User's Manual

H8S, H8SX Family E10A-USB Emulator

Additional Document for User's Manual
Supplementary Information on Using the H8S/2427, H8S/2427R, H8S/2425 Group
HS2427KCU01HE

Supported Devices:
H8S Family / H8S/2400 Series

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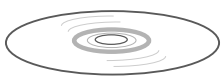
Table of Contents

Section 1 Connecting the Emulator with the User System

1.1 Components of the E10A-USB Emulator

The H8S/2427 E10A-USB emulator supports the H8S/2427 and H8S/2427R group (H8S/24279, H8S/24279R, H8S/24278, H8S/24278R, H8S/24276, H8S/24276R, H8S/24275, H8S/24275R), and the H8S/2425 E10A-USB emulator supports the H8S/2425 group (H8S/24259, H8S/24258, H8S/24256, H8S/24255) (hereafter referred to as the MCU unless the description is specific to any of them). Table 1.1 lists the components of the 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	H8S/2427 E10A-USB and H8S/2425 E10A-USB emulator setup program, H8S, H8SX Family E10A-USB Emulator User's Manual, Supplementary Information on Using the H8S/2427, H8S/2427R, H8S/2425 group*, and Test program manual for HS0005KCU01H and HS0005KCU02H		1	HS0005KCU01SR, HS0005KCU01HJ-H8S, HS0005KCU01HE-H8S, HS2427KCU01HJ, HS2427KCU01HE, HS0005TM01HJ, and HS0005TM01HE (provided on a CD-R)

Note: Additional document for the MPUs supported by the emulator is included. Check the target MPU 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 emulator) with the user system, a connector must be installed in the user system so that an user system interface cable can be connected. When designing the user system, refer to an example of recommended connection between the connector and the MCU 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.

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.

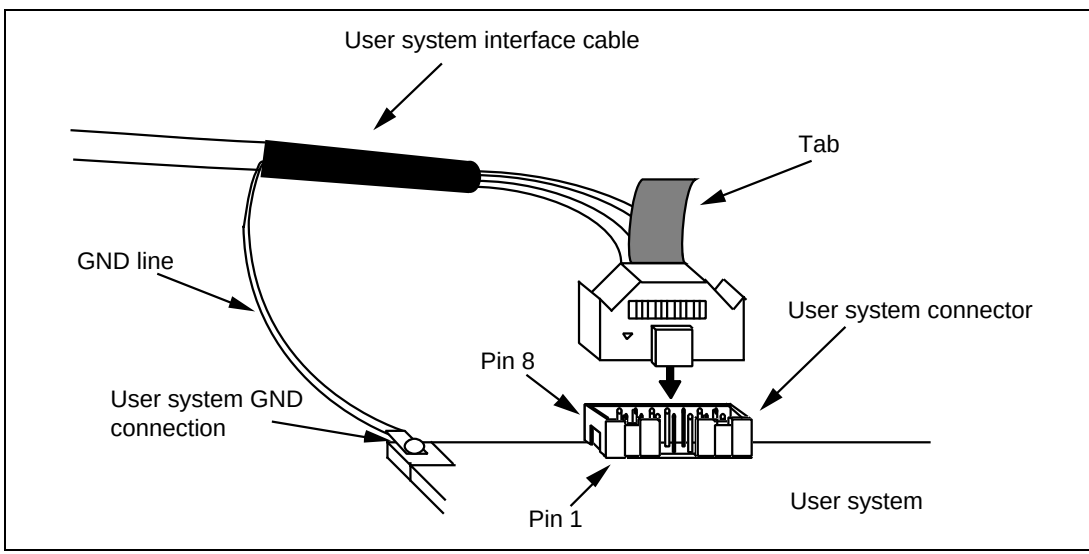


Figure 1.1 Connecting the User System Interface Cable to the User System

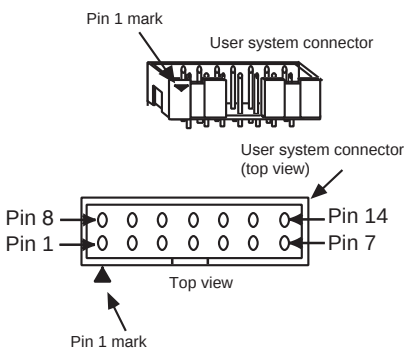
Notes: 1. The pin number assignments of the 14-pin connector differ from those of the E8a emulator; however, the physical location is the same.
2. When designing the connector layout on the user board, do not place any components within 3 mm of the connector.

