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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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### SH7146/SH7149 Group

#### Delay Activation of A/D Converter using MTU2

#### 1. Introduction

This application note describes the procedure to execute the sample program on the Renesas Technology CPU board with the E10A-USB emulator.

#### 1.1 Specifications

Three-phase complementary PWM waveforms including dead time are output from MTU2 channel 3 and 4, and a toggle output synchronized with the PWM period is output from TIOC3A pin. The A/D converter is activated at the time of compare match between TCNT\_4 and TADCORA\_4. The timing of A/D converter activation is updated every compare-match interrupt for MTU2 channel 3. The converted value is stored in RAM by A/D conversion end interrupt.

#### 1.2 Modules Used

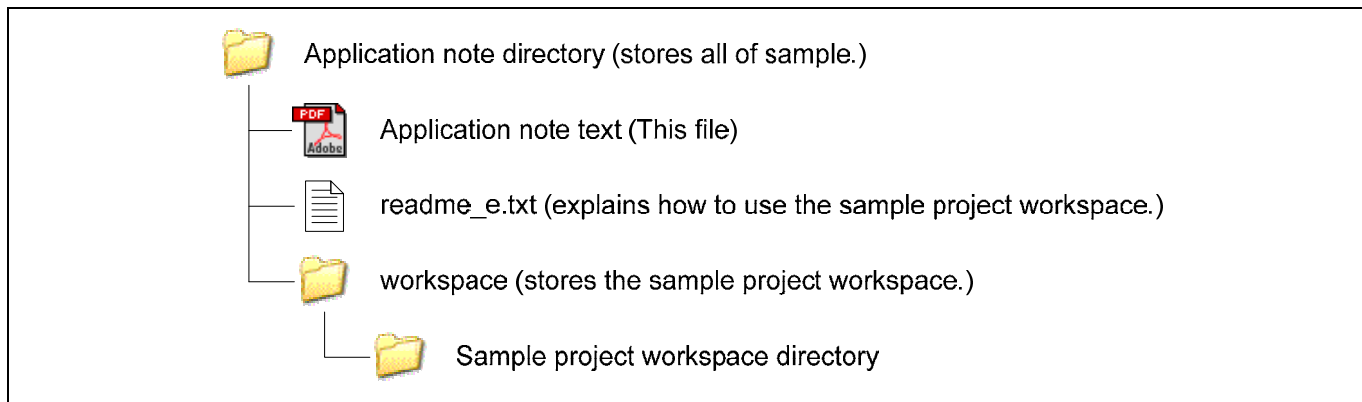
- 10-bit A/D converter

#### 1.3 Applicable Conditions

MCU	SH7149
Operating Frequency	Internal clock: 80 MHz Bus clock: 40 MHz Peripheral clock: 40 MHz
Integrated Development Environment	Renesas Technology Corp. High-performance Embedded Workshop Ver.4.04.01
C compiler	Renesas Technology SuperH RISC engine Family C/C++ compiler package Ver.9.02 Release 00
Compiler options	-cpu=sh2 -include="\$(WORKSPDIR)\inc" -object="\$(CONFIGDIR)\\$(FILELEAF).obj" -debug -gbr=auto -chgincpath -errorpath -global_volatile=0 -opt_range=all -infinite_loop=0 -del_vacant_loop=0 -struct_alloc=1 -nologo

#### 1.4 Directory Configuration of the Sample Program

The sample program consists of the following directories.



**Figure 1.1 Directory Configuration**

Note: Names of the application note directory, application note text (this file), or sample project workspace directory depends on the application note referred.

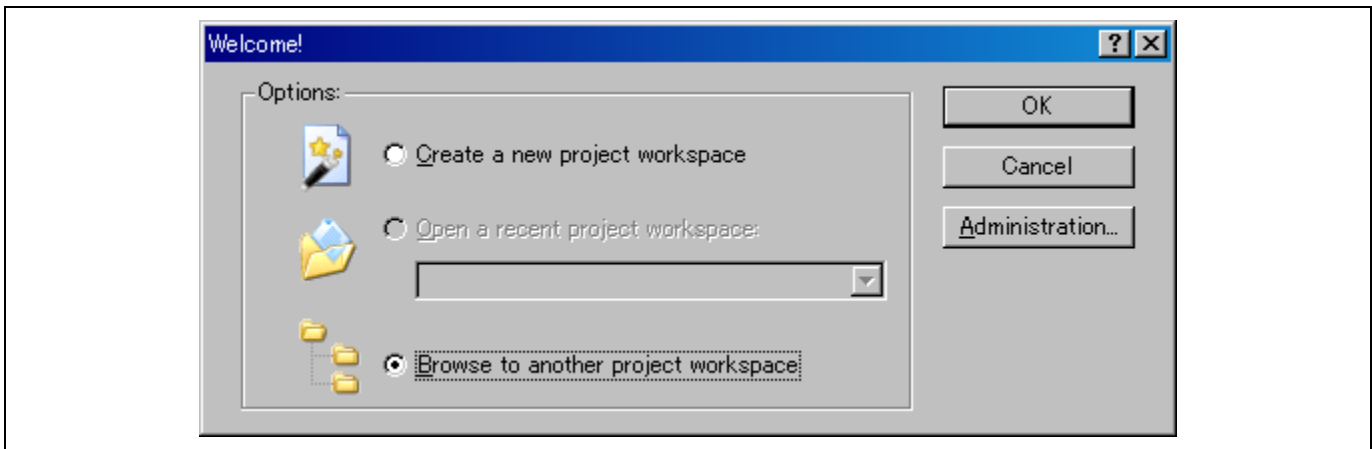
## 2. Downloading the Sample Project Workspace

Copy the "sample project workspace directory" into the working directory of the host computer ("WorkSpace"). When the sample project workspace directory is created with a read-only attribute, cancel the read-only attribute. Do not use double-byte characters in the directory path. Presence of such characters may cause the wrong operation of the cross tools.

