



Instruction

Using the Epsilon5 for programming Z-Wave Single Chips

Document No.:	INS10309
Version:	5
Description:	This document describes how to use the Equinox-Technologies ISP programmer Epsilon5 for programming the flash and lock bits in a Zensys Z-Wave Single Chip
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Date:	2007-03-15
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Restrictions:	None

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REVISION RECORD

Doc. Rev	Date	By	Pages affected	Brief description of changes
1	20050323	MVO JFR	All	200 Series added
1.01	20050818	CMO	Page 5-6	Acquire unlock code
3	20060105	MVO	All	New 1 st page/header/footer contents. New Doc No
4	20070314	MVO	All	Updated the document to fit EQTools 2.1.731 Now refers to Equinox SW installed from a Equinox-SW package

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1 ABBREVIATIONS

Abbreviation	Explanation
CLK	Clock
CM	Contract Manufacturer
EDS	Epsilon Development Suite
GUI	Graphical User Interface
HW	Hardware
ISP	In System Programmer
MISO	Master In Slave Out
MOSI	Master Out Slave In
N/C	Not Connected
Single Chip	Zensys Z-Wave Single Chip
SPI	Serial Peripheral Interface
SW	Software
TBD	To Be Defined

2 INTRODUCTION

2.1 Purpose

The purpose of this document is to give a description of how to program the flash in the Zensys Z-Wave Single Chips by the means of the Equinox Technologies ISP programmer Epsilon5.

2.2 Audience and Prerequisites

The audience for this document SW and HW engineers who are going to use the Epsilon5 for programming Z-Wave Single Chips during SW or HW development. This document is also targeted contract manufactures that are going to program the Single Chip in small series.

3 EQUINOX-TECHNOLOGIES EPSILON5 PROGRAMMER

The ISP programmer Epsilon5 Mark II (Epsilon5) from Equinox Technologies (www.equinox-tech.com) can be used for programming the flash and lock bits in the Zensys Z-Wave Single Chips (e.g. ZW0201) during SW and HW development and for small production series. The Epsilon5 can be acquired from several distributors worldwide. The Epsilon5 is depicted in Figure 1.

The Epsilon5 package includes the programmer hardware, a serial cable, software package, and a User Guide [1].



Figure 1 Equinox-Technologies ISP programmer Epsilon5 Mark II

The Epsilon5 can operate in two modes *AutoProgram* or *Epsilon Development Suite* (EDS). The *AutoProgram* mode can be used for programming small series where the flash image and lock bit setup are downloaded into the Epsilon5, which thereafter can operate as a stand-alone programmer for programming the flash image and lock bits without the use of a PC. The EDS mode can be used for development programming tasks; e.g. tasks where the flow contains re-programming of the same device with different flash images or the contents of the flash must be read back and investigated. The Equinox Toolsuite GUI application (*EQTools*) is used for management of both modes. In the Equinox tool suite you will also find the Equinox-technologies program *Configit*, which is used to download new firmware.

3.1 Programming Setup

The programming setup, which is depicted in Figure 2, consists of

- An Epsilon5
- A Single Chip target system (e.g. a development kit or a programming bed of nails fixture)
- A PC running *EQTools* and *Configit* on either Windows 95, 98, 2000, ME, NT or XP. Please note that some PC/Windows XP configurations can give problems with both *Configit* and *EQTools*.
- A serial cable (supplied with the Epsilon5)
- A ribbon cable (supplied with the Epsilon5)
- One or two power supplies

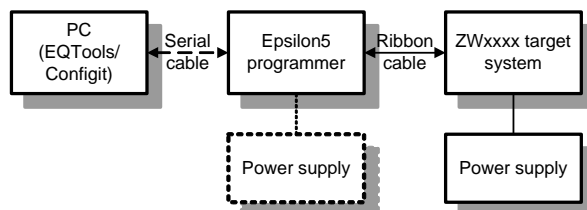


Figure 2 Programming setup

If the power supply connected to the Single Chip target system is able to power the Epsilon5 only one supply is needed. In that case, the power supply for the Single Chip target system must be capable of supplying extra 50mA (3.3v) for the Epsilon5. Refer to Appendix A for a description of Single Chip modules and their capability of powering the Epsilon5.

In the case where the Epsilon5 must have an independent power supply, please refer to the Epsilon5 User Guide [1].

IMPORTANT: A jumper on the Epsilon5 PCB must be set correct depending on the described power supply configurations, see section 3.2.

Please refer to the section called “Earthing requirements” in the Epsilon5 User Guide [1] for a proper ESD protection guideline, but in general, you should avoid having any of the subsystems (Epsilon5 and Single Chip) powered while connecting the serial and ribbon cables.

3.2 Configuration of the Epsilon5

The Epsilon5 can be powered either by dedicated power-supply or by the Single Chip target system. A jumper; J9, on the Epsilon5 PCB must be set correct depending of the power source:

Open:	when an independent power-supply is being used for the Epsilon5
Shorted:	when the Epsilon5 is powered from the Single Chip target system

The jumper, J9, is located on the internal Epsilon5 PCB in the upper right corner, as depicted in Figure 3.

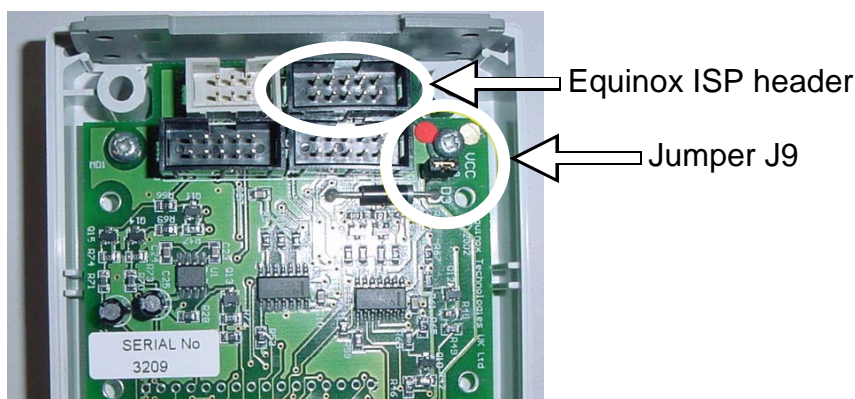


Figure 3 Locations of the J9 Jumper and the Equinox ISP Connector

The ribbon cable must be connected to the Equinox ISP pin-header, J6, (2x5 pins) located in the upper right corner, as depicted in Figure 3. See Appendix C for a description of the pin-out of the Equinox ISP header.

Please, refer to the Epsilon5 User Guide [1] or contact Equinox-Technologies about questions regarding the configuration and powering of the Epsilon5.

3.3 Installation of the EQTools Application and Libraries

Refer to the User Guide [1] contained in the Epsilon5 package and the document *EQTools-Getting Started Guide* [3] regarding installation of the EQTools program and libraries. Use the `EQTools.exe` file located in the `EQTools` directory in the place where you installed the Equinox package, e.g.c:\Program Files\Equinox\EQTools.

3.4 Firmware

Please note, that the revision of the firmware in the Epsilon5 hardware might have to be updated in the following cases:

- Getting an update of the Developer's Kit CD.
- Buying the Epsilon5 hardware from another source.

Use the application *ConfigIt* for downloading firmware etc. into the Epsilon5 hardware. *configit.exe* is located in the *Firmware* directory in the place where you installed the Equinox package, e.g. *c:\Program Files\Equinox\Firmware*. You can use *ConfigIt* to determine the firmware revision that has already been downloaded to your Epsilon5.

IMPORTANT: Remember to close all programs before running *ConfigIt*.

IMPORTANT: Remember to always use the firmware revision that comes with the Developer's Kit CD, even if the firmware revision that comes with the Developer's Kit CD is older than the current.

3.4.1 Check firmware revision

To check firmware revision do following;

1. Start *ConfigIt*. The user interface as the one depicted in Figure 5 will show up.
2. Select the correct communication port and select "Epsilon5" as *Programmer Type*.
3. Press the *Information* button to get the current firmware revision installed in the Epsilon5 hardware.
4. Press the *About* button to see the Epsilon5 firmware revision contained in the current *ConfigIt* application.
5. Don't update the firmware in the Epsilon5 hardware in case the above revisions are the same.

3.4.2 Download firmware

To download new firmware do following;

1. Open the Epsilon5 box and short Jumper J5, which is located in the lower left corner of the PCB (see Figure 4)
2. Connect the Epsilon5 to a serial communication port of your PC.

