



EMI Norwegian HAN - EMIZB-132

Technical manual

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1 Cautionary notes

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2 Features

2.1 Emi Norwegian HAN - EMIZB-132

Develco Products' EMI Norwegian HAN is compatible with Norwegian electricity meters with enabled HAN interface. It collects information and readings from the meter, and this data is sent via ZigBee communication to the ZigBee Gateway. This enables the user to follow the energy consumption, either through a computer or mobile phone. Apart from energy awareness, these data can be used for advanced load-shifting. The EMI Norwegian HAN is customised to Norwegian power meters, and follows the Norwegian HAN standard.

2.2 Key features

Key features are:

- Compatible with Norwegian HAN interface
- Metering devices supporting electrical measurement + metering cluster
- Tunnel is supported to read manufacture specific protocol data
- It is easy to install the EMI Norwegian HAN, since the user only have to put the plug in the installed electricity meter.
- All data can be collected by a ZigBee gateway. The ZigBee profile secures high security in order to protect personal data and prevent hacking. The HAN Interface is OTA upgradable, which increases the longevity of the product.
- RoHS compliant according to the EU Directive 2002/95/EC.
- Standard ZigBee Home Automation security and stack settings are used

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 Metering Device

- End point number 0x02
- Application profile Id 0x0104 (Home Automation)
- Application device Id 0x0053 (MeterInterface)

3.3 Develco Utility

- Application profile Id 0xC0C9 (Develco Products private profile)
- Application device Id 0x0001
- Manufacturer 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>

4 Supported Clusters

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

4.1 Metering Device – EP 0x02

4.1.1 Basic – Cluster id 0x0000

4.1.1.1 Attribute

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0000	ZCLVersion	UInt8	Type range	M	
0x0004	ManufacturerName	String	0-32 byte	O	4.1.1.1.1
0x0005	ModelIdentifier	String	0-32 byte	O	4.1.1.1.2
0x0006	DateCode	String	0-32 byte	O	
0x0007	PowerSource	8 bit enum	Type range	M	

4.1.1.1.1 ManufacturerName

"Develco Products A/S"

4.1.1.1.2 ModelIdentifier

"EMIZB-132"

4.1.1.2 Manufacture Specific Attribute

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x8000	PrimarySwVersion	OctetString		M	SW version
0x8010	PrimaryBootloaderSwVersion	OctetString		M	Bootloader SW version
0x8020	PrimaryHwVersion	OctetString		M	HW version

ZCL header setting – Manufacturer code for Develco Products is 0x1015.

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	
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	

4.1.3 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.

4.1.3.1 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	7.5 seconds
0x0002	ShortPollIntervall	Uint16		M	Default value is 3 seconds
0x0003	FastPollTimeout	Uint16		M	Default value is 5 minutes

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 EMI will send a check-in command in the interval specified in attribute "Check-inInterval. 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 Metering – Cluster id 0x0702

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

4.2.1 0x00 Reading Information attribute set

Id#	Name	Type	Range	SE Req.	Relevance and ref.
0x00	CurrentSummationDelivered	Uint48	Type range	M	Recent summed value of Energy delivered.
0x01	CurrentSummationReceived	Uint48	Type range	O	Recent summed value of Energy generated.

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.

4.2.2 0x01 TOU Information attribute set

No attributes are support in this set.

4.2.3 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.

4.2.3.1 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

Bit 0 - Signifies a problem with the communication between the meter and the EMI

4.2.4 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 *SummationFormatting*, *ConsumptionFormatting*, and *DemandFormatting* attributes. Equations required to accomplish this task are defined below:

Summation = Summation received * Multiplier / Divisor
(formatted using *SummationFormatting*)

Consumption = Summation received * Multiplier / Divisor
(formatted using *ConsumptionFormatting*)

Demand = Demand received * Multiplier / Divisor
(formatted using *DemandFormatting*)

If the Multiplier and Divisor attribute values are zero, just the formatting hints defined in *SummationFormatting*, *ConsumptionFormatting*, and *DemandFormatting* 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 *SummationFormatting*, *ConsumptionFormatting*, and *DemandFormatting* attributes.

