setting is LAST SWITCH STATE.

1.5.3.6. Mode of switch off function:

When the mode of switch On/Off is set to 0, any command of switch off will be disabled and the On/Off function of include button will be disabled. The default setting is enable mode. When manual On/Off function is disabled, the RF command can only switch On but not Off. This is useful function for keeping the device in switch on state.

1.5.3.7. LED indication mode

1.5.3.7.1. Show Switch State : When switch is on, LED is on. When switch is off, LED is off. The default setting is Show Switch State.

1.5.3.7.2. Show Night mode : When switch is on, LED is off. When switch is off, LED is on.

1.5.3.7.3. One Flash mode : When the state of switch changes, LED will be on only one second, then LED keeps off.

1.5.3.8. Auto off timer :

Whenever Plug switches to on, the auto off timer begin to count down. After the timer decrease to zero, it will switch to off automatically. However if Auto off timer is set as 0, the auto off function will be disabled. The default setting is 0.

1.5.3.9. RF off command mode

Whenever a switch off command, BASIC\_SET \ BINARY\_SWITCH\_SET \ SWITCH\_ALL\_OFF, is received, it could be interpreted as 4 variety of commands.

1.5.3.9.1. Switch Off : It switches to OFF state. The default setting is Switch Off.

1.5.3.9.2. Ignore : The switch off command will be ignored.

1.5.3.9.3. Switch Toggle : It switches to the inverse of current state.

1.5.3.9.4. Switch On : It switches to ON state.

## 1.5.4. Protection Command Classes

Plug supports Protection Command Class version 2, it can protect the switch against unintentionally control by e.g. a child. And it can also protect the switch from being turned off by setting it in “No RF Control” state.

After being set to “Protection by sequence” state, any intentional pressing of On/Off button should be hold longer than 1 second, or the switch state will not change.

However, the operation of learn function does not change, because learning will not be protected.

### 1.5.5. Firmware update over the air (OTA)

Plug is based on 500 series SoC and supports Firmware Update Command Class, it can receive the updated firmware image sent by controller via the Z-wave RF media. It is a helpful and convenient way to improve some function if needed.

### 1.5.6. Command Classes

The Switch supports Command Classes including...

- \* COMMAND\_CLASS\_ZWAVEPLUS\_INFO
- \* COMMAND\_CLASS\_VERSION
- \* COMMAND\_CLASS\_MANUFACTURER\_SPECIFIC\_V2
- \* COMMAND\_CLASS\_SECURITY
- \* COMMAND\_CLASS\_DEVICE\_RESET\_LOCALLY
- \* COMMAND\_CLASS\_ASSOCIATION\_V2
- \* COMMAND\_CLASS\_ASSOCIATION\_GRP\_INFO
- \* COMMAND\_CLASS\_POWERLEVEL
- \* COMMAND\_CLASS\_SWITCH\_BINARY
- \* COMMAND\_CLASS\_BASIC
- \* COMMAND\_CLASS\_SWITCH\_ALL
- \* COMMAND\_CLASS\_METER\_V3
- \* COMMAND\_CLASS\_CONFIGURATION
- \* COMMAND\_CLASS\_ALARM
- \* COMMAND\_CLASS\_PROTECTION
- \* COMMAND\_CLASS\_FIRMWARE\_UPDATE\_MD\_V2

## 1.6 Troubleshooting

Symptom	Cause of Failure	Recommendation
The Switch not working and LED off	1. The Switch is not plugged into the electrical outlet properly 2. The Switch break down	1. Check power connections 2. Don't open up the Switch and send it for repair.
The Switch LED illuminating, but cannot control the ON/OFF Switch of the load attached	1. Check if the load plugged into the Switch has its own ON/OFF switch 2. The switch is protected	1. Set the ON/OFF switch of the load attached to ON 2. Unprotected the switch or follow the instruction of protection.
The Switch LED illuminating, but the Detector cannot control the Switch	Not carry out association Same frequency interference	1. Carry out association 2. Wait for a while to re-try
LED keep flashing, but cannot control	Overload occurs	Remove the load attached or check max.

		load cannot exceed 12A (Resistive load)
--	--	--

## 1.7 Specifications

Operating Voltage	220V~240V / 50Hz for EU Type
Operating Voltage	100V~120V / 50Hz/60Hz for US Type
Maximum Load (Ampere)	13A (Resistive load)
Socket Type:	Germany type
	France type
	UK type
	US type
Range	Minimum 40 m in door 100m outdoor line of sight
Operating Temperature	0°C ~ 40°C
Frequency Range	868.40MHz & 869.85MHz/ EU 908.4MHz & 916.0MHz/ USA

**\*\* Specifications are subject to change and improvement without notice.**



OvisLink Corp.,  
<http://www.airlive.com/>  
 TEL: +886 2 2218 6888  
 FAX: +886 2 2918 6988

