



## Instruction

### Development Controller User Guide

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**REVISION RECORD**

Doc. Rev	Date	By	Pages affected	Brief description of changes
1	20050318	PSH	Section 4.4	Added description of group on/off abort
2	20050404	PSH	Section 4.2.2	Added information about group replication
3	20060105	MVO	All	New 1 <sup>st</sup> page/header/footer contents. New Doc No
4	20070228	JFR	Section 3 & 4.2.1	ZW0301 based modules added
4	20090119	PSH	Section 4.2	Added description of network wide inclusion mode at power up.
5	20100223	JFR	Section 4	Press the pushbutton 3 times within 1,5 sec. on the Z-Wave Node to transmit node information frame.
6	20120124	JFR	Section 4.2	Clarified NWI functionality
7	20120525	DDA	All	Updated according to new hardware

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## 1 ABBREVIATIONS

Abbreviation	Explanation
SIS	SUC ID Server
SUC	Static Update Controller
NWI	Network Wide Inclusion (SDK 4.5x and 6.xx supports NWI)

## 2 INTRODUCTION

### 2.1 Purpose

The purpose of this document is to describe the functionalities and features of the ZW0x0x Development Controller sample application.

### 2.2 Audience and prerequisites

The audience of this document is Z-Wave partners and Sigma Designs. It is assumed that the Z-Wave partner already is familiar with the Z-Wave Developer's Kit.

### 3 GETTING STARTED

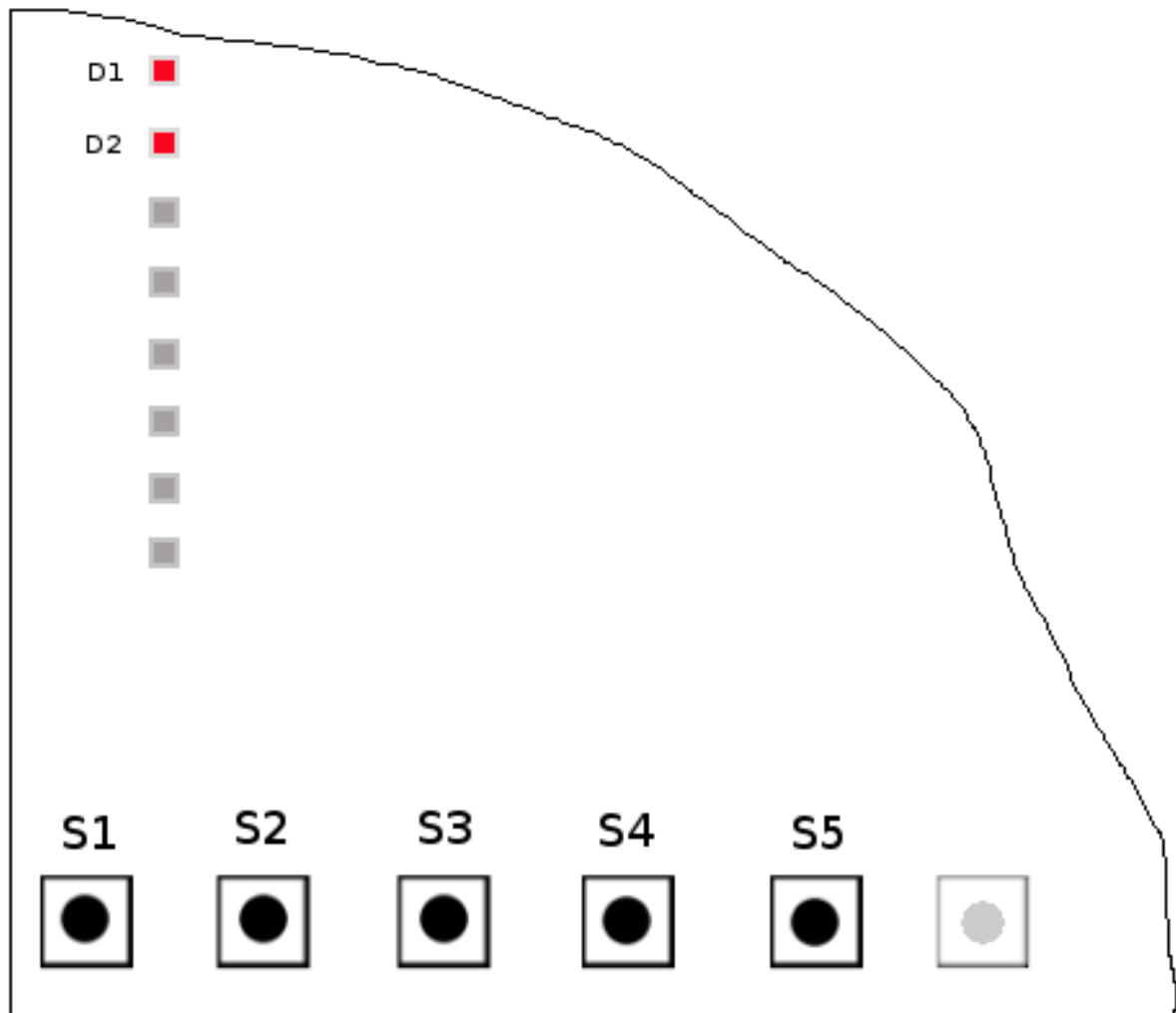
The ZW0x0x Development Controller sample application is designed for the ZW0x0x Development Controller Unit, which is an assembly of the ZDP03A Development Module [2] and a ZW0x0x based Z-Wave Module.