Id#	Name	Type	Range	Man /Opt	Relevance and ref.
0x00	UnitofMeasure	8 bit enum	0x00 to 0xFF	M	Fixed to 0x00 (kW/kWh in pure binary format)
0x01	Multiplier	Uint24	0x000000 to 0xFFFFFFFF	O	Fixed to 1
0x02	Divisor	Uint24	0x000000 to 0xFFFFFFFF	O	Fixed to 1000
0x03	SummationFormatting	8 bit bitmap	0x00 to 0xFF	M	Fixed to 0xF8 (0 digits to the right of the decimal point)
0x06	MeteringDeviceType	8 bit bitmap	0x00 to 0xFF	M	Fixed to 0x00 (Electric Meter)
0x08	MeterSerialNumber	Octet String	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.

4.2.5 0x04 Historical attribute set

Id#	Name	Type	Range	Man /Opt	Relevance and ref.
0x00	InstantaneousDemand	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.

4.2.6 Metering cluster - Manufacture Specific Attributes

Develco Manufacture code is 0x1015.

MFG attribute id 0x0302 – Interface mode	
Attribute value	Description
0x0200	Norwegian HAN
0x0201	Norwegian HAN – Enable extra load. This is need to enable Adion meter communication
0x0202	Aidon Meter supporting Norwegian HAN HW interface. SW protocol is Aidon Manufacture Specific
0x0203	Kaifa meter and Kamstrup meters running old firmware

4.2.7 SE Tunneling – Cluster id 0x0704

The tunneling cluster provides an interface for tunneling a manufacture protocol. It is comprised of commands and attributes required to transport a manufacture protocol within the payload of standard ZigBee frames (including handling of fragmentation).

The Tunneling cluster has 1 attribute set defined. In the following section the set is listed. Refer to the ZigBee specification of the Tunneling cluster.

4.2.7.1 Attribute

Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0001	CloseTunnelTimeout	Uint16	0x0000 - 0xFFFF	M	Read only – value set to 1 hour

4.2.7.2 Tunnel Cluster Commands

The Tunnel Server cluster can receive the following commands

Id#	Name	Man /Opt	Relevance and ref.
0x00	RequestTunnel	M	SE specification section D.6.2.4
0x01	CloseTunnel	M	SE specification section D.6.2.4

The Tunnel Server cluster can generate the following commands

Id#	Name	Man /Opt	Relevance and ref.
0x00	RequestTunnelRsp	M	SE specification section D.6.2.5

4.3 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	MeasurementType	BitMap32	O	Section 4.3.1
0x0304	TotalActivePower	Int32	O	
0x0305	TotalReactivePower	Int32	O	
0x0402	PowerMultiplier	UInt32	O	Fixed to 1
0x0403	PowerDivisor	UInt32	O	Fixed to 1000
0x0505	RMSVoltagePhA	UInt16	O	L1 - Volts (V)
0x0508	RMSCurrentPhA	UInt16	O	L1 - Amps (A)
0x0600	ACVoltageMultiplier	UInt16	O	Depending on attached meter
0x0601	ACVoltageDivisor	UInt16	O	Depending on attached meter
0x0602	ACCurrentMultiplier	UInt16	O	Depending on attached meter
0x0603	ACCurrentDivisor	UInt16	O	Depending on attached meter
0x0905	RMSVoltagePhB	UInt16	O	Fixed to 1
0x0908	RMSCurrentPhB	UInt16	O	Fixed to 1
0x0A05	RMSVoltagePhC	UInt16	O	Fixed to 1
0x0A08	RMSCurrentPhC	UInt16	O	Fixed to 1

4.3.1 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

4.3.2 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 an OTA upgrade server in the network. If it finds a server then ones every 24 hour it will automatically send its "current file version" to the OTA upgrade server.

Note: It is the server that initiates the firmware upgrade process.