⚠ 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.



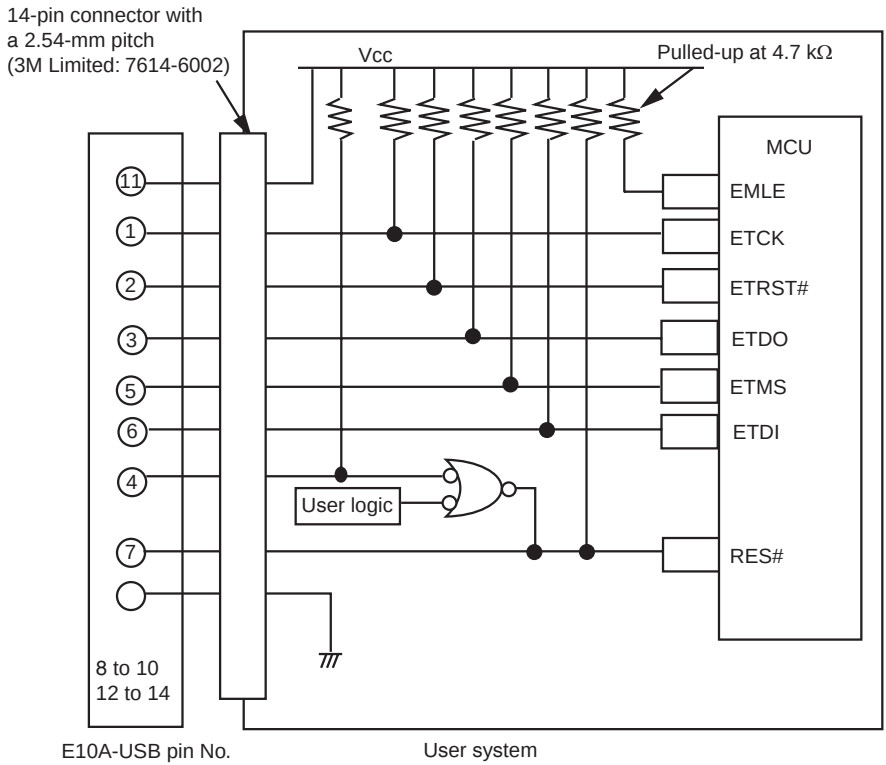
Pin No.	MCU Pin Name *5	Input/Output *1
1	ETCK	Input
2	ETRST#	Input
3	ETDO	Output
4	RES(in)# *2 *6	Input
5	ETMS	Input
6	ETDI	Input
7	RES(out)# *2	Output
8 to 10 12 to 14	GND *3	—
11	Vcc *4	—

Notes: 1. Input to or output of the user system connector on the user system.
2. The symbol (#) means that the signal is active-low.
3. By detecting GND on the user system side, the emulator decides whether the user system is connected or not.
4. Connect Vcc with the Vcc of the MCU.
5. When using E10A-USB, these pins are used only for E10A-USB connector pins, therefore P53 and PG4 to PG6 pin functions, the multiplexed function to these pins, and the WDTOVF# function are not available.
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. Connect RES(in)# of pin 4 and the user system reset circuit 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(out)# must be pulled up before it is connected to pin 7 of the user system connector.

Figure 1.3 Example of Emulator Connection

Notes: 1. The emulator uses on-chip emulator pins ETCK, ETRST#, ETDO, ETMS, and ETDI. Pull up the emulator and MCU pins and connect them to the user system connector.

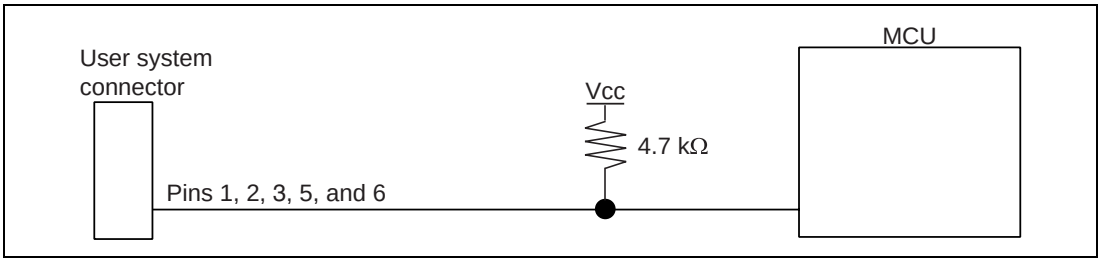


Figure 1.4 Connection of Emulator and the MCU

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.

