DEVELCO
PRODUCTS

Keypad - KEYZB-110

Technical manual

Revised 17.03.2020

ZigBee®
Control your world

Home

Content

RoHS $C\epsilon$

1 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.

2   Features

2.1   Keypad - KEYZB-110

Enables secure access control
The Zigbee-based Keypad includes a tag reader and allows for users to enable and disable an alarm system using a pin code and/or an RFID tag. In addition, access data can be updated remotely via a gateway to facilitate access control.

Saves battery when not in use
The RFID only consumes energy when it is needed. The Keypad includes a sensor that detects when a person is within operating distance, which will enable the RFID and make the Keypad light up in the dark. This saves energy and allows for a longer battery lifetime.

Numerous features and design options
The Keypad includes a tamper switch that detects opening of the unit, which makes it suitable for alarm systems. Also, the Keypad includes a programmable buzzer for indication of entry, exit, alarms, or any other indication needed in your solution. Red, Green, and Yellow LEDs are available for indications of alarms, etc. The Keypad can be delivered in white for indoor use or in black for outdoor use. The device has 16 buttons that you can design to fit your solution. The Keypad can be mounted on the wall using screws or double-sided tape

2.2   IAS ACE

The Keypad is implemented as a IAS ACE ZigBee end point according to ZigBee Home Automation profile. The IAS ACE cluster defines an interface to the functionality of any Ancillary Control Equipment of the IAS system. Using this cluster, an ACE device can access a IAS CIE devices and manipulate the IAS system

2.3   Key features

- RFID tag reader
- Tamper-protected
- Buzzer and LED
- Intelligent backlight
- Battery-powered
- Alarm sensor – IAS Zone
- ZigBee OTA cluster for firmware upgrades
- ZigBee 3.0 stack supported
- Water repellent

3   Endpoints

The device implements the following standard HA devices on different end points.

3.1   ZigBee Device Object (ZDO)

- End point number 0x00
- Application profile Id 0x0000
- Application device Id 0x0000
- Supports all mandatory clusters

3.2   IAS ACE

- End point number 0x2C
- Application profile Id 0x0104 (Home Automation)
- Application device Id 0x0401 (IAS Ancillary Control Equipment)

3.3   Develco Utility

- Application profile Id 0xC0C9 (Develco Products private profile)
- Application device Id 0x0001
- Manufactor code for Develco Products is 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/Products/DownloadZigBeeTechnicalDocuments.aspx

4 Supported Clusters

4.1 Common clusters for each end point

The ZCL "General Function Domain" clusters in this section are implemented as server clusters. Refer to ZigBee Cluster Library Specification. http://www.zigbee.org/Specifications.aspx

4.1.1 Basic – Cluster id 0x0000

Only the first set has mandatory attributes, also the optional attributes that can be relevant to a Develco device are all in set 0x000.

4.1.1.1 Attribute

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0	ZCLVersion	Uint8	Type range	M	
0x4	ManufacturerName	String	0-32 byte	O	4.1.1.1.1
0x5	ModelIdentifier	String	0-32 byte	O	4.1.1.1.2
0x6	DateCode	String	0-32 byte	O	
0x7	PowerSource	8 bit enum	Type range	M	

4.1.1.1.1 ManufacturerName

"Develco Products A/S"

4.1.1.1.2 ModelIdentifier

"KEYZB-110"

4.1.2 Identify – Cluster id 0x0003

4.1.2.1 Attribute

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0000	IdentifyTime	Uint16	Type range	M	

4.1.2.2 Commands

The identify cluster has 2 commands as server.

Id#	Name	Payload	Man/Opt	Relevance and ref.
0x00	Identify	Uint16 - Identify Time (seconds)	M	0x00

0x01	Identify Query	none	M	0x01

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	0x00

4.2 IAS ACE Device – EP 0x2C

4.2.1 IAS Zone - Cluster id 0x0500

The IAS Zone cluster is described in ZigBee Cluster Library Specification.

