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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/2125F

Renesas Microcomputer Development Environment System

H8S Family / H8S/2100 Series

E10A-USB for H8S/2125F HS2125KCU01HE

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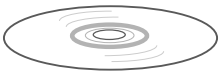
Section 1 Connecting the Emulator with the User System

1.1 Components of the E10A-USB Emulator

The H8S/2125F E10A-USB emulator supports the H8S/2125F (TQFP-80 package). The SDIP-64 and QFP-64 packages do not support debugging on the E10A-USB emulator.

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[*1]: 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/2125F E10A-USB emulator setup program, H8S, H8SX Family E10A-USB Emulator User's Manual, Supplementary Information on Using the H8S/2125F[*2], and Test program manual for HS0005KCU01H and HS0005KCU02H		1	HS0005KCU01SR, HS0005KCU01HJ-H8S, HS0005KCU01HE-H8S, HS2125KCU01HJ, HS2125KCU01HE, HS0005TM01HJ, and HS0005TM01HE (provided on a CD-R)

Notes: 1. When HS0005KCU02H is purchased, the 36-pin type cable is provided; however, it is not available for this MCU.

2. 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 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 arrangement of the user system connector.

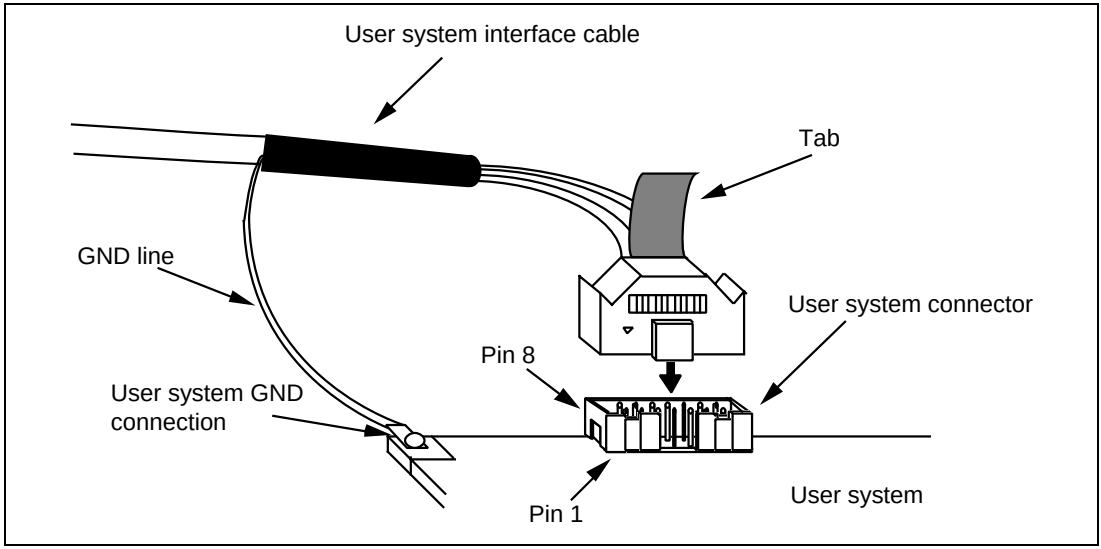


Figure 1.1 Connecting the User System Interface Cable to the User System

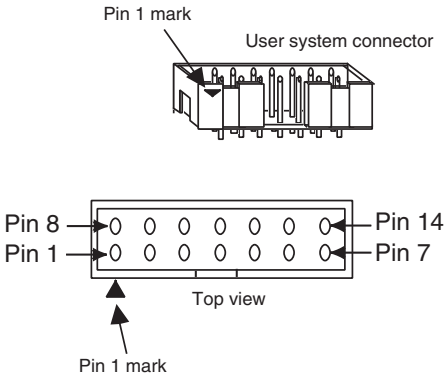
Notes: 1. The pin number assignments of the 14-pin connector differ from those of the E8 emulator; however, the physical location is the same.
2. When designing the connector layout on the user board, do not place any components within 3 mm of the connector.

⚠ 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.



