Quick start: **Plug-in Dimmer EU**

BE NEXT

Technical specs

Normal operating voltage	230Vac 50Hz
Max load	**125 Watt**
Frequency range	868.42 MHz
Wireless Range	Min 150 meter in a mesh network

Basic operations

- The *Plug-in Dimmer* can be operated both manually as with Z-Wave.
- The *Plug-in Dimmer* can dim up to 125Watt.
- The *Plug-in Dimmer* is easy to install and configured.
- The *Plug-in Dimmer* can measure and report energy.

How it operates

A lamp can be switched on and off, manually by pressing the button or by Z-Wave using the basic command class. A (dimmable) lamp can be dimmed to a level, manually by pressing and holding the button or by Z-Wave using the switch multilevel command class.

With the user interface you can use the *Plug-in Dimmer* in all different kind of rules and lifestyle.

Include into a Z-Wave network [1]

1. Make sure a Z-Wave controller or the user interface is in the correct mode: ready for inclusion.
2. When the lamp and indicator light are off (!) press and hold the button. After circa 2 seconds, when the indicator light starts blinking, release the button to start the inclusion process.
3. When classic inclusion failed, the product will start Network Wide Inclusion automatically (max 20 seconds).

Exclude into a Z-Wave network

1. Make sure a Z-Wave controller or the user interface is in the correct mode: ready for exclusion.
2. When the lamp and indicator light are off (!) press and hold the button. After circa 2 seconds, when the indicator led starts blinking, release the button to start the exclusion process.
3. Make sure the *Plug-in Dimmer* is in direct range of the controller!

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[1] Make sure your Z-Wave controller is in the correct operation mode (include or exclude).

BENEXT

Technical Manual: **Plug-in Dimmer EU**

Caution:
- **This device is using a radio signal that passes through walls, windows and doors. The range is strongly influenced by local conditions such as large metal objects, house wiring, concrete, furniture, refrigerators, microwaves and similar items. On average, the indoor range is approximately 30 meters.**
- **Do not expose this product to excessive heat or moisture.**
- **Prevent long term exposure to direct sunlight.**
- **Do not attempt to repair this product. If the product is damaged or if you are in doubt about the proper operation, take the product back to the place of purchase.**
- **Do not clean the product with any liquid.**
- **Indoor use only.**
- **Overload will damage this product.**

Technical details

Normal operating voltage	90-250Vac 50-60Hz
Min load	**works as repeater without load attached.**
Max load attached	**125 Watt (will dim the light to the max 125W)**
Frequency range	868.42 MHz
Wireless Range	Approx. 30-50 meter in line of sight. Max 150 meters with good mesh network (max 4 hops).
Storage temperature	-5°C to +65°C
Storage humidity	10% to 70%
Operating temperature	0°C to 50°C
Operating humidity:	10% to 80%

Product dimensions (Length x Width x Height)

Plug-in Dimmer = 67 x 22 x 35 mm

With childlock protection.

Installation of Plug-in Dimmer

Place the *Plug-in Dimmer* inside your wall socket and plugin your lamp inside the plug-in dimmer socket. The *Plug-in Dimmer* is now ready to control and dim your light. Include in a Z-Wave network to use the wireless functionalities of the *Plug-in Dimmer.*
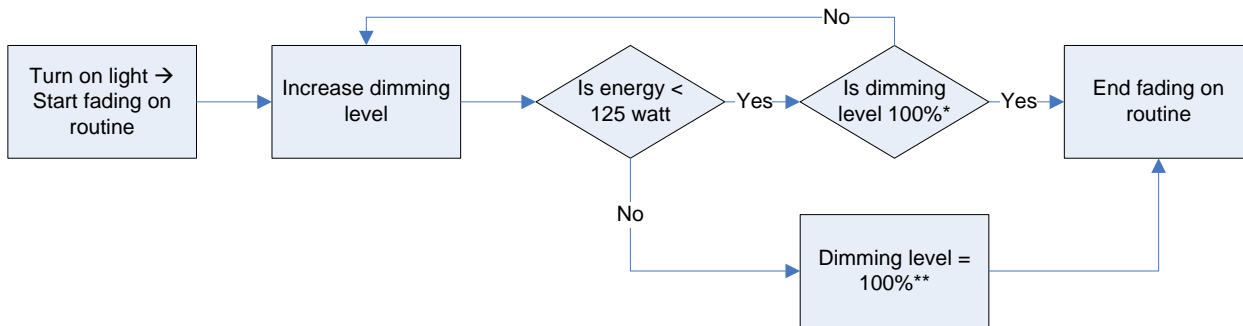
Indication mode

