



Getting Started with Z-Wave

Table of Contents

TABLE OF CONTENTS	3
ABOUT THIS GUIDE	4
System Requirements	4
INTRODUCTION TO Z-WAVE	4
WHAT'S IN THE BOX.....	5
Base Kit Contents	5
Regional Kit Contents	6
REQUIRED SOFTWARE	8
GETTING STARTED.....	9
Installing the Software Tools	9
Getting to know the PC Controller Tool.....	9
Getting to know the Zniffer Tool.....	10
Using the Z-Wave Switch ON/OFF Demo	11
Create a Simple Z-Wave Network.....	13
SETTING UP YOUR DEVELOPMENT ENVIRONMENT	14
Getting and Installing the KEIL™ PK51 Professional Developer's Kit.....	14
Downloading and Installing the SDK	14
Documentation and sample applications	15
Installing the Z-Wave Programmer.....	16
ZDP03A OVERVIEW AND SETUP	16
Setup Name	17
Jumper Configuration.....	17
Programming Z-Wave Modules	18
WRAPPING THINGS UP	19
Development Cycle.....	19
Certification Process	19
APPENDIX A - INSTALLING USB DRIVERS	21

About this Guide

A Z-Wave Base Kit, and its accompanying Regional Kit, are the first steps taken by developers and Original Equipment Manufacturers (OEMs) on the road to design and develop products that network wirelessly using RF-based Z-Wave technology.

These kits contain all the hardware you will need to design and develop software built on top of the Z-Wave Protocol API, as well as to test and debug the final Z-Wave product. Inside you will find Z-Wave ZM5304, ZM5202 and ZM3102 modules that can be used for development and even be directly integrated into your existing products.

This guide will familiarize you with Z-Wave technology by guiding you through the creation of a simple Z-Wave network. It will then help you obtain the software necessary to build your own Z-Wave applications and setup your development environment. Finally, you will be pointed to a wealth of software and documentation resources at the Z-Wave Technical Service website. Here you can get the latest versions of Z-Wave Software Development Kits (SDKs), companion tools, and get access to technical and support documents you can use to further expand your knowledge of Z-Wave technology.

System Requirements

The Z-Wave SDK and companion applications require a PC running Microsoft Windows. The following versions of the operating system are supported:

- ✓ Microsoft Windows XP
- ✓ Microsoft Windows Vista
- ✓ Microsoft Windows 7

Additionally, a recent version of the Microsoft .NET framework is also required.

Introduction to Z-Wave

Z-Wave is a wireless communications protocol that uses low-power RF and is intended primarily for home automation. It is optimized for reliable, low-latency communication of small data packets in the sub-gigahertz frequency range. Z-Wave uses a source routing mechanism to establish a mesh network topology. This enables devices to communicate with one another via intermediate nodes, actively routing around radio-dead spots or obstacles.

A Z-Wave network consists of two basic node types: **controllers** and **slaves**. Controllers are able to create networks, add or remove nodes to networks, and calculate message routes to nodes that have been added to networks. Slaves are generally input/output units that provide information to the network or react to commands.



More, in-depth information about the Z-Wave protocol and its network node types can be found in the following documents:

- Z-Wave Protocol Overview (SDS10243)
- Z-Wave Node Type Overview and Network Installation Guide (INS10244)

Both of these documents can be found on the Z-Wave Technical Services website, under **Instructions** in the **Software** section.

What's in the Box

Base Kit Contents

The following components make up your Z-Wave Base Kit:



4x ZDP03A



1x Programmer Cable



4x Flexi Antenna



4x USB Cable



1x Battery Pack



4x Power Supply Unit



1x USB Stick



1x Getting Started with
Z-Wave

Item	What is it?
ZDP03A	Z-Wave Development platform. This board accepts the ZDB5202, ZDB5304 or ZM3120 modules and is used to program Z-Wave embedded application binaries into their Z-Wave modules using the Z-Wave Programmer PC application.
Programmer Cable	ISP Cable used for the programming of prototype devices.
Flexi Antenna	Rat-tail antenna for sub-gigahertz frequencies that can be screwed into SMA connectors.
USB Cable	Standard 1.8m USB A plug to B plug cable used to connect a ZDP03A board to a PC.
Battery Pack	Holds 6 AA batteries (included) with the objective of providing power to a ZDP03A boards used for the development of battery devices.
Power Supply Unit	AC Adapter for the ZDP03A board.
USB Stick	USB Memory Stick that contains important software that will help you get started with Z-Wave
Getting Started with Z-Wave	This guide.

