

# Synchronous Debugging of Multiple Devices

(E2 Emulator and IE850A: Hardware)

## Introduction

This application note describes hardware which is required for using the synchronous debugging function for multiple devices on the E2 emulator, IE850A, and the e<sup>2</sup> studio integrated development environment.

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### Terminology

Some specific words used in this user's manual are defined below.

#### Integrated development environment

This tool provides powerful support for the development of embedded applications for Renesas microcomputers. It has an emulator debugger function allowing the emulator to be controlled from the host machine via an interface. Furthermore, it permits a range of operations from editing a project to building and debugging it to be performed within the same application. In addition, it supports version management.

#### Host machine

This means a personal computer used to control the emulator.

#### Target device

This means the device to be debugged.

#### User system

This means a user's application system in which the device to be debugged is used.

#### User program

This means the application program to be debugged.

#### User system interface

This means the interface that the E2 or IE850A emulator connects to a target device.

#### E2 expansion interface connector (E2 expansion interface)

This means the interface required for extended functions of the E2 emulator. A self-check connector is used as the E2 expansion interface connector.

## Synchronous Debugging of Multiple Devices (E2 Emulator and IE850A: Hardware)

### Configuration of Manuals

The following manuals contain information relevant to the synchronous debugging of multiple devices.

- Synchronous Debugging of Multiple Devices (E2 Emulator and IE850A: Hardware) Application Note (this document)
- Synchronous Debugging of Multiple Devices (E2 Emulator, IE850A, and e<sup>2</sup> studio) Application Note
- E2 Emulator User's Manual
- IE850A Emulator User's Manual
- Synchronous Adapter for the E2 Emulator User's Manual
- Synchronous Adapter for the IE850A User's Manual
- E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of RH850/U2A)
- E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of RH850/U2B)
- E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of R-Car S4: Common to All R-Car S4 Devices)
- E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of R-Car V4H)

The following application note gives an overview, a description of the usage, and notes on the use of the synchronous debugging function for multiple devices.

Name of Document	Document No.
Synchronous Debugging of Multiple Devices (E2 Emulator, IE850A, and e <sup>2</sup> studio) Application Note	R20AN0695E

The following manuals give the specifications, functional overviews, and notes on the use of each of the emulators.

Name of Document	Document No.
E2 Emulator RTE0T00020KCE00000R User's Manual	R20UT3538E
IE850A Emulator RTE0T0850AKCT00000J User's Manual	R20UT4461E

The following manuals give the functional overviews and notes on the use of each of the synchronous adapters.

Name of Document	Document No.
Synchronous Adapter for the E2 Emulator RTE0T00020KCAAx000J User's Manual	R20UT5435E
Synchronous Adapter for the IE850A RTE0T0850AKCA10000J User's Manual	R20UT5436E

The following manual gives an overview and notes on the use of the debugging function for the RH850/U2A.

Name of Document	Document No.
E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of RH850/U2A)	R20UT4381E

The following manual gives an overview and notes on the use of the debugging function for the RH850/U2B.

Name of Document	Document No.
E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of RH850/U2B)	R20UT5052E

## Synchronous Debugging of Multiple Devices (E2 Emulator and IE850A: Hardware)

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The following manuals give the overviews and notes on the use of the debugging functions for the R-Car S4.

<b>Name of Document</b>	<b>Document No.</b>
E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of R-Car S4: Common to All R-Car S4 Devices)	R20UT5042E
E2 Emulator, IE850A Additional Document for User's Manual (Notes on Connection of R-Car S4 G4MH)	R20UT5043E
E2 Emulator Additional Document for User's Manual (Notes on Connection of R-Car S4 CR52/CA55)	R20UT5050E

The following manual gives an overview and notes on the use of the debugging functions for the R-Car V4H.

<b>Name of Document</b>	<b>Document No.</b>
E2 Emulator Additional Document for User's Manual (Notes on Connection of R-Car V4H CR52/CA76)	R20UT5377E

### Important

Before using this product, be sure to read this application note carefully.

Keep this application note, and refer to it when you have questions about this product.

Purpose of use of this product:

This product is for the support of the development of systems that use RH850-family MCUs and R-Car automotive SoCs from Renesas. It provides support for system development in both software and hardware.

Be sure to use this product correctly according to said purpose of use. Please avoid using this product other than for its intended purpose of use.

For those who use this product:

This product can only be used by those who have carefully read the application note and know how to use it.

Use of this product requires basic knowledge of electric circuits, logical circuits, and MCUs.

