DEVELCO SPLZB-131 Smart Mini Plug Instruction Manual

Smart Plug Mini – SPLZB-131
Technical manual

Revised 21.03.2016

Contents

1 SPLZB-131 Smart Mini Plug
2 Cautionary notes
3 Features
4 Endpoints
5 MMI user guide
6 General network behavior
7 Specifications
8 Contact Information
9 Documents / Resources
9.1 References

SPLZB-131 Smart Mini Plug

RoHS CE

Cautionary notes

Develco Products A/S reserves the right to make changes to any product to improve reliability without further notice. Develco Products A/S does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under patent rights or the rights of third parties.

Features

2.1 Smart Plug Mini – SPLZB-131

The wireless Smart Plug Mini with power metering feature is an intelligent, sharp and sophisticated, remotely controlled adapter.
This extremely efficient Smart Plug Mini can be applied wherever you want to control electrical devices, while monitoring the power consumption in a convenient and maintenance-free way.
The Smart Plug Mini requires no installation tools or electrician, meaning no hassle for you. You just take the Smart Plug Mini out of the box, put it into an electrical outlet, and plug in any electrical device of your choice.
The Smart Plug Mini allows you to instantly turn on and off any device from across the world – or from your living room. The undemanding interface ensures an easy and intuitive way of adding the Smart Plug Mini to your Smart Home system. The Smart Plug Mini is based on ZigBee and can easily be integrated with other ZigBee products or smart control solutions.

2.2 Key features

The ZigBee based relay for Smart Plug Mini mounting is router in the ZigBee 2007 network.
Key features are:

- Remote on/off control
- Power Failure alarm
- Accurate power consumption
- Certified ZigBee Home Automation 1.2

- ZigBee OTA cluster for firmware upgrades
- ETSI compliant.
- RoHS compliant according to the EU Directive 2002/95/EC.

Endpoints

The device has 3 endpoints:

3.1 ZigBee Device Object (ZDO)

- Application profile Id 0x0000
- Application device Id 0x0000
- Supports all mandatory clusters

3.2 Smart Plug Mini – End Point 0x02

- Application profile Id 0x0104 (Home Automation)
- Application device Id 0x0051 (Smart Plug Mini)
- Clusters
  o Clusters supported as server
  • Basic
  • Identify
  • Groups
  • Scenes
  • On Off
  • Metering
  • Alarms (support alarms in relation to the Metering cluster)
  • Device Temperature Configuration
  • Electrical Measurement
  o Clusters supported as client
  • Occupancy Sensing
  • OTA Upgrade
  • Time

3.3 Develco Utility

- Application profile Id 0xC0C9 (Develco Products private profile)
- Application device Id 0x0001
- Develco ZigBee Manufacturer code 0x1015
- Private profile for internal Develco Products use only.

Reference documents
053474r18ZB_CSG-ZigBee-Specification.pdf
075123r03ZB_AFG-ZigBee_Cluster_Library_Specification.pdf
053520r27ZB_HA_PTG-Home-Automation-Profile.pdf

075356r15ZB_ZSE-ZSE-AMI_Profile_Specification.pdf
They can all be downloaded from: **http://www.zigbee.org**

3.4 Basic – Cluster id 0x0000

The Basic cluster has 2 attribute sets defined. In the following sections the attributes of these sets is listed. Refer to [Z2] for ZigBee specification of the basic cluster.
Only the first set has mandatory attributes, also the optional attributes that can be relevant to a device are all in set 0x000
3.4.1 0x000 Basic Device Information attribute set

Id#	Name	Type	Range	Man/opt	Relevance and ref.
0x0	ZCL Version	Uint8	Type range	M	
0x4	Manufacturer Name	String	0-32 byte	O	
0x5	Model Identifier	String	0-32 byte	O	
0x7	Power Source	8 biennium	Type range	M	
0x12	Device Enable	Bool	Type range	O	Always TRUE

3.4.1.1 Manufacturer name
“Develco Products A/S”
3.4.1.2 Model identifier
|“SPLZB-131”
3.4.1.3 Power source
Mains powered single phase
3.4.1.4 Manufacture Specific Attribute

Id#	Name	Type	Man/opt	Relevance and ref.
0x8000	Primary SW Version	Octet String	M	Read only
0x8010	Primary Bootloader SW Version	Octet String	M	Read only
0x8020	Primary HW version	Octet String	M	Read only

