



Manual ZBS Devices

History of changes

DVers.:	Date	Reason for changes	Refer to / comment
01	26.01.2012	Translation from DE/V01, discontinued	Released

Legal Notes

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1 Notes on the document

This chapter provides information on using the document. In addition, it names the requirements for using the product / system.

1.1 Intended audience of the document

The present document is intended for all persons who

- Operate a wireless or wired network
- Install the product on site
- Connect the electrical system of the product on site
- Commission or decommission the products
- Maintain the product

Each person commissioned with performing the tasks mentioned above with or on the system must have read and understood the present document and the associated accompanying documentation.

1.2 Qualification of personnel

Only specialised personnel is permitted to perform the tasks described in the present document. The specialised personnel must be trained and authorised to perform these tasks.

Specialists are persons, who:

- are trained and experienced in the corresponding field.
- are familiar with the applicable standards, regulations and provisions associated with the corresponding task.





1.3 Safety instructions used


Safety instructions in this document point to a hazard that may put persons or the product / system at risk.

Safety instructions will point out:

- the nature of the hazard,
- the source of the hazard,
- measures to be taken to avert the specified hazard.

Shown below are four safety advice symbols which indicate the severity of the danger by means of different keywords (danger, warning, caution, attention). The symbols shown may vary depending on the nature and source of the danger.

	<p>This symbol identifies safety instructions You are warned of an imminent danger for the life or health of persons. → The arrow identifies a precautionary measure designed to avert this danger.</p>
	<p>This symbol identifies safety instructions You are warned of a potential hazard for the life or health of persons. → The arrow identifies a precautionary measure designed to avert this danger.</p>
	<p>This symbol identifies safety instructions You are warned of a potentially hazardous situation for the life or health of persons. → The arrow identifies a precautionary measure designed to avert this danger.</p>
	<p>This symbol identifies safety instructions You are alerted of a hazard for the product/system. → The arrow identifies a precautionary measure designed to avert this danger.</p>


	<p>Important Information This symbol identifies information that may assist in handling and using the product/system. This includes references to further information.</p>
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1.4 Further applicable documents

Apart from the present documentation, the scope of delivery of the product includes additional documents. In addition to the contents of the present documentation, all the other documents associated with the product must always be taken into consideration. They are mandatory for the use of the product.

These may be:

- **Technical data,**
Describe the technical properties of the product
- **Site requirements**
Describe the requirements for the site where the products is used
- **Open Source Acknowledgement**
contains information on the respective Open Source software the product comprises, including the information on the license(s) used and the related license agreements.
- **Project-specific documents,** if any describes the implemented network and the associated properties and requirements.

	<p>Further applicable documents Please also heed the the device specific documentation to prevent negative effects or problems with product.</p>
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1.5 Support Information

If you have any questions or suggestions regarding pikkerton GmbH products, please contact your local service partner responsible or the pikkerton GmbH Support Team directly. For a fast and cost-efficient solution of technical problems during the network operation, pikkerton GmbH offers support contracts upon request. For information on this topic, please also revert to our responsible service partner or directly to pikkerton GmbH.

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2 Safety regulations

This chapter describes the safety regulations relevant for using the product.

2.1 Safety instructions and declaration of conformity

The operation of the product is subject to the statutory provisions of the respective country, in which the product is used. The user of the product is responsible for observing the legal regulations and intended use. The product conforms with the general requirements of the responsible European Directives. This is confirmed by the marking (CE) of the installed components. The Declarations of Conformity of the installed components may be viewed upon request. The directive on radio equipment and telecommunications terminal equipment (Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG)) implemented by the European Directive 1999/5/EC (R&TTE) is applicable in Germany. The product complies with the fundamental requirements and the other relevant provisions of this directive. The product is marked as follows:




Within the scope of the European Directive 1999/5/EC, the network operator must ensure that the health and safety of the product user and other persons, (Article 3 (1)a of 99/5/ EC and 1999/519/EC) is warranted. With regard to the exposure of persons to electromagnetic fields (110 MHz to 40 GHz), product standard EN 50385 must be applied. Within the EU, the product is intended for use in the following member states: Austria (AT), Belgium (BE), Bulgaria (BG), Switzerland/Liechtenstein (CH), Cyprus (CY), Czech Republic (CZ), Germany (DE), Denmark (DK), Estonia (EE), Spain (ES), Finland (FI), France (FR), Greece (GR), Hungary (HU), Ireland (IE), Iceland (IS), Italy (IT), Lithuania (LT), Latvia (LV), Netherlands (NL), Norway (NO), Romania (RO), Sweden (SE), Slovenia (SI), Slovakia (SK), Turkey (TR), England (UK). The use of the respective frequency ranges may vary depending on the country of use. If you have any questions, please contact pikkerton GmbH. The general instructions on safety and accident prevention are documented in the Accident Prevention Guideline "General Regulations" (BGV A1)1) . For work performed on electrical installations, the Accident Prevention Regulations (BGV A3) "Electrical Installations" must be heeded.

The product complies with the safety requirements of the European Low Voltage Directive (2006/95/EC [73/23/EEC]) due to the application of the standard EN 60950-1. The requirements of this standard must not be violated when using the product.

The operator is responsible for ensuring that:

- the product is used exclusively within the scope of the intended use.
- work on the electrical installation is performed only by experts that have been trained accordingly
- special legal requirements that govern the operation of the product are complied with
- product modifications or expansions:
 - are performed only after having consulted pikkerton GmbH
 - comply with the state of the art
 - take into consideration the applicable national and international provisions
 - are performed exclusively by trained specialists, who have been authorized accordingly.
- damage to the product and product defects are immediately remedied by specialists that have been trained and authorized accordingly.
- appropriate measures are taken against radio interference.
- any defects in the service room that come up later on are eliminated immediately.
- for subsequent modifications of the service room, the requirements described in the present document are always taken into consideration.

- appropriate fire precautions are taken as required (e.g. the use of appropriate fire extinguishers).
- special legal requirements that control the operation and handling of batteries and battery systems, if used, are complied with and that appropriate safety devices and measures are provided and taken as required.

	<p>Country-specific laws and provisions All the stipulated laws and provisions of the respective country of use shall always apply. The operator is responsible for the adherence to these laws and provisions.</p>
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2.2 Intended Use

The product is exclusively designed for being used in ZigBee networks.

Intended use also includes that:

- all the safety instructions set forth in the product documents are always heeded.
- all the maintenance tasks described are performed in the interval specified.
- the general, national and in-house safety regulations are heeded.

Any other use is impermissible.

The product is not used as intended, for example, if:


- the requirements described in the product documents haven not been met and instructions are disregarded.
- the structural design of the product is modified without the consent of the pikkerton GmbH.
- replacement parts are used that differ from the components installed by default.

The operator of the product is responsible for damage to the product or damage caused by the product if the product was used beyond the intended application range and/or was not used as intended.

2.3 Safety measures

All the regulations listed in the following must be adhered to without fail:

- If extension cables or multiple socket outlets are used, make sure that they are inspected for proper condition periodically.
- After any safety-related parts have been replaced (e.g. power switch or circuit breakers) a safety check must be performed (visual inspection, protective earthing conductor load, leakage resistance, leakage current measurement, function test).
- Heed all the other job-specific safety measures and requirements listed in the sequences of actions.

	<p>Heed the security labelling!</p> <p>In addition to the safety instructions set forth in the product documentation. All the safety markings in the equipment rack must be observed. They point out potential hazardous areas and must neither be removed nor changed.</p>
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2.3.1 Authorized personnel

The product may be transported, set up, connected, commissioned, operated and serviced only by specialists who are familiar with and comply with the applicable safety regulations and setup instructions.

The specialists must be authorized to perform the required tasks by the person responsible for the safety in the enterprise of the operator.

Specialists are persons, who:

- are trained and experienced in the corresponding field
- are familiar with the relevant standards, regulations, provisions and safety codes, and have been instructed in the mode of operation and the operating conditions of the equipment components
- can identify and avert hazards

Depending on the tasks to be performed, the following user groups are distinguished:

- operators, who
 - operate the product.
 - monitor, interrupt, terminate and restore the operation of the product.
- Service personnel: persons, who perform the following additional tasks as compared to operators
 - Set up the product.
 - Prepare and restore the operational state.
 - Adjust and/or parameterize the product.
 - Maintain, look after and repair the product.