4.2.1.1 Attribute

Id#	Name	Type	Man/Opt	Relevance and ref.
0x0000	Zone State	8-bit Enumeration	M	
0x0001	Zone Type	16-bit Enumeration	M	Hard coded to Keypad
0x0002	Zone Status	Uint16	M	The following bits are supported: Bit2: Tamper Bit3: Battery Bit4: Supervision reports Bit5: Restore reports
0x0010	IAS CIE Address	Valid 64-bit IEEE address	M	
0x0011	ZoneID	Uint8	M	
0x8000	Zone Status Interval	Uint16	O	Default 300 sec

4.2.1.1.1 Zone State

The device will automatically start to scan the network for an IAS Zone client in a predefine interval. When the client is found it will automatically attempt to enrol. When it has successfully enrolled the Zone Status command is send to the IAS Zone client.

The attribute value will change from not enrolled (0x00) to Enrolled (0x01).

4.2.1.1.2 IAS CIE Address

Attribute specifies the address that commands generated by the server shall be sent to.

To un-enrol the device the back end system has to write a new address into this attribute. Any value is valid. If the back end system writes an IEEE address then it will try to enrol to this devices represented by the IEEE address.

4.2.1.1.3   ZoneID

A unique reference number allocated by the CIE at zone enrolment time.
Used by IAS devices to reference specific zones when communicating with the CIE. The *ZoneID* of each zone stays fixed until that zone is un-enrolled.

4.2.1.2   Commands

The IAS Zone cluster has 2 commands as server.

Id#	Name	Payload			Man/Opt	Relevance and ref.
0x00	Zone Status Change Notification	Uint16 – bit mask			M	The status is report to the coordinator every 5 min
0x01	Zone Enroll Request	Bits	16	16	M	
		Data type	16 bit enum	UINT16		
		Field name	Zone type	Manufacturer code		

Init sequence – when the device has join the network it start to scan for an IAS zone client cluster. If a client is found a Zone enroll request command is send and a Zone Enroll response is expected. If it doesn't receive a response it will wait for 15 minutes and try again.

The following bits are supported in Zone status:
Bit2: Tamper
Bit3: Battery
Bit4: Supervision reports
Bit5: Restore reports

Bit3: When the battery is below 4.0 VDC. Battery bit is set high and "Zone Status" is transmitted to the coordinator.

4.2.1.3 Commands

The IAS ACE cluster has 3 commands as client server.

Id#	Name	Payload			
0x00	Arm	Bits	8	Varies	8
		Data type	Enum8	string	Uint8
		Field name	Arm Mode	Arm/Disarm code	Zone ID
0x02	Emergency	No payload, Commands indicate an emergency situation			
0x07	GetPanelStatus	No payload, Commands This command is used by ACE clients to request an update to the status of the ACE server (i.e., the IAS CIE).			

Keypad button functionality

Symbol	Function
🔒	Arm All Zones
🔓	Disarm
🏠	Arm Day/Home Zones Only
💤	Arm Night/Sleep Zones Only
SOS	Emergency – Press button for 3 sec
X	Delete last symbol input from keypress
"0" to "9"	Input to Arm/Disarm code

4.2.2   Power Configuration - Cluster id 0x0001

The power configuration cluster is described in ZigBee Cluster Library Specification

4.2.2.1   Attribute

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0020	BatteryVoltage	Uint8	0x00 - 0xFF	O	ZCL configure reporting is supported

Note: The attribute "*BatteryVoltage*" is measuring the battery voltage, in units of 100mV.

4.2.3   Poll Control - Cluster id 0x0020

The poll control cluster is described in ZigBee Cluster Library Specification

This cluster provides a mechanism for the management of an end device's MAC Data Request rate. For the purposes of this cluster, the term "poll" always refers to the sending of a MAC Data Request from the end device to the end device's parent.

This cluster can be used for instance by a configuration device to make an end device responsive for a certain period of time so that the device can be managed by the controller.

4.2.3.1   Attribute

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0000	Check-inInterval	Uint32	0x00 - 0xFF	M	Default value is 1 hour
0x0001	LongPoll Interval	Uint32		M	Default value is 7.5 sec
0x0002	ShortPollInterval	Uint16		M	Default value is 0.25 seconds
0x0003	FastPollTimeout	Uint16		M	Default value is 10 seconds

Start up, auto scan for client poll control cluster on the coordinator. If it is support on the coordinator an auto bind is created and the smoke sensor will send a check-in command in the interval specified in attribute "Check-in Interval. The coordinator has to reply with a check-in response. The sensor supports the following commands send from the client (Typically the coordinator).