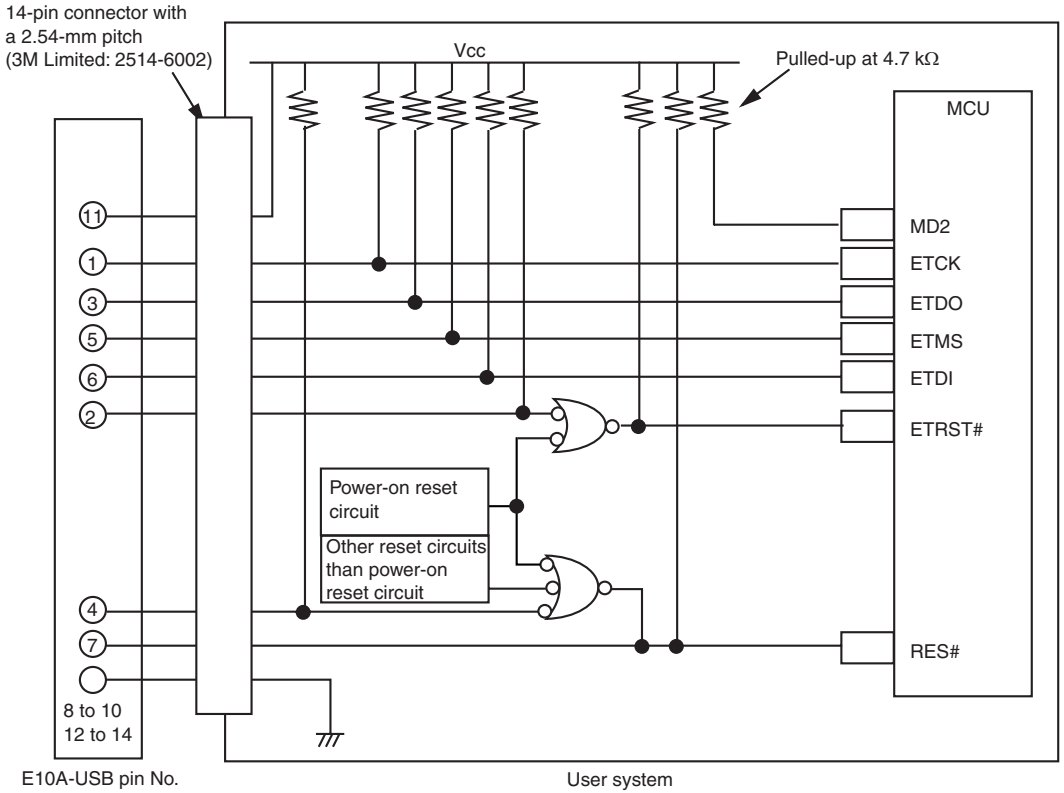
Pin No.	MCU Pin Name	Input/Output *1
1	ETCK	Input
2	ETRST#	Input
3	ETDO	Output
4	RES(in)# *2 *5	Input
5	ETMS	Input
6	ETDI	Input
7	RES(out)# *2	Output
8 to 10 12 to 14	GND *3	—
11	Vcc *4	—

Notes: 1. Input to or output from 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. 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.

· Only the QFP-80 package supports ETCK, ETRST#, ETDO, ETMS, ETDI, and MDI. Therefore, the emulator does not support the SDIP-64 and QFP-64 packages.

Figure 1.3 Example of Emulator Connection

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

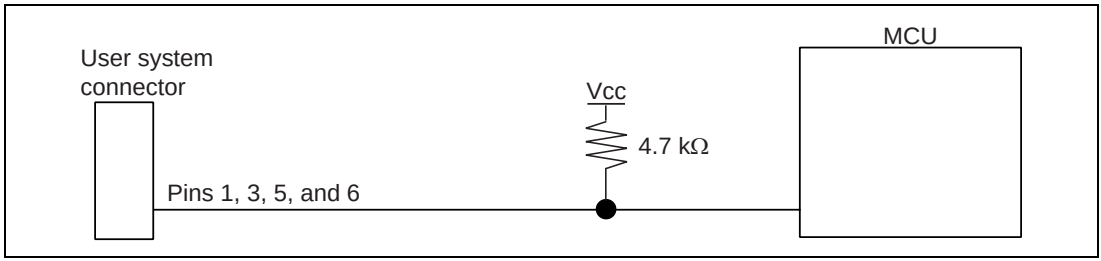


Figure 1.4 Connection of Emulator and the MCU

2. If the emulator is not connected to the user system, ground pin MD2 of the MCU, and when the emulator is connected to the user system, pull up the MD2.