2.3.2 Electromagnetic compatibility

With specific products, e.g. HF radio equipment, increased electromagnetic radiation may occur as a consequence of operation. Taking into consideration that unborn life is increasingly worthy of being protected, pregnant women should be protected through appropriate measures. People with personal medical devices such as cardiac pacemakers and hearing aids can also be endangered by electromagnetic radiation. The operator is obliged to assess workplaces with a considerable risk of exposure to radiation and to avert any hazards.

In proper state and when operated properly, the product complies with all the requirements in respect of interference radiation according to EN 301 489-17, EN 301 489-1 and EN 300 328. The connections conducting HF signals must neither be manipulated nor damaged.

2.3.3 Notes on the electrical system

The product may be operated only in the operational states specified by the manufacturer without impairment of the ventilation.

Make sure that all the safety measures on the equipment, on the connecting cables and on the load have been taken. Electrical connections may be made/disconnected only when neither voltage nor current is applied to the equipment. Voltage may still be present on the outputs of the equipment after the equipment has been switched off. Only perform those tasks described in the documents included in the scope of delivery of the product.

2.3.4 Hazardous substances


The product does not contain any substances specified in the Ordinance on Hazardous Substances, published in BGBL.I p. 1782 (Gefahrstoffverordnung [Ordinance on Hazardous Substances], abbr. GefStoffV).

2.4 Safety markings

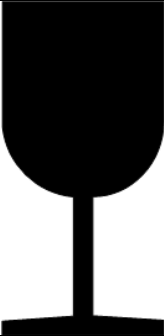
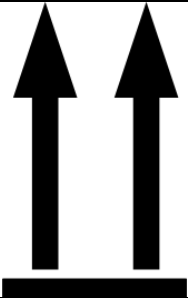

The following sections describe safety markings on the product and its packaging.

2.4.1 Safety markings on transport boxes

To protect against improper handling of the product during a transport, the transport boxes and the product itself are fitted with corresponding safety markings to call attention to proper handling.

	<p>Transport inspection using impact indicators</p> <p>To check whether a product was properly transported, the transport boxes are fitted with impact indicators. The impact indicator shows strong impacts or shocks that occurred due to an improper transport.</p>
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The following safety markings indicate that the corresponding instructions must be followed:

	<p>Safety marking "Fragile" The safety marking "Fragile" points to the necessary protection of the product against shock. Transport boxes with this marking must absolutely be protected against shock.</p>
	<p>Safety marking "Transport Upright" The safety marking "Transport Upright" points to the cover of the transport box. Transport boxes with this marking must always be transported with the cover at the top.</p>
	<p>Safety marking "Keep dry" The safety marking "Keep dry" points to the necessary protection of the product against wetness (e.g. rain, high humidity during the transport in closed vehicles/containers and/or formation of condensate when covered with a tarpaulin). Transport boxes with this marking must absolutely be protected against any wet influences.</p>

2.4.2 Safety markings on the product

The product is equipped with safety markings. They serve as an indication to possible hazards and may not be removed or modified (if necessary, marking in accordance with DIN 4844 BGV A8 (VGB 125)).

3 Device types

ZBS devices are sensors and / or actuators which can be controlled via an easy and human readable plain text based command set. The command set is described in the device specific manuals.

The ZBS device family consists of following devices (per January 2012):

Device Name	Options	Short Description
ZBS-110V2 (mains powered)	/CH /UK / US	Smart Energy Meter / Smart Plug with SART technology
ZBS-111 (mains powered)		As ZBS-110V2, DIN Rail Mount, 2 inputs
ZBS-112 (mains powered)	/Cx /Cy /I	Smart Energy Meter inside device connection cable
ZBS-121 (battery powered)	/PR /RH	Multi sensor (temperature, brightness, motion detection, rel. humidity, air pressure)
ZBS-130 (battery powered)	/FS	Handheld pushbutton with xyz acceleration sensor
ZBS-132 (battery powered)		Door / windows contact sensor with glass breakage detection

4 Network Configuration

4.1 RF Module

Inside the devices an XBee module from DIGI International (US) is used (formerly MaxStream).