The explanation below assumes that the sample project workspace directory has been copied to the working directory of "C:\WorkSpace".

## 3. CPU Board and E10A-USB Startup Procedure

- (1) Connect the host computer and the E10A-USB emulator.
- (2) Connect the CPU board and the E10A-USB emulator. (Do not turn ON the power for the CPU board yet.)
- (3) Select [Start] menu, -> [All Programs] -> [Renesas] -> [High-performance Embedded Workshop] (folder) -> [High-performance Embedded Workshop].
- (4) The [Welcome!] dialog box shown below will appear.
- (5) Select the "**Browse to another project workspace**" radio button, and click "OK".



**Figure 3.1 [Welcome!] Dialog Box**

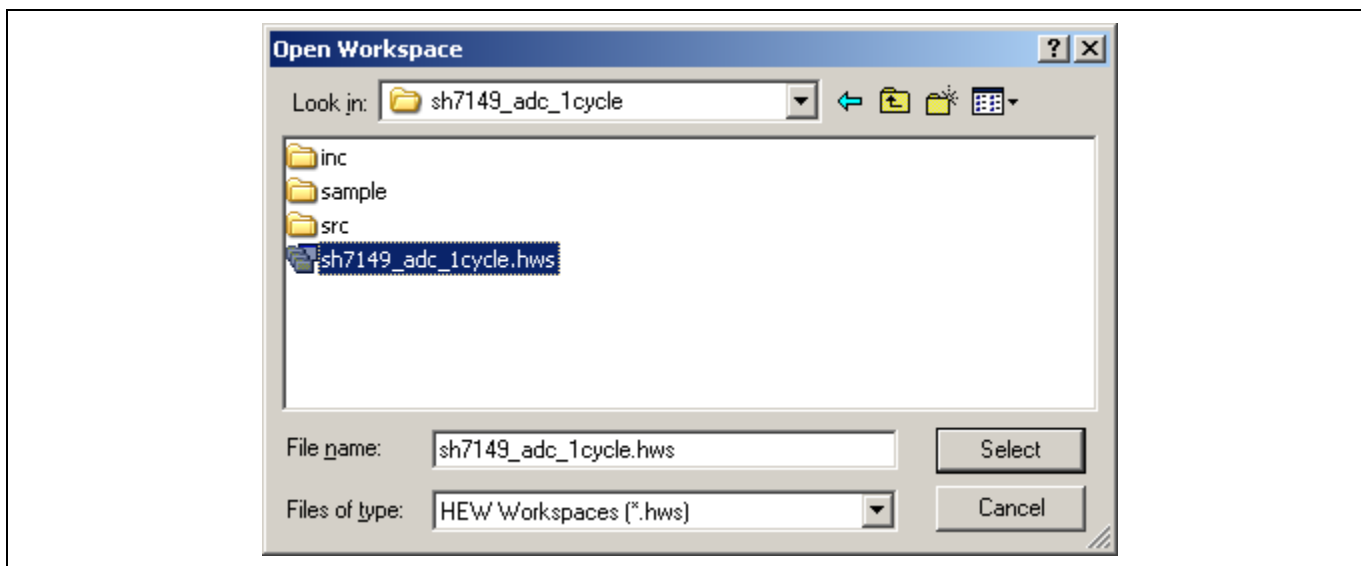
Note: A project workspace is a user's working area to store projects and their configurations. A project consists of a configuration necessary to create programs or final binary files and a set of files. For more information about the project workspace, refer to the "SuperH RISC engine High-performance Embedded Workshop 4 User's Manual".

(6) The [Open Workspace] dialog box shown below will appear. Specify the directory as below in the dialog box. This application note describes an example to execute the "sh7149\_adc\_1cycle".

- Directory that stores the sample project workspace:

"C:\WorkSpace\sh7149\_adc\_1cycle"

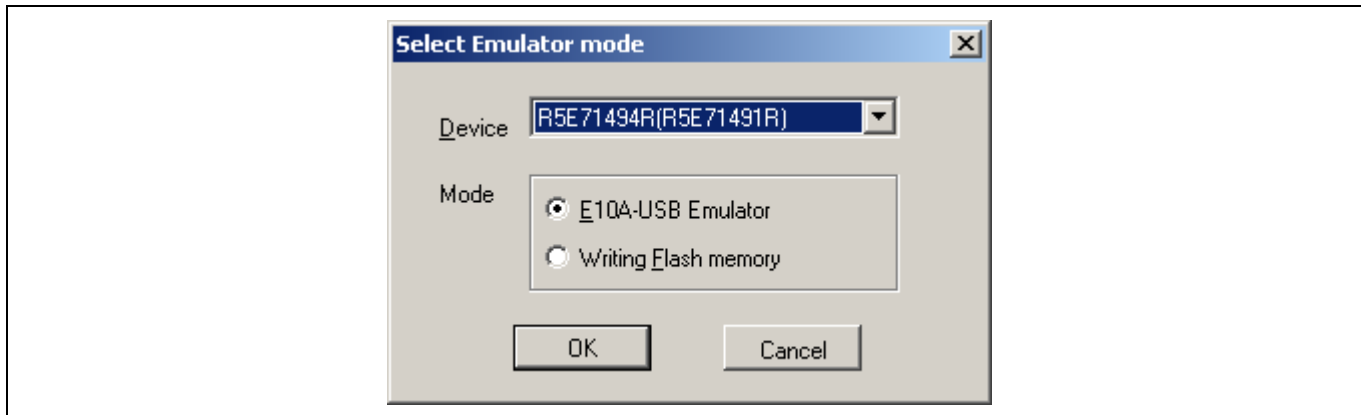
(7) After specifying the directory, select the following file and click "Select" to open.



