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H8/300H Tiny Series E8 Emulator

Programming of On-Chip Flash Memory

Overview

As well as being employed in the debugging of user systems, the E8 emulator can also be used for programming the on-chip flash memory of microcomputers.

This document gives the procedure for starting up the E8 emulator in its programmer mode and for writing load-module data to flash memory.

The contents of this document are applicable to cases where a user system with an H8/300H Tiny-series microcomputer is used with an E8 emulator. Any H8/300H Tiny-series microcomputer can be used.

Contents

1.   Specifications

When the E8 emulator is started up in the programmer mode, it is only capable of writing user-program data to on-chip flash memory after any existing data in the flash memory has been erased. Since the on-chip flash memory does not contain a program for the E8, the user program cannot be debugged by using the E8 emulator. The load modules you wish to download must be registered in the workspace.

2.   Functional Descriptions

The programmer mode is only useful for writing the user program to on-chip flash memory. This allows the user to check the operation of the user program. Since the on-chip flash memory does not contain a program for the E8, program operation must be verified without the aid of the E8 emulator.

This document gives the procedure for programming the on-chip flash memory with a sample program that is contained in the CD-ROM which comes with the E8 or is in the package downloaded from the Renesas website.

> Product version: E8 Emulator Software V.2.09 Release 02

3.   Software Preparation

3.1   Introduction

Expand the sample program (tutorial workspace) to be used with this document onto your personal computer by installing the software provided on the CD-ROM for the E8 emulator.

If the High-performance Embedded Workshop has already been installed on the personal computer where you are installing the software, some dialog boxes in the installation process may be skipped.

3.2   Installing the E8 Emulator Software

Execute HewInstMan.exe from the CD-ROM for the E8 emulator.

For details on installation, refer to the Introductory Guide for the E8 Emulator available on the Renesas website and follow the instructions displayed on the screen. The procedure is not described in this document.

3.3   Installing Other Necessary Software

(1) The procedures in this document include the modification of part of the sample program before checking program operation. For this purpose, the H8S, H8/300 series C/C++ compiler package is necessary. If you already have the product version of the compiler package, install it.

(2) If you do not have the product version of the compiler package, you can use a free evaluation version included in the CD-ROM which comes with the E8 emulator.

The evaluation version is also available from the Renesas website. From the top page of the Renesas site, go to [Support] -> [Software Download for Tools], select [Evaluation Software] from [Category:], and search for the H8S, H8/300 series C/C++ compiler package. For the address of the Renesas website, refer to section 5, Related Documents. For restrictions on usage and the procedure for installing the evaluation version of the compiler package, refer to the download page.

(3) If you select AutoUpdate Utility during the installation process, you can always find the latest version of the software on the Renesas website.

4.   Operations

   This section describes how to activate the High-performance Embedded Workshop (HEW) and how to use the flash-memory programming function in the following steps.
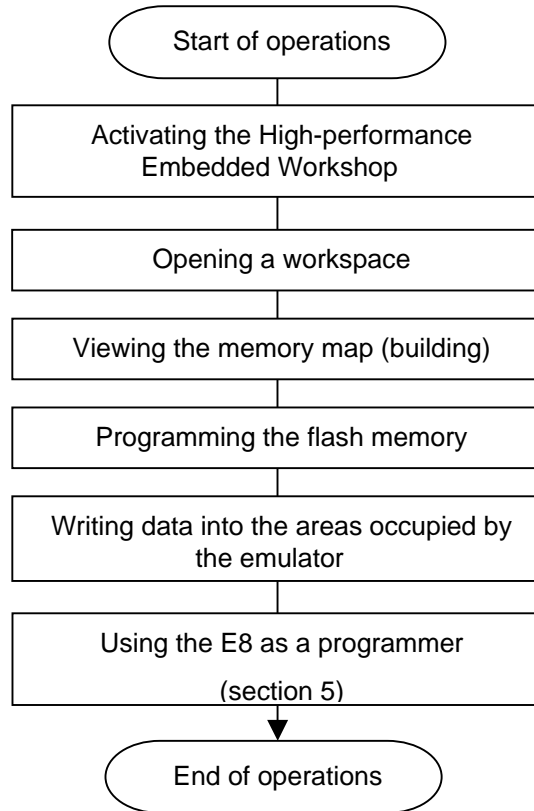
```
        ┌─────────────────────────────┐
        │     Start of operations     │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │  Activating the High-performance│
        │    Embedded Workshop        │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │     Opening a workspace     │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │ Viewing the memory map (building)│
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │  Programming the flash memory │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │ Writing data into the areas occupied by│
        │          the emulator       │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │  Using the E8 as a programmer │
        │        (section 5)          │
        └─────────────────────────────┘
                       │
                       ▼
        ┌─────────────────────────────┐
        │     End of operations       │
        └─────────────────────────────┘
```

Figure 4.1   Procedure for Sample Program Execution

4.1   Activating the High-performance Embedded Workshop

   Firstly, connect the E8 emulator (which is connected to the user system) to the host computer via a USB cable and check that debugging is possible.

   Then, start up the High-performance Embedded Workshop by selecting [Start -> All Programs -> Renesas -> High-performance Embedded Workshop -> High-performance Embedded Workshop].
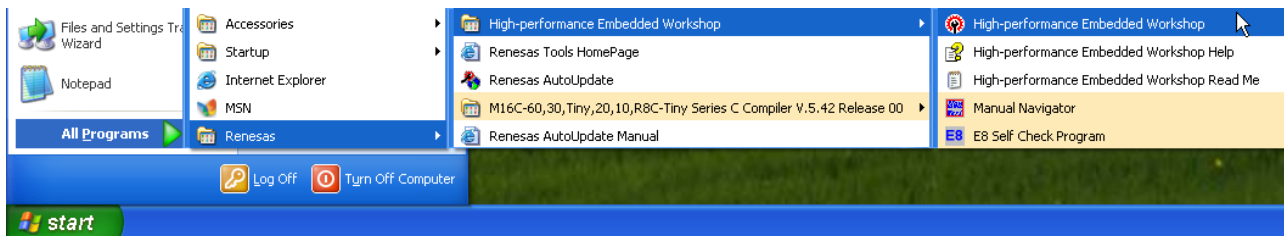
4.2   Opening a Workspace

(1) The [Welcome!] dialog box will appear on the High-performance Embedded Workshop window.
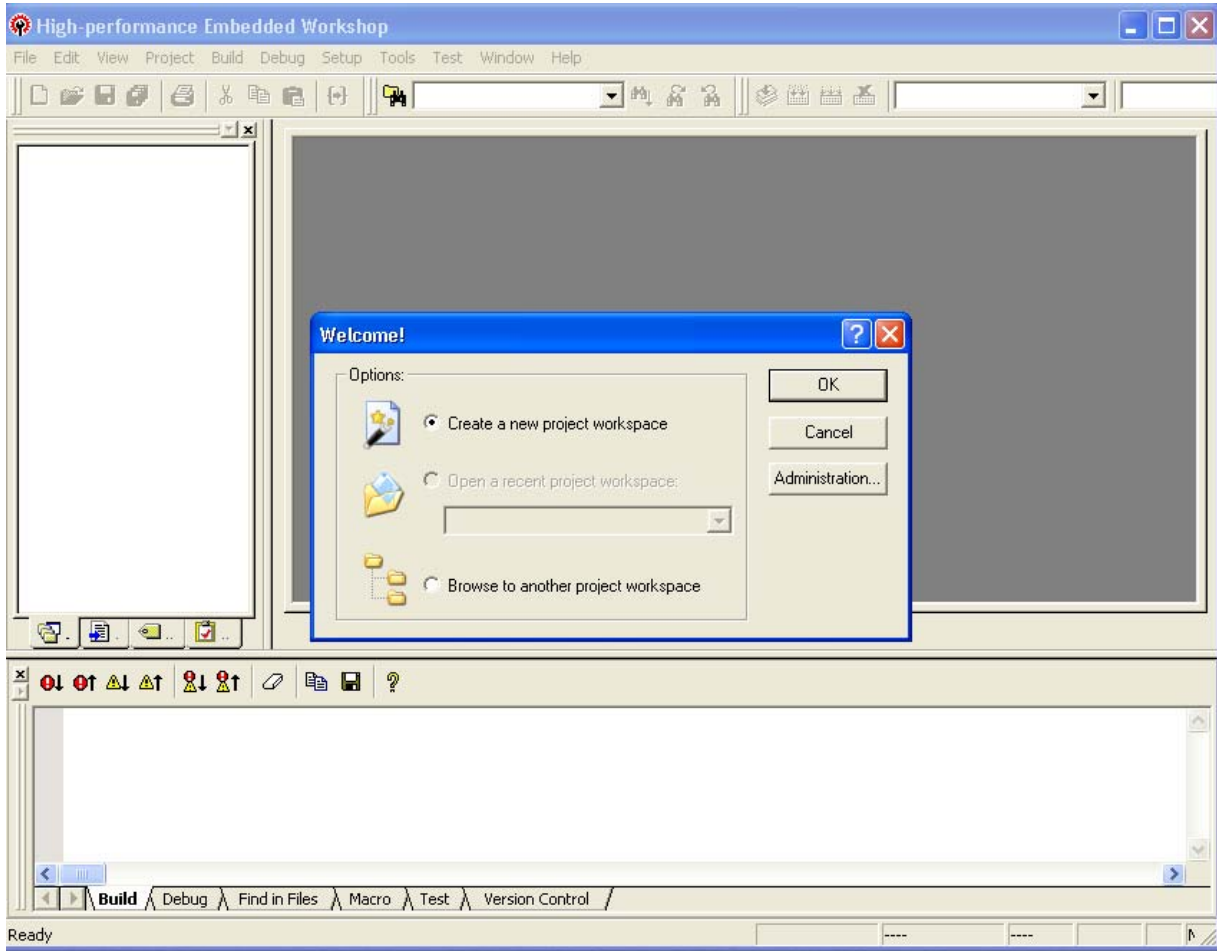
Select the [Browse to another project workspace] radio button in the [Welcome!] dialog box and click on the [OK] button.
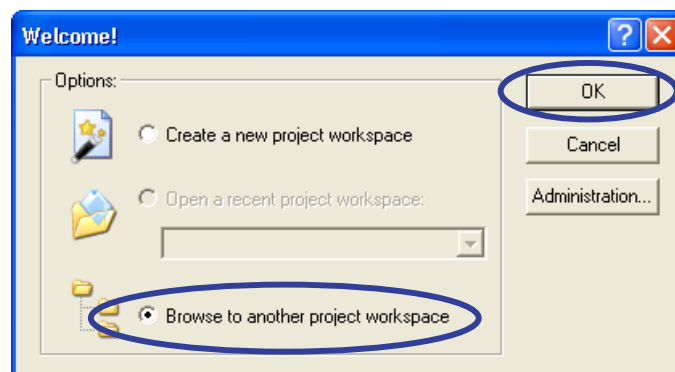
(2) The [Open Workspace] dialog box will appear.
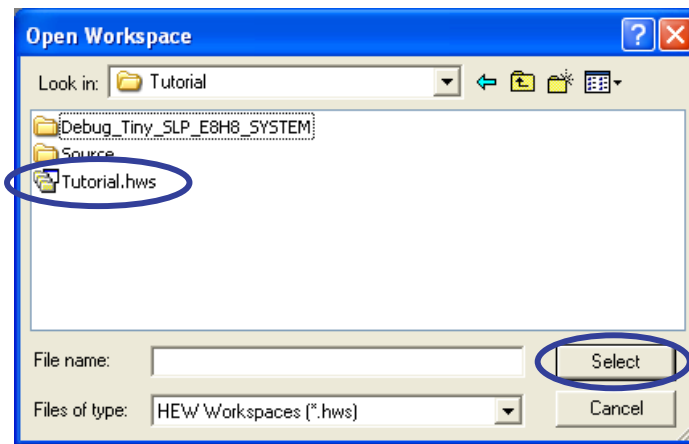
If the software from the CD-ROM for the emulator has been installed, the workspace "Tutorial.hws" will be in the folder shown below (standard location). Specify the correct location by opening the folders in order. Select the workspace "Tutorial.hws" and click on the [Select] button.

C:¥WorkSpace¥Tutorial¥E8¥H8¥Tutorial¥Tutorial.hws
C:¥WorkSpace 　　└Tutorial 　　　　└E8 　　　　　　└H8 　　　　　　　　└Tutorial 　　　　　　　　　　└Tutorial.hws
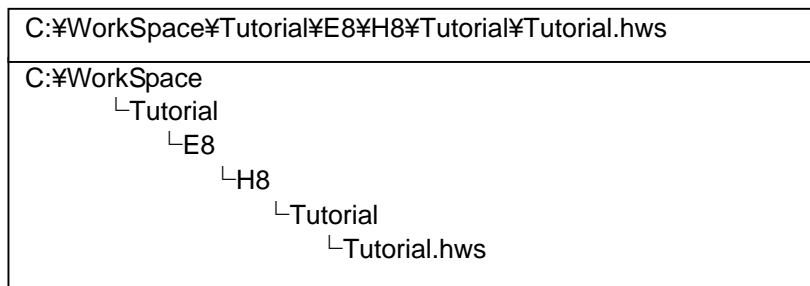
Note: The above directory will not be specifiable for some earlier versions of the High-performance Embedded Workshop. In this case, select the directory indicated below.