The indicator light gives various statuses of the device as follows:

1. Lamp is on   indicator light is steady on
2. Lamp is off   indicator light is steady off
3. Ready for learn mode: indicator light blinks every second.
4. Learn in progress (add):   indicator light 2 times every second.
5. Learn in progress (remove):   indicator light 3 times every 1.5 second.
6. Learn mode success: indicator light is on for one second.
7. RF message send failed   indicator light blinks 6 times rapidly

Maximum load protection

The *Plug-in Dimmer* supports a maximum power load of 125 watt. However it is still possible to have a lamp which has more power load. When the lamp is turned on it fades on to the set dimming level. During this fading on routine the *Plug-in Dimmer* constantly checks if the current energy value is lower then 125 watt. If it notices at some point that the load is more then 125 watt the fading routine stops and the maximum dimming level is reached. In this case the lamp is not fully on.

```
                                                    No
                  ┌──────────────────────────────────────────────────────┐
                  │                                                        │
┌──────────────┐  ▼  ┌──────────────┐      ┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│ Turn on light→│────▶│ Increase      │─────▶│ Is energy <  │─Yes─▶│ Is dimming   │─Yes─▶│ End fading on │
│ Start fading on│     │ dimming       │      │ 125 watt     │      │ level 100%*  │      │ routine       │
│ routine       │     │ level         │      └──────────────┘      └──────────────┘      └──────────────┘
└──────────────┘     └──────────────┘             │                                            ▲
                                                   No                                           │
                                                   │         ┌──────────────┐                   │
                                                   └────────▶│ Dimming level =│──────────────────┘
                                                             │ 100%**        │
                                                             └──────────────┘
```

*In this flowchart the set dimming level is 100%, this can be any other dimming level. However the same routine applies.
** When the 125 watt barrier is reached this will be the new 100% dimming level regardless of the set dimming level.

NOTE: This is not an unlimited feature. There is a limit how much load can be plugged in. When the *Plug-in Dimmer* noticed that the load is far more then specified he automatically switches off the light. The maximum load that is supported is circa 200 watt. The indicator light will blink fast when this happens.

NOTE2: If you want to utilize the full capacity of your lamp we advise to have a lamp with a maximum load of 125 watt.

Supporting Command Classes:

Basic type: BASIC_TYPE_ROUTING_SLAVE
Generic type: GENERIC_TYPE_SWITCH_MULTILEVEL
Specific type: SPECIFIC_TYPE_POWER_SWITCH_MULTILEVEL
Listening: True, Z-Wave Lib: 4.54.01

COMMAND_CLASS_SWITCH_MULTILEVEL
COMMAND_CLASS_VERSION
COMMAND_CLASS_MANUFACTURER_SPECIFIC
COMMAND_CLASS_CONFIGURATION
COMMAND_CLASS_ASSOCIATION
COMMAND_CLASS_METER
COMMAND_CLASS_POWERLEVEL
COMMAND_CLASS_SENSOR_MULTILEVEL
COMMAND_CLASS_PROTECTION
COMMAND_CLASS_SWITCH_ALL
COMMAND_CLASS_MARK
COMMAND_CLASS_BASIC

BE NEXT

ROUTING SLAVE

This Z-Wave product will be used as slave. Slave nodes are nodes in a Z-Wave network that receive commands and perform actions based on the command. A routing slave can route Z-Wave messages to other nodes in the network. This device is always awake and does not go to sleep mode because it is an AC powered device.

This device can act as a wireless repeater to forward commands for another device in the Z-Wave network to expand the range of the network. This function works for every Z-Wave device from any manufacturer when included into the same Z-Wave network.

Unlike a normal slave a routing slave can store a number of static routes which he uses to send a routed rf frame to another node.

