



Instruction

PC based Controller User Guide

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REVISION RECORD

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1 ABBREVIATIONS

Abbreviation	Explanation
API	Application Programming Interface
DLL	Dynamic Link Library
OTA	Over-the-air
SC	Static Controller
SUC	Static Update Controller
SIS	SUC ID Server
ERTT	Enhanced Reliability Test Tool

2 INTRODUCTION

2.1 Purpose

The PC based Controller application is an example on how Static Controller serial API functionality can be used to implement a Z-Wave enabled PC application.

2.2 Audience and prerequisites

The audience is Z-Wave partners and Zensys. It is assumed that the Z-Wave partner already is familiar with the current Z-Wave Developer's Kit.

2.3 Implementation

The PC based Controller application is implemented in Visual Studio .NET 2005 C# and uses the .NET Framework based Zensys Z-Wave DLL for protocol related communication.

Zensys.ZWave.SerialPortTransport – provides an implementation for the communication layer to the underlying communication hardware and acts as an abstraction layer between the physical hardware and the communication.

Zensys.ZWave.SerialPortSession – provides an implementation for the session layer to the underlying sessions, requests and responses.

Zensys.ZWave.SerialPortFrame – provides an implementation for the frame layer to the underlying frame parsing and generation.

Zensys.ZWave.SerialPortApplication – provides an Application Programming Interface (API) to the Z-Wave protocol.

Zensys.ZWave – provides classes, interfaces, enumerations and definitions to the Z-Wave protocol

Zensys.ZWave.CommandClasses – provides a list of existing Command Classes, classes and enumerations in use by the working system.

Zensys.Framework – provides common classes, helpers and functions.

Note: Regarding a detailed description about the Z-Wave DLL, please refer to Z-Wave DLL documentation.

2.4 Limitations

The PC based Controller application has been tested on Windows XP and Windows 7.

Secure PC Controller application should not be used together with Z-Wave module running SerialAPI_Ctl_Static_Single binary since CmdZWaveGetRandom is not implemented in the Z-Wave device.

3 THE PC BASED CONTROLLER

The PC based Controller is an application designed for the Windows platform that is capable of communicating with Z-Wave nodes like switches and sensors through a Static Controller (SC).

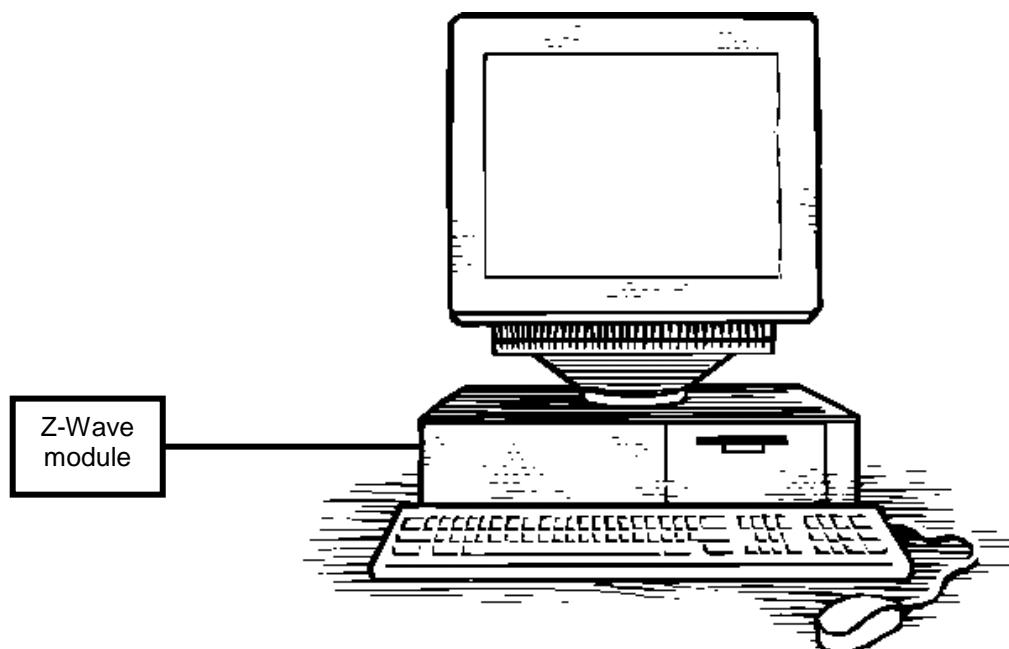


Figure 1. PC with a Z-Wave module connected

3.1 Check the prerequisites

The following components should be pre-installed on the machine that you need to run Z-Wave PC Controller Windows application:

1. .NET Framework, version 2.0 or later
2. Windows Installer 3.0 (Windows Installer 3.1 or later is recommended)

Important: Make sure you have the latest service pack and critical updates for the version of Windows that you are running. To find the recent security updates, visit Windows Update.

3.2 Required Z-Wave hardware

Z-Wave PC Controller application requires a Z-Wave module programmed with Static Controller Serial API application and connected to the appropriate serial or USB port.

To program the Z-Wave module, use the firmware HEX file (usually `SerialAPI_Ctl_Bridge_ZW0x0x_XX.hex`) situated in the directory '`C:\DevKit_X_YY\Product\Bin\SerialAPI_Bridge\`'. Finally connect the Z-Wave module to the COM port on the PC.

3.2.1 UZB

UZB is the Z-Wave USB Adapter. It is a USB-based Static Controller.

As the device exports a USB CDC/ACM class compliant interface, it appears as a serial port, reusing existing standard drivers on most popular PC operating systems. As such there is no vendor driver required. Over the serial port, the Z-Wave Serial API is exported.

UZB.INF is provided that reuses the standard Windows usbser.sys or usbser64.sys driver. The device appears in the Device Manager under the Ports section, and is accessible through the Windows CreateFile API by applications as “\\\\.\\COMxxx” where xxx is the COM Port number assigned by the OS.

For more info on UZB, see INS11850, Instruction, UZB User Manual.

3.3 Limitations

Z-Wave PC Controller application has been tested on Windows XP with Service Pack 3 (x86 platform) and Windows 7.

3.4 Install the Z-Wave PC Controller application

1. Exit all programs.
2. Run the installation file of the Z-Wave PC Controller application.

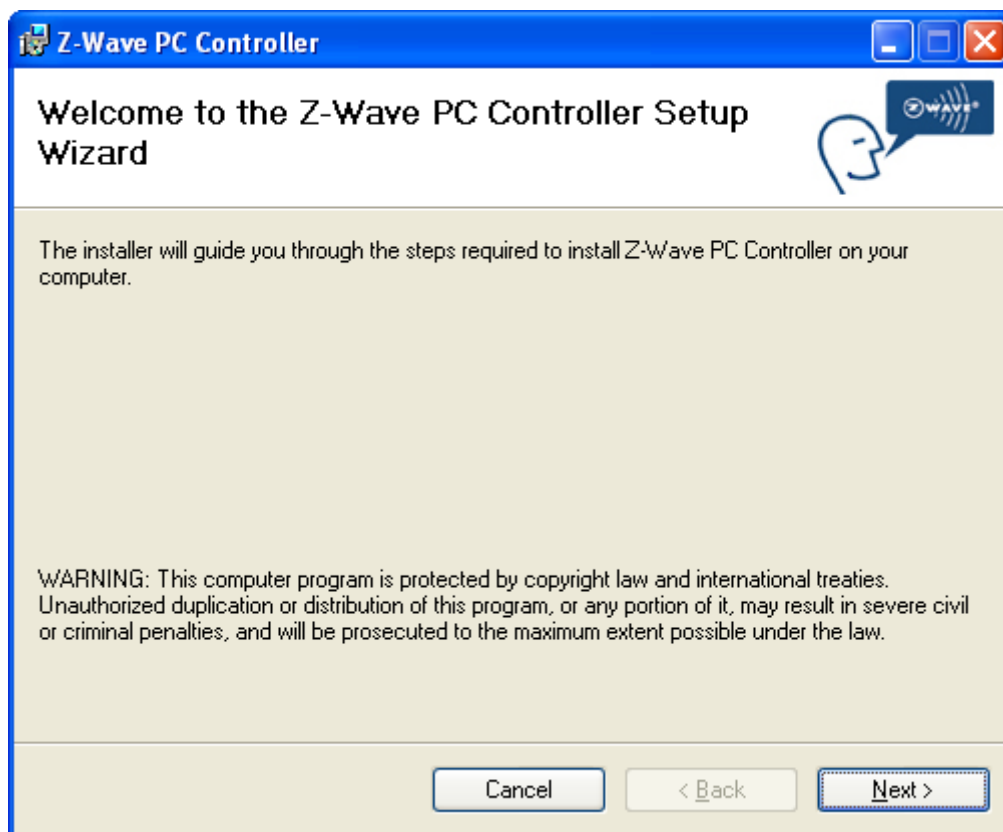


Figure 2. Welcome page of Z-Wave PC Controller installation.

3. Select the installation folder and who should be able to use the Z-Wave PC Controller application.
Please note, that it is not recommended to move the Z-Wave PC Controller application manually after it has been installed into the above specified folder.
When done, click **Next**.

