PAB01 Smart Energy In Wall Meter

Single phase two wire

Fig 2. Assembling

Single phase three wire
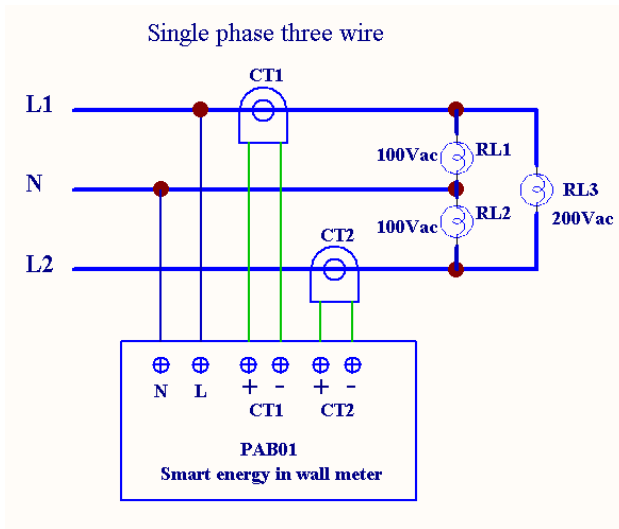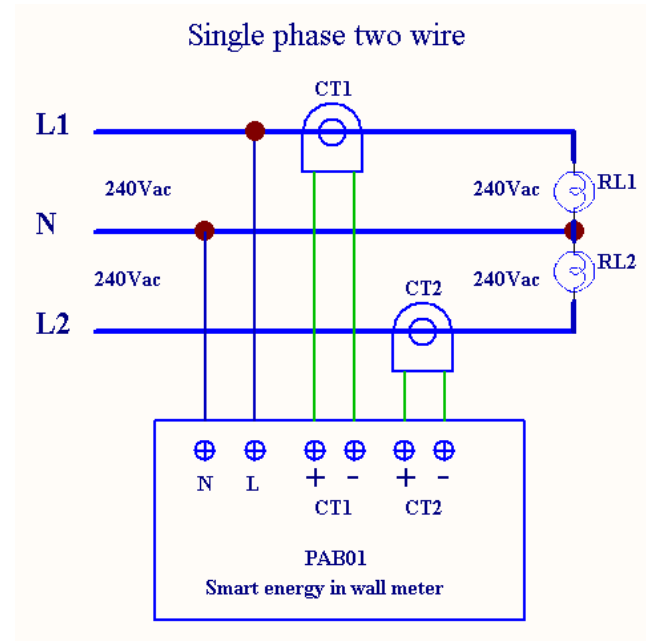
Fig 1. Assembling

This dual meter module is a transceiver which is a Z-WaveTM enabled device and is fully compatible with any Z-WaveTM enabled network. Mini size design let the module can easily hide itself into the electricity distribution box and that will be good for the house decoration.

This dual meter module is able to detect Instant power wattage (13800W/230Vac)(60 Amperes) of connected light or appliances.

Adding to Z-Wave™ Network

In the front casing, there is an on/off button with LED indicator below which is used to carry out inclusion, exclusion, reset or association. After being excluded, its LED flashes on and off alternately and repeatedly at 2-second intervals. It implies that it has not been assigned a node ID and cannot work with Z-Wave enabled devices.

Auto Inclusion

The function of auto inclusion will be executed as long as the meter does not have Node ID and just connect the meter to main power. When first power is applied, its LED flashes on and off alternately and repeatedly at 0.5 second intervals. It implies that it is in leaning mode now.

Note: Auto inclusion timeout is 2 minute during which the node information of explore frame will be emitted once every 5 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 meter.

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	LED Indication
No node ID	The Z-Wave Controller does not allocate	2-second on, 2-second off

	a node ID to the meter.	
Inclusion	1. Have Z-Wave Controller entered inclusion mode.	One press one flash
	2. Pressing INCLUDE_BUTTON three times within 2 seconds will enter inclusion mode.	
Exclusion	1. Have Z-Wave Controller entered exclusion mode.	One press one flash
	2. Pressing INCLUDE_BUTTON three times within 2 seconds will enter exclusion mode.	
	Node ID has been excluded.	2-second on, 2-second off
Reset	1. Pressing INCLUDE_BUTTON three times within 2 seconds will enter inclusion mode.	One press one flash
	2. Within 1 second, press and hold INCLUDE_BUTTON button again for 5 seconds until LED is off.	
	3. IDs are excluded.	
Association	**1.** Have Z-Wave Controller entered association mode. Or Pressing INCLUDE_BUTTON three times within 2 seconds will enter association mode	One press one flash
	2. There are 3 groups for the meter	

LED Indication

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

State Type	LED Indication
No node ID	Under normal operation, when the meter has not been allocated a node ID, the LED flashes on and off alternately at 2 seconds intervals.
Learning	When PAB01 is in learning mode, LED flashes on and off alternately and repeatedly at 0.5 second intervals.

