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Renesas Electronics Corporation

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RSKSH7201 Ethernet Application Note RSK Ethernet & USB Application Board

Application Note

RENEASAS STARTER KITS

RENEASAS SINGLE-CHIP MICROCOMPUTER

SuperHTMRISC engine

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Chapter 1. Preface

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Glossary

CPU	Central Processing Unit	RSK	Renesas Starter Kit
HEW	High-performance Embedded Workshop	MCU	Microcontroller
LED	Light Emitting Diode	LCD	Liquid Crystal Display
PC	Program Counter	PCB	Printed Circuit Board
E8	E8 On-chip debugging module	CD	The RSK software disc

Chapter 2. Introduction

This manual is designed to enable the user to setup and use the RSK Ethernet & USB Application Board in Ethernet configuration with the standard Renesas Starter Kit for SH7201 (hereafter referred to as RSKSH7201). The manual also seeks to answer, in tutorial form, the most common questions asked about using the combination of RSK and the RSK Ethernet & USB Application Board.

The RSK CD contains a tutorial project for use with the RSKSH7201 and the RSK Ethernet & USB Application Board.

Files referred to in this manual are installed using the project generator as you work through the tutorials. The tutorial examples in this manual assume that installation procedures described in the RSK Quick Start Guide have been completed.

Please refer to the Quick Start Guide for details of installation and configuration of the RSK.

NOTE: These tutorials are designed to show you how to use the RSK and are not intended as a comprehensive introduction to the High-performance Embedded Workshop (HEW) debugger, the compiler tool-chains or the E8 Emulator – please consult the relevant user manuals for more in-depth information.

2.1. Software installation and connection details

The RSK Ethernet & USB Application Board is shipped with connectors for the user to apply to the RSKSH7201, the tools required are a soldering iron and suitable lead-free solder (leaded solder maybe used but this would invalidate the lead-free status of the RSK and the RSK Ethernet & USB Application Board).

1. The two 24 way sockets should be soldered on the **underside** of the target RSK in JA5 and JA6 positions.
2. The two 26 way sockets should be soldered on the **underside** of the target RSK in JA1 and JA2 positions.
3. The 50 way socket should be soldered on the **underside** of the target RSK in the JA3 position.

Hint: An easy way to do this is to leave the connectors on the RSK Ethernet & USB Application Board and place the RSK on the top, then solder the connectors with the boards in position.

2.1.1. Installation of the Software

This Application Note assumes the user is setting up for the first time – if you already have RSKSH7201 you can still perform the same procedure, it will simply over-write some aspects of the previous installation and may install a newer version of Flash Development Toolkit.

1. Place the CD into the drive, if Autorun does not start use Windows Explorer and browse to the CD root folder and run setup.exe
2. After the "Welcome" screen click <Next>
3. Read License Agreement, then click <Yes>

4. Select the appropriate Region and click <Next>
5. Select the following options from the list, de-select others for an optimised installation:
 - a. High-performance Embedded Workshop
 - i. High-performance Embedded Workshop Online Manuals
 - b. Super H Family
 - i. SH Toolchains
 - ii. Starter Kit for SH7201
 - c. Flash Development Toolkit FDT
 - d. RSK Ethernet & USB Application Board
 - e. Auto update utility
6. Click <Next>
7. The HEW Destination Folder selection will be shown - we recommend to leave default setting, click <Next>
8. The FDT Destination Folder selection - we recommend to leave default setting, click <Next>
9. The RSK Ethernet & USB Application Board Destination Folder selection - we recommend to leave default setting, click <Next>
10. Review settings, click <Next>
11. Now the software will begin installing.
12. After installation is complete the machine's "Site code" will be displayed. This is the lock code for the compiler toolchain and can be used at a later date is purchasing a full compiler version – there is no need to make a note of this as it is stored, click <Next>
13. The installation is now complete, click <Finish>
14. It is best to restart the machine at this stage.
15. The user may wish to configure the 'Auto update' functionality at this point. 'Auto update' provides an automatic check for updates, download and installation service where the host machine has access to the Internet.

The next stage is to connect the hardware.

2.2.Connection

Please refer to the photograph:

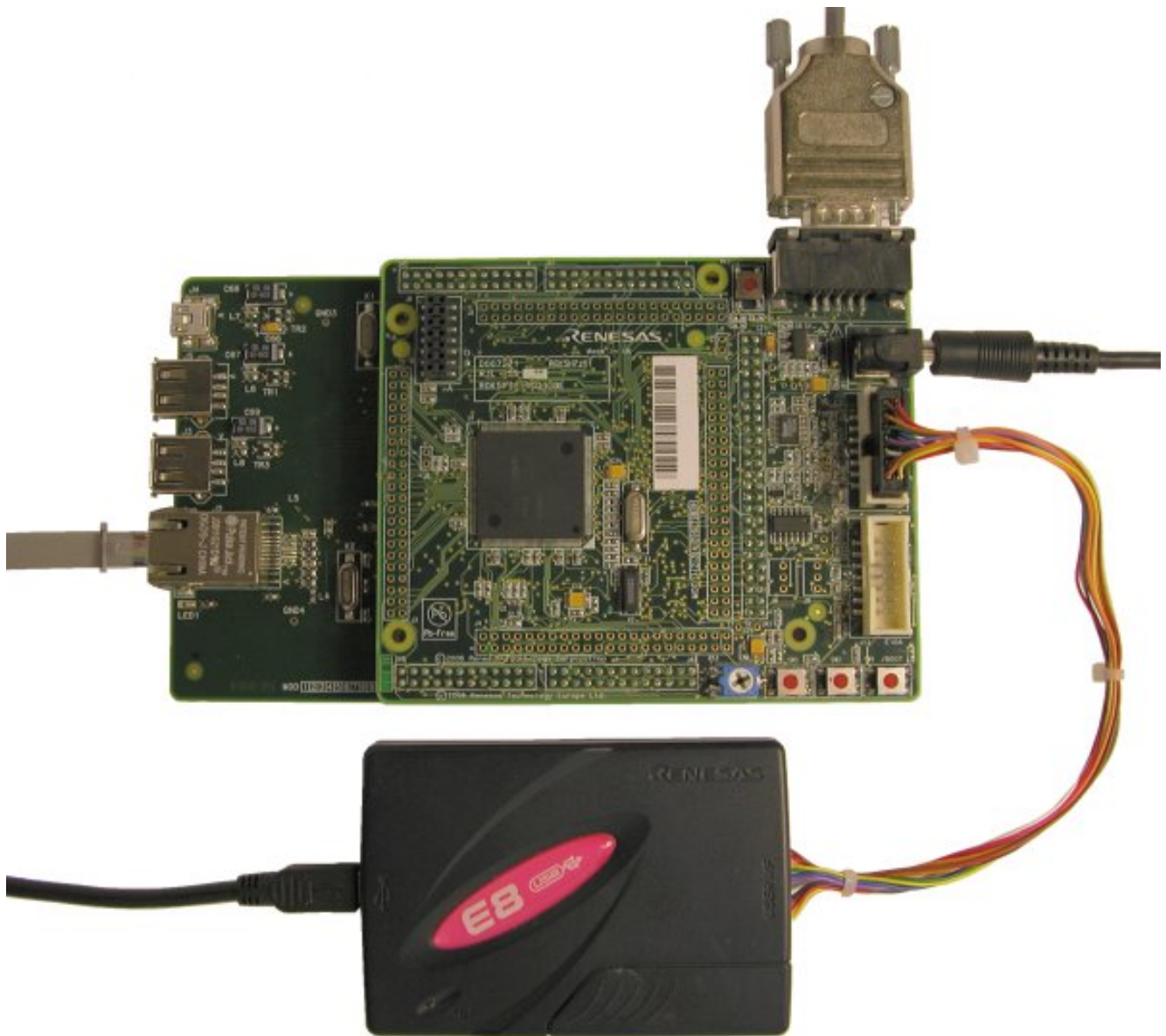


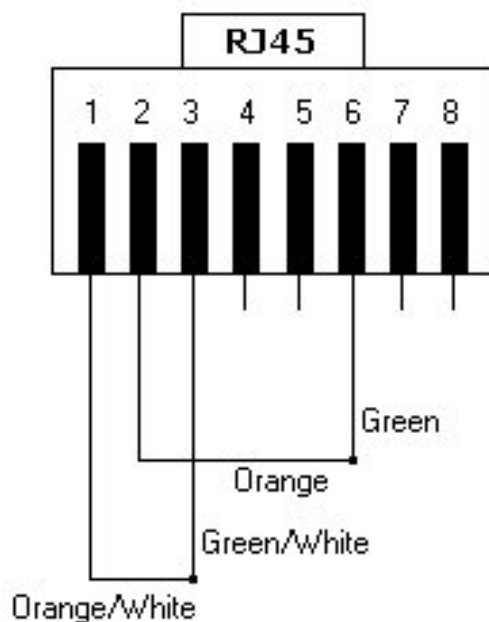
Fig 2.1Connections to the system

1. Connect the RSK Ethernet & USB Application Board to the RSK ensuring careful placement of the pins into the sockets.
2. Insert the power lead to the connector on the RSKSH7201 – NOT the one on the RSK Ethernet & USB Application Board (centre positive, 5V), but do not switch the power on yet..
3. Connect the E8 debugger module to the RSK as shown.
4. Connect the USB cable to the E8, but not to the host PC.
5. If using an Ethernet loop back cable (not supplied), connect this to the Ethernet port - J2 on the RSK Ethernet & USB Application Board.
6. Connect a serial cable (1:1) to the RSK serial port and to a free COM port on the host PC and apply power. The Green power LED on the RSKSH7201 will illuminate.
7. Connect the E8, if you have already carried out the basic Quick Start for the RSKSH7201, this should enumerate without any problem. You are now ready to launch High-performance Embedded Workshop and view the Sample Code.