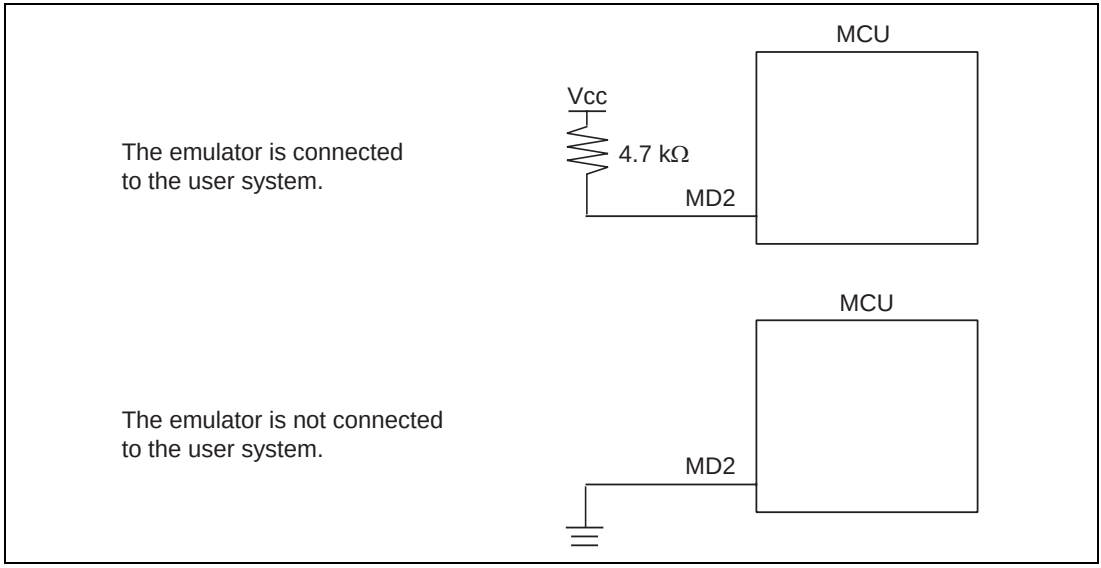


Figure 1.5 MD2 Pin and Emulator

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.

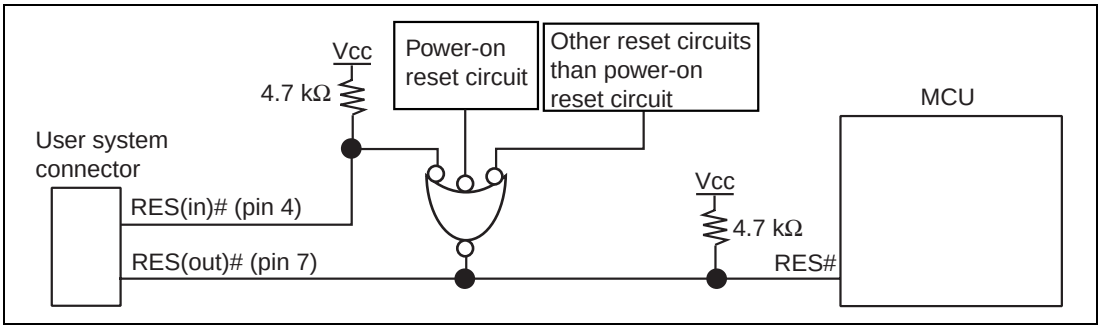


Figure 1.6 Example of Reset Circuits

4. Connect the power-on reset circuit signal to the ETRST# pin as shown in figure 1.7. Otherwise, the MCU may not be initialized even if it is supplied with power when the emulator is not connected. Do not supply any other reset signal to the ETRST# pin. If attempted when the emulator is connected, the communication between the emulator and the MCU may be terminated.

