SKP8CMINI-15,17
Tutorial 2
Creating A New Project Using HEW4

Renesas Technology America Inc.

Overview

This tutorial describes the steps in creating new projects for the R8C using two different methods.

The first method uses the SKP project generator that will create an empty project.
The second method will provide step by step instructions on how to create a new project with existing source files.

Examples shown throughout this tutorial are specific to the SKP8CMINI17. If using the SKP8CMINI-15, replace any references to the SKP8CMINI-17 with SKP8CMINI-15.

To get the most out of the SKP including the development tools, check out the references at the end of this tutorial.

Note: ***This tutorial assumes the user has done the following:***

1. ***Followed the 'Quick Start Guide'***
2. ***Installed the SKP files, examples, and software tools in the default directories.***
3. ***Reviewed Tutorial 1.***

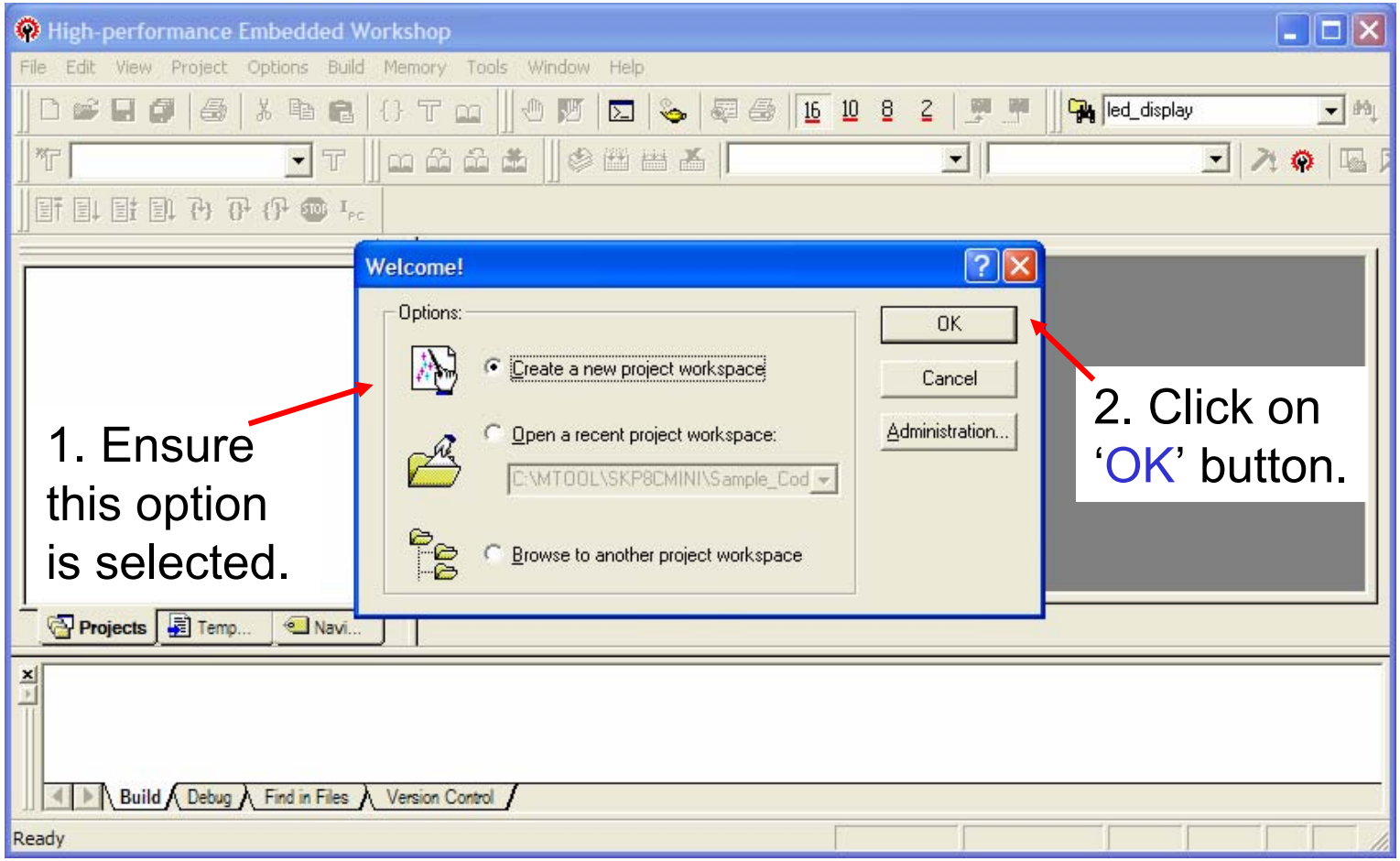
Starting HEW

From the Windows Start menu, click on

Programs > Renesas High-performance Embedded Workshop>

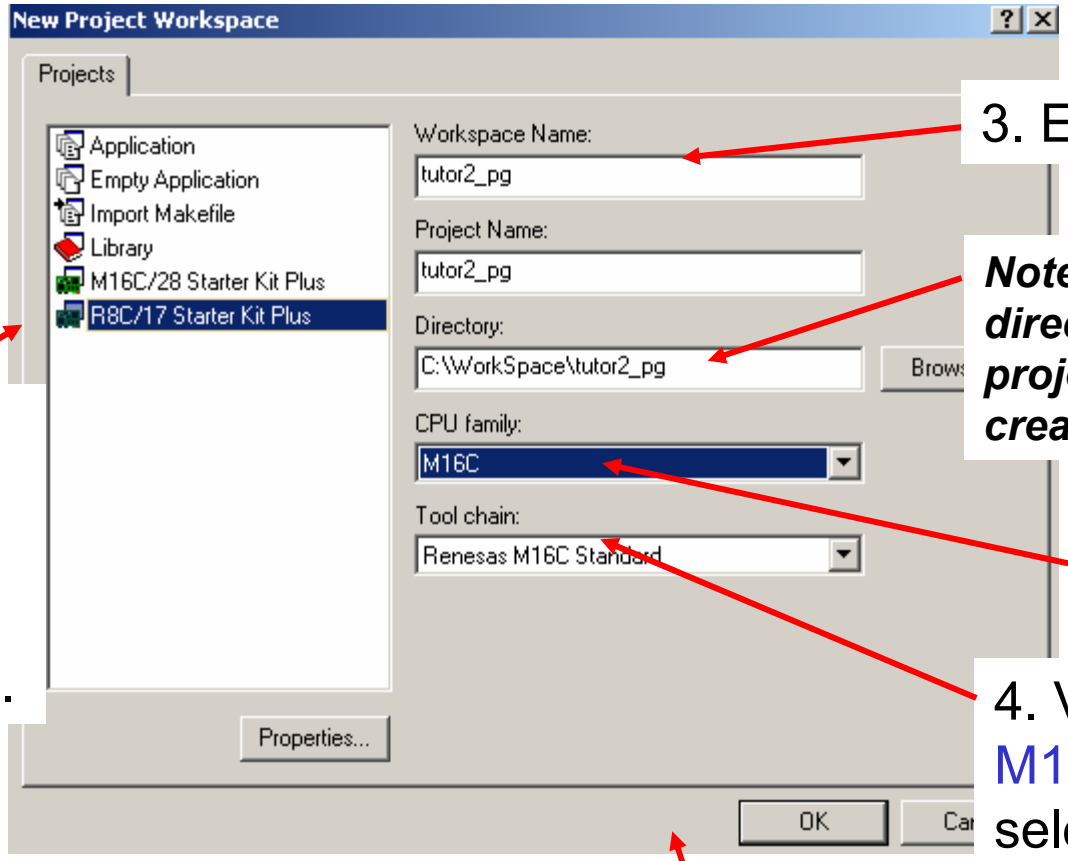
High-performance Embedded Workshop

Creating a Project Workspace



When HEW starts up, you will be prompted to select a workspace.By default, 'Create a new project workspace' option is selected.

Creating a new project with the SKP project generator (1/4)



2. Select 'R8C17 Starter Kit Plus' as the project type.

3. Enter 'Tutor2_pg'.

Note: This is the directory where the project will be created.