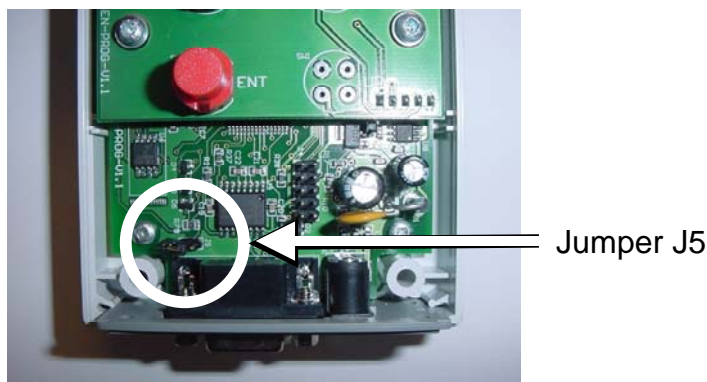


Figure 4 Location of Jumper J5

3. Add power to the Epsilon5
4. Start *ConfigIt*. The user interface window like the one depicted in Figure 5 will show up.
5. Select the correct communication port and select "Epsilon5" as *Programmer Type*.
6. Press the *Load* button to download the firmware revision contained in the current *ConfigIt* application. Notice that the firmware upgrade can fail, requiring a new unlock key (see section 3.4.2.1).
7. Verify the firmware download result.
8. Press the *Exit* button to quit and close the application.
9. Remove power from the Epsilon5

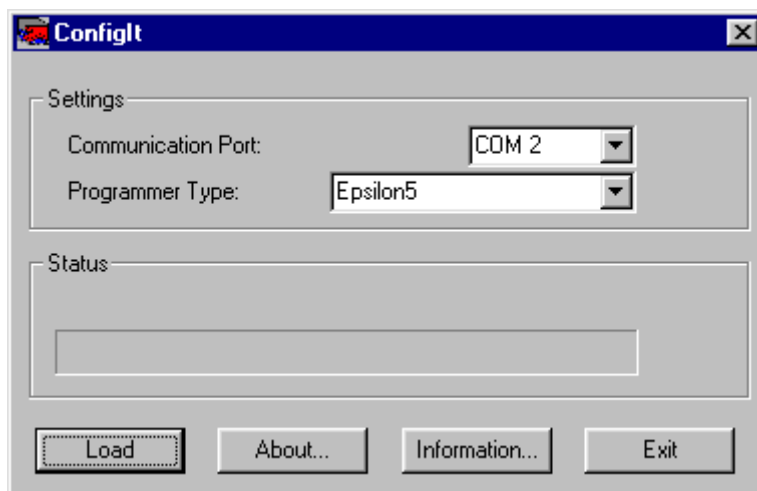


Figure 5 ConfigIt user interface.

10. Open the Epsilon5 box and (**IMPORTANT**) open Jumper J5

3.4.2.1 Acquire unlock code

In case that the download of the firmware download process fails please do as follows to acquire an unlock code from Zensys:

If you have got the following message:

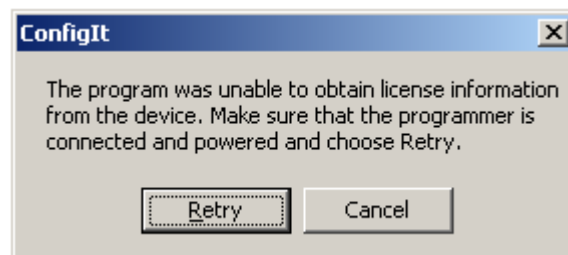


Figure 6 ConfigIt error message

1. Press "Cancel"

Then you get this message:

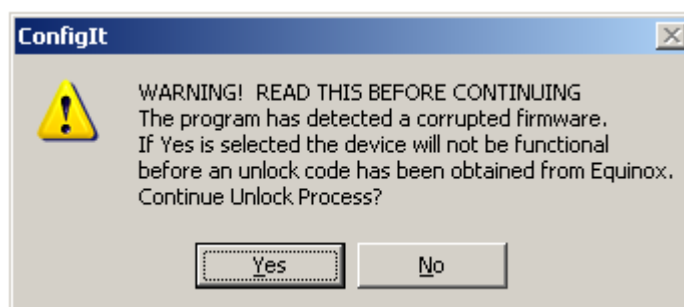


Figure 7 ConfigIt Unlock Process Requester

2. Press "Yes"

Then you get this message:

A screenshot of a Windows-style form titled "Serial License Codes". The text inside reads: "The programmer serial information is corrupted. It is not possible to update the programmer without additional information. Please mail or Fax the code shown below to Equinox Technologies UK Limited. Please enter the code returned by Equinox in the Return Code field". Below this text, there is a text box containing the code "ABEA542FA6544454FE56". Underneath, there is a label "Enter Product Serial Number" followed by an empty text box. To the right of this text box is a button labeled "Text File". Below the "Enter Product Serial Number" text box is a label "Select Product Type" followed by a dropdown menu showing "Epsilon5". To the right of the dropdown menu is a button labeled "Send Mail". At the bottom, there is a label "Enter Returned Code" followed by a text box containing "00000000000000000000". At the very bottom, there are two buttons: "Update" and "Exit".

Figure 8 ConfigIt Serial license Code Request Form

3. Enter the serial number of the Epsilon5, press "Send Mail", and send the mail to <mailto:support@zen-sys.com>. Then we can generate an unlock code for you.

4 EPSILON5 OPERATING GUIDELINES

The following sections explain how to use the EQTools application and manage the Epsilon5 for programming a Single Chip in both AutoProgram and EDS modes.

The EQTools version/build used in this document is Version 2.1 (build 731). Note that earlier or later versions/builds might differ from what is described in this document.

The Epsilon5 must be connected through a serial connection to the PC while the programmer is being managed by the means of the EQTools application.

A full flash image file, a lock bit setup and all other data needed for programming a device is called a *Project* in the EQTools application. Such a project can be uploaded to the Epsilon5 programmer. When the project has been uploaded to the Epsilon5, it can operate as a stand-alone programmer (i.e. with no connection to a PC).

Starting EQTools will open a window like the one depicted in Figure 9. Press “Cancel” so that the serial communication can be setup.

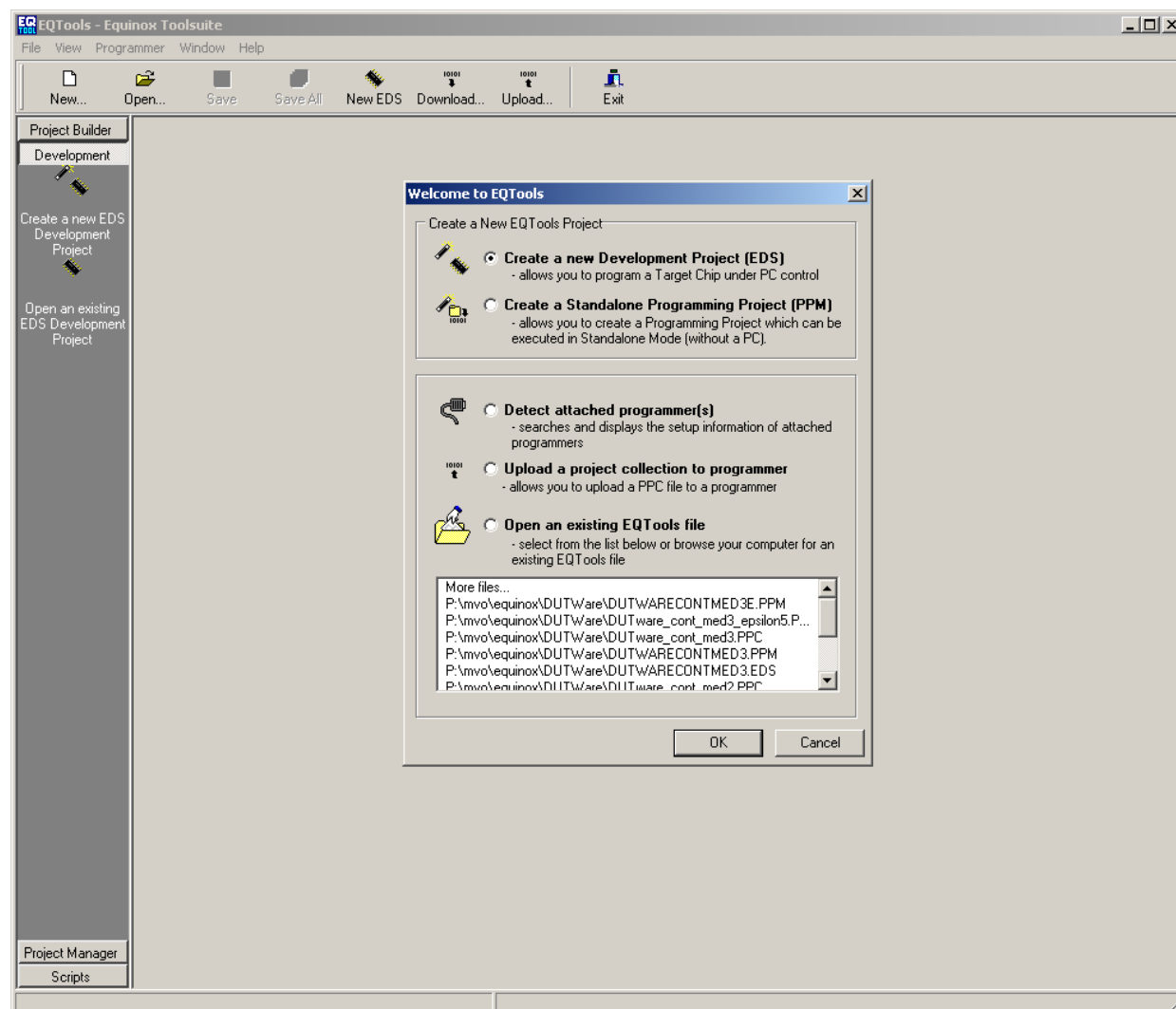


Figure 9 Initial window of EQTools

4.1 Serial Communication Setup

1. Select Programmer, then *Communication and Scripting Setup* in the menu.
2. Select the *Communications* tab, as depicted in Figure 10
3. Set the options according to the current PC serial communication configuration
4. Press the *Test...* button to test the setup