Detailed specification of these devices (SMT / THT / PRO) can be found on the DIGI website:
<http://www.digi.com/>

4.2 Default Configuration

All ZBS devices are delivered with the newest XBee firmware if possible. The module is running in API mode. The device firmware is relying on that configuration so it must not set to other transmission modes.

All devices are delivered in a way, that it can join any unencrypted and open network.

Battery powered devices are configured in a way, that all power configuration registers are set to maximum battery saving for reliable and specified operation. Therefore all answers from the ZBS devices could be late up to approx. 28s.

Register Name	Default Value	Possible Values	Register Description
ID	0	0 - 0xFFFFFFFFFFFFFFFF	PAN ID If 0, the device can join any open network which grants the access for the ZBS device upon request. If fixed, roaming features are not used.
SC	0x1FFE	0 – 0xFFFF	Used channels for network scan in order to join networks. Bit0 = Channel 0x0B ... Bit15 = Channel 0x1A)

Register Name	Default Value	Possible Values	Register Description
SD	0x03	0 – 0x07	Search period for each valid channel. The search time for each channel is $2^{SD} * 15,36ms$
ZS	0	0 - 2	ZigBee stack profile 0 = network specific 1 = ZigBee 2006 2 = ZigBeePro ("2007") This value has to be identical on all devices in a ZigBee network, otherwise the devices cannot join the network.
NJ	0xFF (120/121/220/ 221/130) 0x00 (100/110)	0 – 0xFF	Mains powered devices: Time in period in seconds for granting other devices to join the network (router operation) after device start / reset or specific command. [0xFF = open PAN] Battery powered devices: Defines the behaviour after network loss. 0xFF causes the device to perform a network scan on all configured channels. All other values cause the device to search for another parent in the lost network (therefore no roaming possible).

Register Name	Default Value	Possible Values	Register Description
JV	1	Only mains powered devices 0 = Disabled 1 = Enabled	If disabled (JV = 0), the router will remain operating though coordinator is lost. If enabled (JV=1), the router will try to join another network.
JN	0	0 = Disabled 1 = Enabled	If enabled, the device sends a broadcast message after successful join (realized as a unicast telegram to the coordinator).
DH	0	0 – 0xFFFFFFFF	Upper 32 bits of destination address for messages in AT mode.
DL	0	0 – 0xFFFFFFFF	Lower 32 bits of destination address for messages in AT mode.
NI	Serial Number / Node Identifier	20 bytes ASCII string	String as device identifier, coupled with the SN of the ZBS device.
NH	0x1E	0 – 0xFF	Max. number of hops inside the network. For unicast messages ((50 * NH) + 100) will be the timeout for message and timeout.
BH	0	0 – 0x1E	Defines the max. range for broadcasts inside the network. 0 means max. range.
DD	0x30000	0 – 0xFFFFFFFF	XBee internal product identifier.
NT	0x3C	0x20 – 0xFF	Value * 100ms defines the timeout period for answers a node discover request from the network.

Register Name	Default Value	Possible Values	Register Description
NO	0	0 – 0x03	<p>Defines procedure for handling a node discover answer</p> <p>0x01 = Append DD value (to ND responses or API node identification frames)</p> <p>002 = Local device sends ND response frame when ND is issued.</p>
PL	4	0 = Lowest (-7dBm) 1 = Low (-3dBm) 2 = Medium (-1dBm) 3 = High (+1dBm) 4 = Highest (+3dBm)	Defines max. RF transmit power
PM	1	0 = Boost Mode Disabled 1 = Boost Mode Enabled	RF transmit powered is amplified further 2 dB.
EE	0	0 = Disabled 1 = Enabled	Network encryption
EO	0	0 - 1	Defines procedure for handling the network key
BD	3	0 = 1200 bps 1 = 2400 bps 2 = 4800 bps 3 = 9600 bps 4 = 19200 bps 5 = 38400 bps 6 = 57600 bps 7 = 115200 bps	Communication speed between RF module and host processor.
NB	0	0 = No Paritybit 1 = Even Parity 2 = Odd Parity 3 = Mark Parity	Parity bit between RF module and host processor.