Regional Kit Contents

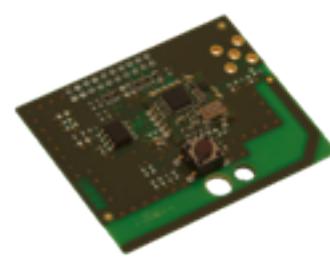
The Regional Kit consists of the following components:



2x ZDB5202



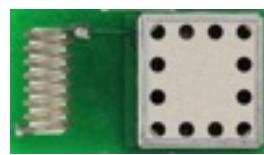
1x ZDB5304



2x ZM3120



4x ZM5202



4x ZM5304



2x ZM3102



1x UZB Controller



1x UZB-S Zniffer



1x ZIPR-CE



1x Power Supply Unit

Item	What is it?
ZDB5202	Reference design module for the ZM5202 module. This module is RF matched for a specific Regional Kit, ensuring optimal RF performance. The module contains an SMA connector, SAW filter and PCB antenna.
ZDB5304	Reference design module for the ZM5304 module. This module is RF matched for a specific Regional Kit, ensuring optimal RF performance. The module contains an SMA connector, SAW filter and PCB antenna.
ZM3120	Reference design module for the ZM3102 module. This module is RF matched for a specific Regional Kit, ensuring optimal RF performance. The module contains an SMA connector, SAW filter and PCB antenna.
ZM5202	Z-Wave 500-series module.
ZM5304	Z-Wave 500-series modem module, complete with helical antenna.
ZM3102	Z-Wave 300-series module.
UZB Controller	USB-based hardware tool that is used in conjunction with PC Software to act as a Z-Wave controller.
UZB-S Zniffer	USB-based hardware tool that “sniffs” for Z-Wave packets and sends them to the PC. Greatly aids the development of Z-Wave Products.

Item	What is it?
ZIPR-CE	Z/IP Gateway, Consumer Electronics version, reference design.
Power Supply Unit	AC Adapter for the ZIPR-CE

Required software

In order to use the hardware included in your Development Kit, you will need to install, and optionally download, additional software.

Companion Applications

Included in the Base Kit is a USB stick containing two essential companion applications:

- ➔ Z-Wave PC Controller
- ➔ Z-Wave Zniffer Tool

These applications will allow you to control and monitor Z-Wave networks using the included Z-Wave Controller and Z-Wave Zniffer hardware.

Getting Started

This section will guide you through installing the companion tools and creating your first Z-Wave network. You will familiarize yourself with the **Z-Wave PC Controller** and the **Z-Wave Zniffer Tool**, two applications that will be very helpful when developing Z-Wave products or analyzing Z-Wave networks.

Installing the Software Tools



If your PC is not running **Microsoft Windows 7** or newer you may need to install USB drivers to be able to communicate with your Z-Wave hardware. Refer to **Appendix A** if you need assistance installing USB drivers for older operating systems.

Installing the PC Controller Tool

The PC Controller Tool is the application you will use to control your Z-Wave network. Run the PC Controller Tool installation program, “**setup.exe**”, located in the **Z_Wave_PC_Controller** folder in the USB stick, and follow the on-screen instructions to install the application.

The **PC Controller Tool** provides a graphic interface that allows you to control a Z-Wave network through a Z-Wave controller device programmed with a ‘**Static Controller Serial API Image**’ that is connected to your PC. A pre-programmed controller is included in this **Development Kit**.

Installing the Zniffer Tool

The Zniffer Tool is the application you will used to monitor and analyze your Z-Wave network. Run the Zniffer Tool installation program, “**setup.exe**”, located in the **Z_Wave_Zniffer_Tool** folder in the USB stick, and follow the on-screen instructions to install the application.

The **Zniffer Tool** provides an advanced graphic interface that passively listens in on a Z-Wave network through a Z-Wave device programmed with a ‘**Zniffer Image**’ that is connected to your PC, allowing you to inspect network traffic and packets in a Z-Wave Network. A pre-programmed Zniffer is included in this **Development Kit**.

Getting to know the PC Controller Tool

This section will introduce you to the Z-Wave PC Controller Tool and how you can use it to control a Z-Wave network. The application’s windows is split into three sections:

- The **Node View** takes up the left-half of the windows and is used for operations with nodes.
- The **Log View** occupies the bottom-right section of the window and displays a log of the application’s events.
- The remainder of the window is used by the **Tab View** which exposes options for **Controller**, **Command Class**, **Association** and **Setup Route** operations.



