

**SE Devices - FWC01 v3.0**

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# **Wheel Controller Z-Wave**

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**User Manual**

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## Introduction

The SE Devices Wheel Controller Z-Wave is a modular Wall-Box mountable control wheel, which is controllable over a Z-Wave Home Automation Network. The device can be added to and remote controlled via a Z-Wave Home Automation network. This product can be operated in any Z-Wave network with other Z-Wave certified devices from other manufacturers. All non-battery operated nodes within the network will act as repeaters regardless of vendor to increase reliability of the network.

The Wheel Controller unit itself can be combined with a Back Unit hidden inside a wall-box to provide local control possibilities. It can also operate in a Stand-Alone mode, powered via a Cascade connector to another unit (Multifunction Switch or Wheel Controller).

There are a variety of Back Units available for the Wheel, which can provide Local control functionality such as Relay Control and Dimming.



The Wheel is backed by 4 push buttons, located at the Upper, Lower, Left and Right sides of the wheel. By pushing on these points of the wheel, the various functions of the wheel can be accessed and controlled.

The Wheel can be rotated in a clockwise and counter clockwise direction to control the Light Level or adjust temperature settings for the Thermostat. The current operation is shown in the display at all times. When used as a Thermostat, the display will show information on thermostat operation when the device is Idle. If the device only controls Light, the display will show a Light Bulb and the current Light level.

## **DISCLAIMER and WARNINGS**

The SE Devices Modular Z-Wave Devices (included but not limited to the Wheel Controller Z-Wave) are powered from Mains voltage (230V), and **MUST ONLY** be installed by authorized electricians. Mains Voltage is very dangerous and can cause serious injury or death if mishandled. If the devices are not correctly installed, the devices can in the worst case pose a fire hazard.

SE Devices can **NOT** be held responsible for injuries or accidents resulting from incorrect installation and configuration, or installations performed by unauthorized installers.

The SE Devices units provide a Floor Max temperature setting. This is a safety feature used for protecting wooden floors from overheating, as excessive floor heat can cause wooden floors to warp and eventually crack. **ALWAYS** use a Floor Temperature sensor in installations controlling floor heating for wooden floors, and configure the Floor MAX temperature according to the floor manufacturer recommendation. Due to the fact that the location of a floor sensor may make it impossible to get representable temperature readings for the entire floor surface, it is highly recommended to never set the MAX higher than 25 degrees unless it is absolutely necessary. Due to this same fact, SE Devices can not be held responsible for any damage to heated floors controlled by the thermostat functionality of the devices, even when configuration and installation is technically correct. Always hire professionals to install floors and floor heating, to reduce the risk of damage caused by the heating system.

## **Assembly and Installation**

Please refer to the “Modular Z-Wave Devices” Installation Manual, for information on device assembly and installation.

## Basic Default Operation

When the Wheel Controller is installed and powered on, the device will provide default functionality depending on which Back Unit it is connected to.

- **Dimmer Back Unit** – The Wheel Controller will operate as a Dimmer Wheel, where the wheel can be turned to adjust the dimmer level. Light is turned ON and OFF by pushing the Upper and Lower part of the wheel respectively.
- **Relay Back Unit** – The Wheel Controller is configured as a Heating Thermostat unit, and requires a Temperature Sensor (Floor or/and Room sensors) to operate.

The device also supports Central Scene control by default. The Central Scene mode can be selected by pushing on the Left or Right side of the wheel. Specific scenes can be selected by pushing Up or Down when the Central Scene mode is active in the Display.

In order to enable other and more advanced functionality, the Device must be included to a Z-Wave network. This makes it possible to change the device configuration, to activate more advanced functionality.

The Wheel Controller is a Security Enabled Z-Wave Plus Product. A Security Enabled Z-Wave Controller must be used to fully utilize the product.

## Light Control Mode

If the Light Control mode is activated, this mode is the default mode active when the wheel is operated. The Light can be turned ON and OFF by pushing the Upper and Lower part of the wheel respectively. To control the Light level, simply turn the wheel clockwise to dim up and counter-clockwise to dim down. The current level is indicated by the circular border on the Screen from 1% (no border) to 100% level.

Please note that the Light Level can also be controlled in OFF mode. The selected level will then become active when the Light is Switched ON.



Light Control Screens in ON and OFF mode

## Heating Thermostat Control Mode

The thermostat control screen can be accessed directly by pushing Left on the Wheel Controller. By default, the Thermostat is in OFF mode, and must be Turned ON before a temperature can be set. The Thermostat supports both Room and Floor Heating, and indicates the current heating type in the Display. The Thermostat is controlled in the following way:

**In OFF Mode:** Display shows OFF

- **Push and Hold UP to turn the Thermostat ON** – The current Set-Point temperature is displayed when the Thermostat is in ON mode

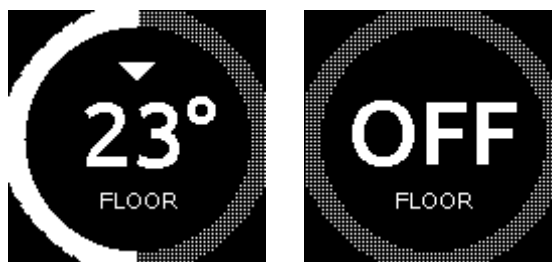
**In ON Mode:** Display shows the Set-Point temperature

- **Do a short push UP to edit the Set-Point** – The displayed Set-Point starts blinking.
  - o Turn the Wheel to change the Set-Point Up or Down (Clockwise and Counter Clockwise)
  - o To select the Set-Point temperature, **Push and Hold UP** until the Set-Point stops blinking.
  - o To abort the temperature change, do a short push DOWN.
- **Push and Hold DOWN to turn the Thermostat OFF** – The Display will show OFF when the mode changes.

NOTE! Push and Hold actions are implemented to avoid accidental Mode and Temperature changes when the Wheel is operated.

After a while, the Display will revert to the [Home Screen](#), where the new Mode or Set-Point is displayed. The circular border indicates the current temperature in relation to the Set-Point. Also the current operational state of the Thermostat is displayed with Arrow Icons. The Arrow Icons have the following meaning:

- **No Arrow or Icon** – The thermostat Set-Point is reached, and the Heating Relay is switched OFF
- **Arrow Pointing UP** – The Thermostat have enabled heating, and the Heating Relay is switched ON
- **Arrow Pointing DOWN** – The measured temperature is higher than the Set-Point, and the thermostat have switched OFF the Heating Relay to let the temperature sink.
- **Circular Point** – This indicates that the Thermostat is in Auxiliary mode, described in the next section.



Thermostat Home Screen in ON and OFF mode. Floor heating is indicated here.

## Thermostat Auxiliary Mode

This Mode is accessible via Z-Wave only, and is used by controllers if multiple heating or cooling systems are controlled in the same room or affect the same area. For instance, in a room with both electrical heating and an air condition system, the heating and air condition would work against each other if both were active at the same time. The Auxiliary mode is indicated with a circular Icon above the Set-Point temperature when active.

To avoid this problem, the Thermostat can be placed in Auxiliary mode, in cases where the controller decides that cooling should be used instead of heating. Enabling auxiliary mode will in effect make the Thermostat switch off any controlled heating sources, but retain the Set-Point and continue to

report measured temperatures. The user can still change the Set-Point as normal using the Wheel Controller, and changes are reported to any associated devices. But the change will not cause the controlled heating sources to switch on until the Controller sets the Thermostat back to Heat mode.