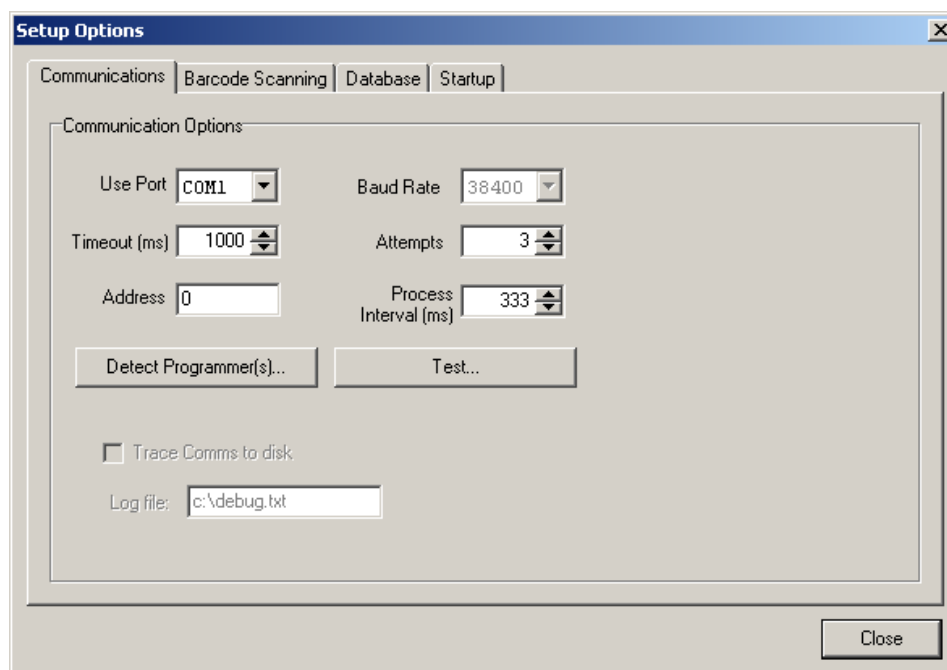


Figure 10 Communications Options

5. If the test fails please go to the troubleshooting section in Appendix B
6. Press "OK" and "Close"

4.2 Build a project

The next thing to do is to build a project. An EQTools project must be built for both the AutoProgram and the EDS modes.

The following description is based on a basic project, where all timing and other electrical and physical parameters have been defined. This basic project should fulfill most programming environments. For a description of all of the Single Chip programming parameters, please refer to [2].

The basic project files are called `*basic.PPM`,

e.g. `ZW010xbasic.PPM`, where `x` is the device type/revision, e.g. `2_2`)

The files are supplied by Zensys on the Developer's Kit CD. The files can also be obtained from Zensys¹.

1. Select *Project Builder* at the left pane (If not already selected).



2. Click the *Open Project* icon and use the file browser to find and open the project file *basic.PPM for the device type/revision to be programmed.
3. You might get the warning message depicted in Figure 11, if the device library revision has been updated since the project file was generated. A new file can be obtained from Zensys¹.

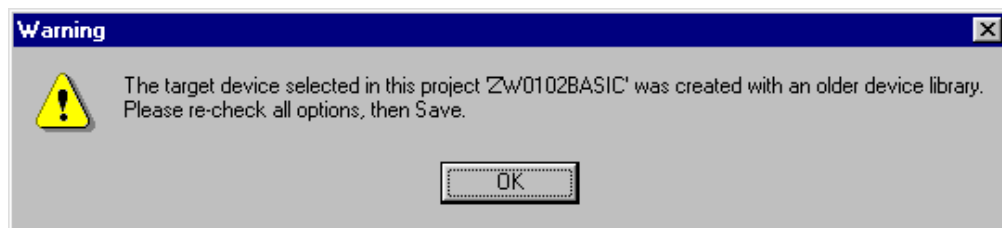


Figure 11 Warning message when loading a project generated with a previous revision of the library

4. Select the *Header Info* tab and fill out the Header Information window fields.

¹ Please, select *Programmer*, then *Create Library Info* in the EQTools menu for generating a library information file. Send this information file in an e-mail to support@zen-sys.com to request a new revision of the project file