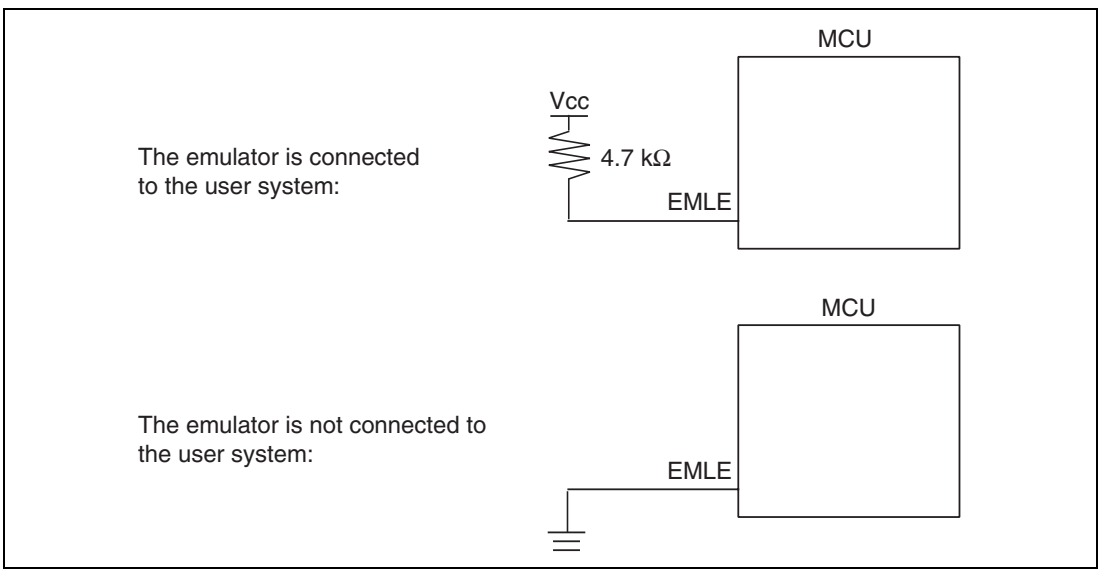


Figure 1.5 EMLE Pin and Emulator

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 system reset circuit must be connected to 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 the RES# signal of the MCU. The RES# must be pulled up before it is connected to pin 7 of the user system connector.

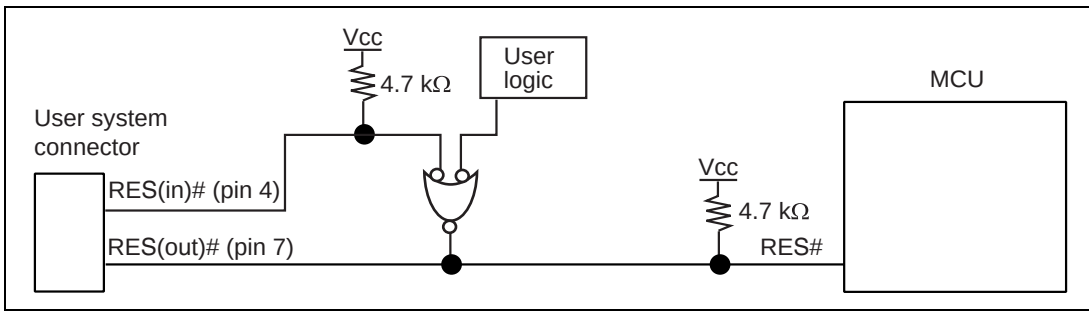


Figure 1.6 Example of Reset Circuits

4. Connect GND of pins 8 to 10, 12 to 14 of the user system connector to ground in the user system.
5. Connect Vcc, pin 11 of the user system connector, to the power supply (Vcc) in the user system. The input voltage, Vcc, is within the range of guaranteed operation of the microcomputer.
6. When the emulator is used, the pin functions listed below are not available.

Table 1.2 Pin Functions Not Available

H8S/2427, H8S/2427R, H8S/2425 Group
PCP53, PG4 to PG6
WDTOVF#
BREQ-A#, BACK-A#, and BREQO-A#
CS4# (∗H8S/2425 group only)
IRQ3-A#
ADTRGO-A#

The symbol '#' means that the signal is active-low.