**Figure 3.2 [Open Workspace] Dialog Box**

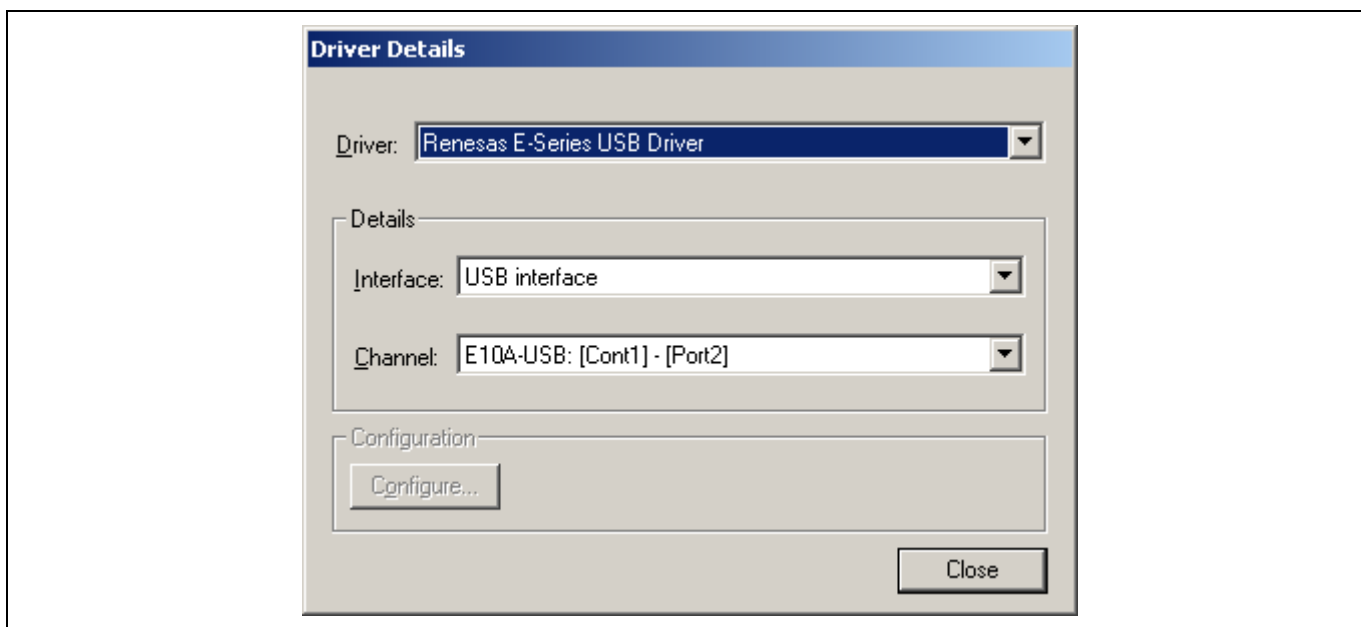
Note: The dialog box that indicates the directory in the workspace has been moved may appear at the first time. Click "Yes" to continue.

(8) The [Select Emulator mode] dialog box will appear. Select the item for the Device and for the Mode. Then, click "OK".



**Figure 3.3 [Select Emulator mode] Dialog Box**

Note: A message "Please choose driver" will appear at the first time. Click "OK" to show the following window to select the driver. Select "Renesas E-Series USB Driver".



**Figure 3.4 [Driver Details] Dialog Box**

(9) Following dialog box will appear. Leave the dialog box, and turn ON the power for the CPU board. Then, press the reset button on the CPU board and click "OK" on the dialog box as shown in Figure 3.5.

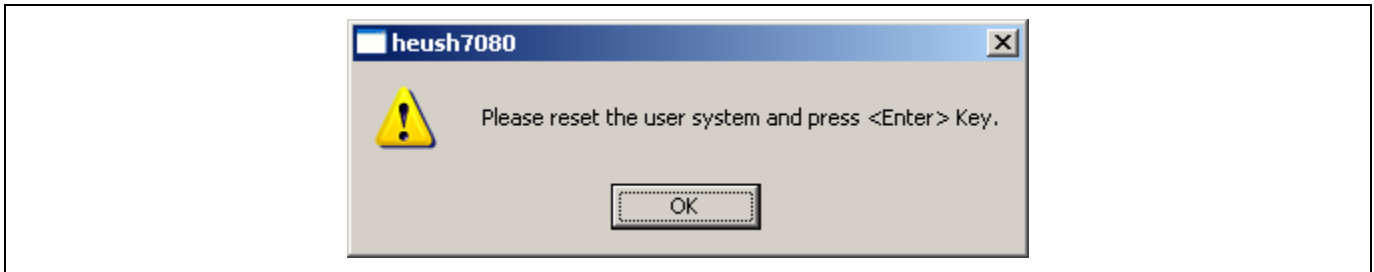


Figure 3.5 Dialog Box to request the Reset signal input

(10) The [System Clock] dialog box will appear. Enter the input clock frequency for the target device, and click "OK". 10.00 (MHz) is entered in this example.