**Figure 1. Development controller**

The application user interface is based on 5 pushbuttons (named S1, S2, S3, S4 and S5) and 2 LEDs (named D1 and D2) on the ZDP03A Z-Wave Development Platform.

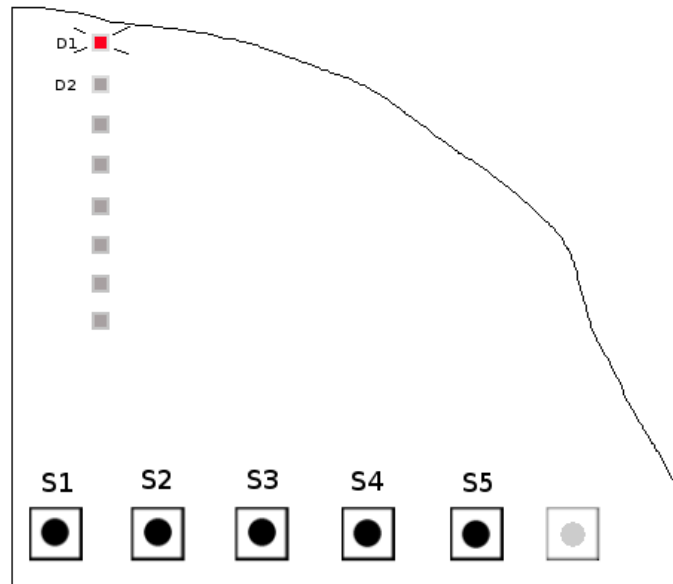
Note: The ZDP03A Z-Wave Development Platform is equipped with 6 pushbuttons and 8 LED's, but only 5 pushbuttons and 2 LED's are used in this version of the ZW0x0x Development Controller sample application – as depicted in Figure 2 below.



**Figure 2. User Interface for ZW0102 Development Controller**

The two LED's are the users only indication of the status of the Development Controller and the various states of those two LED's will be described in the following.