As mentioned, the mode can only be enabled over Z-Wave. But it is fully possible to disable this mode manually if required. This is done by simply turning the Thermostat OFF and then Back ON again. Then the Thermostat will return to Heat mode, and the Set-Point temperature is the same as before.

Other possible use cases for Auxiliary mode include (but not limited to):

- Avoid Heating and Cooling systems conflicts (running at the same time)
- Load distribution in order to avoid all heating circuits running at the same time
- Distributing heating to other systems, such as Gas, Central or Water based heating, based on which is cheapest or most effective at any point.

It's important to know that this have to be controlled by a centralized system, which orchestrates the systems via the Z-Wave Controller and possibly other control networks.

## Central Scene Mode

In addition to the default mode, the device also has a Central Scene mode enabled by default. This mode can be accessed by pushing on the Left or Right side of the wheel.

The device supports control of up to 4 separate Scenes, grouped two and two. You can select which group to use by turning the wheel clockwise (forward) and counter-clockwise (backwards). The Scenes are grouped as follows:

- **Home Scenes (default when mode is activated)**
  - Scene 1 – **Home (up)**
  - Scene 2 – **Away (down)**
- **Day Scenes**
  - Scene 3 – **Day (up)**
  - Scene 4 – **Night (down)**

In order to control other devices using Scene commands, the device must be included to a Z-Wave controller which supports Central Scenes. The Scenes can be assigned to any functionality, but the icons and Scene names in the display are fixed.

### Display Navigation and Controls

By default the Wheel Controller have two functions active; the main function (Lightcontrol or Thermostat) and Central Scene mode. Rotation of the Wheel, and Up or Down pushes always affect the currently active function.

The device is however fully configurable to which modes should be active at any time, and the device can have the following modes active in any combination:

- Thermostat Control
- Light Control of up to four (4) separate Light Zones
- Central Scene Controller, with support for 4 scenes

When multiple modes are enabled, you can push Left or Right on the Wheel to cycle through all available control screens.

When the Wheel is Idle (no user input for a while), the Default Screen is displayed. This screen either displays the current Thermostat status if Thermostat mode is enabled, or the Main Light control screen if the Thermostat mode is not enabled. If both Thermostat and Light Control is actively disabled, the Central Scene mode will be displayed exclusively.

When any Light Control mode is enabled, turning the Wheel or Pushing UP or DOWN directly affects the Main Light Zone.

Pushing Left on the Wheel from the Default Screen will always show the Thermostat Control screen first (if enabled). Pushing Right on the Wheel will always cycle through all Light Zones first. Continuing to push Left or Right will cycle through all enabled modes.

Please refer to the Configuration and Advanced Device Functionality for more information on how to enable the different modes available on the Wheel Controller.



## Z-Wave Network Add and Remove

To add the device to a Z-Wave network, the Z-Wave Controller must first be set into Add mode. Once the Controller is listening for devices to add, Push and Hold the lower part of the Wheel Controller for 5 seconds.

The device will indicate that it sends information to the Controller by showing a Radio Communication Icon in the display. The Controller should now discover the device and add it to the Z-Wave network. Once added, the device should respond commands over the Z-Wave network.

Removal is done by setting the Controller in Remove Mode (instead of Add mode), and then follow the exact same procedure on the device itself.



*Push and Hold the lower part of the wheel down for 5 seconds, to execute an Add or Remove procedure. Radio Communication Icon is displayed when the device is announcing itself.*

### Troubleshooting Inclusion problems

If the device is not added when following this procedure, please first make sure that the device displayed the Radio Communication Icon in the Display. If you did not see the Icon, make sure you pushed the Lower part ONLY of the wheel for at least 5 seconds. Do NOT release the button until you see the Icon in the display.

If the Add procedure still fails (no response from the controller), it may be caused by the device thinking it is already added in another Z-Wave network. This can happen if the device has been added to a different controller before, or if the controller was only able to partially add the device (usually caused by radio coverage problems covered below). Before you proceed, try executing a Remove procedure on the device first, and then execute the Add procedure once more. It is good practice to always do this (Remove first, then re-add) if you have tried and failed to add a device at least once.

### Radio Coverage and Network Wide Inclusion

The most common problem when adding fails is insufficient radio coverage. Z-Wave devices have a minimum line of sight radio range of 40 meters. But depending on the building materials in the surroundings, the experienced range may be less. Typically reinforced concrete walls may cause problems, as such walls can block the Radio signal almost completely. The Z-Wave technology however makes it possible to add devices out of range to the controller, using Network Wide Inclusion mode. If this is supported by your controller, you should try to add other devices with better radio conditions first, and then add the most troublesome devices afterwards. Doing this may provide a “route” for the troublesome devices, via other devices with sufficient radio coverage.

Always work your way outwards from the controller, adding the closest devices first and moving farther and farther away from the controller as you go. Note that concrete walls can be troublesome, and devices mounted on such walls should never be the first to be added (except if they are in close vicinity to the Controller).

#### **Use a Secondary Z-Wave Plus Controller for Adding the devices**

**This procedure is recommended for professional installers, as they can keep a Secondary Hand held Controller as part of his installation Tool Kit.**

First add the Secondary Hand-held Controller to the Z-Wave network. This should be done close to the Primary Controller. Then bring the Secondary Controller close to the troublesome device, and execute the device add procedure from the Secondary (hand held) controller (remember to first execute a Remove procedure, then do another Add procedure. If you do not intend to continue using the Secondary Controller in the Z-Wave network, make sure you Remove the Secondary Controller from the network when you are done.

## Z-Wave Plus Specific Information

The Wheel Controller device is a Z-Wave Plus Device, and thus support all command classes required for Z-Wave Plus. The Device supports Z-Wave S0 and S2 Unauthenticated Security modes, and must be included on a Security Enabled Z-Wave Controller in order to fully utilize all Z-Wave functionality of the device.

## Z-Wave Specific Device Information

The device reports the following Z-Wave device specific information:

Property	Reported value
Device Type	Wall Controller
Basic Device Class	ROUTING_SLAVE
Generic Device Class	GENERIC_TYPE_WALL_CONTROLLER
Specific Device Class	SPECIFIC_TYPE_BASIC_WALL_CONTROLLER
Z-Wave Plus Node Type	NODE_TYPE_ZWAVEPLUS_NODE
Z-Wave Plus Role Type	ROLE_TYPE_SLAVE_ALWAYS_ON
Z-Wave Plus Icon Type	GENERIC_WALL_CONTROLLER
Z-Wave Plus User Icon Type	GENERIC_WALL_CONTROLLER

Manufacturer Specific Device Information:

Property	Reported value
Manufacturer ID	0x024F
Product Type ID	0x0003
Product ID	0x1003

## Supported Z-Wave Command Classes

The following table lists all Command Classes supported by the Z-Wave Device. The usage of each command class is covered in the following sections. The device supports both S0 and S2-Unauthenticated security.