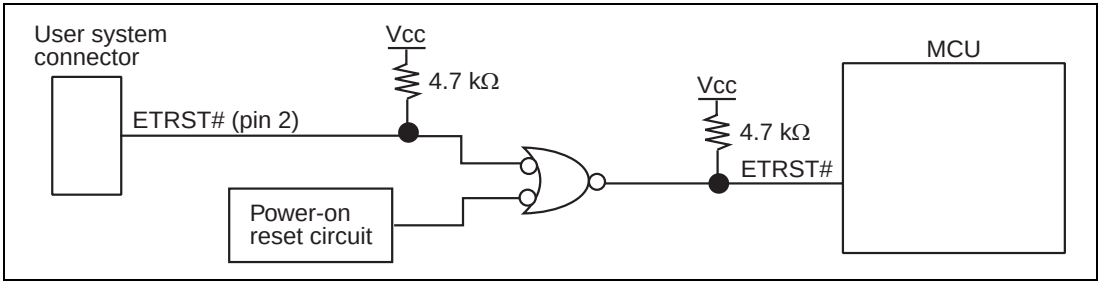


Figure 1.7 Connection of the ETRST# Pin

5. Connect GND of pins 8, 9, 10, 12, 13, and 14 of the user system connector to ground in the user system.
6. 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.

7. The H8S/2125F supports the TQFP-80 package only. The SDIP-64 and QFP-64 packages are not available.

Section 2 Specification of the Emulator's Software

2.1 Differences between the H8S/2125F 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

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.
- When [Short break] (default: 'Enable') is set to 'Disable' in the [Configuration] dialog box, temporary halting of the user program execution by a memory access is disabled. However, automatic update of the watch function and the use of the tool-chip watch function are not available.

4. The emulator communicates with the MCU by using the ETCK, ETDI, ETDO, ETMS, and ETRST# pins. These 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. Sum Data Displayed in the Writing Flash memory Mode
   Sum data, which is displayed in the 'Writing Flash memory' mode, is a value that data in the whole ROM areas has been added by bytes.

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

9. MCU Operating Mode
   The emulator supports modes 6 and 7 (on-chip emulation mode). Use mode 6 for emulation in mode 2, and mode 7 for emulation in mode 3.

10. 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

11. Loading Sessions
    Information in [JTAG clock] of the [Configuration] dialog box cannot be saved by sessions. Thus the TCK value becomes the initial value when loading sessions.
    — When HS0005KCU01H or HS0005KCU02H is used: TCK = 5.0 MHz

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).

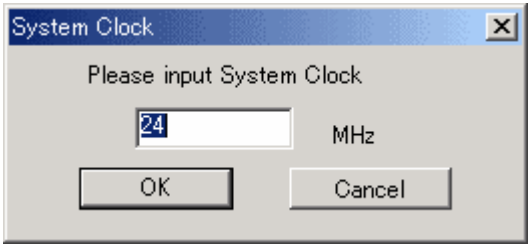


Figure 2.1 [System Clock] Dialog Box

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

2.2 The H8S/2125F 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 2.2 shows drivers which can be selected in the [Driver Details] dialog box.

Table 2.2 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/2125F E10A-USB emulator, eight break conditions (Break condition 1,2,3,4,5,6,7,8) can be set. Table 2.3 lists the items that can be specified.

Table 2.3 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.
Counter acquisition condition	Uses Break condition 1,2 as triggers for acquiring the program counter.

Table 2.4 lists the combinations of conditions that can be set in the [Break condition] dialog box.

Table 2.4 Conditions Set in [Break condition] Dialog Box

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

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

Table 2.5 lists the combinations of conditions that can be set by the BREAKCONDITION_SET command.

Table 2.5 Conditions Set by BREAKCONDITION_SET Command

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

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 area occupied by the emulator program
   - 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 changed, set the frequency to lower than that of the system clock.

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 four-channel branch-source address, the mnemonic, and the operand.

2.2.6 Program Counter Function

The emulator has the program counter function, which counts the number of execution cycles even between the two points that have been specified.

To count the number of execution cycles between the two points, the mode ‘Count 1to2 (Count)’. ‘Count 2to1 (Count)’, ‘Count 1to2 (1shot)’, or ‘Count 2to1 (1shot)’ is used. The mode can be set in the [Break condition 1] dialog box (figure 2.2).