### 3.1 D1 indication



**Figure 3. Position of D1**

D1 indicates the following states:

- |                 |  |
|-----------------|--|
| <b>ON</b>       | Waiting for a Z-Wave frame from another Node |
| <b>Flashing</b> | Controller is processing                     |
| <b>OFF</b>      | Controller is idle                           |

### 3.2 D2 indication

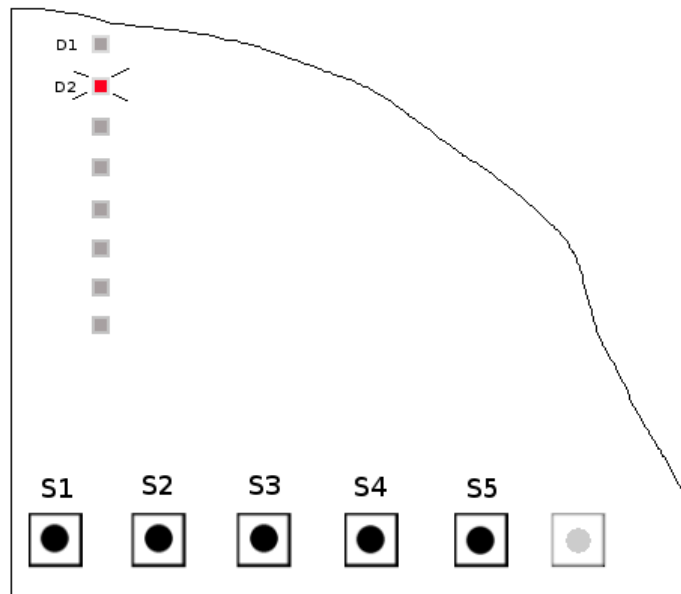


Figure 4. Position of D2

D2 indicates the following states:

<b>ON</b>	<ul style="list-style-type: none"><li>• System error – errors can be reset by pushing any of the push buttons</li><li>• Assigning routes to a binary sensor: D2 will go ON when awaiting signal (Z-Wave frame) from the Binary sensor</li><li>• When resetting the Controller: Reset in progress</li></ul> Please refer to the descriptions of the various system functionalities in the following chapter.
<b>Flashing</b>	Not used
<b>OFF</b>	System is ready



## 4 SAMPLE APPLICATION DESCRIPTION

### 4.1 Features of the Development Controller sample application

The Development Controller sample application shows the following features of the Z-Wave protocol:

1. Include Slave and Controller Nodes to the Z-Wave Network
2. Associate a Node to a Group
3. Switching a Group of Nodes on or off (toggle function)
4. Dimming a Group of multilevel switches (e.g. LED Dimmers)
5. Assigning a Route to a routing slave (e.g. a Binary Sensor)
6. Excluding a Node from the Z-Wave Network
7. Resetting the Development Controller
8. Requesting network updates to a Secondary Controller from a Static Update Controller (SUC) in case it is present in the network
9. Work as Inclusion Controller when a SUC ID Server (SIS) is present in the network
10. Request network wide inclusion in a Z-Wave network

In the following sections is each feature described in details.

## 4.2 Include a Node to the Z-Wave Network

Adding a slave node and a controller node is done in a generic way on Z-Wave protocol level, but the user interface can differ depending on the hardware and software implementation.

When building a new Z-Wave Network using the Development Controller sample application, please make sure that all units are reset in order to avoid problems with duplicate Node ID's when including Nodes to the network. Please refer to section 4.7 for information on how to reset nodes or section 4.8 for information on how to reset the Development Controller.

