On-Chip Debugging Emulator E1/E20

Troubleshooting Guide (for the RX600 and RX200 Series)

R20AN0193EJ0100
Rev.1.00
Sep. 26, 2012

Outline

This document gives examples of problems that may arise while using the E1 or E20 on-chip debugging emulator in combination with CubeSuite+ and RX600- and RX200-series MCUs and remedies for these problems.

Some error messages vary with the version of the debugger. All examples given in this document use CubeSuite+ V.1.02.00.

Contents

1. Troubleshooting on Startup 4
1.1 Why Does the Warning Message “Warning (W0202003) The project file can be restored. But if you save the project, some information may be lost.” Appear after I Load a Project? 4
1.2 Why Does the Error Message “Any Compiler package (CC-RX) using the project is not installed. (E0203028)” Appear after I Load a Project? 4
1.3 Why Does the Warning Message “Warning (W0202005) Can not open the project with last saved status. See the [All Messages] tab in the Output panel.” Appear after I Load a Project? 5
1.4 Why Does the Error Message “Cannot find product file (file name). (E0021001)” Appear after I Load a Project? 6
1.5 Why is the [Emulator serial No.] Section of the [Connect Settings] Tab in the [(debug tool) Property] Panel Blank? 7
1.6 Why Does the Error Message “Cannot detect the user system. Please check the connection between the emulator and the user system. (E1891701)” Appear When I Connect the Emulator? 8
1.7 Why Does the Error Message “Unable to connect to the emulator (E1: **********). (E1899000)” Appear When I Connect the Emulator? 8
1.8 Why Does the Error Message “Power on the user system. (E1891704)” Appear When I Connect the Emulator? 9
1.9 Why Does the Error Message “Failed to connect with the mcu. Please confirm the state of the MD pin and the pin to specify user boot on the target system. (E1891726)” Appear When I Connect the Emulator? 9
1.10 Why Does the Error Message “The target MCU and the selected device do not match. Check the device name specified at debugger startup again. (E1811106)” Appear When I Connect the Emulator? 10
1.11 Why Does the Error Message “A JTAG communication error. Please retry with reducing the JTAG clock. (E1811105)” Appear When I Connect the Emulator? 10
1.12 Why Error Message “A timeout error has occurred in emulator firmware processing. (E1815001)” Appear When I Connect the Emulator? 11
1.13 Why Does the Error Message “A timeout error. The MCU is in the reset state. (E1814001)” Appear When I Connect the Emulator? 12
1.14 Why Does the Error Message “A timeout error. The command is not executable because the signal on the RESET pin is active. (E1814302)” Appear When I Connect the Emulator? 12
1.15 Why Does the Error Message “The input ID code does not match the ID code that is set in the target MCU. (E1811104)” Appear When I Connect the Emulator? 13
1.16 Why Does the Message “Property value is not valid.” Appear When I Enter a Value in [ID code] in the [(debug tool) Property] Panel? 14

2. Troubleshooting in Operations after Startup 15
2.1 What is the Procedure When the Downloaded Program is not Displayed Correctly After I Start Up the Debugger? 15
2.2 Why Are the Contents of I/O Registers in the [Memory] Panel Blank? 15
2.3 What is the Procedure When I Expand the RIIC (I^2C bus interface) Entry in the IOR Panel to View the Values of Registers but the Values are Incorrect because the IOR Panel Reads ICDRR (I^2C Bus Receive Data Register) Every Time the Program Stops? 16
2.4 Why Doesn’t the Value of a Readable/Writable I/O Register Change as a Result of Writing? 16
2.5 Why Do Values in Data Flash Memory Change Every Time I View Them in the [Memory] Window? 16
2.6 What is the Procedure When Rewriting the Flash Memory through the Program Succeeded with the Emulator but Failed with the Actual MCU? 17
2.7 What is the Procedure When the Debugger Cannot Read the Latest Values from Location in the On-Chip Flash Memory That Have been Altered by a User Program? 17
2.8 Why Don’t Values Change as Expected during Realtime RAM Monitoring by the E20? 18
2.9 Why Does the Error Message “Error (E0204001) Download failed. [Direct Error Cause] Address range error. (E1891905)” Appear When I Download a Program? 18
2.10 Why Are the Displayed Addresses Different from Those Entered in the Display Position Specification Area of the Memory Panel? 19
2.11 Why Are the Contents of Data Flash Memory Initialized When I Download a Program? 19
2.12 Why are the Timestamp Values Displayed by the RX210 Trace Panel Incorrect? 19

3. ID-Code Protection 20
3.1 What is ID-Code Protection? 20
3.2 Handling of ID-Code Protection by the E1 and E20 20
3.3 What is the Procedure When I Don’t Remember the ID Code? 20

4. USB Driver 21
4.1 Checking That the USB Driver Has been Installed 21

Website and Support 23

1. Troubleshooting on Startup

1.1 Why Does the Warning Message “Warning (W0202003) The project file can be restored. But if you save the project, some information may be lost.” Appear after I Load a Project?

- This message indicates that the version of CubeSuite+ that was started up was older than the version used to save the project.
- Upgrade CubeSuite+ to the latest version.
- You can debug the program without upgrading CubeSuite+, however, some functions or options may not be available. In addition, some information may be lost when the project is saved.

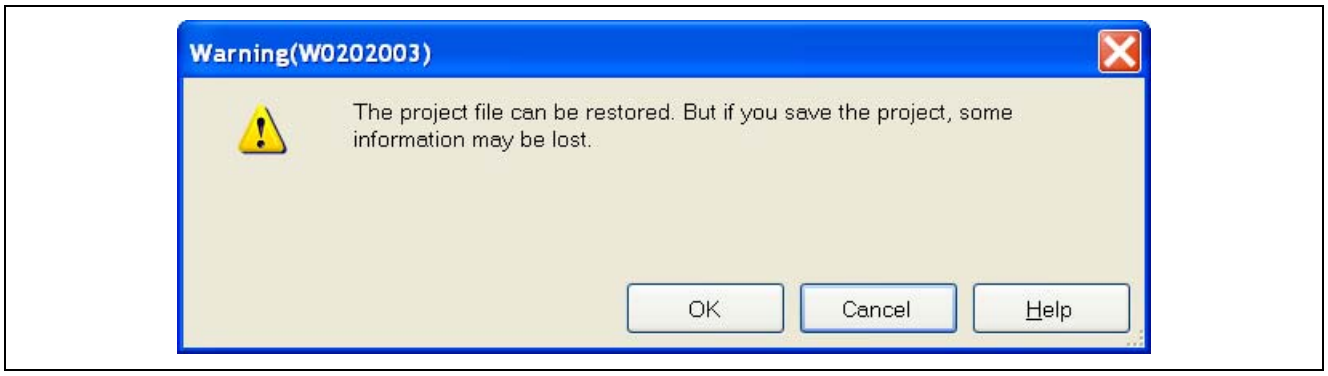


Figure 1.1 If you save the project, some information may be lost

1.2 Why Does the Error Message “Any Compiler package (CC-RX) using the project is not installed. (E0203028)” Appear after I Load a Project?