ZCL header setting – Manufactory code for Develco Products is 0x1015
3.5 Identify – Cluster id 0x0003
The identify cluster serves as a way to make a device identify itself either visually or by sound.
Normally this is done by toggling an LED at some interval.
Refer to [Z2] for ZigBee specification of the identify cluster.
The Identify cluster only defines one attribute.
3.5.1 Attribute

Id#	Name	Type	Range	Man/opt	Relevance and ref.
0x0000	Identify Time	Uint16	Type range	M	

3.5.1.1 Commands
The identify cluster has 2 commands as server.

Id#	Name	Payload	Man/Opt	Relevance and ref.
0x00	Identify	Uint16 – Identify Time (seconds)	M	
0x01	Identify Query	None	M	

The identify cluster has 1 command as client.

Id#	Name	Payload	Man/opt	Relevance and ref.
0x00	Identify Query Response	Uint16 – Identify Time (seconds)	M	

3.6 On/Off – Cluster id 0x0006
The On/Off cluster has 1 attribute set defined. In the following section the set is listed. Refer to [Z2] for ZigBee specification of the On/Off Cluster. The cluster is implemented as a server cluster.
3.6.1 On/Off Cluster – Attributes
On the On/Off cluster the following attributes are defined:

Id#	Name	Type	Range	Man/opt	Relevance and ref.
0x0000	On Off	Boolean	0x00 – 0x01	M	Section 3.8.2.2 ZCL configure reporting is supported

3.6.2 On/Off Cluster Commands
The server generates no commands
The On/Off cluster can receive the following commands from a client

Id#	Name	Man/opt	Relevance and ref.
0x00	Off	M	ZCL specification section 3.8.2.3
0x01	On	M	ZCL specification section 3.8.2.3
0x02	Toggle	M	ZCL specification section 3.8.2.3

3.6.3 On/Off Cluster – MFG Commands
The On/Off cluster can receive the following manufacture specific commands from a client

Id#	Name	Man/Opt	Relevance and ref.
0x00	Sidemode Off	O	0x00
0x01	Sidemode On	O	0x01

ZCL header setting – Manufactory code for Develco Products is 0x1015
3.6.3.1 Overview
The safe mode functionality is default disabled. To enable the safe mode functionality the Safe mode On or Off command has to be send from the client with payload 1 – 255. To disable the safe mode the client has to send a

payload with value 0. Develco Products A/S Olof Palmes Ale 40 DK – 8200 Aarhus N +45 87 400 370 **http://develcoproducts.com** **info@develcoproducts.com**
The safe mode functionality is implemented to assure that the relay enters a predefined state after x minutes.
If “Sidemode On” command is sent to a relay with value 10 minutes, the relay will enter the safe mode after 10 minutes and force the relay to turn **ON.** If a standard **OFF** command from the On/Off cluster is sent within the first 10 minutes. The timer is restarted and the relay will not turn **ON** before the new 10 minute time has timed out. Sending the standard **OFF** command regularly within the 10 minute time interval will prevent the relay to enter safe mode ON state.
The “Safe mode off” functionality is the same as “Safe mode on” the only different is relay entering off state instead of on state.
After a power failure the remaining time before entering “Safe mode” is set to zero and the device will be forced to enter safe mode immediately.

3.6.3.2 Sidemode Off payload

Octets	1
Data type	Uint8
Field name	Safe Mode Time in minute

3.6.1.1 Sidemode On payload

Octets	1
Data type	Uint8
Field name	Safe Mode Time in minute

3.7 Metering – Cluster id 0x0702

In the following sections the ZigBee SE metering cluster, is listed. Refer to [S1] for ZigBee specification of the Metering cluster.