Supported Command Classes	Insecure Inclusion	Insecure on Secure Inclusion	Secure on Secure Inclusion
COMMAND_CLASS_ZWAVEPLUS_INFO (V2)	Yes	Yes	
COMMAND_CLASS_TRANSPORT_SERVICE (V2)	Yes	Yes	
COMMAND_CLASS_SECURITY	Yes	Yes	
COMMAND_CLASS_SECURITY_2	Yes	Yes	
COMMAND_CLASS_SUPERVISION (V1)	Yes	Yes	
COMMAND_CLASS_ASSOCIATION (V2)	Yes		Yes
COMMAND_CLASS_ASSOCIATION_GRP_INFO (V1)	Yes		Yes
COMMAND_CLASS_BASIC (V1)	Yes		Yes
COMMAND_CLASS_CENTRAL_SCENE (V3)	Yes		Yes
COMMAND_CLASS_CONFIGURATION (V1)	Yes		Yes
COMMAND_CLASS_DEVICE_RESET_LOCALLY (V1)	Yes		Yes
COMMAND_CLASS_FIRMWARE_UPDATE_MD (V4)	Yes		Yes
COMMAND_CLASS_MANUFACTURER_SPECIFIC (V2)	Yes		Yes
COMMAND_CLASS_METER (V2)	Yes		Yes
COMMAND_CLASS_MULTI_CHANNEL (V4)	Yes		Yes
COMMAND_CLASS_MULTI_CHANNEL_ASSOCIATION (V3)	Yes		Yes
COMMAND_CLASS_POWERLEVEL (V1)	Yes		Yes
COMMAND_CLASS_SENSOR_MULTILEVEL (V5)	Yes		Yes
COMMAND_CLASS_SWITCH_BINARY (V1)	Yes		Yes
COMMAND_CLASS_SWITCH_MULTILEVEL (V1)	Yes		Yes
COMMAND_CLASS_THERMOSTAT_MODE (V1)	Yes		Yes
COMMAND_CLASS_THERMOSTAT_SETPOINT (V1)	Yes		Yes
COMMAND_CLASS_VERSION (V3)	Yes		Yes

## Supported Light Control Related Command Classes

The following Control command classes are supported for Light control:

Command Class	Supported Back Units	Functionality
<b>Basic</b>	All	Used for ON/OFF and Dimmer Control (see mapping table below)
<b>Switch Binary v1</b>	All	Used for ON/OFF switch functionality. Dimmer Back Units will turn ON to their last Dimmer Level (50% ON by default).
<b>Switch Multilevel v1</b>	All	Used for Dimmer Control, but also works with Relay Back units for simple ON/OFF control
<b>Central Scene Command Class v3</b>	-	Used when device is configured as a Central Scene controller. This can be used to trigger Scenes executed by the Controller.
<b>Multichannel Encapsulation v1</b>	All	The device supports multiple Light Zones, which are each mapped one-to-one to a multichannel End-Point. How Light Zones are controlled by the Buttons is configurable.
<b>Sensor Multilevel</b>	All	Reports Temperature and Power Consumption periodically (once every minute). Can be used to request local Voltage and Current as well.
<b>Meter</b>	All	Reports Accumulated Power Consumption (Energy) over time. One report is sent every 15 minutes, and the current consumption can be requested any time.

### Effect of Basic Set Command Values

When the Basic Set Command Class is used for Light Control, the command values have the following effect:

Values	Effect on Relay	Effect on Dimmer
<b>0</b>	Turns OFF	Turns OFF
<b>1 – 99</b>	Turns ON	Sets Dimmer Level 1 – 100% (99)
<b>100 – 254</b>	Ignored	Ignored
<b>255</b>	Turns ON	Turns ON to last Dimmer level

The Device use Basic Set commands to control associated devices (covered in Association Groups section), in order to achieve the broadest possible compatibility with other devices. Basic Set values to associated devices are also in accordance with the above mapping table.

### Controllable Light Zones

The device can control up to Four (4) external Light Zones, which can consist of both associated dimmers and switches. The local Back Unit can be configured to belong in any of these four Zones, or to be completely separated from any of the Light Zones (in which case it can only be controlled via Z-Wave).

Each of the four available Light Zones are individually controllable via Z-Wave Multichannel Endpoints, where the Endpoint numbers 2-5 indicates the requested Light Zones 1-4. The Root Device and Endpoint 1 always control the Light Zone where the Local Back Unit is assigned. These can also be used to control the Back Unit, when it is not configured to belong to any of the other 4 Light Zones (Disconnected Mode).

The current state of each Light Zone is also shown in the Display, when the control screen for the particular light zone is active.

The Endpoints are mapped to Light Zones as follows

Endpoint	Description
1	Controls the Light Zone where the Back Unit is assigned. The Default Configuration is Light Zone 1. If there is no Back Unit, or the Back Unit is assigned to the Thermostat, it always controls Light Zone 1.
2	Controls Light Zone 1
3	Controls Light Zone 2
4	Controls Light Zone 3
5	Controls Light Zone 4

All Endpoints (1 to 5) provide the same Z-Wave information and command class support:

	Description
Device Type	Wall Controller
Generic Device Class	GENERIC_TYPE_WALL_CONTROLLER
Specific Device Class	SPECIFIC_TYPE_BASIC_WALL_CONTROLLER

The following table lists the Supported Command Classes for all Endpoints 1-5. The device can be queried for this information, using the Multichannel Capability Get and the Security(2) Commands Supported Get commands.

Supported Command Classes	Insecure Inclusion	Insecure on Secure Inclusion	Secure on Secure Inclusion
COMMAND_CLASS_ZWAVEPLUS_INFO (V2)	Yes	Yes	
COMMAND_CLASS_SECURITY	Yes	Yes	
COMMAND_CLASS_SECURITY_2	Yes	Yes	
COMMAND_CLASS_SUPERVISION (V1)	Yes	Yes	
COMMAND_CLASS_ASSOCIATION (V2)	Yes		Yes
COMMAND_CLASS_ASSOCIATION_GRP_INFO (V1)	Yes		Yes
COMMAND_CLASS_BASIC (V1)	Yes		Yes
COMMAND_CLASS_MULTI_CHANNEL_ASSOCIATION (V3)	Yes		Yes
COMMAND_CLASS_SWITCH_BINARY (V1)	Yes		Yes
COMMAND_CLASS_SWITCH_MULTILEVEL (V1)	Yes		Yes

The commands have the same functionality for Endpoints as for the Root device. Refer to the command table in the beginning of this section for a reference.

### Supported Thermostat Related Command Classes

The Thermostat controller in the Wheel Controller is always active and present, but is by default in OFF mode. If the connected back unit is a Relay, Thermostat mode becomes the Default mode of the device. Enabling the Thermostat Mode when there is no back unit or the back unit is a dimmer, requires a configuration change.

In addition to controlling a local Relay Back unit, the Thermostat can also be configured to control external Relays. This is done by adding external relays to association group 7.

The Thermostat requires at least one temperature sensor to operate, and will not turn any heating actuators on if a sensor is not present. If Thermostat mode is enabled and a Temperature sensor is missing, a Sensor Fault warning will be shown in the display.

Command Class	Supports	Functionality
<b>Thermostat Setpoint</b>	Thermostat Modes: HEAT Control: Any Relay Units (*)	Used for Thermostat Set-Point control. (* ) The thermostat functionality is always available, but will NOT control Dimmer Back Units. The thermostat MAY still control external Z-Wave Relay units via Association Group 7.
<b>Thermostat Mode</b>	Supported Modes: OFF, HEAT, AUX Control: All Relay Units (*)	Used for Thermostat Operation Mode control. (* ) The thermostat functionality is always available, but will NOT control Dimmer Back Units. The thermostat MAY still control external Z-Wave Relay units via Association Group 7.
<b>Sensor Multilevel</b>	Requires at least ONE temperature sensor connected to the device.	Reports the control Temperature of the Thermostat as Air Temperature. If both a Room and Floor sensor is used to control the temperature, the report will always provide the temperature currently used by the Thermostat control. Unsolicited report interval is configurable down to a minimum of 60 seconds.

