QEES Ring

Technical manual

Version 1.0

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1. General Information

Table 1. Dimensions

Color	Black
Size	53x33x12 (HxWxD)

Table 2. Technical Specification

Power Supply	1 CR2032 Cell
Battery Life Time	Approx. 1 Year
Number of LEDs	1 (dual color red/green)
MCU	ZW0301 (Z-Wave)

Table 3. Operation

Local	5 Buttons
Radio	ZM3102, 908MHz, Z-Wave certified

Table 4. Installation

Working environment	5 - 55 Degrees Celsius (Non Condensing)(indoor use only)(IP40)

Table 5. Other

Approvals	EMC, CE, RoHS, Z-Wave

1.1. Functionality
The QEES Ring is a fully functional Z-Wave remote controller, with Z-Wave administrative, on/off and light dimming capabilities. As a standalone product the device is capable of setting up a Z-Wave network with other devices regardless of vendor, functioning as primary, secondary and inclusion controller. Together with the QEES Master, the QEES Ring becomes capable of controlling non-listening devices as well, such as most battery driven devices.

1.2. Leds
The QEES Ring has one dual color LED, Red and Green. The LED are used to indicate status of such thinks as Add Node , Remove Node , Learn Mode , Controller Change and Controlled Associations. The Red LED indicates busy or error. After a successful administrative task the Green LED will be on for approx. 2 seconds. In case of an error the Red LED will on for approx. 2 seconds.

1.3. Buttons
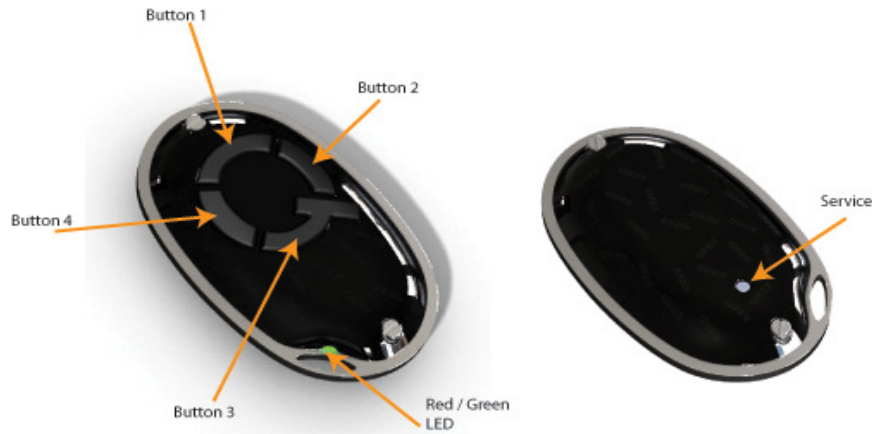
The QEES Ring is equipped with 5 buttons, which can distinguish between short and long presses (also called clicks and holds) and combinations. A press is considered a hold when it is longer than 400 ms. When combinations of presses on a single button are needed, for instance a double click, each press needs to happen within 500 ms of each other, otherwise they will be considered separate sequences, in this case two single clicks. Similarly combinations of presses involving multiple buttons need to happen within 1000 ms of each other. These values are all configurable through Z-Wave, see Section 2.2.4, "Configuration".

Button 1 to 4 is normal operation buttons. The service button, placed on the backside, is used for special administrative actions.

Each Sequence of Button Presses is tied to an Association Group and each Association Group is linked to a Z-Wave Command . When the sequence is pressed, the group is activated and the command is send to the associated nodes.