3.7.1 0x00 Reading Information attribute set

Id#	Name	Type	Range	SE Req.	Relevance and ref.
0x00	Current Summation Delivered	Uint48	Type range	M	Recent summed value of Energy delivered.
0x01	Current Summation Received	Uint48	Type range	O	Recent summed value of Energy generated.
0x02	Current Max Demand Delivered	Uint48	Type range	O	The value is reset at midnight UTC time
0x03	Current Max Demand Received	Uint48	Type range	O	The value is reset at midnight UTC time
0x05	Daily Freeze Time	Uint16	Type range	O	Read only
0x08	Current Max Demand Delivered Time	UTC Time	Type range	O	Represents the time when Current Max Demand Delivered reading was captured
0x09	Current Max Demand Received Time	UTC Time	Type range	O	Represents the time when Current Max Demand Received reading was captured
0x0F	Profile Interval Period	8-bit Enuma	0x00-0xFF	O	Log is stored in a 5 min interval

Above attribute description is to be found in section D.3.2.2.1 “Reading Information Set” document “ZigBee Smart Energy Profile Specification” provided by the ZigBee alliance.

3.7.2 0x01 TOU Information attribute set

No attributes are support in this set.

3.7.3 0x02 Meter Status attribute set

Id#	Name	Type	Range	Man/opt	Relevance and ref.
0x00	Status	8 bit bitmap	Type range	M	0x0032 – Meter Status

Above attribute description is to be found in section D.3.2.2.3 “Meter Status Attribute” document “ZigBee Smart Energy Profile Specification” provided by the ZigBee alliance.

3.7.3.1 Meter Status

The following table describe the meter status bits per metering type:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Service Disconnect Open	Leak Detect	Power Quality	Power Failure	Tamper Detect	Low Battery	Check Meter

3.7.4 0x03 Formatting attribute set

The following set of attributes provides the ratios and formatting hints required to transform the received summations, consumptions or demands/rates into displayable values. If the Multiplier and Divisor attribute values are non-zero, they are used in conjunction with the Summation Formatting, Consumption Formatting, and Demand Formatting attributes. Equations required to accomplish this task are defined below:

Summation = Summation received * Multiplier / Divisor

(formatted using Summation Formatting)

Consumption = Summation received * Multiplier / Divisor

(formatted using Consumption Formatting)
Demand = Demand received * Multiplier / Divisor
(formatted using Demand Formatting)

If the Multiplier and Divisor attribute values are zero, just the formatting hints defined in Summation Formatting, Consumption Formatting, and Demand Formatting attributes are used.
The following set of attributes provides the ratios and formatting hints required to transform the received summations, consumptions or demands/rates into displayable values. If the Multiplier and Divisor attribute values are non-zero, they are used in conjunction with the Summation Formatting, Consumption Formatting, and Demand Formatting attributes.

Id#	Name	Type	Range	Man / opt	Relevance and ref.
0x00	Unit of Measure	8 bit en emy	0x00 to 0xFF	M	Fixed to 0x00 (kW/kWh in pure binary format)
0x01	Multiplier	Uint24	0x000000 to 0 xFFFFFF	O	Fixed to 1
0x02	Divisor	Uint24	0x000000 to 0 xFFFFFF	O	Fixed to 1000
0x03	Summation Formatting	8 bit	0x00 to	M	Fixed to 0xFB (3 digits to
0x04	Demand Formatting	8 bit bit map	0x00 to 0xFF	O	Fixed to 0xFB (3 digits to the ri ght of the decimal point)
0x06	Metering Device Type	8 bit bit map	0x00 to 0xFF	M	Fixed to 0x00 (Electric Meter)
0x08	Meter Serial Number	Octet S tring	0-24 Octets	O	

Above attribute description is to be found in section D.3.2.2.4 “Formatting” ZigBee Smart Energy Profile Specification provided by the ZigBee alliance.

3.7.5 0x04 Historical attribute set

Id#	Name	Type	Range	Man / opt	Relevance and ref.
0x00	Instantaneous Demand	Int24	-8,388,607 to 8,388,607	O	

Above attribute description is to be found in section D.3.2.2.5 “Historical Consumption” document “ZigBee Smart Energy Profile Specification” provided by the ZigBee alliance.