### 4.2.1 Slave Node

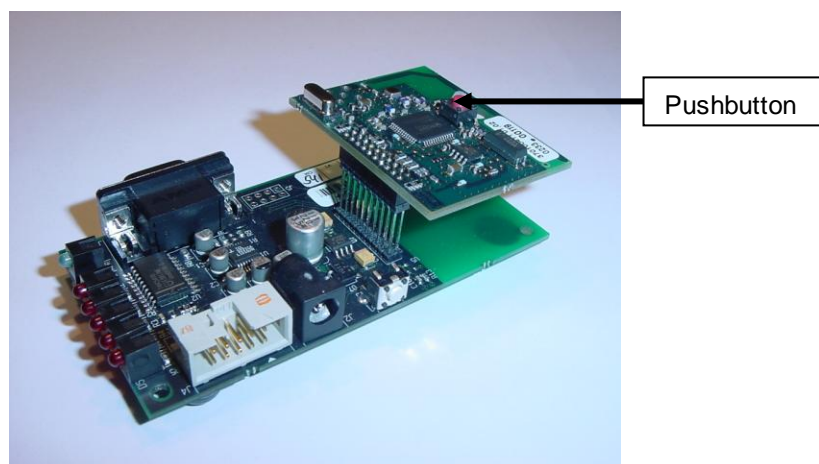
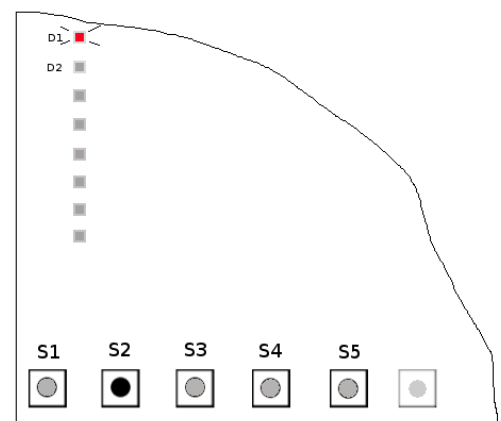


Figure 5. ZW0102 Controller/Slave Unit

The slave applications Led Dimmer, Binary Sensor or Binary Sensor Battery is designed for the Controller/Slave Unit, which is an assembly of the of the ZW0x0x Interface Module and a ZW0x0x based Z-Wave Module. To include this type of module to the Z-Wave Network when using a Development Controller as primary requires the following steps:

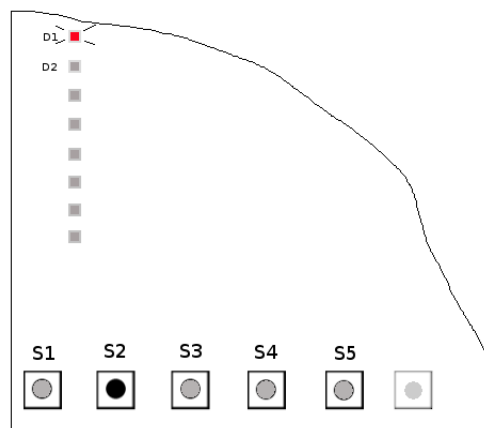
1. On the primary Development Controller, press and hold S2 – this will turn D1 ON, indicating that the system is awaiting node information from the Node which is being included to the Network. Development Controller based on SDK's supporting NWI accepts also network wide inclusion requests.
2. Press the pushbutton 3 times within 1,5 sec. on the Z-Wave slave Node being included in the network. The pushbutton (red) is located on the ZM1220 Z-Wave Module.
3. When D1 starts to flash on the primary Development Controller, PB1 can be released. When the node information has been received and processed by the Development Controller, LED0 will turn OFF, which means that the Node has now been included in the network.
4. Repeat step 1 and 3 to include more Nodes in the Network.



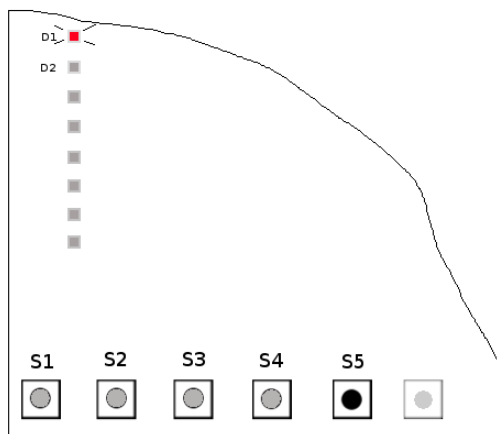
#### 4.2.2 Controller Node

The controller application Development Controller is provided on the ZM1220 Z-Wave Module connected to the ZW0x0x Development Module. To include this type of module to the Z-Wave Network when using a Development Controller as primary requires the following steps:

1. On the primary Development Controller, press and hold S2 – this will turn D1 ON, indicating that the system is awaiting node information from the Node which is being included to the Network. Development Controller based on SDK's supporting NWI accepts also network wide inclusion requests.