<High-performance Embedded Workshop installation directory>

¥Tools¥Renesas¥DebugComp¥Platform¥E8¥H8¥Tutorial

Examples:

C:¥hew3¥Tools¥Renesas¥DebugComp¥Platform¥E8¥H8¥Tutorial

C:¥hew2¥Tools¥Renesas¥DebugComp¥Platform¥E8¥H8¥Tutorial

(3) If the workspace was made with an old version of the High-performance Embedded Workshop, the following dialog box will appear. To update it to the new version, click on the [OK] button.
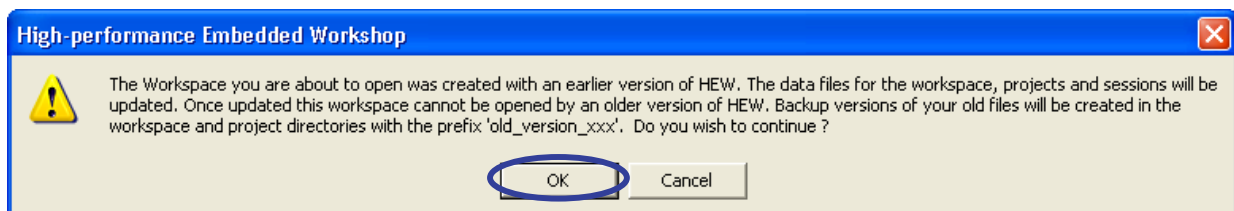
(4) If the [Toolchain Version Not Registered in System] dialog box appears, select the name of the target project and click on the [OK] button.
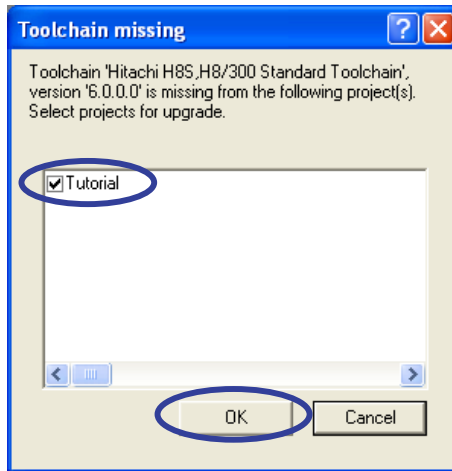
(5) If the [Changing Toolchain Version] dialog box appears, select the desired toolchain version and click on the [OK] button.
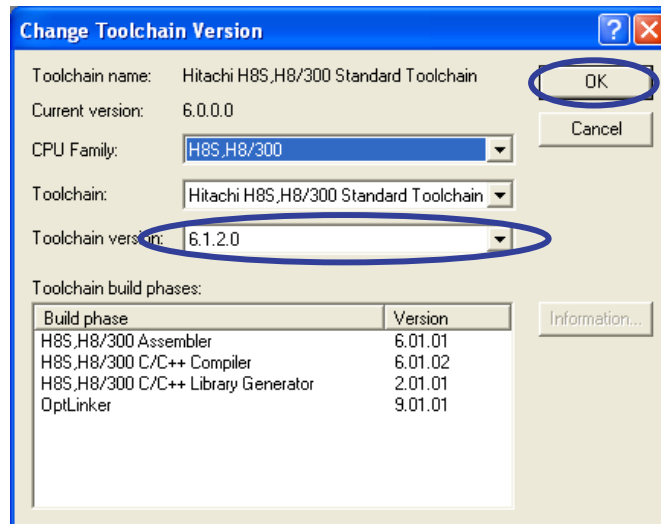
(6) If the [Change Toolchain Version Summary] dialog box appears, just click on the [OK] button.
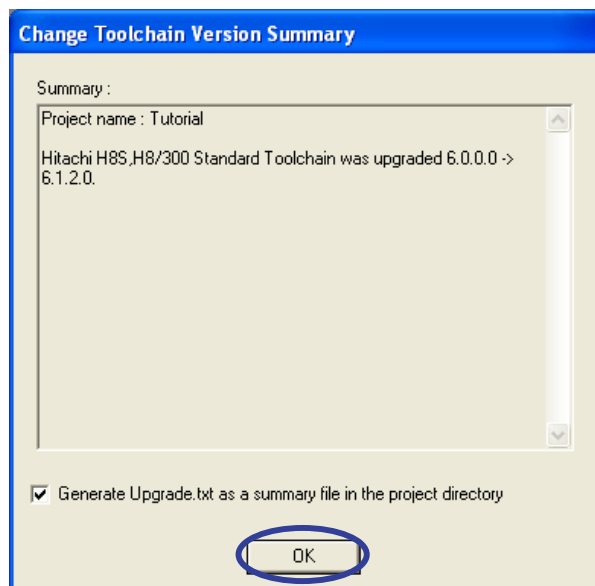
(7) After the workspace has been read, the [Emulator Setting] dialog box opens.
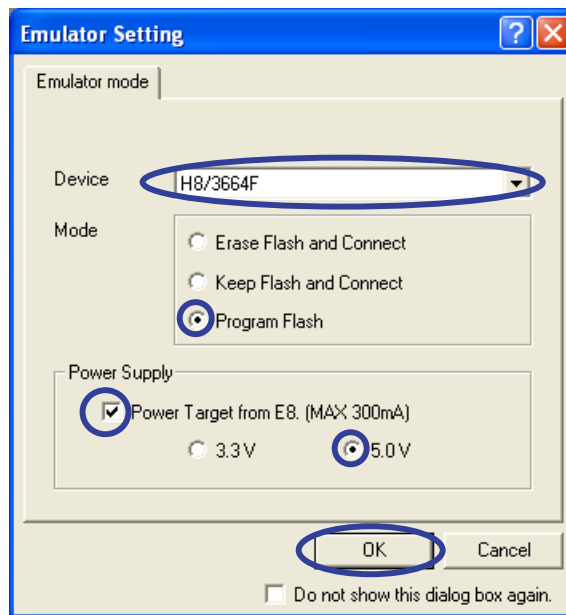
Select the name of the device in your user system from [Device]. In this example, "H8/3664F" is selected. For [Mode], select [Program Flash]. Then, make settings for [Power supply] that fit your system. In this example, [Power Target from emulator.] and [5.0V] are selected. Click on the [OK] button.

(8) The [System Clock] dialog box opens. Enter the value that agrees with the actual operating frequency of your system.
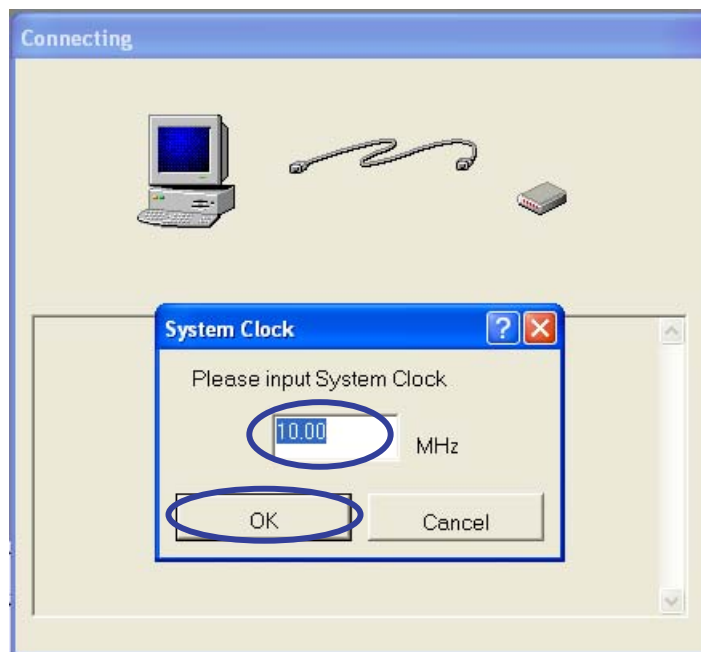
The system clock frequency in this example is 10.00 MHz.

(9) While the connection with the E8 emulator is being made, the [Connecting] information box shown below is displayed.
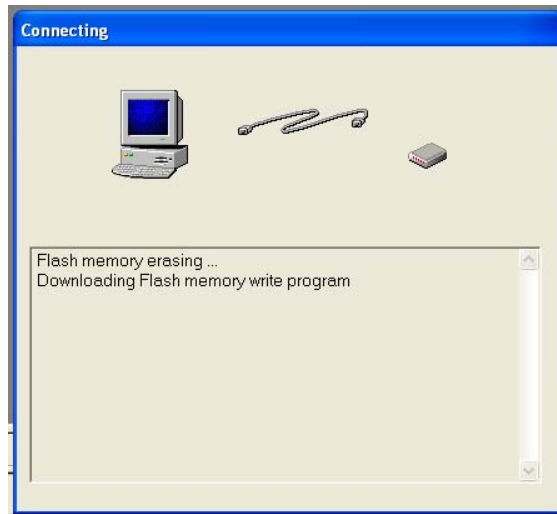
On completion of the connection, the entire on-chip flash memory will be in the erased state in readiness for programming.

For this reason, debugging is not possible while the E8 emulator is operating in the programmer mode; the only available operation is downloading of the load module into the on-chip flash memory. After programming of the flash memory has been completed, exit or restart the emulator.

(10) Connection of the E8 emulator is now complete, so operations in the High-performance Embedded Workshop screen can proceed.
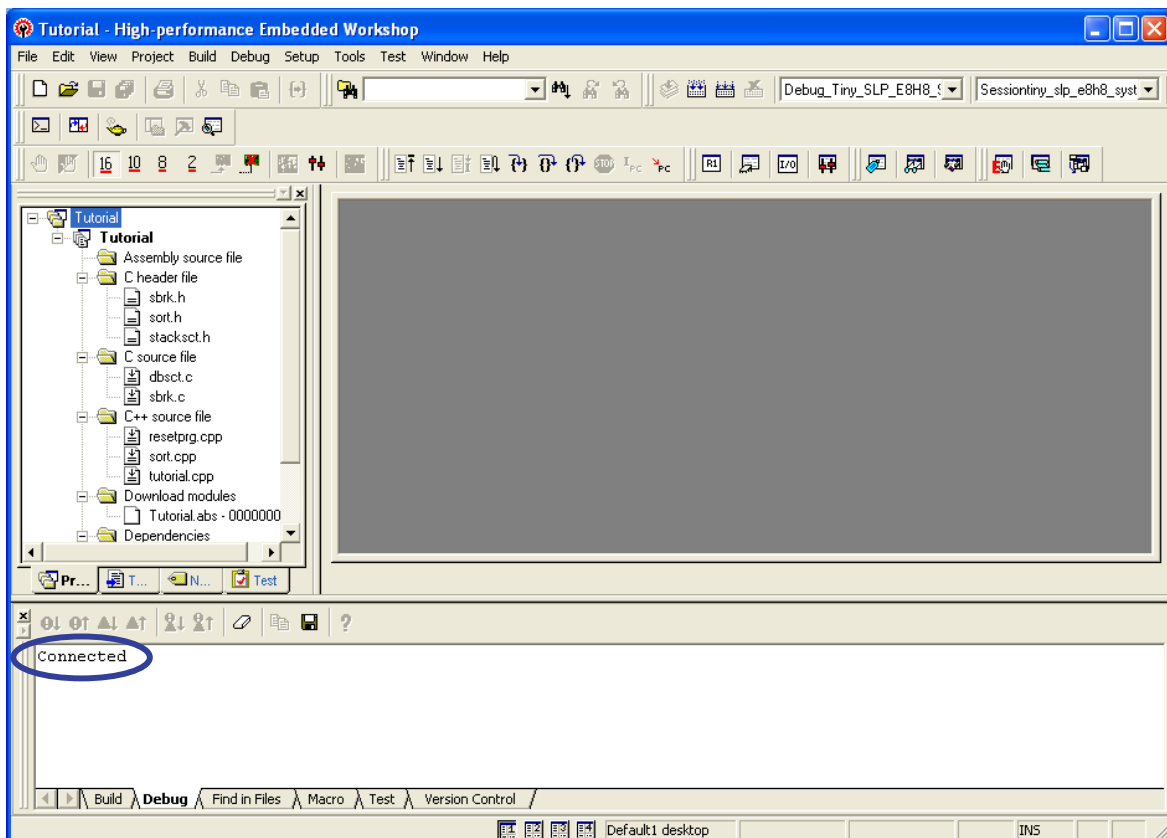
Now that the E8 emulator has been successfully connected, "Connected" appears in the [Debug] tabbed page in the [Output] pane.

4.3 Viewing the Memory Map (Building)

(1) Select [Map] from the [View] menu.
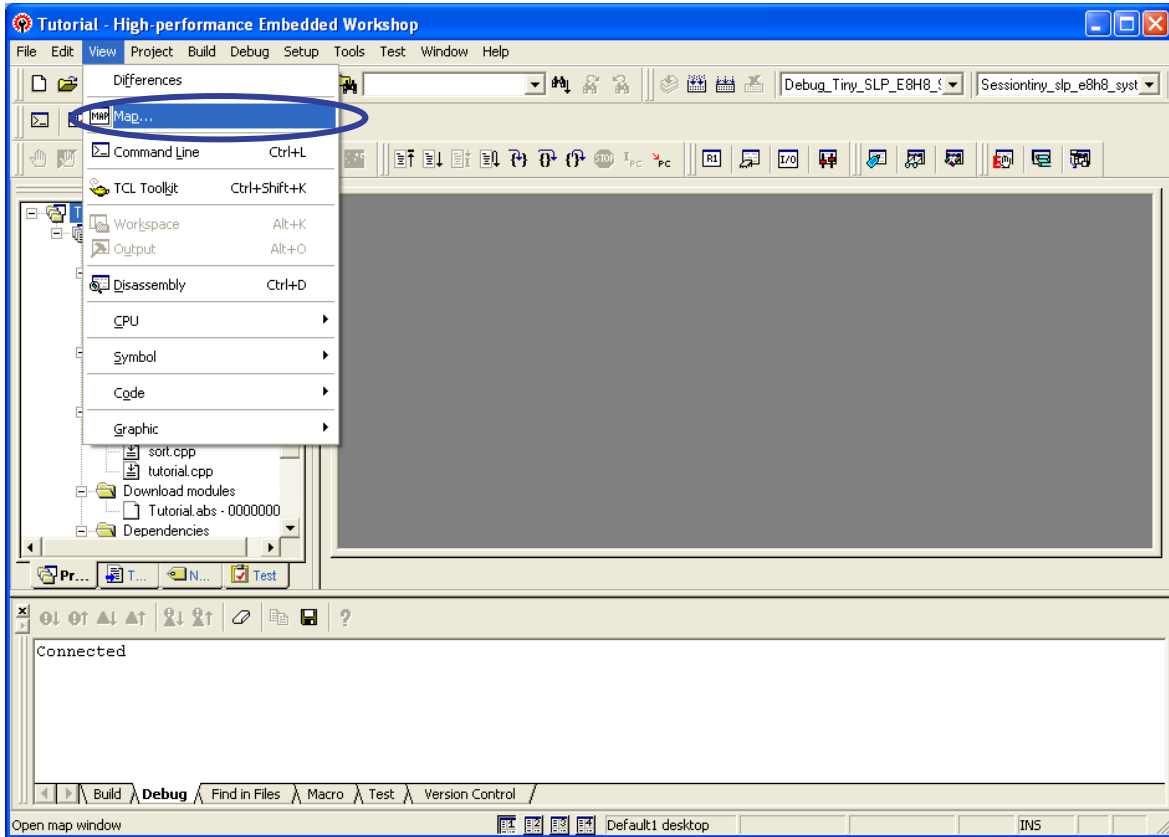
(2) The [Select Map Window Type] dialog box opens. Select [Map Section Information] and click on the [OK] button.
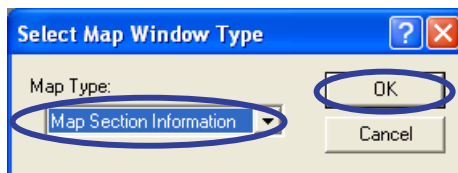
(3) The [Map Section Information] tabbed page shows information on the sections.
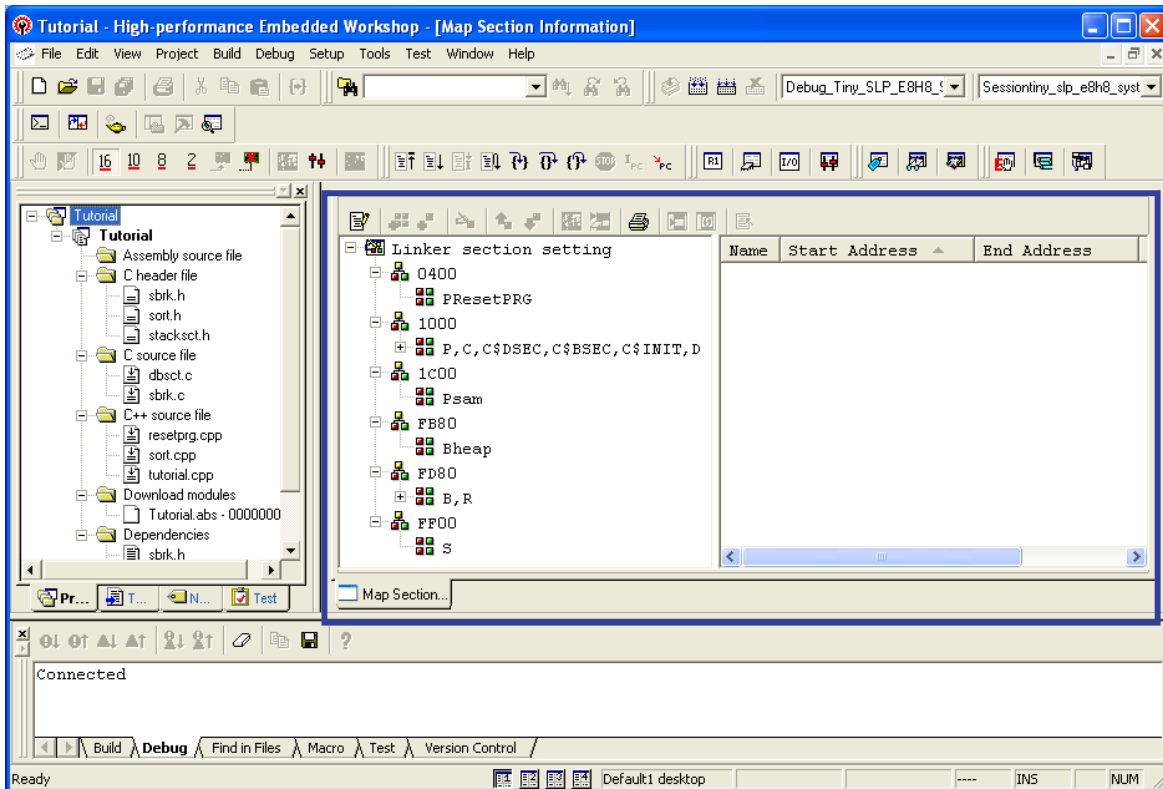
In the initial state set up by the sample program, information on the addresses where sections start and end is not included. Make a setting to enable the output of this information in the following steps (4 to 6) before proceeding with the building process.