- This message indicates that the CC-RX compiler for CubeSuite+ has not been installed.
- Install the CC-RX compiler.

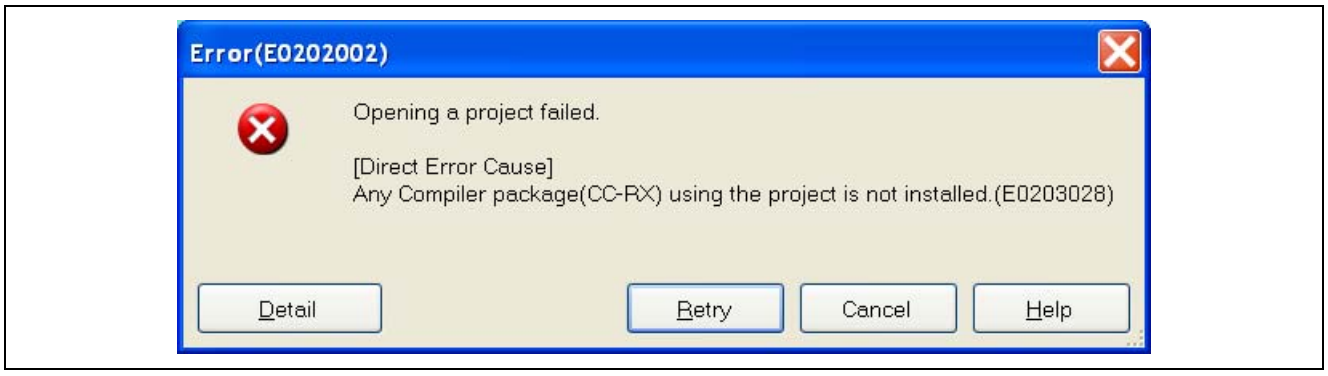


Figure 1.2 Any Compiler Package Using the Project is not Installed

1.3 Why Does the Warning Message “Warning (W0202005) Can not open the project with last saved status. See the [All Messages] tab in the Output panel.” Appear after I Load a Project?

- Check the difference information on the project described in the contents of the [All Messages] tabbed page in the Output panel.
  The following example shows that the version of the CC-RX compiler when a project was opened was V.1.02.01 but the version was V.1.02.00 when it was saved; that is, it indicates the difference in the versions.
  '============ Difference information about project ==========
  RX610_Tutorial_Basic_Operation:
  CC-RX V1.02.00 -> V1.02.01
  ==
  Debugging can still proceed if there is no problem despite the difference in the versions of the CC-RX compiler.
  If there is a problem, the version of the CC-RX compiler must be changed.
  Select [Using compiler package version] in [Version Select] on the [Common Options] tabbed page of the [CC-RX (build tool) Property] panel to change the version of the CC-RX compiler.

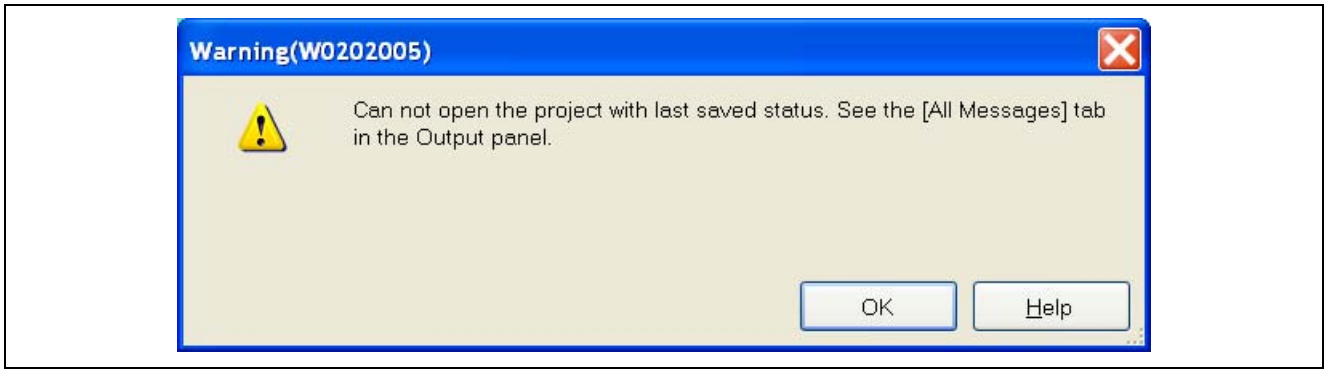


Figure 1.3 Can Not Open the Project with Last Saved Status

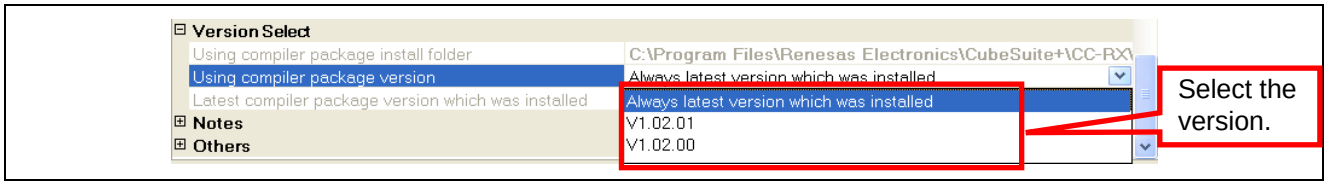


Figure 1.4 Updating the CC-RX Compiler

1.4 Why Does the Error Message “Cannot find product file (file name). (E0021001)” Appear after I Load a Project?

- This message indicates that device information for the target product (MCU) has not been installed in CubeSuite+.
- Install the latest RX device information by using the update manager.
  If the update manager is not available, download the latest RX device information from the following address.

  http://am.renesas.com/products/tools/ide/ide_cubesuite_plus/downloads.jsp

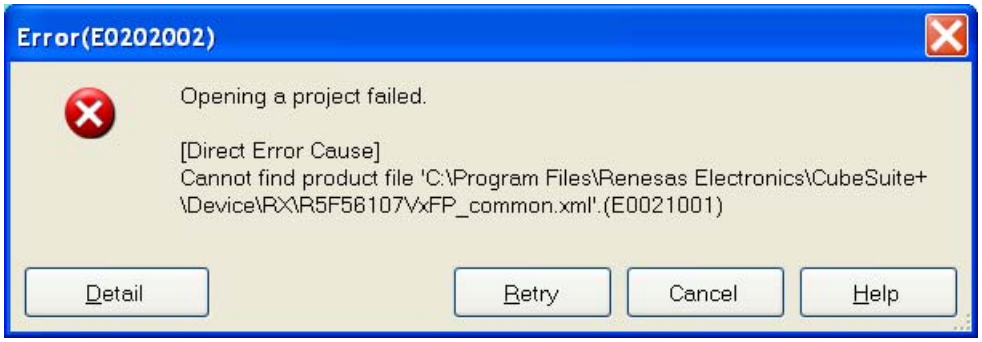


Figure 1.5 Cannot Find Product File

1.5 Why is the [Emulator serial No.] Section of the [Connect Settings] Tab in the [(debug tool) Property] Panel Blank?

- This indicates that the host computer has not recognized the E1 or E20 emulator.
  Check that the USB cable is correctly connected and, if you are using the E20, that the power switch on the E20 is ON, and then select a serial number from the drop-down list.
- If a serial number is still not displayed, refer to section 4, USB Driver.