Register Name	Default Value	Possible Values	Register Description
SB	0	0 = One Stop Bit 1 = Two Stop Bits	Stop bits between RF module and host processor.
SM	5 for all battery powered devices 0 for all mains powered devices	0 = No sleep mode 1 = sleep mode controlled by pin 4 = sleep mode controlled by timer 5 = sleep mode controlled by pin and timer.	Sleep mode definition for energy saving
ST	0x3E8	0x01 – 0xFFFFE	Time period in ms causing the RF module entering sleep mode after last message, just relevant for SM=4 & SM=5
SP	0xAFO	0x20 – 0xAFO (* 10ms)	Mains powered devices: Defines the time period for storing data for joined and sleeping childs. Battery powered devices: Defines the sleep time. During that time the device is not accessible.
SN	0xFFFF (120/121/220/ 221/130) 0x01 (100/110)	0x01 – 0xFFFF	Mains powered devices: Router operation: If a joined device has not answered for a time period of 3*SN*SP, it will get removed from the child table of the router. Battery powered devices: Will get woken up after the time period SP*SN for the time ST even if there is no stored data for the device.

Manual ZBS Devices

Register Name	Default Value	Possible Values	Register Description
SO	0	0 – 0xFF	Bit mask for setting the options for the sleep mode

5 Operation Mode Signalling

The ZBS devices use – unless specified otherwise in the device specific manual – 2 LEDs which might be mounted separately or combined through 1 optical window. The standard colours are green and orange.

- LED1 (green):
- Accessible via the command „set ld0=repetitions, time on (*100ms), time off (*100ms)“, see device specific manual
 - Signals successful network join (3x 500ms on, 3x 500ms off)
 - Signals the successful transmission of a data telegram (1x 100ms)
 - Active when reset / commissioning pushbutton is pressed. Will get switched off if device is reset.
 - Active when device entered the bootloader (both LEDs)
- LED2 (orange):
- Accessible via the command „set ld1=repetitions, time on (*100ms), time off (*100ms)“, see device specific manual
 - Signals unsuccessful network join or network loss (3x 500ms on, 3x 500ms off)
 - Signals the unsuccessful transmission of a data telegram (1x 100ms)
 - Active when device entered the bootloader (both LEDs)

Further LED signalling codes as well as the location of the LEDs might be described in the device specific manuals.

6 Pushbutton

The ZBS devices use a pushbutton for a restart and for several control functions. For a device reset it should get pressed till the green LEDs switches off. After pushbutton release the restart will get initiated. Pushing the button several times, various functions / actions are getting performed. The max. time period between 2 button operations is limited to 1s. Longer delays will get assumed as end of command sequence.

# of operations	Function
1	A DEV package consisting of device specific information is getting transmitted. The information is described in the device specific manual in detail.
4	Reset of RF module configuration. A network scan will start after the reset.

The location of the pushbutton is described in the device specific manual.

7 Firmware Update

For the ZBS devices firmware update files are available as hex files in following nomenclature:

`ZBS-121-0201.hex` (FW version 0201 for device ZBS-121). These files are getting converted while update procedure into a pcf file format. This file gets transmitted packet per packet via RF to the device which should obtain the new firmware.

A new firmware will lead to a new firmware version and might lead to a new PID (product identification).

A new firmware will not touch any of these parameters: hardware version, ID / serial number as well as all storable configuration data. Please refer to the device specific manuals for more detailed information.

For DIGI International's ConnectPort devices update scripts are available. There are 2 different update procedures.

In general both Python scripts should get transferred / copied to the ConnectPort: `gwUpdateZBS.py` und `pypcf.py`.

This will get initiated under the menu "Applications → Python" in the web interface of the gateway.

If the firmware shall reach only 1 specific device the firmware filename shall get renamed from `ZBS-121-0201.hex` to e.g. `ZBS-121.hex` and transmitted onto the gateway. Furthermore prepare the device with the commands

`!#*b1` und `!#*b2` before starting the scripts for entering the bootloader mode.