(4) Select [H8S,H8/300 Standard Toolchain] from the [Build] menu.
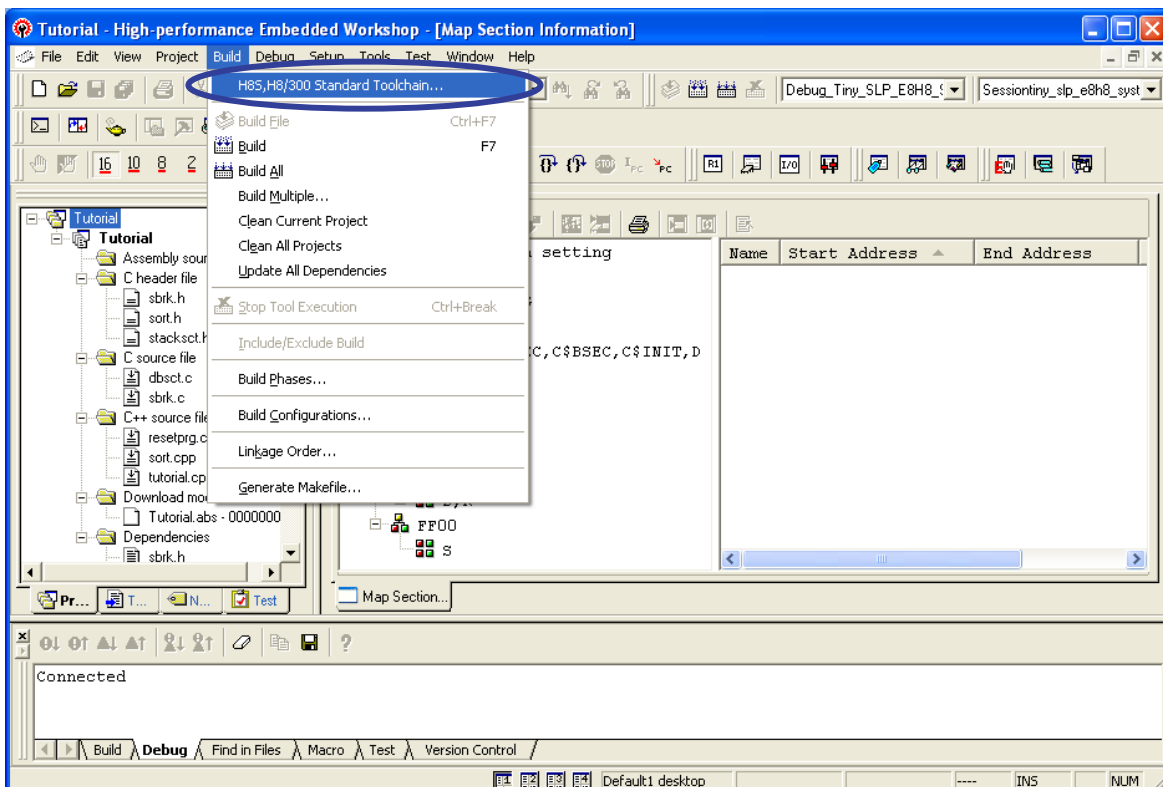
(5) Open the [Link/Library] tabbed page and select [List] from [Category].
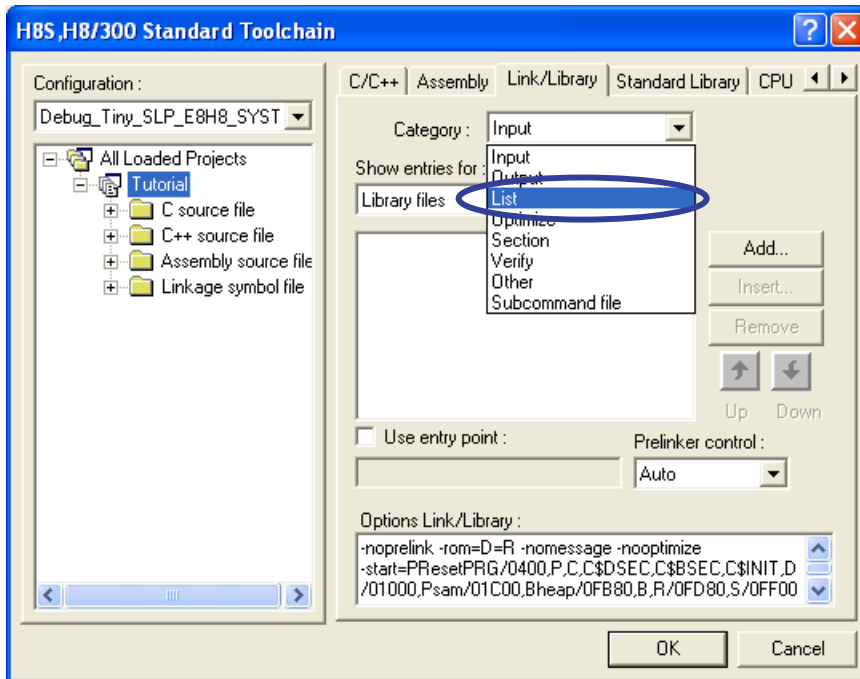
(6) Select the [Generate list file] checkbox and click on the [Enable All] button to enable all entries. Then click on the [OK] button.
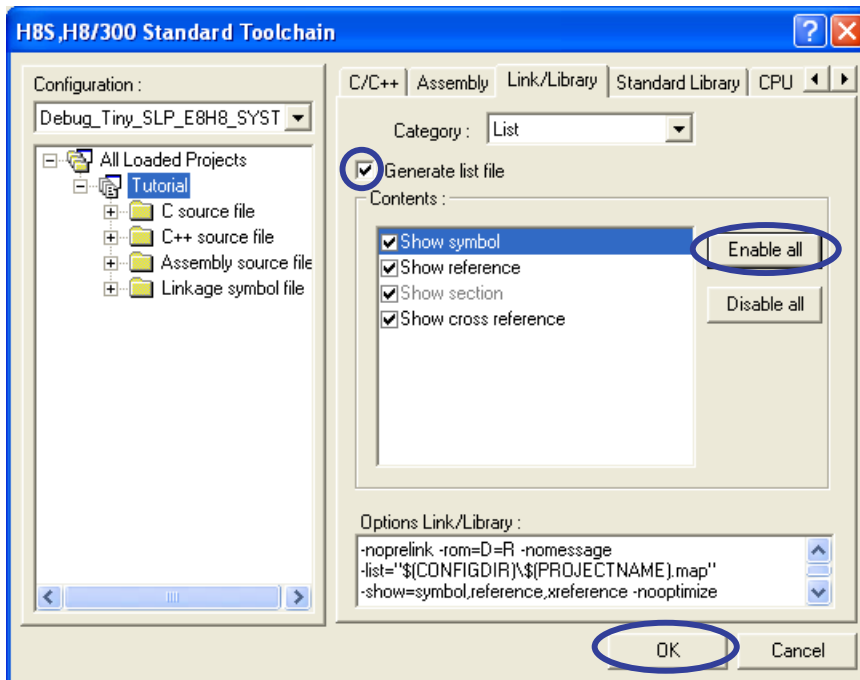
(7) Select [Build] or [Build All] from the [Build] menu.
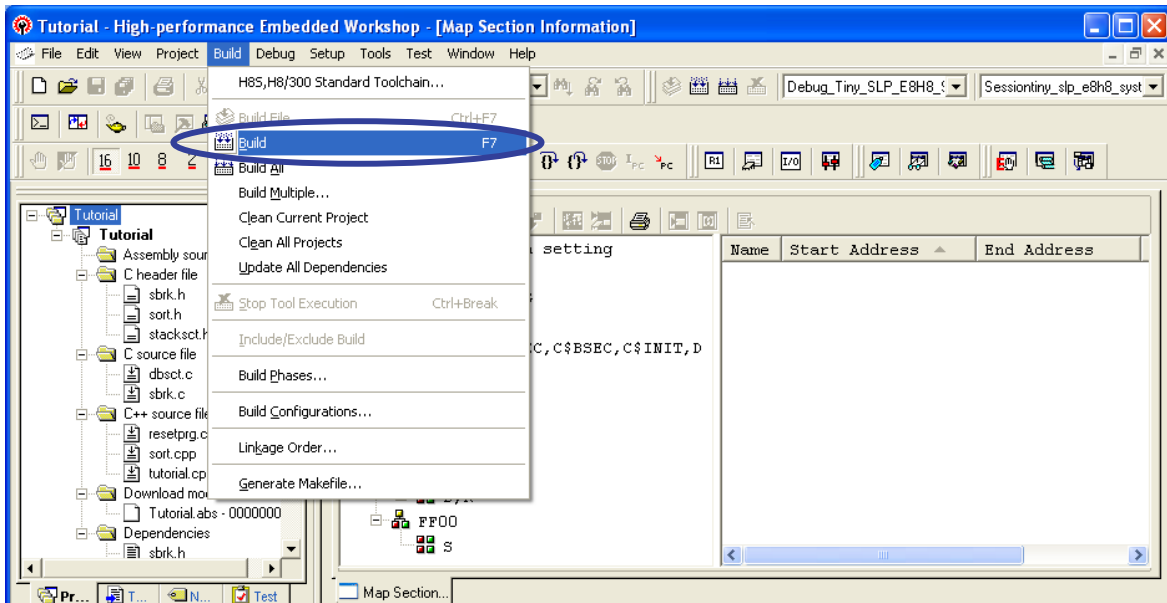
(8) Upon completion of the build, the [Confirmation Request] dialog box appears to request confirmation that data is to be downloaded to the flash memory. At this stage, select [No] or [No To All].
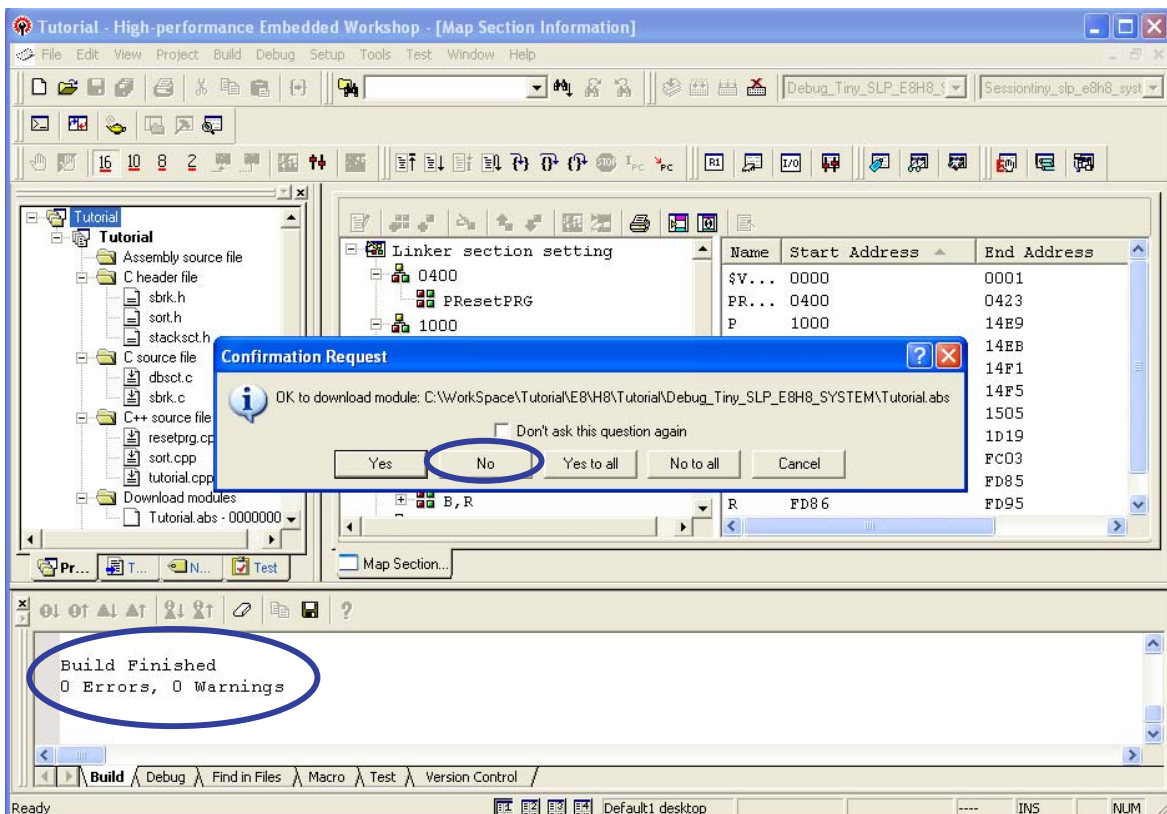
Details of the build as it is executed are shown on the [Build] tabbed page of the [Output] pane. When an error has occurred in building, automatic downloading will not proceed.

In this example, automatic downloading has been canceled because the example of programming is to be introduced after the map information has been confirmed. If you are already sure that the data will be programmed correctly, you can select [Yes] or [Yes To All] to download the data to the flash memory.