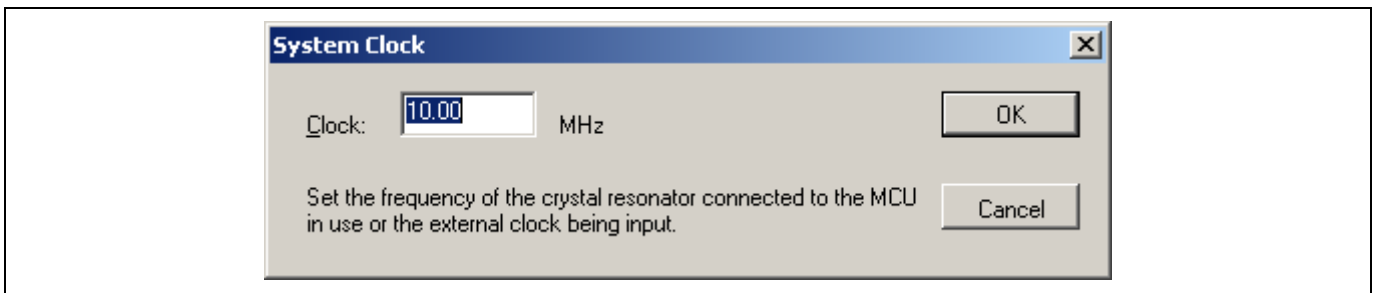


Figure 3.6 [System Clock] Dialog Box

(11) The [ID Code] dialog box will appear. Enter a desired ID code (within eight alphanumeric characters), tick the [New ID code] check box, and click "OK". This eight-digit ID code is necessary for the securing the flash memory.

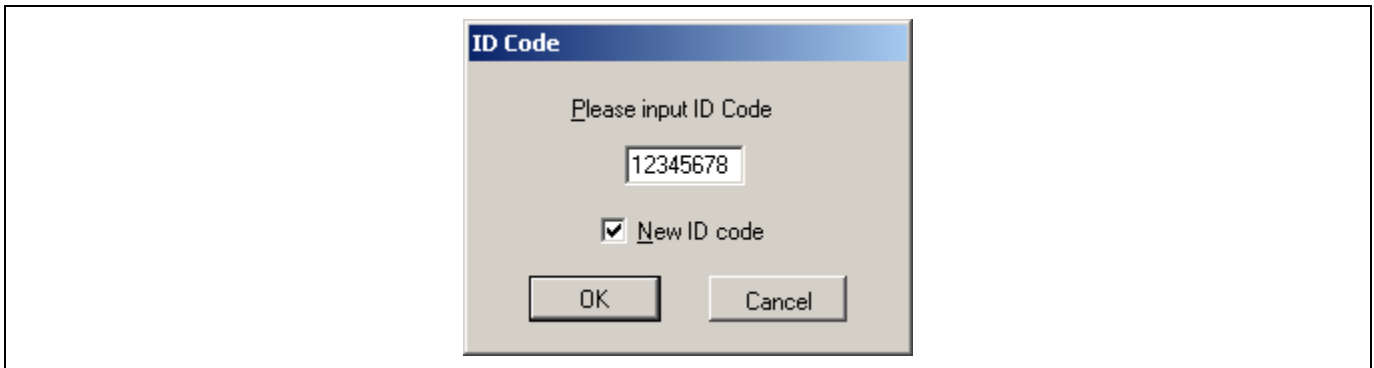
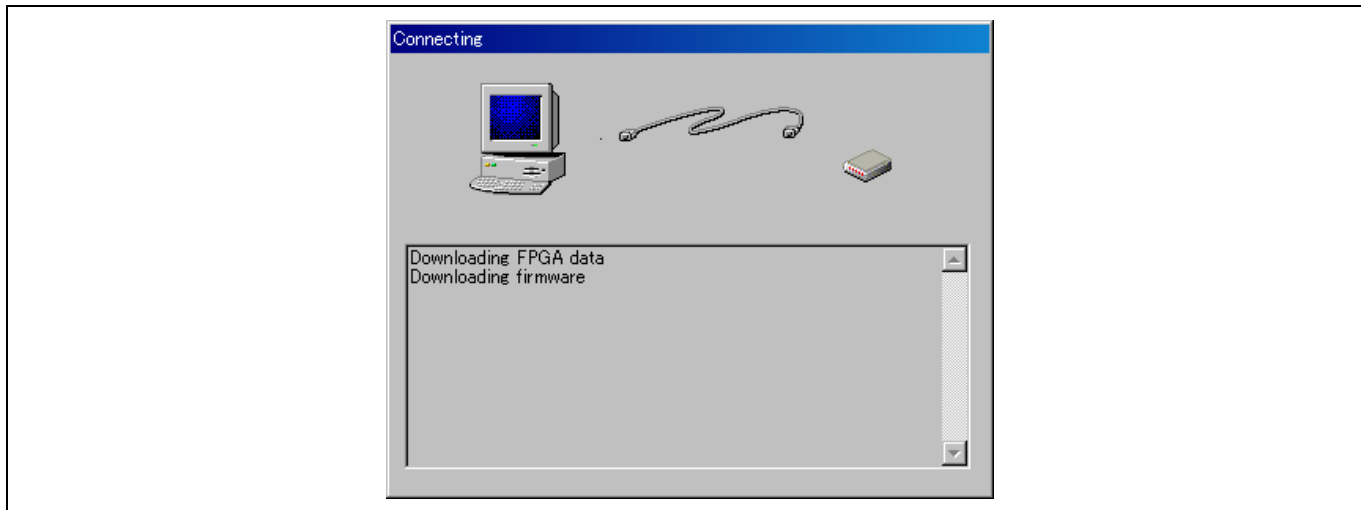


Figure 3.7 [ID Code] Dialog Box

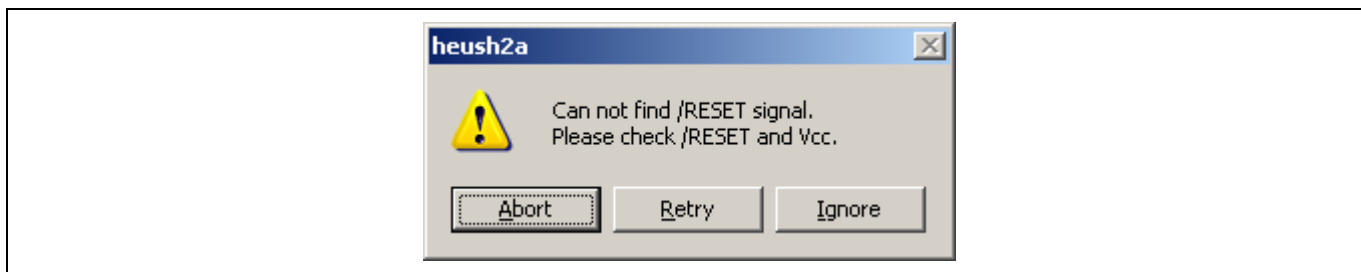
Note: For securing the flash memory, enter a desired ID code; however, "H'FFFFFFF" cannot be set as the ID code. When activating the High-performance Embedded Workshop on the E10A-USB emulator mode after this setting, enter the ID code that is set here, and clear the [New ID code] check box. When entering the wrong ID code or [New ID code] check box is not cleared, the content of flash memory will be erased.