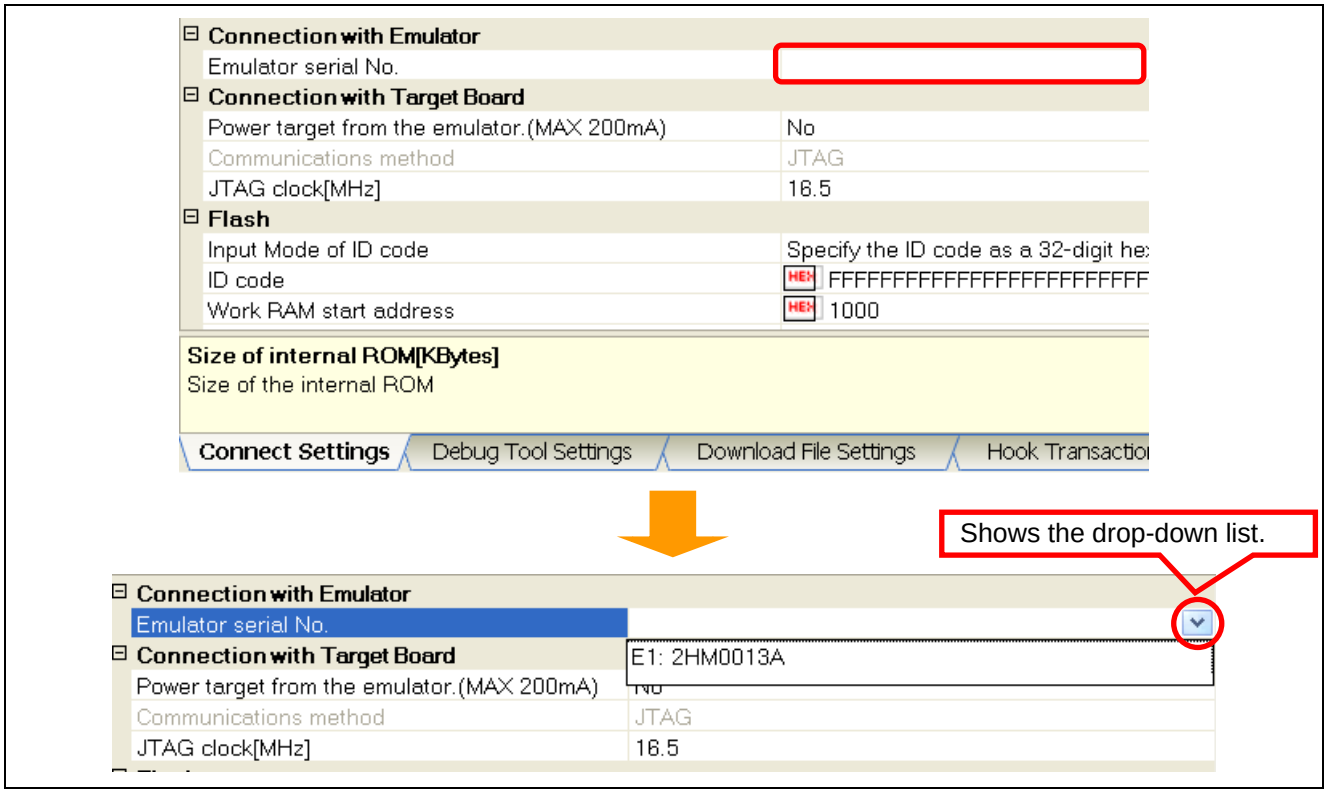


Figure 1.6 Emulator Serial Number Not Displayed

1.6 Why Does the Error Message “Cannot detect the user system. Please check the connection between the emulator and the user system. (E1891701)” Appear When I Connect the Emulator?

- Check that the E1 or E20 connector is firmly connected to the user system.
- If you are using the E1, check that pin 14 of the emulator connector is connected to GND. The E1 recognizes the connection of the user system when it detects that this pin is at the low level.
- If you are using the E20, check that pin 5 of the emulator connector is connected to GND. The E20 recognizes the connection of the user system when it detects that this pin is at the low level.

Figure 1.7 Cannot Detect the User System

1.7 Why Does the Error Message “Unable to connect to the emulator (E1: **********). (E1899000)” Appear When I Connect the Emulator?

- Check that the emulator is connected to the host computer.
  When the emulator is connected, check that the serial number written in the right of S/N on the rear of the emulator is the same as that shown in the error message.
  If the serial numbers are different, change the serial number with reference to section 1.5, Why is the [Emulator serial No.] Section of the [Connect Settings] Tabbed page in the [(debug tool) Property] Panel Blank?.
- If there is no serial number within the parentheses of a message such as “Unable to connect to the emulator ()”, the E1 or E20 emulator will not be correctly connected to the host computer. Refer to section 1.5, Why is the [Emulator serial No.] Section of the [Connect Settings] Tabbed page in the [(debug tool) Property] Panel Blank?.

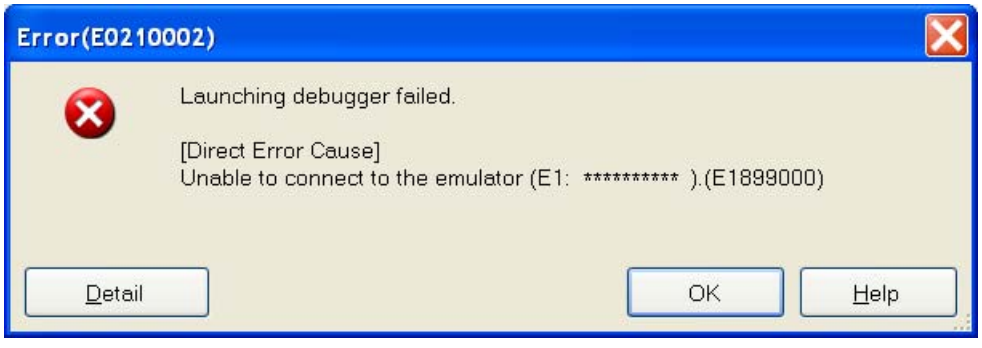


Figure 1.8 Unable to Connect to the Emulator

1.8 Why Does the Error Message “Power on the user system. (E1891704)” Appear When I Connect the Emulator?

- This indicates that the user system is not turned on.
- Turn on the user system. When the power is to be supplied from the E1 emulator, set [Power target from the emulator.] as [Yes] on the [Connect Settings] tabbed page in the [(debug tool) Property] panel before connecting the user system.
  In CubeSuite+ V1.02.00, this setting is not saved; when the project is closed, the setting is restored to the default (power is not supplied from the emulator). When the power is to be supplied from the E1 emulator, specify the setting again when opening the project.