(9) Various information is shown, including the addresses where the sections start and end.
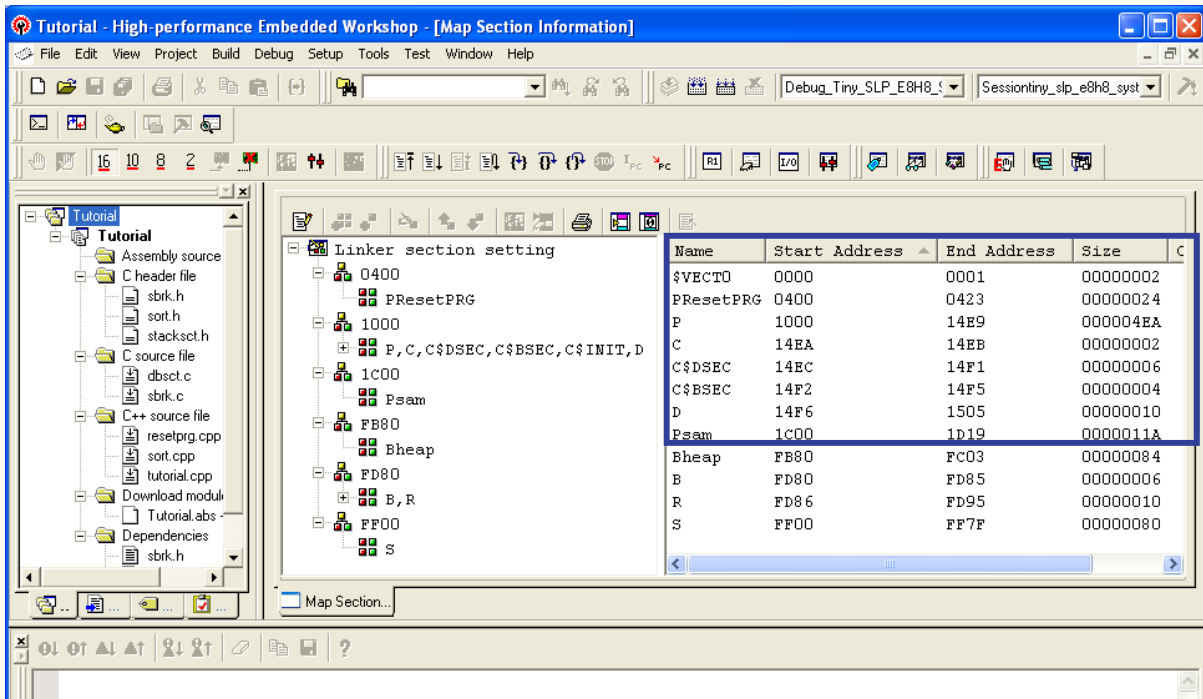
Sort the [Start Address] values in ascending order; we can see that the area of flash memory where the ROM-attributes data are to be stored ends at 1D19.
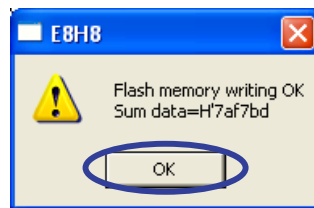
4.4　　Programming the Flash Memory

（1）Select the [Debug] tab. The active tabbed page in the [Output] pane is changed from [Build] to [Debug].
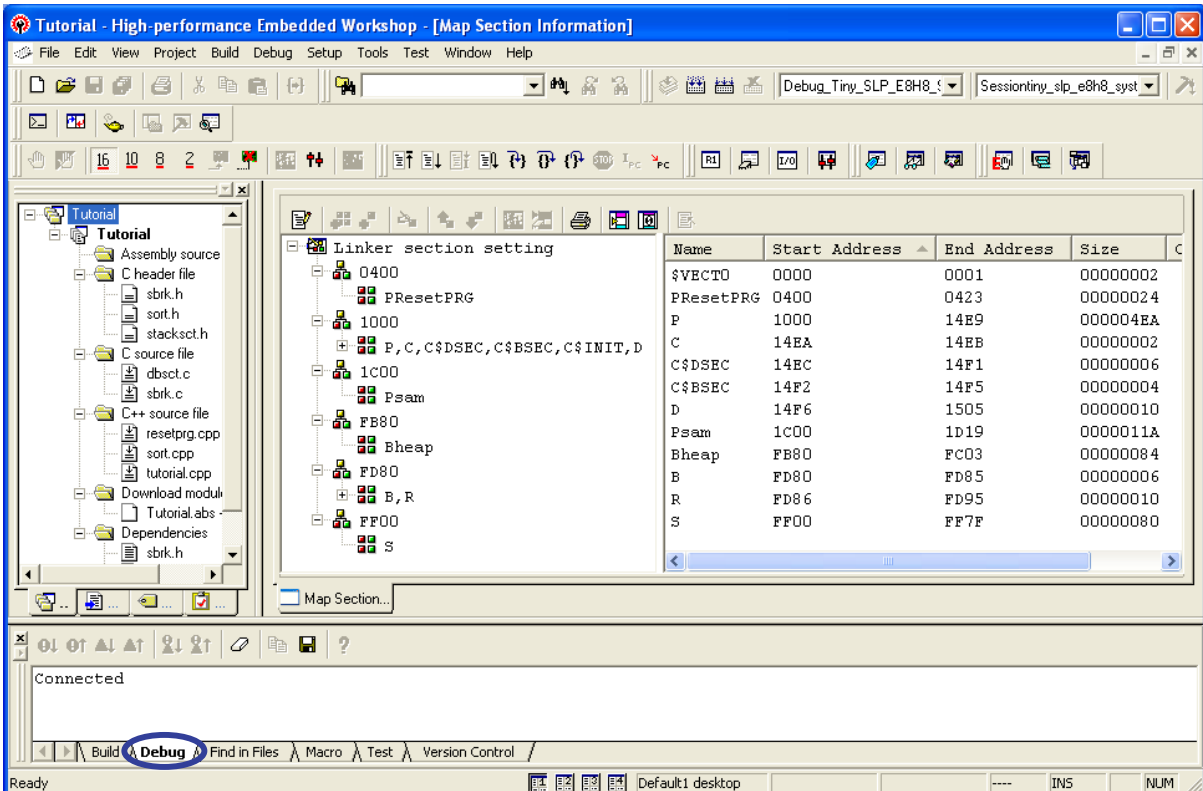
(2) Right-click on the name of the load module under [Download modules] in the workspace tree and select [Download] from the popup menu. Downloading can also be initiated by double-clicking on the file name.
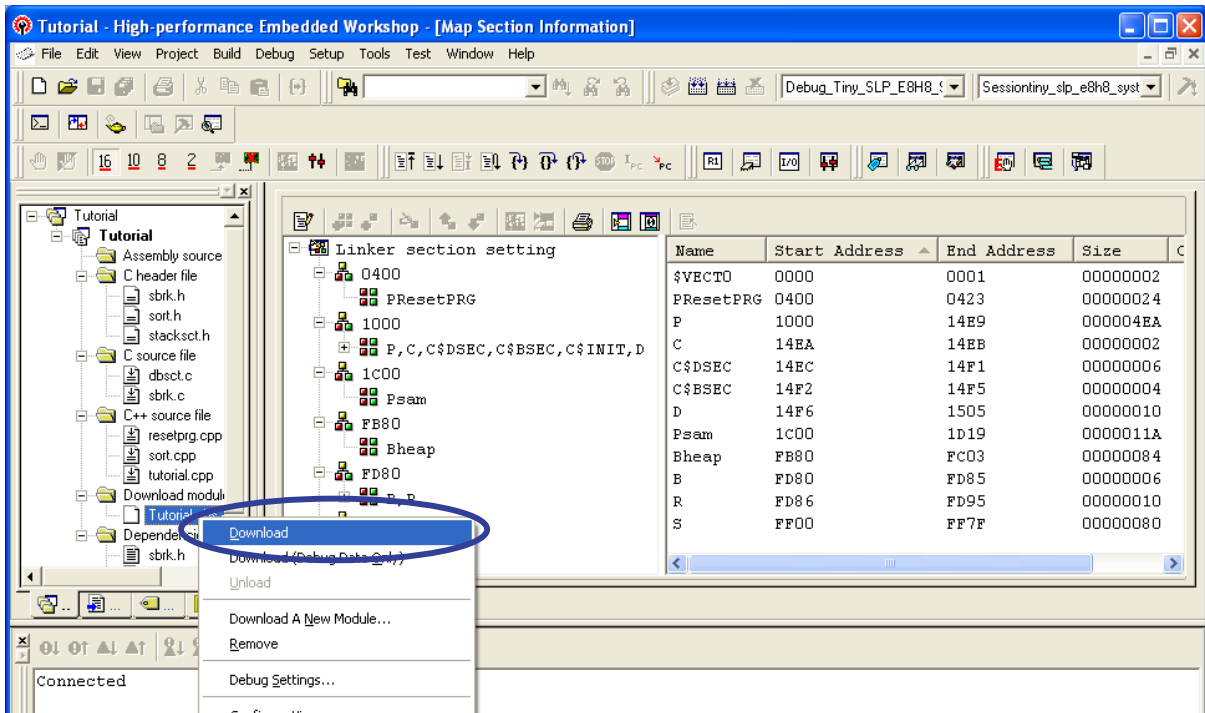
(3) Upon completion of downloading, a message box containing the text "Sum data"* and "Flash memory writing OK." appears. Read the messages and click on the [OK] button.

Programming of the flash memory is now complete. Click on the [OK] button.

Since the on-chip flash memory does not contain a program for the E8, debugging is not possible. If debugging is attempted, the following error message box appears.
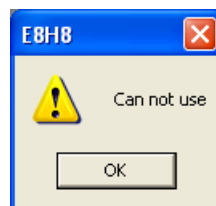
*Note: [Sum data] is the 4-byte sum of all bytes of data in the flash-memory area (excluding on-chip RAM and reserved areas) of the microcomputer in use. Since the whole flash-memory area was erased on connection of the E8, regions to which no data were written by downloading hold the default value, 0xff.

When the H8/3664F is in use, the range from H'0000 to H'7FFF will be the target area. If the microcomputer in use is equipped with a dedicated ROM area for use by the E8, this area will also be included. When the H8/3672F is in use, for example, the range from H'0000 to H'4FFF will be the target area. The addresses of such ROM areas may not be recorded in the hardware manual (e.g. for the H8/36049F).

In such case, refer to the E8 Emulator Additional Document for User's Manual, which provides specific information on the individual microcomputers.

(4) While the flash memory is being programmed, the [Debug] tabbed page in the [Output] pane shows the message "Flash memory writing ...". When programming is completed, a downward-pointing arrow appears on the icon of the load-module file in the workspace.
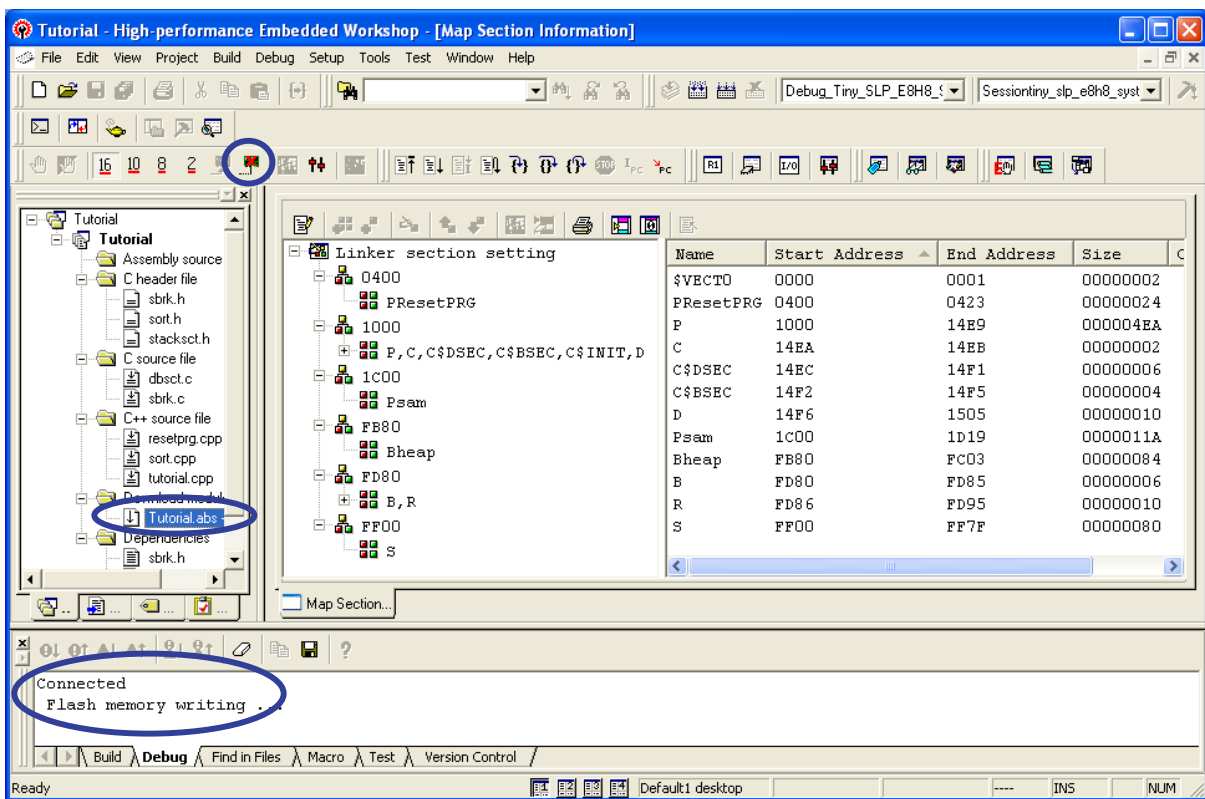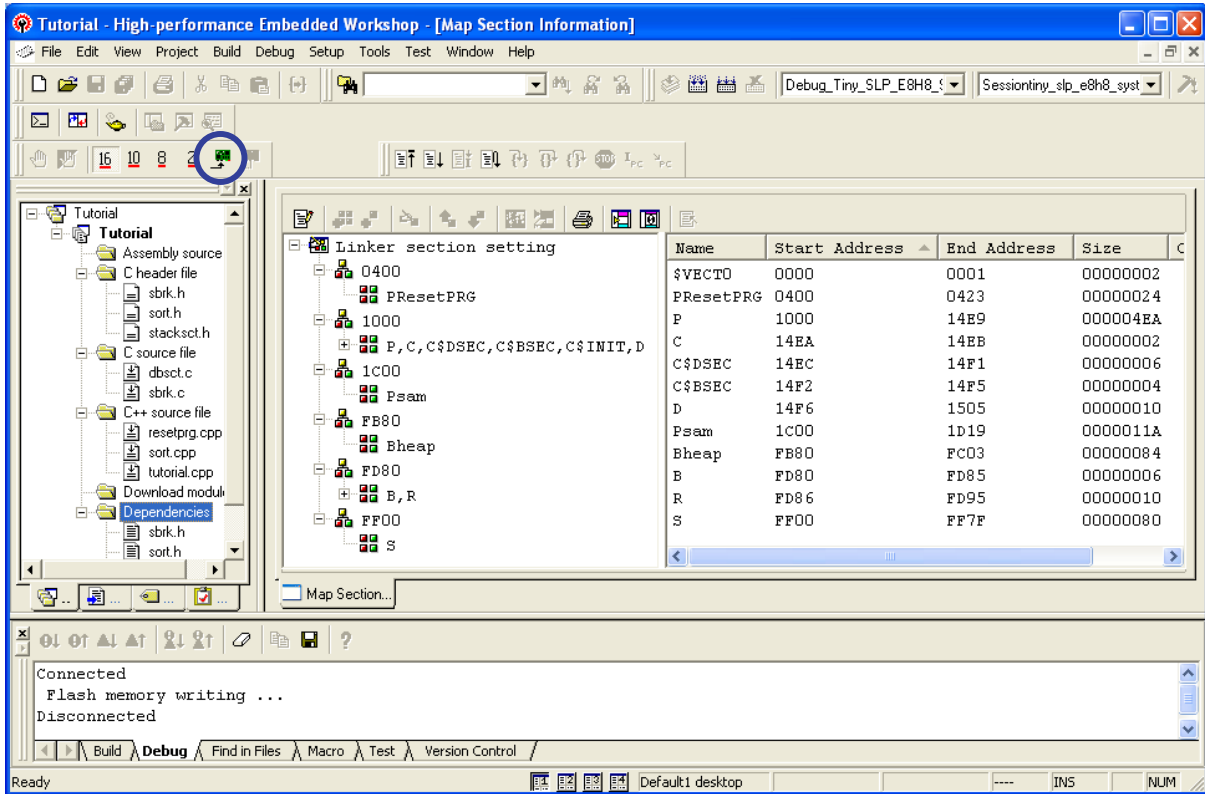

In this example, we will use the [Disconnect] and [Connect] toolbar buttons to restart the E8 so that we can continue to use it.
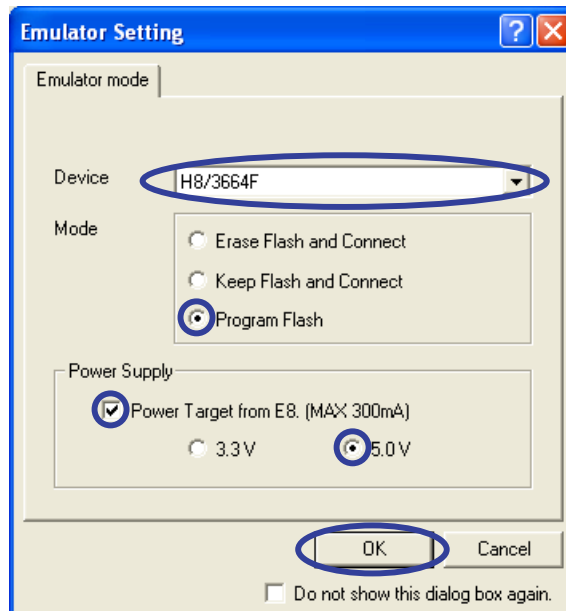
Click on the [Disconnect] button.

