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Renesas Electronics Corporation

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User's Manual

H8S, H8SX Family E10A-USB Emulator

Additional Document for User's Manual
Supplementary Information on Using the H8S_custom_SoC

Renesas Microcomputer Development Environment System
H8S Family

E10A-USB for H8S_custom_SoC HS2000KCU01HE

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CAUTION:	Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

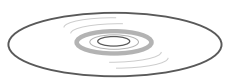
Contents

Section 1 Connecting the Emulator with the User System

1.1 Components of the E10A-USB Emulator

The E10A-USB emulator supports SoCs (systems on chips) that incorporate the H8S processor core (these are hereafter collectively referred to as MCUs unless the description is specific to a particular device). Table 1.1 lists the components of the E10A-USB emulator.

Table 1.1 Components of the Emulator

Classi-fication	Component	Appearance	Quan-tity	Remarks
Hard-ware	Emulator box		1	HS0005KCU01H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 72.9 g or HS0005KCU02H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 73.7 g
	User system interface cable		1	14-pin type: Length: 20 cm, Mass: 33.1 g
	USB cable		1	Length: 150 cm, Mass: 50.6 g
Soft-ware	E10A-USB emulator setup program, H8S, H8SX Family E10A-USB Emulator User's Manual, Supplementary Information on Using the H8S_custom_SoC*, and Test program manual for HS0005KCU01H and HS0005KCU02H		1	HS0005KCU01SR, HS0005KCU01HJ-H8S, HS0005KCU01HE-H8S, HS2000KCU01HJ, HS2000KCU01HE, HS0005TM01HJ, and HS0005TM01HE (provided on a CD-R)

Note: Additional document for the MCUs supported by the emulator is included. Check the target MCU and refer to its additional document.

1.2 Connecting the E10A-USB Emulator with the User System

Before connecting an E10A-USB emulator (hereafter referred to as the emulator) with the user system, a connector must be installed in the user system so that a user system interface cable can be connected. When designing the user system, refer to the connector and recommended circuits shown in this manual.

Before designing the user system, be sure to read the E10A-USB emulator user's manual and the hardware manual for related MCUs.

Connection between the user system connector and the MCU in each device differs depending on the internal circuit of MCU in use. Examples are shown below, however, for pull up, pull down, and required logic ICs, contact Renesas Technology Corp. via the sales office.

Connect pins 8, 9, 10, 12, 13, and 14 of the user system connector to GND firmly on the PCB. These pins are used as electrical GND and to monitor the connection of the user system connector. Note the pin assignments of the user system connector.