Table 2.6 Setting of the Program Counter

Mode	Description
Count 1to2 (Count)	The number of execution cycles between two points, from satisfaction of Break condition 1 to that of Break condition 2, is counted. (Counting is repeated with short breaks inserted.*)
Count 2to1 (Count)	The number of execution cycles between two points, from satisfaction of Break condition 2 to that of Break condition 1, is counted. (Counting is repeated with short breaks inserted.*)
Count 1to2 (1shot)	The number of execution cycles between two points, from satisfaction of Break condition 1 to that of Break condition 2, is counted. (Counting is performed just once during execution.)
Count 2to1 (1shot)	The number of execution cycles between two points, from satisfaction of Break condition 2 to that of Break condition 1, is counted. (Counting is performed just once during execution.)

Note: Short break: The emulator suspends and re-executes the user program to count the number of execution cycles. Therefore, realtime operation cannot be performed.

If the user specifies Break condition 1 and Break condition 2, the number of execution cycles between these two points will be counted. To enable the use of the program counter, select “Count 1to2” or “Count 2to1” in the [Break condition 1] dialog box (figure 2.2).

Table 2.7 lists the results output from the program counter. These results are shown in windows [Output] (figure 2.3) and [Status] (figure 2.4).

Table 2.7 Results Output from the Program Counter

Result	Description
Program Counter: All count	Number of execution cycles/execution time from the start of user program execution to a break.
Program Counter: Point count	Number of execution cycles/execution time between the two points specified in the [Break condition 1] dialog box
Program Counter: Point event	Number of times that execution cycles between the two points have been counted
Program Counter: Point average	Average number of execution cycles/execution time between two points
Program Counter: Point MAX	Maximum number of execution cycles/execution time between two points
Program Counter: Point MIN	Minimum number of execution cycles/execution time between two points