2.3. Ethernet Loop-back Cable

The cable can be created from one end of a disused RJ45 Ethernet cable or from new parts. If using an old cable please ensure the wires are intact by using a continuity test. Only four of the cores are used, discard the others. Connect the two pairs as shown and isolate the joins from one another using insulating tape.

Please refer to the diagram below for the connections:



Chapter 3. Tutorial Project Workspace

The Ethernet tutorial is designed to show the user the basic functions of the RSK Ethernet & USB Board and provide basic sample code which can be expanded upon by the user.

It is recommended that the user attempt the stand-alone RSK tutorials to become familiar with the operation of the High-performance Embedded Workshop, please refer to the Tutorial Manual for the RSKSH7201.

The RSK-only tutorials help explain the following:

- How do I compile, link, download, and run a simple program on the RSK?
- How do I build an embedded application?
- How do I use Renesas development tools?

The project generator will create a tutorial project with two selectable build configurations

- 'Debug' is a project built with the debugger support included.

In order to use the tutorials with the RSK7201 and the RSK Ethernet & USB Application Board as supplied and described herein it is recommended the user connect an Ethernet Loop-back cable to the J2 port on the RSK Ethernet & USB Application Board.

Chapter 4. Project Workspace

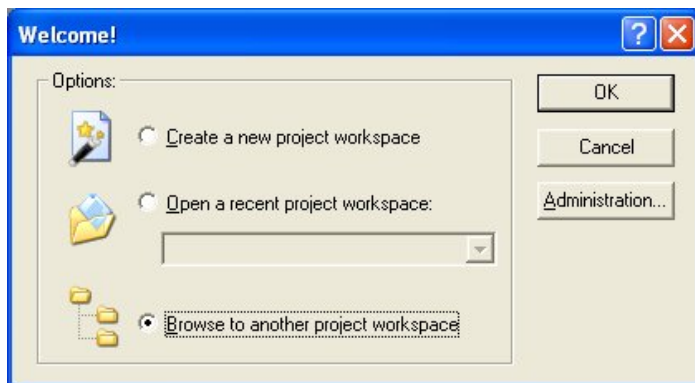
4.1. Introduction

High-performance Embedded Workshop (HEW) is an integrated development tool that allows the user to write, compile, program and debug a software project on any of the Renesas Microcontrollers. HEW will have been installed during the installation of the software support for the RSK product.

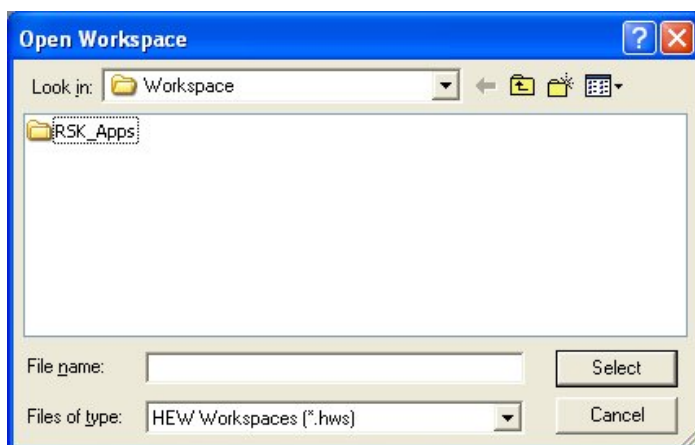
4.2. Accessing the RSK_Apps Project Workspace

Unlike standard RSK boards which are supplied with HEW Project generators, the RSK Ethernet & USB Application Board is supported by a pre-made HEW Workspace; this supports both the Ethernet and USB modes of operation and will have been placed in the "c:\workspaces" folder during the installation procedure described in Chapter 2. The workspace requires only to be built and the communications configured.

1. Launch HEW
2. The HEW Welcome! dialog will be shown:



3. Select "Browse to Another Workspace", click <OK>
4. On the "Open Workspace" view the default is to look in the "Workspace" folder, you will find the "RSK_Apps" workspace folder there.



5. Double click on the "RSK_Apps" folder.
6. Double click on the "Comms" folder.

7. Double click the "Ethernet" folder and then select the "RSKSH7201.hws" workspace file within, click <Select>
8. The workspace will open into the HEW showing the project files.

4.3. Build Configurations and Debug Sessions

The workspace that has been created contains two build configurations and two debug sessions. The Build Configuration allows the same project to be built but with different compiler options. The options available to the user are fully described in the HEW User's Manual.