3.8 Alarms – Cluster id 0x0009

The Alarms cluster has 1 attribute set defined. In the following section the set is listed. Refer to [Z2] for ZigBee specification of the Alarm Cluster. The cluster is implemented as a server cluster

3.8.1 Metering Cluster – Alarm Attribute Set 0x000

On the metering cluster another attribute set related to alarms is defined:

3.8.2 Alarms Cluster Commands

The Alarm Server cluster can receive the following commands

Id#	Name	Man /opt	Relevance and ref.
0x00	Reset Alarm	M	ZCL specification section 3.11
0x01	Reset all alarm	M	ZCL specification section 3.11

The Alarm Server cluster can generate the following commands

Id#	Name	Man /Opt	Relevance and ref.
0x00	Alarm	M	ZCL specification section 3.11

The metering device is able to generate ZCL alarms for various meter events. A binding between the receiving end point of the alarms and the meter end points alarm cluster must have been created before the alarms can be reported. Only mandatory commands are supported.
The following alarms are supported.

3.8.2.1 Alarm code table

ZCL Alarm Code decimal	ZCL Alarm Condition
0x 03	Power Failure

3.9 Time – Cluster id 0x000A

The Time cluster is a general cluster for time it is based on a UTC time in seconds since 0 hrs. 0 mins 0 sec on 1st January 2000. Refer to [Z2] for ZigBee specification of the time cluster.
The metering device will use this clusters as a client – provided that a suitable Time Server is available on the network (most likely on the Gateway/concentrator)

3.9.1 Attribute

Id#	Name	Type	Range	Man / opt	Relevance and ref.
0x000 0	Time	UTC Time (Uint32)	Type range	M	The module will periodically update its clock by synchronizing through this cluster
0x0001	Time Status	8 bit bitmap	00000xxx	M	

3.10 Groups – Cluster 0x0004

The Group cluster has 1 attribute set defined. In the following section the set is listed. Refer to [Z2] for ZigBee specification of the Groups Cluster. The cluster is implemented as a server cluster.

3.10.1 Groups Cluster – Attributes

On the groups cluster the following attributes are defined:

Id#	Name	Type	Range	Man / Opt	Relevance and ref.
0x0000	Name Support	8bitmap	Type range	M	Section 3.6.2.2

3.10.2 Groups Cluster Commands

The groups cluster can receive the following commands from the client.

Id#	Name	Man /opt	Relevance and ref.
0x00	Add group response	M	ZCL specification section 3.6.2.3
0x01	View group response	M	ZCL specification section 3.6.2.3
0x02	Get group membership response	M	ZCL specification section 3.6.2.3
0x03	Remove group response	M	ZCL specification section 3.6.2.3

The groups cluster can generate the following command and send them to the client.

Id#	Name	Man /opt	Relevance and ref.
0x00	Add group	M	ZCL specification section 3.6.2.2
0x01	View group	M	ZCL specification section 3.6.2.2
0x02	Get group membership	M	ZCL specification section 3.6.2.2
0x03	Remove group	M	ZCL specification section 3.6.2.2
0x04	Remove all groups	M	ZCL specification section 3.6.2.2
0x05	Add group if identifying	M	ZCL specification section 3.6.2.2

3.11 Scenes – Cluster id 0x0005

The Scenes cluster has the following attribute sets defined. In the following sections the attributes of these sets is listed. Refer to [Z2] for ZigBee specification of the Scenes cluster.

3.11.1 0x000 Scenes attribute set

Id#	Name	Type	Range	Man / opt	Note
0x0	Scenes Count	Uint8	Type range	M	
0x1	Current Scene	Uint8	Type range	M	
0x2	Current Group	Uint16	Type range	M	
0x3	Scene Valid	Bool	Type range	M	
0x12	Name Support Scen e	Bitmap8	Type range	M	

3.12 Electrical Measurement – Cluster id 0x0B04

The physical meter located on end point 0x02 support the electrical measurement cluster. This cluster provides a mechanism for querying data about the electrical properties as measured by the device.

Id#	Name	Type	Man / opt	Relevance and ref.
0x0000	Measurement Type	BitMap32	O	Section 4.6.1
0x0300	A Frequency	Uint16	O	Non phase specific Measurement R eading in (Hz).
0x030D	MeasuredPhase1stHarmonicCurrent	Sint16	O	Phase1
0x0400	AC Frequency Multiplier	Uint16	O	Fixed to 1
0x0401	AC Frequency Divisor	Uint16	O	Fixed to 1000
0x0405	Phase Harmonic Current Multiplier	Sint8	O	Fixed to -2
0x0505	RMS Voltage	Uint16	O	L1 – Volts (V)
0x0508	RMS Current	Uint16	O	L1 – Amps (A)
0x050B	Active Power	Sint16	O	L1 – Watts (W).
0x050E	Reactive Power	Sint16	O	L1 – Watts (W).
0x0600	AC Voltage Multiplier	Uint16	O	Fixed to 1
0x0601	AC Voltage Divisor	Uint16	O	Fixed to 100
0x0602	AC Current Multiplier	Uint16	O	Fixed to 1
0x0603	AC Current Divisor	Uint16	O	Fixed to 1000
0x0604	AC Power Multiplier	Uint16	O	Fixed to 1
0x0605	AC Power Divisor	Uint16	O	Fixed to 1000

