

# PAN16

## Smart energy plug in switch



### Introduction

This plug-in ON/OFF switch PAN16 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 PAN16 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 re-connect the switch will reset its overload condition to normal status.

### Warning:

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

### Warnung:

- 1.Trennen Sie das Gerät von der Stromzuführung. Verwenden Sie das Gerät nicht mit einem DIP Schalter.
2. Achten Sie darauf, dass die maximale Spannung niemals überschritten wird.

### Warnung:

für zwischenstecker:  
nicht hintereinander stecken

### Specification

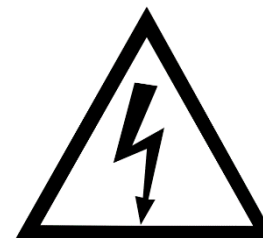
Rated Voltage	100V-240Vac 50Hz-60Hz 13A
Maximum Load (Ampere)	13A (Resistive load) PAN16-1; PAN16-2; PAN16-3
Maximum Load (Ampere)	10A (Resistive load) PAN16-4 (Switzerland)
Socket Type:	Germany type: PAN16-1 France type: PAN16-2 UK type: PAN16-3 Switzerland type: PAN16-4
Range	Minimum 40 m in door 100m outdoor line of sight
Operating Temperature	0°C - 40°C
Frequency Range	868.40MHz & 869.85MHz for EU (PAN16-1/-2/-3/-4);
RF Maximum Power	+5dBm

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

### 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	1.Check if the load plugged into the Switch	1. Set the ON/OFF switch of the load attached to ON

control the ON/OFF Switch of the load attached	has its own ON/OFF switch 2. The switch is protected	2. Unprotected the switch or follow the instruction of protection.
The Switch LED illuminating, but the Detector cannot control the Switch	1. Not carry out association 2. 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 13A (Resistive load)



**DANGER**

**Danger of electrocution!**

**For Instruction to [http:// www.philio-tech.com](http://www.philio-tech.com)**



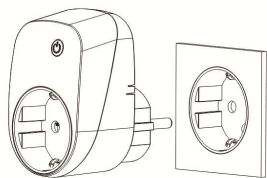
All works on the device may be performed only by a qualified and licensed electrician.

Observe national regulations.

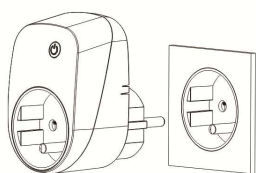
Any works introducing changes into the configuration must be always performed with disconnected voltage.

### Socket Type

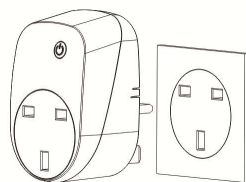
Since the socket type for each country in Europe varies, refer to the outline for each socket suited for each country as follows:



PAN16-1 German



PAN16-2 French



PAN16-3 U.K.

**Note:** Please make sure that the intensity of the plug of the electrical device must be 16A and have same head as the enclosed plug before inserting to the socket.

## 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.

### 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 Add/Remove/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
Add	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.	
Remove	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.	LED 0.5s On, 0.5s Off (Enter auto inclusion)
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 PAN16 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 PAN16 send a 'node information frame or NIF for associations, then pressing the On/Off button three times within 2 seconds will cause the PAN16 to send its NIF.	
	2. There is 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.		

### 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 PAN16 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.

## 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.

## 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.

## Programming

### 1. Basic Command Class / Binary Switch Command Class

The Switch will respond to BASIC and BINARY commands that are part of the Z-Wave system.

### 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: <b>[Command Class Basic, Basic Get]</b>
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>

### 1-2 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.

## 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.

## 2-1 Auto report to Grouping 1 (Maximum Node 1)

### 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)**]

### 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) ]**]

### 2-1-3 Overload alarm report

When PAN16 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**]

## 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.

### 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

### 2-2-2 Accumulated Power Consumption (KWh)

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

Meter Get Command:  
[**Command Class Meter, Meter Get, Scale = 0x00 KWh]**]

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 (KWh)

Meter Value 1 = 0x00(KWh)

Meter Value 2 = 0x01(KWh)

Meter Value 3 = 0x38(KWh)

Meter Value 4 = 0xA3(KWh)