When using the product:

- (1) This product is a development-support unit for use in your program development and evaluation stages. When a program you have finished developing is to be incorporated in a mass-produced product, the judgment as to whether it can be put to practical use is entirely your own responsibility, and should be based on evaluation of the device on which it is installed and other experiments.
- (2) In no event shall Renesas Electronics Corporation be liable for any consequence arising from the use of this product.
- (3) Renesas Electronics Corporation strives to provide workarounds for and correct trouble with products malfunctions, with some free and some incurring charges. However, this does not necessarily mean that Renesas Electronics Corporation guarantees the provision of a workaround or correction under any circumstances.
- (4) The product covered by this document has been developed on the assumption that it will be used for program development and evaluation in laboratories. Therefore, it does not fall within the scope of applicability of the Electrical Appliance and Material Safety Law and protection against electromagnetic interference when used in Japan.
- (5) Renesas Electronics Corporation cannot predict all possible situations and possible cases of misuse that carry a potential for danger. Therefore, the warnings in this application note and the warning labels attached to the product do not necessarily cover all such possible situations and cases. The customer is responsible for correctly and safely using this product.
- (6) Renesas Electronics Corporation will not assume responsibility for direct or indirect damage caused by an accidental failure or malfunction of this product.

When disposing the product:

Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

## Synchronous Debugging of Multiple Devices (E2 Emulator and IE850A: Hardware)

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### Usage restrictions:

The product has been developed as a means of supporting system development by users. Therefore, do not use it as an embedded device in other equipment. Also, do not use it to develop systems or equipment for use in the following fields.

- (1) Transportation and vehicular
- (2) Medical (equipment that has an involvement in human life)
- (3) Aerospace
- (4) Nuclear power control
- (5) Undersea repeaters

If you are considering the use of the product for one of the above purposes, please be sure to consult your local distributor.

### About product changes:

We are constantly making efforts to improve the design and performance of this product. Therefore, the specification or design of this product, or this application note, may be changed without prior notice.

### About rights:

- (1) We assume no responsibility for any damage or infringement on patent rights or any other rights arising from the use of any information, products or circuits presented in this application note.
- (2) The information or data in this application note does not implicitly or otherwise grant a license to patent rights or any other rights belonging to Renesas or to a third party.
- (3) This application note and this product are copyrighted, with all rights reserved by Renesas. This application note may not be copied, duplicated or reproduced, in whole or part, without prior written consent from Renesas.

### About diagrams:

Some diagrams in this application note may differ from the objects they represent.

## Precautions for Safety

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read and understand this chapter before using this product. Contact your local distributor if you have any questions about the precautions described here.



### **WARNING**

**WARNING** indicates a potentially dangerous situation that will cause death or heavy wound unless it is avoided.



### **CAUTION**

**CAUTION** indicates a potentially dangerous situation that will cause a slight injury or a medium-degree injury unless it is avoided.

To avoid a possible danger, the following diagrammatic symbols are used to call your attention.

△ means WARNING or CAUTION.

Example:



**CAUTION AGAINST AN ELECTRIC SHOCK**

⊘ means PROHIBITION.

Example:



**DISASSEMBLY PROHIBITED**

● means A FORCIBLE ACTION.

Example:



**UNPLUG THE POWER CABLE FROM THE RECEPTACLE.**

 **WARNING**

Warnings for AC Power Supply:



Do not repair or remodel the emulator product by yourself in order to prevent danger such as an electric shock or fire and for the sake of quality assurance. For after-sale services in case of a mechanical or electrical fault, please contact your local distributor.

Always switch off the user system before connecting or disconnecting any connectors or cables. Neglecting to take this precaution may result in an electric shock or in this product emitting smoke or catching fire. Also, a user program being debugged may be destroyed.

Make sure that the connectors and cables are connected in the correct directions. Neglect of this precaution will result in getting an electric shock or will result in this product emitting smoke or catching fire.

Warning for Modification:



Do not modify this product. Personal injury due to electric shock may occur if the product is modified. Modifying the product will void your warranty.

Warning for Installation:



Do not set this product in water or areas of high humidity. Make sure that the product does not get wet. Spilling water or some other liquid into the product may cause un-repairable damage.

Warning for Use Temperature:



This product is to be used in an environment with a maximum ambient temperature of 40°C.

Care should be taken that this temperature is not exceeded.



 **CAUTION**

Cautions to Be Taken for Handling This Product:



Use caution when handling this product. Be careful not to apply a mechanical shock.

Do not operate switches before removing static electricity from the operator's body. Doing so may lead to the discharge of static electricity and so damage the internal circuits. Also, do not directly touch connector pins.

When attaching and removing the cable, hold a fixture (such as a connector) to avoid pulling the cable.

Caution to Be Taken for System Malfunctions:



If this product malfunctions because of interference like external noise, do the following to remedy the trouble.

- (1) Exit the emulator debugger, and turn off the emulator and the target system.
- (2) After a lapse of 10 seconds, turn on the power of this product again, then launch the emulator debugger.