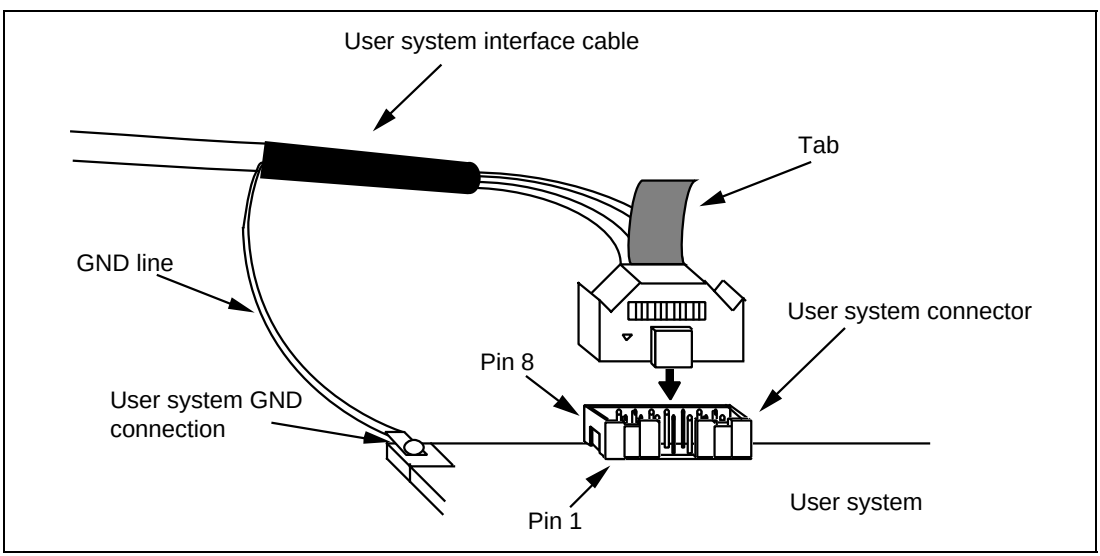


Figure 1.1 Connecting the User System Interface Cable to the User System

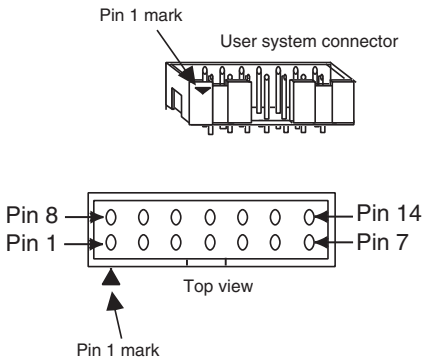
Notes: 1. The pin number assignments of the 14-pin connector differ from those of the E8a emulator; however, the physical location is the same.
2. Do not place any components within 3 mm of the connector.

⚠ WARNING

Be sure to place the GND line of the user system interface cable on the GND of the user system with a screw, etc. Failure to do so will result in a FIRE HAZARD due to an overcurrent and will damage the user system, the emulator product, and the host computer.

1.3 Pin Assignments of the E10A-USB Connector

Figure 1.2 shows the pin assignments of the user system connector.



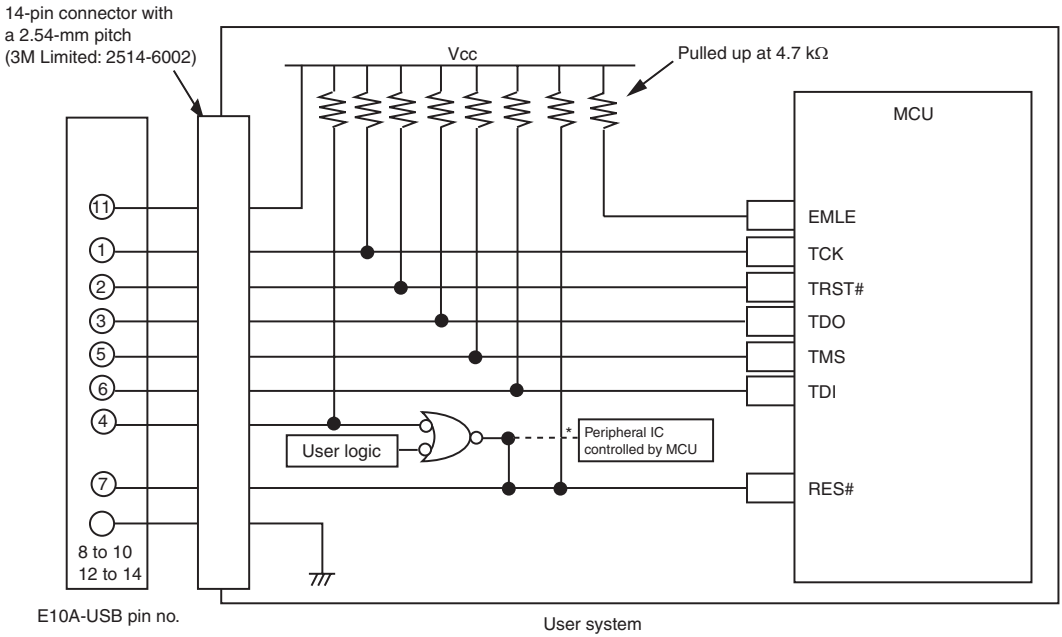
Pin No.	MCU Pin Name	Input/Output *2
1	TCK	Input
2	TRST#	Input
3	TDO	Output
4	RES(in)# *3 *6	Input
5	TMS	Input
6	TDI	Input
7	RES(out)# *3	Output
8 to 10 12 to 14	GND *4	—
11	Vcc *5	—

Notes: 1. The signal names are based on the names of standard H8S microcomputer pins. For pin names and examples of recommended circuits of the MCU in use, contact Renesas Technology Corp. via the sales office.
2. Input to or output from the user system.
3. The symbol (#) means that the signal is active-low.
4. By detecting GND on the user system, the emulator decides whether the user system is connected or not.
5. Connect Vcc with the Vcc of the MCU.
6. RES(in) is not the pin name of the MCU. It cannot be directly connected to the MCU pins.