2. Press and hold S5 on the Development Controller that you want to include into the network as a secondary controller. Remember to keep the S5 pressed until D1 lights up. If D2 lights up the replication failed and should be repeated!



3. When the node information has been received and processed by the Development Controller, D1 will turn OFF, which means that the Node has now been included in the network and S2 can be released.
4. Repeat step 1 and 3 to include more Nodes in the Network.

Please note that the process of replication does include transfer of information about which nodes are included in the Group – So the new controller will be able to control the same group as the controller used to include it.

When additional nodes are included to the network then the secondary Development Controller's network topology is incomplete in case a static update controller (SUC) is not present. By repeating the inclusion process on the secondary Development Controller it will receive the updated network topology. Regarding automatic network updates refer to section 4.9.

#### **4.2.3 Network Wide Inclusion**

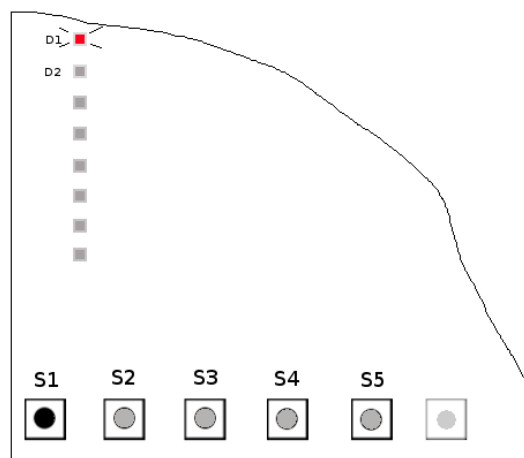
A Development Controller based on SDK's supporting NWI will by default enter NWI to be added to a network when it is powered up and have not already been included or have included other nodes itself. The controller will stay in NWI mode for 4 minutes or until it has been included into the network. Any key press will terminate the NWI mode and the only way to make the controller enter NWI mode again is by doing hardware reset by either remove and reapply the power or press the reset button on the side of the board.

### 4.3 Associate a Slave Node to a Group.

The Development Controller has only one Group that Nodes can be associated to – this Group is controlled via pushbutton PB0.

When associating Nodes to the Group, please follow the description below:

1. Make sure that the Node which you want to associate to the Group is already included in the Z-Wave network
2. Press and hold S1 on the Development Controller – this will turn D1 ON, indicating that the system is awaiting node information from the Node you want to associate.



3. Press on the pushbutton 3 times within 1,5 sec. on the Z-Wave module mounted on the Node being associated. This will prompt the Z-Wave Module to send out a node information frame.
4. When the node information has been received and processed by the Development Controller, D1 is flashing. The Node has now been associated to the Group. D1 will turn OFF when S1 is released.
5. Repeat step 1 to 4 if more Nodes should be associated to the Group.

To remove an association from the group hold down S1 and press shortly on the pushbutton located at the Z-Wave module to be removed. The node is still a part of the Z-Wave network.

### 4.4 Switching a Group of Nodes On and Off

The switching On and Off of the Development Controller Group is done by pressing S1 shortly. When S1 is pressed, D1 turns briefly ON and turns OFF again, indicating that the processor is processing the signal.

#### 4.4.1 Aborting a Group On or Off command

When a group On or Off command is issued the development controller will start to send commands to each node in the group. If that process wants to be aborted then the S1 button can be pressed again to abort the commands to the remaining nodes.

#### **4.5 Dimming a Group of Nodes**

The dimming of a Group of Nodes is done by pressing, and holding S1. While dimming is ongoing, D1 will be ON indicating that the processor is busy.

Dimming will continue for as long as S1 is kept pressed, but the Nodes will only continue to either Full ON or Full OFF. Releasing S1 and then keep pressing again will toggle the direction of the dimming.