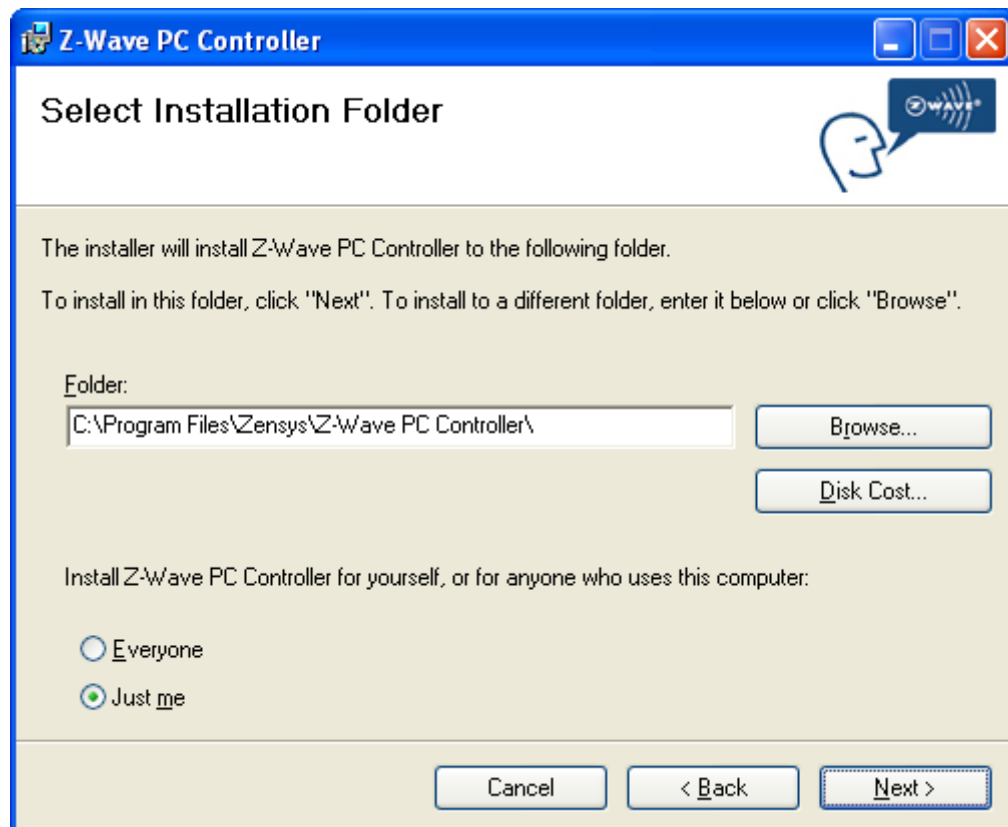


Figure 3. Installation folder

4. Installation confirmation appears. Click **Next** again to confirm and start the installation.

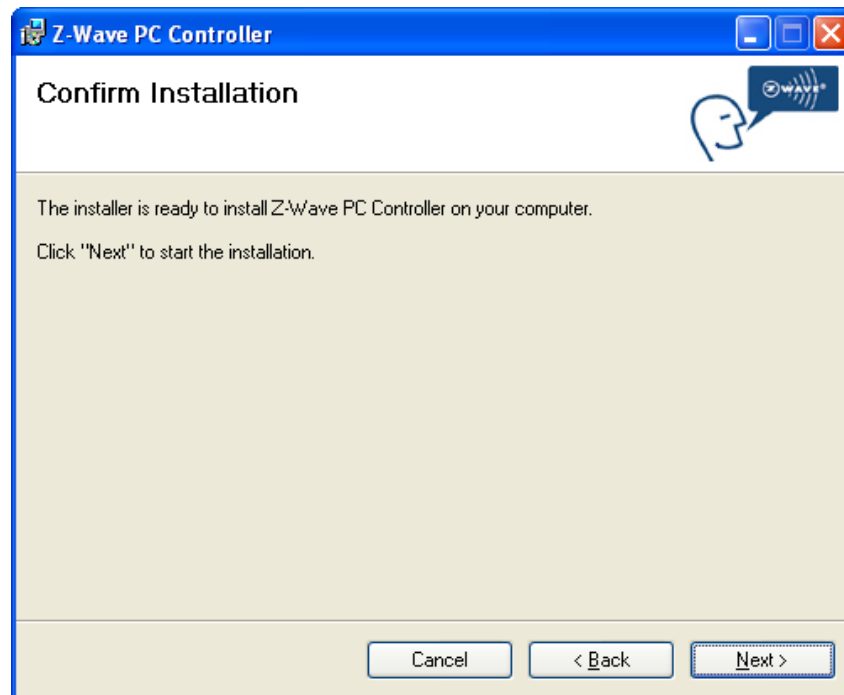


Figure 4. Confirmation page of Z-Wave PC Controller installation

5. The actual installation procedure will pass with progress indicator and final confirmation appears.
6. Click **Close** to complete the installation.

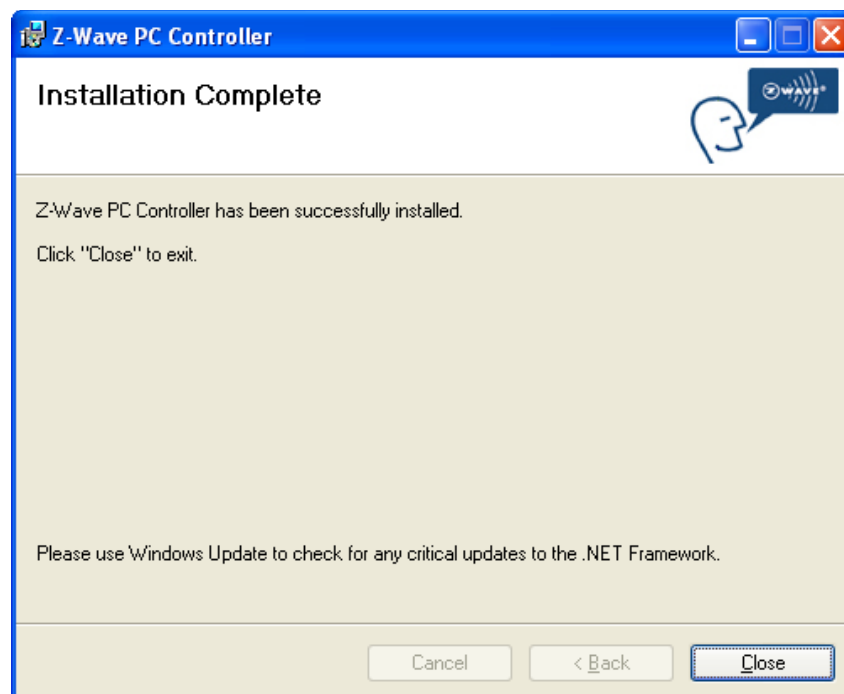


Figure 5. Installation complete

3.5 Start the Z-Wave PC Controller application

You can start the Z-Wave PC Controller using the Start menu. To open the Start menu, click the **Start** button in the lower-left corner of your screen. Or, press the **Windows logo** key on your keyboard. The Start menu appears.

To open Z-Wave PC Controller, click its icon shown in the left pane of the Start menu that displays the most frequently used programs list. If you don't see its icon there, click **All Programs** at the bottom of the left pane. Instantly, the left pane displays a long list of programs in alphabetical order, followed by a list of folders. Click **Zensys** folder, then click **Z-Wave PC Controller** folder and finally **Z-Wave PC Controller** icon.

Each time you start Z-Wave PC Controller, you are actually running the “C:\Program Files\Zensys\Z-Wave PC Controller\ZWaveController.exe” executable file, although you do not usually type its name or even see it.

Run the PC based Controller application, and the Main window will appear as shown below:

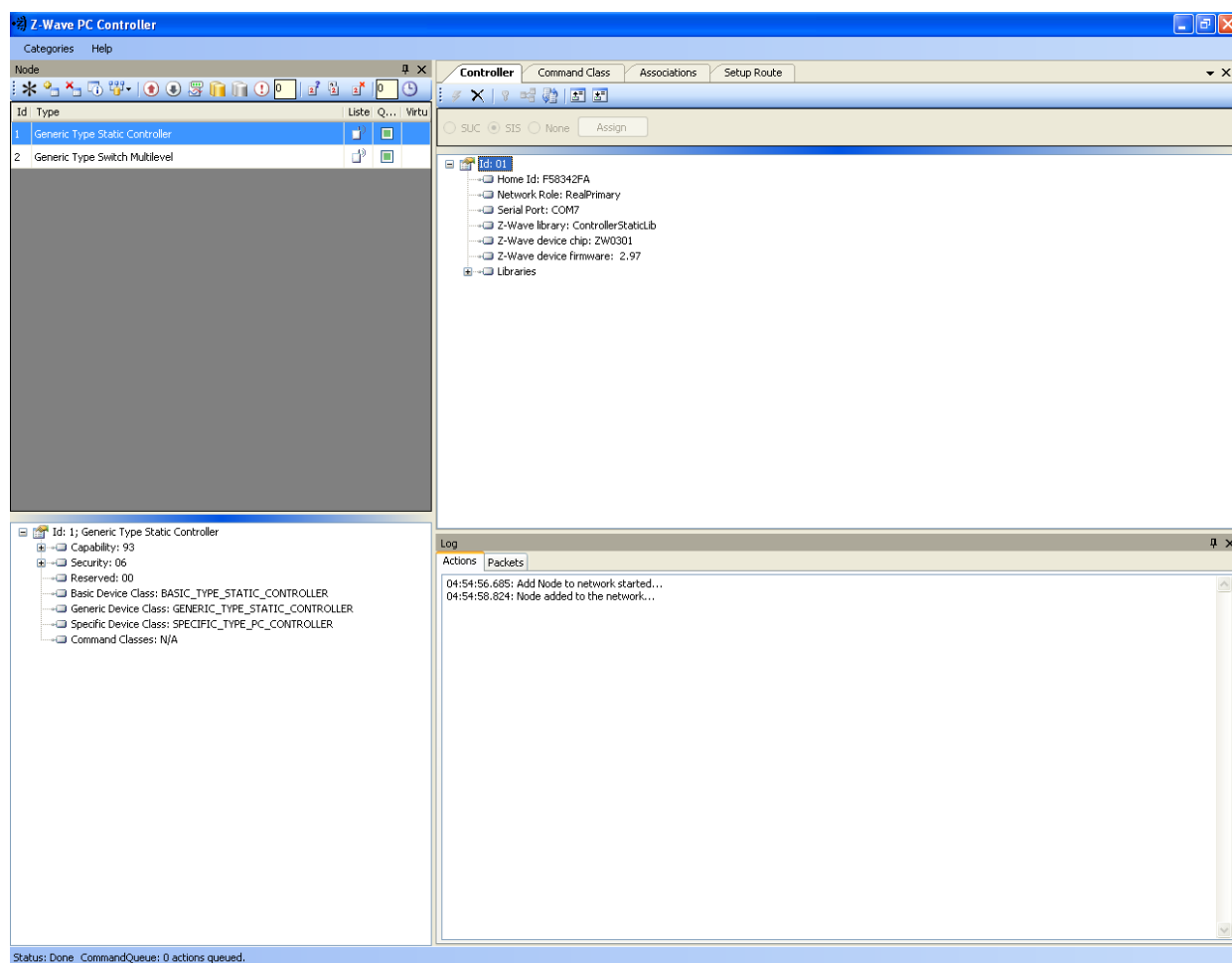


Figure 6. 7PC based Controller Main Window

3.6 Remove Z-Wave PC Controller

You can uninstall Z-Wave PC Controller from your computer if you no longer use it.

1. Open **Add or Remove Programs** in Control Panel.

To do it, click **Start**, then click **Control Panel** (in Classical View – click **Start**, then point to **Settings**, and click **Control Panel**), and then double-click **Add or Remove Programs**.

2. Click the program in the list and then click the **Remove** button. You can sort programs by selecting different options in **Sort by**.
3. Standard confirmation dialog appears. Click **Yes** to continue the removal of the Z-Wave PC Controller software.
4. Z-Wave PC Controller and its settings will be removed without prompting you further.

4 USER INTERFACE

The PC Based Controller application Main window (See Figure 3) is divided into the following views:

- **Title bar**
- **Menu bar**
- **Node**
- **Controller**
- **Command Class**
- **Associations**
- **Setup Route**
- **Node Info**
- **Log**
- **Status Bar**

4.1 Main Menu

On top of the Main window is the Application **Main Menu**. It has the following items:

4.1.1 Categories Menu

Menu item	Description
Node	Toggle shows the Node section
Controller	Toggle shows the Controller section
Cmd Class	Toggle shows the Command Class section
Associations	Toggle shows the Associations section
Setup Route	Toggle shows the Setup Route section
Log	Toggle shows the Log section
Settings	To detect available serial ports and query them to find all connected Z-Wave devices
Security Test Schema	Toggle shows the Security Test Schema tab (only in Z-Wave Security PC Controller)
ERTT	Toggle shows the ERTT tab
Exit	To exit the application.

4.1.2 Help menu

Z-Wave Pc Controller comes with its own built-in Help system. The Help menu includes the items to access this Help system.

Menu item	Keyboard Shortcut	Description
Index		Browses Help system by keywords.
Contents	F1	Browses Help system by topics.
Search		Opens search tab of the Help system.
About...		Displays the version and short status information of the application

4.2 Node View

The **Node View** contains *Menu Bar*, *Node List* and *Node information* for the selected node.

It is used for operations with nodes.