4.3.1. Build Configuration

The build configurations are selected from the left hand drop down list on the tool bar. The options available are Debug and Release. The debug build is configured for use with the debugger. The Release build is configured for final ROM-able code.

A common difference between the two builds may be the optimisation settings. With Optimisation turned on the Debugger may seem to execute code in an unexpected order. To assist in debugging it is often helpful to turn optimisation off on the code being debugged.

- Select the 'Debug Build' Configuration.



4.3.2. Debug Session

The debug sessions are selected from the right hand drop down list on the tool bar. The options vary between RSK types however one will always start Debug and include the type of debug interface, the alternate selection is the 'DefaultSession'. The purpose of the debug sessions is to allow the use of different debugger tools or different debugger settings on the same project.

- Select the 'Session_SH2A_7201_HMon' debug session.



Chapter 5. Building the RSK_Apps Project

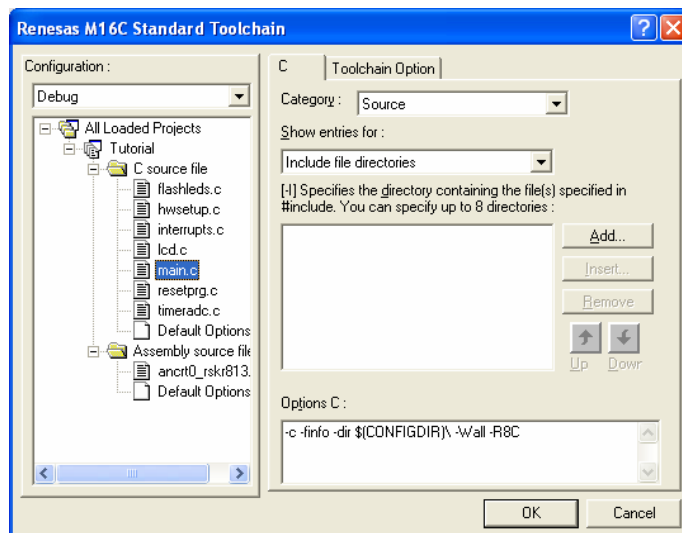
The project build settings have been pre-configured in the tool-chain options. To view the tool chain options select the 'Build' Menu item and the relevant tool-chain. This should be the first option(s) on the drop down menu.

The dialog that is displayed will be specific to the tool-chain selected.

The configuration pane on the left hand side will exist on all the tool-chain options. It is important when changing any setting to be aware of the current configuration that is being modified. If you wish to modify multiple or all build configurations this is possible by selecting 'All' or 'Multiple' from the 'Configuration' drop down list.

- Review the options on each of the tabs and 'Category' drop down lists to be aware of the options available.

Note: For the purposes of the tutorial, leave all options at default.



When complete close the dialog box by clicking <OK>.

5.1. Building Code

There is a choice of three shortcuts available for building the project.

1. Selecting the 'Build All' tool bar button. 

This will build everything in the project that has not been excluded from the build. This includes the standard library.

2. Selecting the 'Build' tool bar button. 

This will build all files that have changed since the last build. The standard library will not be built unless an option has been changed.


3. Pressing <F7>

This is equivalent to pressing the 'Build' button described above.

- Build the project now by pressing <F7> or pressing one of the build icons as shown above.
During the build each stage will be reported in the Output Window.
The build will complete with an indication of any errors and warnings encountered during the build.

5.2. Connecting to the target with the E8

This section will take you through the process of connecting to the device, programming the Flash and executing the code.