1. Select M16C.

4. Verify Renesas M16C Standard is selected.

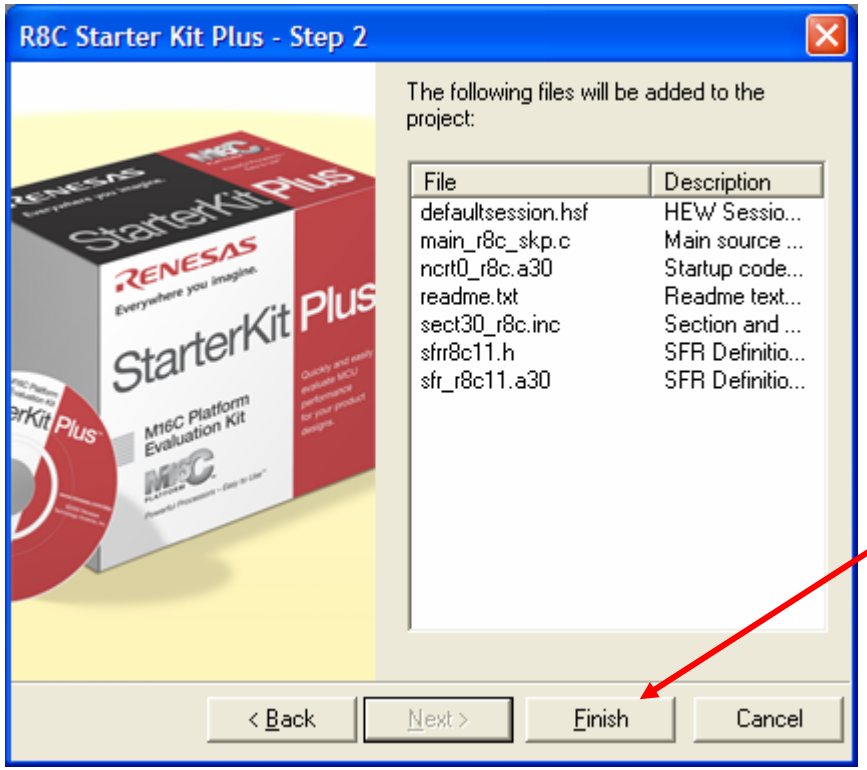
5. Click on 'OK' button.

Creating a new project with the SKP project generator (2/4)

Select 'Empty Project'.

Note: The other project selections (Verify SKP & Sample Code) allow you to test the SKP and evaluate the MCU peripherals and features using pre-built sample code.

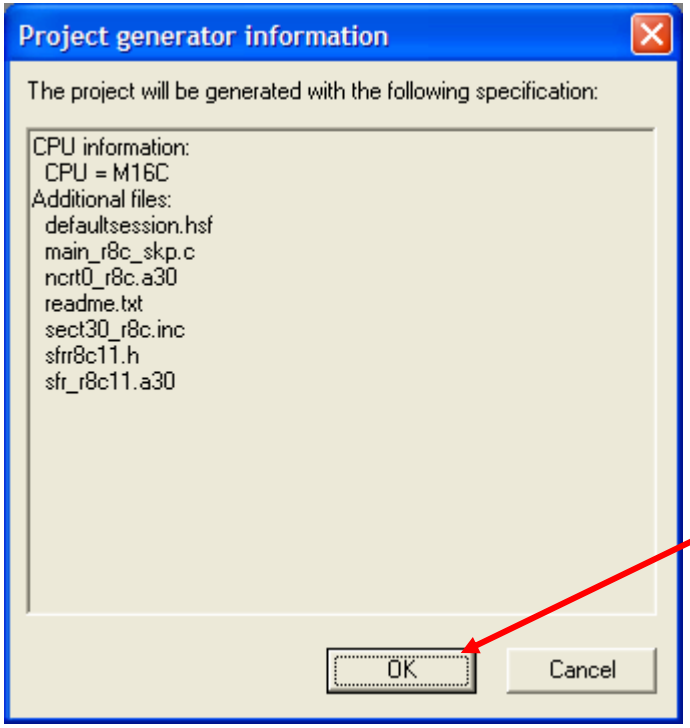
Creating a new project with the SKP project generator (3/4)



Click ‘Finish’.

Step 2 shows the files that will be added to the new project and their descriptions.

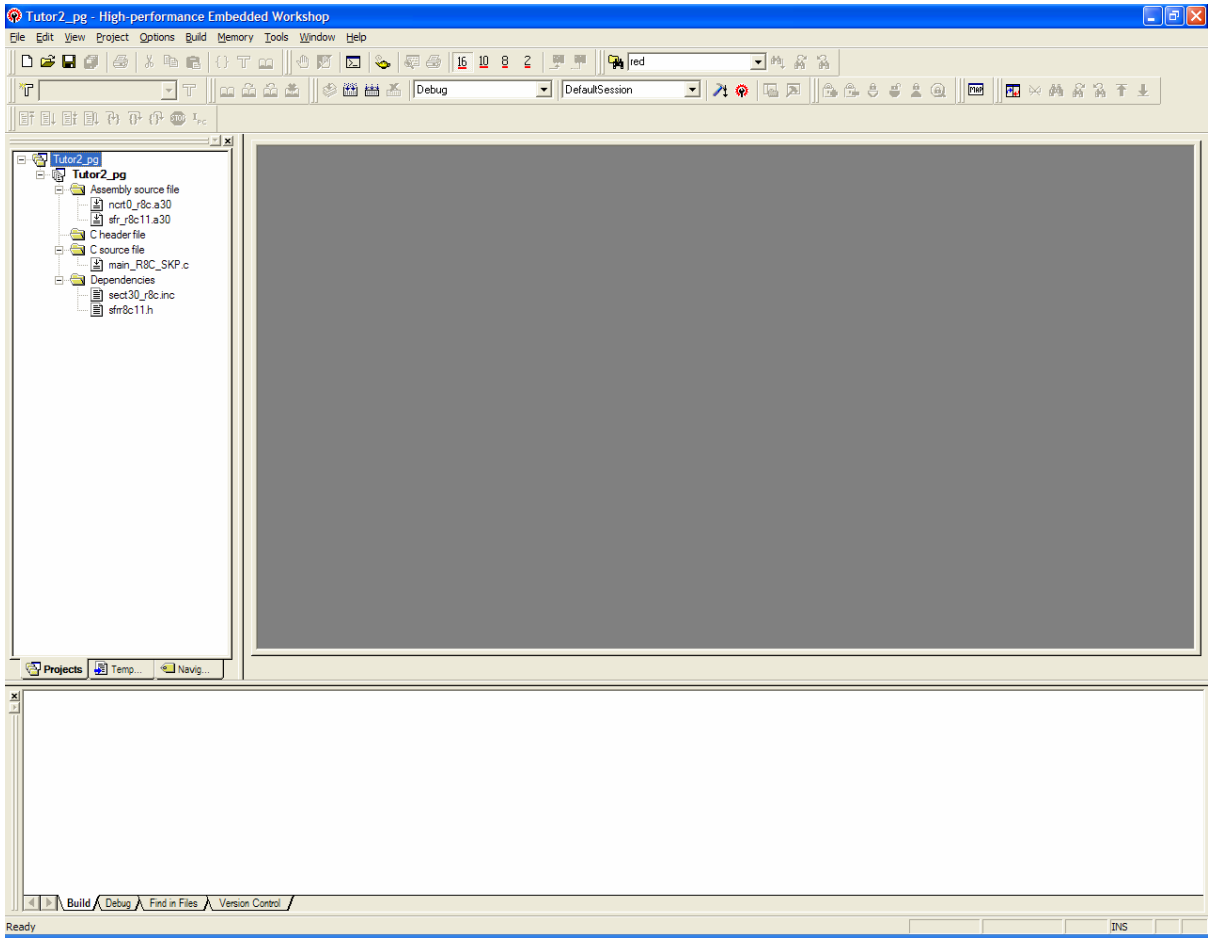
Creating a new project with the SKP project generator (4/4)



Click 'OK'.

The project generator information is shown once the project has been created.