4.3.2.1 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	0	
0x0009	MinimumBlockRequestDelay	Uint16	Type range	0	

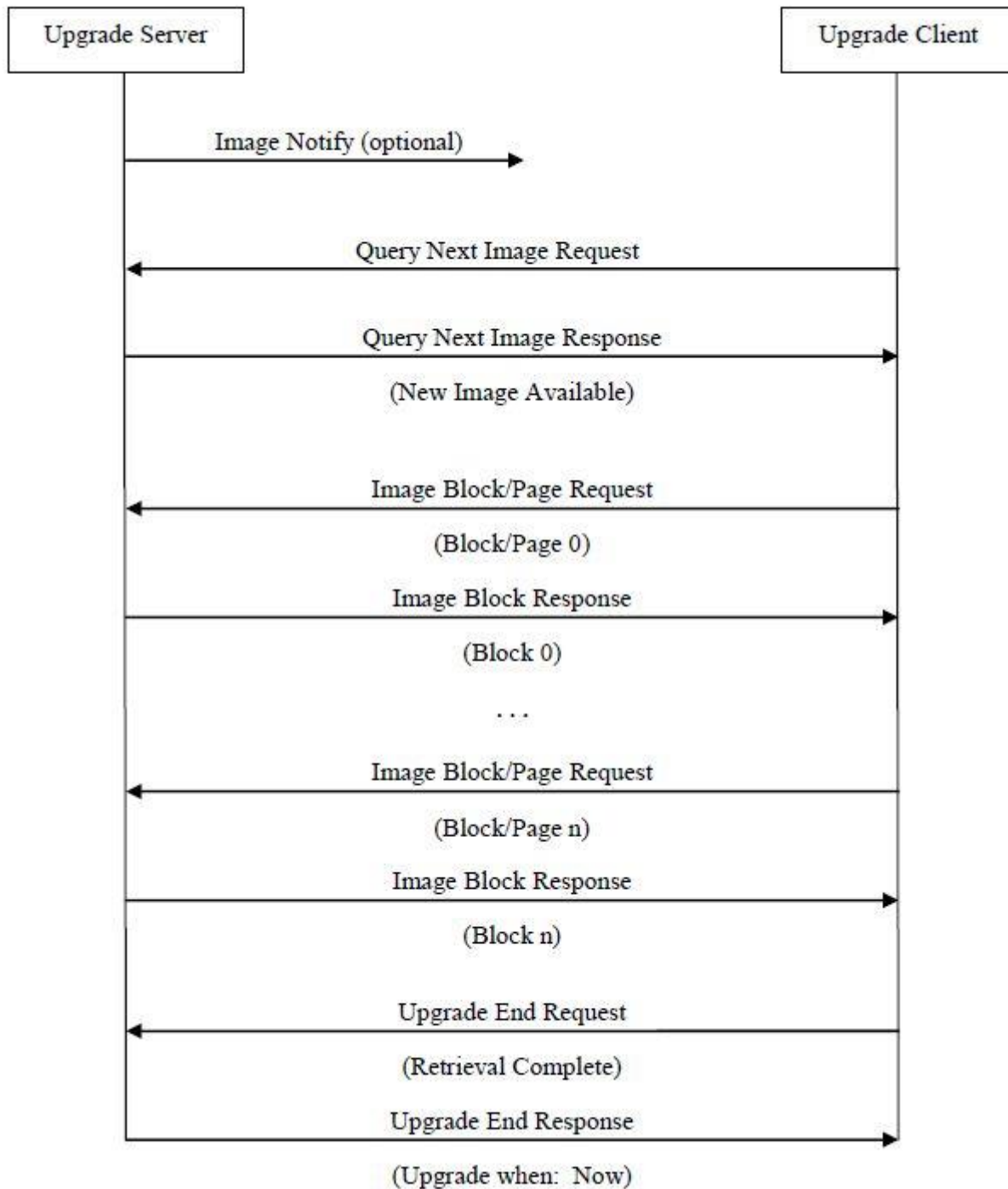
Above attribute description is to be found in section 6.7 "OTA Cluster Attributes" in ZigBee document – "zigbee-ota-upgrade-cluster-specification" provided by the ZigBee alliance.