- 0x00 Check-in Response,
- 0x01 Fast Poll Stop,
- 0x02 Set Long Poll Interval,
- 0x03 Set Short Poll Interval,

If it doesn't find a poll client it will search again periodically.

4.2.4 OTA Upgrade – Cluster id 0x0019

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

When the devices has joined a network it will automatically auto scan for a OTA upgrade server in the network. If it finds a server an auto bind is created and ones every 24 hour it will automatically send its "current file version" to the OTA upgrade server. It is the server that initiate the firmware upgrade process.

4.2.4.1 Attributes

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0000	UpgradeServerID	IEEE Address	-	M	
0x0001	FileOffset	Uint32	Type range	O	
0x0002	CurrentFileVersion	Uint32	Type range	O	
0x0003	CurrentZigBeeStackVersion	Uint16	Type range	O	
0x0004	DownloadedFileVersion	Uint32	Type range	O	
0x0005	DownloadedZigBeeStackVersion	Uint16	Type range	M	
0x0006	ImageUpgradeStatus	8 bit enum	0x00 to 0xFF	O	
0x0007	Manufacturer ID	Uint16	Type range	O	
0x0008	Image Type ID	Uint16	Type range	O	
0x0009	MinimumBlockRequestDelay	Uint16	Type range	O	

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

4.2.4.2 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

4.2.4.3 OTA Upgrade Messages Diagram
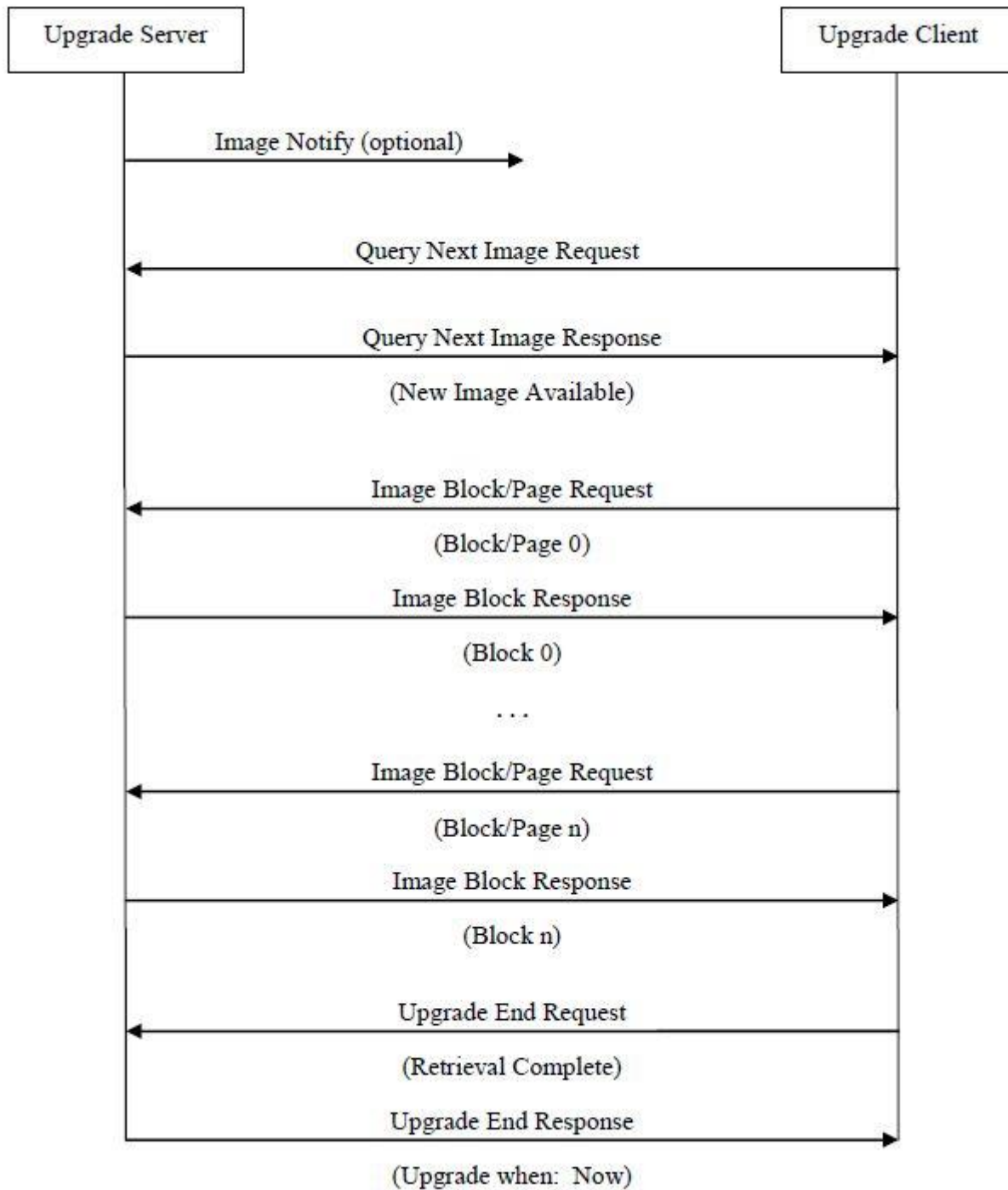
4.2.5   Time – Cluster id 0x000A