3.12.1 Measurement type
Indicates a device’s measurement capabilities

Bit	Flag name
0	Active measurement (AC)
1	Reactive measurement (AC)
2	Apparent measurement (AC)
3	Phase A measurement
4	Phase B measurement
5	Phase C measurement
6	DC measurement
7	Harmonics measurement
8	Power quality measurement

3.12.2 Measured Phase1st Harmonic Current
The Measured Phase1st Harmonic Current attributes represent the most recent phase of the 1st harmonic current

reading in an AC frequency. The unit for this measurement is 10 ^
Phase1sthHarmonicCurrentMultiplier degree

3.13 Device Temperature – Cluster id 0x0002

The device will use this clusters as a server – provided a temperature from the sensor in the Smart Plug Mini.

3.13.1 Attribute

Id#	Name	Type	Range	Man / opt	Relevance and ref.
0x0000	Current temperature	Analog (Uint16)	Temperature in Celsius	M	Resolution 1 ºC

3.14 OTA Upgrade – Cluster id 0x0019

The cluster provides a ZigBee standard way to upgrade devices in the network via OTA messages.

3.14.1 OTA Cluster Attributes

Id#	Name	Type	Range	Man /opt	Relevance and ref.
0x0000	Upgrade ServerID	IEEE Address	–	M	
0x0001	File Offset	Uint32	Type range	O	
0x0002	Current File Version	Uint32	Type range	O	
0x0003	Current Zig Bee Stack Version	Uint16	Type range	O	
0x0004	Downloaded File Version	Uint32	Type range	O	
0x0005	Downloaded Zig Bee Stack Version	Uint16	Type range	M	
0x0006	Image Upgrade Status	8 biennium	0x00 to 0xFF	O	
0x0007	Manufacturer ID	Uint16	Type range	O	
0x0008	Image Type ID	Uint16	Type range	O	
0x0009	Minimum Block Request Delay	Uint16	Type range	O	

Above attribute description is to be found in section 6.7 “OTA Cluster Attributes” in ZigBee document – “zigbeeota-upgrade-cluster-specification” provided by the ZigBee alliance.