### Supported Management Command Classes

This table defines all supported command classes not required explicitly by the Z-Wave Plus standard.

Command Class	Functionality
<b>Association</b>	Association is used to set up control of external devices. Described in detail in the Association section of this document.
<b>Configuration</b>	Used to control operational functionality of the device beyond the simple Default operation.
<b>Version</b>	Provides Hardware and Software version information for the device
<b>Firmware Update</b>	Makes it possible to update the firmware of the device Over The Air

### Multilevel Sensor Command Class and Events

The device supports the Sensor Multilevel Command Class (V5), which is used to report the following parameters:

- **Air Temperature** – Reports temperature measurement from Thermostat functionality. Unsolicited Reports are only sent if a Temperature Sensor is connected, and according to the configured report interval and threshold (by default, every 10 minutes, and if temperature change by +/- 1 degree).
- **Power** – Reports the Power consumption on the device output. Reported unsolicited once every minute, and can otherwise be requested at any time via the Sensor Multilevel Get command.
- **Voltage** – Reports the supply voltage of the device. Only Reported as a response to a Sensor Multilevel Get command.
- **Current** – Reports the current draw on the device output. Only Reported as a response to a Sensor Multilevel Get command.



## Association Groups

The device Association Groups is central in the Remote Control functionality of the device. Remote devices can be controlled from any of the four Light Zones by adding the external device to the corresponding Association Group.

The Wheel Controllers local Thermostat function is capable of controlling external Heating Actuators, in addition to other Z-Wave thermostats (for instance Radiator Valve Thermostats) in the same Heating Zone.

It is important to understand that all functionality of the Wheel Controller can be remote controlled by other Z-Wave devices, including the Thermostat functionality.

All Association Groups in the device, supports both normal Association and Multichannel Association. The Wheel Controller Root Device provides the following Association Groups:

Association Group	Node Limit	Functionality
1	Max 5 Nodes (Lifeline Group)	The Lifeline group where all Local State Changes are reported. All unsolicited Reports for the supported command classes will be issued to this group. Commands Issued: - <b>Basic Report</b> - Notifies Local Light Zone changes (control wheel input) - <b>Central Scene Notification</b> - Notifies Scene events from the controller (in Scene Mode) - <b>Sensor Multilevel Report</b> - Reports Power Consumption and Temperatures - <b>Meter</b> - Reports power consumption to the Controller every 15 minutes. - <b>Device Reset Locally</b> – Reports factory resets to the Controller - <b>Thermostat Mode</b> - Reports local changes of Thermostat Mode - <b>Thermostat Set-Point</b> – Reports local changes of Thermostat Set-Point
2	Max 5 Nodes (Light Zone 1)	Associated devices will be controlled by Light Zone 1. Also supports multichannel association in any combination. Command Issued: <b>Basic Set</b>
3	Max 5 Nodes (Light Zone 2)	Associated devices will be controlled by Light Zone 2. Also supports multichannel association in any combination. Command Issued: <b>Basic Set</b>
4	Max 5 Nodes (Light Zone 3)	Associated devices will be controlled by Light Zone 3. Also supports multichannel association in any combination. Command Issued: <b>Basic Set</b>
5	Max 5 Nodes (Light Zone 4)	Associated devices will be controlled by Light Zone 4. Also supports multichannel association in any combination. Command Issued: <b>Basic Set</b>
6	Max 5 Nodes (Thermostat Control)	Control Set-Point and Mode of an external Thermostat Device Commands Issued: <b>Thermostat Setpoint Set</b> and <b>Thermostat Mode Set</b>
7	Max 5 Nodes (Thermostat Relay Control)	Control external Relay from the Local Thermostat Command Issued: <b>Basic Set</b> (ON and OFF values ONLY).

### Endpoint Association Groups

Each of the 5 Endpoints supported by the device also provides 2 Association Groups each. These are the same for all 5 endpoints:

Association Group	Node Limit	Functionality
1	Mapped to Lifeline on Root Device. <u>Report 0 nodes supported.</u>	The Endpoint Lifeline group where all Local Light Zone state changes are reported. Commands Issued: - <b>Basic Report</b> - Notifies changes in Light Zone represented by the Endpoint
2	Max 5 Nodes	Associated devices will be controlled by the Light Zone corresponding to the current Endpoint. Also supports multichannel association in any combination. Command Issued: <b>Basic Set</b>

### Root Device Association Group mapping

The Root Device Association groups 2 to 5 are mapped to the association groups of the corresponding Endpoints 1 to 4. This means that devices in either mapped groups are treated as one group, and Commands are sent to all associated devices in both. The mapping is as follows:

Root Device Association Group	Mapped to Endpoint	Endpoint Association Group	Description
2	2	2	Associated devices in both groups receives <b>Basic Set</b> messages corresponding to a State Change in Light Zone 1
3	3	2	Associated devices in both groups receives <b>Basic Set</b> messages corresponding to a State Change in Light Zone 2
4	4	2	Associated devices in both groups receives <b>Basic Set</b> messages corresponding to a State Change in Light Zone 3
5	5	2	Associated devices in both groups receives <b>Basic Set</b> messages corresponding to a State Change in Light Zone 4

### Configuration

All functionality except for the Default Operation is controlled via Configuration SET commands. All available configuration is described in the following sections, in relation to the functionality each configuration controls.

## Advanced Device Functionality

This section details all the Advanced functionality available on the device, and also explains the Z-Wave Configuration Parameters which controls the specific functionality.

### Advanced Wheel and Display Configuration

By default the Wheel Controller configures itself according to which back unit is connected. This however limits the device functionality to either (single zone) Light control or Thermostat control.

However, the Wheel Controller can be configured to control several external units as well, in addition to choose if the local user interface controls the local or external devices

The following sections detail how to set up such configurations, and provides use-case examples for each configuration.

The following Z-Wave Configuration Parameters are involved in controlling the Wheel Controller User Interface and available functionality:

Config Register	Value Size	Default Value	Configuration Name	Description
14	1	Auto-Detect (0)	<b>UI Modes Enable</b>	<p>Defines which modes should be available in the Display User Interface. The following values can be used:</p> <p>0 – Automatic based on Back Unit (default)</p> <p>The following values can be added to enable the specified function:</p> <p>1 - Thermostat mode 2 - Light mode 4 - Central Scene Mode</p> <p>In addition, the number of Light Zones to be controllable via the display can be chosen by adding ONE of these value to the configuration above:</p> <p>16 - 2 Light Zones enabled 32 - 3 Light Zones enabled 48 - 4 Light Zones enabled</p> <p>NOTE! If Light mode is not enabled, the Zones selection has no effect!</p> <p>Example: To enable 3 Light Zones in addition to Thermostat mode, set the value to <math>(32 + 2 + 1) = 35</math></p>
15	1	Dimmer	<b>Light Control Mode</b>	<p>This can be used to disable the Dimming capability of Light Zones, and make it operate as a simple light switch. Associated devices will then only receive ON and OFF Basic Set commands.</p> <p>Setting this value to 1, will enable switch mode for all Light Zones.</p> <p>Switch mode can also be enabled pr. Light zone,</p>