The following table lists the possible operations on the buttons and the associated groups:

Table 6. Button to Group Relationship

Button	Groups
1	1
2	2
3	3
4	4

The following table shows what administrative actions the button sequences activate:

Table 7. Button Sequence Administrative Action Relationship

Button sequence	Actions
Click (Service)	Start add node
Double Click (Service)	Start remove node
Click (Service) followed by Click (1-4)	Button learn (1-4)

Double Click (Service) followed by Click (1-4)	Button clear (1-4)
Triple Click (Service)	Start learn mode (Self). Include controller as secondary or inclusion controller in a foreign network.
Click (Service) followed by Hold (Service)	Send node information
Hold (Service)	Send Wakeup
Triple Click (Service) followed by Click (3)	Start controller change
Triple Click (Service) followed by Double Click (4)	Factory reset

1.3.1 Factory Reset

This action should only be used as a last resort since it will leave the rest of the Z-Wave network in an undefined state. A better option is to use a controller, which is part of the network, to exclude the device, see Section 2.7, "Learn Mode". Factory reset will set the device back to the configuration and state it had from the factory. When done the Green LED will turn on for approx.2 seconds to confirm the action.

1.3.2 Time-out and Cancel

Any operation that is waiting for a user interaction, this could be Add Node , Remove Node , Learn Mode , etc. has a timeout value of 10 seconds, hereafter it will simply cancel. It is also possible to manually cancel the operation, by pressing any button which is not part of the operation.

2. Z-Wave

2.1 Device Information

Table 8. General Information

Z-Wave Developer's Kit Version	5.01 SP1
API Library	zw_controller_portable_zw030xs.lib
Chip	ZW0301 Single Chip
Z-Wave Device Class Version	13
RF Operating Frequency	868,42 MHz (EU)
Basic Type	Controller
Generic Device Type	Generic Controller
Specific Type	Portable Remote Controller
Listening	No
Optional Functionality	Yes

2.2. Supported Command Classes

The following subchapters list the supported command classes, with information specific to the device.

2.2.1. Association

Supported command class version is 1. The number of supported groupings is 4. The maximum number of nodes per group is 30, if a group reaches this amount of associations, further attempts to associate will result in an error, and the request being ignored. Only node ids within the legal range (1-232) will be

accepted, if an Association Set contains a node id outside this range the request will be ignored and result in an error.

The following table lists the Z-Wave Commands send to the nodes in each group when they are activated:

Table 9. Groups and Commands

Button sequence	Groups	Command
Single click	1-4	COMMAND_CLASS_BASIC
		BASIC_SET
		0xFF
Double click	1-4	COMMAND_CLASS_BASIC
		BASIC_SET
		0x00
Hold	1-4	COMMAND_CLASS_SWITCH_MULTILEVEL
		SWITCH_MULTILEVEL_START_LEVEL_CHANGE
		0x20
		0x00
Click followed by Hold	1-4	COMMAND_CLASS_SWITCH_MULTILEVEL
		SWITCH_MULTILEVEL_START_LEVEL_CHANGE
		0x60
		0x00
Release	1-4	COMMAND_CLASS_SWITCH_MULTILEVEL
		SWITCH_MULTILEVEL_STOP_LEVEL_CHANGE

All commands are multicast with acknowledge option on. If a device is removed from the network by the QEES Ring or any other controller in the network, all associations with the QEES Ring are removed.

2.2.3. Battery
Supported command class version is 1. The device will respond with Battery Low Warning on Battery Gets if levels reach less than approximately 20% of the battery.

2.2.4. Configuration
Currently no documented configuration parameters exist.

2.2.5. Manufacture Specific
The Manufacture command class is supported and will return a report with the following data:

Table 12. Manufacture report

Field	Value
MANUFACTURER_ID1	0x00
MANUFACTURER_ID2	0x95
PRODUCT_TYPE_ID1	0x00

PRODUCT_TYPE_ID2	0x01
PRODUCT_ID1	0x00
PRODUCT_ID2	0x01

2.2.6. Version

Supported command class version is 1. The Version command class makes it possible to read version information from the device. This includes Z-Wave library type, protocol version, command class versions and the application software version.