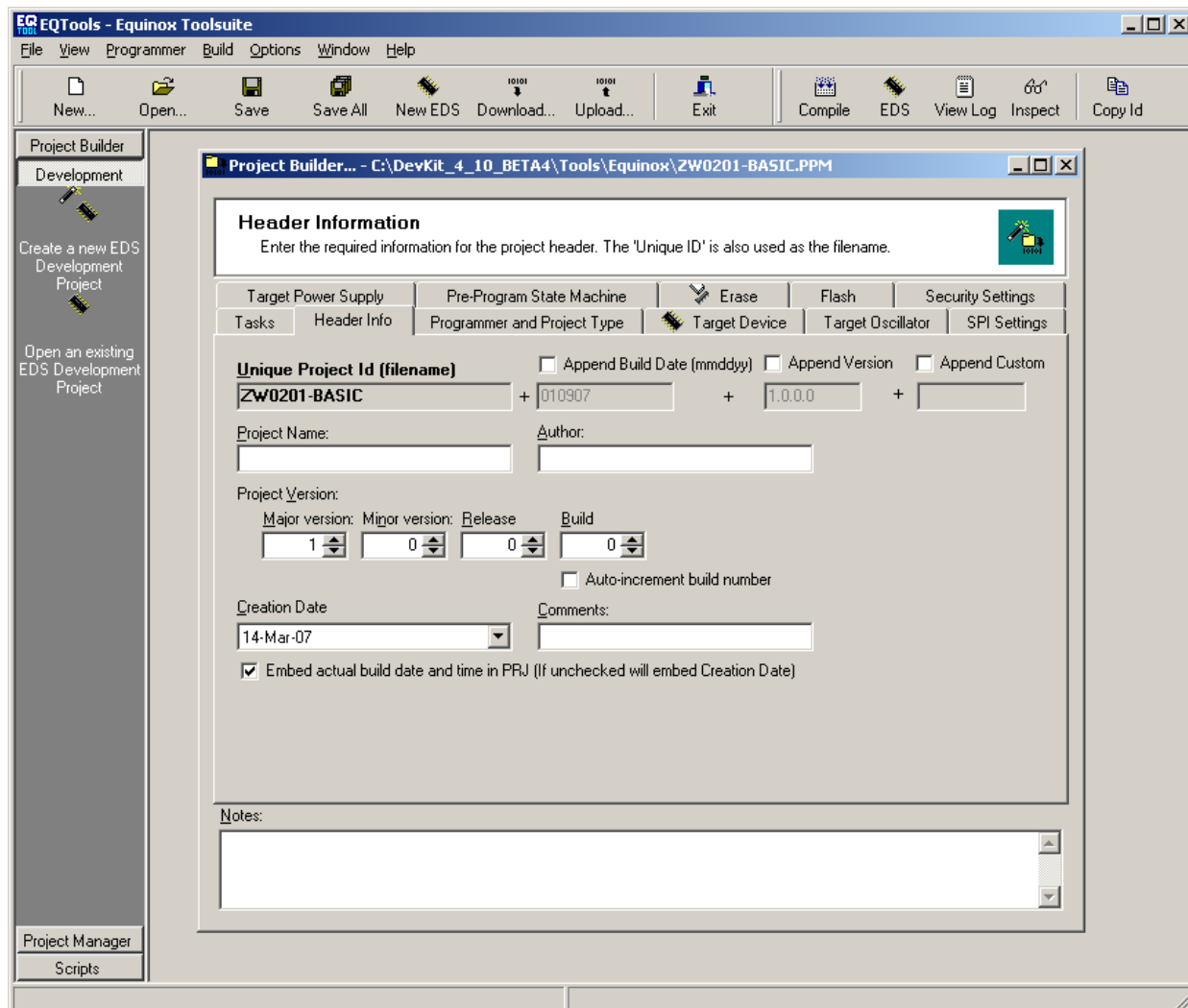


Figure 12 Project Header Information window

5. Open the Target Programmer window by clicking the *Programmer and Project Type* as depicted in Figure 13

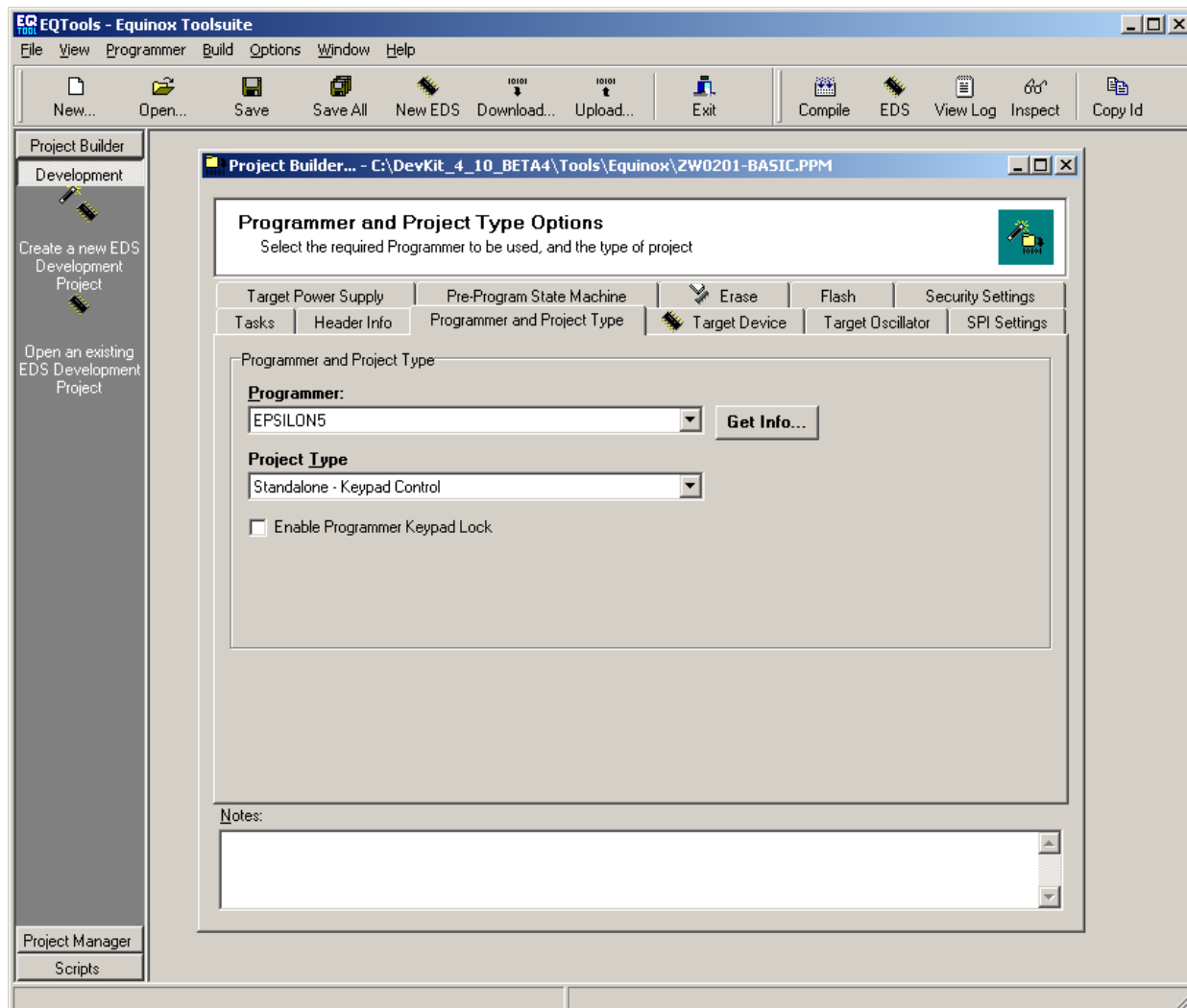


Figure 13 Programmer and Project Type window

6. Select *Standalone – Keypad Control* in the *Project Type* Combo box
7. Open the *FLASH Area Programming Options* window by clicking the *Flash* tab as depicted in Figure 14

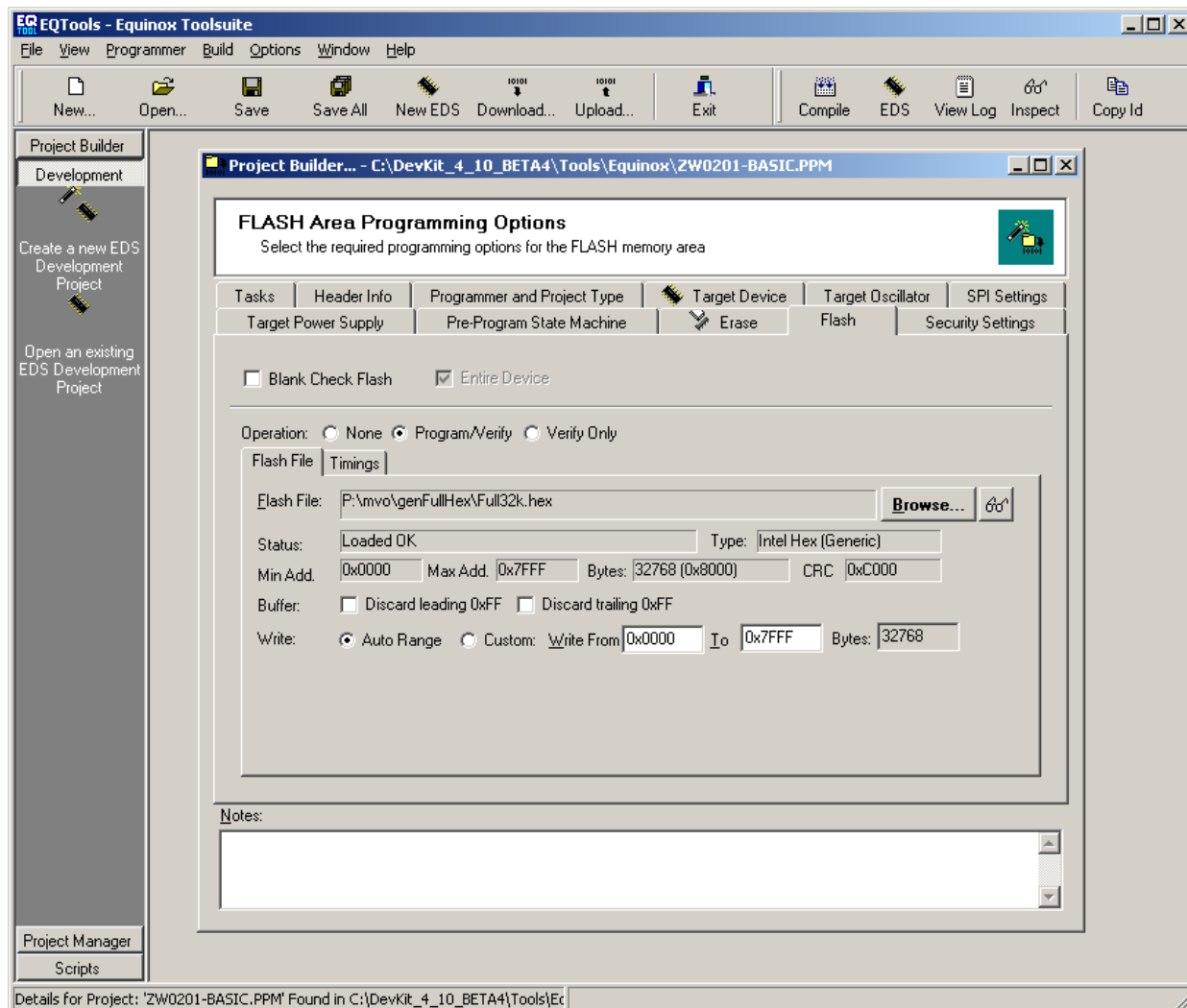


Figure 14 FLASH Area Programming Options window

8. Press the **Browse...** icon and use the file browser to find and open the flash image hex file to be downloaded to the chip.

If the lock bits are going to be left untouched go to step 11.

9. Open the Security Setting window by selecting the *Program Security* tab, as depicted in Figure 15.

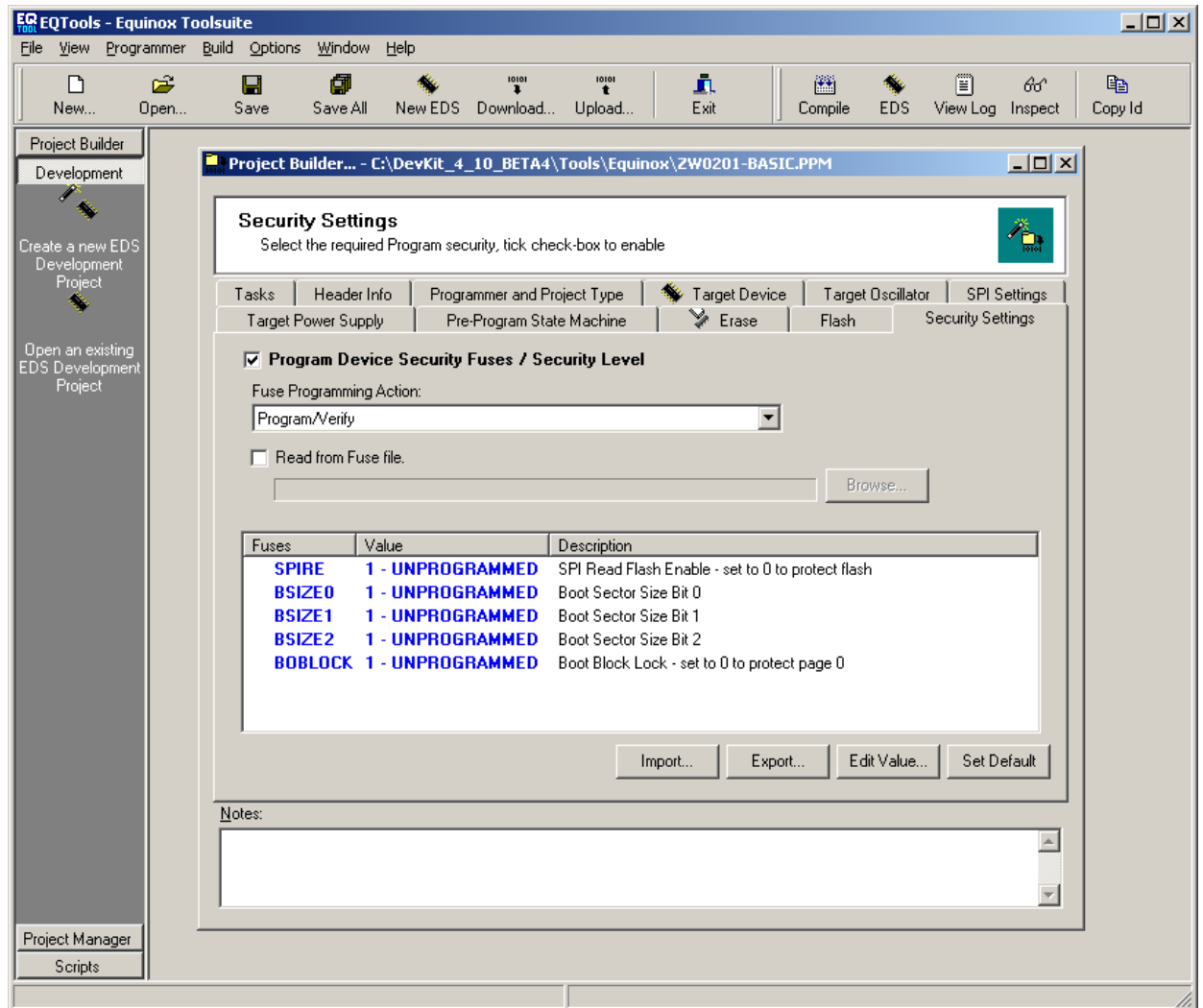







Figure 15 Security Settings window

10. Select the fuse to be changed and press  to change the value (Refer to [2] for a description of the Lock bits)
11. Select File, then Save as... in the menu to save the project under a new name
12. Press the  symbol to compile the project into a binary file
13. Select  Add Project file to a new Project Collection to generate a new Project Collection and then go to section 4.3
 Select  Update this project in an existing Project Collection to update an existing Project Collection and then go to section 4.3
 Select  Test this project in Equinox Development Suite to use the generated project in interactive mode (EDS mode) and then go to section 4.4