4.5   Writing Data into the Areas Occupied by the Emulator

(1) To start connection of the E8 emulator, click on the [Connect] toolbar button.
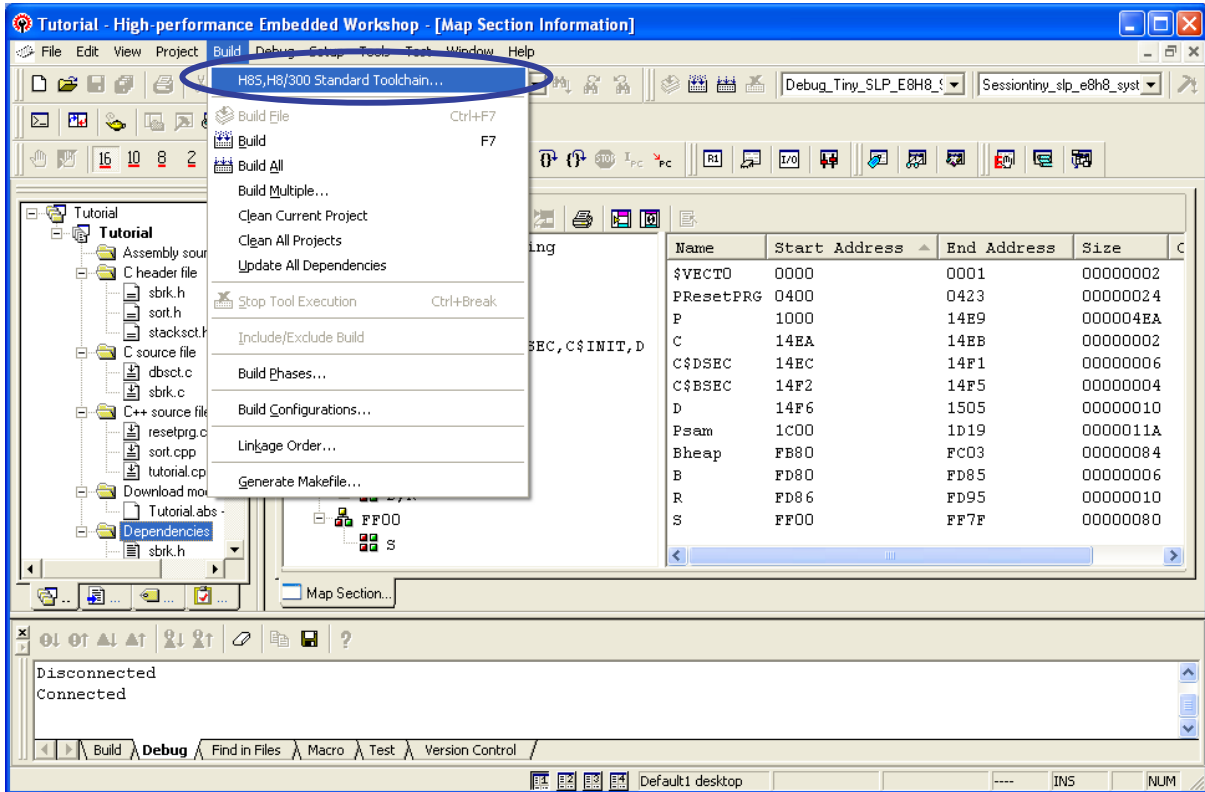

(2) As in the previous connection, select [Program Flash] as the emulator mode.
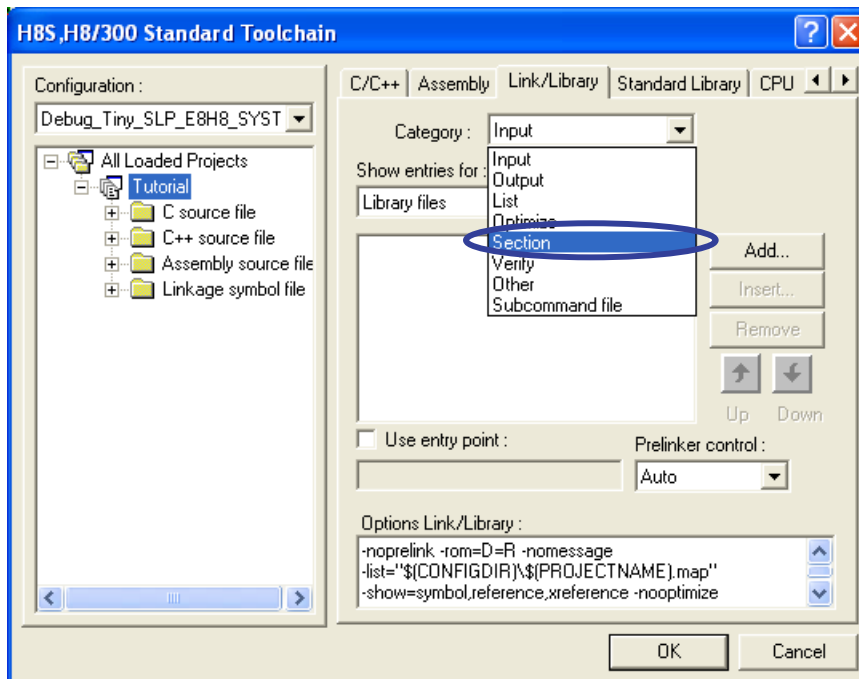

All other settings must be the same as in step (7) of section 4.2.

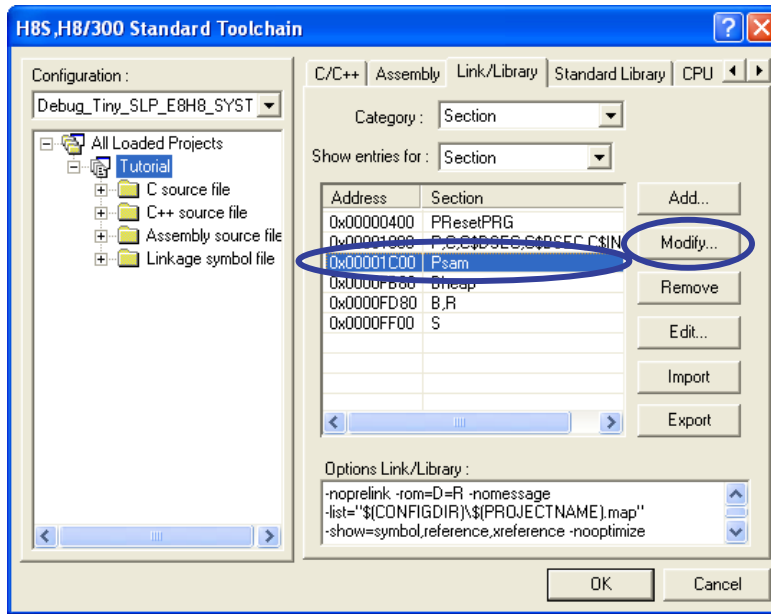In the subsequently opened [System Clock] dialog box, select "10.00" as well as in step (8) of section 4.2.

(3) Now the start address of a section should be changed. Select [H8S, H8/300 Standard Toolchain] from the [Build] menu.
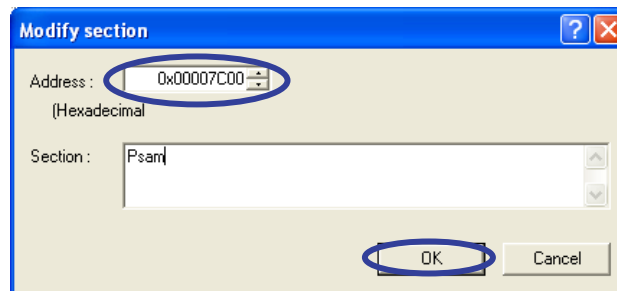

(4) Click on the [Link/Library] tabbed page and select [Section] from [Category].
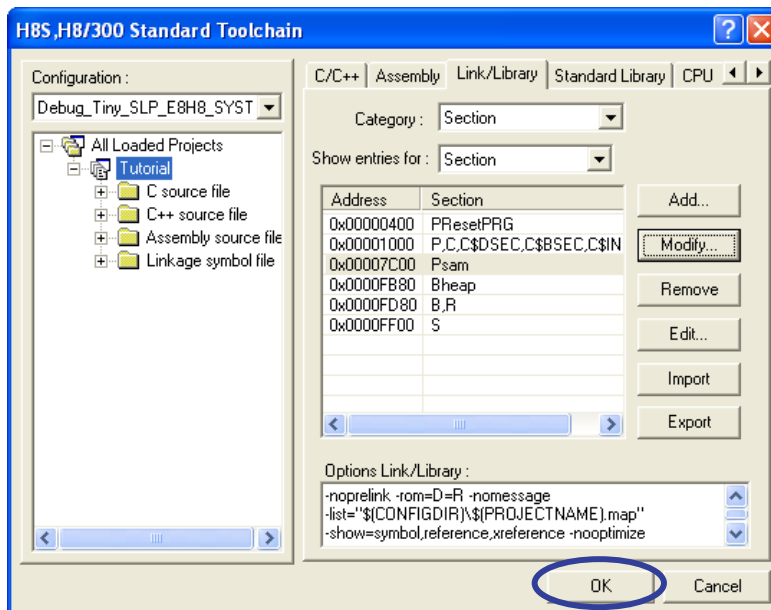
(5) Select the section whose address is 0x00001C00 and click on the [Modify] button.
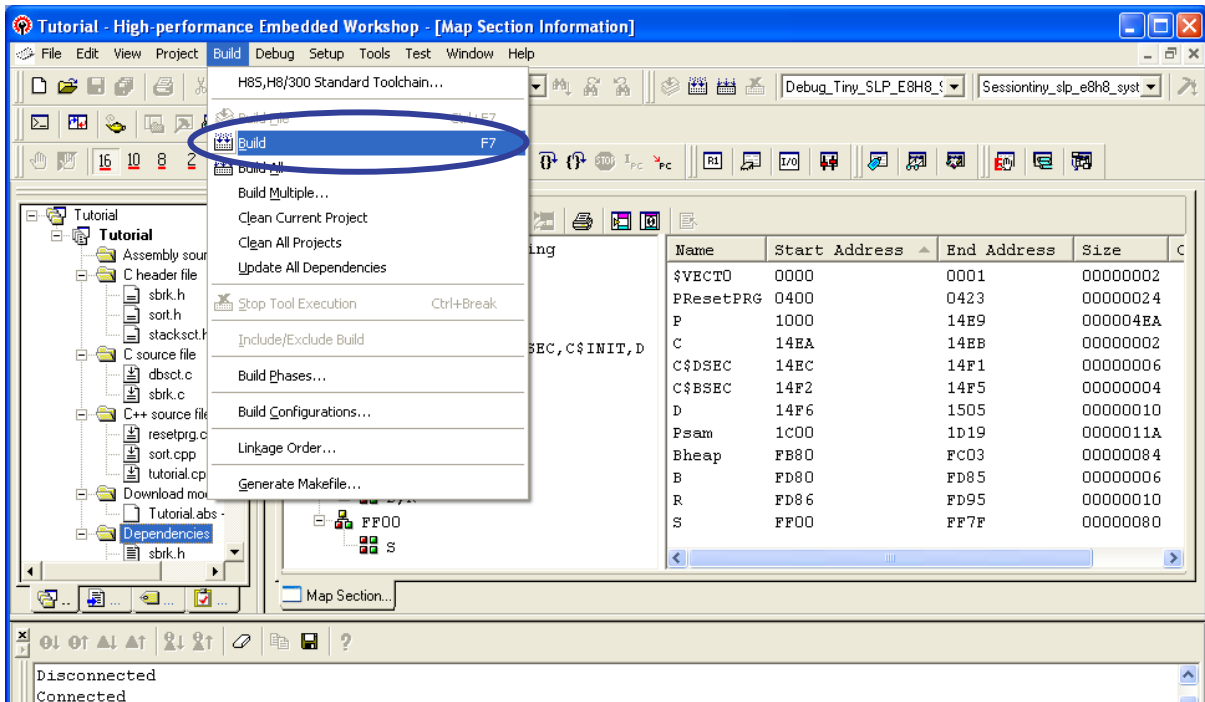