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 device will use this clusters as a client – provided that a suitable Time Server is available on the network (most likely on the Gateway).

4.2.5.1   Attribute

Id#	Name	type	Range	Man/Opt	Relevance and ref.
0x0000	Time	UTCTime (Uint32)	Type range	M	The module will periodically update its clock by synchronizing through this cluster
0x0001	TimeStatus	8 bit bitmap	00000xxx	M	

5 MMI user guide

5.1 Panel description

Symbol	Function
🔓 (closed lock)	Arm All Zones
🔓 (open lock)	Disarm
🏠	Arm Day/Home Zones Only
🛌	Arm Night/Sleep Zones Only
SOS	Emergency – Press button for 3 sec
X	Delete last symbol input from keypress
"0" to "9"	Input to Arm/Disarm code
LED 1	Arm All Zones: RED LED solid on for 30 sec Arm Day/Home Zones Only: RED LED solid on for 30 sec Arm Night/Sleep Zones Only: RED LED solid on for 30 sec Exit delay: Red LED flash slow along with beep In alarm: Red LED flash fast
LED 2	Network connection lost: Yellow LED flash when it scans for network to re-join

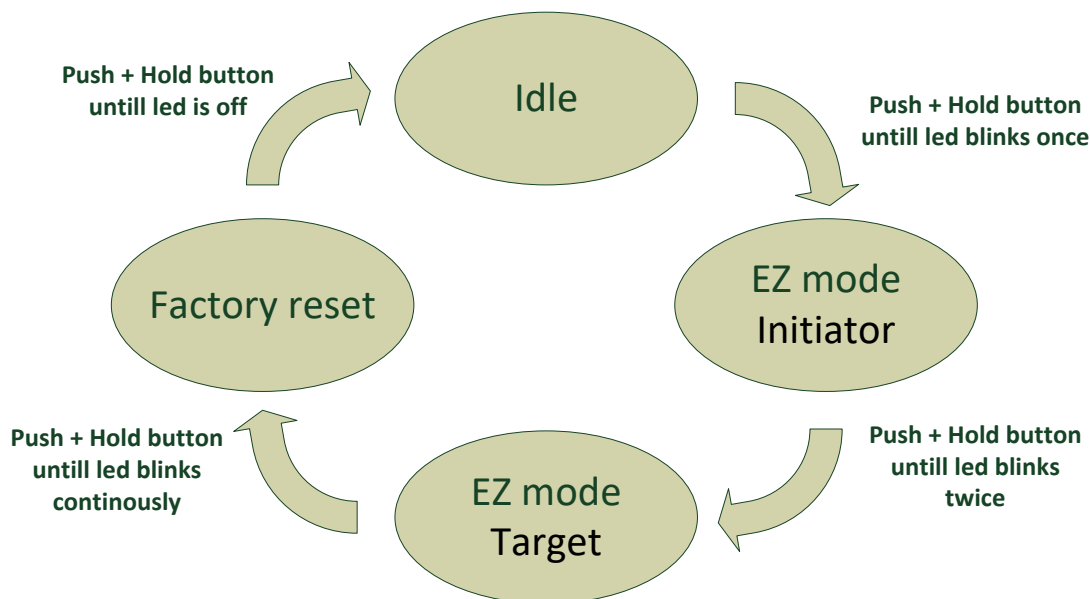|	
	Low battery: Yellow LED will blink 2x every 60 second
	Timeout since last input (5 sec): Yellow LED blink 3x
	Wrong PIN code: Yellow LED blink 3x
LED 3	Disarm: Green LED solid on for 3 sec
	Not ready to arm: Green LED solid on for 3 sec
	Entry delay: Green LED flash along with beep
Sensor	Presence Sensor + Light Sensor + RFID tag reader