				<p>by adding ANY of the following values together:</p> <p>2 - (bit 2) Enables switch mode for Zone 1                  4 - (bit 3) Enables switch mode for Zone 2                  8 - (bit 4) Enables switch mode for Zone 3                  16 - (bit 5) Enables switch mode for Zone 4</p> <p>Example: To enable switch mode for Light Zones 2 and 3 (only), set the configuration value to:  <math>4+8 = 12</math></p>
<b>17</b>	1	Thermostat	<b>BU role</b>	<p>Configures the Role of the Back Unit, which dictates what Local functionality controls it. Valid configuration values are:</p> <p>0 - The Thermostat will control the Back Unit (if the back unit is a dimmer, then this value has no effect as Thermostats requires a relay to function)                  1 - The Light Control feature will control the Back Unit.                  2 - Disconnected mode means the Back Unit is not controlled by any local UI or features, and can only be controlled via Z-Wave End-Point 1 (or the Root Device).</p>
<b>18</b>	1	1	<b>Back Unit Light Zone</b>	<p>Selects the Light Zone which control the Back Unit (in Light Mode). Possible values are:</p> <p>1 – Light Zone 1 (default)                  2 – Light Zone 2                  3 – Light Zone 3                  4 – Light Zone 4</p> <p>This can be used to assign the back-unit control to any of the Light Zone (1 - 4). This does NOT have any effect when the BU role is set to Thermostat or Disconnected!</p>

### User Interface Modes

The Wheel Controllers user interface can provide local control of all available functionality via the Wheel and Display. Which modes should be active is configurable via Configuration Parameter 14.

Which modes should be active is selected by adding the Mode values below together:

- **1 - Thermostat Mode** – When activated, Thermostat Control will become available via the Wheel. Also, the current thermostat operation is shown in the display when the device is idle. The wheel can be used to change the thermostat set-point and change the Thermostat Mode to OFF or HEAT (AUX mode is only available via Z-Wave control).
- **2 – Light Mode** – When this mode is activated, Light Zone control will be available to control from the Wheel. Any wheel input will automatically be directed to Light Zone 1, even when the Thermostat Mode is active. The wheel can be pushed at the Upper and Lower parts to control the Light ON and OFF. Turning the Wheel will change the Dimming Level of the active zone.
- **4 – Central Scene Mode** – Enables the Central Scene controller mode. This mode gives access to control up to 4 separate scenes from the Wheel, which is grouped in the display under Home/Away and Day/Night. The scene group to use can be selected by turning the Wheel, and the scene to activate can be selected by pushing Up or Down on the wheel. The Central Scene mode takes precedence over the Light mode, and will receive any input on the Wheel when it is idle. The Light Zones can still be accessed by pushing Right on the Wheel (if Light Mode is enabled)

If a temperature sensor (Floor or / and Room sensor) is connected, the display will show temperature info in the display when the wheel is Idle. This screen will however be dismissed if the wheel is pushed or turned, forwarding any input to the Central Scene or Light Control mode. If none of these are enabled, it is required to push Left or Right to bring up the Thermostat Edit screen. This is done to avoid accidental changes to thermostat mode and set-point temperature.

Further it is possible to enable up to 4 Light Zones which can be controlled by the Wheel. This is done by adding ONE of the following values to the configuration value described above (if Light Mode is not activated, these values have no effect):

- **16 – Enable Control of 2 Light Zones**
- **32 – Enable Control of 3 Light Zones**
- **48 – Enable Control of 4 Light Zones**

For example, if you would like to enable both Thermostat and Light Mode for 3 Zones, simply add the values together ( $1+2+32 = 35$ ), and set this value to the configuration Parameter.

The Main Light Zone will always be the default one when the wheel is turned or pushed UP or DOWN. To access the other Light Zone Screens (2-4) push the Right Side on the Wheel to cycle through the Zones. The current Light Zone number is displayed in the center of the Light Bulb icon on the screen, and the level is indicated by the circular border of the display. Turn the wheel to select the wanted light level, and push Up and Down as usual to turn the Light ON and OFF in that zone. After not operating the wheel for some time, the display reverts back to the "home screen". Turning or Pushing (UP/DOWN) the wheel then yet again controls the Main light zone.

Devices to control from Zones 2-4 is set up using the appropriate association groups, and the Zone used by the Back Unit is configurable (see the **Back-Unit Light Zone** configuration above).

### Thermostat Local Back Unit Control Mode

If the Wheel Controller has a Relay type back unit, the device is automatically configured to control the relay via a thermostat mode. For this to work, at least one temperature sensor must be connected to the unit.

Thermostat Back Unit control can also be enabled explicitly by setting **Configuration Parameter 17** to **value 0** over Z-wave. This will cause the internal thermostat to take over control of the relay Back Unit (note that the Light Zones can still control external devices via association). Note that if the Back Unit is a dimmer type, the thermostat will NOT control the Back Unit, and this configuration will not have any local effect. In this case, the Back Unit is implicitly set to be controlled by the Light Mode of the unit (if enabled via Configuration Parameter 14)

It's also important to know that the Thermostat function can also control external Relay type devices by assigning these in Association Group 7.

### Disconnected Mode

Disconnected Mode allows for the Back Unit to be controlled exclusively over Z-Wave. In this mode the wheel is only used for controlling associated devices. Any standard commands (non-encapsulated) to the device will be directed to the Back Unit, but will not affect the Button States. Multichannel encapsulated commands to End-Point 1 is always routed to the Light Zone which the Back-Unit belongs to.

Disconnected Mode is enabled by setting **Configuration Parameter 17** to **value 2** via Z-Wave.

### Advanced Relay Back Unit Operation Configuration

Normally the Back Unit is set up to be controlled by local functionality, but it is possible to also configure the Back Unit to be “disconnected” from the Front and only controllable via Z-Wave.

One particular Use-Case for this is to use a Relay Back Unit to control Heating, which is controlled remotely from a separate Thermostat unit. One problem with such a configuration is what will happen if the Remote Unit for some reason stops sending Control commands, leaving the Heating in a permanent ON state. In worst case scenario this could be a fire hazard.

The Wheel Controller has a solution to this, which can put the Back Unit in a Safety Mode if no control message has been received for a period of time. The Safety Mode can be configured to turn the Load off indefinitely, or alternate between ON and OFF at given intervals. This of course depends on the Remote Thermostat also having a feature to repeat Commands periodically, in order to avoid the Back Unit to go into safety mode under normal operation (see Advanced Thermostat Operation Configuration for more information). The safety function will also be activated if a Temperature Sensor fails.

The Relay Back-Unit safety mode is controlled by the following configuration registers:

Config Param	Value Size	Default Value	Configuration Name	Description
4	2	0 sec	<b>Safety Activate Delay</b>	Safety Mode is activated after the configured number of seconds has elapsed. It will start by turning OFF the Back Unit when activated. A 0 value Disables Safety Mode. The MAX limit is 32767 seconds (9 hours, 6 minutes and 7 seconds)
5	2	10 min	<b>Safety OFF Period</b>	The number of seconds to stay in OFF mode when Safety is activated. The Back unit turns ON when the timer has elapsed. If value is 0, the Back Unit will not turn back ON. The MAX limit is 32767 seconds (9 hours, 6 minutes and 7 seconds)
6	2	5 min	<b>Safety ON Period</b>	The number of seconds to stay in ON mode when Safety is activated. The Back Unit turns back OFF when the timer has elapsed (and continues to turn ON and OFF alternately). If value is 0, the Back Unit WILL NOT turn ON at all. The MAX limit is 32767 seconds (9 hours, 6 minutes and 7 seconds)

NOTE1! By default, the Back-Unit Safety feature is disabled, and must be actively enabled via Configuration Parameters.