HEW after creating a new project using the SKP project generator



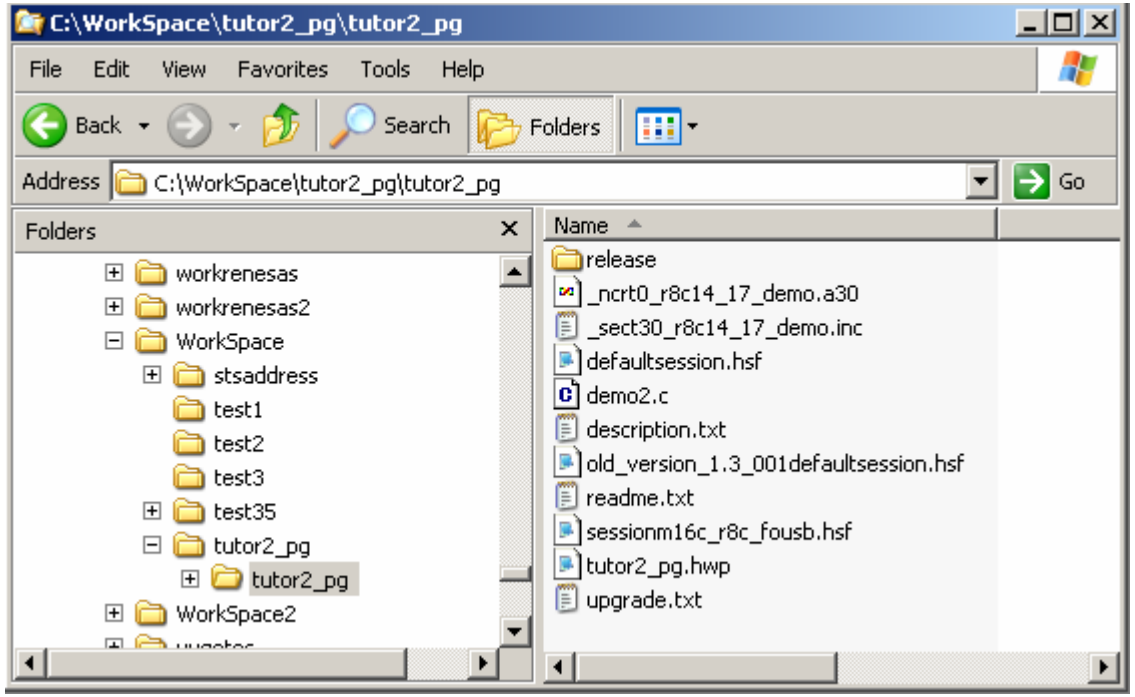
SKP Project Generator Summary (1/2)

The following is a summary of what happens when creating a new project using the SKP project generator Empty Project:

1. The following files are created in the workspace or project directory (in this example, under C:\Workspace\Tutor2_pg):
   - A copy of the user startup (ncrt0_r8c.a30 and sect30_r8c.inc) files.
   - A .c file (main.c) that contains the main function.
   - Copies of the SKP header file (sfrr8c17.h) included in the .c file.
   - A copy of the sfr_r8c17.a30 file so SFR names are visible during debugging.
2. Links the startup files first as shown in “Linking the startup files first” (slides 25).
3. Adds an FoUSB Debug Session (slide 18).
4. Adds the phase to generate a hex file when building a project as shown in the slide “Generate a hex file for Programmer” (slide 28).

SKP Project Generator Summary (2/2)

The project structure and files created when using the SKP project generator are shown here.



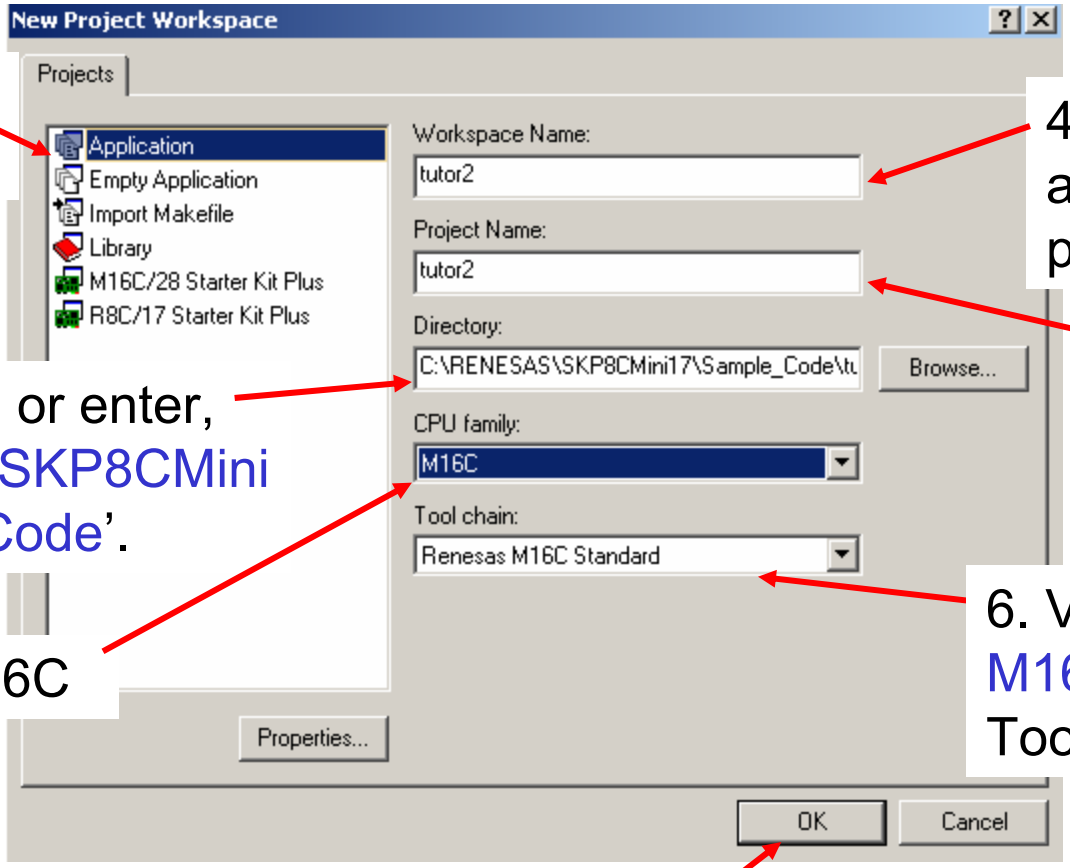
Creating a New Project Environment

The SKP Project Generator simplifies several steps in creating a new project but what if you already have source files? The following slides will walk you through the following:

- ❑ Creating a new workspace from scratch
- ❑ Adding source files
- ❑ Setting up the software development environment
  - -including linker, build, debugger and programming configurations

Creating a New Project (1/8)

Select 'New Workspace' from the File menu…



1. Select 'Application'.

2. Browse to, or enter, 'C:\Renesas\SKP8CMini 17\Sample_Code'.

3. Select M16C

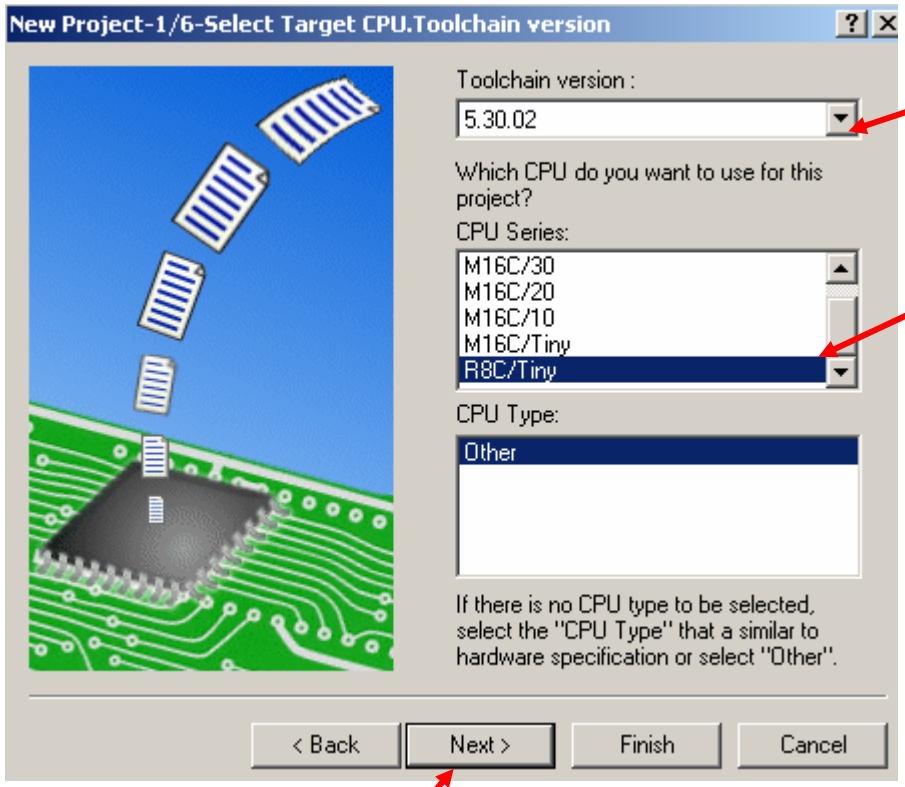
4. Enter 'Tutor2' as name of the project.

