

WIRELESS FAMILY DEVICES
ZB-CONNECTION
PLUG sensor
(Remote Controlled Socket & Energy meter)

products code:

ZR-PLUG-EU-M (Schuko plug)
ZR-PLUG-IT-M (Italian 10/16Amp plug)
ZR-PLUG-UK-M (UK plug)
ZR-PLUG-FR-M (French plug)

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1) GENERAL DEVICE CHARACTERISTICS

ZR-PLUG belongs to ZB-Connection devices family.

It is put between the wall mains socket and an electric load, typically a home appliance. It can measure active power and energy consumptions and can switch on/off an electric load with radio messages. It is also possible to set a Power threshold below which the device considers its electric load as working in stand-by mode and therefore it is switched off (Stand-by Killer).

This device has to be directly and continuously main powered.

For network purposes, it is a Router (Repeater) i.e. it has function of maintaining radio traffic from and to other similar devices and it can also act as a parent device for battery-powered sensors of the same family.

2) ELECTRICAL DEVICE CHARACTERISTICS

POWER SUPPLY:	85-250 Vac; 50/60 Hz
WIRELESS CHARACTERISTICS:	2405 MHz ÷ 2480 MHz DSSS Modulation Nominal transmission Power +3dBm IEEE 802.15.4 compliant Stack EmberZNet3.5.x Stack version 0 Proprietary profile ID Proprietary encryption key
MEASURES:	Energy consumed [Wh] Active Power [W] Time of measurement [sec]
RELAY CHARACTERISTICS:	Contacts 10A 250V (resistive load)
CONNECTIONS:	Plug (Schuko/Italian/UK/French Depending on the product code)
OPERATING CONDITIONS:	-10 + 55 °C
PROTECTION CLASS:	IP30

3) ASSOCIATING THE DEVICE TO A COMPATIBLE NETWORK

The process to be followed when annexing the ZR-PLUG node to a network is the same as that for all ZB-Connection routers.

The annexing process is activated automatically by the device if the node does not have network parameters, this happens if the device is new or if it has been voluntarily disassociated.

The annexing process consists in scanning all 16 radio channels, in search of an "open" and compatible network (i.e. a ZB-Connection network).

Scanning lasts about 20 seconds. If the annexing process terminates unsuccessfully, the device resets and the annexing process is re-started.

Network opening is performed by stimulating the Gateway, by pressing the Gateway's push button or sending the appropriate command password (for further information, refer to the document relating to the Gateway).

4) DISASSOCIATING THE DEVICE FROM THE NETWORK

Device disassociation causes the loss of network parameters, with the consequent exiting of the device from the network it belongs to.

In addition to the loss of network parameters, the device loads the default value for each of its operation parameters (HoldingRegister).

Disassociation can be commanded in two ways:

- 1) Receipt of the appropriate command password.
- 2) Holding the button pressed for at least 6 seconds, until led becomes green colored. Disassociation using the push button is only possible within 60 seconds from when the device is switched on.

Attention: The procedure just described lets keep the device address previously set. To restore also this parameter to its default value (127) it is necessary to hold the button pressed for a time longer than 12 seconds, until led color passes from green to red.

5) LEDES INTERFACE

The ZR-PLUG device has a bi-color led (red/green) that provides information about device operation status.

The device also has a push button used for stimulating it and for the disassociation process.

Behaviour of leds at the start-up:

At the reset of device led lighted for 2 seconds, then it flash fast for another 2 seconds with orange colour.

At the end of flashing device starts the normal functioning.