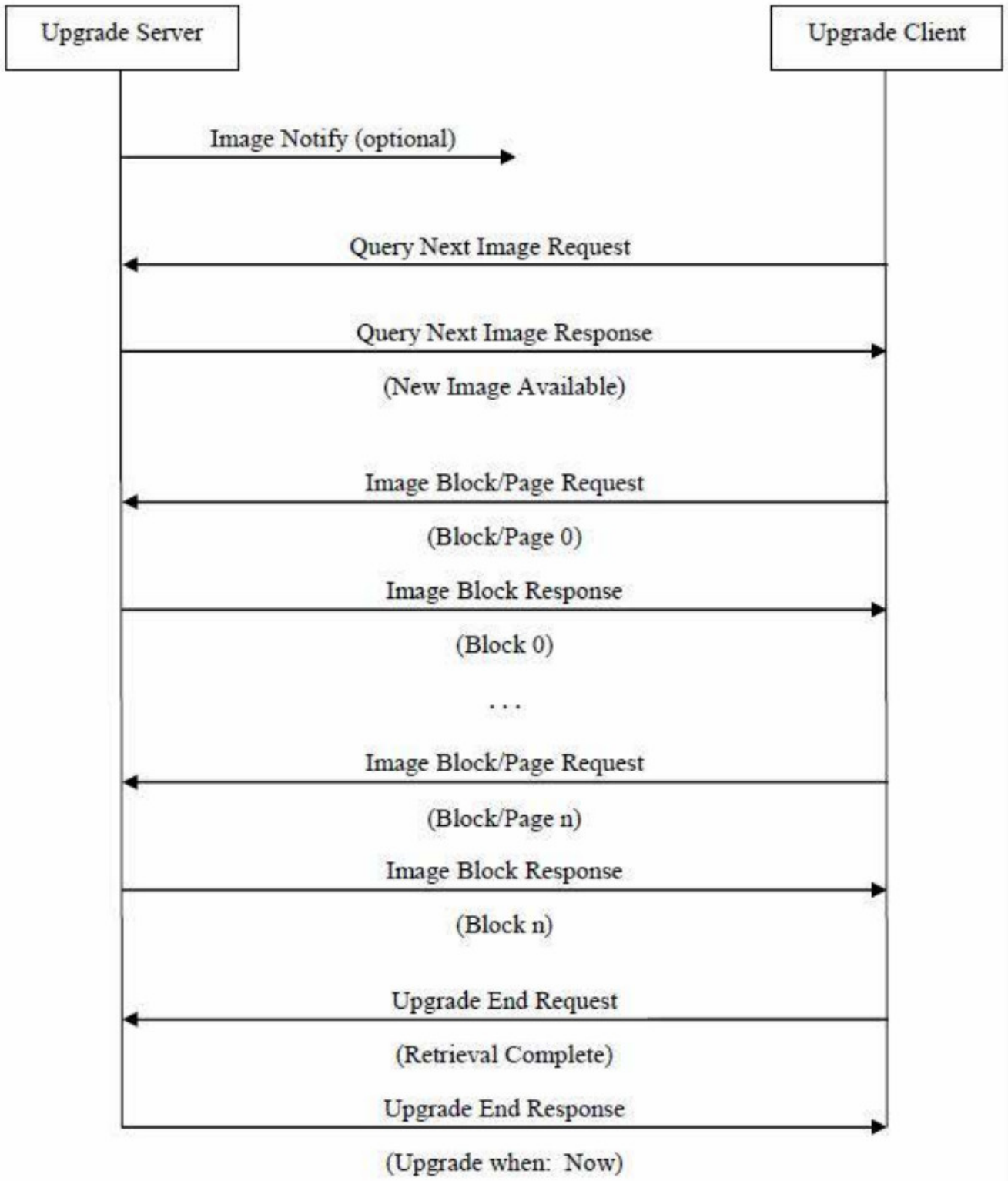
3.14.2 OTA Cluster Commands

The OTA Client cluster can send the following commands

Id#	Name	Man / Opt	Relevance and ref.
0x01	Query Next Image request	M	6.10.1 OTA Cluster Command Identifiers
0x03	Image Block Request	M	6.10.1 OTA Cluster Command Identifiers
0x06	Upgrade End Request	M	6.10.1 OTA Cluster Command Identifiers