Choosing a Suitable Location

1. Do not locate the meter 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 meter where exists combustible substances or any source of heat, e.g. fires, radiators, boiler etc.
4. After putting it into use, the body of meter will become a little bit hot of which phenomenon is normal.

Installation
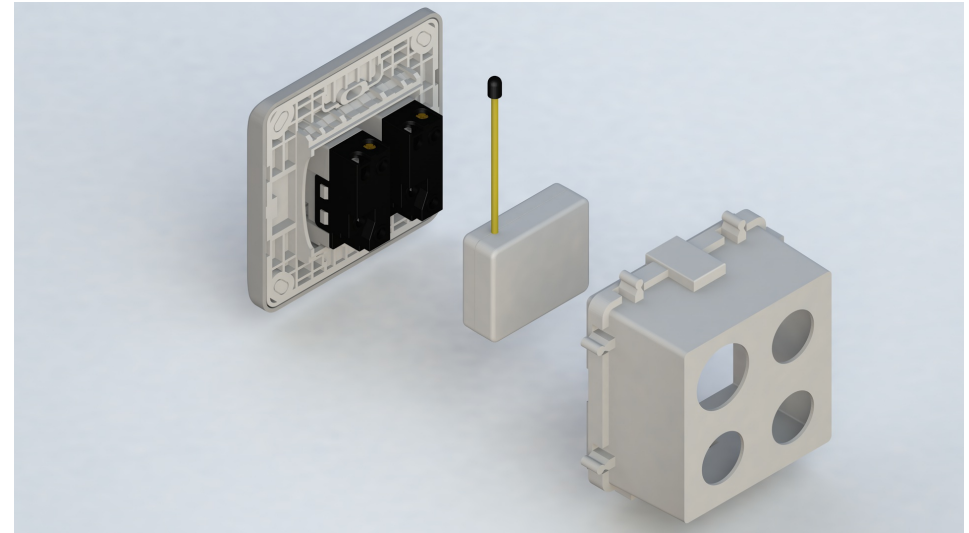
1. Put the in wall switch into a wall box and connect the AC power wire L,N to PAB01 connector L, N.
2. The black wire of current sensor, CT1 or CT2, should connected to the negative terminal of PAB01,CT1- or CT2-. Another wire should connected to the plus terminal of PAB01,CT1+ or CT1+.
3. There is a clasp on the side of the current sensor, it can lock or unlock the clamp. It is convenient to circle the already connected cable.

Programming

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1. **Z-Wave's Groups (Association Command Class Version 2)**

The meter can be set to send reports to associated Z-Wave devices. It supports 3 association groups which every group has one node support. Group1~Group3 support METER_REPORT_COMMAND_V3

For group 1, the Switch will report (1) The sum of instant Power Consumption (Watt) read from CT1 and CT2 (2) The sum of accumulated Power Consumption (KWh) read from CT1 and CT2.

For group 2, the Switch will report (1) Instant Power Consumption (Watt) read from CT1 (2) Accumulated Power Consumption (KWh) read from CT1.

For group 3, the Switch will report (1) Instant Power Consumption (Watt) read from CT2 (2) Accumulated Power Consumption (KWh) read from CT2.

2-1 Auto report to Grouping 1 ~3 (Maximum Node 1 per Group)

2-1-1 Instant Power Consumption vary over 5% report

When the instant power consumption read from CT1 or CT2 vary over 5%, it will send Meter report to the nodes of Group

Meter Report Command: **[Command Class Meter，Meter Report，scale(bit 2) +Rate Type +Meter Type，Precision + Scale(bit 1,0)+ Size，Meter Value 1，Meter Value 2，Meter Value 3，Meter Value 4]**

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 input 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)

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

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

Meter Report Command: **[Command Class Meter，Meter Report，scale(bit 2) +Rate Type +Meter Type，Precision + Scale(bit 1,0)+ Size，Meter Value 1，Meter Value 2，Meter Value 3，Meter Value 4]**

Rate Type = 0x01

Meter Type = 0x01

Precision = 1

Scale = 0x02(W)

Size = 4 Bytes (Meter Value)

Meter Value 1 = (W) MSB

Meter Value 2 = (W)

Meter Value 3 = (W)

Meter Value 4 = (W)LSB

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 asked.