#### 4.6 Assigning a Route to a Routing Slave

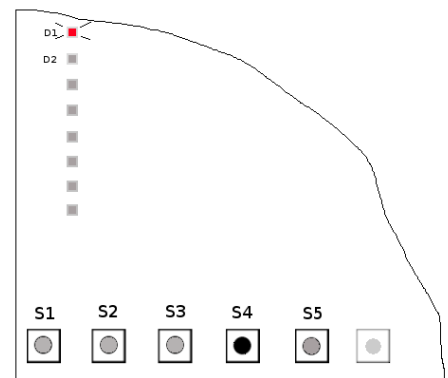
The Development Controller can also be used for assigning a Route to a Routing Slave e.g. a Binary Sensor. Please refer to [1] for detailed information on how the assigning of routes is actually handled by the protocol.

Assigning a Route to a Routing Slave is done to make the Routing Slave capable of reaching another Node even via routing when certain conditions are met. An example could be a setup consisting of a Binary Sensor and a LED Dimmer (or any other kind of Node). The user would like the LED Dimmer turned on, when the Binary Sensor is activated – this would require the assigning of a route to the Binary Sensor in order to make this Node know, which Node to control.

Assigning a Route to the Binary Sensor is done as described below:

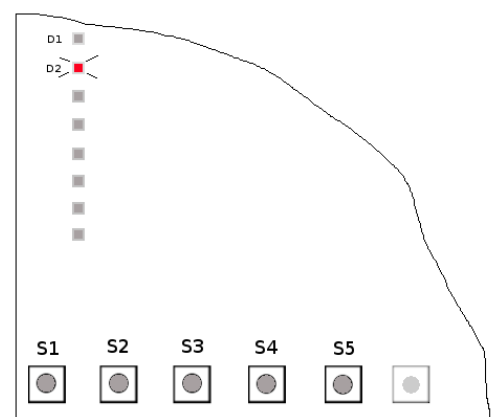
1. Press shortly on S4 – this will turn D1 ON, indicating that the system is awaiting node information from the LED Dimmer that the Binary Sensor should get a route to.

2. Press on the pushbutton 3 times within 1,5 sec. on the Z-Wave module, which is a part of the LED Dimmer. This will prompt the Z-Wave Module to send out a node information frame.



When the node information has been received and processed by the Development Controller, D1 will turn OFF and D2 will turn ON, indicating that the system is awaiting node information from the Binary Sensor to which you want to assign a route.

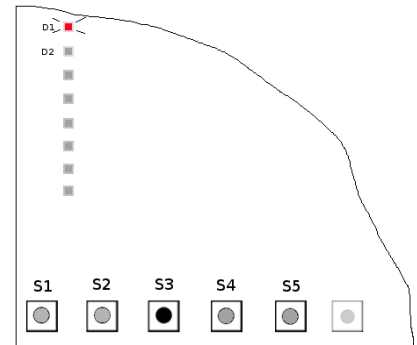
3. Now press the pushbutton 3 times within 1,5 sec. on the Z-Wave module, which is a part of the Binary Sensor.
4. When the node information has been received and processed by the Development Controller, D2 will turn OFF, and a route has been assigned from the Binary Sensor to the LED Dimmer.
5. When the Binary Sensor is activated (in this case by pressing the pushbutton on the Binary Sensor) the LED Dimmer will turn on for a few seconds and then it turns off again.



#### 4.7 Excluding a Node from the Z-Wave Network (reset Node)

The Development Controller application is capable of excluding Nodes and deleting them from the Z-Wave Network. The procedure is as follows:

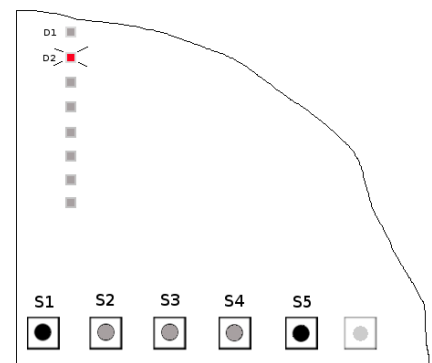
1. Press and hold S3 on the Development Controller – this will turn D1 ON, indicating that the system is awaiting node information from the Node to be excluded from the Network.
2. Press the pushbutton 3 times within 1,5 sec. on the Z-Wave slave Node to be excluded from the network.  
Or press and hold the S5 button on the secondary Development Controller to be excluded from the network.
3. When D1 turns OFF on the Development Controller then the Node has been excluded and reset. S3 can now be released.