5. Leave as is (i.e. 'Tutor2').

6. Verify Renesas M16C Standard Tool chain

7. Click on 'OK' button.

Creating a New Project (2/8)

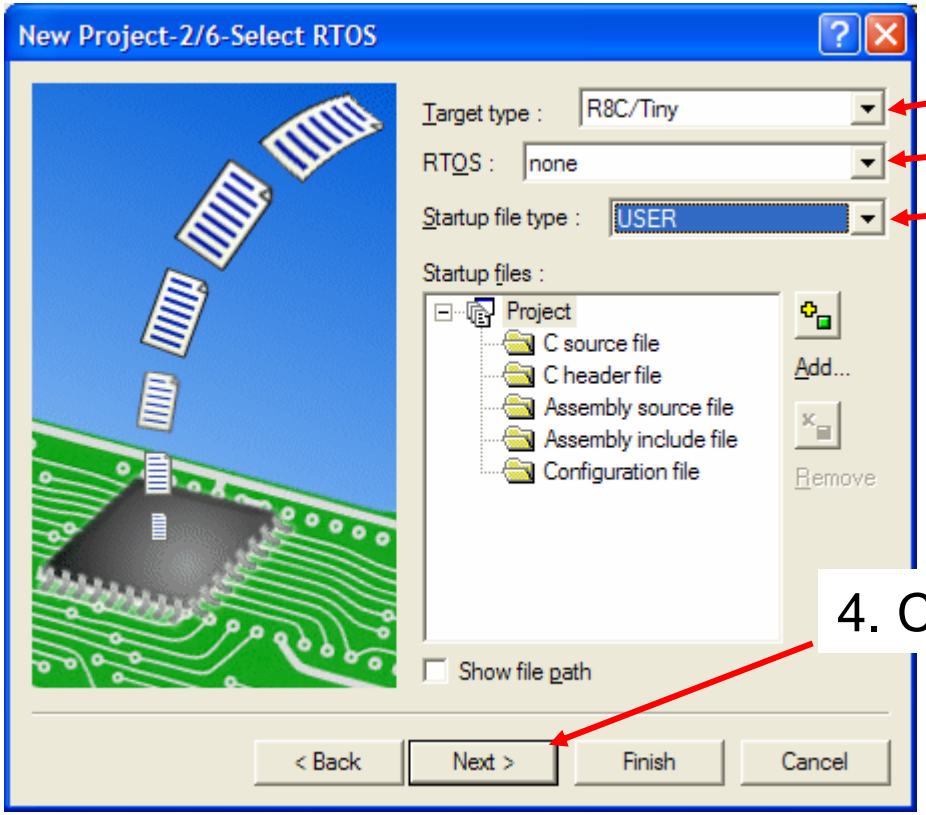


1. Latest compiler version is selected

2. R8C/Tiny selected

3. Click on 'Next' button.

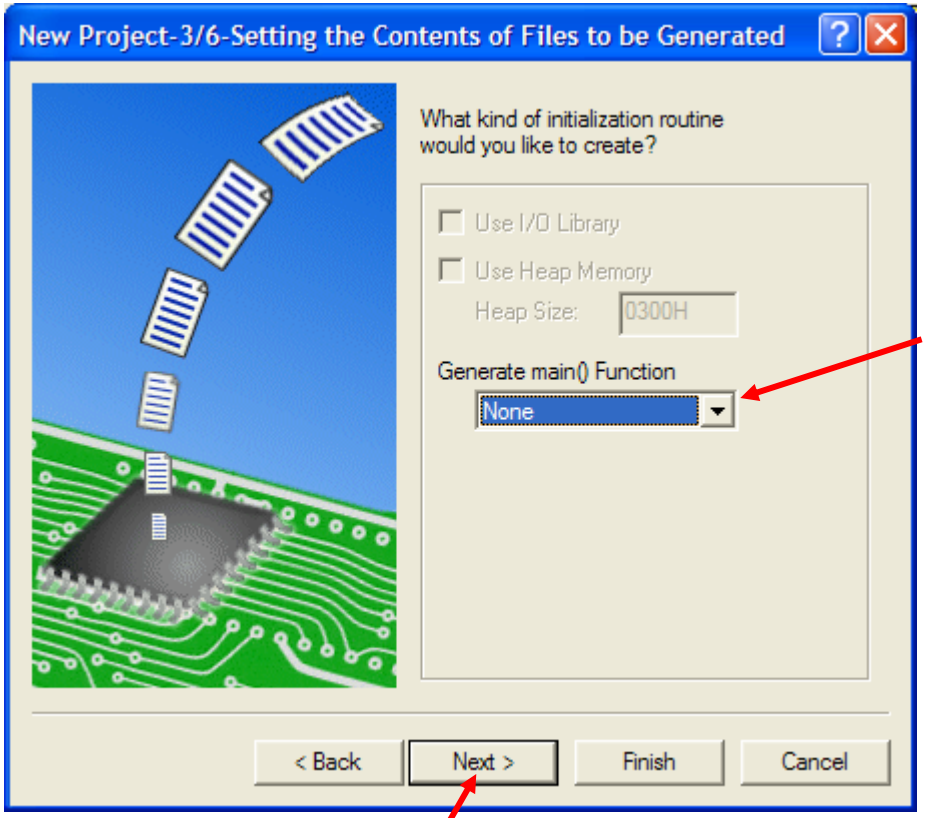
Creating a New Project (3/8)



1. Select ‘R8C/Tiny’.
2. Leave as is.
3. Select ‘USER’[1].
4. Click on ‘Next’ button.

Note: 1. Differences between Default and USER Startup files are discussed after the project is created.

Creating a New Project (4/8)