Figure 1.2 Pin Assignments of the User System Connector

1.4 Example of Emulator Connection

The figure shown below is an example of connecting the user system to the emulator.



- RES(in)# of pin 4 of the user system connector is a signal line in which the emulator outputs signals to the MCU. RES(in)# (pin 4) and the user logic reset circuit for the signal line must be connected to the MCU as shown above.
- RES(out)# of pin 7 of the user system connector is a signal line in which the emulator monitors the RES# signal of the MCU. The RES# must be pulled up before it is connected to pin 7 of the user system connector.
- When a reset processing is required for a peripheral IC controlled by the MCU at a reset of the H8S CPU, also connect the RES# to the peripheral IC indicated by * in the figure.

Figure 1.3 Example of Emulator Connection

Notes: 1. Pins TRST#, TCK, TMS, TDO, and TDI are used by the emulator. Pull up and connect the emulator and the MCU pins.

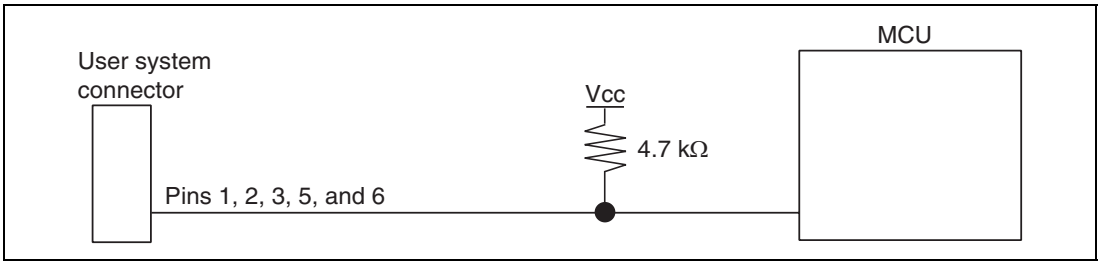


Figure 1.4 Connection of Emulator and MCU

2. If the emulator is connected to the user system, pull up pin EMLE of the MCU, and when the emulator is not connected to the user system, ground the EMLE.