Include Initiator

The include initiator is used when Primary and Inclusion Controllers include nodes into the network. When both the include initiator have been activated simultaneously the new node will be included to the network (if the node was not included previously).

Exclude Initiator

The exclude initiator is used by Primary Controllers to exclude nodes from the network. When the exclude initiator and a slave initiator are activated simultaneously, it will result in the slave being excluded from the network (and reset to Node ID zero). Even if the slave was not part of the network it will still be reset by this action.

Z-Wave compatibility

Because this is a Z-Wave device, it means it can co-operate with other Z-Wave devices of other manufacturers. It can co-exist in a Z-Wave network existing with product from other manufacturers.

Hops & Retries

The Z-Wave range has a range of up to 30 meters in line of sight. This signal is not limited to the 30 meter range due to routing the Z-Wave message to other nodes in the network. This way the range of the Z-Wave network can be expanded to 150 meters indoors (limit of 4 hops).

class: 0x20 COMMAND_CLASS_BASIC

The basic command class has both the controlling as supporting role.

The controlling role is when the light is switched on/off with the button (manual) a Z-Wave basic set frame with the value 0/255 is sent to the associated nodes.

The supporting role of the basic command class is mapped to the switch multilevel command class.

class: 0x26 COMMAND_CLASS_SWITCH_MULTILEVEL

The switch multilevel command class is used to set the light to a preferred dim level. Values 0 – 99 (%) are used to set the dim level, value 255 is used to switch light on to dim level that was last known. Every other value is ignored.

Only version 1 of the SWITCH_MULTILEVEL command class is supported.

Note: The dimming levels are based on a linear timescope of the used frequency, so for 50hz this is 20ms and for 60hz this is 16ms. This is not always linear in light intensity, at least not what the human eye considers. This also depends on the type of lamp that is used.

class: 0x86 COMMAND_CLASS_VERSION

BE⌂NEXT

This Command Class is used to obtain information about the *Plug-in Dimmer*. The Z-Wave library type, the Z-Wave protocol version and the application version will be reported.

class: 0x72 COMMAND_CLASS_MANUFACTURER_SPECIFIC

This will report information about the manufacturer. This product will contain the manufacturer ID of *BeNext*. Manufacturer ID of *BeNext* is 138, the ID of this product is 24.

class: 0x70 COMMAND_CLASS_CONFIGURATION

Configure parameters:

0. **not used**
1. **Set to default**
   Description: Set all config values to default values (factory settings).
                        Read more in chapter Configuration Reset.
   Size: 1 byte*
   Param1:   if 0xFF then set to default

2. **Not used (dummy)**
3. **Not used (dummy)**
   Description: This is a dummy param, you can set/request it but has no effect on the
                        product.
   Default: 0x00
   Size: 1 byte*

4. **Dimming enabled**
   Description: This parameter is used to enable the dimming option of the product.
                        When disabled the dimming and fading routine are disabled.
   Default: 0x02

   Size: 1 byte*
   Param1:   If 0x00: Dimming disabled.
                        If 0x01 – 0xFF: Dimming enabled.

5. **Not used (dummy)**
   Description: This is a dummy param, you can set/request it but has no effect on the
                        product.
   Default: 0x00
   Size: 1 byte*

6. **Maximum powerload**
   Description: The maximum powerload when light is turned on, when measured
                        higher then this value the Plugin Dimmer automatically stops with
                        dimming or is turned off. See also chapter 'Overload protection'
   Default: 0x007D
   Size: 2 bytes*
   Param1, Param2:   Value in watts, minimum 25 watt, maximum 150 watt.

7. **Dimming speed**
   Description: The speed of dimming when activated (manual and RF)
   Default: 0x03 (1% per 30 ms)
   Size: 1 byte*
   Param1:   Dim speed is 1% per *configuration value* (* 10 ms)

8. Fading up speed

Description:	The speed of fading up when light is switched on (manual and RF)
Default:	0x01 (1% per 10 ms)
Size:	1 byte*
Param1:	Fade speed is 1% per value (* 10 ms)

9. Not used (dummy)

Description:	This is a dummy param, you can set/request it but has no effect on the product.
Default:	0x00
Size:	1 byte*

10. Not used (dummy)

Description:	This is a dummy param, you can set/request it but has no effect on the product.
Default:	0x00
Size:	1 byte*

11. Auto meter report: percentage

Description:	A percentage that a energy value must be different compared to a previous sent value before a unsolicited meter report is sent
Default:	0x01 (1%)
Size:	1 bytes*
param 1:	A value in %.
	Minimum value = 1%
	Maximum value = 100%
param 2, 3, 4:	not used.