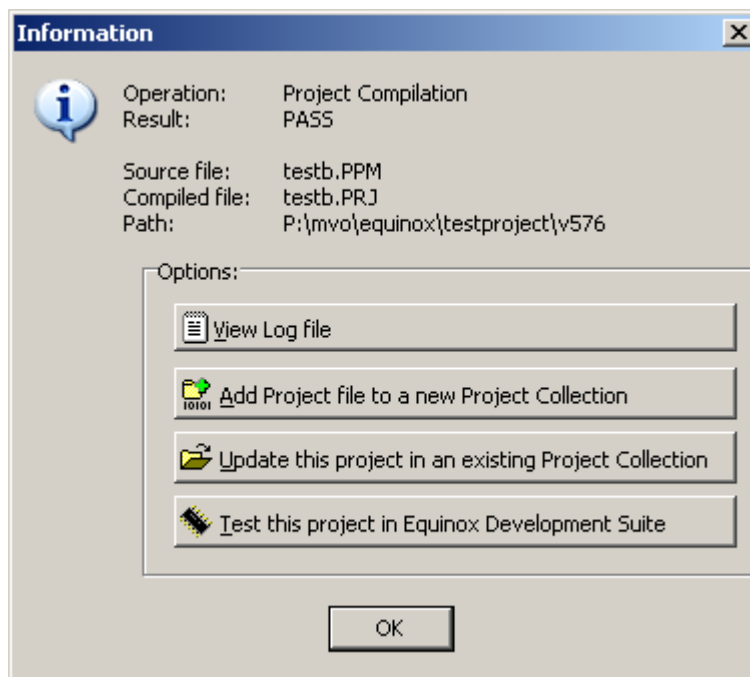


Figure 16 Next Steps after Compilation

14. Close the Project Builder window

4.3 AutoProgram Mode

The information that is uploaded to the programmers from the EQTools application in AutoProgram mode is called a *Project Collection*. The EQTools application is designed for other Equinox ISP programmers than the Epsilon5. These programmers can store several projects at the same time. This is why the EQTools has the possibility to generate the so-called *Project Collections*, which is a set of several projects. The Epsilon5 only can hold one project at a time and therefore EQTools only allows that a collection holds one project when it is managing an Epsilon5.

The programming process in the AutoProgram mode contains three major steps:

- Build an EQTools project
- Upload project collection into the Epsilon5
- Program the Single Chips

Refer to section 4.2 for a description of how to build an EQTools project.

4.3.1 Build project collection

1. If coming direct from compile window in Project Builder (Figure 16) then either select the existing file or set the new file, depending on whether you are updating an old project Collection generating a new respectively. Then go to step 7.
2. Select *Project Manager* in the left pane



3. Press the *New Collection* icon for generating a new collection. Then the Project Manager window will open, as depicted in Figure 17.

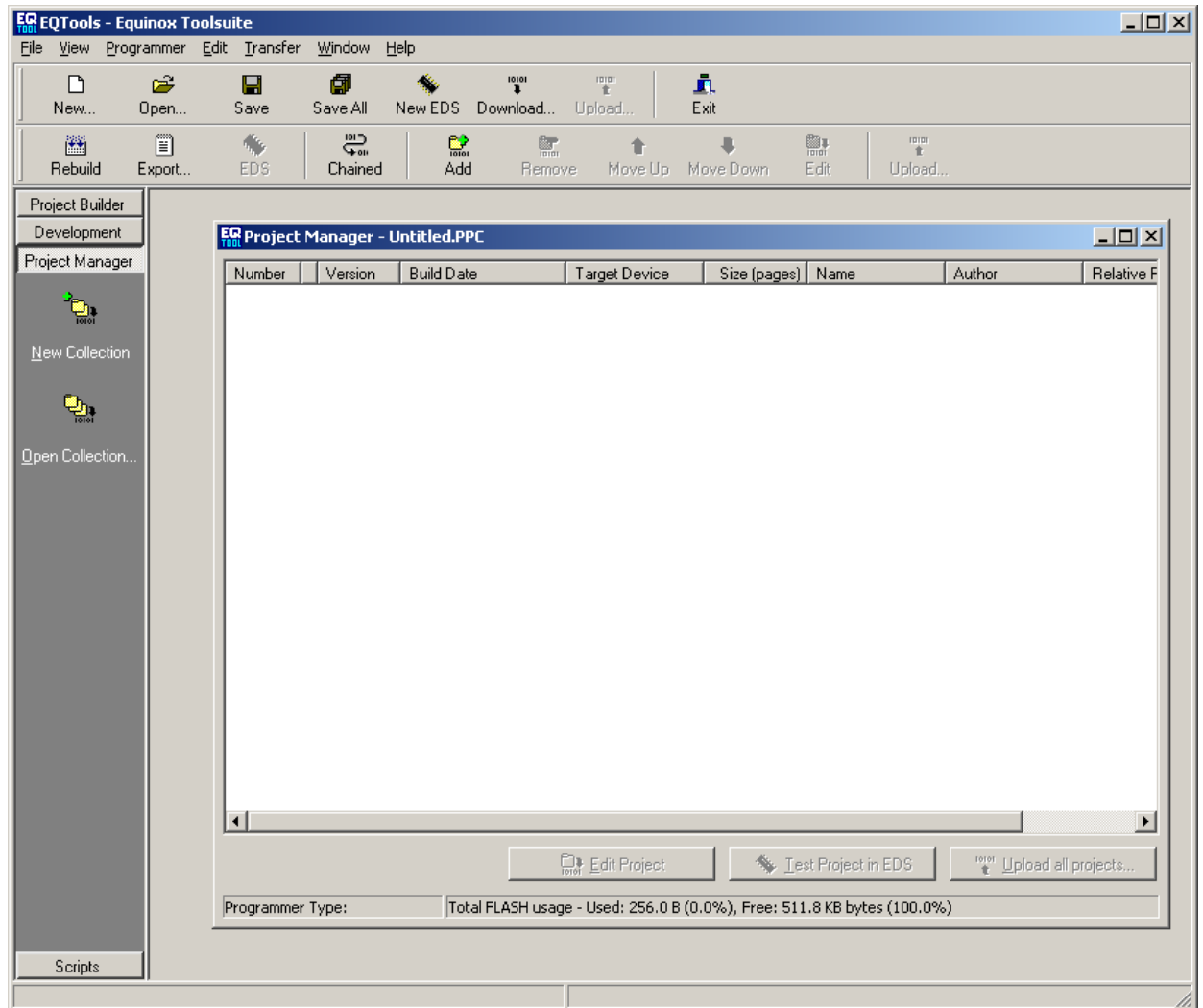





Figure 17 Project Manager window

4. Press  in the menu or press CTRL-A for adding the project file that was generated in section 4.2.
5. Press *OK*
6. Select *File*, then *Save as...* in the menu for saving the Project Collection.
7. Use the file browser to set the path and filename of the project collection file.
8. Press  or CTRL-U to upload the project to the Epsilon5 programmer and the Programmer Upload Wizard window will open.
9. Follow the instructions in the next section for uploading the Project Collection to the programmer.

4.3.2 Upload Wizard

The Upload Wizard can be started either by pressing the upload button,  in EQTools as explained in the previous section or by executing the program direct. The executable file is called UploadWizard.exe and it is located in the UploadWizard directory in the place where you installed the Equinox package, e.g. c:\Program Files\Equinox\UploadWizard.