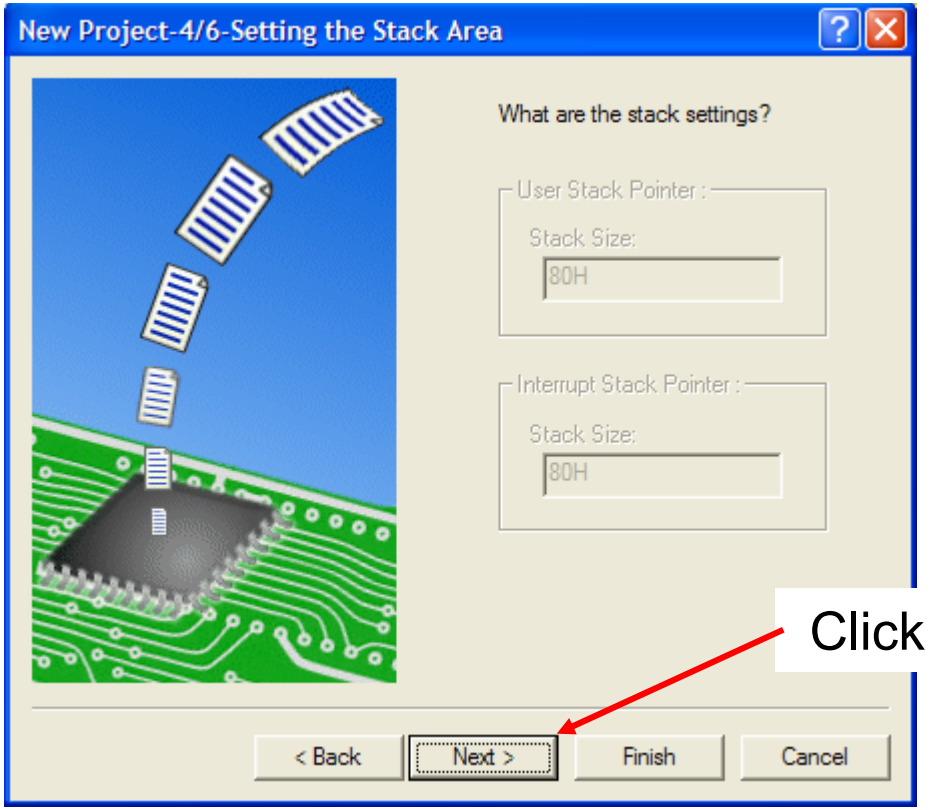


1. Select 'None' as we already have a file with the main() function

2. Click on 'Next' button.

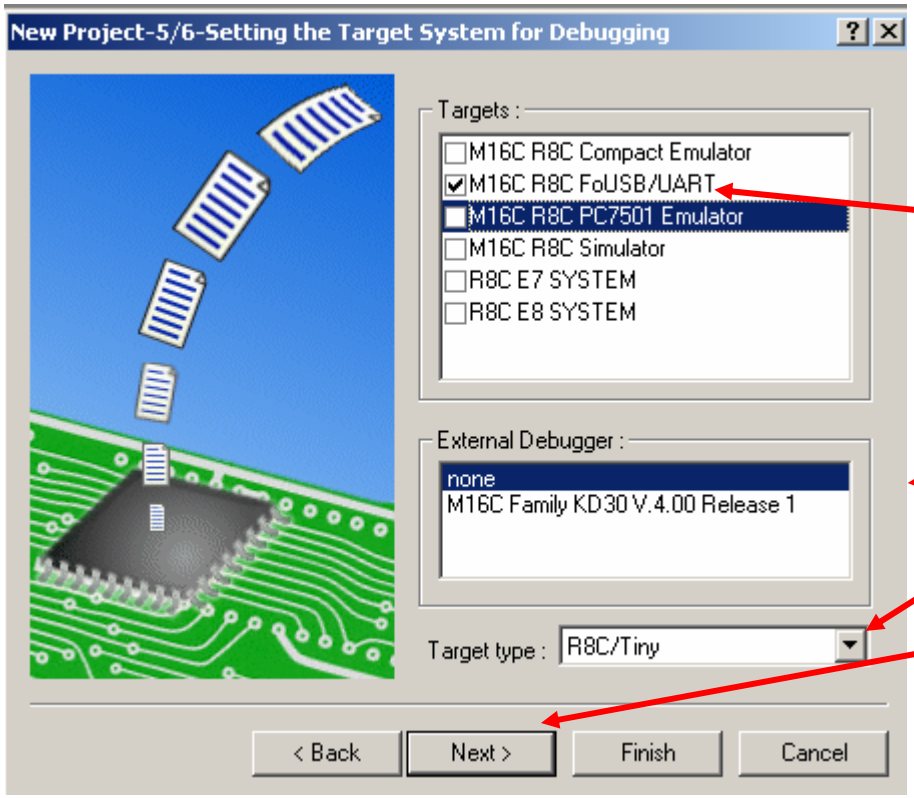
Creating a New Project (5/8)

The stack settings are grayed out because USER startup file was selected (see Creating a New Project 3/8). If DEFAULT startup file was selected, these settings become available.



Click on 'Next' button.

Creating a New Project (6/8)



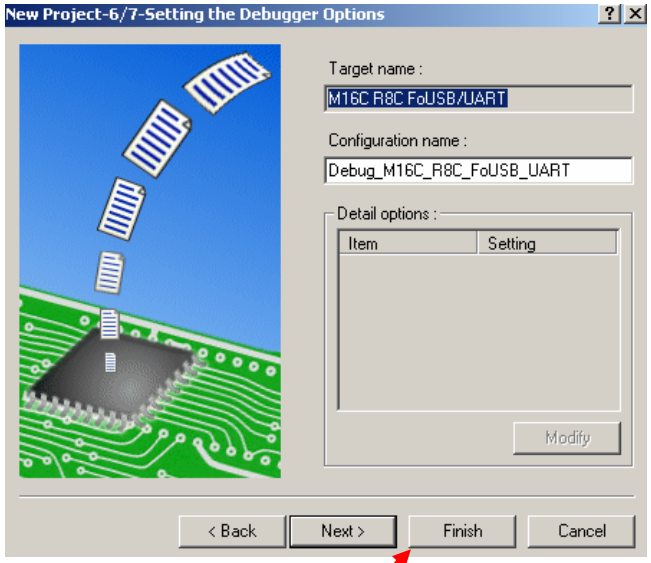
1. Select ‘M16C_R8C_FoUSB/UART‘

2. Leave as is.

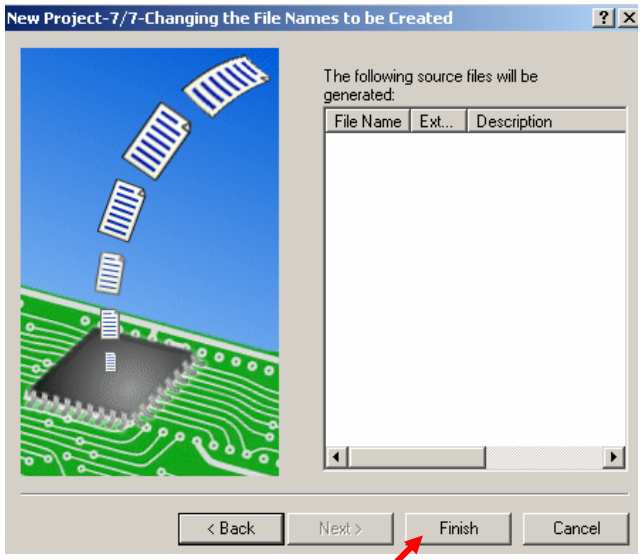
3. Click on ‘Next’.

Creating a New Project (7/8)

We already have the source files and selected USER startup files (see Creating a New Project 3/8 and 4/8) and so, there are no source files that will be generated.



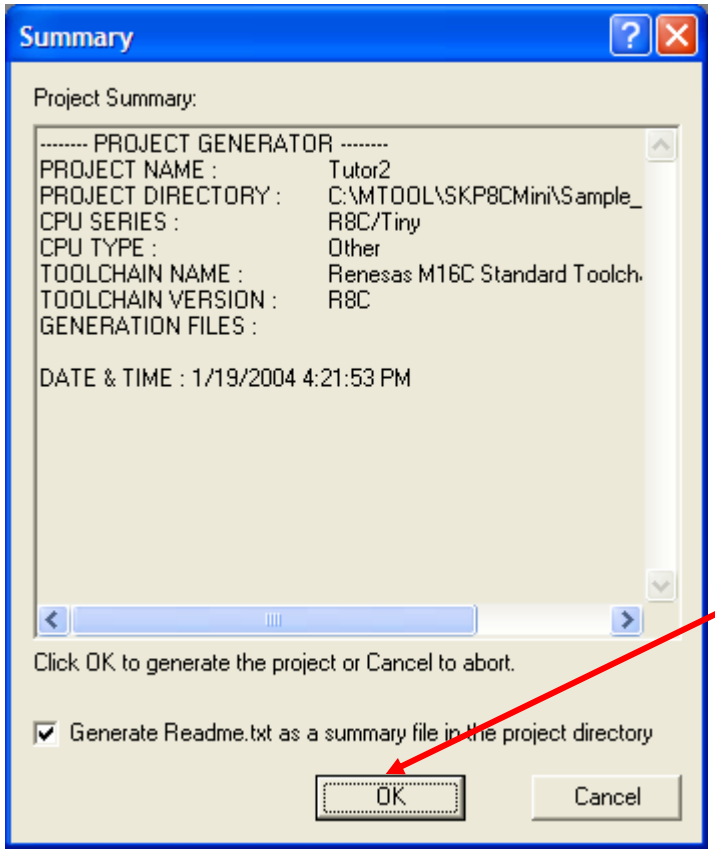
3. Click on ‘Next’.



Click on ‘Finish’ to complete project creation process…

Creating a New Project (8/8)