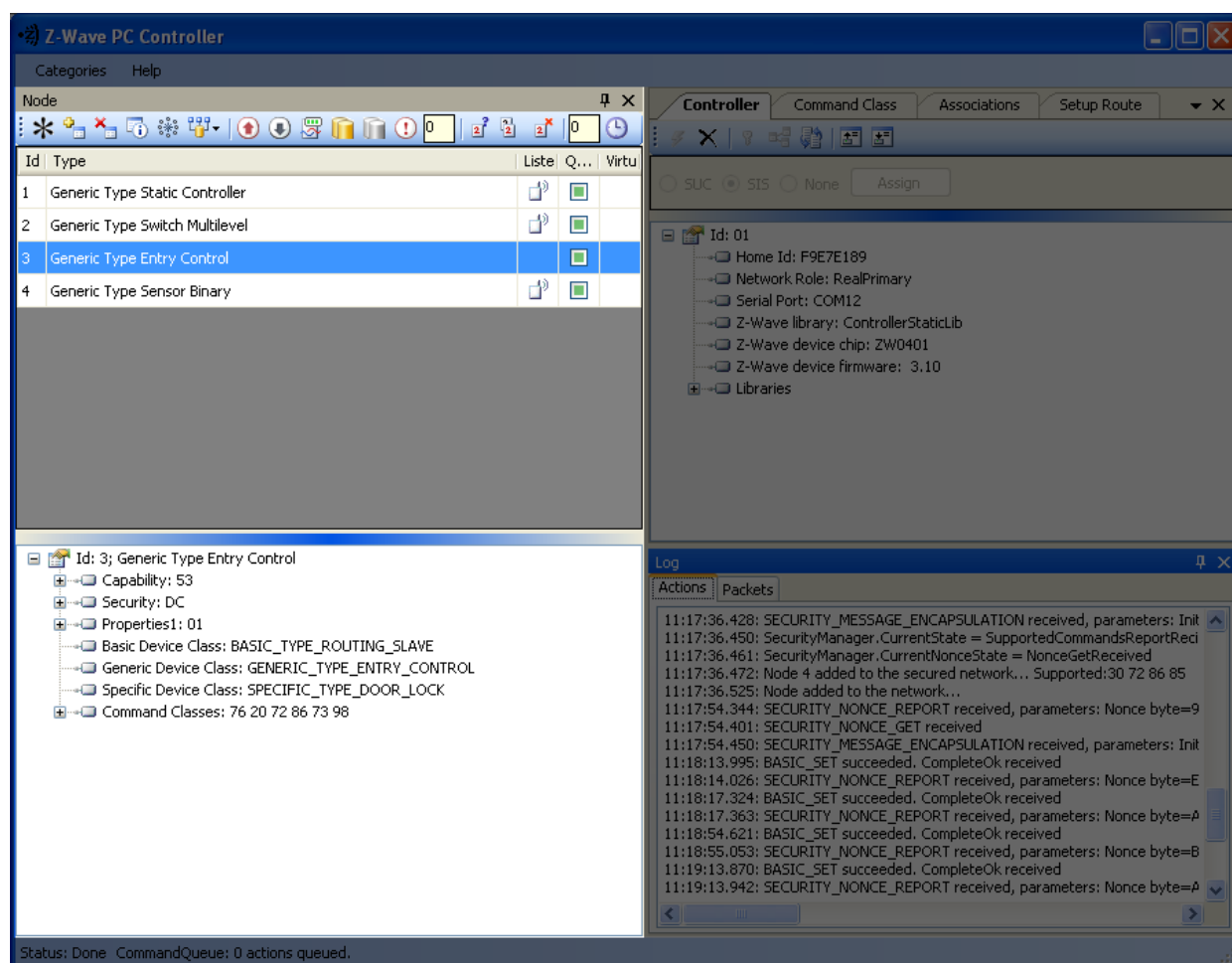


Figure 8. Node section

The Node's *Menu Bar* has the following items:

Menu item	Description
NW Inclusion	Network Wide Inclusion, to include all nodes into network once they have been reset and given power
Add	To Add a node
Remove	To Remove a node
Node Info	To request Node info from a node
Request Node Neighbour Update	To get the neighbours from the specified node.
Set SUC/SIS	To set the "Set SUC" or "Set SIS" command to the selected Controller
Basic Set On	Send the BASIC SET ON command to Switch a selected node(s) ON
Toggle Basic Get	Starts/stops sending consequent BASIC GET commands to the selected node(s)
Basic Set Off	Sends the BASIC SET OFF command to Switch a selected node(s) OFF
Switch All On	To switch all nodes in the network ON
Switch All Off	To switch all nodes in the network OFF
Send NOP	'No Operation' – to send a frame not carrying any functional info to a node
Numeric box after NOP	To enter the Node ID of the node to which a NOP frame is to be sent
Is Failed	To send a Failure signal to a node
Replace failed	To Replace a failed node
Remove Failed	To Remove a failed node
Wake Up Interval (Set)	To set up the Wake Up Interval for a non-listening node

The *Node List* has three columns:

- **Node Id** – shows the IDs of all nodes in the network;
- **Device Type** – shows description of the type of every node in the network;
- **Status** – shows the current status of a node.

The *Node Info* section gives structured information about the selected node. For more information, please refer to Z-Wave Device Class Specification documentation.

4.3 Controller view

The **Controller view** includes *Menu Bar*, *Network Role Option* and *Controller Information* sections.

The **Controller view** is used for operations with controllers.

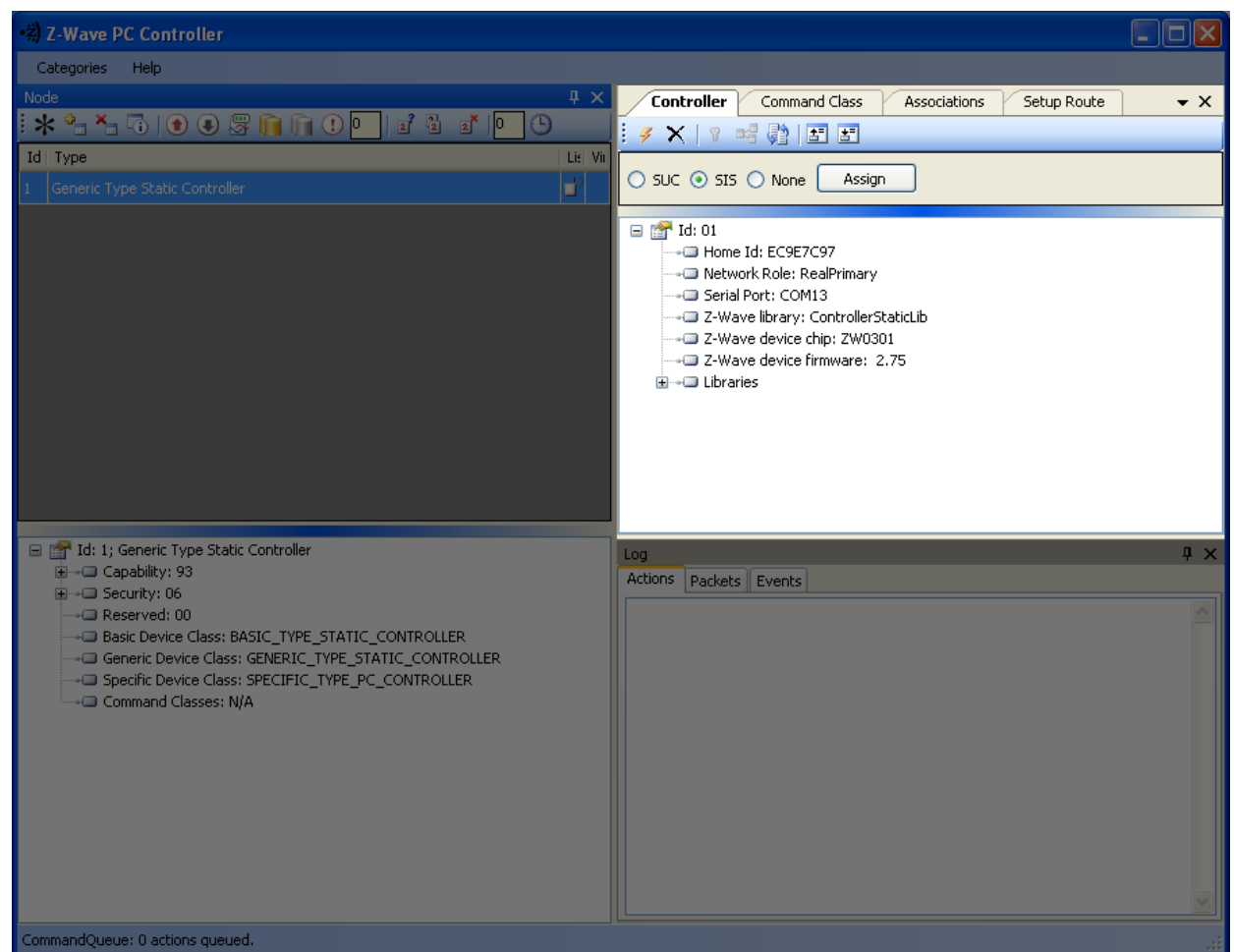


Figure 9. Controller view

The Controller's *Menu Bar* has the following items:

Menu item	Description
Start Learn Mode	Starts learn mode for the controller if it is needed to include it in another controller's network
Reset	Resets a controller
Create New Primary	A SUC can create a new Primary Controller in the network if the existing Primary controller fails
Request Update	An Inclusion controller can request network updates from a SUC or a SIS
Shift	Is used to shift primary role to another controller in the network
Load Command Classes from device memory	To load command classes from the device memory (previously saved to device memory)
Save Command Classes to device memory	To save command classes from the PC Controller application memory to the Static Controller device memory

The *Network Role Option* section has controls to assign the role of the SC in the network:

- **SUC – Static Update Server**
- **SIS – Static Update Controller with ID server**
- **None**

General information regarding the SC is displayed in the *Controller Information* section in the following items:

Section	Description
Controller ID	Displays the node ID of the PC based SC
Controller Home ID	Displays the current Home ID of the PC based SC
Controller Network Role	Displays the PC based SC network role
Serial Port	Displays the serial port in use.

4.4 Associations view

The **Associations** view has a *Menu bar*, and two fields: *Source* and *Groups*. It is used to set up associations between nodes.

The *Menu bar* has two items:

Menu item	Description
Create Association	Creates an association between selected nodes
Remove Association	Removes selected association

The *Source* field shows the list of available source nodes that support the Association command class, e.g. Binary sensor.

The *Groups* field shows the association groups that can be or have been created.

The “Assign Return Routes” checkbox is to define whether the Controller should assign return routes together with setting the association.