3.14.3 OTA Upgrade Diagram

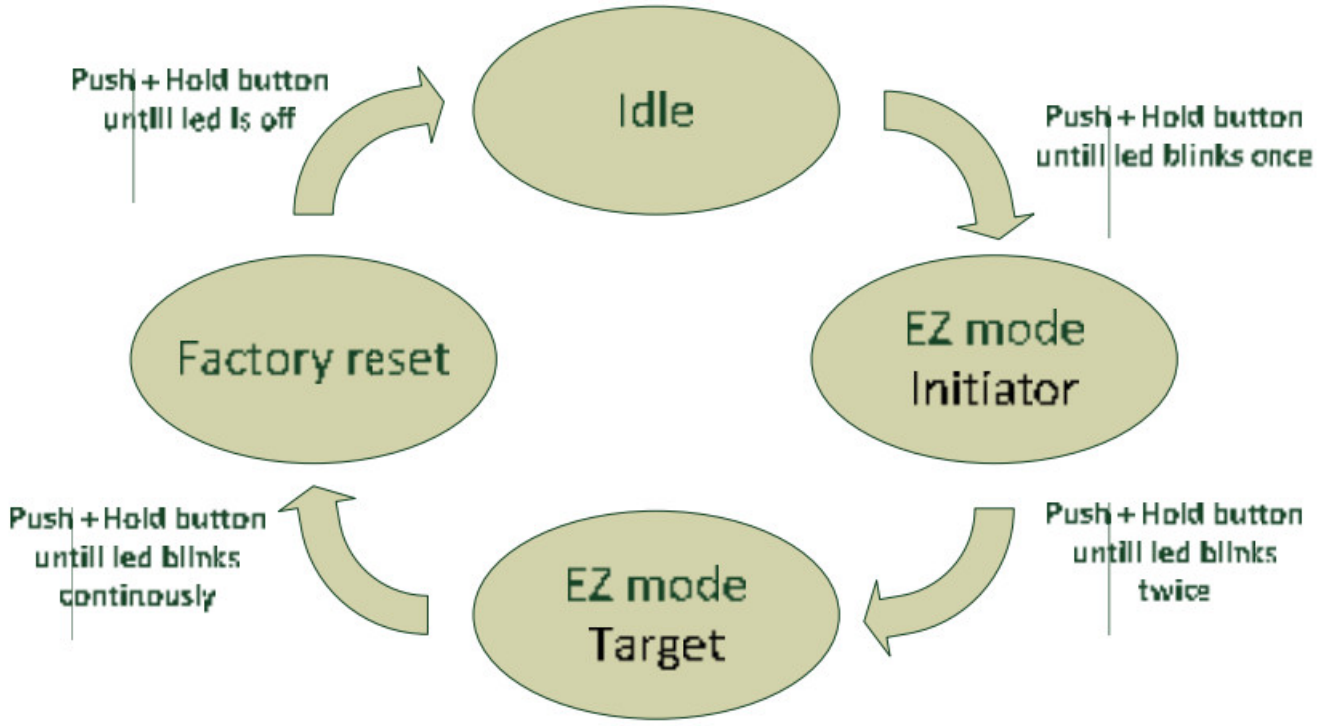
OTA Upgrade Message Diagram



MMI user guide

4.1 Push button menu

Pushing the button on a device provides the user with several possibilities.
Pushing the button for longer (push, hold for a few seconds, and release) allows the user to set the device into a desired mode. A mode change happens at 5 second interval. Below, these modes are illustrated in a state chart.



When cycling through the menu modes, the state is indicated by a number of 100ms blinks on the LED. The device is supporting the ZigBee standardized EZ- mode Commissioning.

4.1.1 EZ mode – Initiator

If the devices is not on the network EZ-Mode Network Steering is invoked when the user enter this menu. The led blinks once every 1 sec until the devices has joined the network. If the device was already on the network it will broadcast the Permit Join messages. It is the trust center policy that decides if the device is allowed to join the network.

When the device has joined the network EZ-Mode Finding and Binding is invoked and the device start to blink every 3 sec until a cluster match is found. When a match is found or the cluster examine is finished the blinking stops and the device sends a messages to the target device to stop the identify time.

The following clusters are support in EZ-mode finding and binding:

- On/Off cluster
- Metering cluster
- Electrical measurement cluster

The EZ-mode time is hard coded to 3 minutes. This is the Minimum and recommended Permit Join time broadcast for EZ-Mode Network Steering and minimum Identify Time set for EZ-Mode Finding and Binding. If the user enters the menu again another 3 minutes is started.

4.1.2 EZ mode – Target

If the devices is not on the network EZ-Mode Network Steering is invoked when the user enter this menu. The led blinks twice every 1 sec until the devices has joined the network. If the device was already on the network it will broadcast the Permit Join messages. It is the trust center policy that decides if the device is allowed to join the network.

When the device has joined the network identify mode is invoke and the device start to blink twice every 3 sec until identify mode is stopped or after the EZ-mode time has expired. If the user enters the menu again another 3 minutes is started.

4.1.3 Factory reset

To allow a device to join a network, one either has to power up a device that has not previously joined a network or push the button until the Reset To Factory default mode is indicated – and subsequently release the button. This will cause the device to reset to its factory default state and scan for a suitable coordinator.

4.2 Action on Power On

As a general rule, all end devices and routers that have not previously joined a network (or have been reset to

factory default) will start up and search for a network with join permit open. In this mode, the LED will flash once every second.
Once the device has joined the network, is will start scanning for an OTA server, Time server, Poll control client, Occupancy Sensor client and an IAS Zone client.
If a device has joined a network and is powered down, it will attempt to rejoin this network upon power up. For the first 30 seconds hereafter, the device will be available for communication. This time can be expanded using the poll control cluster functionality.