Section 2 Specifications of the Emulator's Software

2.1 Differences between the H8S/2427, H8S/2427R, H8S/2425 Group 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

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 on-chip emulator pins. The functions multiplexed with the on-chip emulator pins cannot be used.

5. When the emulator is used, 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. Do not use an MCU that has been used for debugging.
   If the flash memory is rewritten many times, and the MCU is left for a few days, data may be lost due to retention problems.
   If the flash memory is rewritten many times, the data will not be erased. If an error message is displayed, exchange the MCU for a new one.

7. MCU Operating Mode
   The emulator supports mode 1, 2, 4, and 7 (on-chip emulation mode).

8. Programming Flash Memory during Debugging
   The flash memory is programmed in the following functions because they use breakpoints:
   - When executing [Go to cursor]
   - When stepping over the subroutine
   - When executing the subroutine at step-out operation

9. Sum Data Displayed in the Program Flash Mode
   Sum data, which is displayed in the 'Program Flash' mode, is a value that data in the whole ROM areas has been added by bytes.

10. Note on Executing the User Program
    The set value is rewritten since the emulator uses flash memory and watchdog timer registers during programming (Go, Step In, Step Out, or Step Over) of the flash memory.

11. Loading Sessions

    — Information in [JTAG clock] of the [Configuration] dialog box cannot be recovered by loading sessions. Thus the value of the JTAG clock (TCK) becomes the initial value at execution of start-up.

12. Value Set in the [System Clock] Dialog Box when Connecting the Emulator

    Input the frequency of the oscillator in use in the [System Clock] dialog box (this also applies when the MCU is multiplied by the PLL circuit).

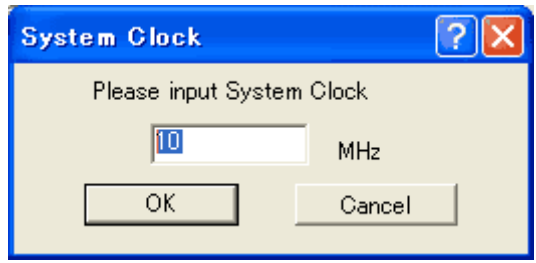


Figure 2.1 [System Clock] Dialog Box

13. Emulation on Programming or Erasing the Internal Flash Memory

    A break cannot be generated while the program for programming or erasing the internal flash memory is being called. Note that the following processing also cannot be performed:

    - Execution of the [STOP] button
    - Auto-update of the watch function and use of the tool-chip watch function
    - Memory operation during executing emulation

14. Table 2.2 shows a list of devices supported by the H8S/2427, H8S/2427R, and H8S/2425 group emulator.

Table 2.2 A List of Devices Supported by the Emulator

Register	Initial Value
H8S/2427 E10A-USB SYSTEM (CPU2600)	H8S/24279, H8S/24279R, H8S/24278, H8S/24278R, H8S/24276, H8S/24276R, H8S/24275, H8S/24275R
H8S/2425 E10A-USB SYSTEM (CPU2600)	H8S/24259, H8S/24258, H8S/24256, H8S/24255

2.2 The H8S/2427 E10A-USB and H8S/2425 E10A-USB Emulator Functions

Notes: 1. Do not use an MCU that has been used for debugging.
2. If the flash memory is rewritten many times, and the emulator is left for a few days, data may be lost due to retention problems.
3. If the flash memory is rewritten many times, the data will not be erased. If an error message is displayed, exchange the MCU for a new one.

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/2427 E10A-USB and H8S/2425 E10A-USB emulator, eight break conditions (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.
Trace acquisition condition	Acquires trace information based on Break Condition 1.

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 (<addropt> option)**	**Data Condition (<dataopt> option)**	**Read or Write Condition (<r/wopt> option)**
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.

Notes on Setting the Break Condition:

1. When [Step In], [Step Over], or [Step Out] is selected, the settings of Break Condition are disabled.
2. The settings of Break Condition are disabled when an instruction to which a BREAKPOINT has been set is executed.
3. When step over function is used, the settings of BREAKPOINT and Break Condition are disabled.

2.2.3 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 flash memory or the RAM area. A BREAKPOINT cannot be set to the following addresses:
   - An area other than flash memory or RAM
   - An instruction in which Break Condition is satisfied
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 and Break Condition are invalid while the STEP OVER function is being used.

2.2.4 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. The value of the JTAG clock (TCK) becomes the initial TCK value that has been set at the starting up of the emulator, after [Reset CPU] or [Reset Go] is executed*.