(6) The [Modify section] dialog box opens. In this example, specify 0x00007C00 for [Address] and click on the [OK] button.
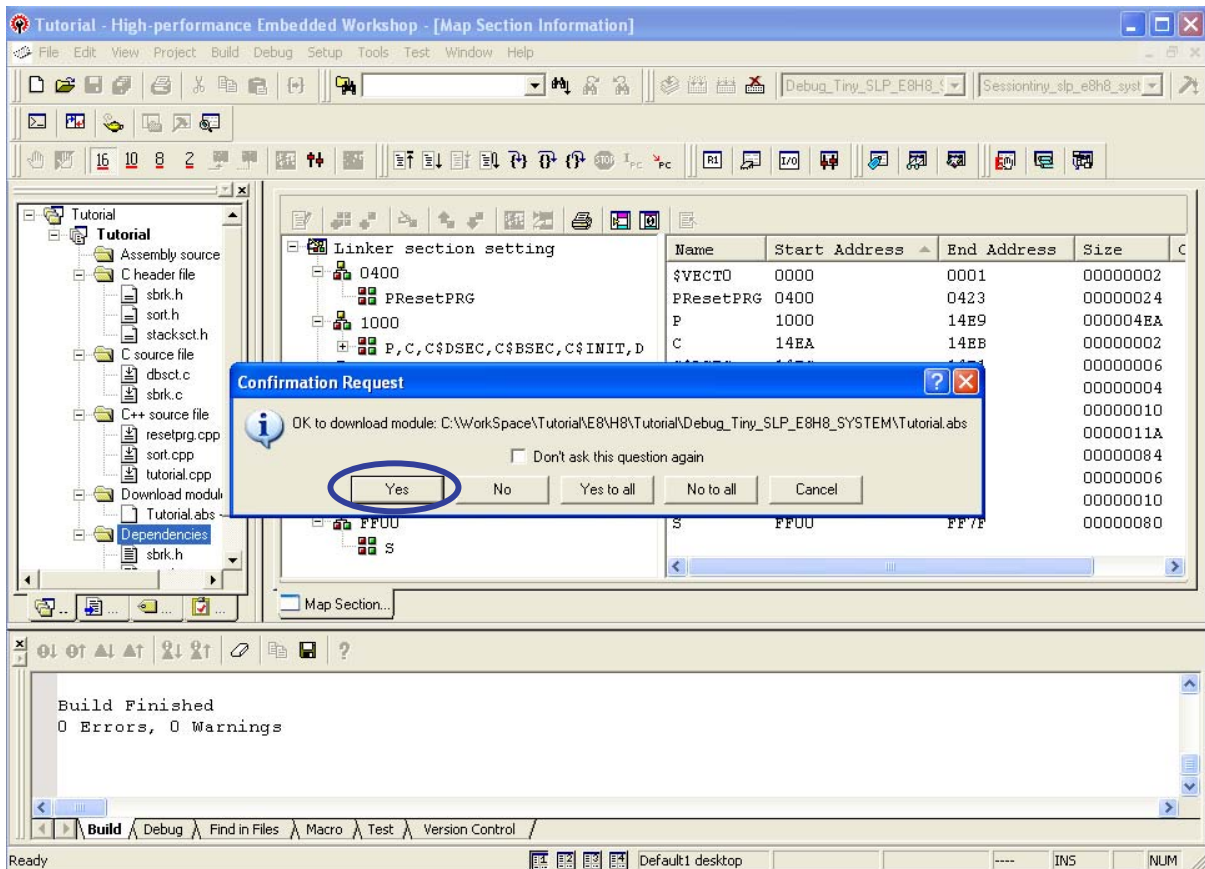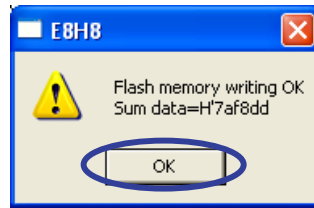

(7) Click on the [OK] button.

(8) Select [Build] from the [Build] menu.

（9) Upon completion of the build, the [Confirmation Request] dialog box appears to request confirmation that data is to be downloaded to the flash memory. At this stage, select [Yes] or [Yes To All].
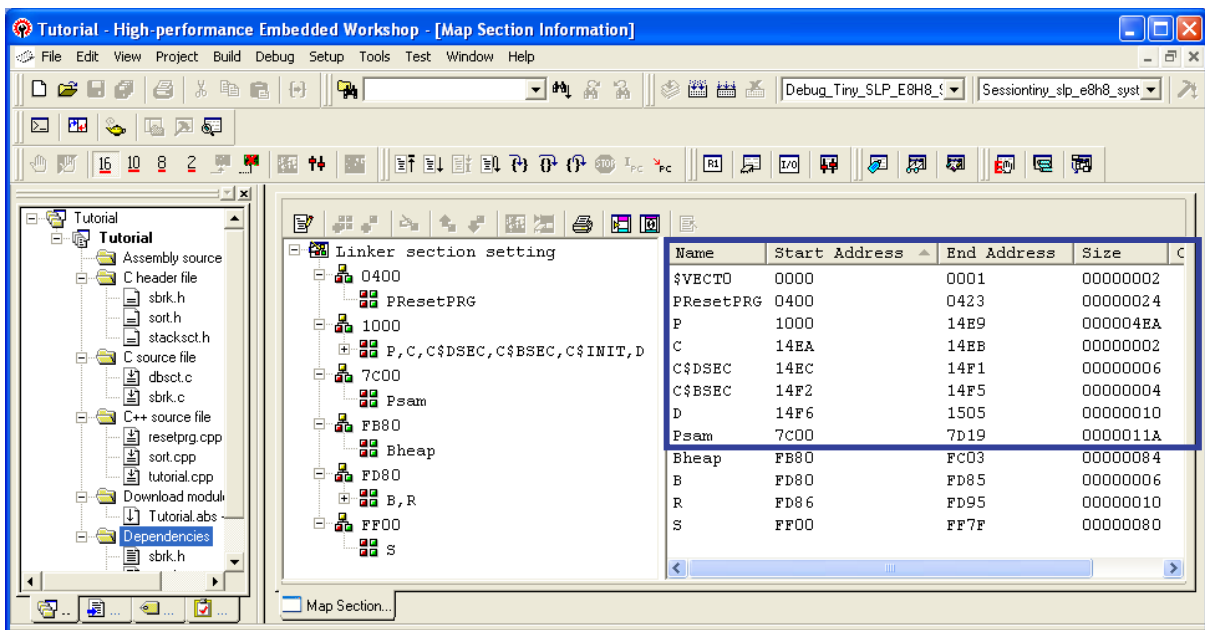
(10) Upon completion of downloading, a message box containing the text "Sum data" and "Flash memory writing OK." appears. Read the messages and click on the [OK] button.

A message box to inform that the programming has completed appears. Click on the [OK] button.

(11) Programming of the flash memory is now complete.

In this example, the E8 is writing data to the flash-memory area beyond address H'7000. Since the E8 emulator occupies the range from H'7000 to H'7FFF in the flash memory to control debugging, no program or data can usually be written to this range. In the programmer mode, however, the E8 is capable of programming the whole flash-memory area.

This allows the user to store a program whose size is equal to or smaller than that of the flash memory in the microcomputer and verify the user-system operation.

After programming of the flash memory has been completed, exit the E8 emulator software.

Note:

Debugging is not possible if the E8 emulator has programmed flash memory in the programmer mode because the flash memory does not contain a program for the E8. The user-system operation must be verified and evaluated independently of the E8.

(12) To check the current emulator mode, select [Setup -> Emulator -> Emulator Setting].
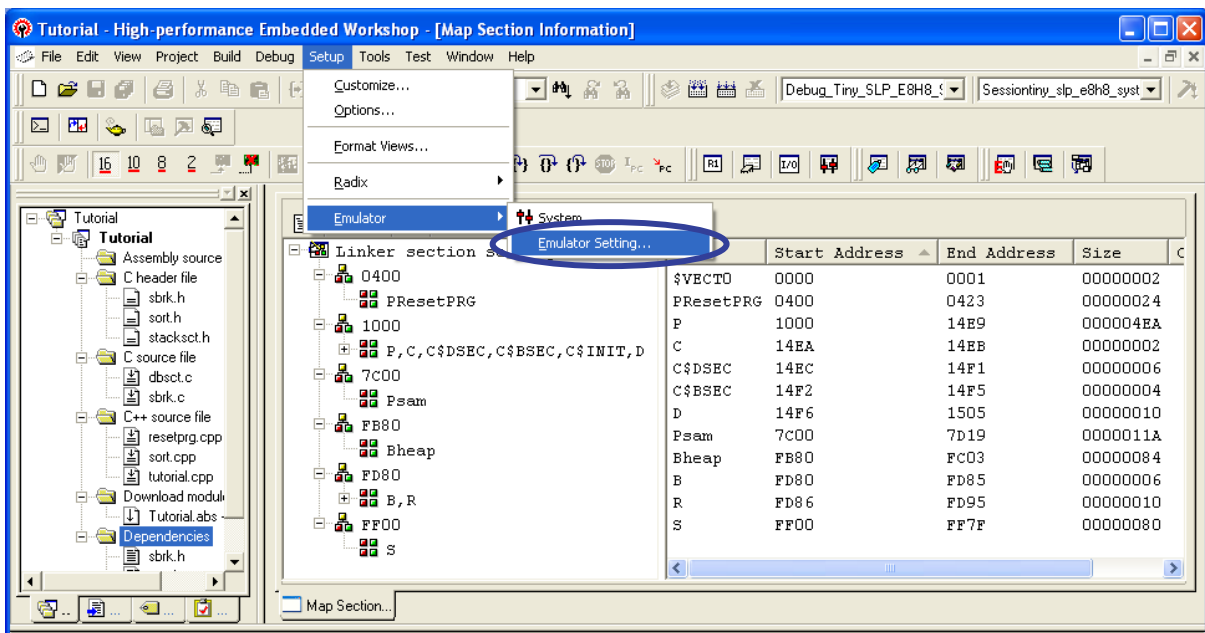
The [Emulator Setting] dialog box opens. The [Mode] section shows the emulator modes in gray. Check which radio button is currently selected.
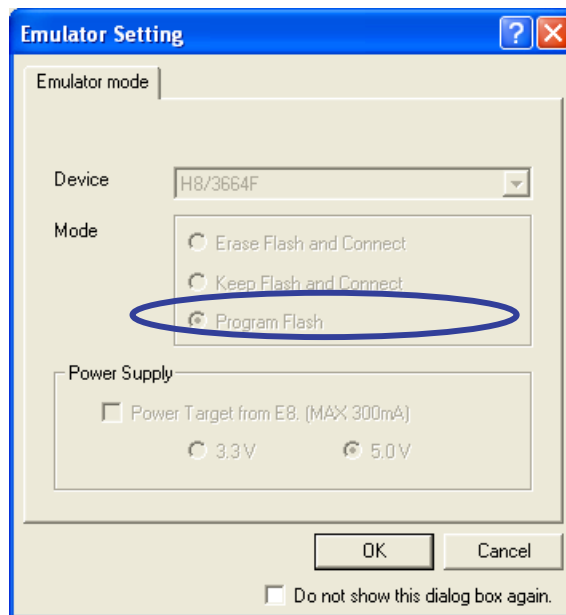

The picture shown above is an example where the current emulator mode is [Program Flash]. In this case, debugging by using the E8 is not possible.

While the E8 is connected, items shown in gray cannot be changed. Changing the current settings is only possible when the E8 is being started up.

5. Using the E8 as a Programmer

(1) Select the [Create a new project workspace] radio button in the [Welcome!] dialog box opened at the startup of the High-performance Embedded Workshop.
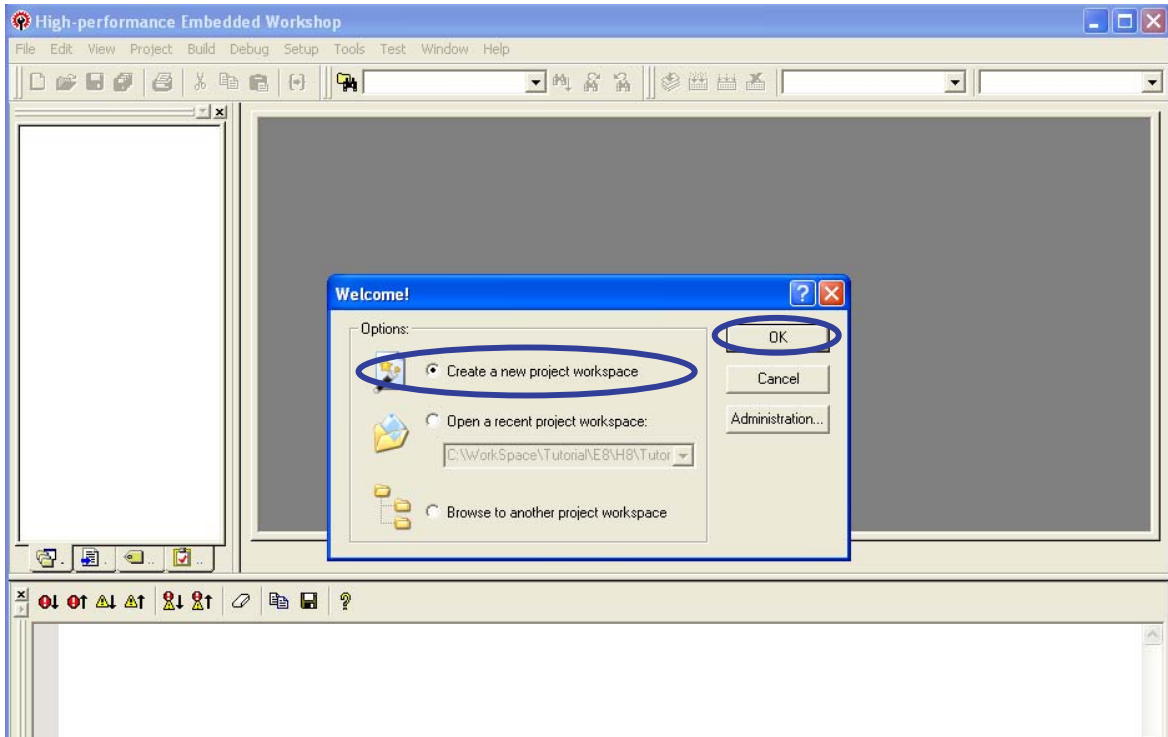
(2) The [New Project Workspace] dialog box opens. Select [None] for [Tool chain] and enter the workspace name in the [Workspace Name] field. Then click on the [OK] button.
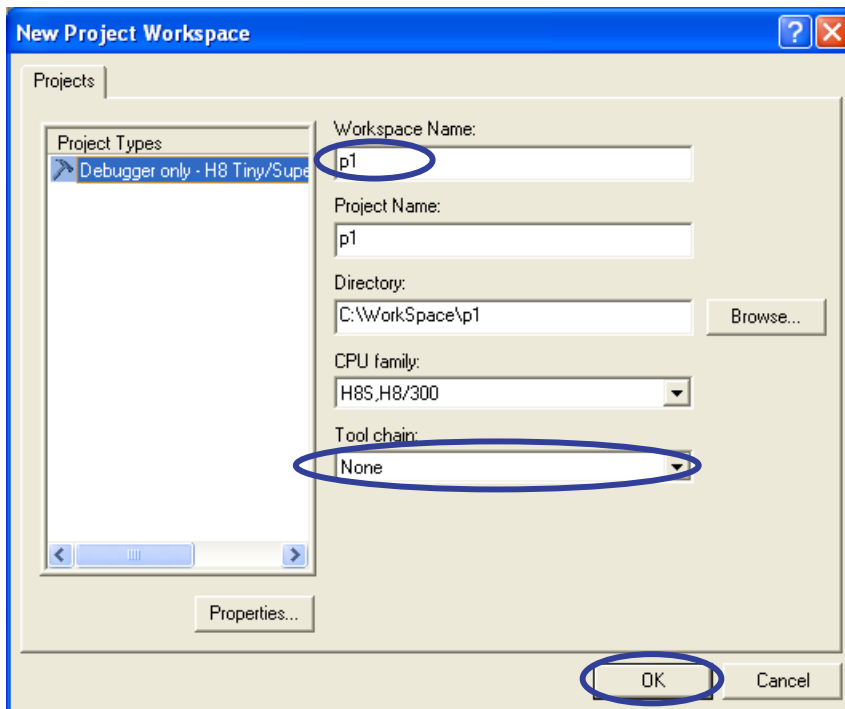
In this example, the workspace name is "p1".