12. Auto meter report: watt

Description:	A watt value that a energy value must be different compared to a previous sent value before a unsolicited meter report is sent
Default:	0x05 (5 watt)
Size:	1 bytes*
param 1:	A value in watt.
	Minimum value = 5 watt
	Maximum value = 255 watt
param 2, 3, 4:	not used.

13. Auto meter report: time

Description:	A time value that has to be passed compared to a previous sent value before a unsolicited meter report is sent
Default:	0x0A (10 seconds)
Size:	1 bytes*
param 1:	A value in seconds.
	Minimum value = 10 seconds
	Maximum value = 255 seconds
param 2, 3, 4:	not used.

14. Last known status

Description:	What to do with lamp status when power applied
Default:	0x00
Size:	1 byte*

Param1:   If 0x00: Always switch light off when power applied
                          If > 0x00: Switch lamp on/off depending on last known lampstatus
                          before power was disconnected.

15. **Fading down speed**

Description: The speed of fading down when activated (manual and RF)
Default: 0x01 (1% per 10 ms)
Size: 1 byte*
Param1:   Fade speed is 1% per value (* 10 ms)

* if a size is other then given size the frame is ignored totally so configuration values are **not** changed

class: 0x85 COMMAND_CLASS_ASSOCIATION
The Association Command Class is used to associate other devices with the *Plug-in Dimmer*. The devices that are associated can be controlled on application level.

The *Plug-in Dimmer* can be associated into a grouping. If so, the *Plug-in Dimmer* can control other Z-Wave device (does not have to be a controller).

The *Plug-in Dimmer* has 2 association groups of its own.

Group 1
Maximum supported nodes: 8

All nodes in this group will receive a BASIC_SET frame when light is set to a certain state with the button of the *Plug-in Dimmer* (manual switching).

When light is switched off with button: BASIC_SET frame with value 0 is sent to associated nodes
When light is set to a dim level with button: BASIC_SET frame with value 0 – 99 is sent to associated nodes
When light is switched on with button: BASIC_SET frame with value 255 is sent to associated nodes

It is most likely that switch_binary/switch_multilevel devices are associated in this group so that you can switch multiple nodes on/off with 1 button press.

Group 2
Maximum supported nodes per group: 1

The node associated in this group will receive a unsolicited SWITCH_MULTILEVEL_REPORT frame every time the level of light is changed, where the value represents the (changed) dim level. The status is reported after every change that means manual but also if changed by Z-Wave.
The node in this group will also received the (auto) METER_REPORT (see § COMMAND_CLASS_METER →
unsolicited METER_REPORT for more information about this feature).

It is most likely that a controller or screen is associated in this group to report (unsolicited) any changes to the light and energy.

class: 0x32 COMMAND_CLASS_METER_V2

This command is used to read the values from the *Plug-in Dimmer's* energy measuring unit. Data is collected automatically.

A report can be requested containing the accumulated consumption, this can be done using the METER_GET command. The scale must also be entered:

kWh	0x00	Accumulated
W	0x02	instant measured

Note: When devices supporting Meter Command Class (Version 2) receive a Meter Get Command of Version 1 they must report their default scale which is the accumulated value.

Note2: Every non-supported scale will be ignored by application

The kWh(accumulated) report, will contain the following:

- The current measurement value (meter value).
- The previous measurement value (previous meter value).
- The time between the measurements (delta time).

Note3: To prevent unwanted power drops in the kWh report (when power is lost) the current meter value, the meter previous value and the delta time are updated every 10 minutes.

The W(instant measured) report will not contain a previous measured value. The rest will be the same.
The valid values for time are 1(0x0001) – 65534(0xFFFFE) seconds.

The meter can be reset by using the METER_RESET command.

Unsolicited METER_REPORT
The *Energy Switch* has a feature that it reports unsolicited that there has been a change in instant meter value. This happens when there is a change in value.