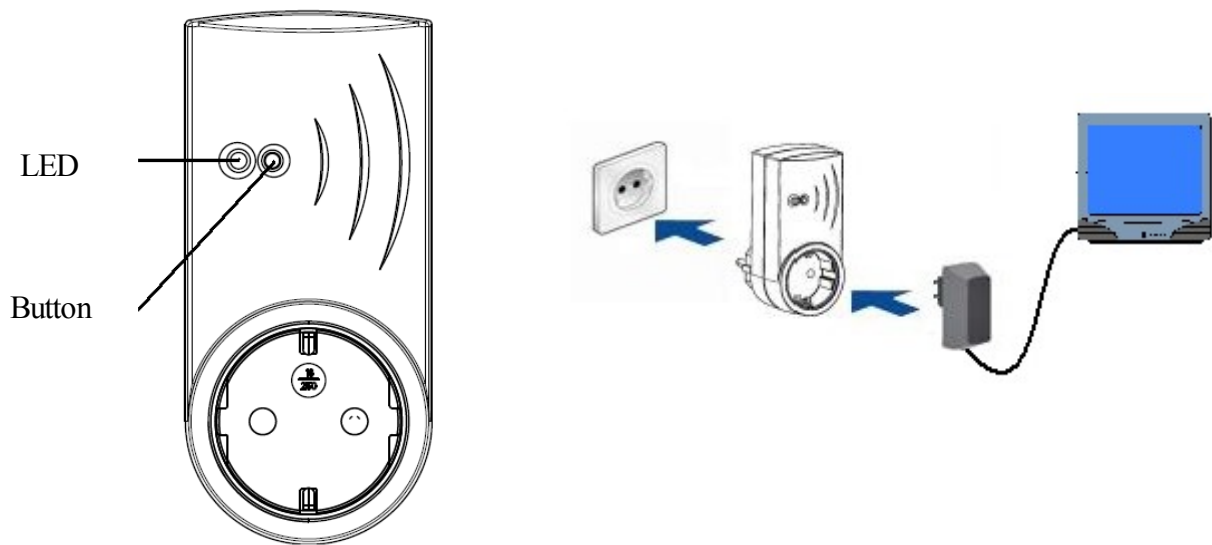
Led functioning when device is NOT joined with a network:

Led lighted steady with orange colour (2 seconds of blink each 20 seconds).

Led functioning when device is joined with a network:

- Orange flash: Device joined, default address (127)
- Green flash: Device joined, address assigned, relay off
- Red flash: Device joined, address assigned, relay on

6) PRODUCT VIEW



7) DEVICE ADDRESSING

The default value for address is fixed to 127.

Until device is not associated with a valid address (between 16 and 126) its operation is disabled.

The address assignment procedure is the following:

- 1) enter value 6521 into HoldingRegister[0];
- 2) specify a valid address value (between 16 and 126) into HoldingRegister[2];
- 3) confirm it by activating CoilStatus[0].

An alternative simpler approach consists setting the new address value directly using Z-HANDZER which is a portable hand held tool (refer to the Z-HANDZER manual).

Attention: Be careful when assigning the addresses. Two devices with the same address put their data into the same container of Gateway and this would generate ambiguity, which would be difficult to identify.

8) DEFAULT PARAMETERIZATION AND PROGRAMMING MAXIMUMS/MINIMUMS

The device has some operating parameters, which are saved in non-volatile memory and at the time of initialisation are loaded with default values.

The default parameter loading also takes place after device disassociation.

At the time of the programming of an operation parameter, the device checks that the new value is within the minimum and maximum limits.

If the new value is lower than minimum, the value effectively written will be equal to the minimum. If the new value is higher maximum, the value effectively written will be equal to the maximum.

Parameter	MIN	MAX	DEFAULT	unit
Transmission Time	1	3600	20	[sec]
Calibration Parameter	3000	32000	Factory set	//
Stand-by-killer Time Window	5	255	60	[sec]
Stand-by-killer Power Threshold	0	255	5	[W]

Note on Calibration Parameter:

This value is set in the Factory Calibration Process; this value can be changed using a special command password. The Calibration value it is not lost at the disassociation.

9) PERFORMING MEASUREMENTS

The device is able to evaluate active power (Watt), total energy consumed (Watt hour) and the time from start of measurements (seconds).