General network behavior

5.1 Installation

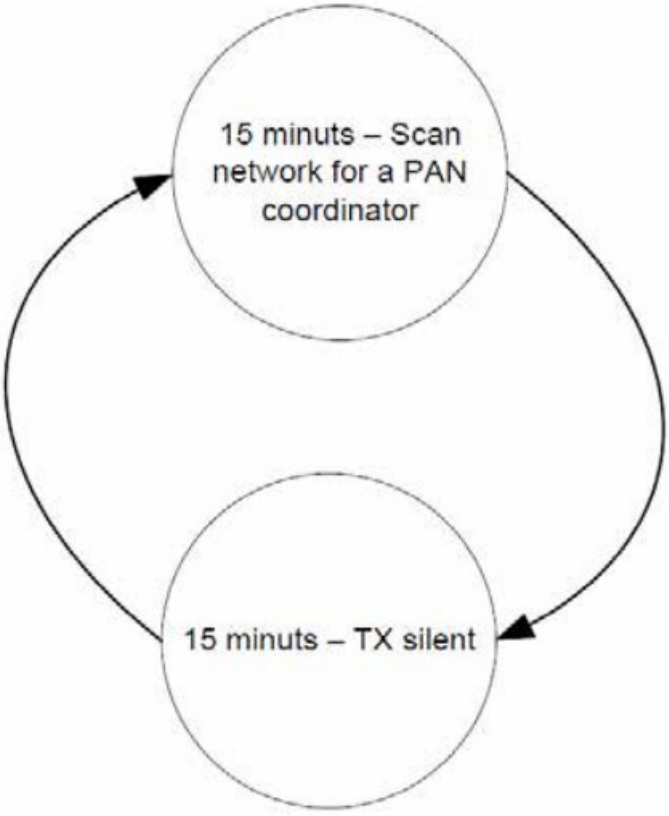
When the device is virgin and powered for the first time it will start looking for a ZigBee PAN Coordinator or router to join. The device continually scans each ZigBee channel starting from 11 to 24. The LED will flash once every second until it joins a device.
In section 5 “MMI” it is explained how to put the device into a join or leave network mode.
Network settings are stored in NV-memory are after a power cycle the device re-join the same network.
If the device has to join a new PAN coordinator the MMI menu supports a “Join / Leave” mode.

5.2 Normal – Keep alive

The device is sending a “keep alive” message to the PAN coordinator every 15 minutes to verify that the device is still connected to the network.

5.2.1 Network lost

If no “keep alive” responses are received 5 times in a row (1 hour and 15 minutes), the devices will start scanning every ZigBee channel for the PAN coordinator and try to re-join it. The LED will flash once every second until it rejoins the
network.
According to the ZigBee specification TX is NOT allowed to be enabled all the time and a TX silent period has to be defined.



Specifications

6.1 General

Dimensions	Ø 41 x 45 mm
Colour	White
Power consumption,	0.4W
Max. switch voltage	250VAC
Max. switch current	10A
Max. switch power	4000VA
IP-class	40
Storage temperature	-20°C to +80°C
Operation temperature	0 to +40°C
Supply voltage	207 to 253 VAC
Sensitivity	-101 dBm @ 1% PER
Output power	+8 dBm
Frequency band	47 to 53 H

6.2. Power Meter functionality in relays

Voltage range	207 to 253VAC
Voltage accuracy	typ. 0.5%
Current range	10A
Current accuracy	typ. 0.3%

Contact Information

Technical support: Please contact Develco Products for support.
products@develcoproducts.com
Sales: Please contact Develco Products for information on prices, availability, and lead time.
info@develcoproducts.com

DS CERTIFIED QUALITY SYSTEM DS/EN ISO 9001

Olof Palmes Allen 40
DK-8200 Aarhus N

ZigBee Control your world Home

http://develcoproducts.com

info@develcoproducts.com

Documents / Resources

	DEVELCO SPLZB-131 Smart Mini Plug [pdf] Instruction Manual SPLZB-131, SPLZB-131 Smart Mini Plug, Smart Mini Plug, Mini Plug, Plug

References

- Develco Products - White label products for security, home care, and energy management.
- CSA-IOT - Connectivity Standards Alliance