An unsolicited meter report is sent when 3 conditions are true.
- There must be a percentage difference compared to the last sent meter value. (configuration parameter 11)
- There must be a watt difference compared to the last sent meter value. (configuration parameter 12)
- A certain time must be passed since the last sent meter value. (configuration parameter 13)

NOTE: You can disable the unsolicited meter report by configuring parameters 11, 12 & 13 to value 0

class: 0x73 COMMAND_CLASS_POWERLEVEL
The Powerlevel Command Class defines the RF transmitting power. This command is used to test the connectivity of a network. This command class makes it possible for supporting controllers to SET/GET the RF transmitting power level of a node and test specific links between nodes in the network.

class: 0x75 COMMAND_CLASS_PROTECTION
The Protection Command Class is used to protect the device being controlled unintentional or unwanted by e.g. a child. When this is applied the push button will not work.

This can be set using the PROTECTION_SET command. The following three protection states can be used:

    0x00: Unprotected – The device is not protected and can be operated normally with the push button.

    0x01: Protection by sequence: The device can be used by a different way of operating, three rapid button presses are used to switch manually.

    0x02: No operation possible – it is not possible to control the device by the push button. Off course you can control the device by z-wave.

Note: every other state will be ignored by application.

class: 0x31 COMMAND_CLASS_SENSOR_MULTILEVEL_V6

Sensor_multilevel_get

The Sensor Multilevel Command Class is used to get a report from the Plugin Dimmer. The returned value is the measured frequency of the mains power. This is multilevel type 32 with scale 00. Because there is only one supported type, other types will be ignored by application.

The reported value will be 50Hz or 60Hz.

class 0x27 COMMAND_CLASS_SWITCH_ALL

The Plug-in Dimmer supports switch all functionality and therefore can be in included in a switch all broadcast.

If Plug-in dimmer is configured to switch all mode:

0x00   : is excluded from all switch on/off functionality.

0x01   : is excluded from the all on but not the all off.

0x02   : is excluded from the all off but not the all on.

0xFF   : All on and all off are both included.

Configuration Reset

The Plug-in Dimmer Supports a configuration resets function. Configuration reset means
-     All configuration values are defaulted.
-     All energy values are reset

This function can be activated by sending a configuration set frame:

CONFIGURATION_SET
Parameter: 0x01
Size: 0x01 (can't be different from 1)
Value: 0xFF (can be any value except for 0x55 or 0xAA)

When the value of configuration value is requested 2 possible values can be returned

CONFIGURATION_REPORT
Parameter: 0x01
Value 0x55:   Device doesn't have all his factory configuration settings anymore.
                    Even when a configuration parameter is changed back to the default value
Value 0xAA: Devices still has all his factory settings.
                    These are all configuration parameters.

Back to factory settings

This product has an option to set back to its factory settings. This can be done manually without the interference of a Z-Wave controller. The following things will apply:

- Product is excluded from its Z-Wave network
- All associations are cleared
- All configurations are set back to default settings

To reset the device follow the steps:

1. When the light is off, press and hold the push button for 2 seconds and then release to start the exclusion routine (indicator light start blinking 3 times per second).
2. Now to reset the device, press and release the push button 4 times within 1.5 seconds during the exclusion routine.
3. When 'back to factory settings' is done successfully, the indicator light is turned on for 1 second at the end of the exclusion routine.

Frequently Asked Questions

Q: I can't have my *Plug-in Dimmer* included into my Z-Wave network, what am I doing wrong?

A: **1**. Is the controller ready to include any device into the Z-Wave network? If the controller is not in Include or exclude mode, the *Plug-in Dimmer* will not be included or excluded.

   2. The *Plug-in Dimmer* is already included in a Z-Wave network (check your led feedback!). Exclude the *Plug-in Dimmer* and try again.

Q: I have configured a value but when I request it, it is not changed?

A: It is mandatory that the correct size is used while configure a parameter; go to the documentation about the configuration command class to check if the right size is used during configuration. If the wrong size is used the frame is ignored totally.

Q: I have configured a new value and when I request it the correct value is returned but the behavior is still the same?

A: Some configuration parameters have limits of what they can do, go to the documentation about configuration to check if the value of the configured parameter is out off limit.