These measurements are performed on the current flow through relay and are performed only when the relay is on. Therefore, when the electric load is disconnected also the elapsed time counting is stopped.

Active power is measured each 2 seconds; its value is measured in a period of 2 seconds.

It is possible to store into a non volatile memory the data acquired (however an automatic and periodic saving occurs every six hours). It is also possible to reset data collected using the proper single coils. For further information, refer to the next table that depicts how data is mapped into the device (agent).

From firmware version 2053 and higher it is possible to set the energy consumed counter.

10) MANAGE RELAY OUTPUT

To active the relay output set Coil Status CS[1]; to deactivate it set Coil Status CS[2]. The logic state of this output is shown in Input Status IS[0].

The state of this output is saved in non-volatile memory.

When relay output is off, a pressing on button causes the relay turning on.

11) STAND-BY-KILLER MODE

Stand-By-Killer mode is enabled by operating on CS[3].

When it is enabled the device automatically turn off the relay output when the power flow through relay is below a preset threshold (parameter HR[4] Stand-by-killer Power Threshold) for a time higher than a preset value (parameter HR[3] Stand-by-killer Time Window).

When Stand-By-Killer mode is enabled and relay output is off, a pressing on button causes the relay turning on; in this case the Time Window value is fixed to 15 minutes.

12) MAPPING DEVICE DATA (AGENT)

Like almost all ZB-Connection family devices, the ZR-PLUG device displays its data through a so-called Agent.

The agent of a particular device resides locally in the Gateway, and is made up of the data sent via radio by the device and of some data generated by the Gateway.

The Gateway allows access in read and write mode to the agents relating to its network devices (and the Gateway agent) through a serial interface or TCP and RTU modbus protocol.

Given the nature of the Modbus protocol, the data is broken down into four memory areas:

```
InputRegister    (16-bit variables in read only mode)
InputStatus      (1-bit variables in read only mode)
HoldingRegister  (16-bit generally non-volatile variables)
CoilStatus       (1-bit variables)
```

The Gateway is compatible with the most common modbus commands such as single and sequential reading of all memory spaces and single write of all holding registers and coil statuses.

The ZR-PLUG device has the following data:

```
(15+5) InputRegister
      80 InputStatus
(7+1) HoldingRegister
      16 CoilStatus
```

12.1) DEVICE INPUT REGISTERS

InputRegister[0]	Type of device (=38)
InputRegister[1]	Firmware version (Major/Minor)
InputRegister[2]	Messages sent by device counter
InputRegister[3]	Level of the radio signal of the last message received by the device ⁽²⁾
InputRegister[4]	Energy Meter calibration parameter
InputRegister[5]	Active Power [W]
InputRegister[6]	Energy consumed [Wh] (low)
InputRegister[7]	Energy consumed [Wh] (high)
InputRegister[8]	Measurement time [s] (low)
InputRegister[9]	Measurement time [s] (high)
InputRegister[10]	Seconds passed since receiving last messages ⁽¹⁾
InputRegister[11]	Counter of messages received from Gateway ⁽¹⁾
InputRegister[12]	Gateway Receiving instant time (100 * hours + minutes) ⁽¹⁾
InputRegister[13]	Signal Level of the last message received from Gateway ^{(1) (2)}
InputRegister[14]	Device network address ⁽¹⁾
InputRegister[15]	Copy of InputStatus[0..15]
InputRegister[16]	Copy of InputStatus[16..31] (holding Register writing pendings flag) ⁽¹⁾
InputRegister[17]	Copy of InputStatus[32..47] (not used) ⁽¹⁾
InputRegister[18]	Copy of InputStatus[48..63] (CoilStatus writing pendings flag) ⁽¹⁾
InputRegister[19]	Copy of InputStatus[64..79] (General pending flag and presence flag) ⁽¹⁾

1) This data are not sent by the device but generated by the Gateway.