More, in-depth information about the Z-Wave PC Controller Tool can be found here:

- ➔ [PC based Controller User Guide \(INS10240\)](#)

First, you will need to connect your Z-Wave Controller to your PC and instruct the Z-Wave PC Controller Tool to use it. To do this, access the “**Categories**” menu item and select “**Settings.**” Have the application detect which serial ports are available and query them for Z-Wave devices that might be connected. Once this process is complete, select your Z-Wave controller.

You should see your Z-Wave Controller listed in the **Node View**. You can now perform operations on the Z-Wave network, such as adding devices and controlling them, using the Z-Wave Controller. Before doing this, we will setup the Z-Wave Zniffer Tool to be able to view and analyze the messages that will be sent to nodes of the Z-Wave network.

Getting to know the Zniffer Tool

This section will introduce you to the Z-Wave Zniffer Tool and how you can use it to capture packages in a Z-Wave network. The application’s windows is split into two sections:

- ➔ The **Frame List Pane** takes up the top-half of the window and is where all captured (or opened) Z-Wave frames are listed.
- ➔ The **Frame Details View** is located in the bottom-half of the window. This is where details about the currently selected frame are displayed.



More, in-depth information about the Z-Wave Zniffer Tool can be found here:

- ➔ [Z-Wave Zniffer User Guide \(INS10249\)](#)

You can obtain a copy of this document from the ZTS website. It can be found by selecting **Z-Wave Zniffer** under **SW Development Tools** in the **Software** section.

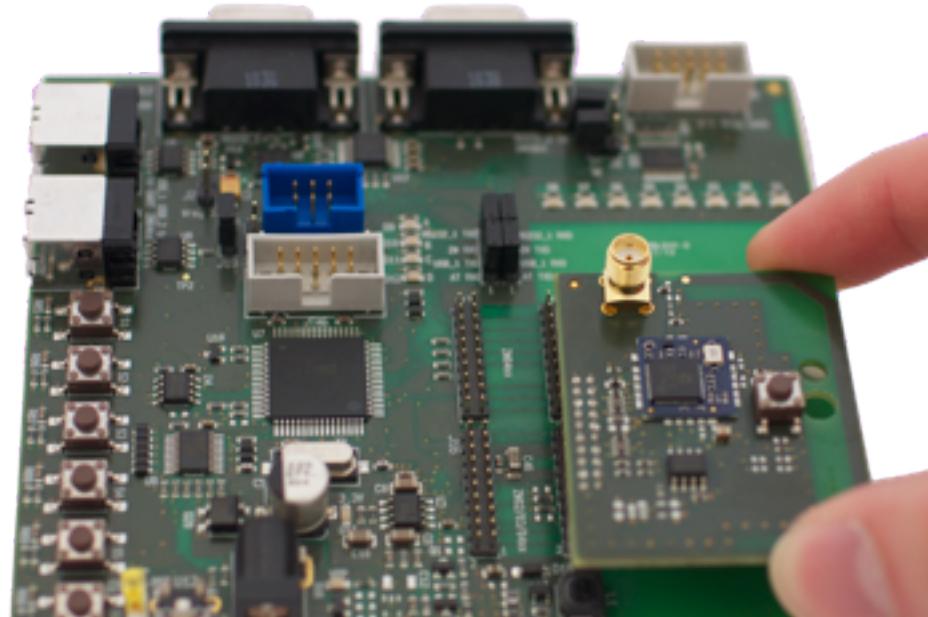
As with the Z-Wave PC Controller Tool, the first step will be to instruct the application to use the Z-Wave Zniffer hardware. Connect your Z-Wave Zniffer to your PC and access the “**Capture**” menu, press the “**Detect Serial Ports**” menu item. This will automatically query all detected serial ports for connected Z-Wave devices. Once the process completes, select your Z-Wave Zniffer from the “**Port Selection**” menu item, in the “**Capture**” menu.

You will also need to instruct the Z-Wave Zniffer Tool as to which RF frequency it should monitor. To do this, access the “**Capture**” menu item again and navigate to the “**Frequency Selection**” menu item. Select the RF frequency that matches your Z-Wave Controller and Z-Wave Regional Kit.

You are now ready to passively monitor messages in a Z-Wave network. Press the “**Start**” button on the Z-Wave Zniffer Tool’s toolbar to start capturing Z-Wave frames.