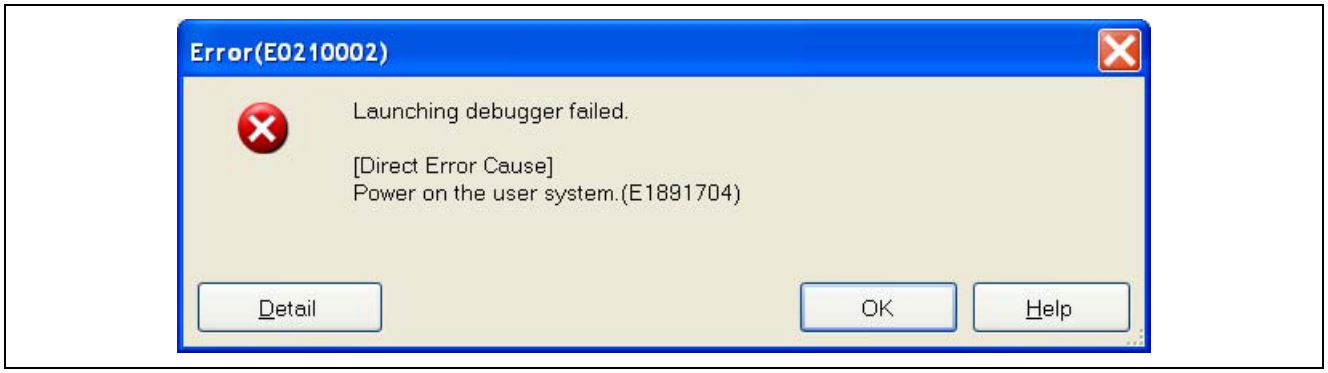


Figure 1.9 Power on the User System

1.9 Why Does the Error Message “Failed to connect with the mcu. Please confirm the state of the MD pin and the pin to specify user boot on the target system. (E1891726)” Appear When I Connect the Emulator?

This indicates that the MCU cannot be connected to the emulator.

- Check that the levels on the mode pins (for the RX610 and RX62x: MD0 and MD1 pins; for other devices: the MD pins and user-boot pins (such as PC7, P00, etc., depending on the MCU)) are not set for the boot mode. If the MCU is in the boot mode, the emulator cannot be connected.

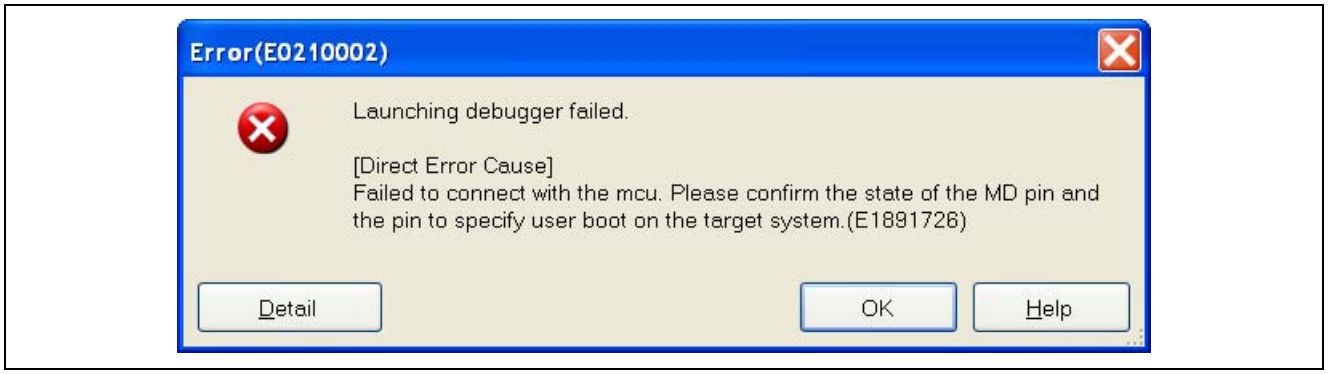


Figure 1.10 Failed to Connect with the MCU

1.10 Why Does the Error Message “The target MCU and the selected device do not match. Check the device name specified at debugger startup again. (E1811106)” Appear When I Connect the Emulator?

- The type number of the MCU that has been installed in the user system does not match that set in the project. Check that the type number of the MCU that has been set in the project is correct.

Figure 1.11 The Target MCU and the Selected Device Do Not Match

1.11 Why Does the Error Message “A JTAG communication error. Please retry with reducing the JTAG clock. (E1811105)” Appear When I Connect the Emulator?

This message indicates that the MCU cannot operate normally or the connection between the MCU and the emulator is incorrect. Although there are a number of possible causes, typical examples are listed below.

- Check the connection between the MCU and the emulator connector.
- When an RX610-group MCU is in use, the connection pattern between the MCU and the emulator connector depends on whether the emulator is being used as an on-chip debugging emulator or in the boot mode. Check that the emulator connector (attached to the E1 or E20) is the one for an on-chip debugging emulator.
- If you are using an extension cable to connect the MCU and the emulator connector, try using a standard cable instead.
- Check whether a filtering circuit is placed between the MCU and the emulator connector. If this is the case, temporarily remove the filtering circuit and check the operation.
- Check that the handling of pins necessary for the correct operation of the MCU (pins associated with power supply and reset, e.g. VCC, GND, VCL, RESET) is correct.
- Check that the oscillator circuit connected to the MCU is operating correctly.
- Check that the EMLE pin is pulled-down (this pin must not be directly connected to GND) and connected to the emulator connector. If the EMLE pin is not connected to the emulator connector, the pin must be manually switched to the high level before debugging proceeds.
- If you are using the E20, check that the GND bus lead of the Mictor connector is correctly connected to GND (“GND bus lead” refers to the pin at the center of the connector).
  Pin 5 of the Mictor connector is not GND. Failure to correctly connect the bus lead to GND will lead to this error and to unstable operation.
- This error message will appear when the type number of the MCU that has been installed in the user system does not match that set in the project (e.g., when an attempt was made to connect a project for the RX610 to an RX210). Check that the type number of the MCU is correct.
- Check that the setting for the type of communications (JTAG or FINE) in the project is correct.
- If you are using the MCU with an IC socket, check there is no failure in the connection between the IC socket and the MCU.

Figure 1.12 JTAG Communication Error

1.12 Why Error Message “A timeout error has occurred in emulator firmware processing. (E1815001)” Appear When I Connect the Emulator?

Possible causes are the same as those given in section 1.11, Why Does the Error Message “A JTAG communication error. Please retry with reducing the JTAG clock. (E1811105)” Appear When I Connect the Emulator?.

Figure 1.13 A Timeout Error Has Occurred in Emulator Firmware Processing

1.13 Why Does the Error Message “A timeout error. The MCU is in the reset state. (E1814001)” Appear When I Connect the Emulator?

This error message appears when the MCU is in reset state and the RES# pin of the emulator connector is at the high level.