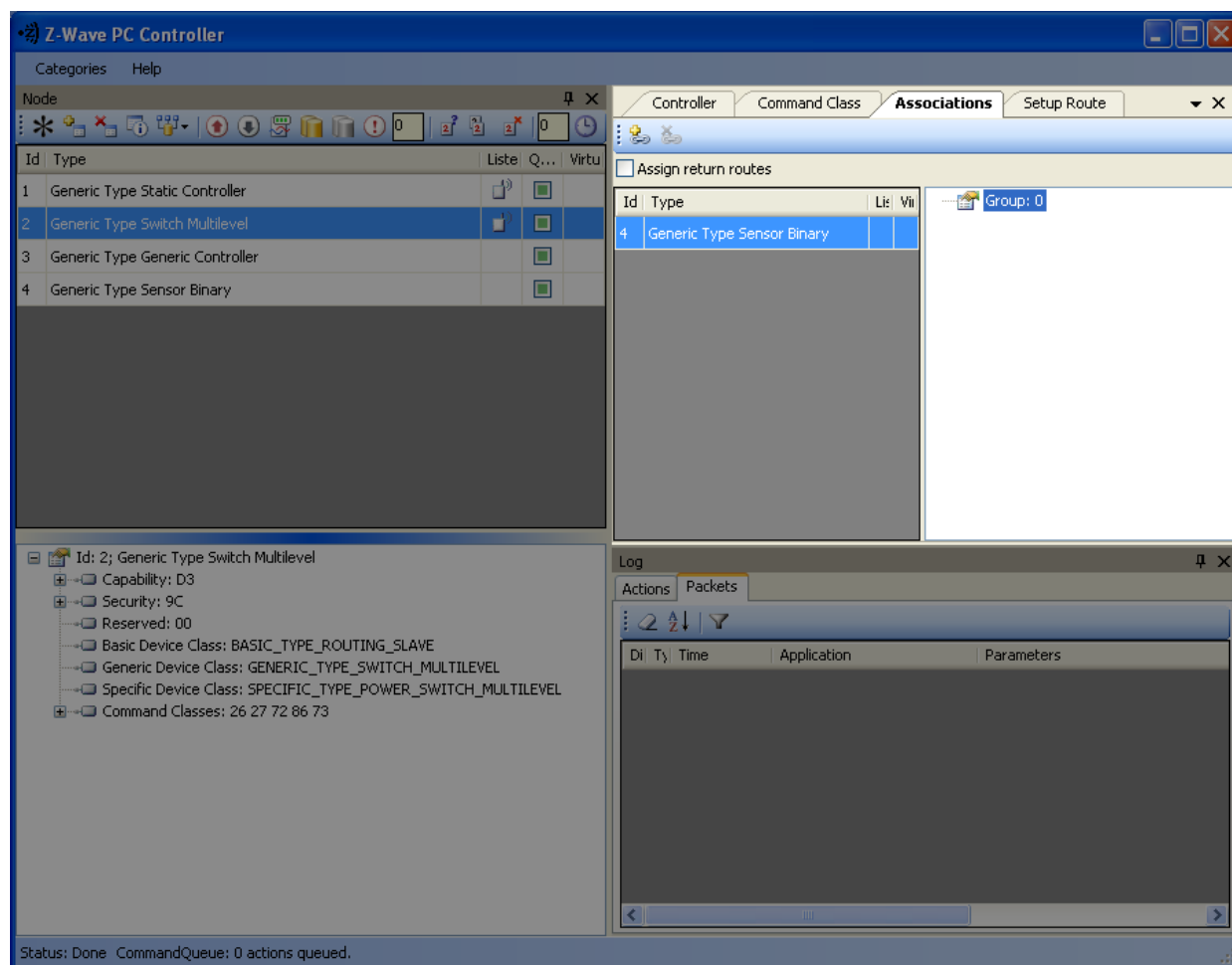


Figure 10. Associations view

4.5 Command Class view

The **Command Class view** is used to send a specified command class to a selected node. It has the following items:

- **Command Classes:** drop-down list to select a command class;
- **Command Name:** drop-down list to select a command name belonging to the selected class;
- **Command Parameters Grid:** to enter command parameters.

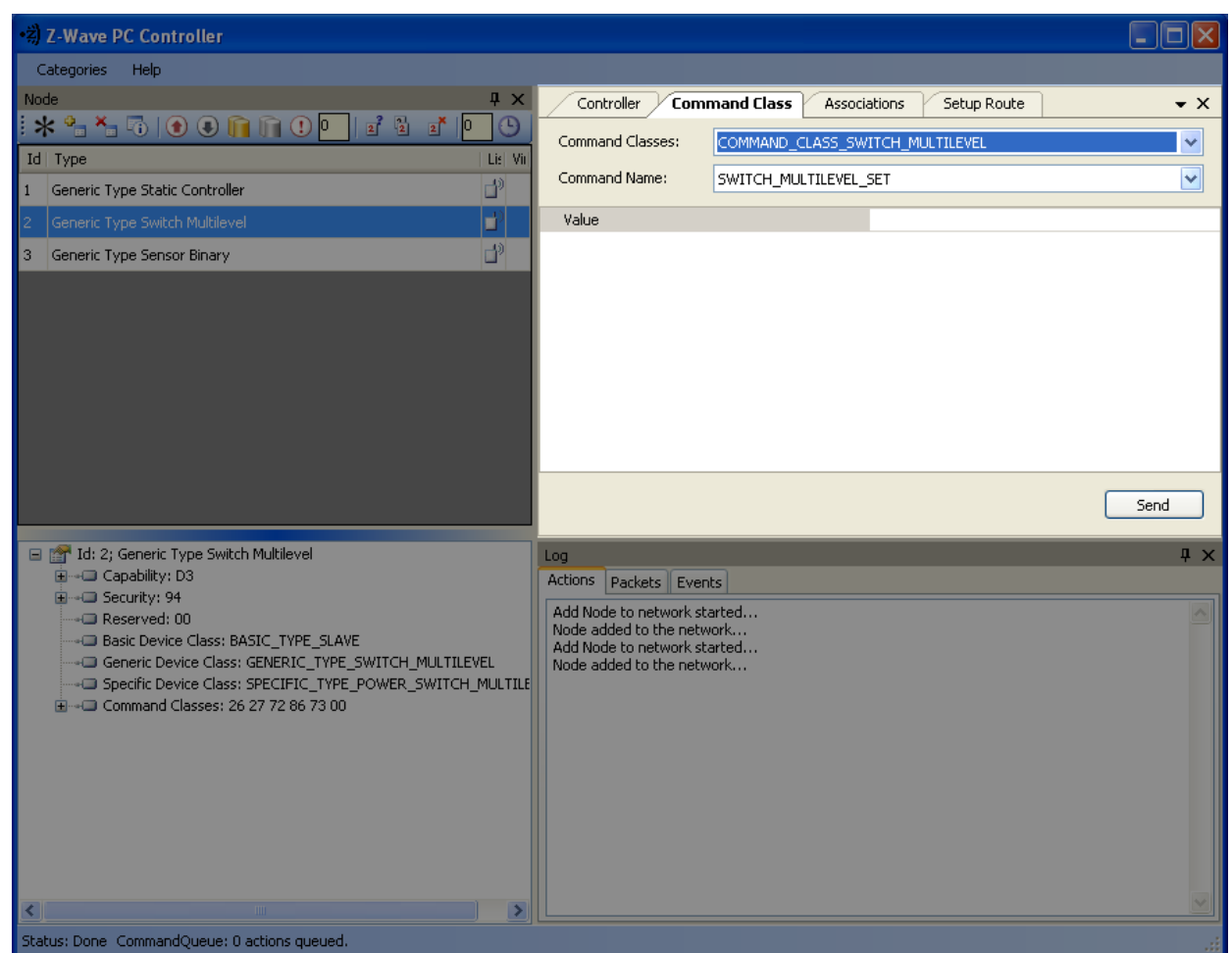


Figure 11. Command Class view

4.6 Setup Route view

The **Setup Route** view has a *Menu Bar*, *Source Node list* and *Destination Node list*. It is used to set up routes between nodes.

The *Menu Bar* has two items:

Menu item	Description
Assign	To assign routes via nodes
Delete	To delete assigned routes

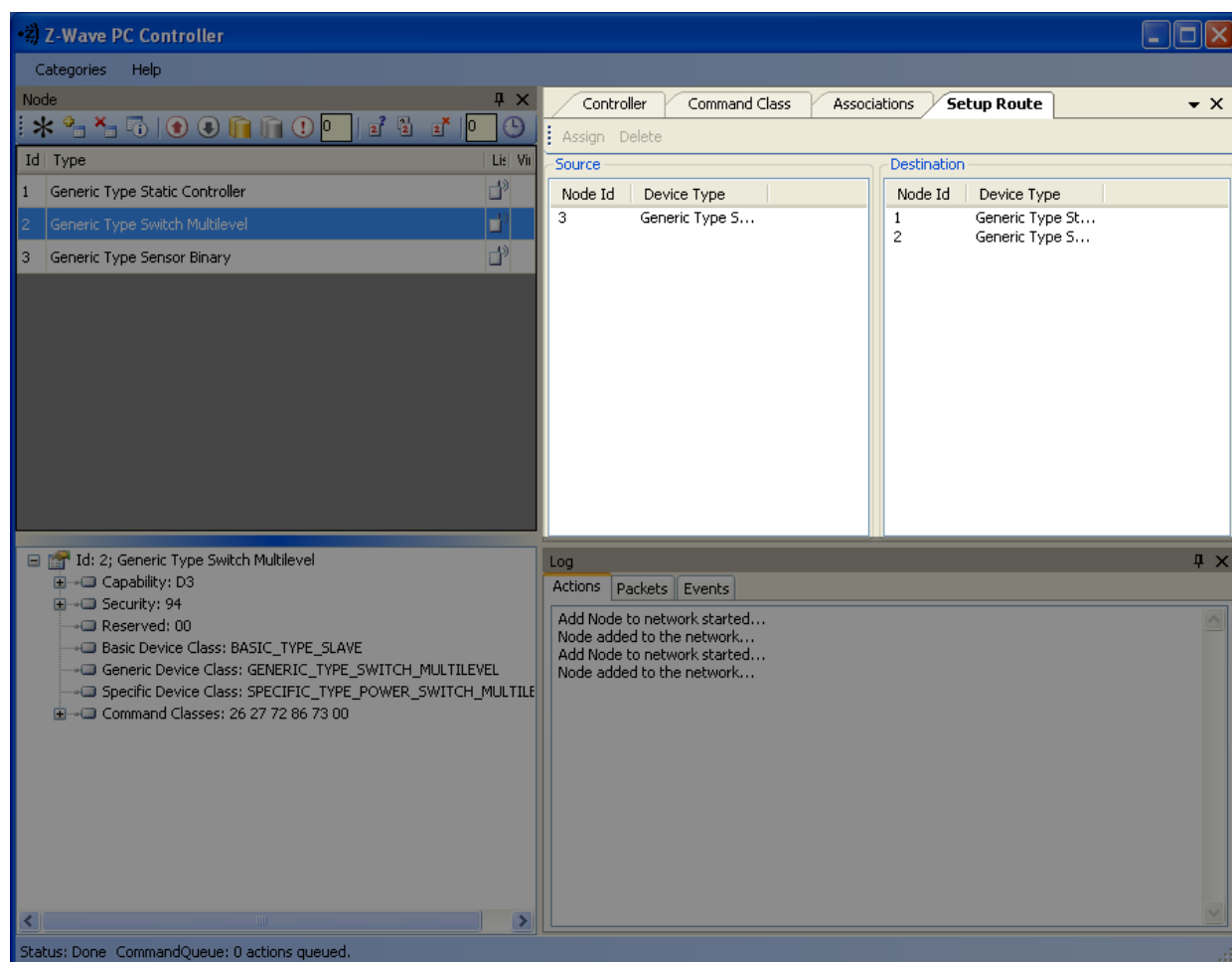


Figure 12. Setup Route view

Source Node list and *Destination Node list* show lists of source and destination nodes in a routed network respectively.

4.7 Setup Route view

The **Setup Route** view has a *Menu Bar*, *Source Node list* and *Destination Node list*. It is used to set up routes between nodes.