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

Meter Report Command: **[Command Class Meter，Meter Report，scale(bit 2) +Rate Type +Meter Type，Precision + Scale(bit 1,0)+ Size，Meter Value 1，Meter Value 2，Meter Value 3，Meter Value 4]**

Rate Type = 0x01

Meter Type = 0x01

Precision = 2

Scale = 0x00 (KWh)

Size = 4 bytes (Meter Value)

Meter Value 1 = (KWh) MSB

Meter Value 2 = (KWh)

Meter Value 3 = (KWh)

Meter Value 4 = (KWh) LSB

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

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

2-2-4 AC input Voltage (V)

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

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

Meter Report Command:
[Command Class Meter，Meter Report，scale(bit 2) +Rate Type +Meter Type，Precision + Scale(bit 1,0)+ Size，Meter Value 1，Meter Value 2]

Rate Type = 0x01

Meter Type = 0x01

Precision = 1

Scale = 0x04(V)

Size = 2 Bytes (Meter Value)

Meter Value 1 = High Byte (V)

Meter Value 2 = Low Byte (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 asked.

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

Meter Report Command:
[Command Class Meter，Meter Report，scale(bit 2) +Rate Type +Meter Type，Precision + Scale(bit 1,0)+ Size，Meter Value 1，Meter Value 2]

Rate Type = 0x01

Meter Type = 0x01

Precision = 2

Scale = 0x05(I)

Size = 2 Bytes (Meter Value)

Meter Value 1 = High Byte (I)

Meter Value 2 = Low Byte (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 asked.

   If the value of configuration parameter 3 is 1, it will report the power factor of CT1,

but not the sum of PF of CT1 and CT2.

Meter Get Command: **[Command Class Meter, Meter Get, Scale =0x06(PF)]**
Meter Report Command: **[Command Class Meter，Meter Report，scale(bit 2) +Rate Type +Meter Type，Precision + Scale(bit 1,0)+ Size，Meter Value 1]**

Rate Type = 0x01

Meter Type = 0x01

Precision = 2

Scale = 0x06(PF)

Size = 1 Bytes

Meter Value 1

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

2-3 Multi Channel Command Class Version 3

PAB01 also support muti channel command class(version 3) , which include

METER_SUPPORTED_GET, METER_RESET,METER_GET.

You may get report from 3 endpoint of PAB01

 2-3-1 METER_SUPPORTED_GET：

This command is to ask the endpoint of PAB01 what kind of meter data can be

reported

The example show how to get the meter report type

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x01	(this is the endpoint of command owner here we assume endpoint is 1，if the owner doesn't support multi Channel this value will be 0)
(Bit Address+Destination End Point = 0x03)	(Bit Address =0；Destination End Point range1~3)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x03	(Meter_Supported_Get = 0x03)

Below is the example show PAB01 report to last command

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x03	
(Bit Address+Destination End Point = 0x01)	
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x04	(Meter_Supported_Report = 0x04)
Parameter 1 = 0x81	(Meter Reset =1, Meter Type=0x01)
Parameter 2 = 0x75	(Scale Supported = KWh+W+V+A+Power Factor = 0x75)

2-3-4 METER_RESET

This command is to reset the Accumulated Power Consumption (KWh) to 0

The example show how to reset the KWh

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x03	(this is the endpoint of command owner, here we assume endpoint is 3, if the owner doesn't support multi Channel this value will be 0)
(Bit Address+Destination End Point = 0x01)	(Bit Address =0；Destination End Point range1~3)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x05	(Meter_Reset = 0x05)

2-3-5 METER_GET：

Using meter get command to get the KWH,W,V,I,PF from endpoint of PAB01

2-3-5-1 Get KWH from endpoint

Meter_GET example:

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x05	(this is the endpoint of command owner, here we assume endpoint is 5, if the owner doesn't support multi Channel this value will be 0)
(Bit Address+Destination End Point = 0x03)	(Bit Address =0；Destination End Point range1~3)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x01	(Meter_Get = 0x01)
Parameter 1 = 0x00	(Scale = KWH = 0x00)

Accumulated power consumption (KWH) Report example：

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x03	(Meter report = Endpoint3)