- Check that the correct voltage is being supplied to the MCU (e.g., that 3.3 V is not being supplied to an MCU that operates at 5 V).
- Check that the RESET pin of the MCU is not at the low level.

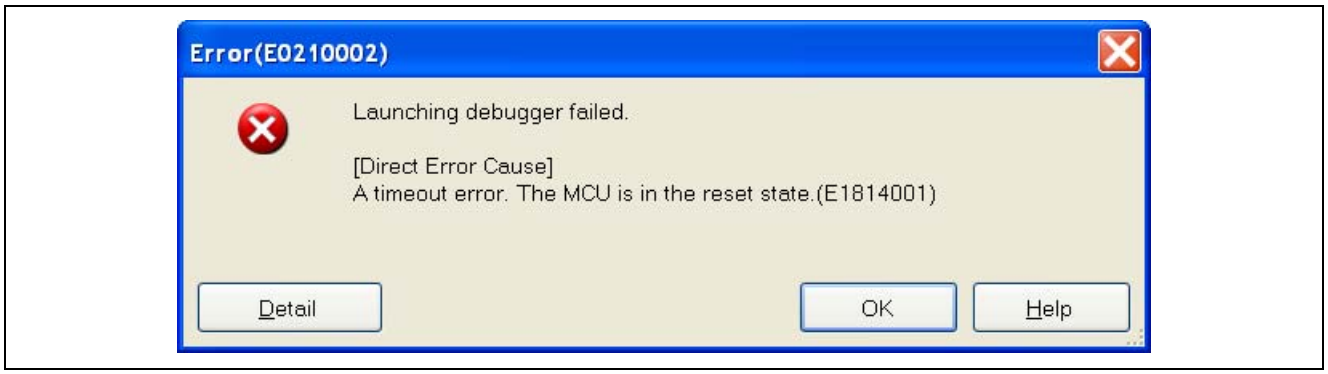


Figure 1.14 The MCU is in the Reset State

1.14 Why Does the Error Message “A timeout error. The command is not executable because the signal on the RESET pin is active. (E1814302)” Appear When I Connect the Emulator?

- This message indicates that CubeSuite+ cannot control resetting of the MCU. Ensure that the RES# pin of the emulator connector and the reset circuit on the user system are not fixed to the low level.

Figure 1.15 The Signal on the RESET Pin is Active

1.15 Why Does the Error Message “The input ID code does not match the ID code that is set in the target MCU. (E1811104)” Appear When I Connect the Emulator?

- ID-code protection is in effect and the value entered in [ID code] on the [Connect Settings] tabbed page in the [(debug tool) Property] panel did not match the ID code written in the MCU.
  Enter the correct ID code for [ID code] on the [Connect Settings] tabbed page in the [(debug tool) Property] panel.
  For details on ID-code protection, or if you do not know the ID code, refer to section 3, ID-Code Protection.

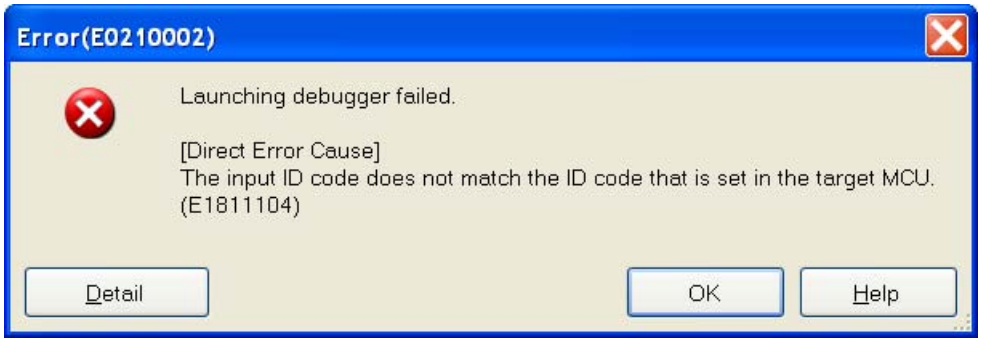


Figure 1.16 The Input ID Code Does Not Match the ID Code That is Set in the Target MCU

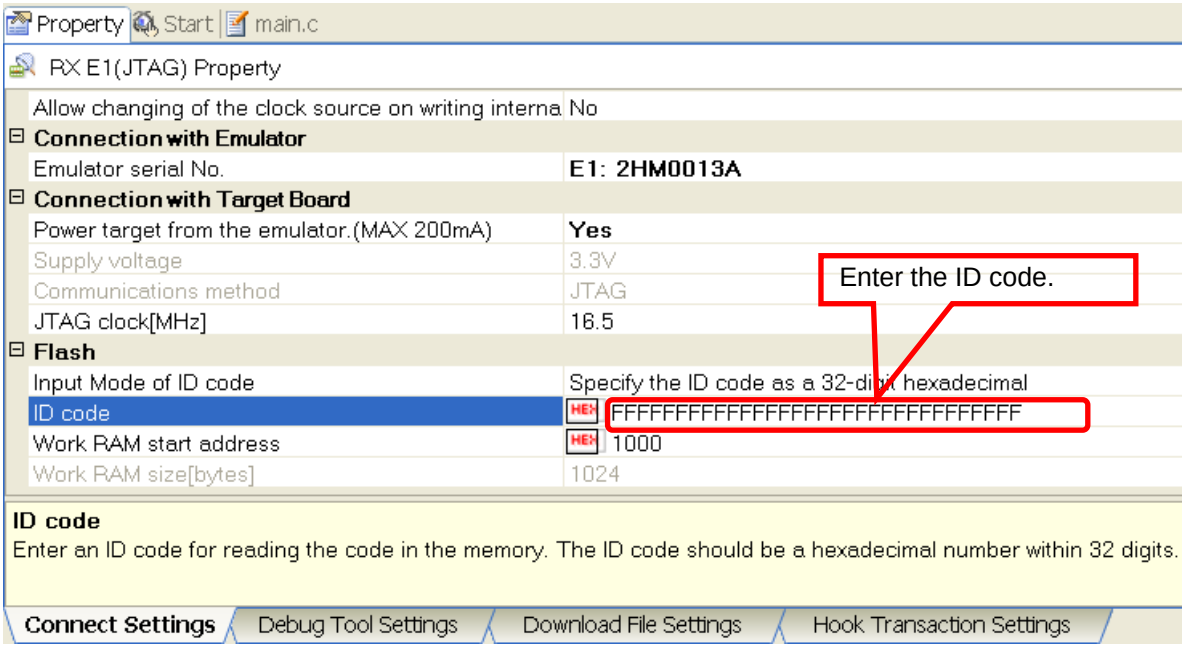


Figure 1.17 Entering the ID Code

1.16 Why Does the Message “Property value is not valid.” Appear When I Enter a Value in [ID code] in the [(debug tool) Property] Panel?

- This message indicates that the ID code that has been entered is not a 32-digit hexadecimal value. Check that the ID code has been correctly entered.
  In particular, if the number of digits entered is other than 32 (31 digits or fewer, or 33 digits or more), an error will occur. Be sure to enter 32-digit data.