4.3.2.2 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

4.3.2.3 OTA Upgrade Messages Diagram



4.3.3 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 the 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 coordinator in the network.

4.3.3.1 Attribute

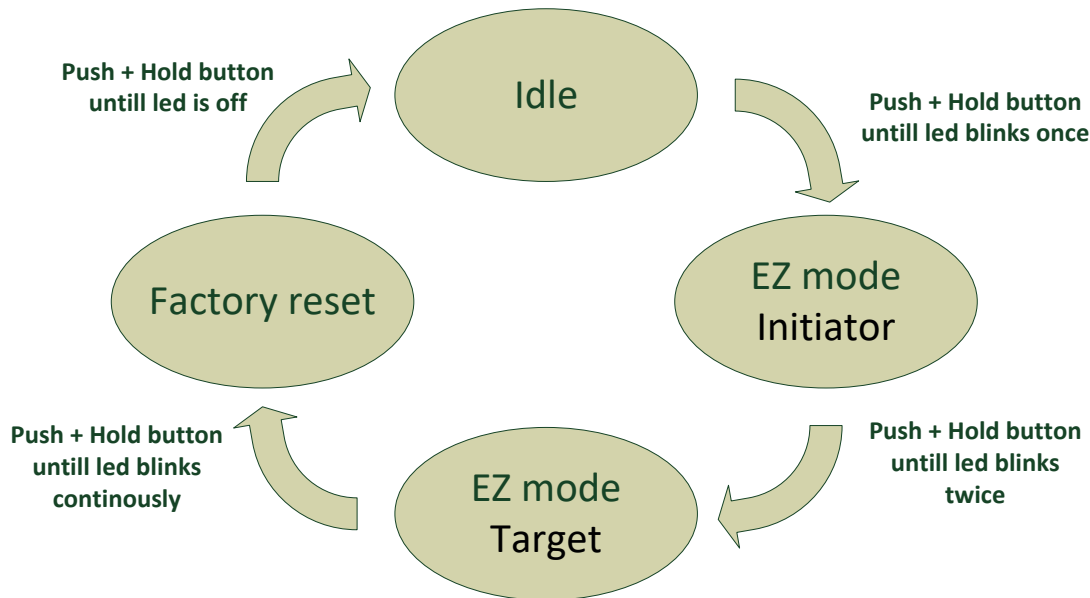
Id#	Name	Type	Range	Man/Opt	Relevance and ref.
0x0000	Time	UTCTime (Uint32)	Type range	M	The module will periodically update its clock by synchronizing through this cluster
0x0001	TimeStatus	8 bit bitmap	00000xxx	M	

5 MMI user guide

5.1 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.

5.1.1 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 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:

- Metering cluster
- Electrical Measurement 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.

5.1.2 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 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.

5.1.3 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.

5.2 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 and Poll control 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 channels 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 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 ch 3 times Scan remaining 15 ch 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 ch 1 time	MCU is in sleep mode (Radio off) 15 minutes	Scan current ch 3 times Scan remaining 15 ch 1 time

7 Specifications

General	
Dimensions (Ø x H)	Ø 30 x 90 x 18 mm
Colour	White
Cable length	800mm
Power supply	Supplied by the HAN interface
Radio	Sensitivity: -94 dBm
	Output power: +8 dBm
Environment	IP class: IP40
	Operation temperature 0 to +50°C
Interfaces	
Norwegian HAN interface	Range: 0 to 100% RH
Hardware	Based on EN13757-2
Software	Based on IEC 62056-7
Communication	
Wireless protocol	ZigBee Home Automation 1.2 compliant
	ZigBee end-device
Certifications	
	Conforming to CE, RoHS and RED directive

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.
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QUALITY SYSTEM
DS/EN
ISO 9001