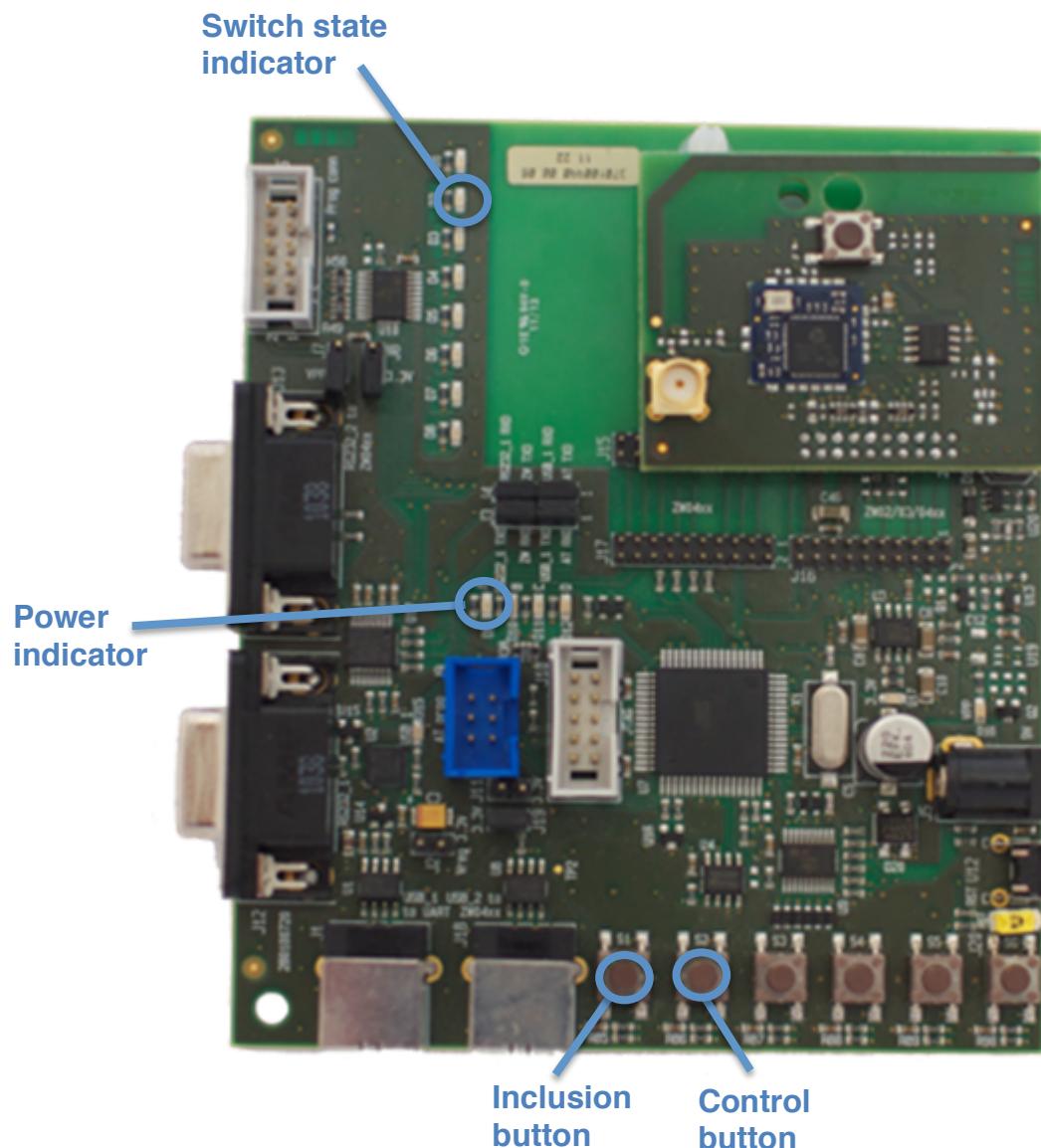
Using the Z-Wave Switch ON/OFF Demo

This section will guide you through preparing a ZDP03A board for running the Z-Wave Switch Demo. Carefully take the ZDB5202 module that is pre-programmed with the Z-Wave Switch Demo software and connect it to J14 on a ZDP03A board, being careful to align the connectors as shown in the illustration below.



Mount a flex-antenna to the SMA connector on the ZDB5202.

Before including the Z-Wave Switch Demo into your Z-Wave network, take a moment to familiarize yourself with the board and the functionality it provides.



Command Input	Action
Press Button	Turn LEDs on or off.
Press and Hold Button	Dim the brightness level up or down.
Triple Press Button	If the LED Dimmer Demo is not currently part of a network, triple pressing will request controllers to include it into network. Otherwise, it will request to be excluded from the network.



If the ZDP03A is not behaving as expected, you may need to adjust the jumpers on the board. Refer to section **ZDP03A Overview and Setup** for instructions on setting the board's jumpers.

Create a Simple Z-Wave Network

Before continuing further, make sure that both your Z-Wave Controller and Z-Wave Zniffer are connected to your PC and that the Z-Wave Zniffer Tool and Z-Wave PC Controller are both running and configured properly.