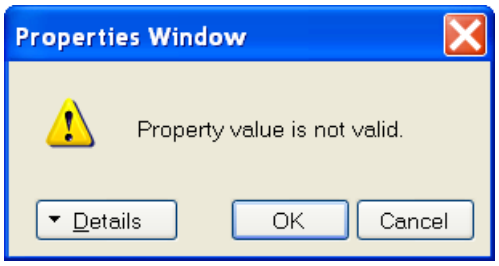


Figure 1.18 Property Value is not Valid

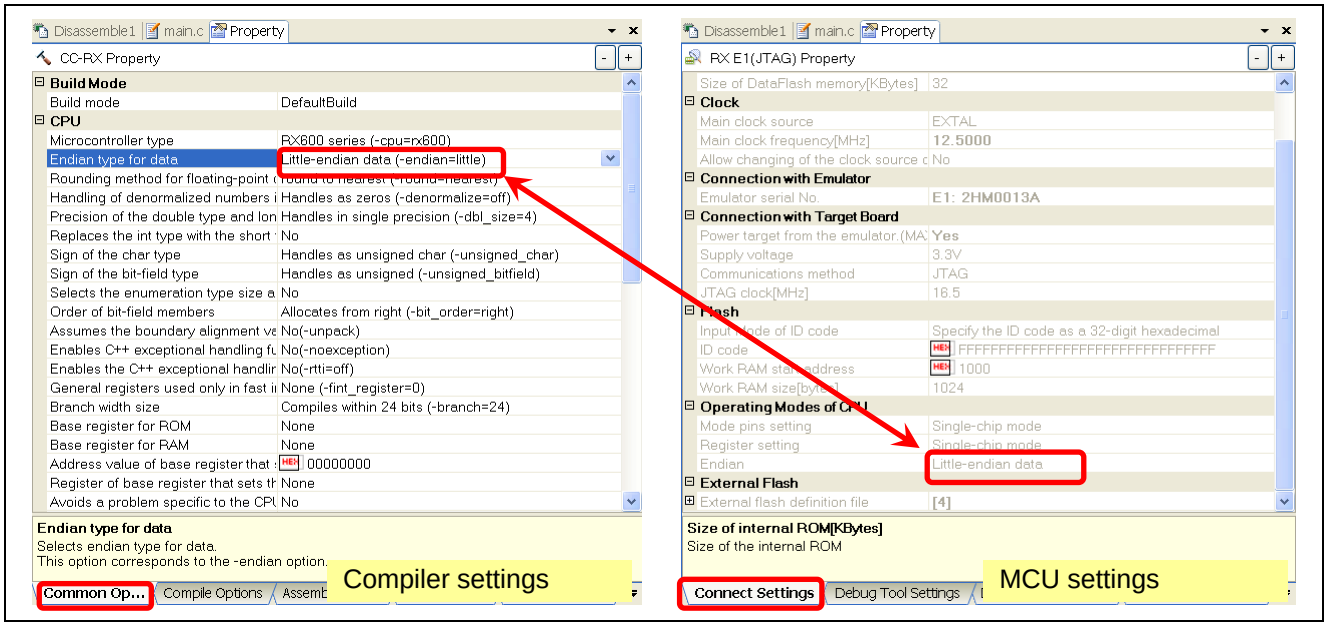
2. Troubleshooting in Operations after Startup

2.1 What is the Procedure When the Downloaded Program is not Displayed Correctly After I Start Up the Debugger?

The endian is selectable for a RX-family MCU. If the endian selected for the MCU does not match that selected when the program was created, the debugger cannot recognize the reset vector value of the downloaded program.

To check the endian selected when the program was created, select [Common Options] tabbed page of the [CC-RX (build tool) Property] panel and [Connect Settings] tabbed page on the [(debug tool) Property] panel in CubeSuite+.

If the selections do not match, modify either of them.



2.2 Why Are the Contents of I/O Registers in the [Memory] Panel Blank?

CubeSuite+ does not display or set the contents the I/O registers in the [Memory] panel.

Use the IOR panel for displaying and setting the contents of the I/O registers.

2.3 What is the Procedure When I Expand the RIIC (I^2C bus interface) Entry in the IOR Panel to View the Values of Registers but the Values are Incorrect because the IOR Panel Reads ICDRR (I^2C Bus Receive Data Register) Every Time the Program Stops?

After the entry for a module is expanded in the IOR panel, the window reads the values of the registers of that module every time the program stops.

However, reading changes the states of some registers, including ICDRR in RIIC. Such registers should not be read from the IOR panel.

Select either of the following ways to prevent the IOR panel from reading such registers.

- Collapse the entry for the IO module containing the register that you do not want to be read.
  Modules collapsed in the IOR panel will not be read.

2.4 Why Doesn't the Value of a Readable/Writable I/O Register Change as a Result of Writing?

When a new value is written to a readable/writable I/O register but the value of the register does not change, the possible reasons are as follows.

- The module containing the target I/O register is in the module stop state.
  Writing to the I/O registers of a module in the module stop state (controlled by the module stop control register) is disabled.
  Release the module from the module stop state and write to the I/O register.

- The target I/O register is write-protected due to the register write protection function.
  Devices of the RX200 series and the RX630, RX631, and RX63N groups have a write protection function to protect important registers from being overwritten in case a program runs out of control.
  Write the I/O register after setting the protection register for the register write protection function to enable writing.

2.5 Why Do Values in Data Flash Memory Change Every Time I View Them in the [Memory] Window?

The default state (immediately after erasure) of the Data Flash in RX-family MCUs is undefined so different values are read out every time. This is simply one of the MCU's specifications and is not a defect.

2.6 What is the Procedure When Rewriting the Flash Memory through the Program Succeeded with the Emulator but Failed with the Actual MCU?

The data in the FCU ROM must be transferred to the FCU RAM before rewriting the flash memory in an RX-family MCU.

When the emulator is in use, the emulator program transfers data from the FCU ROM to the FCU RAM, so rewriting the flash memory is possible even if the user program does not handle the transfer.

For usage of the FCU ROM and FCU RAM, refer to the user's manual for the MCU.

Some MCUs will not require data transfer from the FCU ROM to the FCU RAM.

2.7 What is the Procedure When the Debugger Cannot Read the Latest Values from Location in the On-Chip Flash Memory That Have been Altered by a User Program?

Since caching of the on-chip flash memory on the host computer is enabled by default, it is not possible to read the most recently updated values from the on-chip flash memory.

If the on-chip flash memory is to be updated by a user program, set [Debug the program re-writing the on-chip PROGRAM ROM] or [Debug the program re-writing the on-chip DATA FLASH] as [Yes] on the [Debug Tool Settings] page of the [(debug tool) Property] panel.