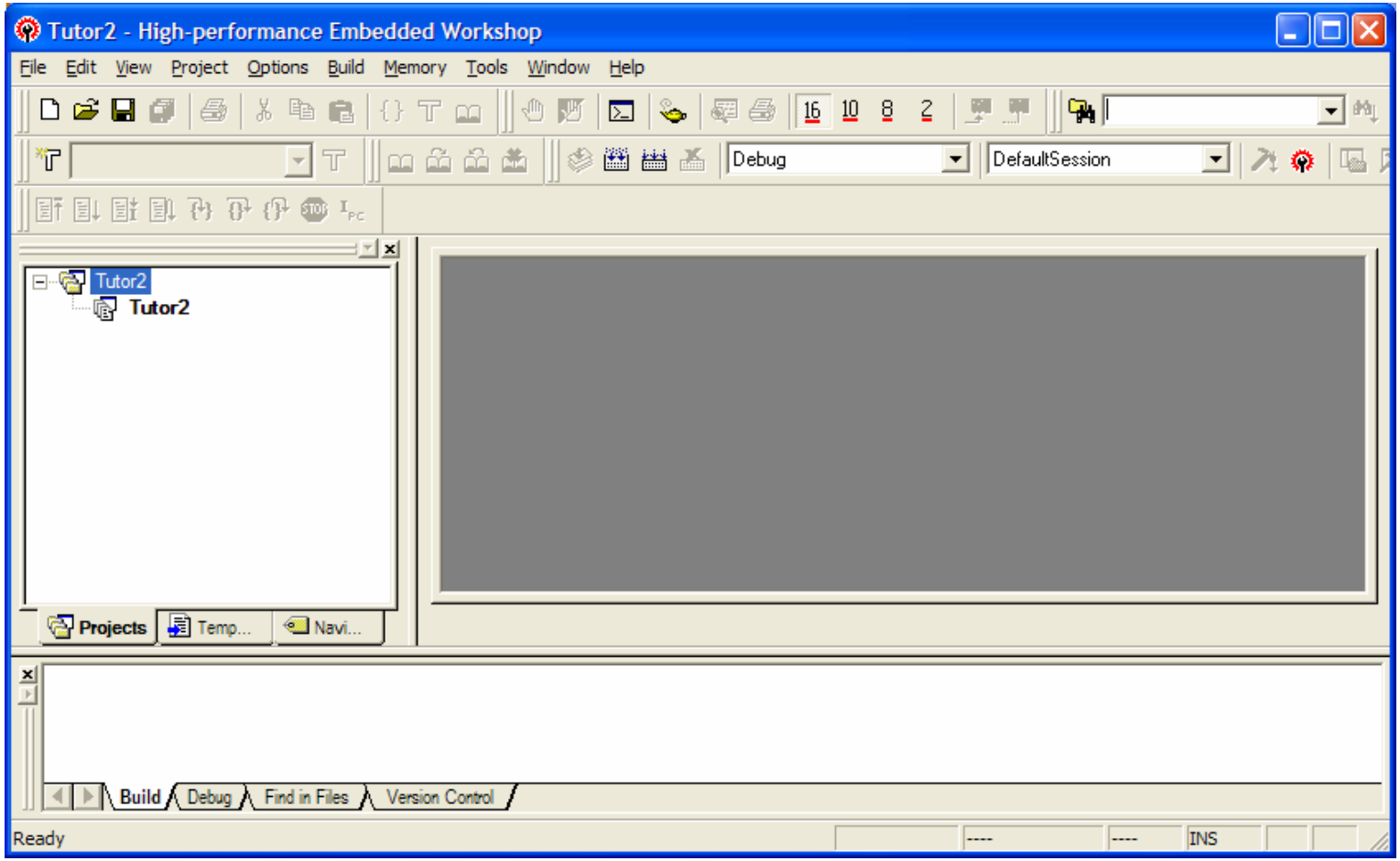
A project summary is displayed to indicate a successful creation of the new project, Tutor2.



Click on ‘OK’.

HEW

After creating the project, HEW will look similar to the figure below.



Default and R8C Startup Files

Startup files have been specifically created for the Mini R8C SKP. It is recommended that you use these files (*ncrt0_r8c.a30* and *sect30_r8c.inc*) instead of the default startup files (*ncrt0.a30* and *sect30.inc*) that come with NC30. The differences between these startup files are listed below:

Ncrt0_r8c.a30

- **Macros moved to sect30_r8c.inc.**
- **Stack size, Int stack size and vector addresses moved to sect30_r8c.inc.**
- **Heap removed.**
- **Processor mode initializations removed in ncrt0_r8C.a30.**
- **Conditional assembler switches for R8C/M16C.**

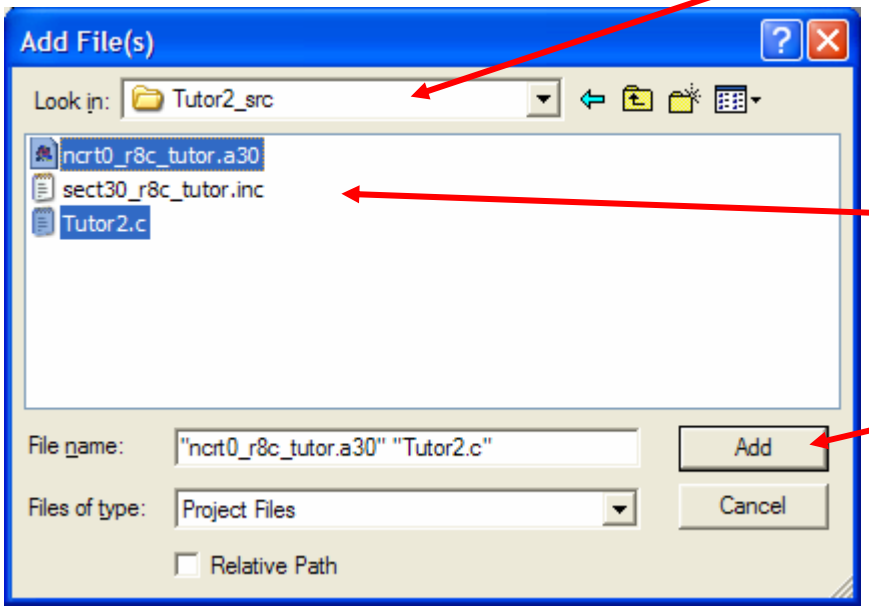
Sect30_r8c.inc

- **Variable Vector Definition – Simplified and described in user file**

Note: ***You can use the default startup files but ensure that you understand how to make the necessary modifications. The customized startup files for the R8C17 can be found under C:\Renesas\SKP8CMINI17\Sample_Code\Startup_Files directory.***

Adding Source Files (1/2)

1. From HEW's Project menu, select Add Files and the Add Files dialog box is displayed.



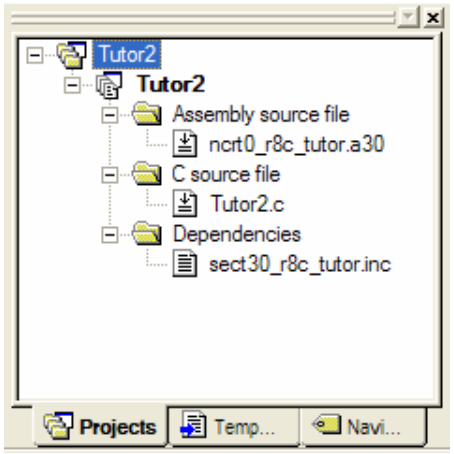
2. Browse to C:\Renesas\SKP8CMini17\Sample_Code\Tutor2_src folder, which contains the source codes for this tutorial.

3. Select main_tutor2.c and ncrt0_tutor2.a30.

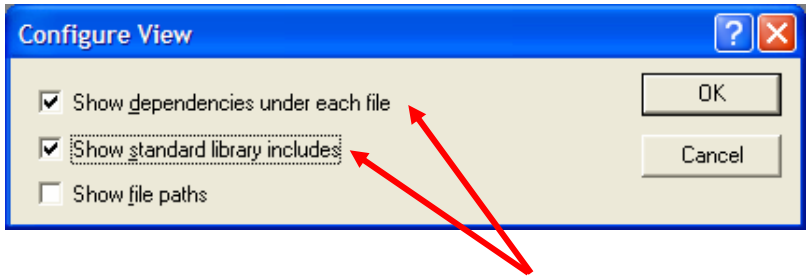
4. Click on Add.

Adding Source Files (2/2)

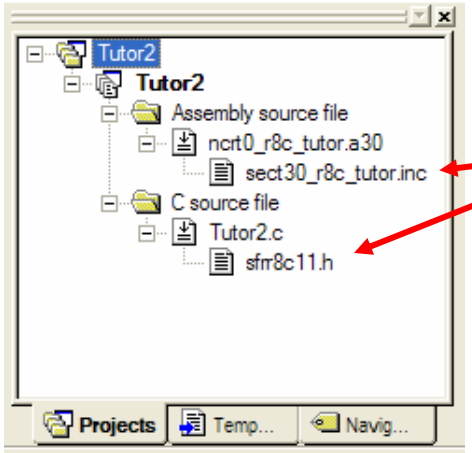
After adding source files, HEW's workspace will look like the figure below.



1. To display dependencies per source file, right-click on the Workspace window, and click on the Configure View.



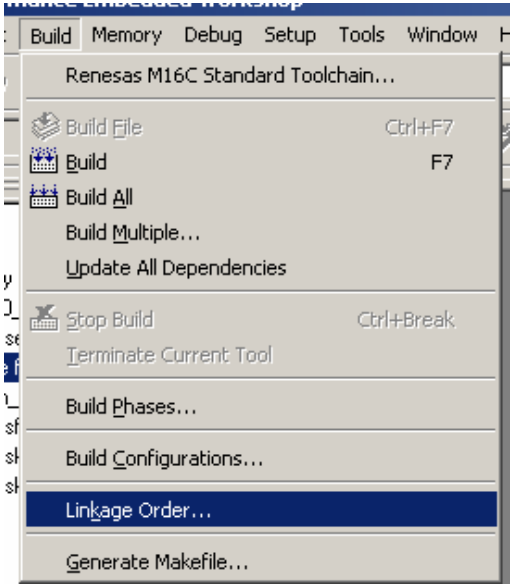
2. Click on check boxes in Configure View dialog box.
3. Click on OK button.