If the firmware shall reach all devices the original firmware file(s) as well as the delivered `zbs-versionen.txt` have to get transmitted onto the gateway.

In case of this update method no device shall be in bootloader mode.

The file structure on the gateway should look roughly like this:

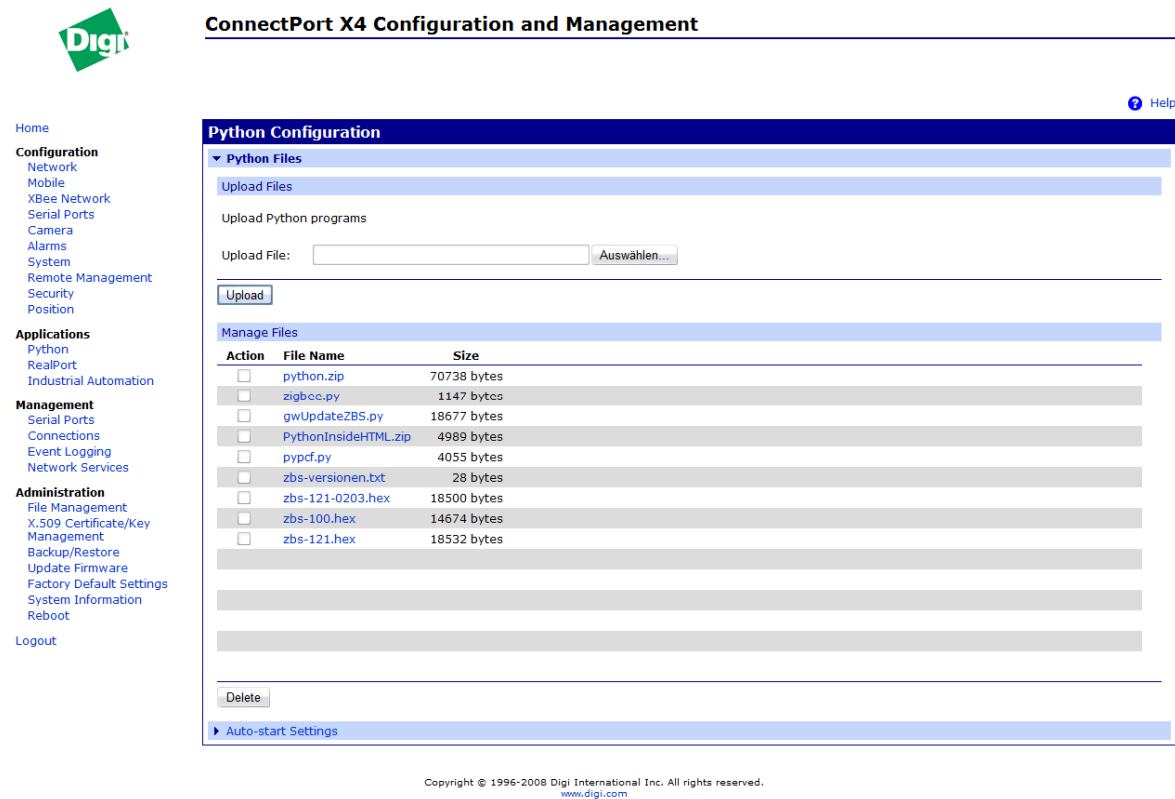


Figure 1: Web interface ConnectPortX - Python

For the next steps a Telnet connection is needed. Via this connection the update script is started.

For a single device update use

```
python gwUpdateZBS.py
```

First answer the bootloader question. In case of a positive answer all joined / connected devices are listed. The desired device can get chosen.

After entering the device type the script will perform the update till the restart of the updated device.

For a complete update rollout use

```
python gwUpdateZBS.py --all
```

A network scan will get performed immediately. This should ensure, that all devices are reached and treated with the update method.

Every device is getting asked for its firmware version and the device type.

All devices mentioned in the file `zbs-versionen.txt` will now get the firmware file till device restart. After that procedure a list of all connected devices with its firmware versions is shown.

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