NOTE2! These settings have no effect when a Dimer Back-unit is used.

### Advanced Dimmer Operation Configuration

When the Front Unit is connected to a Dimmer Back unit, it is very often necessary to adjust Dimmer Settings in order to make Light fixtures operate correctly. The default settings are normally OK for standard Light Bulbs and Halogen lamps, but may cause problems with LED type Light fixtures. Such problems are mostly an issue with 230V dimmers, as the 1-10V dimmer normally always work fine with the defaults.

Dimmer operation parameters are set via Configuration Parameters, and the following settings can be configured for dimmer operation:

Config Param	Value Size	Default Value	Configuration Name	Description
13	1	15	<b>Minimum Level</b>	The Minimum Light Level of the dimmer. This should be adjusted so the controlled Light is still ON and stable. Remember that LED type lights may work if dimmed down to a low value, but may not start if the light is turned OFF and ON again. Range 1-99.
12	1	90	<b>Maximum Level</b>	The Maximum Light level of the dimmer. Typically there is no visible difference when the dimming level reaches a point in the range 75 - 90, and the installer should set this value to the lowest value where no change is visible. The default value of 90 is usually OK. Range 1-99.
44	1	20	<b>Cold Start Minimum Level</b>	Defines the Minimum Level the Dimmer should go to when the Light state change from OFF to ON. If this level is Higher than the minimum level, it will cause the Dimmer to dim up to the Cold Start Minimum Level before going to the requested Dim level. This is useful when dimming LED light fixtures which requires a higher level to start stably.
11	1	LE	<b>Dimmer Mode</b>	[ <u>Leading Edge (LE) = 0, Tailing Edge (TE) = 1</u> ] Defines if Dimmer should operate in Leading or Tailing Edge mode. Most Lights work quite OK in the default Leading Edge mode, but this mode also usually cause some noise from the dimmer unit. During installation it is therefore recommended to try TE mode, and use this if the Light operates properly. Tailing Edge mode is known to cause instability in some LED type Lights! This configuration does not have any effect on 1-10V Dimmer Back Units!
10	2	300 (3 second)	<b>Dimming Speed</b>	Defines the "fade" time when setting a dim level from a controller. Fade time is defined as the time it takes to dim from MIN level to MAX level, which means an increase of 10% in light level takes 1/10th of the configured time. The value defines the dim time in 1/100'th of a second, which means a value of 200 means the Dimming Speed is 2.0 seconds from MIN to MAX. Max time is 327.67 seconds (almost 5 and a half minutes).



				Values below 300 (0.3 seconds) are ignored, and values below 1000 (1 second) are discouraged.
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### Guidelines for Configuring Dimmer Back Units

NOTE! Normally 1-10V dimmers do not require any special mode configurations, and the defaults work fine. Only adjust the defaults in case Speed, MIN and MAX levels are not satisfactory with 1-10V dimmers.

After installation start by tuning the MIN and MAX limit of the Dimmer, to provide a noticeable change in the Dimming level over the full dimming range. This is easiest to test by setting Dimmer levels via Z-Wave, where a 1 value is the MIN level and 99 value is the MAX level. It may be necessary to turn the MAX level down, and the MIN level UP in order to get the best result. This is done by adjusting the values in **Configuration Parameters 13 (MIN level) and 12 (MAX level)**.

Be aware that some LED light fixtures will have problems turning from OFF to ON when the light level is too low. However, once ON they can be turned down to a much lower level than needed to start up. This problem can be fixed by setting the MIN level to the Lowest level which gives stable operation at light level 1. Then turn up the Cold Start Minimum level until the Lights turns ON stably at the Minimum level.

When the MIN and MAX levels are as desired, continue by adjusting the Dimming speed as desired. By default, the dimming speed is 2 seconds from MIN to MAX level, which normally gives good Dimming Control via the Wheel Controller Wheel. Adjust the value of **Configuration Parameter 10** UP to slow the speed down, and DOWN to speed the dimming up. If you use the Wheel Controller to control external Dimmers via Association, make sure you configure the external Dimmers to use the SAME or a lower dimming speed as the Local Dimmer. Setting the Dimming speed of the external devices higher than the wheel will cause unpleasant side effects. This is noticeable as jerkiness (speed is too high) or lagging behind (speed is too low) the dimmer level set by the Wheel. It is recommended to keep the dimming speed at the default when controlling external dimmers via the Wheel.

### Troubleshooting 230V Dimmer problems

230V Phase Cutting dimmers can (by their nature of operation) cause problems with some types of Light fixtures. The 230V Dimmer back unit supports Standard Bulbs, Halogen and (most) Dimmable LED type lights, but may not always operate correctly with the default settings. The defaults have been chosen to provide the widest possible range of compatibility, but they may also cause some unwanted effects. The most common problems are:

- **Buzzing Noise from Dimmer or Light Fixture**

This is caused by the Dimmer Mode being Leading Edge, and is usually not very prominent. Try changing the dimmer mode to Tailing Edge Mode by setting **Configuration Parameter 11** to **Value 1**, to solve the problem. Turn the Lights OFF and ON again for the configuration to take effect!

WARNING! Some light fixtures operate poorly in Tailing Edge mode. If you experience general instability (not only at Low Dimmer levels) or a loss of usable Dimming range, it's recommended to switch back to Leading Edge mode. For some light fixtures, the buzzing noise is simply not possible to fix!

- **Light is unstable at low Dimmer levels**

This can be fixed by increasing the MIN level via **Configuration Parameter 13**. Start by increasing the MIN level by steps of 5, until the Lights stops flickering at the Minimum Dimmer level. Then try adjusting the level down 1 step at a time, until the Flickering or instability returns. Finally increase the MIN level by 1 to get stable Operation.

Then keep the Dim level at the lowest setting, and turn the Light OFF and ON again. If the Light does not turn back on or flickers, adjust the Cold Start Minimum Level up until the problem goes away (start with setting it 5 points higher than the Minimum Dim level already found). Make sure you turn the Light OFF and ON again for the change to take effect, and to see if the problem is solved. When configuration is correctly set up the Light should operate stably on ALL dimming levels, and should turn from OFF to ON at the Minimum Dimmer level.

- **Light Dimming Range is very Narrow**

If the range from MIN level to MAX level is very low (some times not even noticeable) or only change in the lower part of the dimming range, the culprit is usually one of the following:

- The Light fixture does not operate well in Tailing Edge Mode. Switch the mode back to Leading Edge (**Configuration Parameter 11, value 0**) and check if this solves the problem (Remember to turn Light OFF and ON to activate the change). Note that in some cases, buzzing from the Dimmer and/or Light Fixture is impossible to remove completely.
- The MAX level is too high. Some Light Fixtures have no noticeable dimmer level change above MAX level 60-70 (in rare cases even lower), and the MAX level should be adjusted down accordingly. Please note that MIN and MAX level change DOES NOT affect the "resolution" of the dimming, only the maximum and minimum voltage output. The resolution is fixed to 99 steps regardless of MIN and MAX settings.
- The MIN level is too high. Note that some Light fixtures will only dim significantly below a certain level, but may not start stably at that same level. Try adjusting the Minimum Cold Start Level up, until the Light turn on stably at the minimum Dim level. In some rare cases however there is no way to improve the Dimming Range of

the Light fixture.