(12) The [Connecting] dialog box will appear, and the system starts to connect the E10A-USB emulator.



**Figure 3.8 [Connecting] Dialog Box**

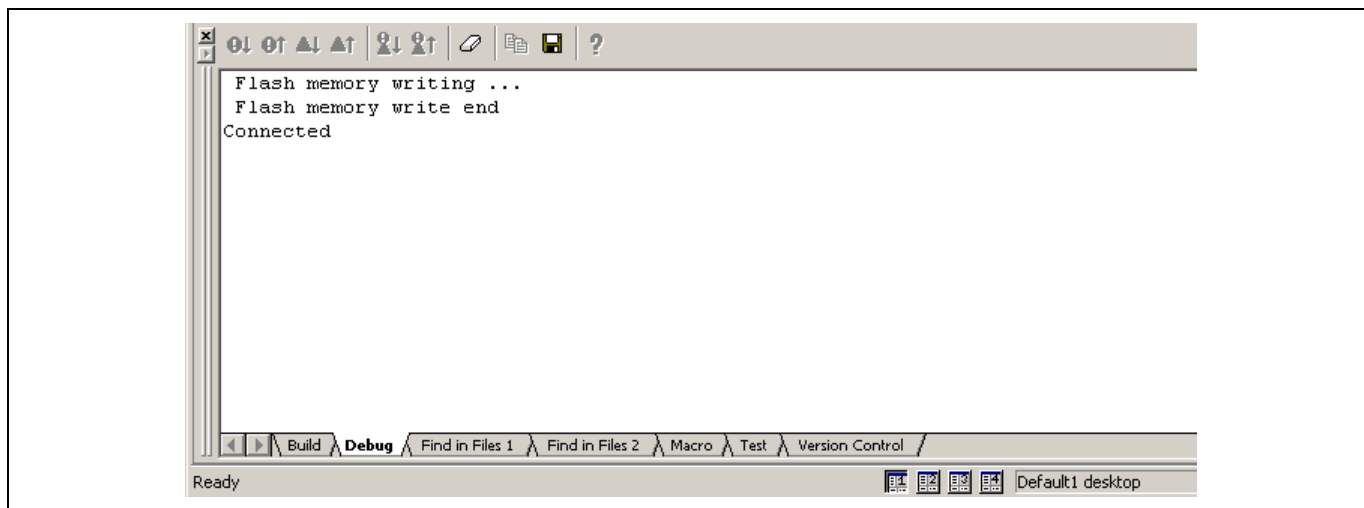
Note: If the reset signal cannot be detected, the dialog box below will appear. Click "Retry", and press the reset button on the CPU board. The window as Figure 3.5 will appear, and press the reset button on the CPU board again.



**Figure 3.9 [Cannot find/RESET signal] Dialog Box**



- (13) When the message "Connected" appears in the [Output] window of High-performance Embedded Workshop, the E10A-USB emulator startup is now completed.



**Figure 3.10 [Output] Window**

#### 4. E10A-USB Emulator Connection Error Dialog

When the E10A-USB emulator does not start up, the following dialog box will appear.

- (a) When the dialog box appears, the CPU board system power may not be supplied. Check the power supply of the CPU board.

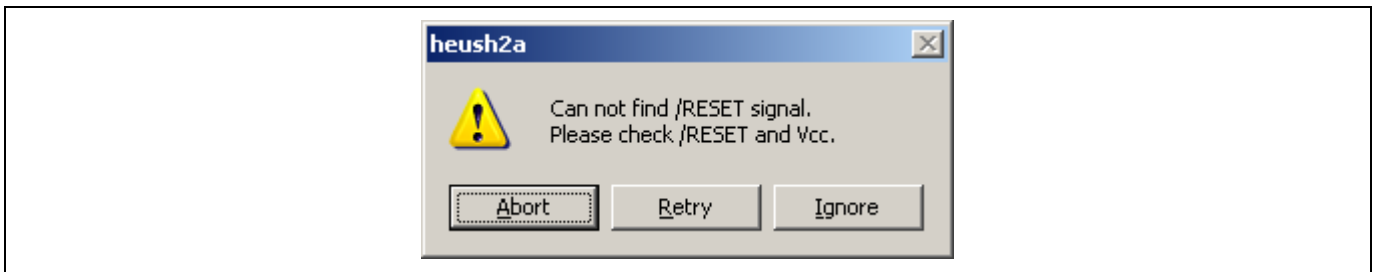


Figure 4.1 [Cannot find/RESET signal] Dialog Box

- (b) When the following dialog box appears, the H-UDI pins and the H-UDI port connector may not be connected correctly. Check the connection between the H-UDI pins and the H-UDI port connector.