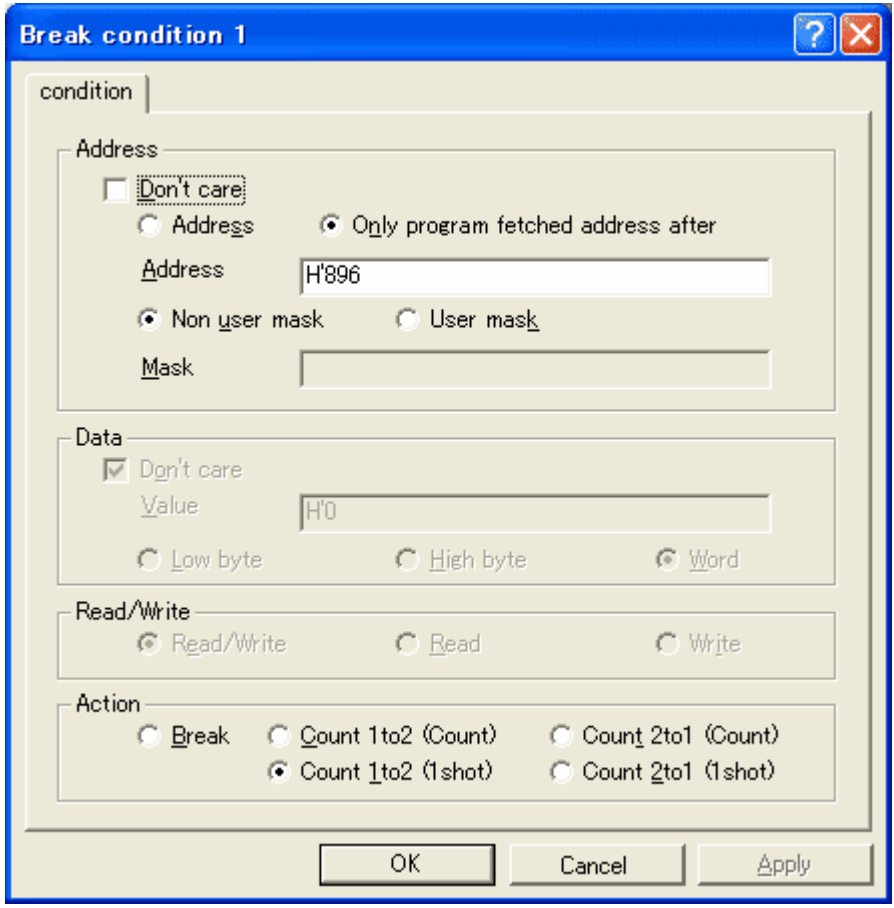


Figure 2.2 [Break condition 1] Dialog Box

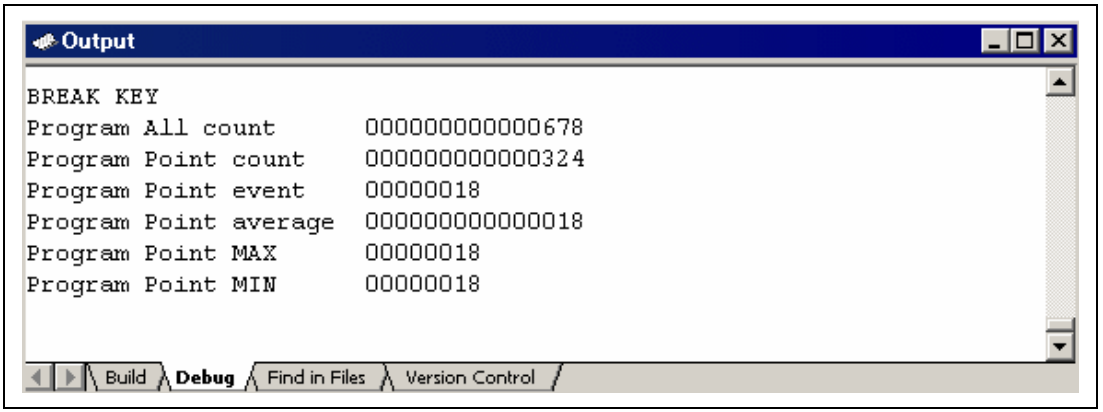


Figure 2.3 [Output] Window

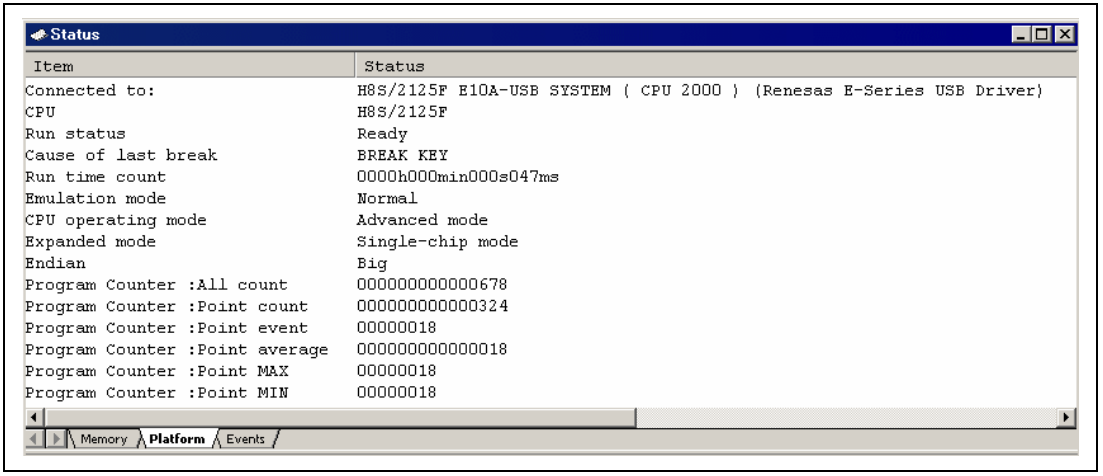


Figure 2.4 [Status] Window

Notes on using the program counter:

1. Since the CPU clock is the source of the counter, when the CPU clock stops in the sleep mode, counting is also stopped.
2. For measurement tolerance,
   - The measured value includes tolerance.
   - Tolerance will be generated before or after a break.

H8S, H8SX Family E10A-USB Emulator
Additional Document for User's Manual
Supplementary Information on Using the H8S/2125F

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