The *Menu Bar* has two items:

Menu item	Description
Assign	To assign routes via nodes
Delete	To delete assigned routes

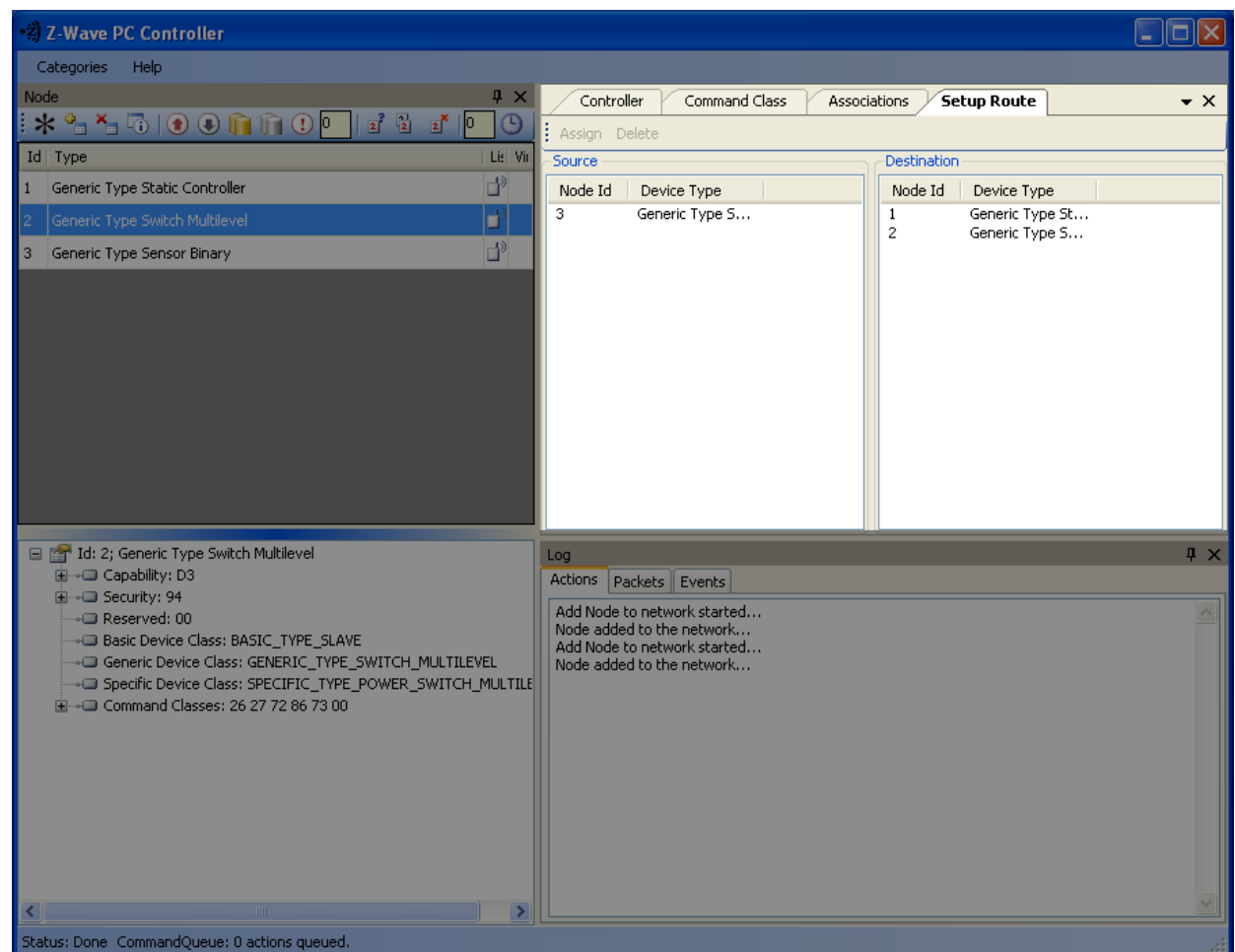


Figure 13. Setup Route view

Source Node list and *Destination Node list* show lists of source and destination nodes in a routed network respectively

4.8 Security Test Schema

In Z-Wave Security PC Controller, Security Test Schema functionality is available for the purposes of testing secure networks for failures in case of device malfunctioning.

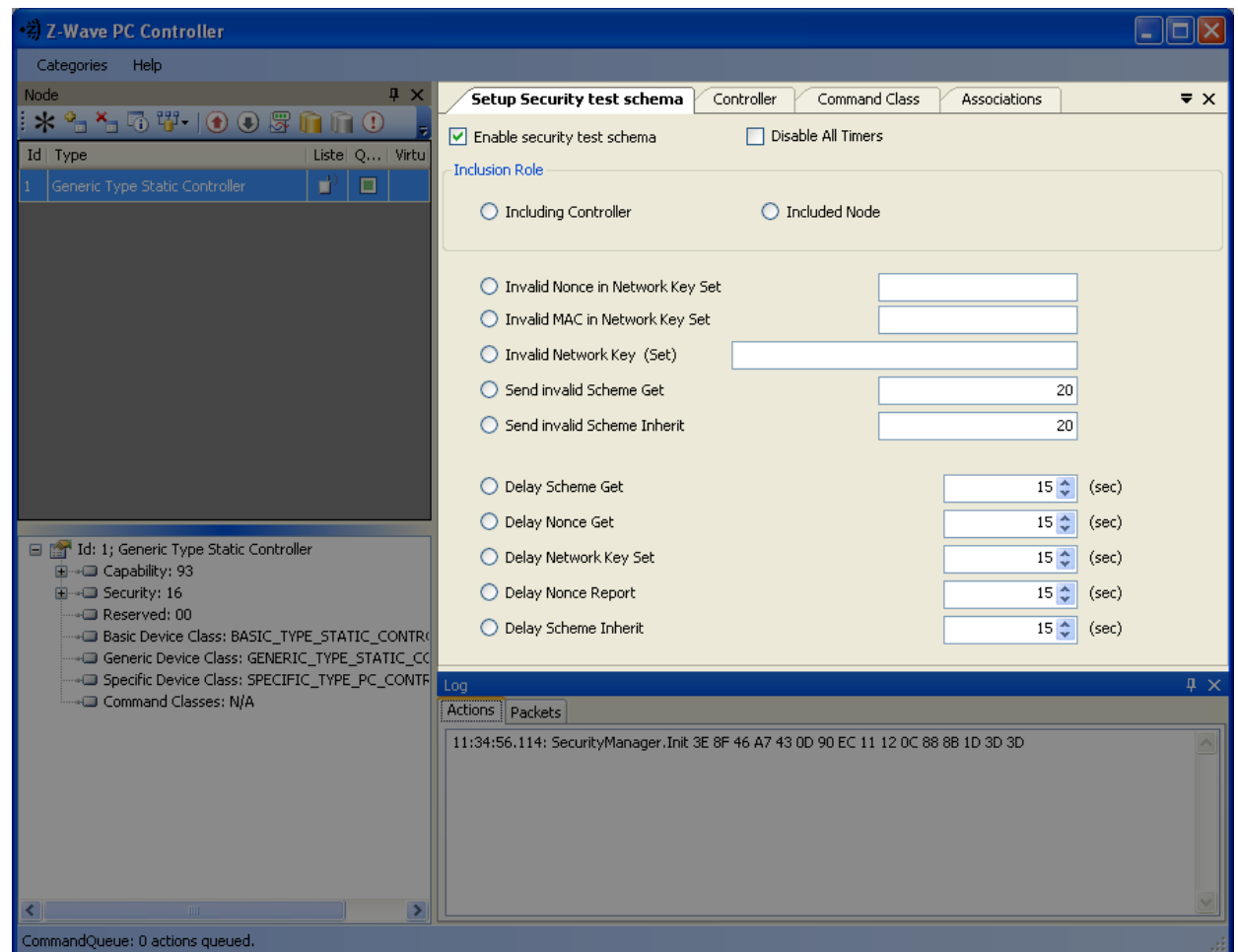


Figure 14. Security Test Schema

4.9 ERTT

Z-Wave PC Controller has the **Enhanced Reliability Test Tool** implemented. It can be activated as a tab through the **Categories** menu or through Ctrl+E keyboard shortcut.

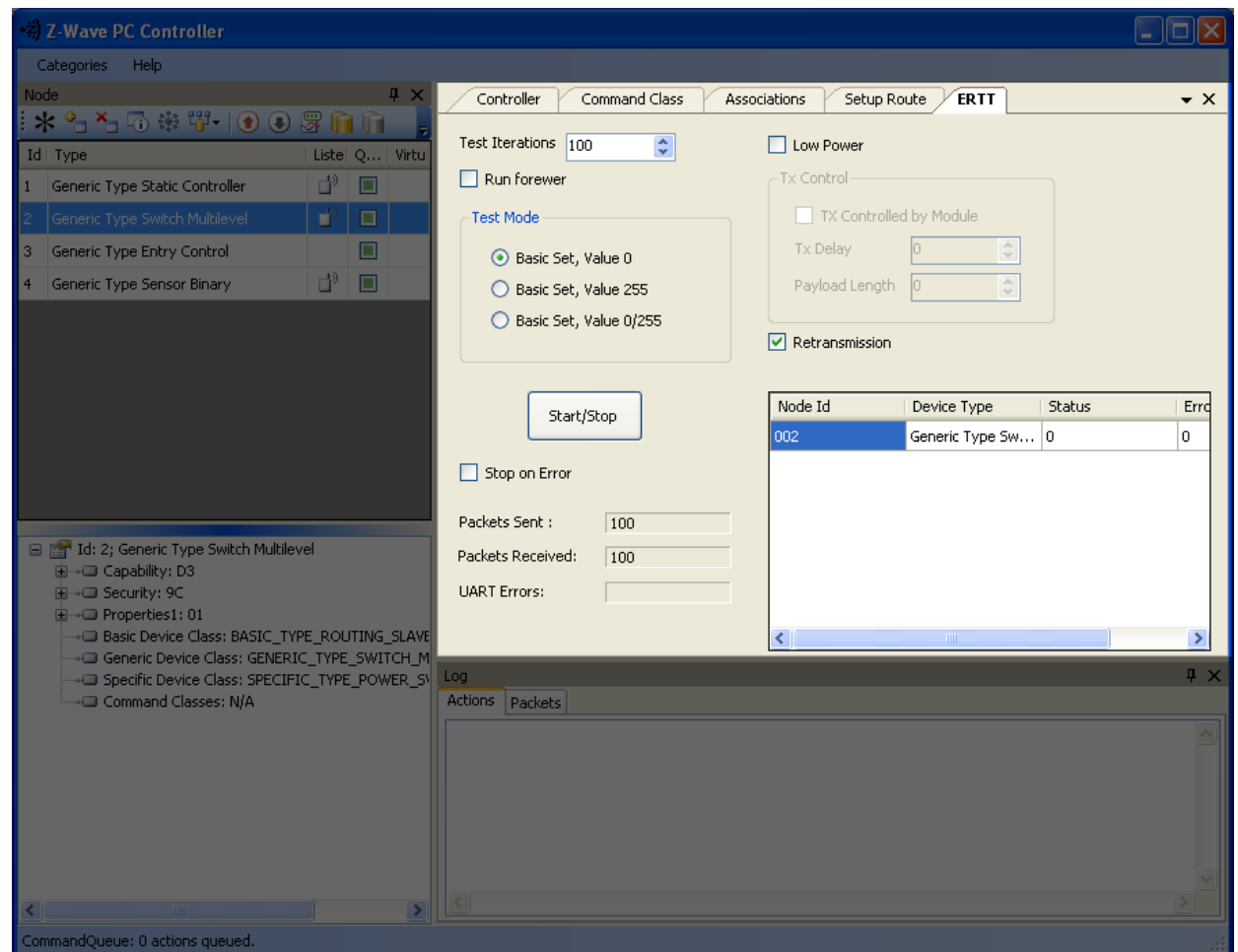


Figure 15. ERTT

4.10 Log View

The Actions tab presents a log of controller actions in user-friendly language. It also shows a warning if some function is not supported in the connected Z-Wave device.

The Packets tab presents a log of Serial API calls with parameters.