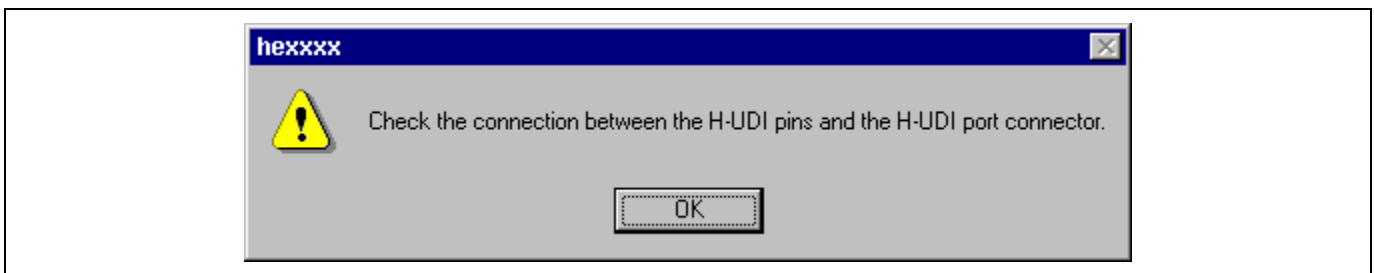


Figure 4.2 [Check the connection] Dialog Box

- (c) When the following dialog box appears, the E10A-USB emulator firmware may not be set up correctly. Use the setup tool or the license tool to for device group addition to set up the firmware for the device group to use.



Figure 4.3 [The Product Currently Connected] Dialog Box

(d) When the following dialog box appears, the version of the firmware set up in the E10A-USB emulator may be old. Use the setup tool to set up the appropriate version of the firmware.

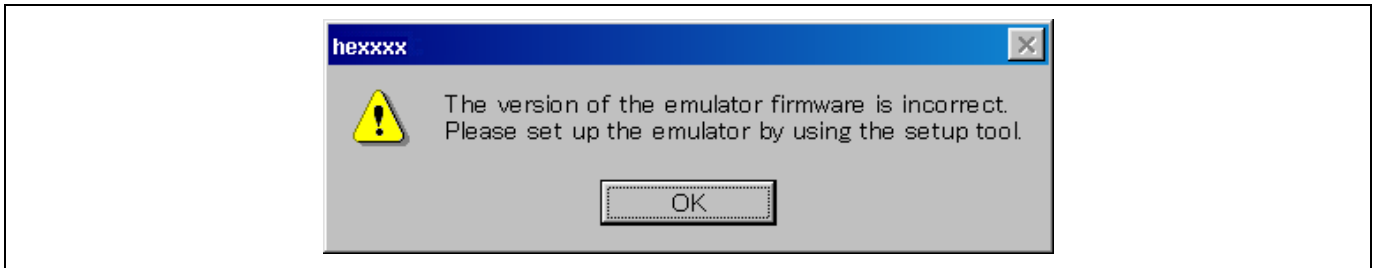


Figure 4.4 [The version of the emulator firmware is incorrect] Dialog Box

(e) If the driver has not been set up correctly, the following dialog box will appear.

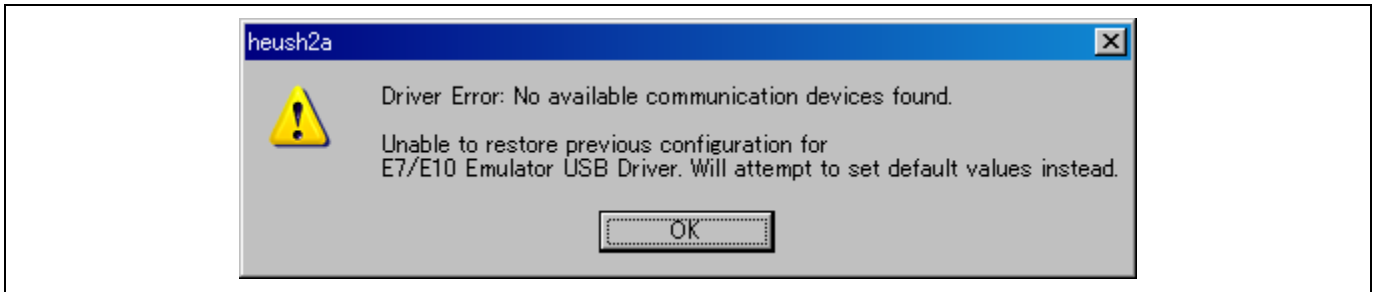


Figure 4.5 [Unable to restore the previous driver setting] Dialog Box

## 5. Downloading the Sample Program

This section describes how to download the load module of the sample program.

### (1) Download the sample load module

Select [Debug] menu, -> [Download Modules] to select the sample load module "sample.abs". Figure 5.1 shows the download operation window.