- Select the "Configure Flash project" button from the toolbar 

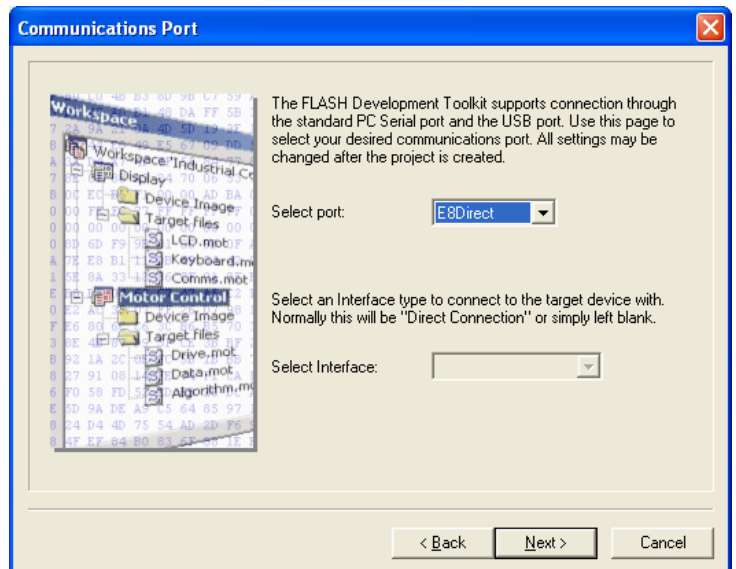
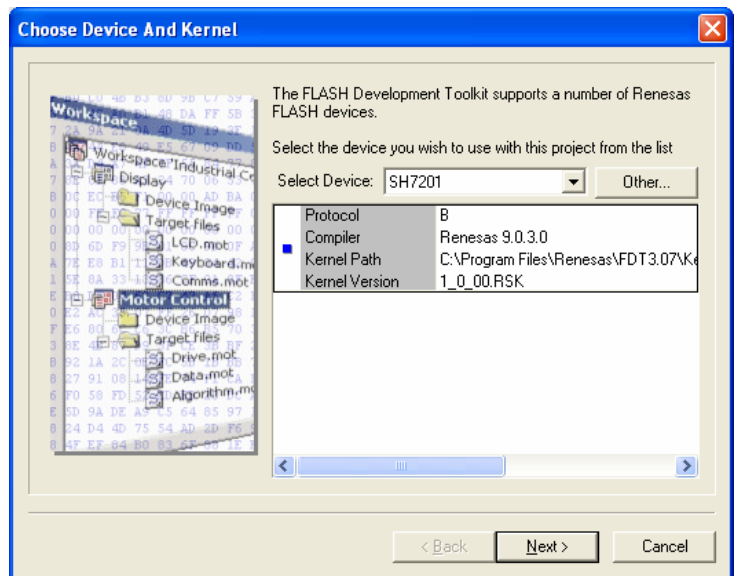
If the flash kernel is already configured then a confirmation window will open with the kernel settings. To modify any of the settings just double click on the item. If FDT is already configured then please proceed to section 5.2.1.

The first stage is to select the specific device from the installed kernels. The installer will have added the kernel to the FDT registry so it will appear under the device list drop down menu. If for any reason the kernel has to be re-build such as the crystal frequency on the board has changed, then the installation path is: <FDT Installation>\Kernels\ProtB\7201\Renesas\1_0_00.RSK

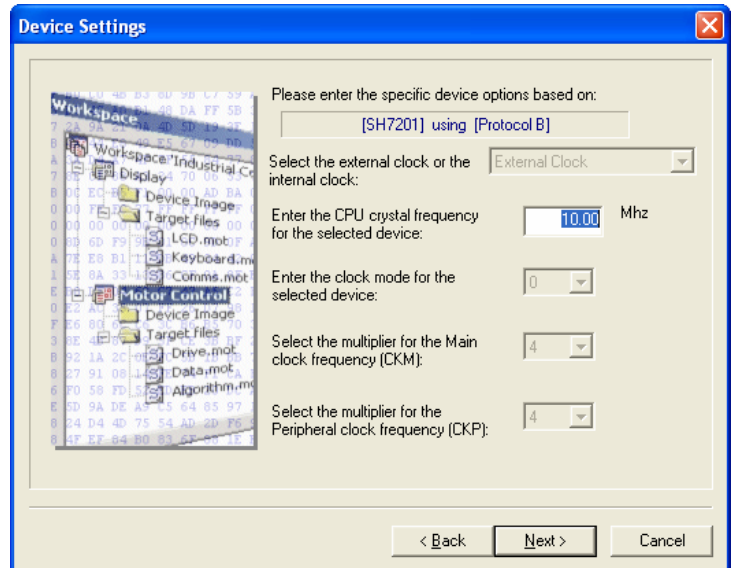
- Select the Device on the RSK from the drop down list.
- In the sub pane, select the kernel version that ends in '.RSK'.
- Press <Next>.

If you have copied the kernel to another location to modify for a different crystal frequency, the device will not be listed in the sub pane. In this case:

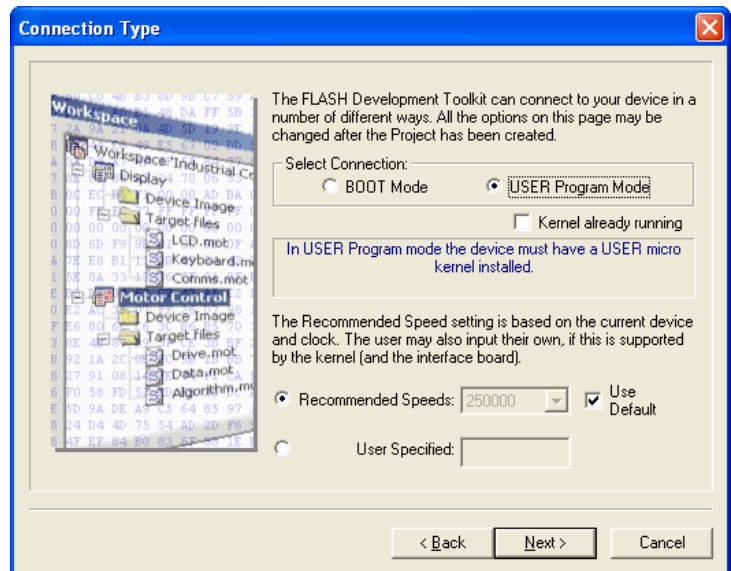
- Press <Other...> and navigate to your modified kernel.
- Select E8DIRECT as the communication Port
- Press <Next>.