1. When the Upload Wizard has started the window depicted in Figure 18 will open.

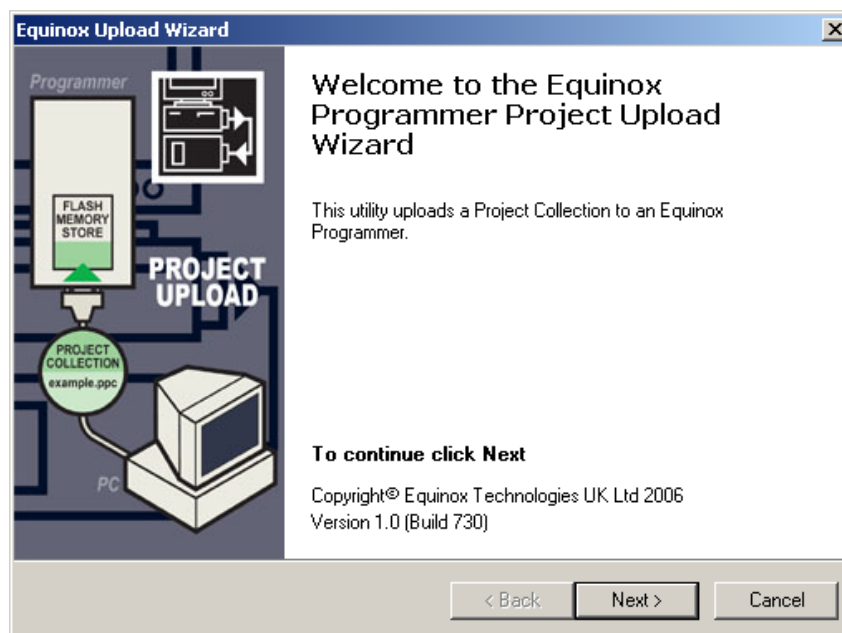


Figure 18 Programmer Upload Wizard – Welcome window

2. Press *Next* and the window depicted in Figure 19 will open

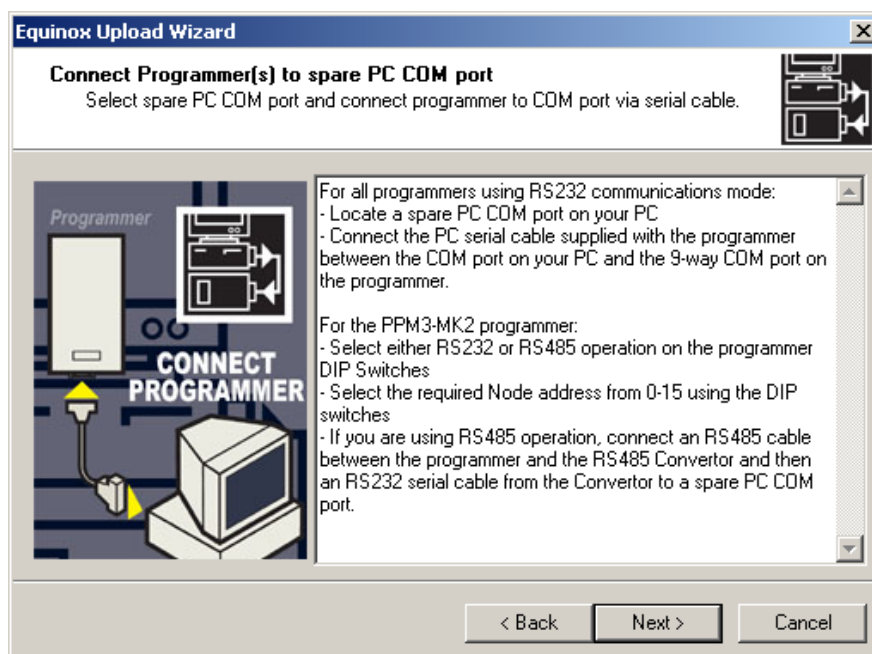


Figure 19 Programmer Upload Wizard – Connect Programmer

- Press *Next* and the window depicted in Figure 20 will open

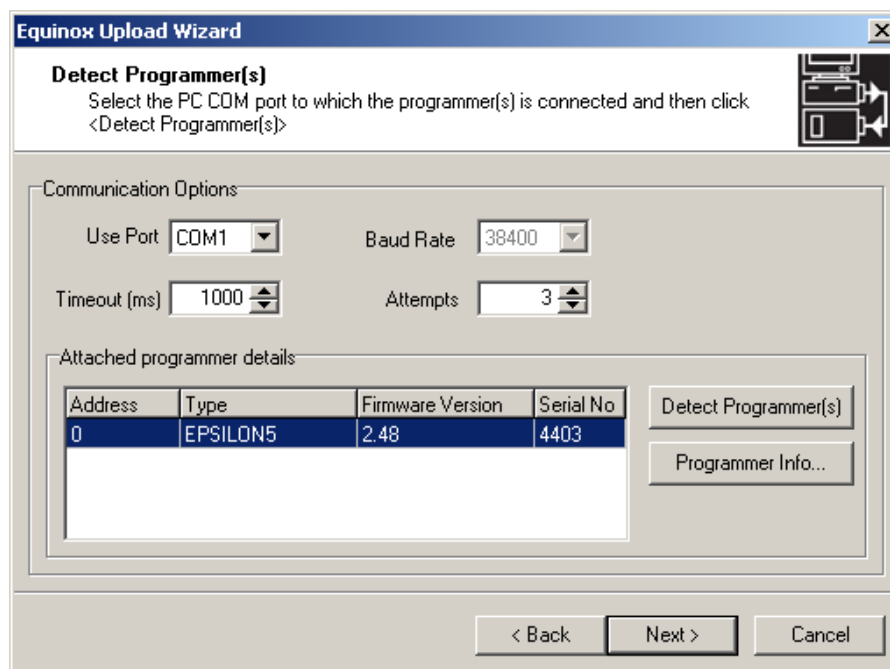


Figure 20 Programmer Upload Wizard – Select COM port

- Select the COM port that is used for the serial connection between the PC and the Epsilon5 (see section 3.1) and press *Next* and the window depicted in Figure 21 will open.

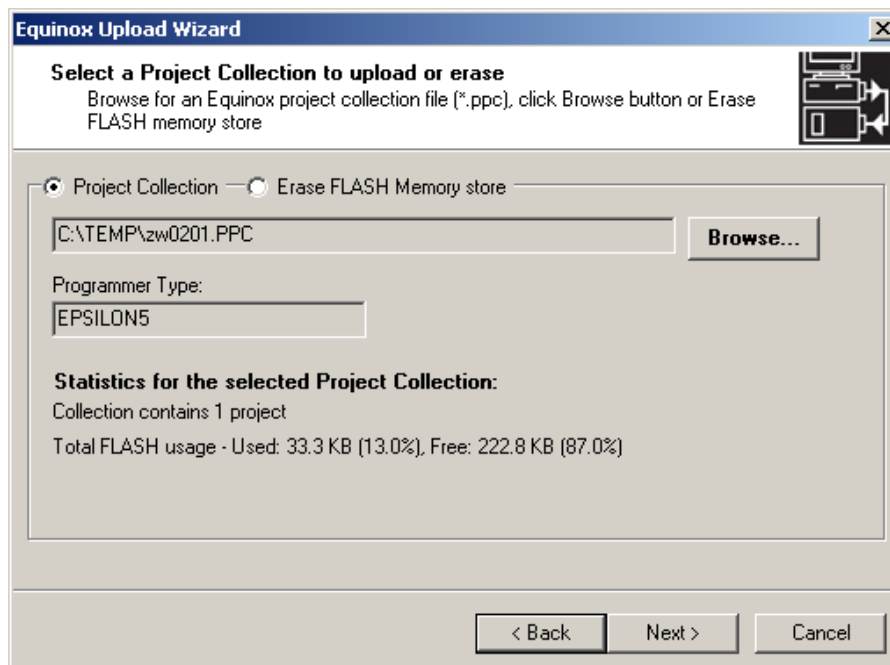


Figure 21 Programmer Upload Wizard – Select Project Collection File

- Select the Project Collection file to be uploaded (if not already set) by using the *Browse...* button. Then press *Next* and the window depicted in Figure 22 will open.