Locate and click the “Add” button on the Z-Wave PC Controller’s **Node View** toolbar. The Z-Wave Zniffer Tool’s **Frame List Pane** will begin filling up with captured **Transfer Presentation** frames at a regular interval. These frames indicate that the Z-Wave Controller is now ready to include a new device in it’s network.

Apply power to the Switch Demo board using one of the included AC adapters. Triple pressing the Switch Demo’s “Inclusion Button” will make it attempt to join a network.

You will notice a new capture in the Z-Wave Zniffer Tool. The captured frame is a **Node Information Frame** and contains important information about the profile of the device that broadcasted it.

When the Z-Wave PC Controller Tool receives a **Node Information Frame** while it is in “Add” mode, it will verify that the device that broadcasted the frame is in it’s default state and if so, begin the process of including it into it’s network. A device is in it’s default state when it’s *node id* is 0. The Z-Wave PC Controller Tool’s **Node List** will now contain a new device, your Switch Demo. Study the frames captured by the Z-Wave Zniffer Tool, they outline the inclusion process into a Z-Wave network.

You can control your Switch Demo board from the Z-Wave PC Controller Tool by selecting it from the **Node List** and then clicking the **Basic Set On** and **Basic Set Off**



buttons on the **Node View** toolbar. Inspect the frames captured by the Z-Wave Zniffer tool when doing so. Additionally, inspect the **Command Class** tab of the **Tab View** for a list of the command classes that the Switch Demo supports. Study the captured frames in the Z-Wave Zniffer Tool.



To remove the Switch Demo from the network, click the “Remove” button on the Z-Wave PC Controller’s **Node View** toolbar. Now you must press three times quickly on the button of the ZDB5202 that is mounted on the ZDP03A. Notice that the Switch Demo’s *node id* is set back to 0. You can repeat the inclusion steps in this section to re-include the Switch Demo at any time.

Setting up your Development Environment

Now you have successfully created a small Z-Wave network.

It is time to develop your own application, start by obtaining a copy of KEIL PK51 and download the SDK from Z-Wave Technical Service website (ZTS). If you do not have access to ZTS contact Z-Wave Support.

Secondly familiarize yourself with the basic Z-Wave documentation, in the chapter **Documentation and sample applications**, we have given some suggestions on documents to read initially.

Getting and Installing the KEIL™ PK51 Professional Developer's Kit

Developing embedded Z-Wave applications requires an 8051 C Compiler to be installed in your system. The officially supported compiler is the KEIL™ 8051 C Compiler.



The **Z-Wave SDK** does not include a **C Compiler**. The officially supported compiler for embedded Z-Wave applications, the **KEIL 8051 C Compiler**, can be purchased directly from **KEIL** or one of their local distributors. Visit <http://www.keil.com> for details.

Make sure to purchase the “**PK51 Professional Developer's Kit**” as it contains the required Compiler, Linker and Assembler as well as the μ Vision IDE.



Depending on the version of the **Z-Wave SDK** you have downloaded, you will need specific versions of the **Assembler**, **C Compiler**, **Linker** and **Librarian** for seamless integration with the Z-Wave protocol APIs. Refer to your SDK's software release notes for details on which version to use.

Follow the instructions included with the software package to install the development tools and IDE.

Downloading and Installing the SDK

Log on to the Z-Wave Technical Service website and navigate to the **SOFTWARE** section. Download the latest release of the Z-Wave SDK that matches your development platform, either 300, 400 or 500-series. Once the download completes, extract the zipped file into the desired install directory.

Purchase and install



The **Z-Wave SDK** is not included in your Base Kit. It must be downloaded from the **Z-Wave Technical Service** website. Log in at <http://support.sigmadesigns.com> to download a copy of the latest **Z-Wave SDK**.

Documentation and sample applications

The below listed documentation is a good starting point, to familiarize yourself with the basics of Z-Wave hardware and software



Hardware Documents available on ZTS:

- ⇒ ZM5101 datasheet (DSH12625)
- ⇒ ZM5202 datasheet (DSH12435)
- ⇒ ZM5304 datasheet (DSH12461)
- ⇒ 500 series integration guide (INS12213)
- ⇒ 500 Series Calibration User Guide (INS12524)



Software Documents available on ZTS:

- ⇒ Working in 500 Series Environment User Guide (INS12366)

Software Documents available in the SDK zip file:

- ⇒ Z-Wave 500 Series Application programmers Guide
- ⇒ Z-Wave 500 Series SDK Contents
- ⇒ Z-Wave 500 Series SDK software release notes