2) The radio signal level value provides information on the energy value in relation to the last hop performed by the radio message. The value is expressed in dB+100, it varies from a minimum of 8 (very poor signal) to a maximum of 70 (maximum signal)

12.2) DEVICE HOLDING REGISTER

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HoldingRegister[0]	Command password
HoldingRegister[1]	Transmission time (expressed in seconds)
HoldingRegister[2]	Custom parameter to be used in conjunction with command password (HR0)
HoldingRegister[3]	Stand-by-killer Time Window
HoldingRegister[4]	Stand-by-killer Power Threshold
HoldingRegister[5]	Custom parameter to be used in conjunction with command password (HR0) ⁽¹⁾
HoldingRegister[6]	Custom parameter to be used in conjunction with command password (HR0) ⁽¹⁾
HoldingRegister[7]	Copy of CoilStatus[0..15]

1) This register is present only in firmware version 2053 and higher

12.3) DEVICE COIL STATUS

CoilStatus[0]	Command password activation.
CoilStatus[1]	Electric load is set to ON
CoilStatus[2]	Electric load is set to OFF
CoilStatus[3]	Stand-by-killer enable - Electric load is set to ON
CoilStatus[4]	Measurement data are reset to zero
CoilStatus[5]	Measurement data are saved in non-volatile memory
CoilStatus[6]	Not used
...	...
CoilStatus[15]	Not used

12.4) DEVICE INPUT STATUS

InputStatus[0]	Output State (0=off; 1=on)
InputStatus[1]	Stand-by Killer status (1=On/0=Off)
InputStatus[2]	Not used
...	...
InputStatus[15]	Not used
InputStatus[16]	HoldingRegister[0] writing pending ⁽¹⁾
InputStatus[17]	HoldingRegister[1] writing pending ⁽¹⁾
InputStatus[18]	HoldingRegister[2] writing pending ⁽¹⁾
InputStatus[19]	HoldingRegister[3] writing pending ⁽¹⁾
InputStatus[20]	HoldingRegister[4] writing pending ⁽¹⁾
InputStatus[21]	HoldingRegister[5] writing pending ⁽¹⁾
InputStatus[22]	HoldingRegister[6] writing pending ⁽¹⁾
InputStatus[23]	Not used
...	...
InputStatus[47]	Not used
InputStatus[48]	CoilStatus[0..15] writing pending ⁽¹⁾
InputStatus[49]	Not used
...	...
InputStatus[63]	Not used
InputStatus[64]	Device presence status (agent data validity) ⁽²⁾
InputStatus[65]	General status of pending (logic OR of all writing pendings) ⁽¹⁾
InputStatus[66]	Not used
...	...
InputStatus[79]	Not used

1) These flags are managed by the Gateway and are set at the time a holding register or coil status group is written. They are reset at the time of effective receipt of the data by the device (which occurs immediately after transmission).

2) The device presence flag is managed by the Gateway; it is set when the present data is valid. The flag is reset if the Gateway does not receive messages from the device for a time more than four times the automatic transmission time.

13) SPECIAL COMMANDS - COMMAND PASSWORD

Command passwords can be used to give the device certain special commands.

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The command is performed when the CoilStatus[0] bit is set.

HoldingRegister[0] (HEX)	HoldingRegister[0] (DEC)	Action
0x01F4	500	Set calibration value (value in HR[2]) ⁽¹⁾
0x01F5	501	Load factory calibration value ⁽¹⁾
0x0258	600	Set energy measured counter Value in HR[3] (low part), HR[4] (high part) ⁽¹⁾
0x1968	6504	Start device Bootloader
0x1970	6512	Device reset
0x1973	6515	Device disassociation
0x1975	6517	Network re-initialisation
0x1979	6521	Set new modbus address. New Address in HR[2]

1) This command is present only in firmware version 2053 and higher