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

### 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]**

#### 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)

#### 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)

#### 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)

### 3. Z-Wave's Configuration

Configuration Parameter	Function	Size (Byte)	Value	Unit	Default	Description
1	Watt Meter Report Period	2	0x00-0x7FFF	5s	720	0: Disable Watt Report 1~32767 : 5s~ 45h
2	KWH Meter Report Period	2	0x00-0x7FFF	10min	6	0:Disable KWh Report 1~32767 : 10min~ 227days
3	Threshold of current for Load caution	2	10-1300	0.01A	1300	1300*0.01A = 13A
4	Threshold of KWh for Load caution	2	1-10000	1KWh	10000	10000*1KWh = 10000 KWh
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	0 : Disable 1 : 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 command mode	1	0-3		0	0 : Switch off 1 : Ignore 2 : Switch toggle 3 : Switch on
11	Manual Switch Report mode	1	0-1		1	0 : Disable 1 : Enable
12	Auto Report after Reset	1	0-1		0	0 : Disable 1 : Enable
13	Adjustable Overload	2	450-1450	0.01A	1450	1450*0.01A=14.5A
14	Watt differential mode	1	0-1		1	0 : Disable 1 : 5%

### 3-1 Watt Meter Report Period:

If the setting is configured for 1hour (set value =720), PAN16 will report its instant power consumption to Group1 node every 1 hour. The maximum interval to report its instant power consumption is 45 hours (5s\*32767/3600=45hr). When the setting is 0, PAN16 will disable Watt auto report function. The default value is 720.

### 3-2 KWH Meter Report Period:

If the setting is configured for 1hour (set value =6), PAN16 will report its Accumulated Power Consumption (KWh) to Group1 node every 1 hour. The maximum interval to report its Accumulated Power Consumption (KWh) is 227.55 days (10min\*32767/1440=227.55 days). When the setting is 0, PAN16 will disable KWH auto report function. The default value is 6.

### 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, PAN16 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.

### 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, PAN16 will send KWH meter report to warn the Group1 node, minimum value is 1KWh and default value is 10000 kWh.

### 3-5 Restore switch state mode :

Whenever the AC power return from lost, PAN16 will restore the switch state which could be SWITCH OFF、LAST SWITCH STATE、SWITCH ON. The default setting is LAST SWITCH STATE.

### 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.

### 3-7 LED indication mode : The default setting is Show Switch State.

3-7-1 Show Switch State : When switch is on, LED is on. When switch is off, LED is off.

3-7-2 Show Night mode : When switch is on, LED is off. When switch is off, LED is on.

3-7-3 One Flash mode : When the state of switch changes, LED will be on only one second, then LED keeps off.

### 3-8 Auto off timer : The default setting is 0.

Whenever PAN16 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.

### 3-9 RF off command mode: The default setting is Switch Off.

Whenever a switch off command,

BASIC\_SET、BINARY\_SWITCH\_SET、SWITCH\_ALL\_OFF, is received, it could be interpreted as 4 variety of commands.

3-9-1 Switch Off : It switches to OFF state.

3-9-2 Ignore : The switch off command will be ignored.

3-9-3 Switch Toggle : It switches to the inverse of current state.

3-9-4 Switch On : It switches to ON state.

### 3-10 Manual Switch Report mode : The default setting is Enable the function.

Whenever PAN16 manually switch on or off, it will send BINARY\_SWITCH\_REPORT to the node of group1.

### 3-11 Auto Report after Reset :

Whenever PAN16 is repowered, it will check this parameter for if sending a BINARY\_SWITCH\_REPORT to the node of group1 or not. The default setting is Disable the function.

### 3-12 Adjustable Overload :

The overload current can be adjustable from 4.5A to 14.5A. The default value is 1450 for 14.5A. (1450 \* 0.01A = 14.5A)

3-13 Watt differential mode : The default setting is 1 (= 5%).

Whenever Watt value of PAN16 changes over 5% of last reading value, it will send Meter report to the group 1 nodes. However if Watt differential mode as 0, the unsolicited report will be disabled.

#### 4. Protection Command Classes

PAN16 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.

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

PAN16 is based on 500 series SoC and supports Firmware Update Command Class, it can receives 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.

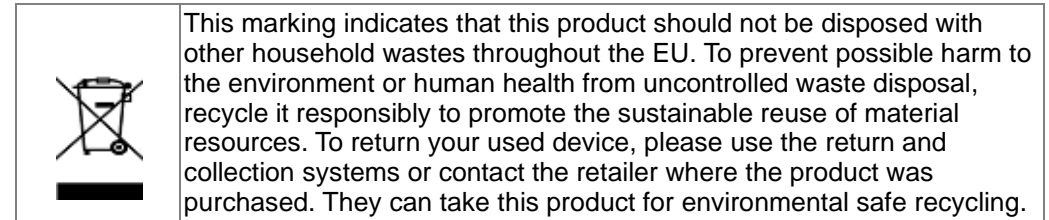
#### 6. Command Classes

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

#### Disposal



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