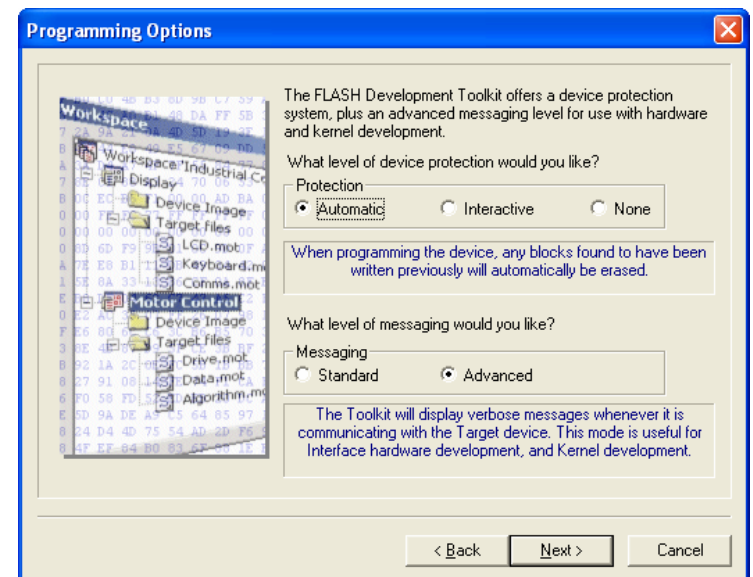
- The default settings are suitable for an un-modified RSK board.
- Confirm the Crystal Frequency matches the board.
- Confirm the main clock frequency multiplier.
- Confirm the peripheral clock multiplier.
- Press <Next>.



- Ensure that 'USER Program Mode' is selected.
- Confirm that 'Use Default' is selected.
- Press <Next>.

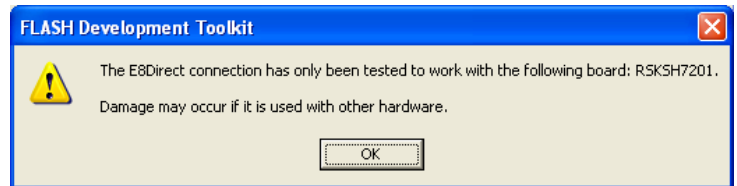


- Confirm the default selections of 'Automatic' and 'Advanced'.
- Press <Next>.



The following warning dialog will be displayed.

- Press <OK>

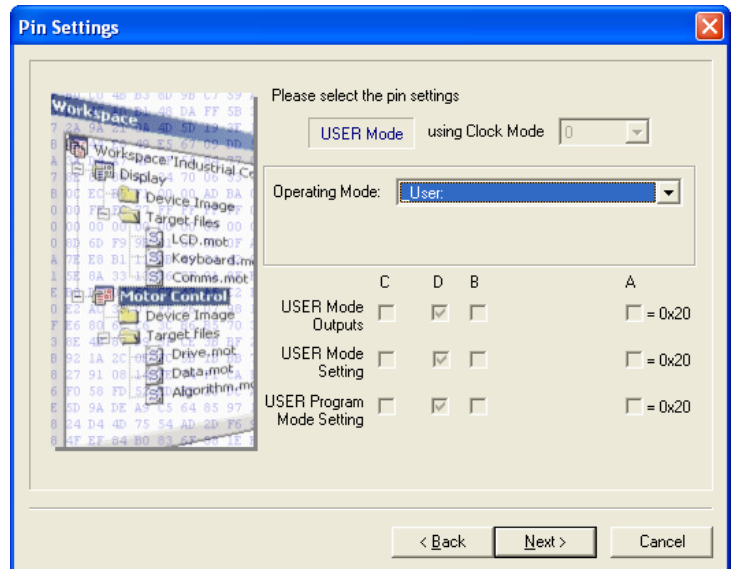


To communicate with the RSK FDT and HMon need to be able to change the operating mode of the microcontroller. To do this there are settings to control the state of the Mode pins via the E8Direct interface. These settings are confirmed in the following screens.

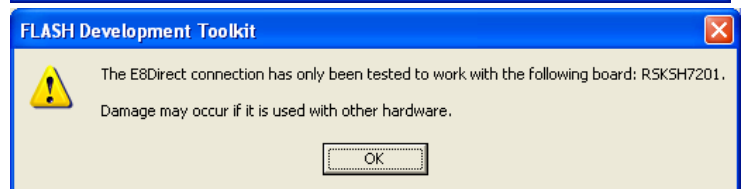
Unless you are very sure that the mode pin settings need to change. Do not modify the default settings.