(3) Select the target and click on the [Next] button.
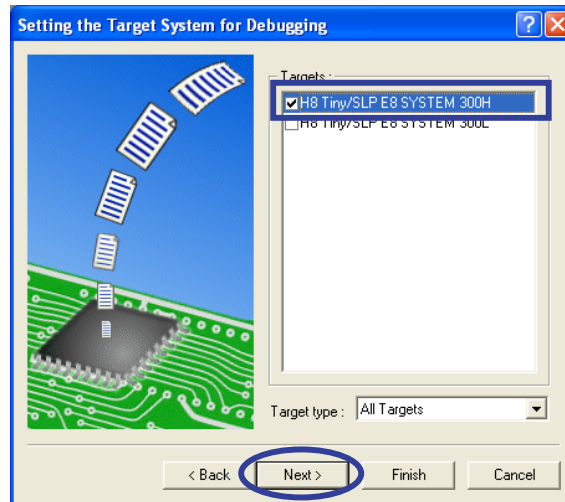
(4) The [Setting the Debugger Options] dialog box opens. Keep the default setting and click on the [Finish] button.

(5) The [Project Summary] dialog box appears. Click on the [OK] button.

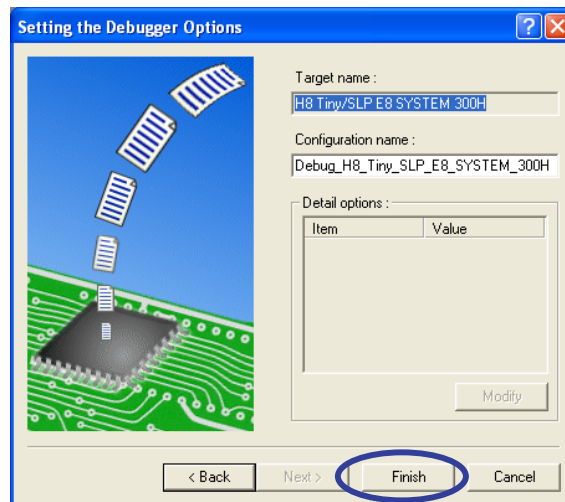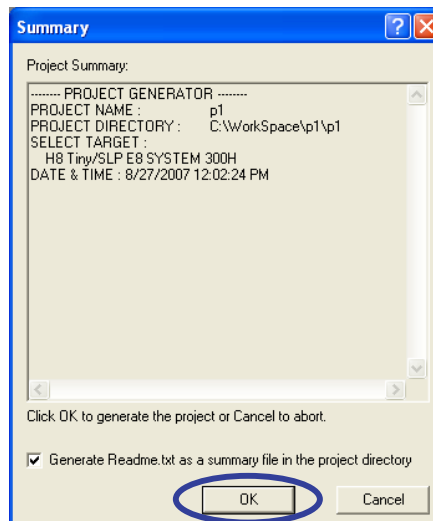(6) The [Emulator Setting] dialog box opens. Select the target device from [Device]. For [Mode], select [Program Flash]. Then,make settings for [Power supply] that fit your system and click on the [OK] button.
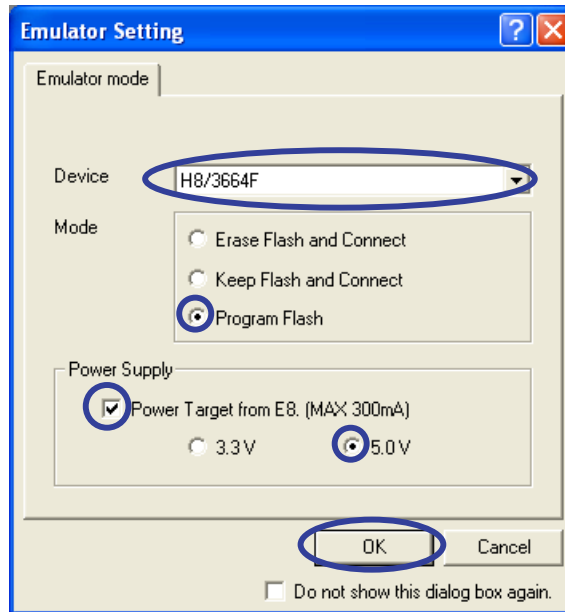
If the [Emulator Setting] dialog box does not appear, select [Connect] from the [Debug] menu.

If you intend to program flash memory in mass-produced microcomputers, do not use the function to supply power from the E8 to the user system.

(7) The [System Clock] dialog box opens. Enter the value that agrees with the actual operating frequency of your system.
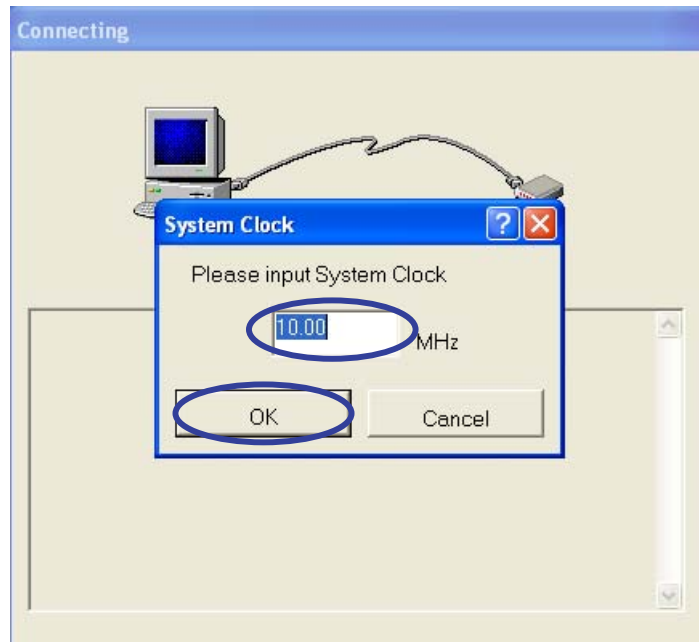
(8) On completion of the connection, the entire on-chip flash memory is in the erased state.
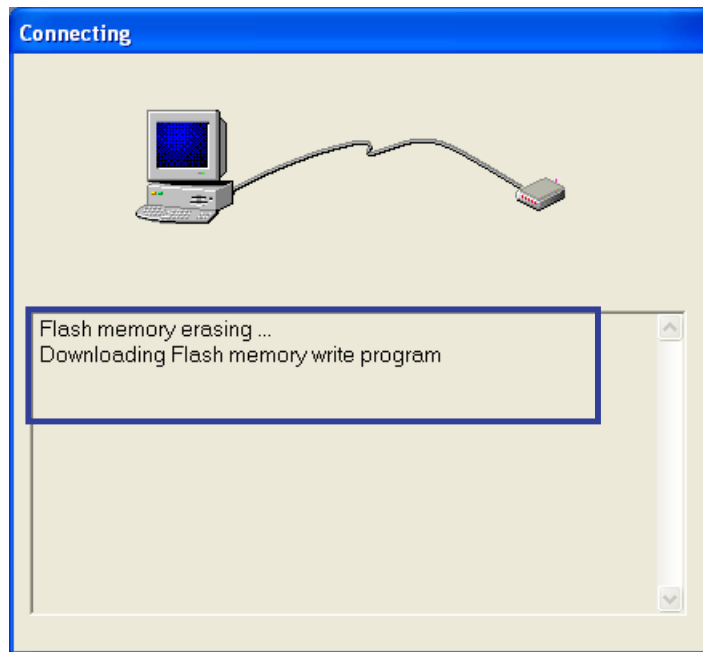
(9) Select [Debug settings] from the [Debug] menu.
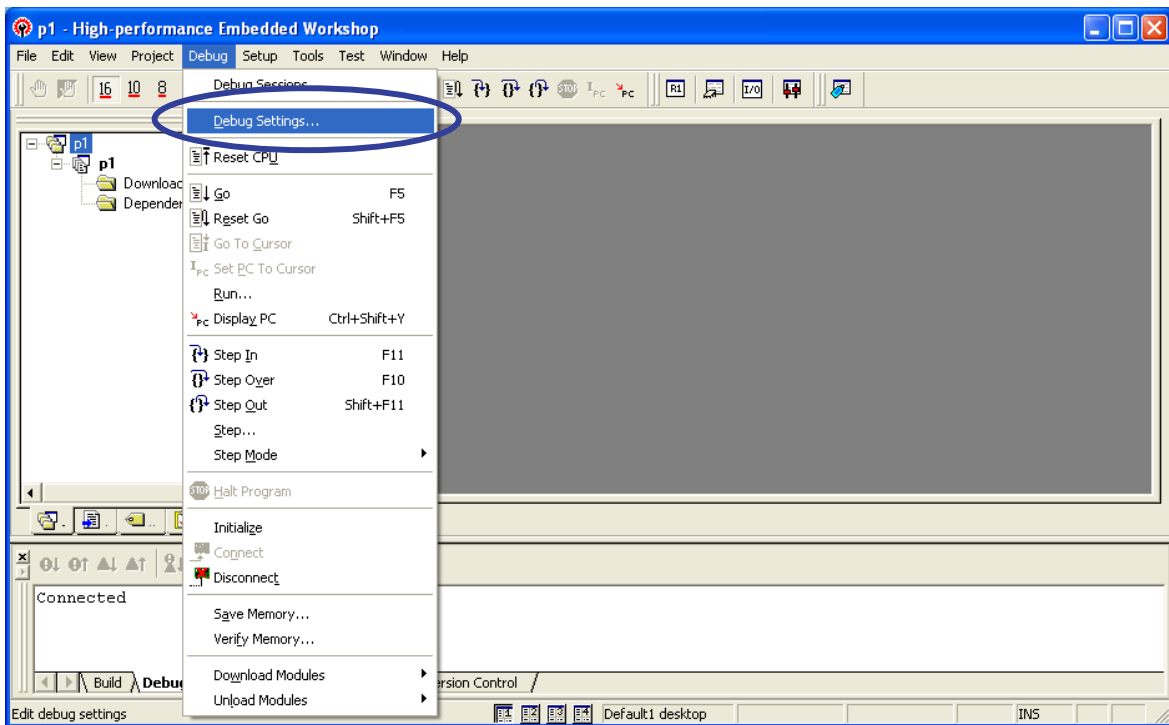
(10) The [Debug Settings] dialog box appears. Click on the [Add] button.
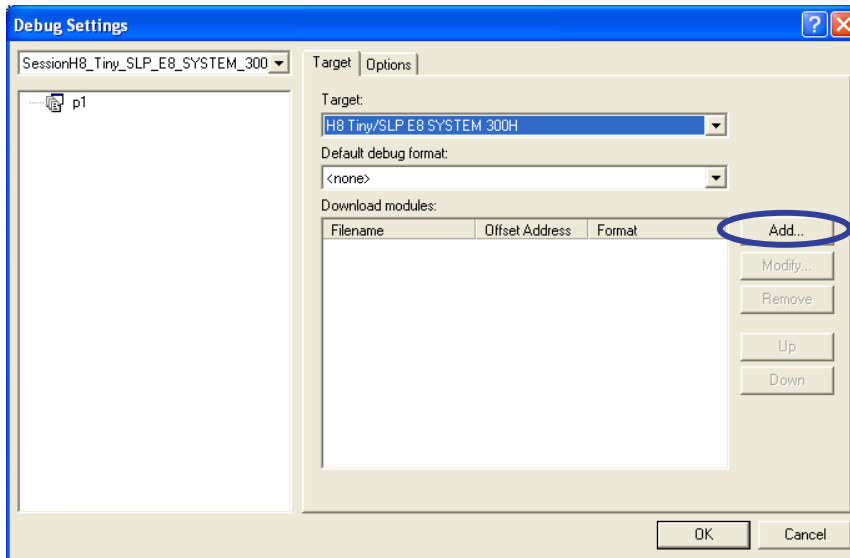
(11) The [Download Modules] dialog box opens. Select the file format from [Format] and click on the [Browse] button to select a file you wish to download (i.e., to be written to flash memory).
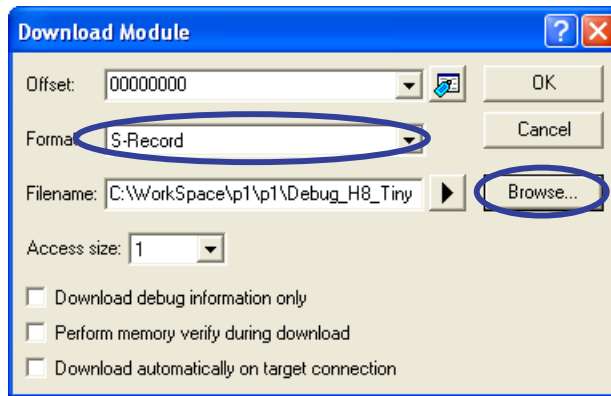
(12) Check the settings in the [Debug Settings] dialog box and click on the [OK] button.
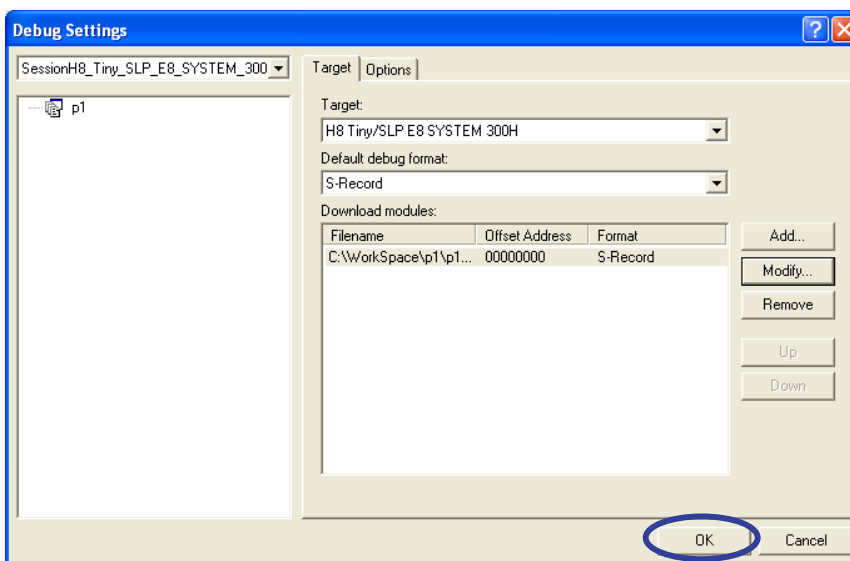
(13)The [Download modules] list box shows the file you have selected.
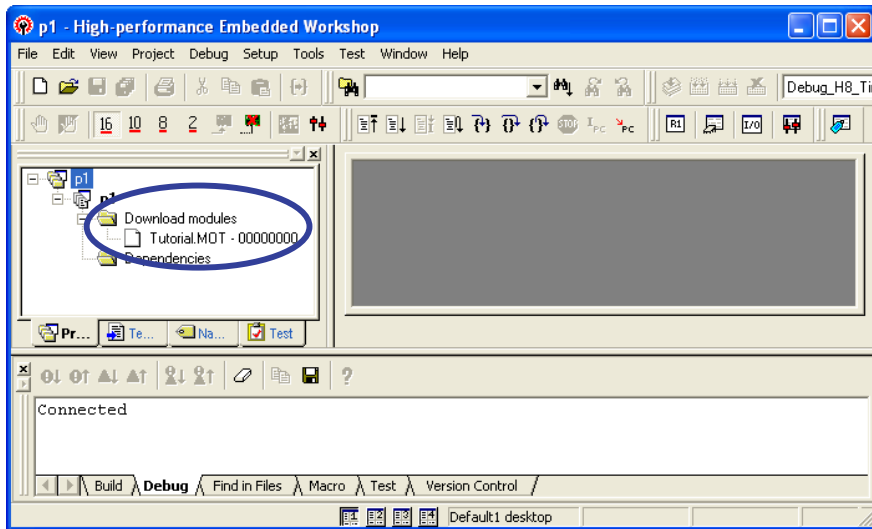
No data have yet been written to the flash memory.