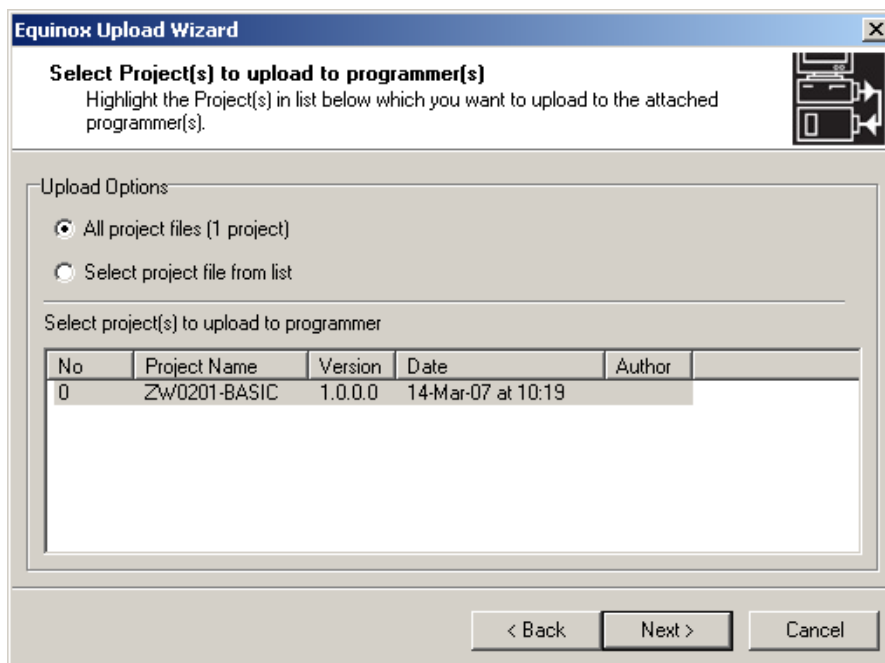


Figure 22 Programmer Upload Wizard – Select Project

6. Press *Next* and the window depicted in Figure 23 will open.

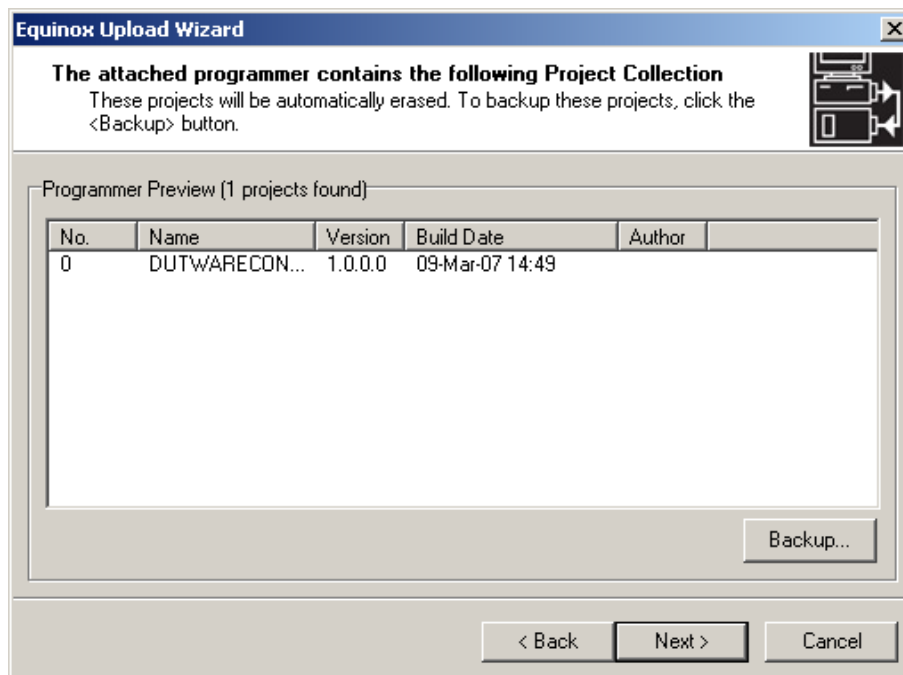


Figure 23 Programmer Upload Wizard – Current Project Collections

7. Press *Next* and the window depicted in Figure 24 will open.

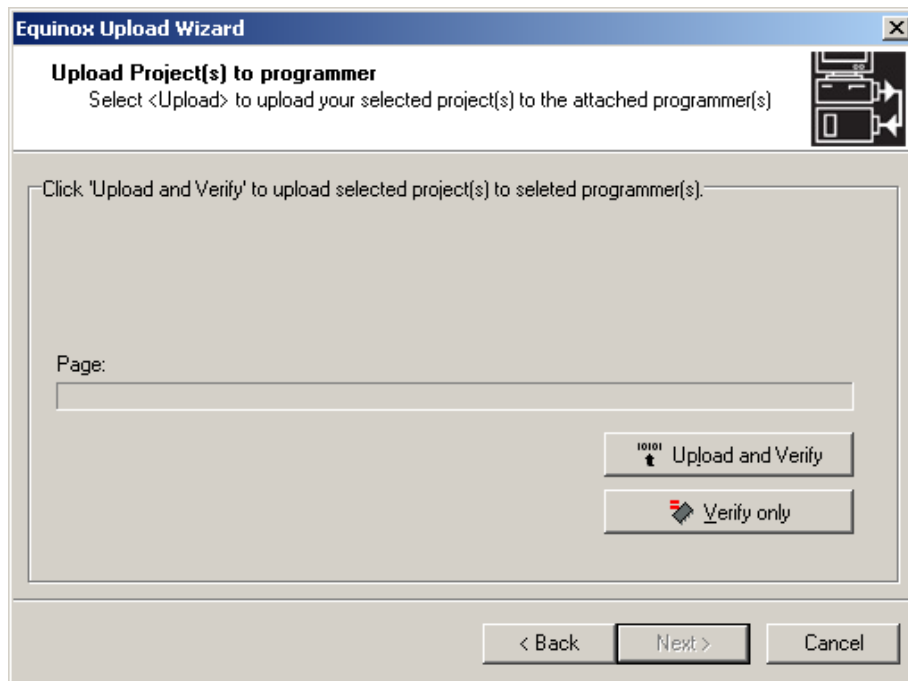


Figure 24 Programmer Upload Wizard – Upload window

8. Press *Upload and Verify* and when the upload process is done a window like the one depicted in Figure 25 will open. If not go to the troubleshooting section in Appendix B.

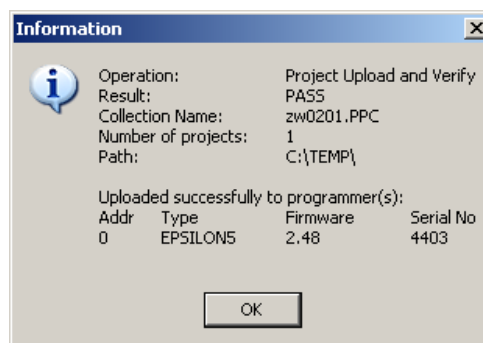


Figure 25 Programmer Upload Wizard – Result window

9. Press *OK* and the window depicted in Figure 26 will open

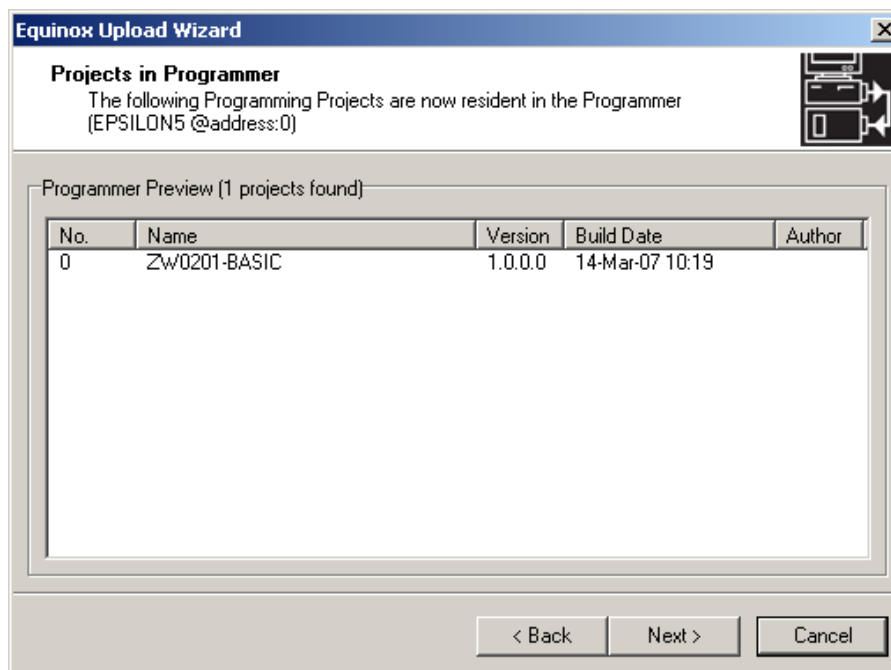


Figure 26 Programmer Upload Wizard – Resulting Projects in programmer

10. Press *Next* and the window depicted in Figure 27 will open.

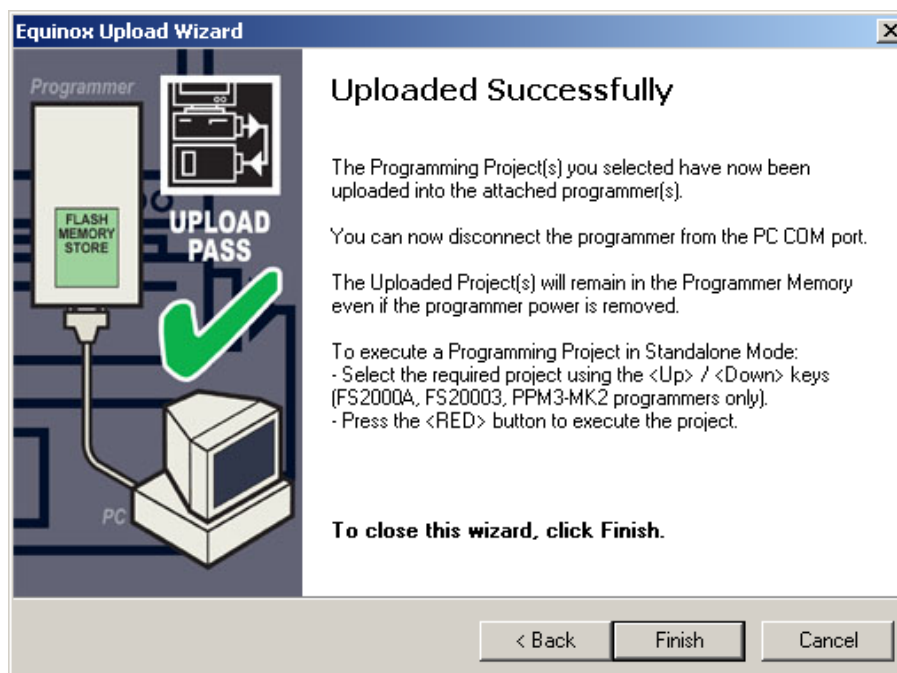


Figure 27 Programmer Upload Wizard – Final window

11. Press *Finish*

12. The serial cable can now be disconnected from the programmer (stand-alone mode) and the Epsilon5 can be powered off without losing the project data.

4.3.3 Programming Single Chips

Finalizing the process in the previous sections makes the Epsilon5 ready for programming the devices.

1. Connect the Epsilon5 to the Single Chip target system (if not already connected)
2. Power on the Single Chip target system and the Epsilon5 (Note that the Epsilon5 may be powered from the Single Chip target system).
3. Press the YES button on the Epsilon5 box (one or two times) until the BUSY LED is lit.
4. Wait until the BUSY LED goes out
5. If the PASS LED flashes the programming operation succeeded, go to step 7
6. The programming operation failed (FAIL LED flashes). Go to the troubleshooting section (Appendix B)
7. To program a new Single Chip refit new Single Chip in the Single Chip target system and go to step 3. Remember to turn off the power when connecting to a new Single Chip target.


4.4 EDS Mode

This section describes how to use the Equinox Development Suite (EDS). First find the description of how to generate a new EDS project. Finally the EDS functions are described.