Sample applications designed for the new Z-Wave Plus certification program can be found in **<SDK_Install_Path>\ProductPlus**

These applications are a good starting point for designing your own application

Installing the Z-Wave Programmer

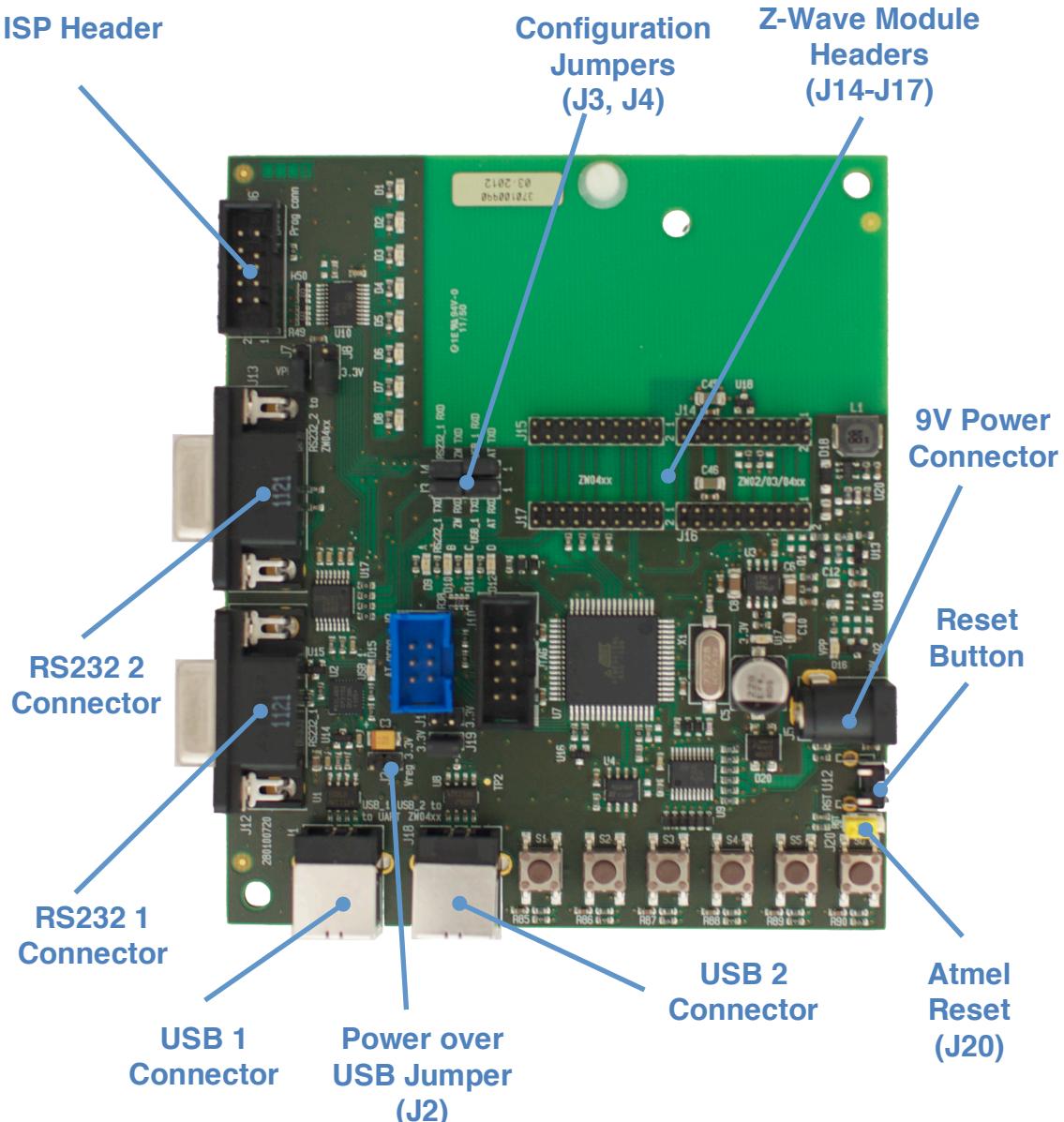
To install the Z-Wave Programmer Tool to your PC and run the setup program “**setup.exe**” located in **<SDK_Install_Path>\Tools\Programmer\PC** and follow the installation instructions on the screen.