When requesting the version information using Version Get, the device will respond with the following:

Table 13. Version Report

Z-Wave Library Type	0xXX
Z-Wave Protocol Version	0xXX
Z-Wave Protocol Sub Version	0xXX
Application Version	0xXX
Application Sub Version	0xXX

2.2.7. Wake Up

Supported command class version is 2.

Table 14. Wake Up Capabilities

Minimum Wake Up Interval Seconds	0x000100
Maximum Wake Up Interval Seconds	0x00FF00
Default Wake Up Interval Seconds	0x000E00
Wake Up Interval Step Seconds	0x000100

Note: The device will just use the middle byte when setting intervals, so illegal intervals can still result in changes in wake up behavior. Warning: Setting interval to 0 will disable wake up. Wake Up Notifications will then no longer be possible, except by using the service button to manual force a wakeup frame.

The device will stay awake for 3 seconds after a wake up has been notified or a packet has been received. So each packet received by the device will prolong the time awake by 3 seconds. The QEES Ring will go to sleep immediately when receiving a Wake Up No More Information or if the wake up isn't notified successfully.

Setting wake up node to 0xFF will make the device broadcast its Wake Up Notifications, this is also the default setting.

If the wake up node is removed from the network by the QEES Ring itself or any other controller, the wake up node will be set back to the broadcast address.

2.3. Controlled Command Classes

The following chapter lists the controlled command class with information specific to the device. The listed command classes are those that are available when using the remote as a standalone product and exposed through normal associations and button presses.

2.3.1. Basic

Controlled command class version is 1. The QEES Ring sends Basic Set with the value 0xFF and 0x00 to nodes associated with group 1-4, upon click and double clicks. See Table 9, "Groups and Commands".

2.3.2 Multilevel Switch

Controlled command class version is 1. The QEES Ring sends Multilevel Switch Start Level Change to nodes associated with group 1-4, upon hold and click hold. Multilevel Switch Stop Level Change are send upon button release. See Table 9, "Groups and Commands".

2.4. Add Node

The QEES Ring I capable of including other nodes (Controllers or Slaves) into the Z-Wave network by starting the Z-Wave add node process, see Table 7, "Button Sequence Administrative Action Relationship" . The process uses normal TX power. Low power inclusion is not possible. The Green LED will flash once a second when the QEES Ring is ready to receive information from the device to be included. Learn Mode must then be started on the target device. When the QEES Ring detects the presents of a target device, the state immediately changes to busy and a lot of protocol information is exchanged. When done successfully the Green LED will turn on for 2 seconds. In case of an error the Red LED will turn on for 2 seconds. In case of failures one should generally exclude the device before trying to include it again because the state of the device is somewhat uncertain.

The remote will try to set any included static controller to SUC/SIS if there is no such device already.

The time awake is extended following a successfully node inclusion. See Section 2.12.1, "Extended Awake Time".

2.5. Remove node

The QEES Ring is capable of excluding other nodes (controllers or slaves) in the Z-Wave network by starting the Z-Wave remove node process, see Table 7, "Button Sequence Administrative Action Relationship" . The process uses normal TX power. Low power exclusion is not possible. The Green LED will flash twice a second when the QEES Ring is ready to receive information from the device to be excluded. Learn mode must then be started on the target device. When the QEES Ring detects the target device, the state immediately changes to busy and protocol information is exchanged. When done successfully the Green LED will turn on for 2 seconds. In case of an error the Red LED will turn on for 2 seconds. In case of failure, repeat the process.

2.6. Controller Change

The QEES Ring can perform a Controller Change, provided it is a Primary Controller in the Z-Wave network, by starting the Z-Wave Controller Change process, see Table 7, "Button Sequence Administrative Action Relationship" . The process uses normal TX power. Low power Controller Change is not possible.

The Red LED will flash three times each second indicating the QEES Ring is ready to receive information from the device to become the new Primary Controller. Learn Mode must then be started on this device. When the QEES Ring detects the new controller, the state immediately changes to busy and protocol information is exchanged. When done successfully the Green LED will turn on for 2 seconds. In case of an error the Red LED will turn on for 2 seconds. In case of failure, repeat the process.