(Bit Address+Destination End Point = 0x05)	(Bit Address =0；Destination End Point = command owner Endpoint value)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x02	(Meter_Report = 0x02)
Parameter 1 = 0x21	(Scale Bit2 = 0，Rate Type = 0x01，Meter Type=0x01)
Parameter 2 = 0x44	(Precision = 2，Scale Bit1Bit0 = 0，Size = 4)
Parameter 3 = 0x00	Accumulated Power Consumption = 0x000005FD = 15.33 KWh
Parameter 4 = 0x00	
Parameter 5 = 0x05	
Parameter 6 = 0xFD	

2-3-5-2 Get Instant Power Consumption (Watt) from endpoint

METER_GET example：

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x05	(this is the endpoint of command owner, here we assume endpoint is 5，if the owner doesn't support multi Channel this value will be 0)

(Bit Address+Destination End Point = 0x03)	(Bit Address =0；Destination End Point range 1~3)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x01	(Meter_Get = 0x01)
Parameter 1 = 0x10	(Scale = W = 0x02)

PAB01 Instant Power Consumption (W) Report example：

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x03	(Meter report = Endpoint3)
(Bit Address+Destination End Point = 0x05)	(Bit Address =0；Destination End Point = command owner Endpoint value)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x02	(Meter_Report = 0x02)
Parameter 1 = 0x21	(Scale Bit2 = 0，Rate Type = 0x01，Meter Type=0x01)
Parameter 2 = 0x34	(Precision = 1，Scale Bit1Bit0 = 0x02，Size = 4)
Parameter 3 = 0x00	

Parameter 4 = 0x00	Instant Power Consumption = 0x000003EA
Parameter 5 = 0x03	= 100.2W
Parameter 6 = 0xEA	

2-3-5-3 Get load voltage V from endpoint

Meter_GET example:

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x05	(this is the endpoint of command owner, here we assume endpoint is 5，if the owner doesn't support multi Channel this value will be 0)
(Bit Address+Destination End Point = 0x03)	(Bit Address =0；Destination End Point range1~3)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x01	(Meter_Get = 0x01)
Parameter 1 = 0x20	(Scale = V = 0x04)

PAB01 AC input Voltage report example：

COMMAND_CLASS_MULTI_CHANNEL	

MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x03	(Meter report = Endpoint3)
(Bit Address+Destination End Point = 0x05)	(Bit Address =0；Destination End Point = command owner Endpoint value)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x02	(Meter_Report = 0x02)
Parameter 1 = 0xA1	(Scale Bit2 = 1，Rate Type = 0x01，Meter Type=0x01)
Parameter 2 = 0x22	(Precision = 1，Scale Bit1Bit0 = 0x00，Size = 2)
Parameter 3 = 0x09	Voltage = 0x0910 = 232.0V
Parameter 4 = 0x10	

2-3-5-4 Get load current I from endpoint

Meter_GET example:

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x05	(this is the endpoint of command owner, here we assume endpoint is 5，if the owner doesn't support multi Channel this value will be 0)

(Bit Address+Destination End Point = 0x03)	(Bit Address =0；Destination End Point range1~3)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x01	(Meter_Get = 0x01)
Parameter 1 = 0x28	(Scale = A = 0x05)

PAB01 AC input current (I) example：

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x03	(Meter report = Endpoint3)
(Bit Address+Destination End Point = 0x05)	(Bit Address =0；Destination End Point = command owner Endpoint value)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x02	(Meter_Report = 0x02)
Parameter 1 = 0xA1	(Scale Bit2 = 1，Rate Type = 0x01，Meter Type=0x01)
Parameter 2 = 0x4A	(Precision = 2，Scale Bit1Bit0 = 0x01，Size = 2)
Parameter 3 = 0x00	Current = 0x002B = 0.43A

Parameter 4 = 0x2B	

2-3-5-5 Get power factor PF from endpoint

Meter_GET example:

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x05	(this is the endpoint of command owner, here we assume endpoint is 5，if the owner doesn't support multi Channel this value will be 0)
(Bit Address+Destination End Point = 0x03)	(Bit Address =0；Destination End Point range1~3)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x01	(Meter_Get = 0x01)
Parameter 1 = 0x30	(Scale = PF = 0x06)

PAB01 power factor report example：

COMMAND_CLASS_MULTI_CHANNEL	
MULTI_CHANNEL_CMD_ENCAP	
Source End Point = 0x03	(Meter report = Endpoint3)

(Bit Address+Destination End Point = 0x05)	(Bit Address =0；Destination End Point = command owner Endpoint value)
Command Class = 0x32	(Command_Class_Meter_V3 = 0x32)
Command =0x02	(Meter_Report = 0x02)
Parameter 1 = 0xA1	(Scale Bit2 = 1，Rate Type = 0x01，Meter Type=0x01)
Parameter 2 = 0x51	(Precision = 2，Scale Bit1Bit0 = 0x10，Size = 1)
Parameter 3 = 0x63	Power Factor = 0x63 = 0.99

Note：If the Destination End Point is 1, it will report the power factor of CT1, but not the sum of PF of CT1 and CT2.

