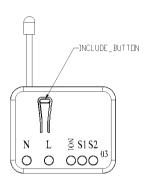# PAN03-1B/-2B/-3B   PAN10-1B/-2B/-3B
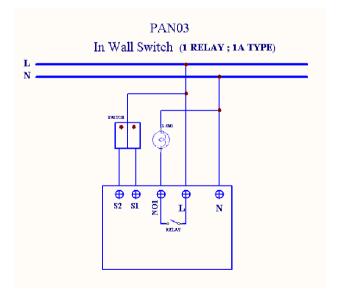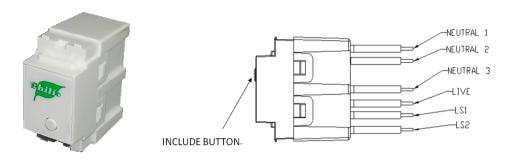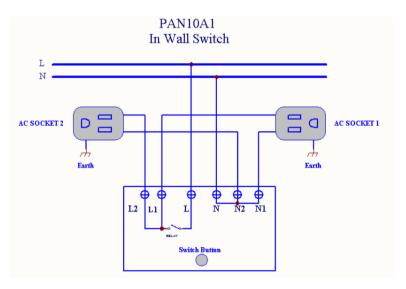## Switch Module with meter

Fig 1. PAN03 Assembling

Fig 2. PAN10 Assembling

This plug-in ON/OFF switch PAN03/PAN10 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 PAN03/PAN10 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 and overload current (12A 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.

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™ Certified 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.	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.	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.	0.5s On, 0.5s Off (Enter auto inclusion)
Association	1. The PAN11 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 PAN11 send a 'node information frame' or NIF for associations, then pressing the On/Off button three times within 2 seconds will cause the PAN11 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.

Sometimes people are not easy to execute exclusion or inclusion especially when PAN03 already installed in a wall box. To solve this issue, PAN03 support a special feature that can use S1 or S2 to execute "exclusion, inclusion, Reset or Association" at the first 3 minutes when first time connect to main power. PAN10 does not support S1/S2 function.

LED Indication
To distinguish what mode the switch is in, view from the LED for identification.

State Type	LED Indication
Normal	Whenever we switch On and off of the PAN03/PAN10 by S1 S2 or On/Off button or RF command, the LED will lights up 1 second and then 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 S1 S2 or On/Off button, it will stop flashing temporarily.
Learning	When PAN03/PAN10 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℃~40℃.
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. Put the in wall switch into a wall box and connect the AC power wire L,N to PAN03/PAN10 connector L, N.

2. Connect the wall switch to the PAN03/PAN10 as Fig1.

3. There are 3 mode PAN03/PAN10 can be configured to match different kind of wall switch,
   please refer to **3-10 Edge / Pulse / Edge-Toggle mode** which described in next section of this user manual.

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

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

   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.

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

1. **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 PAN03/PAN10 detects the current is more than 12A, 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 (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)

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)
Load power factor (PF) = Meter Value 1 =0.99

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 KWh for Load caution	2	1-10000	1KWh	10000	
5	Restore switch state mode	1	0-2		1	0 : Switch off 1 : Last switch state 2 : Switch on
6	Manual On/Off mode	1	0-1		1	0 : Disable manual On/Off 1 : Enable manual On/Off
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
10	Edge or Pulse mode or Edge-Toggle mode	1	1-3		1	1 : Edge mode 2 : Pulse mode 3 : Edge-Toggle mode

3-1 Watt Meter Report Period:

If the setting is configured for 1hour (set value =720), the PAN03/PAN10 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*32767/3600=45hr).

3-2 KWH Meter Report Period:

If the setting is configured for 1hour (set value =6), the PAN03/PAN10 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*32767/1440=227.55 days).

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 1100, when the load current of Relay1 over this value, PAN03/PAN10 will send current meter report to warn the Group1 node, the Range of the setting value is from 10 to 1100, and the default value is 1100.

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, PAN03/PAN10 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, PAN03/PAN10 will restore the switch state which could be SWITCH OFF、LAST SWITCH STATE、SWITCH ON. The default setting is LAST SWITCH STATE.

3-6 Manual On/Off Mode:

The On/Off function of S1、S2 and learn switch can be disabled or enabled by this parameter, default value is Enable. But the learning operation won't be affected. 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:

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.

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：

Whenever PAN03/PAN10 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.

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.
3-9-1 Switch Off：It switches to OFF state. The default setting is Switch Off.
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 Edge mode、Pulse mode and Edge-Toggle mode

Manual switch S1 and S2 can set to Edge mode or Pulse mode or Edge-Toggle mode, default value is Edge mode. But this parameter is useless to PAN10.

3-10-1 Edge mode: this mode is suitable for the bi-stable wall switch that has indicator point on the switch, and the same position correspond to same state of relay1. If the PAN03/PAN10 relay change the state because of receiving Z-Wave RF command, it may need two times of change (switch on to off or switch off to on) to let relay back to the correspond state. Manual switch S2 is disabled in this mode.

3-10-2 Pulse mode: this mode is suitable for the toggle type wall switch to swap the state of Relay1.

3-10-3 Edge-Toggle mode: this mode is suitable for the normal bi-stable switch, whenever change the state of the wall switch will also swap the state of Relay1.

4. **Protection Command Classes**
PAN03/PAN10 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)**

PAN11 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

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	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 12.0A(Resistive load)

Specification

Operating Voltage	100 ~240VAC /50Hz/60Hz
Maximum Load	11A (Resistive load)
Range	Minimum 40 m in door 100m outdoor line of sight
Operating Temperature	0℃ ~ 40℃
Frequency Range	868.40MHz & 869.85MHz/EU/CN (PAN03-1B/-2B/-3B/-8B /PAN10-1B/-2B/-3B/-8B), 908.40MHz & 916.00MHz/UL(PAN03-4B /PAN10-4B), 922~927MHz/TW/JP(PAN03-5B /PAN10-5B)

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

FCC ID : RHHPAN03

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.

Company of License Holder：Philio Technology Corporation

Address of License Holder：8F.,No.653-2,Zhongzheng Rd., Xinzhuang Dist., New

Taipei City 24257,Taiwan(R.O.C)

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.