#### 4.8 Resetting the ZW0102 Development Controller

When resetting a Development Controller all information about the network topology is removed. Remember that resetting the primary Development Controller does not reset the Nodes that are included in the network that the Development Controller hosts. Each Node must be reset individually and this can be done either before or after having reset the primary Development Controller.

1. Press and hold both S1 and S5 on the Development Controller – after 2 seconds, D2 will turn ON signaling that the reset is in progress, and the pushbuttons can be released.
2. After a few seconds D2 will turn OFF and D1 will flash shortly, meaning that the Development Controller has been reset.





#### 4.9 Using Automatic Network Update Feature of Controllers

The secondary controllers will have an outdated network topology when the primary Development Controller includes/excludes new nodes. Having a static update controller (SUC) present in the network allows the secondary controllers to obtain the latest network topology by requesting network updates from the SUC. The PC based Controller application [3] can be used as SUC.

All changes in the network are transferred from the primary Development Controller to the SUC. The SUC can hold up to 64 changes of the network. A network change can be a node inclusion or exclusion to/from the Z-Wave network.

To use this functionality the following should be done:

1. Use the primary Development Controller to include a static controller to the network. The primary Development Controller will automatically try to allocate the first static controller included in the network to be a SUC. Refer to section 4.2 regarding how to include a node.
2. Add a new Development Controller to the network. During the inclusion process the new secondary Development Controller is informed about the presence of a SUC.
3. Now the secondary Development Controller will start requesting network updates from the SUC. A random request interval is used between 1 and 4 minutes.

When a new node is included to the network then the secondary Development Controller will receive this information at the next request to the SUC and will then be able to control it. Similar will the secondary Development Controller be updated when a node is removed.

#### 4.10 Using Inclusion Controllers

Only the primary Development Controller has the capability to include/exclude nodes to/from the Z-Wave network. Having a SUC ID Server (SIS) present in the network allows all controllers to include/exclude nodes on its behalf. A SIS is a SUC with enabled node ID server functionality. The PC based Controller application [3] can be used as SIS.