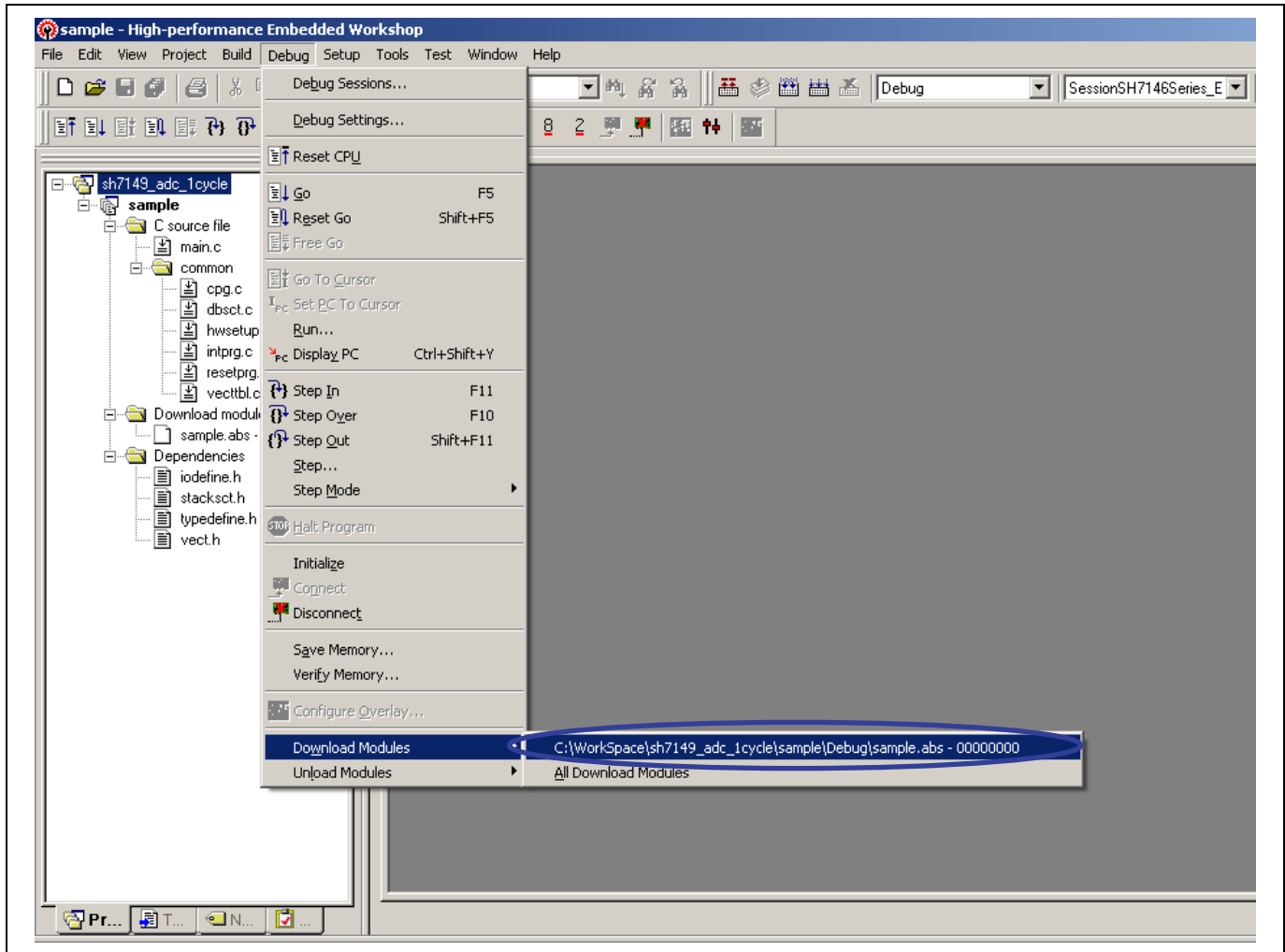


Figure 5.1 [Download Operation] Window

(2) Download completed

When downloading the sample load module is completed, the program counter will appear in the "resetprg.c" (See Figure 5.2).