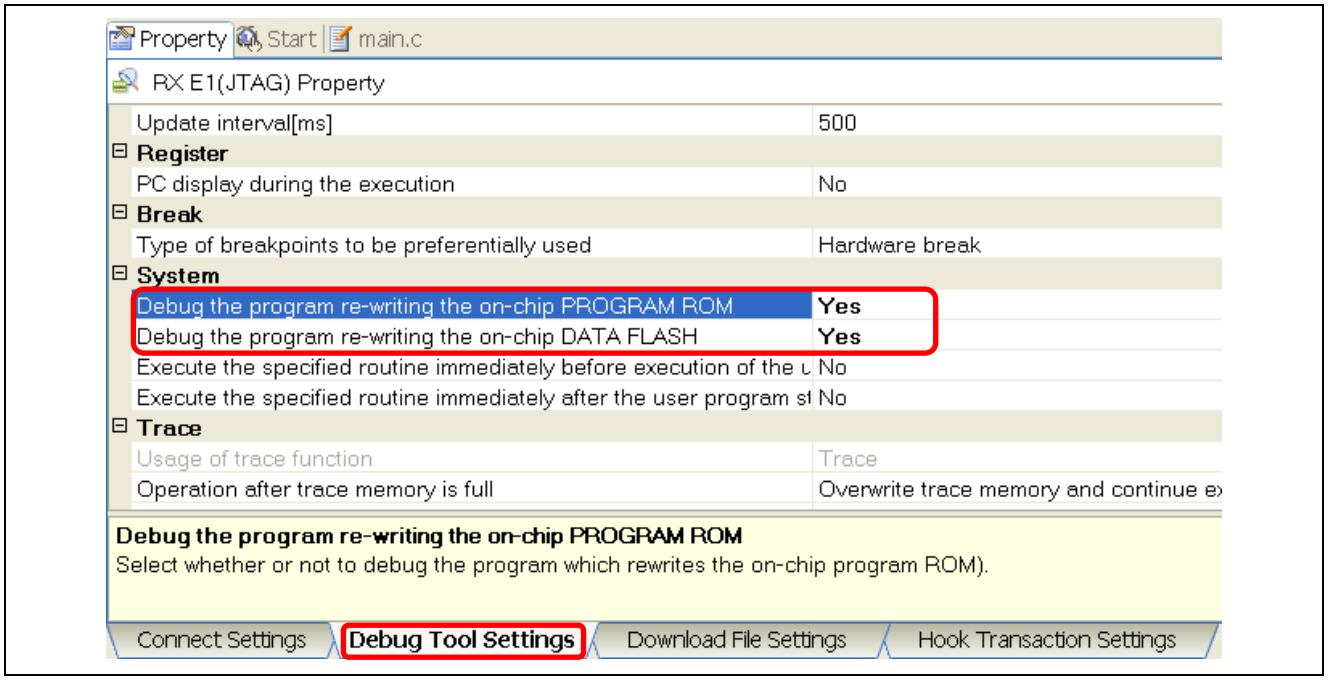


Figure 2.1 Debugging of Programs That Involve Rewriting of the On-Chip Flash Memory

2.8 Why Don't Values Change as Expected during Realtime RAM Monitoring by the E20?

Check the following points.

- [Realtime RAM monitor] must be selected for [Usage of trace function] under [Trace] on the [Debug Tool Settings] tabbed page in the [(debug tool) Property] panel.
- [No] and [Yes] must be selected for [Access by stopping execution] and [Update display during the execution] for [Access Memory While Running], respectively, on the [Debug Tool Settings] tabbed page in the [(debug tool) Property] panel.
- Automatic variables cannot be monitored by realtime RAM monitoring because values are stored in registers or on the stack.
- If optimization by the compiler eliminates a variable to be monitored or its assignment, declare the variable as volatile to prevent this optimization.
- DMA (DTC or DMAC) access cannot be monitored by realtime RAM monitoring.
- Monitoring of I/O registers for which the values are constantly being updated is not possible because realtime RAM monitoring is actually realized by monitoring reading and writing of memory by the MCU. Detecting changes of values in areas that are not read or written by programs is thus not possible.

2.9 Why Does the Error Message "Error (E0204001) Download failed. [Direct Error Cause] Address range error. (E1891905)" Appear When I Download a Program?

- This message indicates that the destination is an access-prohibited area.
- See the memory map in the hardware manual for the MCU and check that a file to be downloaded does not include a reserved area (access-prohibited area).
- If part of a file to be downloaded is for the external address space, check that [Single-chip mode] is not selected in [Register Settings] for the [CPU Operating Mode] item on the [Connection Settings] page of the [(debug tool) Property] panel. If the single-chip mode has been selected, select the on-chip ROM enabled expansion mode or the on-chip ROM disabled expansion mode.

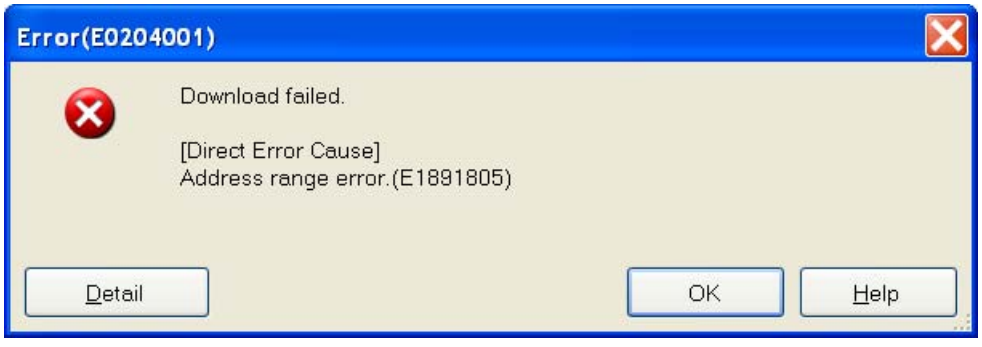


Figure 2.2 Address Range Error

2.10 Why Are the Displayed Addresses Different from Those Entered in the Display Position Specification Area of the Memory Panel?

Entries in the display position specification area are taken as decimal by default. If “1000” is entered, it is converted into hexadecimal and the will be from address 3E8.

To enter an address in hexadecimal, add 0x as a prefix to the address.

For example, when you want to show the address range from address 1000 in hexadecimal, enter 0x1000.

2.11 Why Are the Contents of Data Flash Memory Initialized When I Download a Program?

Check that the setting of [Erase flash ROM before download] on the [Download File Settings] tabbed page of the [(debug tool) Property] panel is not [Yes].

If [Yes] is selected for this setting, all of the flash memory (on-chip ROM and data flash) will be erased on downloading of a program.

If [No] is selected for this setting, the contents of the on-chip ROM and data flash are retained except where they are overwritten by the downloaded program.

2.12 Why are the Timestamp Values Displayed by the RX210 Trace Panel Incorrect?

The timestamp for RX210 tracing and the timer measurement function share the same clock source for counting.

Accordingly, when start and end conditions for the timer measurement function are set, the display of timestamp information from tracing will not be correct.

Do not use the timer measurement function when you need an accurate timestamp display for tracing.