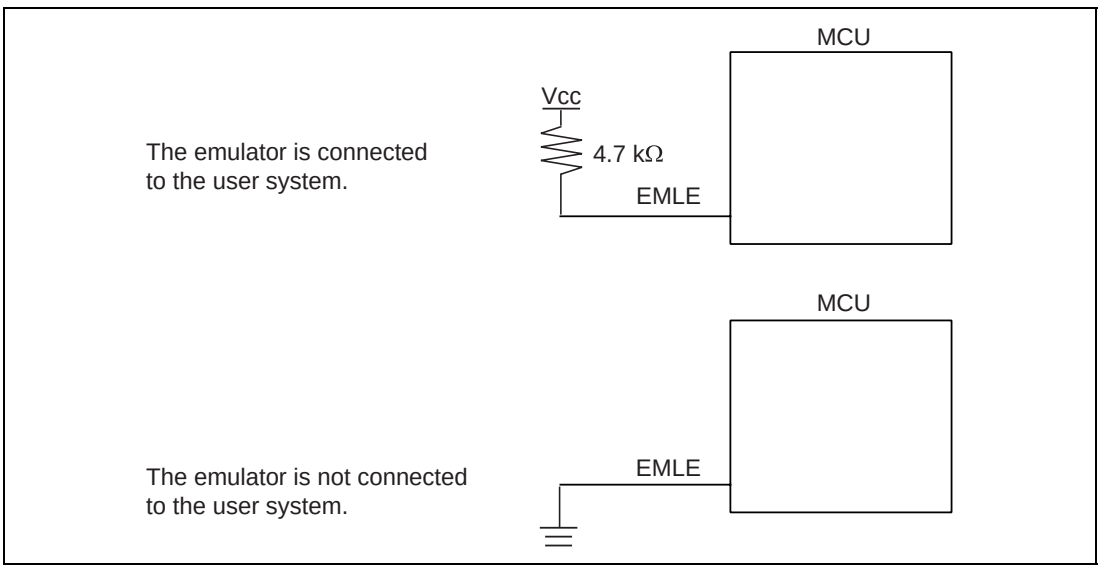


Figure 1.5 Emulator and Pin EMLE

3. RES(in)# of pin 4 of the user system connector is a signal line in which the emulator outputs signals to the MCU. RES(in)# of pin 4 and the user logic reset circuit for the signal line must be connected to pin RES# of the MCU as shown in figure 1.6.
   RES(out)# of pin 7 of the user system connector is a signal line in which the emulator monitors pin RES# of the MCU. The RES# must be pulled up before it is connected to pin 7 of the user system connector.
   When a reset processing is required for a peripheral IC controlled by the MCU at a reset of the H8S CPU, also connect the RES# to the peripheral IC indicated by * in the figure.

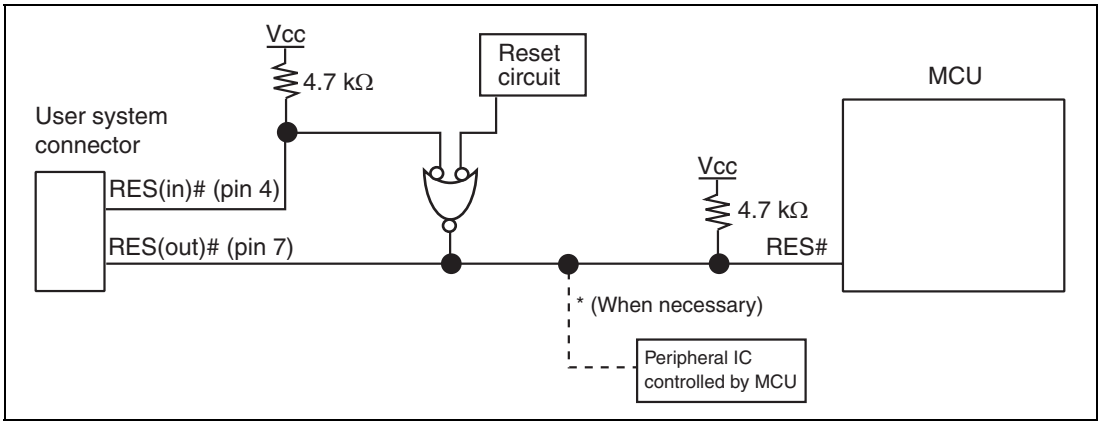


Figure 1.6 Connection of Pin RES#

4. Ground pins 8, 9, 10, 12, 13, and 14 of the user system connector.
5. Pin 11 of the user system connector must be connected to the user system Vcc (power supply). The amount of voltage permitted to input to the user system connector must be within the guaranteed range of the MCU.

Section 2 Specification of the Emulator's Software

2.1 Differences between the MCU and the Emulator

1. When the emulator system is initiated, it initializes the general registers and part of the control registers as shown in table 2.1. The initial value of the MCU is undefined. When the emulator is initiated from the workspace, a value to be entered is saved in a session.
   For the registers shown in table 2.1, values other than PC or CCR are not changed even if the CPU reset command is issued. If ER7 (SP) is changed as an odd value, it must be modified in the [Register] window.

Table 2.1 Register Initial Values at Emulator Power-On

Register	Initial Value
PC	Reset vector value in the vector address table
ER0 to ER6	H'0
ER7 (SP)	H'10
CCR	1 for I mask, and others undefined
EXR	H'7F
MACH*	H'0
MACL*	H'0

Note: Only when the H8S/2600 CPU is in use

2. System Control Register

   In the emulator, the internal I/O registers can be accessed from the [IO] window. However, be careful when accessing the system control register. The emulator saves the register value of the system control register at a break and returns the value when the user program is executed. Since this is done during a break, do not rewrite the system control register in the [IO] window.