NOTICE! It is very important to know that there are Light Fixtures on the market which claim to be “dimmable” which in reality is not (or does not perform very well). It is highly recommended that Light Fixtures intended for Dimming is acquired from Light Fixture professionals or professional Electrical equipment suppliers with experience in dimmable Light Fixtures. This includes Light Bulbs and replaceable LED Bulbs as well.

## Advanced Thermostat Operation Configuration

The built in Thermostat function in the Wheel Controller can be used to control Electrical Heating connected to a Relay Back unit type, or an external Heating Actuator via Z-Wave association. The Thermostat Set-Point and HEAT / OFF mode can be controlled via the Wheel Controller User Interface. In order for the Thermostat functionality to be used, the Wheel Controller must have a Temperature sensor directly connected (either a room sensor or a floor sensor connected to the Back Unit).

The Thermostat function is quite flexible and can operate in multiple possible configurations:

- **Directly controlling a Relay Back Unit**

This is the most common configuration, where the Relay Back Unit is controlled directly from the Thermostat. This is the Default operation mode when the Wheel has a Relay Back Unit which is configured for Thermostat control (via **Configuration Parameter 17 to value 0** covered in a earlier section). Please note that this setting will NOT affect dimmer back units!

- **Controlling an external Heating Actuator (Relay)**

This configuration is normally used when the connection point for the Heating Actuator is located at a separate location than where the temperature sensor(s) needs to be located. In this configuration, the Thermostat will measure the temperature from its sensors, but control the external relay unit via Z-Wave Commands. The external Actuator(s) should then be added to **Association Group 7** of the Wheel Controller, and **Configuration Parameter 17** is normally set to value 1 or 2 (meaning the Thermostat does NOT control the local back unit). In this configuration it is highly recommended to activate the Safety function of the external Actuator, to avoid the heating getting stuck in ON mode if the communication or controller device should fail (covered in detail in a following section).

- **Control Set-Point of an external Thermostat**

It is also possible to set the Thermostat function up to control the Set-Point of an external Thermostat. This can be used in addition to the local control, for instance to have a common set point for floor heating and a Radiator for instance. This configuration is achieved by adding the external thermostats (supporting the Thermostat Set-Point Command Class) to **Association Group 6** of the Wheel Controller.

- **Set-Point controlled from an external Thermostat**

If you have another Z-Wave thermostat, this can be set up to control the Set-Point of the Wheel Controller. The other device is required to support controlling the Set-Point of other devices via a Z-Wave Association Group. Add the Wheel Controller to the “Thermostat Set-Point” Association Group of the external device to enable this configuration.

### Thermostat Configuration

The Thermostat functionality can be controlled via Z-Wave Configuration with the following configuration parameters:

Config Register	Value Size	Default Value	Configuration Name	Description
32	2	270 (27 C)	<b>Set Point Max</b>	Maximum Set Point the Thermostat is allowed to be set to. If the Thermostat is used for Floor Heating, please make sure that this value is configured to the same value as (or lower than) the Max Floor Temperature. Given in 1/10 of a degree Centigrade, which means a value of 300 means 30 degrees C. Range: 0 – 500 (0-50 degrees).
34	2	50 (5 C)	<b>Set Point Min</b>	Minimum Set Point the Thermostat is allowed to be set to. Given in 1/10 of a degree Centigrade, which means a value of 50 means 5 degrees C. Range: 0 – 500 (0-50 degrees).
36	2	3600s	<b>Resend Interval</b>	Defines the interval between each time the Thermostat will repeat its last control command. This is used in combination with the Relay Safety configuration when controlling external Relays. If the Thermostat should fail, it would then stop sending control commands, which means the Relay will turn it self off after the safety mode delay has expired. This insures that heating will not be left on indefinitely in failure situations.
37	2	300s	<b>Minimum On/Off Interval</b>	This configuration defines the minimum delay the controlled Thermostat Relays will be ON and OFF. This is a feature intended to avoid turning control relays ON and OFF too frequently, which should insure a better lifetime of controlled actuators. It will also have a dampening side-effect on heating, since this will constrain the oscillation frequency of the thermostat. The default value is 5 minutes, which is OK for most electrical heating control. If used to control Water based heating, the value MUST be adjusted in accordance with the manufacturer specifications of the controlled system.
38	2	270 (27 C)	<b>Floor Temp Max</b>	Max floor temperature if a local floor sensor is connected. If the Floor Sensor reads a temperature Higher than the configured value, it will immediately turn the controlled relay (and any associated actuators) OFF. The relay will stay off until the temperature sinks below this value, and the Thermostat issues its next control command. If the configuration value is 0 or no floor sensor is available, this functionality will be disabled. The value is given as 1/10th of a degree Celcius. Range: 0 – 500 (0-50 degrees). NOTE! MAX 27 degrees is recommended for Wooden

				Floors!
<b>40</b>	1	3 (Both)	<b>Sensor Select</b>	<p>Defines which temperature Sensor should be used for Heating Control. The default value is Both (3), which should work well in most scenarios (even when only a Floor or Room sensor is present). If both a Room and Floor sensor is used, the Thermostat will always control heating based on the lowest temperature reading of the two, to insure a comfortable floor temperature even if the room is already warm enough. If this is not wanted, the Thermostat should be configured to use the Room sensor only. NOTE! The Floor Max Temperature feature will ALWAYS be active as long as a floor sensor is available, even if the Thermostat is configured to only use the Room Sensor.</p> <p>1 - Local Room - Use temperature from Locally connected Room sensor ONLY. Max Floor Temp protection is still active as long as a floor sensor is available.</p> <p>2 - Local Floor - Use temperature from Locally connected Floor sensor ONLY</p> <p>3 - Both - Use temperature from Locally connected Floor AND Room sensor if available (Default).</p>
<b>67</b>	1	0 (Disabled)	<b>On/Off Interval Override Threshold</b>	<p>This configuration value can be used to override the Configured Minimum ON/OFF interval, if the temperature changes more than the configured Value. The result is that if the temperature change exceeds the configured threshold, the Thermostat will make an ON/OFF state change decision even if the Minimum ON/OFF interval has not passed. The value is given in 1/10th of a degree Celcius. A 0 value (default) disables this override feature.</p>

### Controlling External Heating Actuators

The Thermostat function supports controlling external Heating Actuators according to local temperature readings. This is useful when the temperature sensors need to be located at a different location than the Heating Actuator itself.

Setting this up is relatively straight forward:

- Add the external Z-Wave Heating Actuator to **Association Group 7** of the Wheel Controller. The external device will now be controlled by the Thermostat functionality in the Switch.
- If the Thermostat should not control any Locally connected Relay Back Unit, set **Configuration Parameter 17** to value 1 (for control by Light Functionality in the wheel) or 2 (for Z-Wave control only).

When controlling a Heating Actuator via a Radio Link (including but not limited to Z-Wave), there is always a risk that a control message may not arrive to the destination device. This is especially important to consider when controlling Heating Actuators, as such conditions may cause the Heating Actuator to be stuck in ON mode (if messages stops arriving when the Actuator is ON). To avoid this scenario, the external Heating Actuator should at a minimum support automatic OFF functionality. This insures the heating is eventually switched OFF, which greatly reduce the risk of heat damage or fire caused by excessive heating.