Displaying the source file dependencies this way makes it easier to verify if the header files are included before building the project.

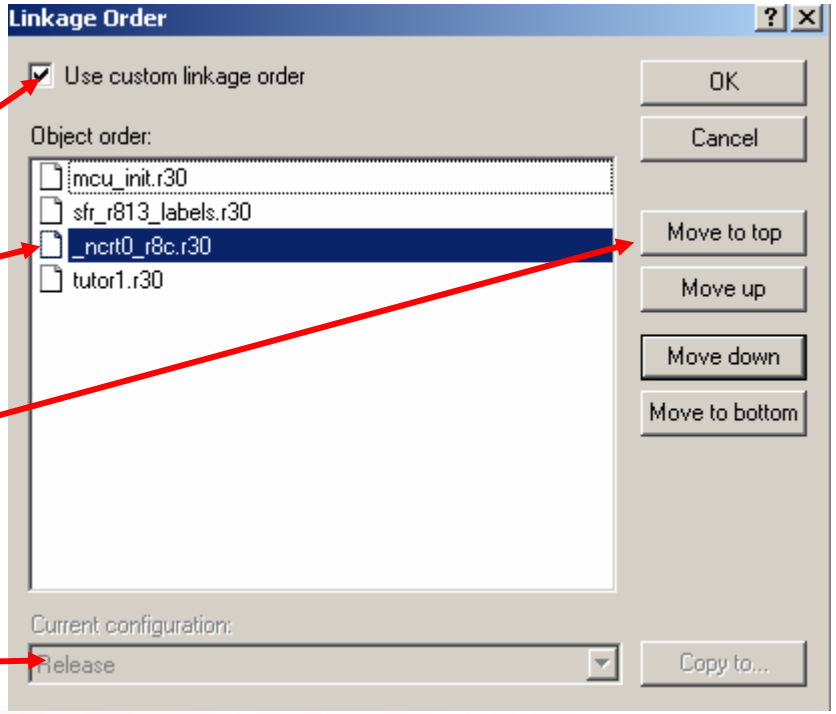
Linking the Startup File First

After checking dependencies, HEW4 must be setup to link the startup files first. The startup files contain information on memory addresses and sections which the linker uses to place the code at the correct addresses. Note if the startup file is named “Ncrt0.a30”, HEW4 will automatically link it first.



1. Select Build > Linkage Order...

2. Select

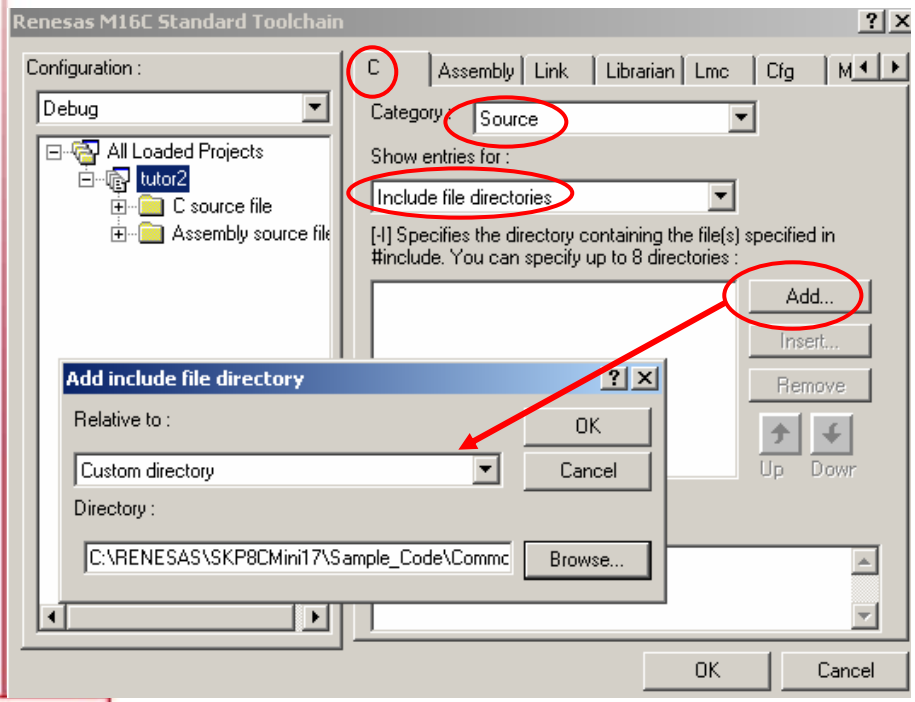


3. Click ‘Move to top’...

4. For multiple configurations, set linkage order for each configuration, then click ‘OK’

Defining an Include Directory

For this SKP, files that are common to all the sample code are kept in a directory named “\Common” under \Sample_Code. An example is the register definition file sfr.h that is included for all the projects, yet never needs to be modified. Because of this, we will need to setup up in HEW how to instruct the compiler where to look for these files during compile time.



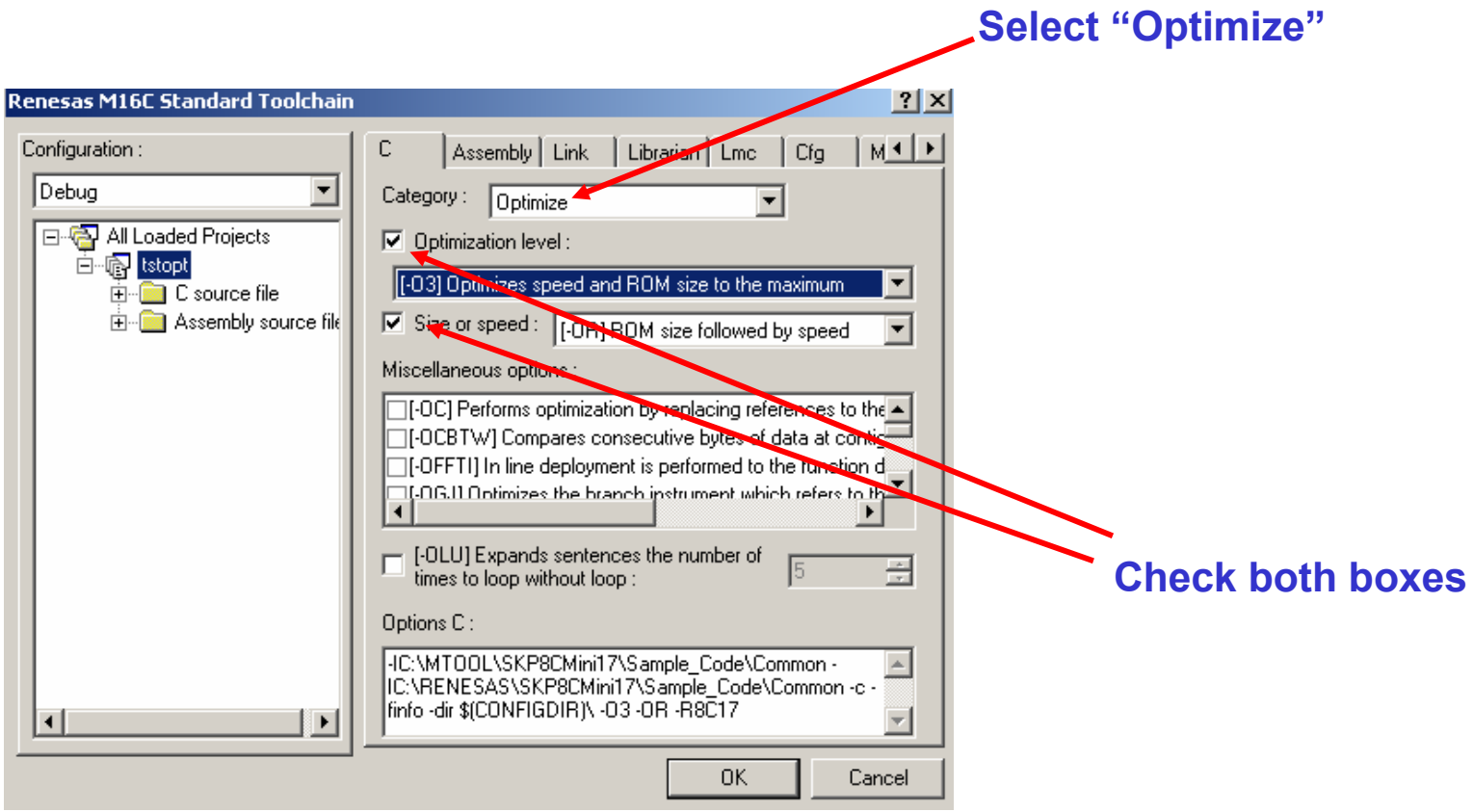
1. Select Renesas M16C Standard Toolchain from the Build menu and this window is displayed.