(14)Select the file and right-click to open a popup menu. Select [Download] to start downloading.
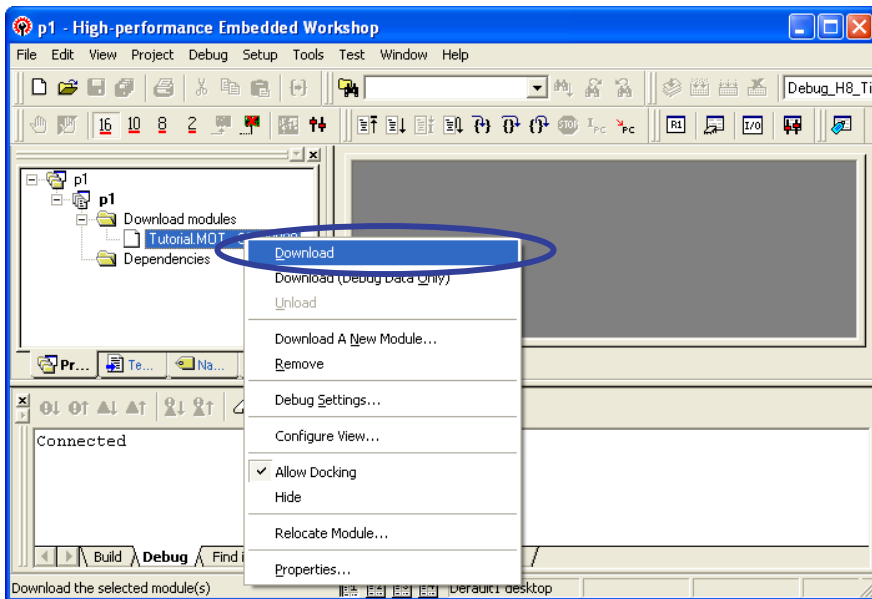
(15)Upon completion of downloading, a message box containing the text "Sum data" and "Flash memory writing OK." appears. Read the messages and click on the [OK] button.
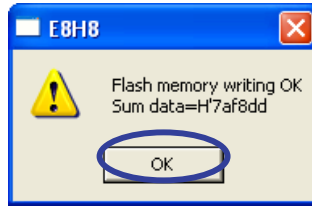
A message box to inform that the programming has completed appears. Click on the [OK] button.

(16)Programming of the flash memory is now complete.
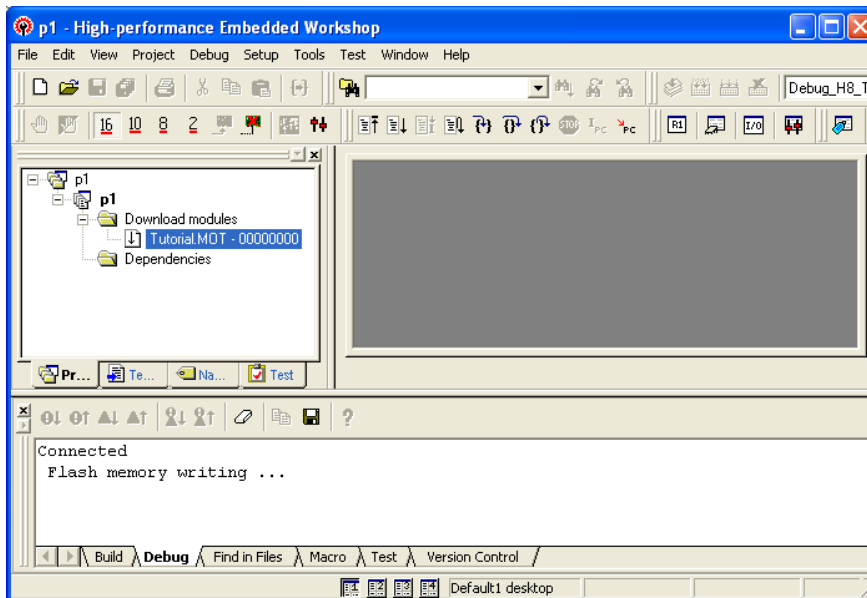
After programming has been completed, exit the E8 emulator software.

(17)The next time you start up the HEW, open the workspace you have created in this section.
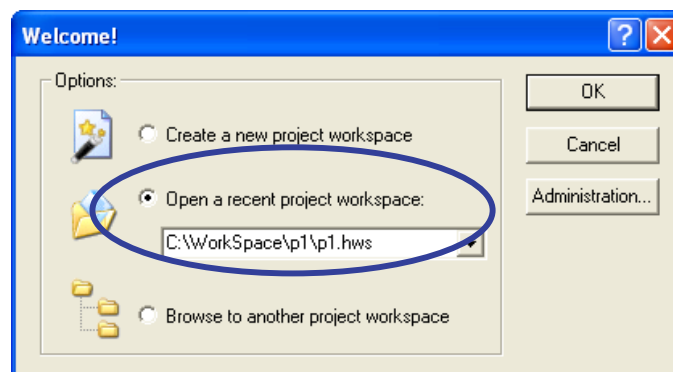
The subsequent procedures are the same as those given in section 4.6 (6) and later.
The HEW can also be started up by double-clicking on a HEW workspace file (with extension ".hws") in the Windows Explorer, etc.

(18) If you wish to select one from multiple workspace files, add these files to the [Debug Settings] dialog box beforehand.
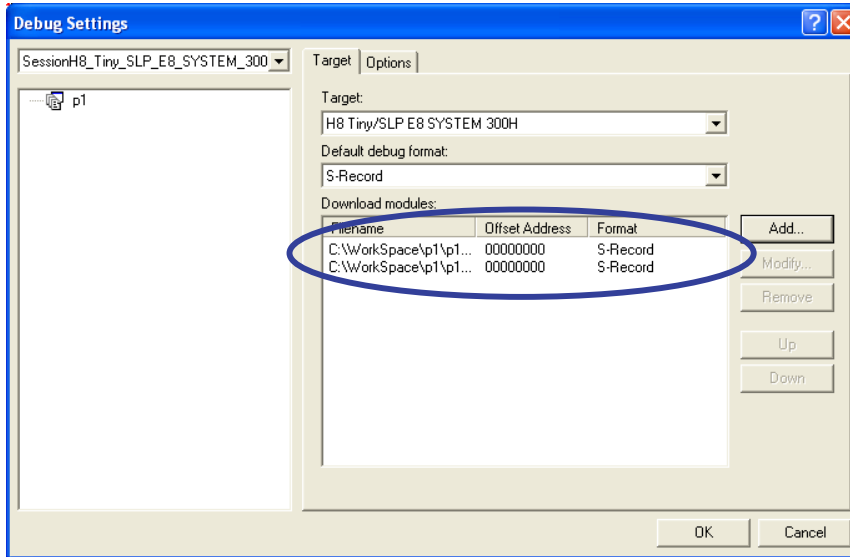
This allows the user to select a desired file in the [Workspace] pane.

Note, however, that only one file is selectable for downloading. It is not possible to download two or more files at the same time.
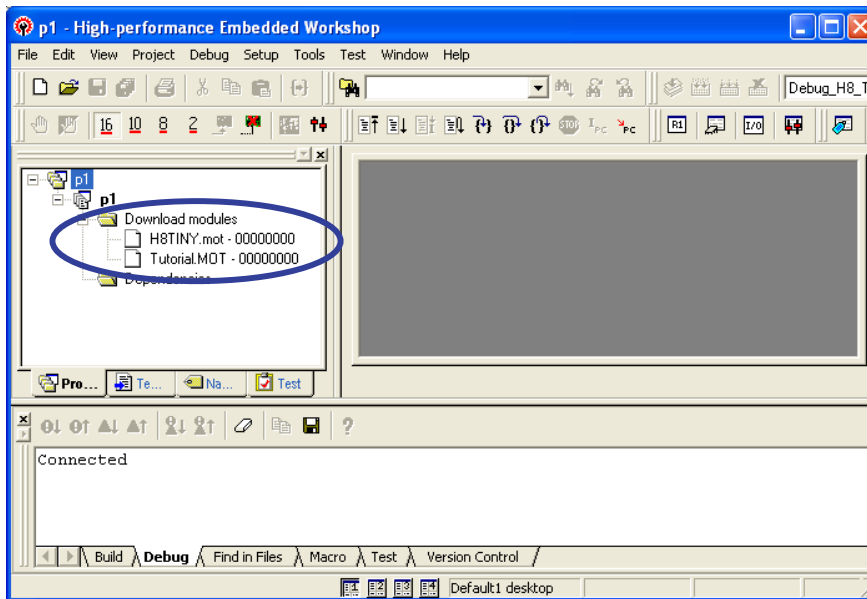
(19) If you wish to change the target board of the user system, select [Initialize] from the [Debug] menu.
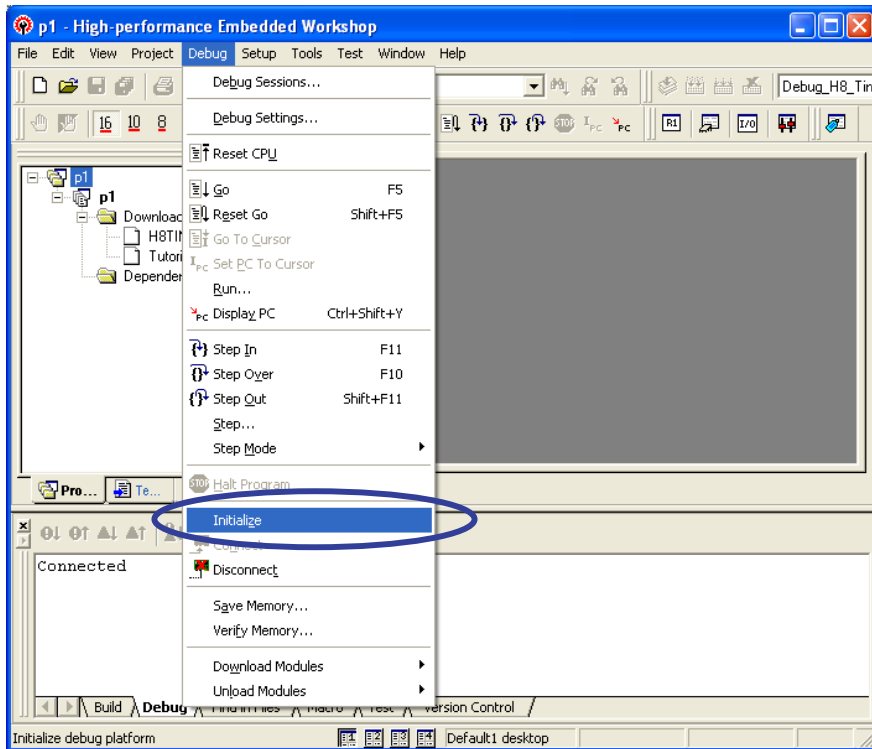
Change the board after "Disconnected" is shown on the [Debug] tabbed page of the [Output] pane.

6. Frequently Asked Questions

6.1 Can you provide any notes on checking the operation of the microcomputer operating independently of the emulator after debugging has been completed?

The notes given below are based on the assumption that the microcomputer is an H8 and that the specifications of the E8 emulator have led to a problem arising in independent operation. If you have selected [Program Flash], the E8 is capable of programming the whole ROM area as a normal ROM programmer. When checking operation independent of the E8, check the following points.

(1) Settings of the RES and NMI pins when the E8 is disconnected

Examples have been found where the RES or NMI pin had been fixed low when the E8 was disconnected, and this led to incorrect operation of the microcomputer (for example, if a pull-up resistor is not connected to the NMI pin on the board, disconnecting the E8 will also make the pin not connected).

(2) Checksum affected by areas occupied by the E8

As stated in the separate manuals for the individual devices, certain ROM areas are occupied by the E8. If the initialization section of a user program is calculating the checksum of data in all ROM areas, the checksum value will differ according to whether [Erase Flash and Connect] or [Program Flash] has been selected, because the contents of some regions of memory will be different. If you intend to calculate the checksum of data in ROM, take this point into account when creating your program.

(3) WDT setting

According to its specification, the E8 emulator may turn the WDT off during debugging.

The WDT may thus become active in independent operation of the actual device, even though the WDT wasn't active during debugging.

Firstly, refer to the hardware manual of the device you are using to check whether the WDT is initially on or off. If you have selected [Erase Flash and Connect], it is only possible to check the independent operation of the actual device after the E8 has been disconnected because the E8 performs debugging while programming the on-chip flash ROM. However, if PC breakpoints that have been set remain, a break instruction written to the ROM may lead to incorrect operation. For this reason, select [Keep Flash and Connect] where possible. If you wish to select [Erase Flash and Connect] for some reason, remove all breakpoints and ensure that the ROM has been correctly programmed before disconnecting the E8.

(4) Initialization of the stack pointer in the user program

In debugging with the E8 emulator, the debugger may initialize the stack pointer. Even if the device appears to be operating correctly during debugging, the operation of the actual device may be incorrect because the stack pointer has not been initialized beforehand. The stack pointer must be initialized in the user program.

7. Typical Error Messages and Resolutions

(1) Driver Error : Illegal driver inter face select

Communication with the E8 is not available. Disconnect the USB cable from the host computer and re-connect it.

(2) Driver Error：No available communication devices found.

The E8 is not connected. Check the state of the USB connector.

(3) Connector disconnected. Please, connect and press <Enter> key.

The user board and the E8 are not connected. Connect them and press the Enter key.

(4) Invalid value

An invalid value has been selected as the operating frequency. Check the oscillator on the user board.

(5) Flash memory erase error ! Change device

Erasing of the flash memory has failed. Change the device.

(6) Flash memory write error

Programming of the flash memory has failed.

This may be because the voltage on the user board is 3.0 V or lower while the E8 is operating in the programmer mode.

(7) Communication timeout error

The device does not respond.

Refer to the Frequently Asked Questions regarding the E8 on the Renesas website.

8. Related Documents

The E8 emulator and High-performance Embedded Workshop provide many other useful functions not mentioned in this document.

Please refer to the following related documents for important information such as detailed specifications, technical information, or restrictions.

Documents Related to the E8 Emulator:

- E8 Emulator User's Manual

- E8 Emulator Additional Document for Users Manual, Notes on Connecting the H8/3664F and others

Documents Related to High-performance Embedded Workshop:

- High-performance Embedded Workshop User's Manual

- High-performance Embedded Workshop Release Notes

Documents Related to CPU:

- H8/3664 Group Hardware Manual

- H8/300H Series Programming Manual

Documents Related to H8S, H8/300 Series C/C++ Compiler Package:

- H8S, H8/300 Series C/C++ Compiler, Assembler, Optimizing Linkage Editor User's Manual

- Notes on Usage of the C/C++ Compiler Package for H8S, H8/300 series

Information on this product is available at the following Renesas websites:

Global site:	http://www.renesas.com/e8

Japanese site:	http://japan.renesas.com/e8

Renesas Website and Customer Support

Renesas Technology Website:
http://www.renesas.com/

Customer Support:
http://www.renesas.com/inquiry
csc@renesas.com

Revision Record

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		Page	Summary
1.00	Sep.26.07	—	First edition issued

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