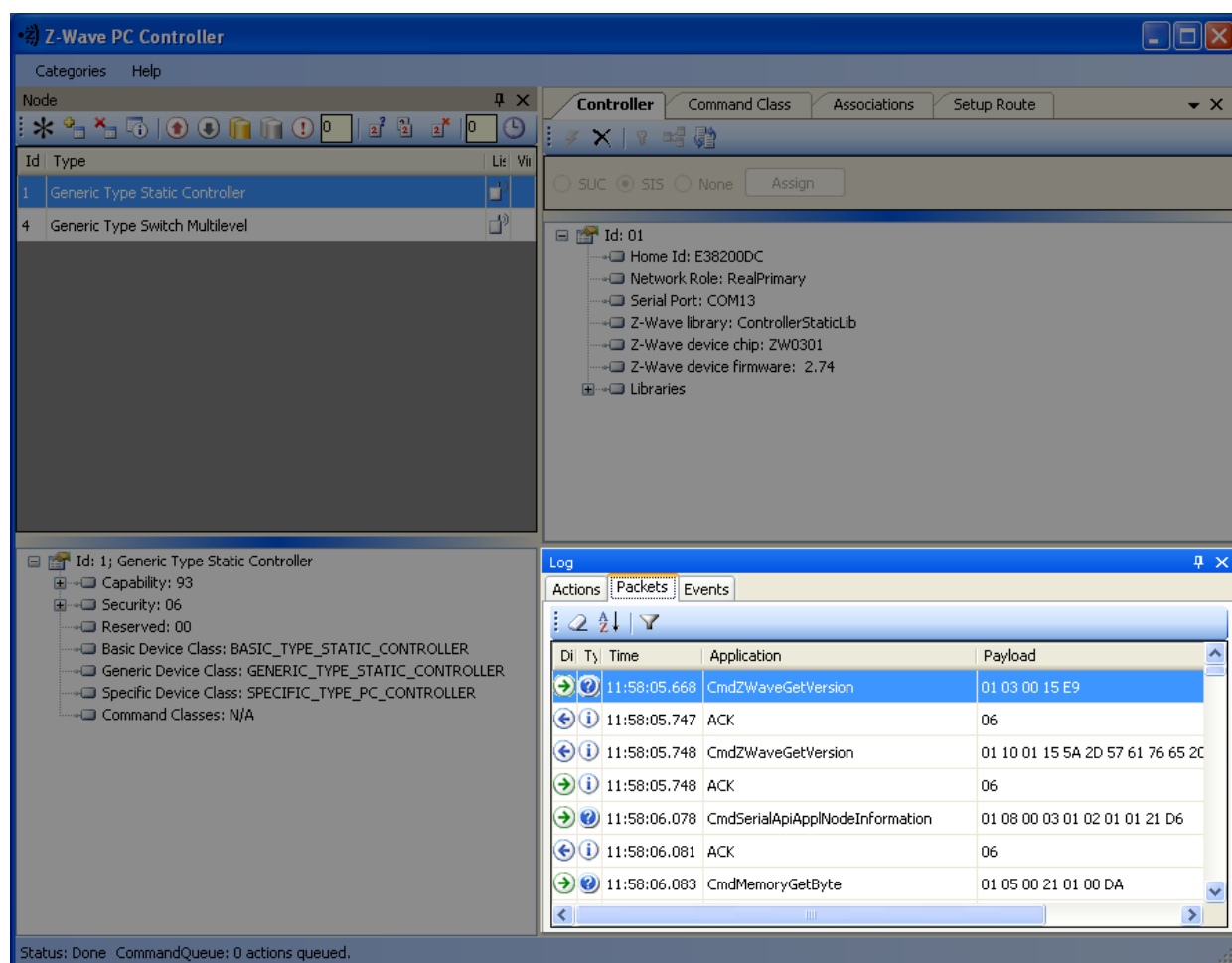


Figure 16. Log View

4.11 Status Bar

Status Bar displays Home ID, controller node ID and Command queue status.

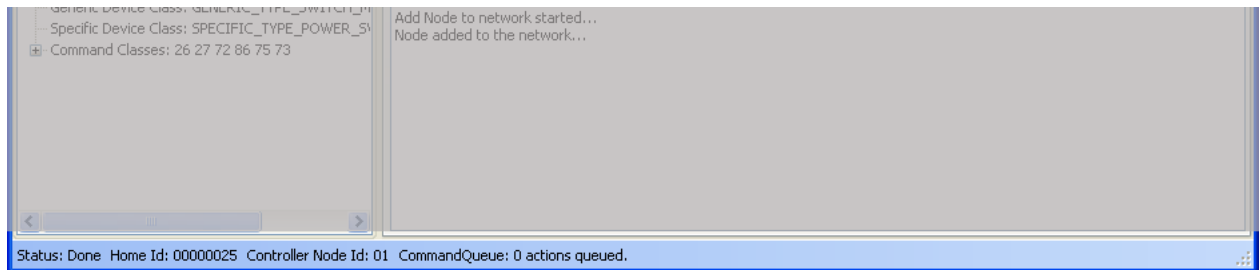


Figure 17. Status Bar

4.12 Topology Map

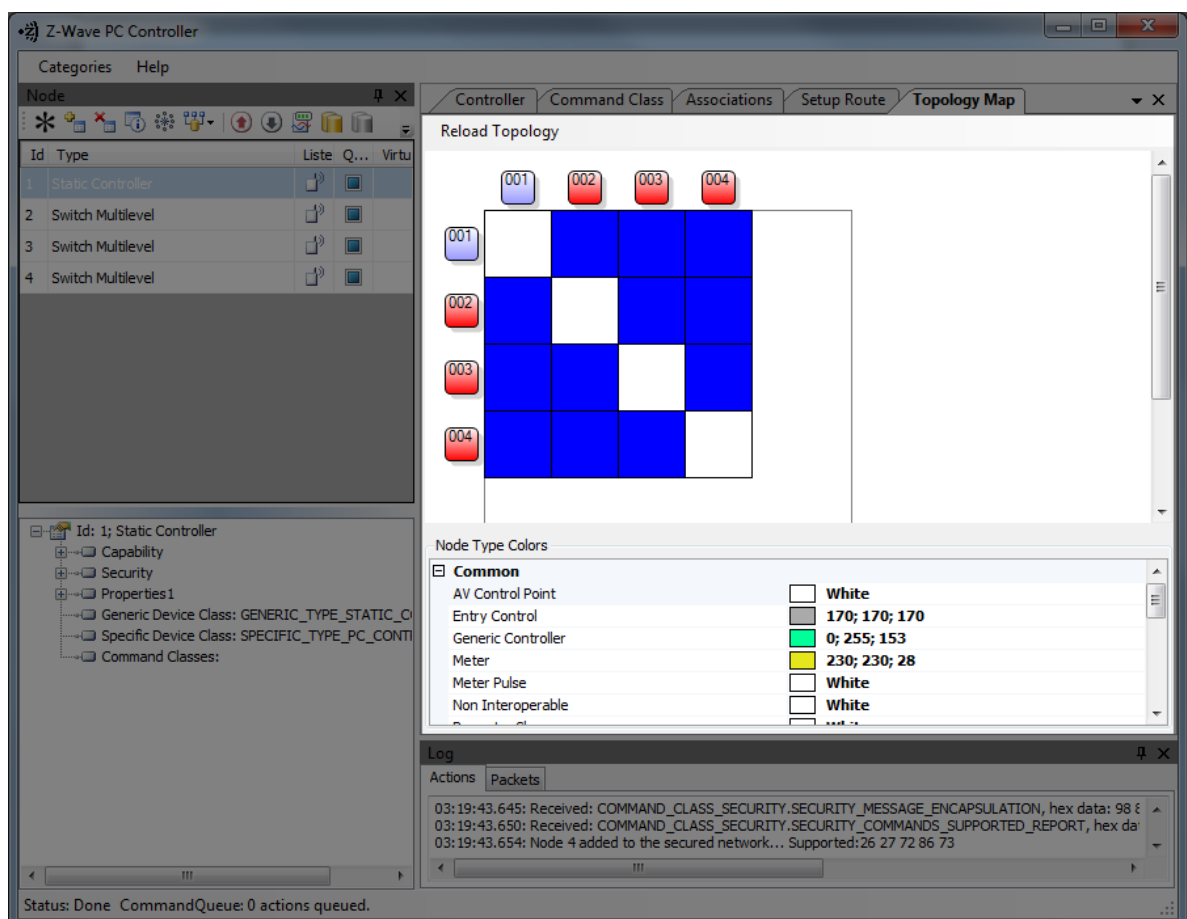


Figure 18. Topology Map

The **Topology Map** view consists of:

- The **Graphical topology scheme** itself,
- **Node Type Colors** section,

4.12.1 The Map

Item	Description
Graphical topology scheme	Graphically represents the network scheme, showing the nodes of all types differentiated through colorization, and the link statuses between the Installer controller and slave nodes.
Reload Topology button	To reload the topology

4.12.2 Node Type Colors

Node Type Colors is a list of node types with colours assigned for graphical representation on the Topology Scheme. It is possible to select a special colour for each node type.

4.13 Security Encrypt/Decrypt

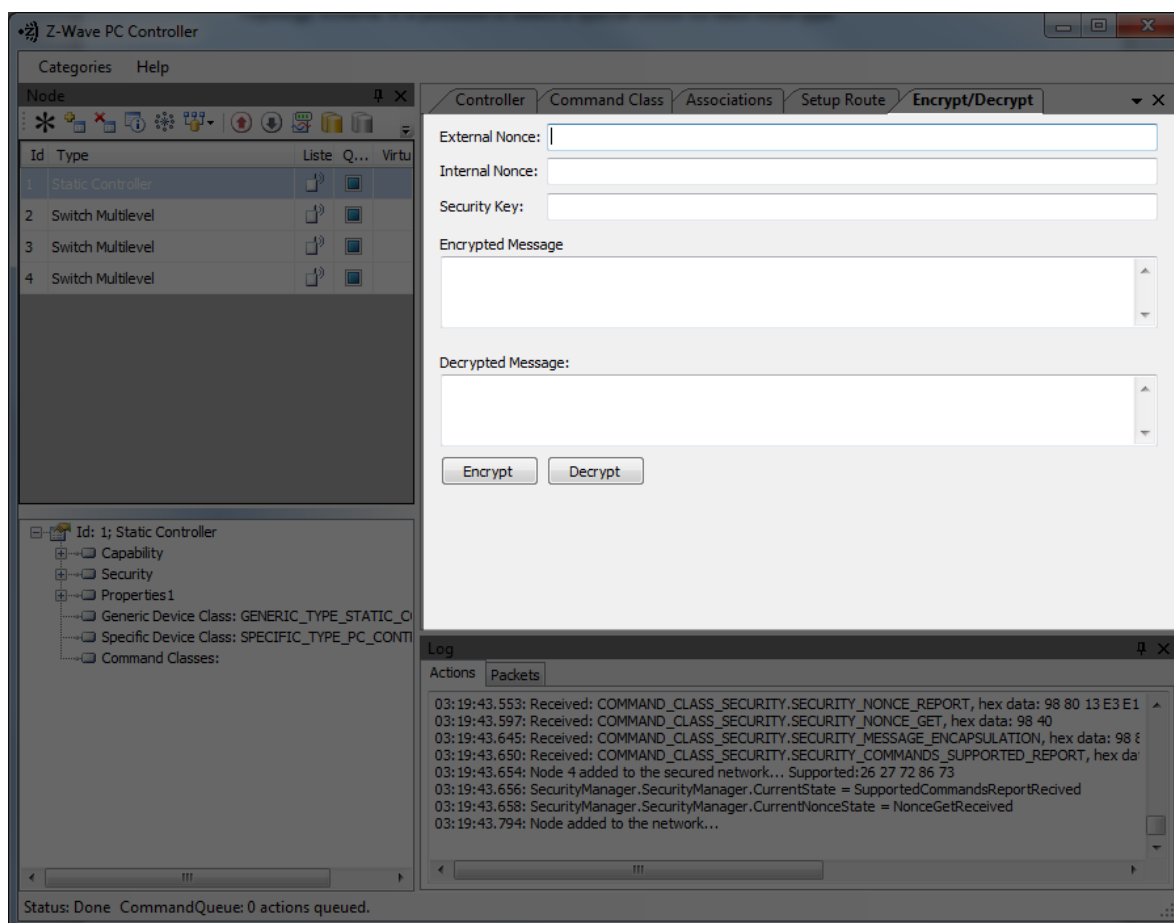


Figure 19. Security Encrypt/Decrypt

The Security Encrypt/Decrypt feature allows encrypting and decrypting secured messages using the External Nonce, Internal Nonce, and the Security Key.