5.2   Menu button

How to get access to the menu button on the keypad:
Open the casing of the device by removing the screw at the bottom of the device. The menu button is placed between the batteries and a thin pin (eg. a paper clip) can be used to activate the button.

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

Push + Hold button untill led is off → Idle
Idle → **Push + Hold button untill led blinks once** → EZ mode Initiator
EZ mode Initiator → **Push + Hold button untill led blinks twice** → EZ mode Target
EZ mode Target → **Push + Hold button untill led blinks continously** → Factory reset

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

5.2.1   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 PermitJoin 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:

* Power configuration cluster

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

5.2.2   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 PermitJoin 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.

5.2.3   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.

5.3   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 Yellow LED will flash while searching for a network to join

Once the device has joined the network, is will start scanning for an OTA server, Time server, Poll control 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.

6 General network behaviour

6.1 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 will scan each ZigBee channel starting from 11 to 24. The LED will flash once every second until it joins a device.

#Scan mode - 1	#Sleep mode	#Scan mode - 2	#Sleep mode	#Scan mode - 2
Scan all 16 ZigBee channel until join network or 15 minutes	MCU is in sleep mode (Radio off) 15 minutes	Scan all 16 ZigBee ch x 1 or until join network ~ 30 seconds	MCU is in sleep mode (Radio off) 15 minutes	Scan all 16 ZigBee ch x 1 or until join network ~ 30 seconds

The device will start up using scan mode 1. To increase battery lifetime when the device is joining a network for the first time a scan mode 2 will be used after scan mode 1 has expired. Scan mode 1 it will only be executed one time when the device is powered. If the user invokes EZ-mode it will start scanning the next 3 minutes

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 **"Reset To Factory Fresh Settings"** mode. This will erase all current network information.

6.2 Normal – Keep alive

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

6.2.1 Network lost

If no "keep alive" responses are received 5 times in a row (Worst case 1h15m), the devices will start scanning as specified in the table below.

When the device is in scan mode the YELLOW LED will flash once every second until it re-joins 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.

#Scan mode - 1	#Sleep mode	#Scan mode - 2	#Sleep mode	#Scan mode - 2
Scan current channel 3 times Scan remaining 15 channel 1 time Scan all 16 ch 3 times	MCU is in sleep mode (Radio off) 15 minutes	Scan current ch 3 times Scan remaining 15 channel 1 time	MCU is in sleep mode (Radio off) 15 minutes	Scan current channel 3 times Scan remaining 15 channel 1 time

6.3   Low battery

The current battery voltage can be read from the power configuration cluster described in section 4.3.1. The attribute "*BatteryVoltage*" is measuring the battery voltage, in units of 100mV.

Low batt LED indication – YELLOW LED will blink twice every 60 second

7 Specifications

General	
Dimensions (L x B x H)	90 x 90 x 22 mm
Colour	White – Optional black
Battery	Battery: 4 x AA Alkaline
Battery life	12 Months (Normal usage)
Radio	Sensitivity: -100 dBm
	Output power: +8 dBm (EU)
Environment	IP class: IP65
	Operation temperature 0 to +50˚C
Function	
Presence	Detection of person present within 5 – 10 cm Detection interval 500 ms (1s reaction)
RFID	Mifare reader Reading distance ~5 cm
Keypad	'0' – '9' + 6 function buttons Backlight: On when unit active (person present) and light level low
Communication	
Wireless protocol	ZigBee 3.0
	ZigBee end-device
Certifications	
	Conforming to CE, RoHS and REACH directives

8   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