	Meter Report Period		0x7FFF			hour
3	Slected End Point	1	1-3		1	1：CT1 and CT2 2：CT1 3：CT2
4	Threshold of Current for Load Caution	2	10-750	0.01A	750	750*0.01A=7.5A
5	Threshold of KWH for Load Caution	2	1-10000	1KWh	10000	

3.Z-Wave's Configuration

Configuration Parameter	Function	Size (Byte)	Value	Unit	Default	Description
1	Watt Meter Report Period	2	0x01-0x7FFF	5s	720	5*720s=3600s=1 hour
2	KWH	2	0x01-	5s	720	5*720s=3600s=1

3-1 Watt Meter Report Period:

If the setting is configured for 1hour (set value =720), the PAB01 will report its instant power consumption every 1 hour to the node of correspond Group. 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 =720), the PAB01 will report its Accumulated Power Consumption (KW/h) every 1 hour to the node of correspond Group. The maximum interval to report its Accumulated Power Consumption (KW/h) is 45 hours (5s*32767/3600=45hr).

3-3 **Selected Endpoint**

If Controller not using Multi_Channel command class to access the endpoint of PAB01, you may configure the endpoint value to react the Basic Command Class 、Binary Switch Command Class or Meter Command Class V3

3-3-1 Selected Endpoint 1：Default Selected Endpoint is 1

Get command	parameter	Report to command sender
Meter_Get	KWh	CT1 KWh1+CT2 KWh2
Meter_Get	Watt	CT11 W1+CT2 W2
Meter_Get	Voltage	CT1 and CT2 are the same voltage
Meter_Get	Current	CT1 I1+CT2 I2
Meter_Get	Power factor PF	CT1

3-3-2 Selected Endpoint 2

Similar like Selected Endpoint 1 but only relate to CT1 and ignore CT2

3-3-3 Selected Endpoint 3

Similar like Selected Endpoint 1 but only relate to CT2 and ignore CT1

3-4 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 750, when the load wattage of CT1 or CT2 over 7.5A, PAB01 will send current Meter Report command to the node of correspond Group.

3-5 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 CT1 or CT2 over this value, PAB01 will send KWh Meter Report command to the node of correspond Guoup, minum value is 1KWh and default value is 10000 kWh

4. Command Classes

The Switch supports Command Classes including…
* COMMAND_CLASS_ZWAVEPLUS_INFO
* COMMAND_CLASS_VERSION
* COMMAND_CLASS_MANUFACTURER_SPECIFIC_V2
* COMMAND_CLASS_DEVICE_RESET_LOCALLY
* COMMAND_CLASS_ASSOCIATION_V2
* COMMAND_CLASS_ASSOCIATION_GRP_INFO
* COMMAND_CLASS_POWERLEVEL
* COMMAND_CLASS_MULTI_CHANNEL_V3
* COMMAND_CLASS_METER_V3
* COMMAND_CLASS_CONFIGURATION

Troubleshooting

Symptom	Cause of Failure	Recommendation
The meter is not working and LED off	1. The meter is not connect to the Main power 2. The meter break down	1. Check power connections 2. Don't open up the meter and send it for repair.
The meter cannot report to the group	1. Not carry out association 2. Same frequency interference	1. Carry out association 2. Wait for a while to re-try

Specification

Operating Voltage	100~240VAC
Rated Primary Current	0.05A~60A x 2 Channel ; Split Core Transformer
Range	Minimum 40 m in door 100m outdoor line of sight
Operating Temperature	0°C ~ 40°C
Frequency Range	PAB01-1 868.40 & 869.85MHz (EU) / PAB01-2 908.40 & 916.0MHz(USA/Canada) / PAB01-3 922~927MHz (Taiwan/JP)

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

FCC ID : RHHPAB01
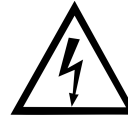
DANGER

Danger of electrocution!

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.

Choosing a Suitable Location

1. Do not locate the Module facing direct sunlight, humid or dusty place.

2. The suitable ambient temperature for the Module is 0°C~40°C.

3. Do not locate the Module where exists combustible substances or any source of heat, e.g. fires, radiators, boiler etc.

4. After putting it into use, the body of Module will become a little bit hot of which phenomenon is normal.

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.