3. Memory Access during Emulation

   If the memory contents are referenced or modified during emulation, realtime emulation cannot be performed because the user program is temporarily halted.

4. The emulator communicates with the MCU by using the pins listed in table 1.2 of section 1.3, Pin Assignments of the E10A-USB Connector. These pins cannot be used.

5. The power consumed by the MCU can reach several mA. This is because the user power supply drives ICs to make the communication signal level match the user-system power-supply voltage.
6. Table 2.2 shows the restrictions for H8S_custom_SoC2 (2000) relative to the H8S_custom_SoC2 (2600).

Table 2.2 Restrictions for H8S_custom_SoC2 (2000) and H8S_custom_SoC2 (2600)

Function	Available/Not available
Start/Stop function	Not available
Processing to accelerate memory fill operations	Not available
Processing to accelerate program downloading	Not available

7. Break Due to an Address Condition

   When an address break is set immediately after a branch-to-subroutine instruction, the break may actually occur at the branch destination.
8. [Step Over] by Using a Break Condition

   When stepping over a subroutine branch instruction due to the setting the [Step Over Option] in the [Configuration] dialog box being [No Programming of the flash memory], the break may actually occur at the branch destination.

2.2 The H8S custom SoC E10A-USB Emulator Specific Functions and Notes

2.2.1 Emulator Driver Selection

Table 2.3 shows drivers which can be selected in the [Driver Details] dialog box.

Table 2.3 Type Name and Driver

Type Name	Driver
HS0005KCU01H, HS0005KCU02H	Renesas E-Series USB Driver

2.2.2 Hardware Break Functions

Hardware Break Conditions: In the H8S custom SoC E10A-USB emulator, conditions of Break Condition 1,2,3,4,5,6,7,8 can be set. Table 2.4 lists the items that can be specified.

Table 2.4 Hardware Break Condition Specification Items

Items	Description
Address bus condition	Breaks when the MCU address bus value matches the specified value.
Data bus condition	Breaks when the MCU data bus value matches the specified value. High or low byte or word can be specified as the access data size.
Read or write condition	Breaks in the read or write cycle.

Table 2.5 lists the combinations of conditions that can be set in the [Break condition] dialog box.

Table 2.5 Conditions Set in [Break condition] Dialog Box

	Condition		
Dialog Box	Address Bus Condition	Data Condition	Read or Write Condition
[Break condition 1]	O	O	O
[Break condition 2]	O	O	O
[Break condition 3]	O	X	O
[Break condition 4]	O	X	O
[Break condition 5]	O	X	O
[Break condition 6]	O	X	O
[Break condition 7]	O	X	O
[Break condition 8]	O	X	O

Note: O: Can be set by checking the radio button in the dialog box.

Table 2.6 lists the combinations of conditions that can be set by the BREAKCONDITION_SET command.

Table 2.6 Conditions Set by BREAKCONDITION_SET Command

	Condition		
Channel	**Address Bus Condition (option <addropt>)**	**Data Condition (option <dataopt>)**	**Read or Write Condition (option <r/wopt>)**
Break condition 1	O	O	O
Break condition 2	O	O	O
Break condition 3	O	X	O
Break condition 4	O	X	O
Break condition 5	O	X	O
Break condition 6	O	X	O
Break condition 7	O	X	O
Break condition 8	O	X	O

Note: O: Can be set by the BREAKCONDITION_SET command.

2.2.3 ROM Correction Function*

The emulator uses the ROM correction function in the device to cause a break by replacing the instruction of the specified address with a special instruction. A break occurs with the address condition.
Addresses in the internal ROM or external ROM (CS0 area) can be specified for four channels (addresses other than in the internal RAM or CS0 area are not available).
Since the [Go To Cursor] command uses ROM correction 4, setting of ROM correction 4 is invalid.

Note: This function is only specific to R8J32500 and R8J32700.