2. Click the Add… button.

3. Set the “Relative to:” option to Custom directory and the “Directory:” to the location of your Common directory for your SKP.

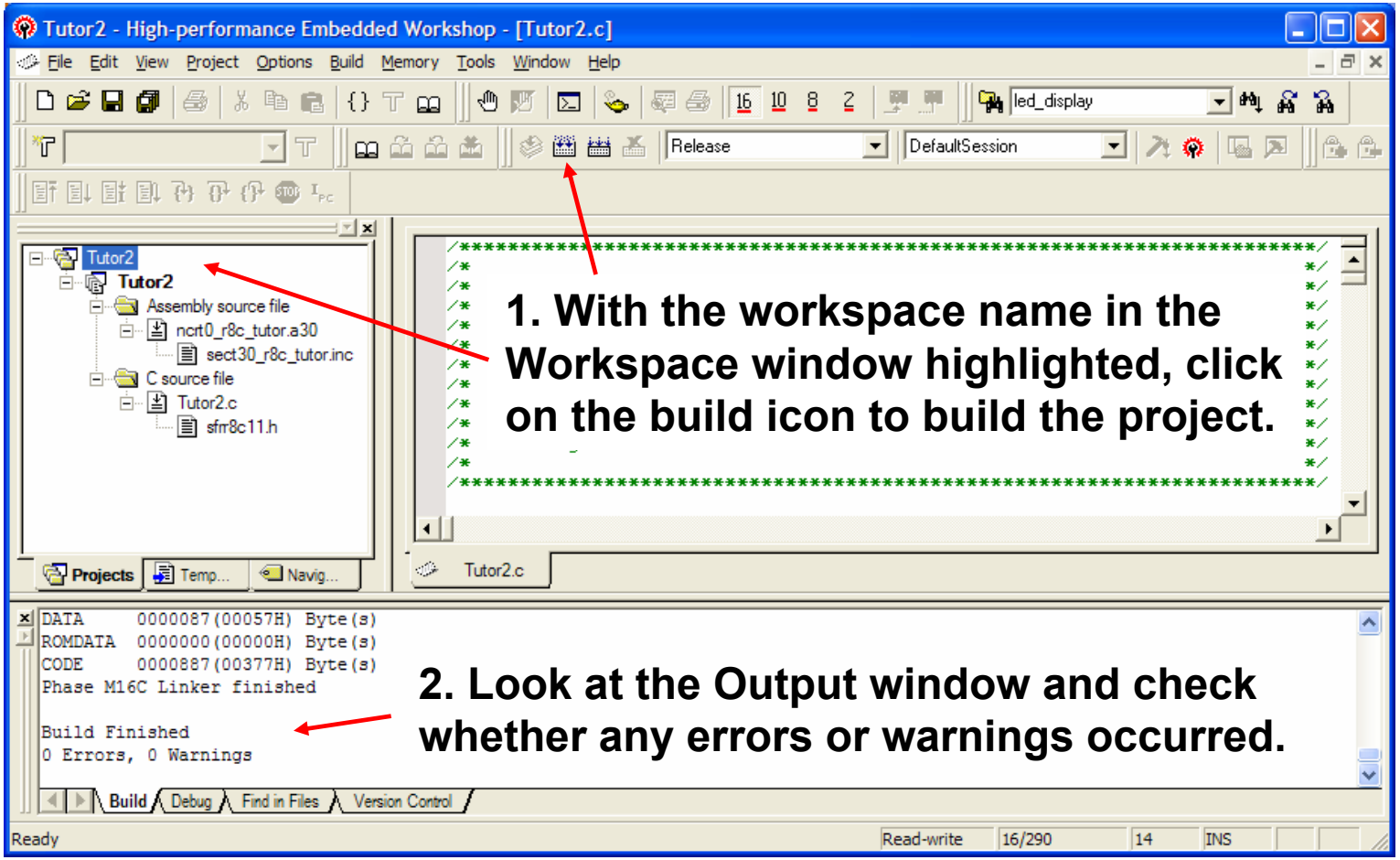
Optimization

All compiler optimization is off by default



See the NC30 (compiler) manual for details on optimization.

Building (compile & link) the Project



If there are no errors, you can try running the program on the mini R8C board using the ICD Debugger.

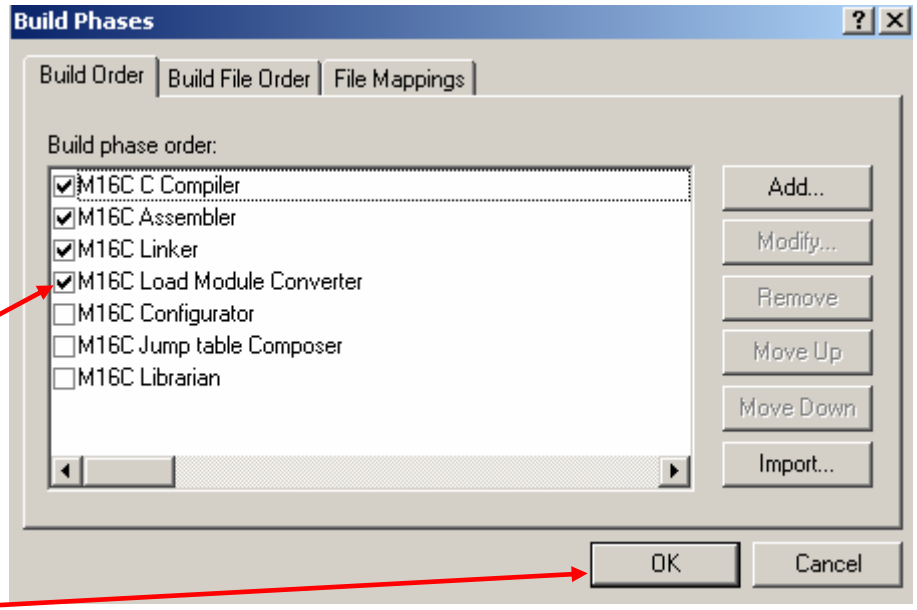
Generate a hex file for Programmer

After building a program, a file with an .x30 is generated. For this example, 'tutor2.x30' is generated. This .x30 file can be downloaded using HEW. Device programmers, including the FoUSB Programmer, use hex files in Motorola or Intel format.

1. To generate a hex file during the build process, select 'Build Phases' from the 'Build' menu.

2. Click on M16C Load Module converter checkbox.

3. Click on OK.



With the feature enabled, a .mot file is also created when building the project.

End of Tutorial 2

This is the end of tutorial 2. You can try modifying or downloading other sample programs from the \Sample_Code directory.

The completely built tutor2 project can be found in the Zip file under C:\Renesas\SKP8CMINI17\Sample_Code\tutor2_src folder.

Be sure to check out the references on the following pages.

Have Fun!!

References and Recommended Reading

All documents that came with the SKP can be found using the "Document Description" from the Start > Programs > Renesas > SKP8CMINI17 (15) menu.

- **SKP8CMINI17 User's Manual:** This is a "must read" document! It details all the things you need to know on how to use the Starter Kit.
- **R8C Hardware Manuals:** Device specifications for R8C/Tiny MCUs.
- **HEW User's Manual:** To fully understand and get the most out of HEW. This is recommended reading.
- **NC30WA Version X.XX User's Manual:** Check this manual out for features specific to the NC30 compiler.
- **RTA-FoUSB-MON User's Manual:** Read this manual to understand how the In-Circuit Debugger / Flash Programmer works.

References and Recommended Reading

- **M16C Series C Language Programming Manual:** This is a great document for any level of programmer. The first chapter is an introduction and reference on the C language. The next chapter explains specifics of C programming with the M16C family of microcontrollers.
- **R8C/Tiny Series Software Manual:** This document describes the instruction set and timing information for the R8C/Tiny series MCUs.
- **AS30 Version X.XX User's Manual:** Read this manual if you plan on writing programs in Assembly or when making changes to the startup file.
- **Application Notes and Sample Programs:** Application notes and other sample programs can be accessed from Renesas Technology America's website: http://www.renesas.com.
- **SKP updates:** www.renesas.com/skp.