The Wheel Controller supports repeating external actuator control commands at a configured interval to insure stable operation. It will repeat commands regularly (even if the control state have not changed) to insure the external Actuator stays in the wanted state when communication works as it should. This is configured by setting the interval between such reports via **Configuration Register 37** in seconds (the default is 300 seconds which equals to 5 minutes). The configured interval should always be 5-10 seconds shorter than the OFF delay configured in the external Actuator, to insure any timing differences in the two devices will NOT cause the external relay to go into Safety mode, and then be switched back momentarily after.

NOTE! All SE Devices units have support for automatic OFF after a period of time (including the Wheel Controller). In addition, they also support reverting to periodic ON/OFF switching at configured intervals, to insure a safe heating level without any thermostat input. This is very useful in installations where there is a risk freezing if the heating is left off for a long period of time.

### Temperature Sensor Configuration

The following configurations are available to change the behavior of the temperature sensors readings. Temperature offsets are applied for both the thermostat and the reported temperature, and is useful in cases where the sensor location cause an inaccurate temperature reading.

Config Register	Value Size	Default Value	Configuration Name	Description
<b>64</b>	2	600 (10 minutes)	Temperature Report Interval	Defines the Periodic Report interval for temperature readings. This can be configured to a minimum of 60 seconds and maximum of (32767 seconds). A 0 value disables the Interval based Periodic reporting, and any value below 60 results in a 60 second interval.
<b>66</b>	1	10 (1°C)	Temperature Report Threshold	Defines a temperature change threshold where a temperature report is sent regardless of the Report Interval. This also works if the report interval is disabled. The value is given in 1/10 of a degree celsius, and can be in the range 1-127. A zero value disables the Threshold.
<b>240</b>	1	0 (0°C)	Floor Sensor Offset	Defines an offset to the Floor Temperature, given as a signed integer at 1/10 of a degree celcius. This provides an offset range of –12.8 to +12.7 degrees celcius (-128 to 128). Negative offset byte values are calculated from: $256 - \langle \text{negative temp} \rangle$ . Example: A negative offset of –3 degrees is achieved by setting the parameter to: $256 - 30 = 226$
<b>241</b>	1	0 (0°C)	Room Sensor Offset	Defines an offset to the Room Temperature, given as a signed integer at 1/10 of a degree celcius. This provides an offset range of –12.8 to +12.7 degrees celcius (-128 to 128). Negative values are the same as for the Floor Sensor Offset.



### Other Configuration Parameters

The device has a couple of Read-Only parameters which can be used to retrieve additional information from the device. These parameters cannot be changed by the user, and only provides information about the current device combination.

Config Param	Value Size	Configuration Name	Description
1	1	<b>Hardware Combination Identifier</b>	<p>Byte which uniquely describes the combination of Front and Back Unit in the current installation. The first nibble (4 bits) Identifies the Controlling Unit (Front unit), which is always 0x3 for the Wheel Controller.</p> <p>The combined Byte then yields the following:</p> <ul style="list-style-type: none"> <li>- 0x30 – 2-Pole 8A Relay</li> <li>- 0x31 – 1-10V Dimmer</li> <li>- 0x32 – 230V MOSFET Dimmer</li> <li>- 0x33 – 1-Pole 16A Relay</li> <li>- 0x3F – No Back Unit connected</li> </ul>
16	1	<b>Back Unit type</b>	<p>Provides an Identifier for the connected Back Unit. This configuration is fixed across the SE Devices range, and provides a consistent way to determine local device functionality across the entire range of devices.</p> <ul style="list-style-type: none"> <li>- 0xFF – No Backunit Connected</li> <li>- 0x00 – 2-Pole 8A Relay</li> <li>- 0x02 – 230V MOSFET Dimmer</li> <li>- 0x04 – 1-10V Dimmer</li> <li>- 0x06 – 1-Pole 16A Relay</li> </ul>

## Factory Reset

Follow this procedure to Factory Reset the Wheel Controller. This will restore all configuration parameters back to the default settings, and remove the device from the Z-Wave network.

**WARNING! Executing a Factory Reset on a device may make it stop working as wanted, and will disable remote control of the device. The device will have to be re-added to the Z-Wave network and reconfigured afterwards, to regain the previous operation of the device. Please DO NOT execute this procedure unless it is absolutely necessary.**

**Step 1:** Push and Hold the DOWN and LEFT wheel buttons at the same time, and keep holding them for approximately 15 seconds. It is recommended to use two fingers to insure that both buttons are pushed completely down.

**Step 2:** Release the buttons when the text “RESET” appears in the display, after approximately 15 seconds.

**Step 3:** Then Push and Hold UP (marked OK) for approximately 1 second to CONFIRM the Factory Reset. Pushing any other direction button will Cancel the Factory Reset, and restore normal operation. Also, if the RESET is not confirmed within 5 seconds, the device will resume normal operation.

**Step 4:** When you confirm the Reset by pushing and holding UP, the RESET text will start blinking. Then the device will resume operation, but with all configuration Reset to their defaults. Also, if the device was added to a Z-Wave network, the device will no longer be available for Z-Wave control (only Local control will work).

## Error messages and Trouble Shooting

If the device experiences a problem, it will report an error message in the Display. The error message shows a warning icon and text which describes the problem which occurred. Error Notifications are also sent to the controller if the device is included in a Z-Wave network.

When an error occurs, the device will switch off the Local Back Unit for safety reasons and the error message is displayed as the default screen. The message will be present until the error is cleared by the user by switching the device OFF then ON again. If the error persists, the message will however return if it is switched back ON.

The following error messages can occur in the display:

### SENSOR FAULT

This message is shown in the display if the Thermostat function is enabled and the device is unable to detect any temperature sensors. If the device has a Relay Back Unit but no temperature sensors connected, this message will be displayed on startup.

The error message can have the following causes:

1. Configure the device in Light Control mode by setting value 1 to Configuration Parameters 14 and 17 over the Z-Wave Network.
2. Connect a Temperature sensor to the device (either a Room Sensor, Floor Sensor or both). The message should then disappear.
3. Make sure the Temperature sensor is properly connected:
  - a. Is the Room Sensor connector in place inside the frame?
  - b. Is the Floor Sensor connected properly and with the correct polarity?
  - c. Are you using the correct Floor sensor? The Two-Pole relay requires a digital sensor, and the One-Pole Relay requires an analog sensor.

### OVERLOAD

The Back Unit was overloaded, and shut down to protect the device. Make sure the Load connected to the device is within the maximum power limit of the devices. Also note that if the load is right at the limit of what the device is rated for, variations in the Mains voltage can trigger this error sporadically. Always make sure the Load is reasonably below the rated maximum load of the device.

Also note that some types of LED fixtures have a very high startup current. So even if the rated power of the fixtures and bulbs are within the MAX limit, they may exceed the maximum when power is switched ON.

If the problem persists, an electrician should be contacted to troubleshoot the problem.

## **HIGH VOLT**

This message is displayed when the Voltage exceeds 260V, which is well above the maximum tolerance allowed for 230V 50Hz. This may indicate a problem with your mains power. In rare cases, this problem can also be caused by defective fluorescent Light fixtures.

In any case, if this error message persists or appears sporadically, an electrician should be contacted to troubleshoot the problem.