The time awake is extended following a successfully controller change. See Section 2.12.1, "Extended Awake Time".

2.7. Learn Mode (include self)

The QEES Ring can be added to a foreign Z-Wave network or be removed from a Z-Wave network or made a Primary Controller by setting it in Learn Mode, see Table 7, "Button Sequence Administrative Action Relationship" . Another Inclusion Controller (needs to be primary if it's a Controller Change) is needed to initiate the process. The controller needs to be put in add node, remove node or controller change state, see the device manual for how this is done. When ready the QEES Ring will flash the Green LED three times each second. Once the other controller is detected, the state will change to busy lighting both the Red and Green LED continuously until the process is done. The state is changed to confirm and the Green LED will be on for 2 seconds indicating the process completed successfully. In case of an error the Red LED will be on for 2 seconds. Learn Mode will time out if no other controller is detected within 10 seconds.

When excluded the device is put into Factory Default state resetting all protocol and application data to defaults.

The time awake is extended following a successfully inclusion of the QEES Ring itself. See Section 2.12.1, "Extended Awake Time".

2.8. Send Wake Up Notification

Wake up notifications are send every time the QEES Ring wakes up. To change default wake up time and other options please refer to section 2.2.7. "Wake Up".

To manual force a wakeup package, hold the service button. See table 7.

2.9. Send Node Information

The QEES Ring can be forced to send a Z-Wave Node Information Frame, see Table 7, "Button Sequence Administrative Action Relationship". The QEES Ring confirms the action by turning on the Green LED for 2 seconds.

The time awake is extended following send *note information*. See Section 2.12.1, "Extended Awake Time".

2.10. Configure Buttons

This describes how the buttons, on the QEES Ring, can be configured to control other Z-Wave devices. There are two primary operations the user can perform in relation to configuring buttons, see Table 7, "Button Sequence Administrative Action Relationship". Button learn describes the process of adding or removing a single device from a button. Button delete removes all devices linked to a specific button. Only the buttons 1-4 can be configured.

2.10.1. Button Learn

Table 7, "Button Sequence Administrative Action Relationship" shows how to activate button learn, when activated both the Red and Green LED will be flashing once a second. This indicates that the QEES Ring is ready to accept a Node Information frame from the target device, see the specific device manual for instructions on how to activate leaning state. When the QEES ring receives a Node Information frame it will check whether the target device is already in any of the affected groups, if so it would be removed, otherwise it is added to the button. During the learn process the QEES Ring will indicate busy. At the end of the learn process the QEES Ring will indicate either success or failure.

Note there is a limited amount of room for devices in each group, see Section 2.2.1, "Association". Add a device to a group with no more room for new devices will result in an error.

2.10.2. Button Clear

Table 7, "Button Sequence Administrative Action Relationship" shows how to clear the contents of a button. Every node associated with the selected button deleted by this action. Please note that the no devices are excluded from the Z-Wave network during the process.

2.11. Network Topology Updates

The device can use a Static Update Controller to keep its routes up to date. The QEES Ring will request the SUC for updates two times a day if one is present.

2.12. Non-Listening

Since the QEES Ring isn't normally listening, the device is said to be "sleeping" to save power, communication with the device is only possible at specific times, limited to the time after a successful Add Node , Remove Node , Controller Change , Learn Mode , Send Node Information Frame and Send Wake Up Notification . It is possible to communicate with the device at other times as well, but these are periods where the device is guaranteed to at least stay awake for a while.

This also means the QEES Ring cannot function as a repeater in the Z-Wave network.

3. Assembly

P/N: 0110000-01

P/N: 0110001-01

P/N: 0110001-02

P/N: 0110100-03

P/N: 0110000-04

P/N: 0110000-05

P/N: 0110000-02