4.14 Firmware Update

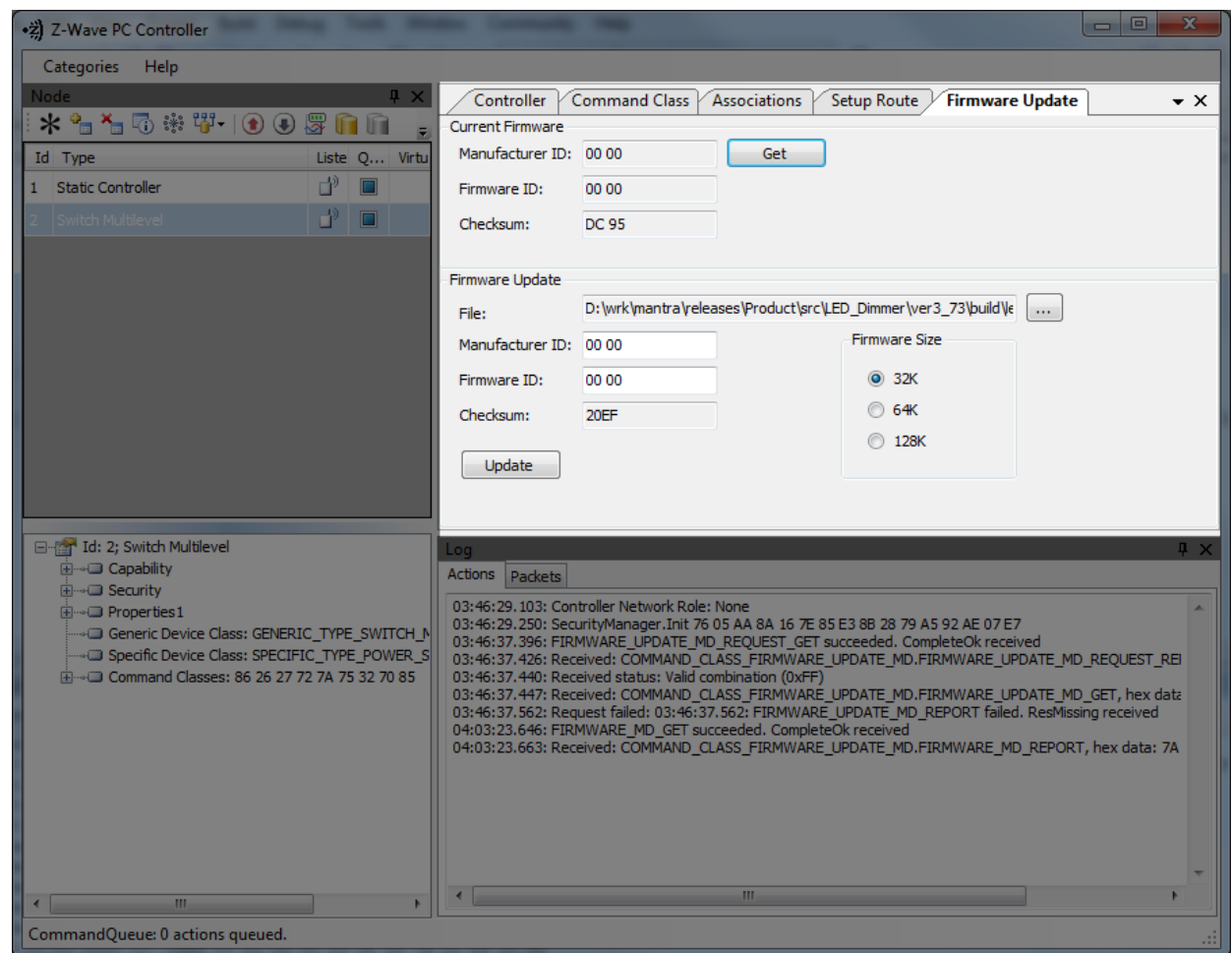


Figure 20. Firmware Update

The Firmware Update functionality provides the possibility of over-the-air (OTA) update of firmware for devices supporting the Firmware Update Meta Data Command Class.

5 FUNCTIONALITY

5.1 PC based Controller application

For each SC in the network, a separate instance of the PC based Controller application must be started.

The SC can be configured to one of the following controller types:

- **Primary SC**
- **Secondary SC**
- **Secondary SC with Static Update Controller functionality (SUC)**
- **Primary SC with SUC and node ID Server functionality (SIS)**
- **Inclusion SC**

Primary SC

When configured as primary the SC can be used to include/exclude nodes in the Z-Wave network. The primary SC will automatically update a SUC if present in the Z-Wave network. Only one primary controller is allowed in the Z-Wave network.

Secondary SC

When configured as secondary, the SC cannot include/exclude nodes in the Z-Wave network. Several secondary controllers are allowed in the Z-Wave network.

Secondary SC with Static Update Controller functionality (SUC)

When configured as SUC it is not possible to include/exclude nodes in the Z-Wave network, but the SUC can create a new primary controller upon request. Only one secondary controller can act as Static Update Controller (SUC) in the Z-Wave network. The primary controller will automatically update the SUC in case the Z-Wave network changes.

To read more about SUC functionality, see reference [3].

Primary SC with SUC and node ID Server functionality (SIS)

The SIS enables other controllers to include/exclude nodes in the network on its behalf. The SIS is 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. When including additional controllers to the network they become inclusion controllers because they have the capability to include/exclude nodes in the network on behalf of the SIS. The SIS cannot shift its primary role to other controllers in the network.

To read more about SIS functionality, see reference [3].

Inclusion SC

The inclusion SC has the capability to include/exclude nodes in the network on behalf of the SIS. The inclusion SC's network topology is dated from last time a node was included or it requested a network update from the SIS and therefore it can't be classified as a primary controller.

5.2 The SC Properties

Depending on functionality required in the network, the PC based SC can shift role to obtain the wanted functionality.

Primary

If the SC is the first node in a network it will automatically be configured to act as primary.

Secondary

If the SC is not the first node in a network it will automatically be configured to act as secondary.

SIS, SUC or Secondary

On the 'Controller' tab in the PC based application, there is a 'Network Role Options' section where you can decide which role the SC must play. It is possible to set the 'Network Role Option' by either selecting SUC or SIS and by activating the 'Assign to this node' button. This option is only possible as long as no device is yet added to the network.

The three radio buttons SIS, SUC and None are enabled when no device are yet added to the network and when no 'Network Role Options' has been set.

When selecting the SIS option, the SC will become a SIS either by pressing the button 'Assign', or by receiving information from another Controller. If a SIS is already present the SC will become an inclusion controller.

When selecting the SUC option, the SC will become a SUC either by pressing the button 'Assign to this Node' or by receiving information from another Controller. If a SUC is already present the SC will become a secondary controller.

When selecting the 'None' option, the SC will become a primary controller. If a primary controller is already present the SC will become a secondary controller. Once SUC or SIS have been set, the None radio button will be disabled.

The table below shows which functionality is available for the PC based SC depending on the configuration on the controller.

Table 1. Overview of the Static Controller properties

	Primary	Inclusion	SIS	Secondary	SUC
Node:					
Network Wide Inclusion	X	X	X		
Add Node	X	X	X	-	-
Reset Node	X	X	X	-	-
On	X	X	X	X	X
Off	X	X	X	X	X
Request Node Info	X	X	X	X	X
Toggle Basic Get	X	X	X	X	X
NOP	X	X	X	X	X
Mark Node as Failed	X	X	X	-	-
Replace Failed Node	X	X	X	-	-
Remove Failed Node	X	X	X	-	-
Set wake Up Interval	X	X	X	X	X
Controller:					
Receive Information	X	X	-	X	X
Send Information	X	X	X	-	-
Create New Primary	-	-	-	-	X
Controller Shift	X	-	-	-	-
Reset Controller	X	X	X	X	X
Request Update	-	X	-	X	-
Network Role Options ¹	X	-	X	-	X
Command Class:					
Send	X	X	X	X	X
Association:					
Create Association	X	X	X	X	X
Remove Association	X	X	X	X	X
Get Associations	X	X	X	X	X
Setup Route:					
Assign Route	X	X	X	X	X
Delete Route	X	X	X	X	X
General:					
All On	X	X	X	X	X
All Off	X	X	X	X	X
Abort	X	X	X	X	X

¹ Available if no devices are added to the network.

5.3 Node

5.3.1 How to add a node

5.3.1.1 PC based SC is Primary / Inclusion / SIS

In order to add a node to the Z-Wave network, activate the button 'Add'. When activating this button, the Status popup message will display 'Press shortly the pushbutton on the node to be included in the network'. Select the node that should be added to Z-Wave network by activating the node's button. During the inclusion process, the node must be located at its final position, so that it can obtain the correct neighbours within its range. If the operation was successful, information regarding the node type will be displayed in the node list. The PC based SC reduces the RF output power during the inclusion process which can cause range problems because it is static, i.e. located in a fixed position. It is therefore recommended to use a portable controller as primary for adding new nodes to the Z-Wave network.

5.3.1.2 PC based SC is Secondary

It is not possible to add nodes to the Z-Wave network.

5.3.1.3 PC based SC is SUC

It is not possible to add nodes to the Z-Wave network.

5.3.2 How to remove a node

5.3.2.1 PC based SC is Primary / Inclusion / SIS

To remove a node from the Z-Wave network, select the node in the node list and activate the button 'Remove'. After activating the button the Status popup message will display 'Press shortly the pushbutton on the node to be excluded from the network'. If this operation was completed successfully, the node and its information will now be removed from the node list. The PC based SC reduces RF output power during the exclusion process which can cause range problems because it is static, i.e. located in a fixed position. It is therefore recommended to use a portable controller as primary to remove a node when having range problems.

5.3.2.2 PC based SC is Secondary

It is not possible to remove nodes from the Z-Wave network.

5.3.2.3 PC based SC is SUC

It is not possible to remove nodes from the Z-Wave network.

5.3.3 Network Wide Inclusion

The NWI button on the PC Controller results in the PC Controller calling AddNodeToNetwork, and after a successful inclusion, the AddNodeToNetwork is called again.

To start the process of mass inclusion of nodes to the controller, press the Network Wide Inclusion button. The dialog will appear carrying the text: "Controller is waiting for the node information... Press shortly the pushbutton on the node to be included in the network."

Once all nodes have been included, press the 'Abort Action' button to stop NWI.

5.3.4 Node Info

When the Node Info button is pressed, the PC Controller application sends a REQUEST NODE INFO command to the selected node.

5.3.5 Request Node Neighbor Update

It is possible to send the Find Nodes In Range command to the selected node.

5.3.6 Set SUC/SIS

It is possible to assign SUC/SIS network role to the selected controller by sending CmdZWaveSetSucNodeId to it.

5.3.7 'Switch All On' command

5.3.8 PC based SC is Primary / Inclusion / SIS / Secondary / SUC

In order to send an 'All on' command to all nodes in the Z-Wave network, press the button 'Switch All On'. This operation is possible for a primary SC, secondary SC and secondary SC with SUC functionality.

5.3.9 'Switch All Off' command

5.3.9.1 PC based SC is Primary / Inclusion/ SIS / Secondary / SUC

In order to send an 'All off' command to all nodes in the Z-Wave network, press the button 'Switch All Off'. This operation is possible for a primary SC, secondary SC and secondary SC with SUC functionality.

5.3.10 Toggle Basic Get

This option is for stress test purposes. When the 'Toggle Basic Get' button is pressed, the PC Controller consequently sends a BASIC GET command to the selected node(s). After a BASIC REPORT is received from the node in queue, the next BASIC GET command is sent either to the same node (if it is the only node selected for operation), or to the next node in the list. If the node does not respond, the controller sends the next command or moves to the next node after a timeout of 10 seconds.

5.3.11 Switching a node or a subset of nodes on and off

5.3.11.1 PC based SC is Primary / Inclusion / SIS / Secondary / SUC

Basic Set On

Activate the button 'On' to send the 'On' command to the selected node(s).

Basic Set Off

Activate the button 'Off' to send the 'Off' command to the selected node(s).