2.2.4 Notes on Setting the [Breakpoint] Dialog Box

1. When an odd address is set, the address is rounded down to an even address.
2. A BREAKPOINT is accomplished by replacing instructions. Accordingly, it can be set only to the RAM or flash memory area. However, a BREAKPOINT cannot be set to the following addresses:
   - An area other than RAM or flash memory
   - An instruction that satisfies Break Condition
3. During step execution, a BREAKPOINT is disabled.
4. A condition set at Break Condition is disabled immediately after starting execution when an instruction at a BREAKPOINT is executed. A break does not occur even if a condition of Break Condition is satisfied immediately after starting the execution.
5. When execution resumes from the breakpoint address after the program execution stops at the BREAKPOINT, single-step execution is performed at the address before execution resumes. Therefore, realtime operation cannot be performed.
6. Settings of BREAKPOINT, ROM correction, and Break Condition are invalid while the STEP OVER function is being used.
7. To set a BREAKPOINT in the external flash memory, set the function described in section 2.2.7, Debugging in the External Flash Memory.

2.2.5 Note on Using the JTAG Clock (TCK)

When the JTAG clock (TCK) is used, set the frequency to lower than that of the system clock.

2.2.6 Trace Function

The trace function in the emulator uses the eight-branch-instruction trace function in the MCU, and acquires a trace by operating the user program in realtime. The branch-instruction trace function displays the branch-source address, the mnemonic, the operand, and the source code. It is also possible to acquire trace information on exception branches and cause a trace break, which can be specified in the [Acquisition] dialog box.

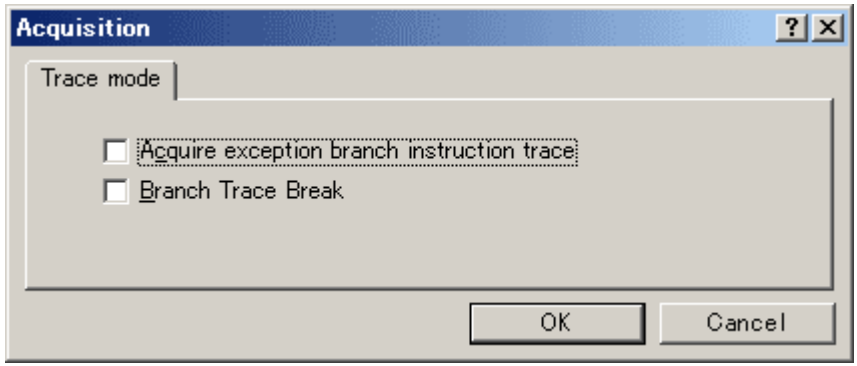


Figure 2.1 [Acquisition] Dialog Box

Table 2.7 Items in [Acquisition] Dialog Box

Item	Description
[Acquisition exception branch trace] checkbox	Select whether or not to acquire trace information on exception branches. When this checkbox is selected, trace information on exception branches is acquired. (An exception branch can be exception processing of an interrupt or illegal instruction, or a SLEEP, TRAPA, or RTE instruction.)
[Branch trace break] checkbox	Select whether or not to cause a break when a branch instruction is executed. When this checkbox is selected, a break occurs at execution of a branch instruction.

2.2.7 Debugging in the External Flash Memory

This emulator supports debugging in the external flash memory, which is the function to allow downloading of programs to the external flash memory area. Settings for the external flash memory should be made in the [External Flash memory setting] dialog box opened at initiation of the emulator. To display the [External Flash memory setting] dialog box, check [Use External Flash memory setting] in the [Select Emulator mode] dialog box. Debugging function equivalent to that in the H8SX E10A-USB system becomes available in the external flash memory area by specifying the initialization, write, or erase module* and filling information on the external flash memory. Settings made in the [External Flash memory setting] dialog box are retained. Next time this dialog box is launched, the previous settings are displayed. Clicking the [Save] button saves the contents that have been set. The file to be saved (*.EFF: external flash memory data setting file) is loaded by clicking the [Browse…] button for [Select External Flash setting file]. When the file has been set, it is registered as the history (recent 10 files) in the combo box and selected to be loaded. Up to 1024 blocks can be specified for the external flash memory via the [External Flash memory setting] dialog box of the emulator. The maximum size allowed between the start address and the end address of the external flash memory is 16 Mbytes. Since this function forcibly changes the device settings in the emulator when the initialization, write, or erase module is called, the emulator operates differently with the contents of the user program. To verify the operation of the user program, disable the [Use External Flash memory] check box and activate the emulator.