Damage to the microcontroller can be sustained with incorrect settings.

- Confirm the mode pin settings.
- Press <Next>.



- The following warning dialog will be displayed.
- Press <OK>.

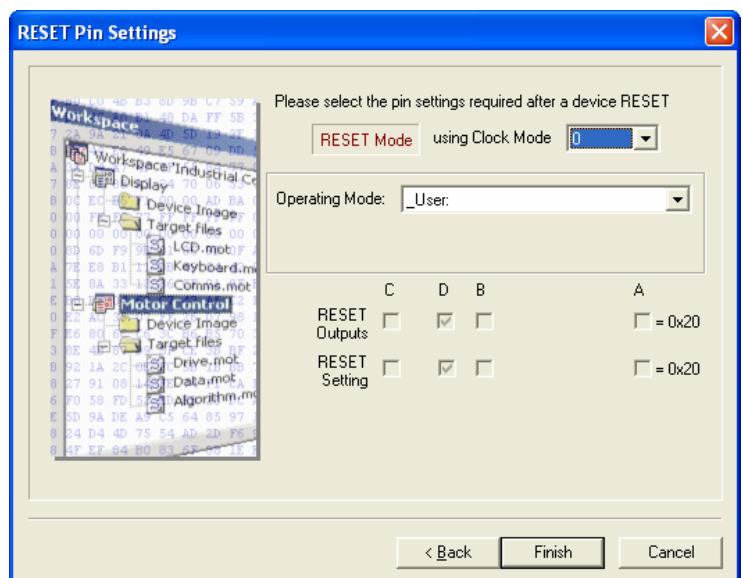


Note: Damage to the microcontroller can be sustained with incorrect settings.


- Confirm the mode pin settings.
- Press <Finish>.
- The Flash configuration has now been completed.

If you have changed any workspace settings now is a good time to save the workspace.

- Select [File' -> 'Save Workspace'].



5.2.1. Connecting to the target with the E8

- Provide power to the hardware – refer to chapter 2 for connection details
- Click the <Connect> button on the debug toolbar 

HMon is able to discover the internal flash configuration of the device from the FDT kernel we configured earlier. HMon also needs information on the location of the IO registers and internal / external RAM. This information is stored in a '.TCF' file. The TCF file is supplied and registered with HEW. As it is possible to have TCF files with slightly different configurations the following dialog is displayed to allow selection.

- When the "Select USB Device" dialog appears, click <OK>.

Notes: If the E8 is not set up as "E8DIRECT" then please follow the on-screen instructions and refer to the RSKSH7201 Tutorial Manual.

If running the E8 for the first time, the "Found Hardware Wizard" may automatically run after a short delay and install the appropriate drivers.

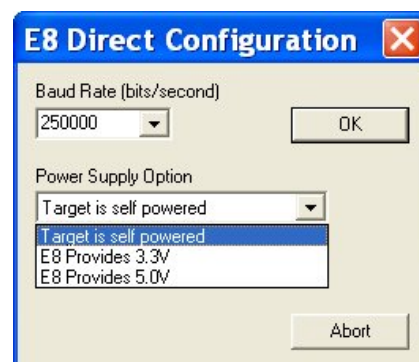
- The next dialog is the E8 Direct Configuration, select "Target is self powered" and click <OK>.
- If the target will not connect it may be because HMON is not resident, click <Abort> then select "Download HMON using Boot Mode", <OK> then re-attempt the E8 Direct connection.

Now is a good time to save the HEW session.

- Select 'File' | 'Save Session'.

If you have changed any workspace settings, save the workspace.

- Select 'File' | 'Save Workspace'.



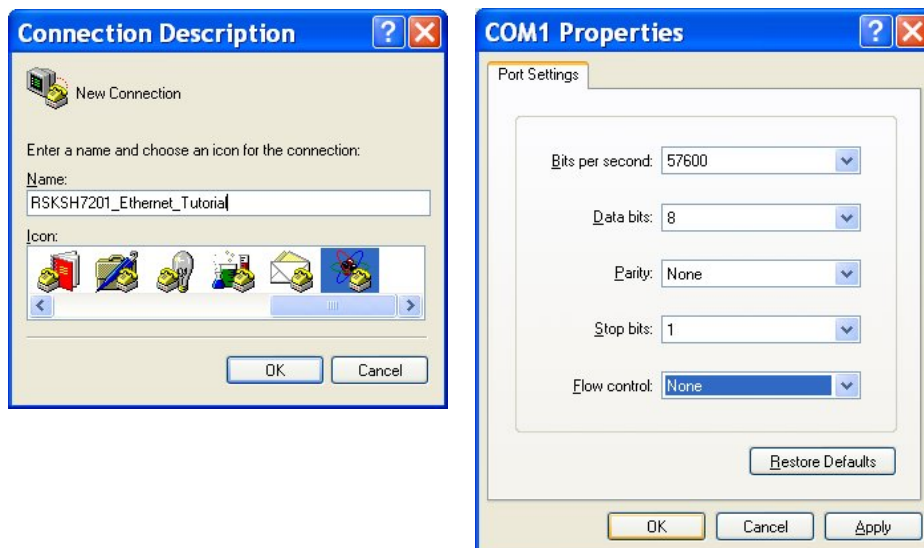
5.3. Terminal Setup

The RSKSH7201 and the RSK Ethernet & USB Application Board combination is now connected and ready to run the tutorial sample code.