5.3.12 Send NOP

This button is used to send a NOP frame to a selected node. Enter the Node ID of the target node in the text box and press the 'Send NOP' button.

5.3.13 How to send a failure signal to a node

If a node is corrupt and does not respond to commands, it can be marked as failed, and then either replaced or removed.

5.3.13.1 PC based SC is Primary / Inclusion / SIS

Push "Is Failed" button for the selected node. The node will be marked in the list as failed (with red typing).

5.3.14 How to replace a failed node

5.3.14.1 PC based SC is Primary / Inclusion / SIS

A non-responding node can be replaced by another node from the node list in the Z-Wave network by activating the button 'Replace Failed'. The following message will appear: "Replacing the non-responding node... Press shortly the pushbutton on the replacement node to be used instead of the failed one". If the operation was successful, the failed node is removed and the other node will take the node ID of the failed node. Association setup in the failed node will be lost and must be reprogrammed.

5.3.14.2 PC based SC is Secondary

It is not possible to replace a failing node.

5.3.14.3 PC based SC is SUC

It is not possible to replace a failing node.

5.3.15 How to remove a failing node

5.3.15.1 PC based SC is Primary / Inclusion / SIS

A non-responding node can be removed from the Z-Wave network by activating the button 'Remove Failed'. If the operation was successful, the node and its information will be removed from the node list. Responding nodes cannot be removed.

5.3.15.2 PC based SC is Secondary

It is not possible to remove a failed node.

5.3.15.3 PC based SC is SUC

It is not possible to remove a failed node.

5.3.16 Set Wake-Up Interval

It is possible to set the wake up interval for a non-listening node. Enter the desired wake up interval (in minutes) into the textbox, and press the 'Set Wake Up Interval' button. The WAKE UP INTERVAL SET command will be queued in the application memory and sent to the non-listening node the next time it wakes up.

5.4 Controller

Activate the **Controller Tab** to include controllers, reset controllers, and shift the primary role between controllers; to request network topology updates and re-establish the primary controller.

5.4.1 Including a PC based SC to a network

5.4.1.1 PC based SC is Primary / Inclusion / Secondary / SUC

When including a PC based SC to a network, activate the 'Add Node' button on the primary controller, and then activate the 'Start Learn Mode' button on the second PC based SC (the sequence of these two steps is not vital). This will include the SC into the Z-Wave network and transfer the complete network topology. Further it is possible to update the network topology in an existing secondary controller.

If the replication went successfully, then the second PC based SC's functionality depends on the selected option button:

If 'SIS' has been chosen, and there does not already exist one in the network, the SC will become the SIS in the network. If a SIS is already present, the SC will become an Inclusion controller.

If 'SUC' has been chosen, and there does not already exist one in the network, the SC will become the SUC in the network. If a SUC is already present the SC will become a secondary controller.

If 'None' has been chosen, then SC will become a secondary or inclusion controller.

5.4.1.2 PC based SC is Primary

It is not possible to replicate to a primary SC.

5.4.1.3 PC based SC is SIS

It is not possible to replicate to a SC when it is SIS.

5.4.1.4 PC based SC is Secondary / SUC

It is not possible to add a new secondary controller to the Z-Wave network using a PC based SC.

5.4.2 Controller shift

5.4.2.1 PC based SC is Primary

To shift the primary role from the PC based SC to another controller in the network; activate the 'Start Learn Mode' button within the controller to be made primary, and the 'Shift' button within the second controller interface. The second PC based SC will now become Secondary, whilst the first one will become Primary.

5.4.2.2 PC based SC is Inclusion / SIS / Secondary / SUC

It is not possible to shift primary role from the PC based SC.

5.4.3 Create new primary

5.4.3.1 PC based SC is Primary / Inclusion / SIS

It is not possible to create a new primary controller because only one primary is allowed in the network.

5.4.3.2 PC based SC is Secondary

It is not possible to create a new primary controller because PC based SC is a secondary controller without SUC functionality.

5.4.3.3 PC based SC is Secondary with SUC functionality

If the primary controller is defect, then it is possible to create a new primary controller in the Z-Wave network. Set the new controller in 'Learn mode' and activate the 'Create New Primary' button on the PC based SC. The new controller is now included as primary into the network and receives the complete network topology.

On how to create a PC based SC secondary with SUC functionality, please see reference [1].

WARNING: Avoid including multiple primary controllers.

5.4.4 Reset controller

5.4.4.1 PC based SC is Primary / Inclusion / SIS / Secondary / SUC

To reset the PC based SC, activate the 'Reset Controller' button. Only the PC based SC will be removed from the Z-Wave network. See also paragraph 5.3.2 regarding how to exclude nodes from the network.

5.4.5 Request update of PC based SC

5.4.5.1 PC based SC is Primary / SIS / SUC / Secondary

It is not possible to request network topology update from another controller.

5.4.5.2 PC based SC is Inclusion

The PC based SC can request network topology updates from a Static Update Controller (SUC) by pressing the 'Request Update' button.

5.4.6 Save Command Classes to device memory

By default, command classes are not stored in the Static Controller memory, but it is possible to save them to the Static Controller's memory using this function. This can be used if a configured Static controller is to be used with another PC.

5.4.7 Load Command Classes from device memory

It is possible to load previously saved command classes from the Static Controller memory using this function.

5.5 Command Class

Activate the **Command Class Tab** to send specific command classes to nodes.

5.5.1 Send frame with a specific command

5.5.1.1 PC based SC is Primary /Inclusion / SIS / Secondary / SUC

Select the node ID to receive the command from the node list.

Select a command class from the 'Command Classes' dropdown list. When the command class has been selected, the 'Command Name' dropdown list will only contain those commands that are supported by the selected command class. Here as well, a command name must be selected.

Some commands require setting a value, e.g. Value. In such case additional value fields will appear below with their names.

Finally, send the frame by activating the button 'Send'.

5.6 Association

Activate the **Association Tab** to configure associations between nodes.

Add any nodes that support the Association command class, e.g. Binary sensor.

5.6.1 Create Association

Select the node you want to associate with the node that supports the Association command class, and push the 'Create' button. The node ID will appear in the appropriate group.

Activating the 'Create Association' button with the selections in the above figure will update group 1 in node ID 7 with associations to node ID 5. Z-Wave routing slaves will in addition clear all return routes and assign new return routes from the selected node in the 'Source' list box to the nodes in the selected group in the 'Groups' list box.

5.6.2 Remove Association

Select the node to be removed from the association in the Groups list, and press 'Remove'.

5.7 Routing Setup

Activate the **Setup Route Tab** to assign return routes between two nodes in the network.

5.7.1 Assign a route

5.7.1.1 PC based SC is Primary / Inclusion / SIS / Secondary / SUC

The PC based SC supports assignment of a route between e.g. a Binary Sensor and any other node. Assigning a route specifies how the binary sensor can communicate with the node. To assign a route select first a source and a destination node. The source node could be any node based on the routing slave library while destination node could be any node that is always in listening mode. Activate 'Assign' button to generate a route between the two nodes. For a binary battery sensor, the route assignment will be executed when it wake up next time. Until then, the request is queued in the PC based Controller.

5.7.2 Delete a route

5.7.2.1 PC based SC is Primary / Inclusion / SIS / Secondary / SUC

To delete the routes in a node, press the 'Delete Route' button. All routes assigned to the source node will be deleted. The new routing can be built either automatically or manually.

For a binary battery sensor, the route deletion will be executed when it wakes up next time. Until then, the request is queued in the PC based Controller.

5.8 Security Test Schema

In Z-Wave Security PC Controller, Security Test Schema functionality is available for the purposes of testing secure networks for failures in case of device malfunctioning.

With this feature, it is possible to simulate different malfunctions of a Security PC Controller. This is needed to test proper functioning of other devices in the network.

To use this feature, the "Enable Security Test Schema" checkbox must be checked.

The testing Controller can be configured either as the Including Controller, or as the Included Node. The corresponding options for an Including Controller or Included Node are present dependent on the selection.

Also, it is possible to disable all timers of the node at once, if the "Disable all timers" checkbox is checked.

5.9 ERTT

The ERTT (Enhanced Reliability Test Tool) is used to test the reliability of an RF link by sending a defined number of frames and performing a simple count on how many frames were not received correctly.

A DUT node must be included to the network first. Then, select the DUT in the node list of the PC Controller, and configure the ERTT.

The following controls are available:

Test Iterations – enter the required number of iterations.

Run forever – check this box for the test to run until stopped.

Test Mode – select the data format to be used in the test (Basic Set, value 0; Basic Set, value 255; Basic Set, value 0/255).

Stop on error – check this box for the test to stop on an error.

Low Power – check this box to use low power RF transmission.

TX Control – an optional group of controls which is active only if SerialAPI reports support for (#define FUNC_ID_SERIAL_API_TEST 0x95):

- **TX is Controlled by module** – If ticked, ZW_Test is used instead of SendData, and the module is informed to send the specified command the defined amount of times. If checked, the following fields must become available:
 - **TX Delay Field:** Define delay between each transmitted frame
 - **Payload length** field

Retransmission - if not ticked, send data will be called with `TRANSMIT_OPTION_NO_RETRANSMIT = 0x40`.

Packets sent: shows the numbers of sent packets.

Packets received: shows the number of reply packets received from the node.

UART Errors: shows the number of UART errors. These errors are logged when the Serial API returns transmit completion status `TRANSMIT_COMPLETE_FAIL (0x06)`.

The UART error is a count of packages not sent to the other Z-Wave device on air traffic. Z-Wave does listen before talk to avoid interference with undergoing communication. So if the Z-Wave protocol "is listening" to Z-Wave air traffic, it will not send the package. Normally the Z-Wave protocol will automatically do a random back off and re-try communication. But the ERTT is a special version and will not do the random back-off. The ERTT will therefore have a higher count of non-transmitted packages.

When calculating the Frame Error Rate (FER), the UART error must be subtracted from the Packets sent to obtain the number of Packets transmitted:

Packets transmitted = Packets sent – UART Errors

$$FER = (Errors/Packets\ transmitted) * 100\ (\%)$$

Node list grid: displays information about the nodes which ERTT communicates with:

- **Node ID**
- **Device type**
- **Status** – current transmit completion status for the node. 0 stands for TRANSMIT_COMPLETE_OK. For other transmit statuses, see [2].
- **Errors** – the total number of errors (all transmit completion statuses different from TRANSMIT_COMPLETE_OK).

5.10 Topology Map

The small squares on the sides of the graphic map use the color codes shown in the Node type Colors area.

The larger squares indicate the state of link between two units. Blue squares indicate that the link between two nodes exist, red squares indicates that the link does not exist and white squares indicate that no link can exist. Note that the table always will be symmetrical around the white line.

5.10.1 Reload Topology

The “*Reload Topology*” button loads the Topology map from the Z-Wave module. This is not done during startup because of the time it takes when the Z-Wave module holds a large network setup.

5.11 Security Encrypt/Decrypt

Enter External Nonce, Internal Nonce, and Security Key. Then either enters the encrypted message and presses the Decrypt button, or enters the decrypted message and press the Encrypt button. The outcome will be presented in the corresponding field.

5.12 Firmware Update

If the device supports the Firmware Update Meta Data command class, it is possible to use this feature to update its firmware over the air.

Current firmware ID and manufacturer ID of the device can be checked. Press the Get button to send Firmware MD Get command to the device.

New firmware file can be uploaded through selecting the file and pressing the Update button. Also, the firmware size can be specified (use 128k for 500 Series).

6 REFERENCES

- [1] Sigma Designs, INS10236, Instruction, Development Controller User Guide
- [2] Sigma Designs, INS12308, Instruction, Z-Wave 500 Series Appl. Prg. Guide v6.50.00
- [3] Sigma Designs, INS10244, Instruction, Z-Wave Node Type Overview and Network Installation Guide

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