4.4.1 Generate New EDS Project

1. Select *Development* in the left pane of the main EQTools window



2. Click the *Create a new EDS Development Project* icon , then the Equinox Development Suite window will open, as depicted in Figure 28.

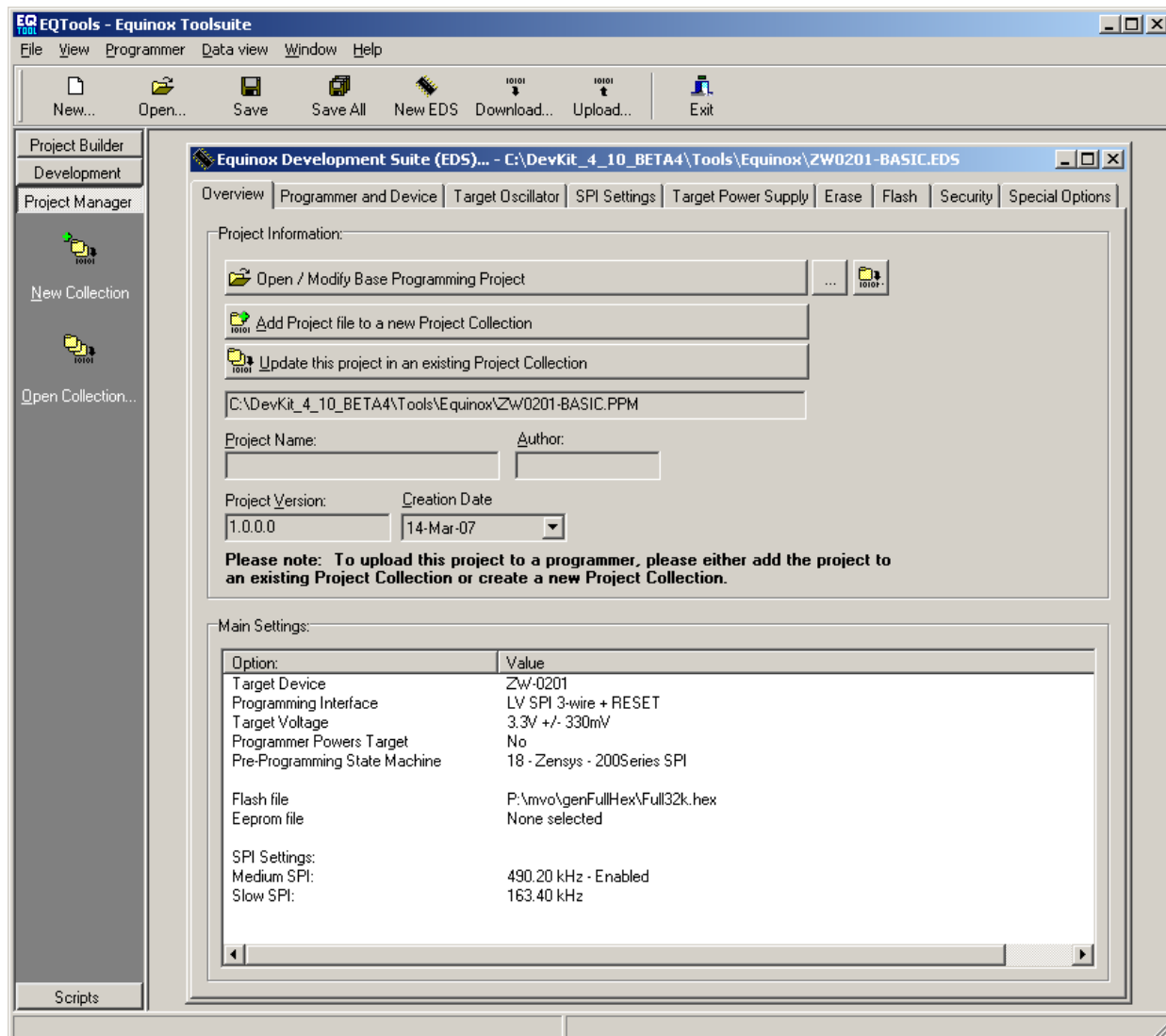




Figure 28 EDS mode window

3. Press the  icon and use the navigator to find and open the project file generated in section 4.2
4. Press the  icon to save the EDS project.
5. Select the *Flash* tab to go to the interactive flash programming page.

4.4.2 EDS functions

Selecting the Base Project tab enables the following functions:

- Reset the Programmer
- Check signature of device in the Single Chip target system
- Erase the Single Chip
- Blank Check the Single Chip

Selecting the Flash tab enables the following functions:

- Read/write/verify flash contents
- (Re)Load flash image file into application buffer (can be done automatically)
- Calculate CRC
- Erase and blank check device
- Edit flash image buffer
- Automatic upload to device if flash image file changes

Selecting the Lock Bits tab enables the following functions:

- Read/write/verify lock bits contents

For a description of the lock bits please refer to [2]

4.5 Script, barcode reader, and database functions

It is out of scope for this document to describe script mode, the barcode reader function, and the Database function. Note that these options require a special license from Equinox Technologies.

5 REFERENCES

- [1] Equinox Technologies UK Ltd, Epsilon5 MKII Programmer – User Guide V.1.03, March 6, 2002
- [2] Zensys, APL10312, Application Note, Programming the 200-Series Z-Wave Single Chip Flash
- [3] Equinox Technologies UK Ltd, EQTools – Getting Started Guide

APPENDIX A EPSILON5 AND ZENSYS MODULES

The following Zensys Z-Wave modules have an Equinox ISP connector (2x5 pin-row) and can thereby be connected directly to the Epsilon5 programmer:

Zensys product number	Module name	Module part number	Zensys documentation number	Note
4403	Single Chip Interface Module	370100460	903501300	The Single Chip Interface Module is able to power the Epsilon5, i.e. only the power supply connected to the Interface Module is needed and the J9 jumper must be shorted
4402	Single Chip Development Module	370100470	903501400	The Single Chip Development module is able to power the Epsilon5, i.e. only the power supply connected to the Development Module is needed and the J9 jumper must be shorted

Note: Other Single Chip Modules may be offered in the future.

APPENDIX B TROUBLESHOOTING

Description of Problem	Step	Problem course	Action	Possible results and next action
Running the Communications Test in "Communication and Scripting Setup" window fails	1.	No power to the Epsilon5	Check the that there is power Epsilon	<i>Not powered:</i> Connect power try to run test again. <i>Power OK:</i> go to step 2
	2.	Wrong COM port	Select the correct COM port	<i>Wrong COM port:</i> Run test again <i>Correct COM port:</i> go to step 3
	3.	Other Windows Application has control of COM port	Close the application and restart EQTools	-
The FAIL LED flashes after an AutoProgram programming operation	1.	No power to the Single Chip	Check the that there is power to the Single Chip	<i>Not powered:</i> Power up the Single Chip is try to run the programming operation again. <i>Power OK:</i> go to step 2
	2.	Wrong device	Activate EDS mode and try to read the signature	<i>Signature check fails:</i> The device type is wrong – select the right device type in the library or connect the right device to the ZWxxxx target system <i>Failed to read device:</i> go to step 4 <i>Signature OK:</i> go to step 3
	3.	The device is defect	The device is defect	Replace the device
	4.	Check that the Single Chip have proper connection to the Single Chip target system and that all cables are connected correctly	Check that the Single Chip have proper connection to the Single Chip target system and that all cables are connected correctly	Go to step 2

Description of Problem	Step	Problem course	Action	Possible results and next action
The "Target Vcc" LED on the Epsilon5 is not lit after the Epsilon5 has been connected to the target system	1.	The Single Chip target system has no power	Check that the Single Chip target system has power	<i>Power OK:</i> The Epsilon5 is powered from the target system go to step 2 The Epsilon5 has its own power supply go to step 3
	2.	Jumper J9 is not set correct.	Short Jumper J9. (See section 3.2)	
	3.	The Epsilon5 has no power	Check the power to the Epsilon5 (3.1-5V DC, '+' in center of connector)	

Please also refer to the Error message section in the Epsilon5 "User Guide" document that is included in the Epsilon5 box.

APPENDIX C EQUINOX 10-WAY ISP HEADER

This appendix describes the pin-out of the Equinox ISP header (J6) used as the programming interface in the Epsilon5. The programming interface consists of SPI, programming and power signals.

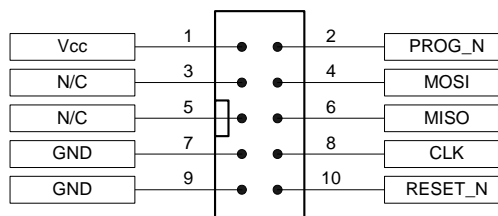


Figure Appendix C-1 The male 10-way Equinox ISP pin header and the Single Chip target system pin names (top view)

Pin No	Programmer pin name	Programmer IO	Single Chip Target System pin	Description
1	PROG_VCC	Power	Vcc	Vcc power pin. This voltage could be used to power the programmer depending on the settings of the power jumper (J9) on the programmer
2	PROG_MOSI-2/ Slave Select	O	PROG_N	This signal is used to set the ZW0102 in programming mode. Unused by other Z-Wave Single Chips
3	PROG_TSCK2	O	N/C	-
4	PROG_MOSI1	O	MOSI	SPI Master Out Slave In signal
5	N/C	O	N/C	-
6	PROG_MISO	I	MISO	SPI Master In Slave Out signal
7	PROG_GND	Power	GND	Power ground
8	PROG_SCK1	O	CLK	SPI clock signal
9	PROG_GND	Power	GND	Power ground
10	PROG_RESET	O	RESET_N	Reset signal