Make sure that the **ZDP03A** board is not connected to your PC before proceeding with the installation of the Z-Wave Programmer

ZDP03A Overview and Setup

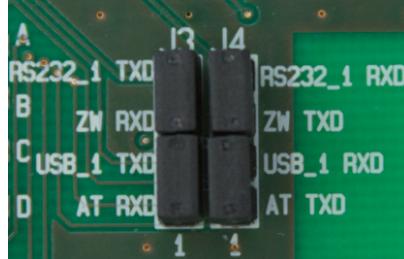
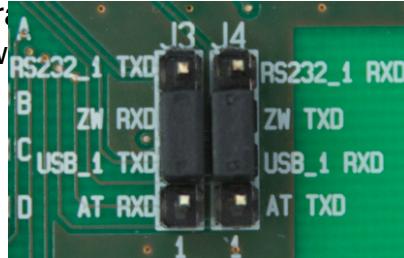
The ZDP03A is a versatile board that allows for programming, debugging and testing of embedded Z-Wave applications. It is a modular board that can accept both 300, 400 and 500-series Z-Wave modules. The following diagram illustrates key parts of the board that are used through this guide.





The **ZDP03A** board can be powered through the USB 1 port, without the need for the AC adapter or battery pack. For this to work, ensure that neither the AC adapter or battery pack are connected to the **ZDP03A** and short jumper **J2** before connecting the USB cable.

The following table shows the two most common ways of setting up a ZDP03A board

Setup Name	Jumper Configuration
Programmer Board	<p>Use two jumpers to jump J3 pin 1 to pin 2 and pin 3 to pin 4. Use two jumpers to jump J4 pin 1 to pin 2 and pin 3 to pin 4. Ensure J20 is off. It is recommended to power the ZDP03A via USB 1 when using this configuration.</p> 
Interface Board	<p>This configuration connects USB 1 to the Atmel processor, enabling the PC Programmer Tool to program connected Z-Wave modules. Additionally, RS232 1 is connected to the Z-Wave module for debugging purposes.</p> <p>Use a jumper to jump J3 pin 2 to pin 3. Use a jumper to jump J4 pin 2 to pin 3. For convenience, it is recommended to power the ZDP03A via USB when using this configuration. Short jumper J2 if the board is being powered via USB 1.</p> 

Programming Z-Wave Modules

Begin by setting up a ZDP03A as a “**Programming Board**”. Connect either a ZM3120 or a ZDB5202 module to the ZDP03A. Note that 300-series are not recommended for new designs, so it is advisable to use a ZDB5202 module. Power the ZDP03A and connect it to your PC using a USB cable. Make sure to connect the cable to **USB 1** on the ZDP03A. Once the board is powered and connected, start up the Z-Wave PC Programmer Tool.



Detect your target module by accessing the “**Tools**” menu and choose “**Detect Target**”. Verify that the correct platform is detected. This guide uses a ZW050x target, so be sure to select that tabbed view. This document will guide you through programming a Z-Wave controller on the Z-Wave module. Controllers require the Z-Wave Flash memory and external EEPROM memory to be programmed, which will be done in two steps.

First, make sure to be at the “**Flash Code Memory**” section and that “**SPI**” is the selected programming interface. Click the browse button labeled “...”. Navigate to **<SDK Install Path>\ProductPlus\Bin\SwitchOnOff** and choose the file **“SwitchOnOff_ZW050x_xx.hex”**. This is the same image of the Z-Wave Switch On/Off that was used in the previous sections. Replace “**xx**” in the filename to match your region. Proceed to program the Z-Wave flash memory by clicking the “**Program**” button in the “**Flash Code Memory**” section.



Make sure that you program Z-Wave modules only with applications with the correct frequency settings i.e. US based modules must only be programmed with US frequency based applications.

Your Z-Wave module is now ready to be used. You can test it by using the Z-Wave PC Controller Tool and including it into a network.



More, in-depth information about the Z-Wave Programmer can be found here:

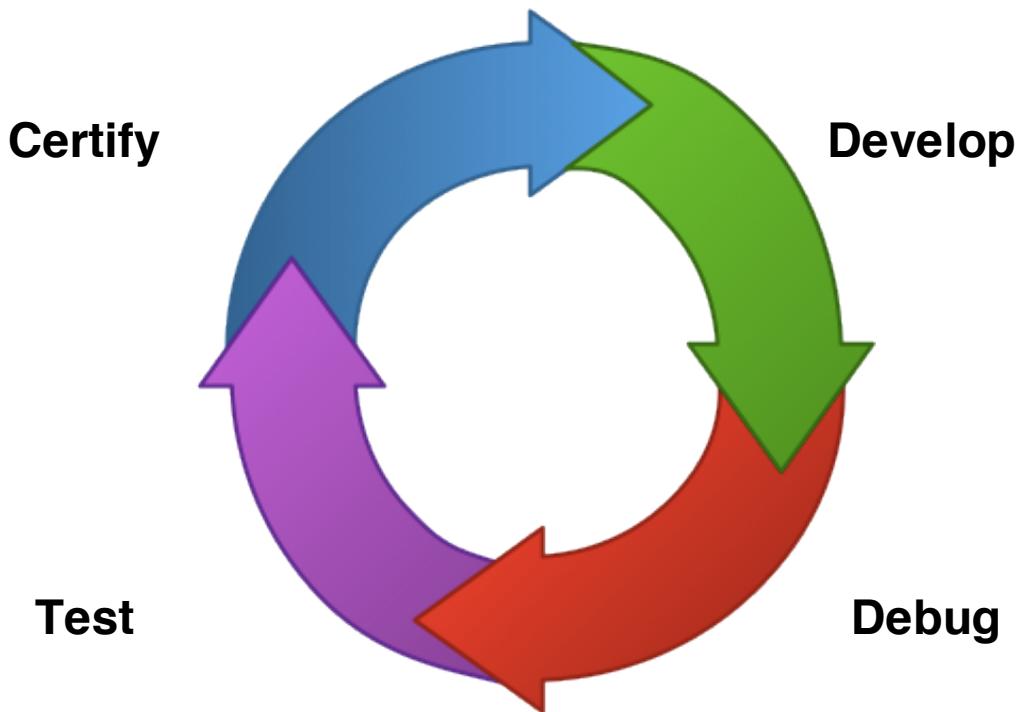
- ➔ [Z-Wave Programmer User Guide \(INS10679\)](#)

You can obtain a copy of this document from the ZTS website. It can be found by selecting **Z-Wave Programmer** under **SW Development Tools** in the **Software** section.

Wrapping Things Up

Development Cycle

When developing your applications, it is recommended that you follow a development cycle similar to the one illustrated here.



Develop and test your application in house. This internal testing should uncover coding errors and memory leaks and allow for some optimizations to be made to your code. Once the application is behaving as expected, make sure it will pass the tests suggested by the self-certification. Test that your product works correctly when in a network of devices by running external tests where the device is not isolated. Once you are satisfied with the overall quality of the application and the product's behavior apply for Z-Wave Certification to verify the product's conformance to Z-Wave standards.

Certification Process

Certification is an important and integral part of developing a Z-Wave product. The goal of the Z-Wave certification process is to ensure to end-users that the Z-Wave protocol has been correctly and robustly implemented in the product. It also guarantees that the product will interoperate with other Z-Wave certified products from either the same vendor, or someone else.

The certification process is basically a “self-certification” process. You as a developer and product manufacturer are responsible for ensuring that products are certified and remain certified during their life cycle. In order to make the certification process as smooth and as quick as possible it is highly recommended that you become involved with it as soon as you start developing your product.

Early involvement in the process will provide you with invaluable feedback from the test centers and the certification manager that will help shape your product to be compliant from the start and avoid common pitfalls that could waste valuable development time and delay your product's launch.

Navigate to the **Z-Wave Certification** section on the Z-Wave Technical Service website to get started.



More, in-depth information about the Z-Wave Certification process can be

- ➔ [Z-Wave Certification Overview \(INS10638\)](#)

You can obtain a copy of this document from the ZTS website. It can be found under **Downloads & Frequently Asked Questions** in the **Z-Wave Certification** section.

Appendix A - Installing USB Drivers

Communication with the ZDP03A requires VCP USB drivers from SiLabs to be installed in your PC.



Make sure that the **ZDP03A** board is not connected to your PC before proceeding with the installation of the USB drivers.

Run the SiLabs USB driver program “**CP210x_VCP_Win2K_XP.exe**” located in **<SDK_Install_Path>\Tools\Programmer\PC**. This action will result in a **SiLabs** folder being created with USB driver data files inside.

Connect the ZDP03A board to your PC and apply power to it. Windows will start a “Found New Hardware Wizard” and attempt to find drivers for the board. Do not allow Windows to find/install the drivers on its own. Instead, instruct the wizard to use the drivers in the **SiLabs** folder created by the USB driver’s installer.



Restart your PC once the drivers have been installed.



Contact Details	Contact Information
North America	Bill Scheffler +1 201 981 3009 bill_scheffler@sigmadesigns.com
South America	Bent Sorensen +1 786 239 4845 bent_sorensen@sigmadesigns.com
Europe	Ricco Winther +45 2925 2056 ricco_winther@sigmadesigns.com
Asia-Pacific	Chong Li +45 3913 0029 chong_li@sigmadesigns.com

Z-Wave Certification

z-wave_certification@sigmadesigns.com

Support

z-wave_support@sigmadesigns.com