Note: The value of the JTAG clock (TCK) that has been set at the starting up of the emulator is appropriately calculated on the basis of the value entered in the [System clock] dialog box.

2.2.5 Trace Function

The emulator uses the 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 eight-channel branch-source address, the mnemonic, and the operand.

2.2.6 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 H8S E10A-USB system becomes available in the external flash memory area by specifying the initialization, write, or erase module*[1] 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*[2]. 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.

Notes: 1. Prepare initialization, write, and erase modules that are suitable for the external flash memory being used.
2. Make settings accord with the region of memory on the individual device.

Table 2.7 lists the items contained in the [External Flash memory setting] dialog box.

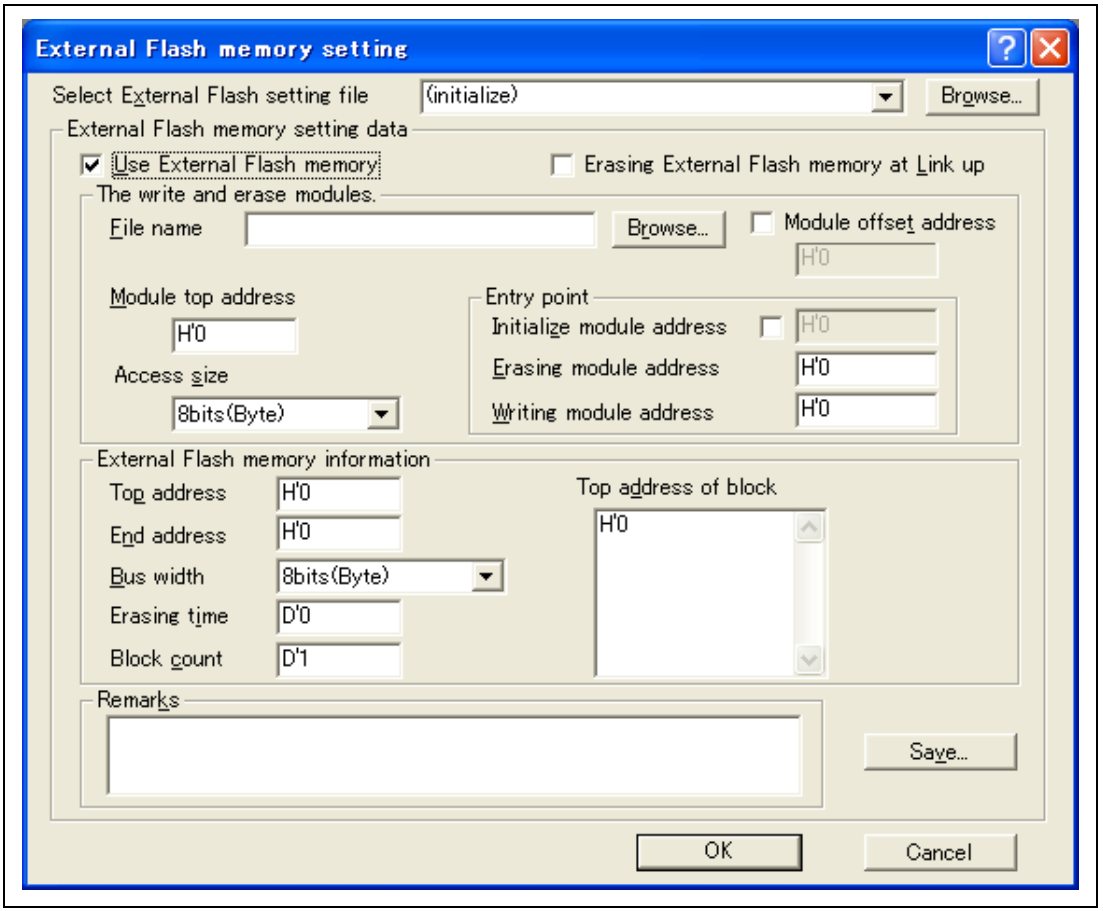


Figure 2.2 [External Flash memory setting] Dialog Box

Table 2.7 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 top 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 2.7 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	Top 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.

Note: Define in accord with the region of memory on the individual device.

2.2.7 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 2.7 (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 2.8 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.

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Additional Document for User's Manual
Supplementary Information on Using the H8S/2427,
H8S/2427R, H8S/2425 Group
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