3. ID-Code Protection

3.1 What is ID-Code Protection?

ID-code protection is a function that prevents the reading and modification of flash memory by third parties. This is a security function of the MCU rather than the debugger.

After the user writes an ID code to a specific address in the on-chip flash memory, anyone who does not know the ID code is unable to read or modify data in the on-chip flash memory. For details on ID-code protection, refer to the hardware manual for the MCU.

3.2 Handling of ID-Code Protection by the E1 and E20

ID-code protection that has been set by a user program is ineffective in this mode (i.e. all bytes of the ID code are FF even when downloading or control via the [Memory] window is attempted) except in cases where the flash memory has been updated by the user program.

3.3 What is the Procedure When I Don't Remember the ID Code?

If you do not remember the ID code, you can try to do so in the three ways described below.

- First, enter an ID code in which all digits are 0.

  The ID code area is adjacent to the vector area. All digits may be 0 unless a particular ID code has been intentionally specified by a user program.

- When you know which program was the last to have been downloaded

  Use a simulator to download the program, check the value at the ID-code address, and then enter that value in the [ID code] dialog box.

- When you do not know which program was the last to have been downloaded

  Use an on-board programmer (e.g. the Flash Development Toolkit) to connect to the MCU. When the dialog box for ID-code authentication appears, enter any ID code.
  Depending on the control code for ID-code protection (refer to the hardware manual for the MCU), the contents of the flash memory can become erasable when the ID code does not match.

If you still cannot connect the debugger even in any of the above ways, Renesas is unable to offer any other solution.

4. USB Driver

4.1 Checking That the USB Driver Has been Installed

To check that the USB driver is working correctly, see the state of the ACT LED on the E1 or E20 emulator after connecting the emulator and host computer via a USB interface cable.

Table 4.1 shows the states of the ACT LED and their meanings.

Table 4.1 ACT States and Meanings

ACT LED	Communication between the Host Computer and Emulator	Checkpoint
Illuminated	The emulator is usable.	The USB driver has correctly been installed.
Blinking	The emulator is not usable yet because the USB driver has not been recognized.	Check whether the USB driver has correctly been installed (by following the procedure below).
Not illuminated	Communication has not been established.	Check whether the USB interface cable is correctly connected, the host computer and emulator are supplied with power, and no items are damaged.

Follow the procedures below to check whether the USB driver has successfully been installed.

(1) Open the properties window for [My Computer] ([System Properties] dialog box).

(2) Open the [Hardware] tabbed page and click on the [Device Manager] button as shown in Figure 4.1.

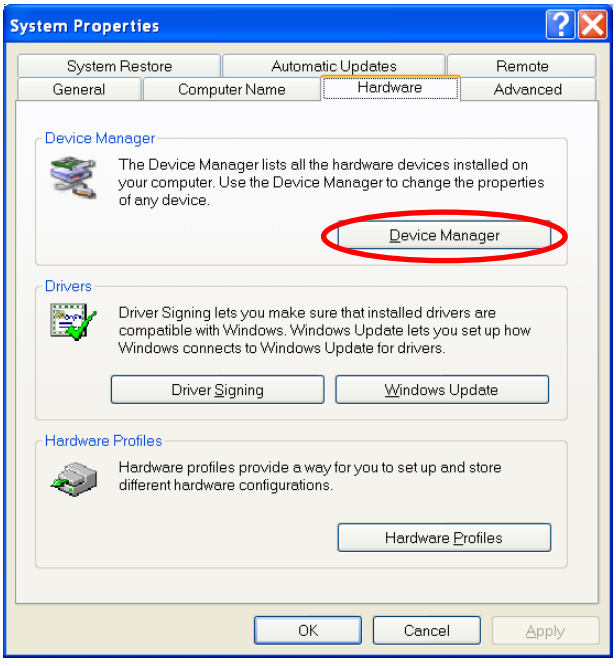


Figure 4.1 [System Properties] Dialog Box

(3) Check that [Renesas E-Series USB Driver] is shown under the [Renesas Emulator] category (Figure 4.2).

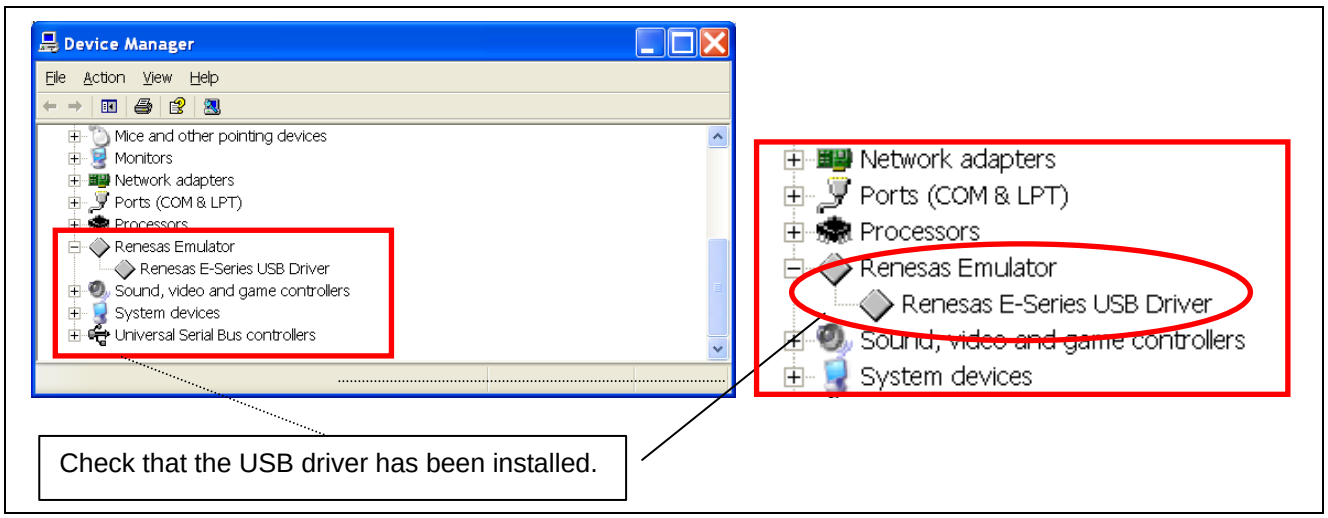


Figure 4.2 Device Manager

Some drivers under the [Renesas Emulator] category may have a [!] or [?] mark attached to the icon. These drivers may not have been successfully installed, so delete them, disconnect and re-connect the USB cable, and then re-install the USB drivers.

Figure 4.3 Display Indicating Failed Installation of a USB Driver

If you cannot find any driver under the [Renesas Emulator] category, check that the emulator software has been installed, disconnect and re-connect the USB cable, and then re-install the USB drivers.

Website and Support

Renesas Electronics Tools Website

http://www.renesas.com/tools

Inquiries

http://www.renesas.com/inquiry

All trademarks and registered trademarks belong to their respective owners.

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Sep. 26, 2012	—	Newly created

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
3. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.
6. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

© 2013 Renesas Electronics Corporation. All rights reserved.

Colophon 2.2