It is now necessary to set up a Terminal session – this can be on the same host machine or a different machine.

The example used is “Hyperterminal” provided with Microsoft Windows.

The settings are located in the comment header of the main C function of the tutorial code; they are 57600 baud, 8 data bits, 1 stop bit, no parity and no flow control. Save the connection settings and leave session open. See screenshots below.



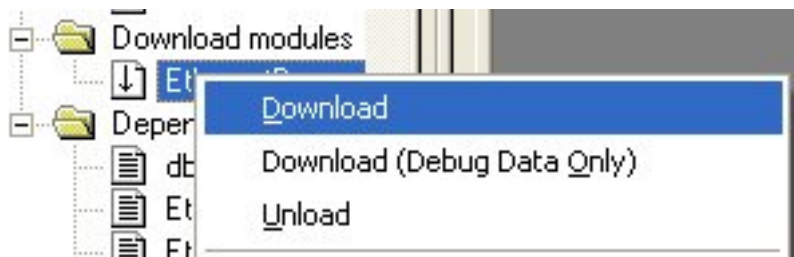
Chapter 6. Downloading and Running the Tutorial

Once the code has been built in HEW it needs to be downloaded to the RSK itself.

There will now be an additional category in the workspace view for 'Download Modules'

- Right click on the download module listed and select 'Download'

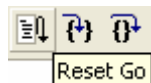
Note: If shown the "HMON Configuration" dialog, select "Compare with Cache" and click <OK>.



On completion of the download the debugger is ready for the code to be executed.

To start the sample code it is necessary to reset the debugger and target and start the code, this can be done in one hit.

- Press 'Reset Go' on the Debug Tool Bar.



When the code runs the following message will appear in HyperTerminal.

```
=====  
Renesas Starter Kit - Embedded Test Suite (Release 01.00)  
RSK Ethernet & USB Application Board with RSKSH7201  
=====  
1. Ethernet Test Menu  
2. SRAM Test Menu  
3. Set Verbose level  
-----  
Command:>
```

- The "Ethernet Test Menu" enables the user to run various pieces of the sample code.
- The "SRAM test Menu" enables the user to test the SRAM on the RSK Ethernet & USB Application Board.
- "Set Verbose level" enables the user to select the amount of messaging information displayed in the HyperTerminal window. Level "0" displays only the result of the test, Pass or Fail. Level "1" give intermediate results as well, Level "2" displays detailed result information on each test.
- Selecting Option "1" will display the following menu

```

=====
Ethernet Test Menu

  1. Read MAC Address Test
  2. SMSC Interrupt Test
  3. MAC Loopback Test
  4. PHY Loopback Test
  5. External Loopback Test

M. Program MAC address

T. Transmit ARP packet

E. Exit Menu

=====

```

Command:>

- In order to pass these tests a loopback cable must be inserted into J2 on the RSK Ethernet & USB Application Board.
- Run through the tests as is to see what they do with and without the loopback cable.
- Each test has its own source code file in the HEW project, to view the code simply double click on the source file of the relevant name and read the comments – all the source files are fully commented.
- Use the breakpoint and stepping functionality of HEW (as described in the RSKSH7201 Tutorial Manual) to view how the various files work together.
- Selecting the 'E' function will take you back to the main menu.
- On the main menu, select '2', the following will be shown.

```

=====
SRAM Test Menu

  1. Data Bus Test
  2. Address Bus Test
  3. SRAM Device Test

E. Exit Menu

=====

```

Command:>

- Again, run through the tests and refer to the comments in the source code.

Chapter 7. Additional Information

For details on how to use High-performance Embedded Workshop (HEW), refer to the HEW manual available on the CD or from the web site.

For information about the SH7201 microcontrollers refer to the SH7201 Group Hardware Manual.

For information about the SH7201 assembly language, refer to SH-2A, SH2A-FPU Software Manual.

Further information available for this product can be found on the Renesas website at:

http://www.renesas.com/renesas_starter_kits

General information on Renesas Microcontrollers can be found at the following websites.

Global: <http://www.renesas.com/>

Regional (English language) sites can be accessed from the Global site, or directly by going to:

Europe: <http://eu.renesas.com>

Americas: <http://america.renesas.com>

Asia: <http://sg.renesas.com>

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