Note: Prepare initialization, write, and erase modules that are suitable for the external flash memory being used.

Table 2.8 lists the items contained in the [External Flash memory setting] dialog box.

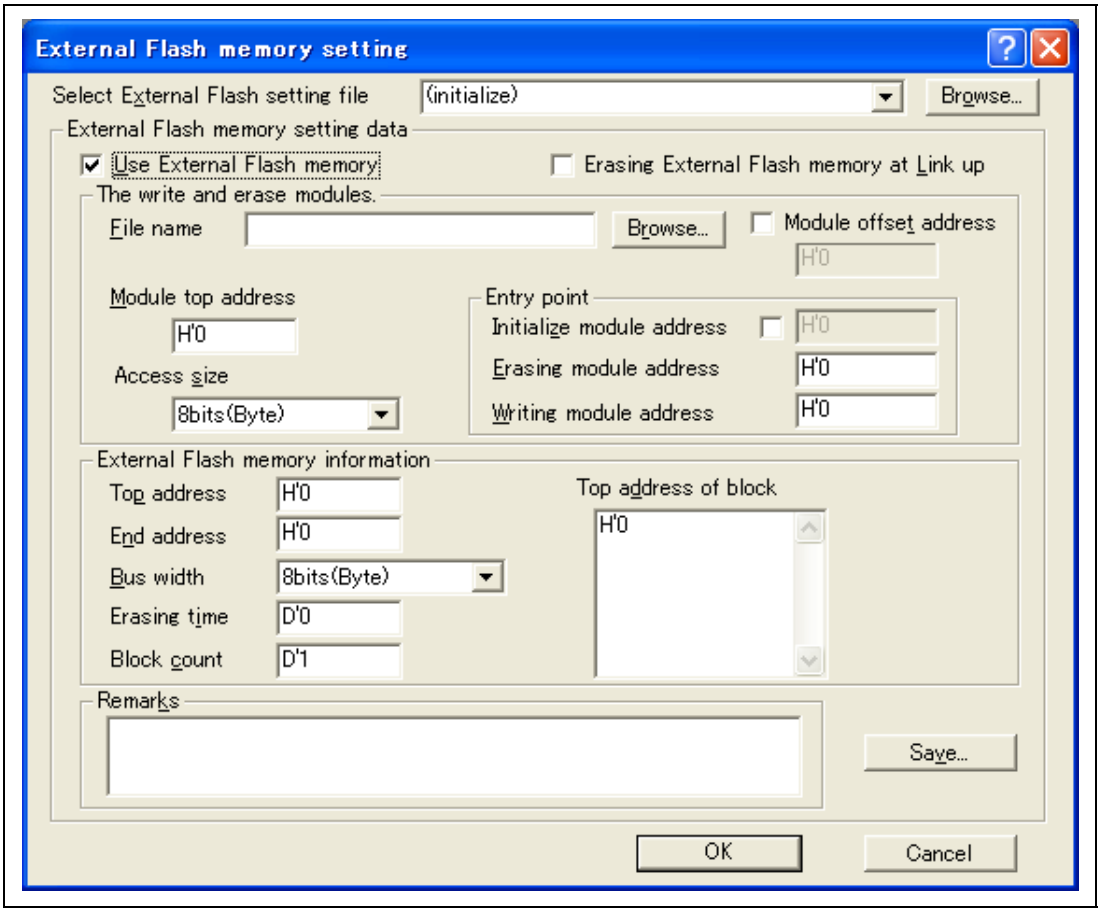


Figure 2.2 [External Flash memory setting] Dialog Box

Table 2.8 Items in [External Flash memory setting] Dialog Box

No.	Item	Description
1	Select External Flash setting file	Specify the data file (*.EFF) for setting the external flash memory. If not specified, select the setting of [recent setting data] (data previously changed) in the combo box. To make a new setting, select [initialize] and input data.
2	Use External Flash memory	Enable or disable use of the external flash memory debugging function. Checked: Enabled Not checked: Disabled (default)
3	Erasing External Flash memory at Link up	Select whether or not to erase the contents of the flash memory at initiation of the emulator. Checked: Erases the contents of the flash memory at initiation of the emulator. Not checked: Reads the contents of the flash memory at initiation of the emulator (default).
4	File name	Specify the file of initialization, write, and erase modules. A program file must be specified for programming the flash memory. Prepare a file suitable for the flash memory being used.
5	Module offset address	Specify the top address by an offset where the initialization, write, erasing modules are to be expanded. (Initial value is H'0). If not specified, disable offset. Checked: Enables offset. Not checked: Disables offset (default). (If the address exceeds H'FFFFFFFF, it will become H'0.)
6	Module top address	Specify the start address where the initialization, write, and erase modules are to be expanded. (The 4-kbyte address areas starting from that address are saved by the emulator; it is possible to expand the initialization, write, and erase modules without affecting on the user program.)
7	Initialize module address	Entry address of the initialization module The initialization module is used to set the device that is required for accessing the external flash memory. If not specified, disable entry. Checked: Enables entry. Not checked: Disables entry (default).
8	Erasing module address	Entry address of the erase module

Table 2.8 Items in [External Flash memory setting] Dialog Box (cont)

No.	Item	Description
9	Writing module address	Entry address of the write module
10	Access size	Select the unit of accesses for transfer of the programs. 8bits(Byte): Bytes 16bits(Word): Words 32bits(Long): Longwords
11	Top address	Start address of the flash memory
12	End address	End address of the flash memory
13	Bus width	Select the unit of accesses to the flash memory. 8bits(Byte): Bytes 16bits(Word): Words 32bits(Long): Longwords
14	Erasing time	Waiting time for erasure (in seconds) (Specification of a decimal or hexadecimal value is recommended.)