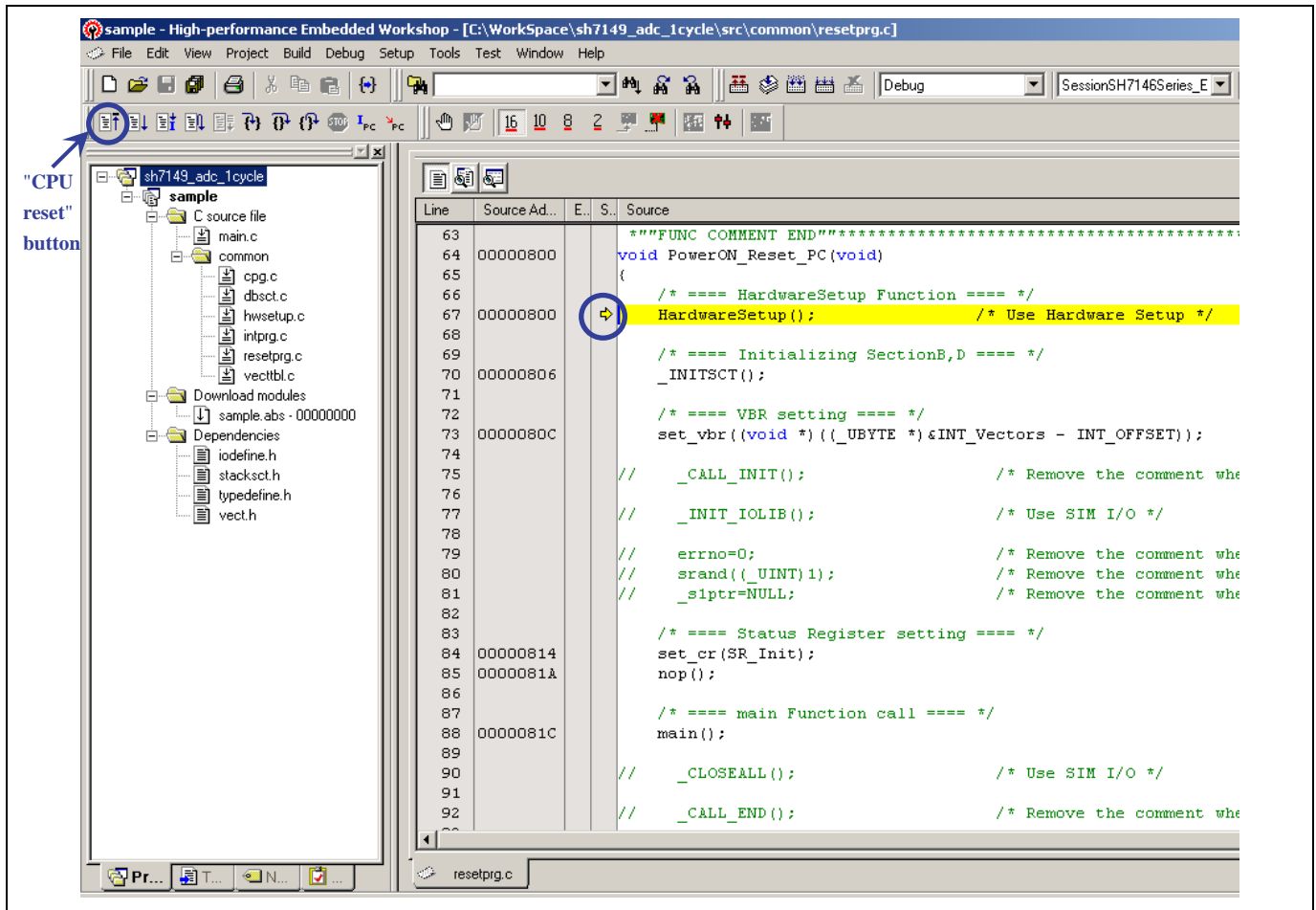
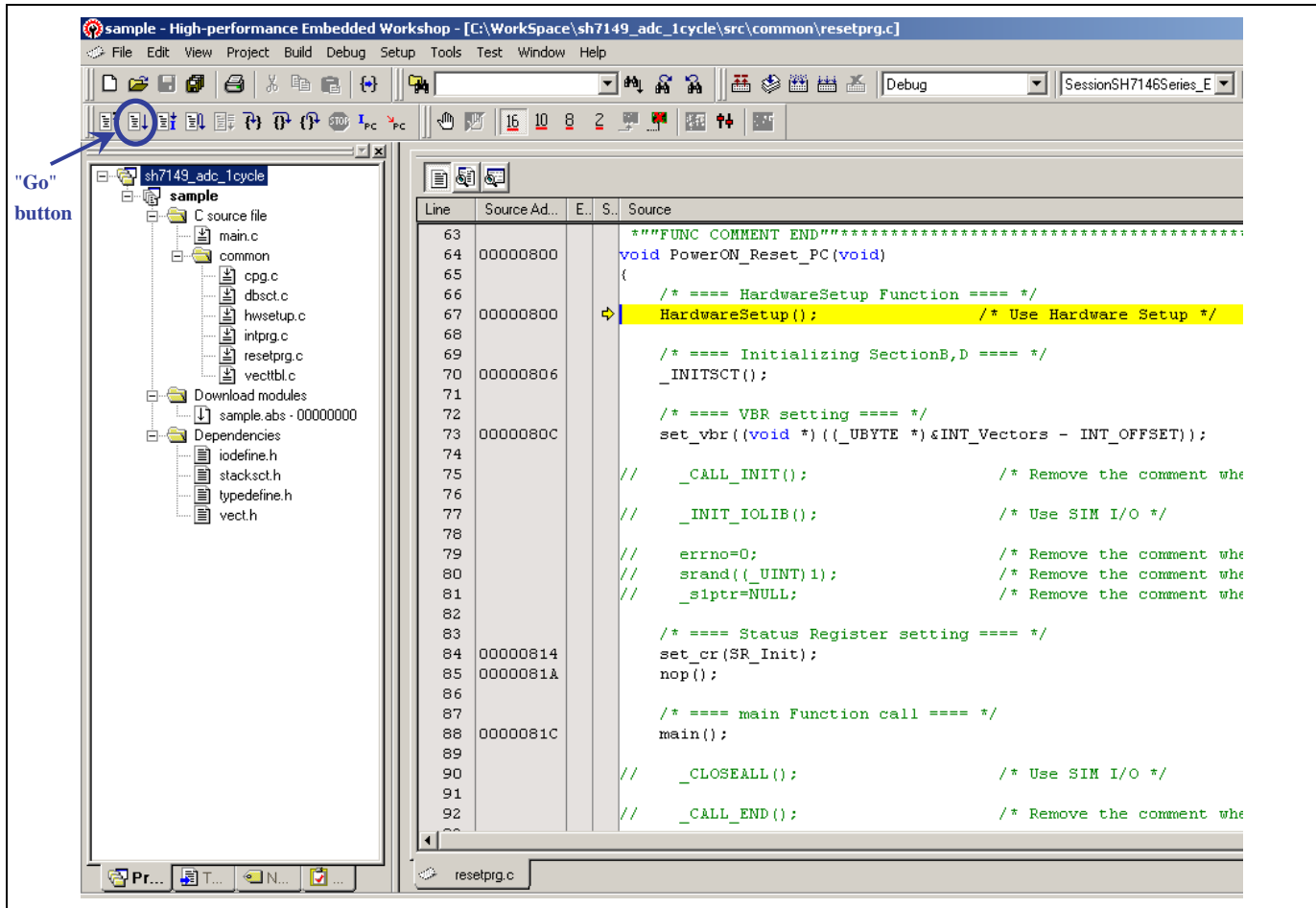


Figure 5.2 [Download Completion] Window

Note: Press the "CPU reset" button of the High-performance Embedded Workshop to show the program counter.

### (3) Execute the program

Select "Go" from the [Debug] menu to execute the program (See Figure 5.3).



**Figure 5.3 Executing the Program**

#### Notes:

- (1) The contents of the "resetprg.c" may depend on the version of the sample program.
- (2) If an error occurs or the sample software does not operate correctly, the hardware or software may not have been set up correctly. Check the setup procedures described in the installation manual.

## 6. More Information

### MCU Evaluation Board User's Manual

SH7149 CPU Board (M3A-HS49) User's Manual (REJ10J0917-0100/Rev.1.00)

### Hardware Manual

SH7146 Group Hardware Manual (REJ09B0229-0300/Rev.3.00)

### Reference Application Note

SH7080/SH7146/SH7125/SH7200 Series: Delayed Activation of A/D Converter Using MTU2  
(REJ06B0477-0100/Rev.1.00)

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## Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Mar.11.09	—	First edition issued

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