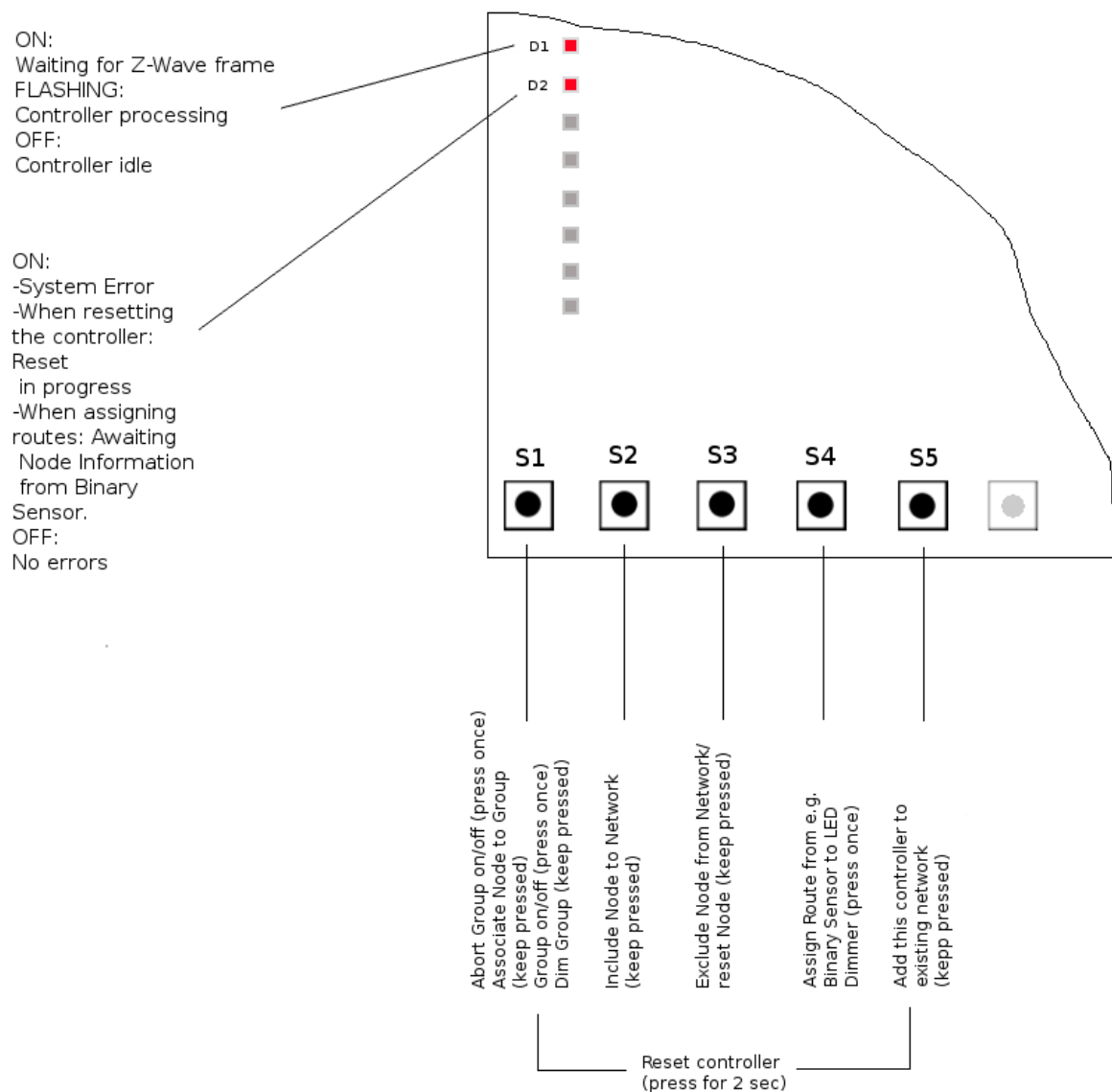
To use this functionality the following should be done:

1. Use the primary Development Controller to include a static controller to the network. The primary Development Controller will automatically try to allocate the first static controller included in the network to be a SIS. Refer to section 4.2 regarding how to include a node. In case a PC based Controller is used then remember to configure it to be a SIS when included to the network.
2. Add a new Development Controller to the network. During the inclusion process the new inclusion Development Controller is informed about the presence of a SIS.
3. Now the inclusion Development Controller will start requesting network updates from the SIS. A random request interval is used between 1 and 4 minutes. In addition it can include/exclude nodes in the network. The D1 will flash on the inclusion Development Controller until a node ID is allocated from the SIS. When D1 turns ON then the inclusion Development Controller is ready to include the node.

The SIS becomes the primary controller in the network because it has the latest update of the network topology and capability to include/exclude nodes in the network. The old primary Development Controller becomes an inclusion Development Controller. The SIS enables the inclusion Development Controller to include/exclude nodes in the network on its behalf.

## 5 FUNCTION OVERVIEW

The figure below summarizes the functions of the Development Controller and the descriptions that have been given in the previous sections.



## 6 REFERENCES

- [1] Zensys, INS10244, Instruction, Z-Wave Node Type Overview and Network Installation Guide
- [2] Zensys, DSH11243, Datasheet, Development Controller User Guide
- [3] Zensys, INS10240, Instruction, PC based Controller User Guide
- [4] Zensys, DSH10275, Datasheet, ZM2120C Z-Wave Module
- [5] Zensys, DSH10857, Datasheet, ZM3120C Z-Wave Module