15	Block count	Number of blocks in the flash memory (Specification of a decimal or hexadecimal value is recommended. Up to 1024 blocks can be specified.)
16	Top address of block	Define the start addresses of all blocks. If the flash memory has D'10 blocks, the definition will be as shown below. Press the Return key between the definitions for each of the blocks. Example: H'0 H'1000 H'2000 H'3000 H'4000 H'5000 H'6000 H'7000 H'8000 H'9000
17	Remarks	Use for writing a text. Contents of data that has been set can be entered. If not specified, setting is not needed.

2.2.8 Interface with Initialization, Write, and Erase Modules and Emulator Firmware

The initialization, write, and erase modules must be branched from the firmware when the emulator is initiated and the external flash memory is written or read*.

Note: The modules are not called if the external flash memory data is not updated.

To branch from the emulator firmware to the initialization, write, and erase modules, or to return from the initialization, write, and erase modules to the emulator firmware, the following conditions must be observed:

- The size of each initialization, write, or erase module must be consecutive 4 kbytes or less (including work areas and stack areas).
- Save and return all the general register values and control register values before and after calling the initialization, write, or erase module.
- Return the initialization, write, or erase module to the calling source after processing.
- The initialization, write, and erase modules must be Motorola S-type files.
- For the write module, write data ER1(L) to address ER0(L) and store the top address of flash memory ER2(L) then the result in ER0(L).
- For the erase module, erase the block of address ER0(L) and store the top address of flash memory ER1(L) then the result in ER0(L).
- Set the write size of the write module as described in No. 13 'Bus width' in table 2.8 (byte, word, or longword).
- The initialization module is used to set the device that is required for accessing the external flash memory. Store the result in ER0(L).

The module interface must be as follows to correctly pass the information that is required for accessing flash memory.

Table 2.9 Module Interface

Module Name	Argument	Return Value
Write module	ER0(L): Write address ER1(L): Write data ER2(L): Top address of the flash memory	ER0(L): Result (OK = 0, NG ≠ 0)
Erase module	ER0(L): Address of the block to be erased ER1(L): Top address of the flash memory	ER0(L): Result (OK = 0, NG ≠ 0)
Initialization module	-	ER0(L): Result (OK = 0, NG ≠ 0)

Notes: 1. The (L) means the longword size.
2. The initialization module is not always set.

2.2.9 Tutorial

This product does not contain tutorial.

H8S, H8SX Family E10A-USB Emulator
Additional Document for User's Manual
Supplementary Information on Using the H8S_custom_SoC

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