Caution to Be Taken for Disposal:



Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

European Union Regulatory Notices:



The WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the European Union only. This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner.

Renesas Electronics Europe GmbH can take back end of life equipment, register for this service at "<http://www.renesas.eu/weee>".

## 1. Outline

The synchronous debugging of multiple devices is possible in combination with a user system on which RH850-family MCUs and R-Car automotive SoCs from Renesas Electronics are mounted, emulators, and synchronous adapters from Renesas Electronics.

This chapter describes the hardware environment required for the synchronous debugging of multiple devices.

### 1.1 Target Devices

Table 1-1 lists the devices supporting the synchronous debugging function.

Prepare a user system on which these target devices are mounted.

**Table 1-1 Target Devices Supporting the Synchronous Debugging Function**

Family	Target Device
RH850	U2A
	U2B
R-Car	S4
	V4H

### 1.2 Emulators

Table 1-2 lists the emulators which support the synchronous debugging function.

Prepare an emulator which suits the user system.

**Table 1-2 Emulators Supporting the Synchronous Debugging Function**

Product Name	Ordering Part Number
E2 emulator	RTE0T00020KCE00000R
IE850A	RTE0T0850AKCT00000J*

Note: Connecting the IE850A to an R-Car S4 system evaluation board requires the following conversion adapter: R-Car Nexus Aurora Conversion Adapter (RTP8A779F0ASKB0SR0SN080)

### 1.3 Synchronous Adapters

Table 1-3 lists the synchronous adapters which support each emulator.

Prepare a synchronous adapter for the emulator you are using.

**Table 1-3 Synchronous Adapters Supporting Each Emulator**

Product Name	Ordering Part Number
Basic set of the synchronous adapter for the E2 emulator	RTE0T00020KCAA1S00J
Synchronous adapter for an additional E2 emulator	RTE0T00020KCAA1100J
Synchronous adapter for the IE850A	RTE0T0850AKCA10000J

### 1.4 Product Specifications

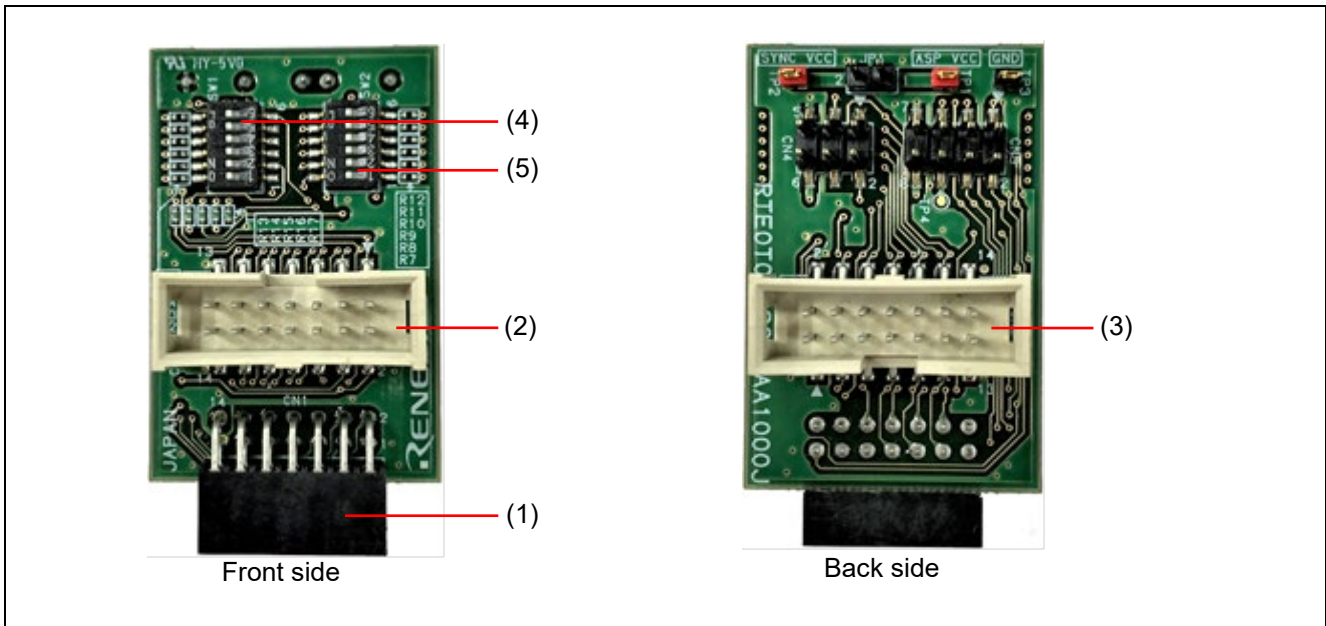
For details on the product specifications of the E2 emulator, IE850A, and synchronous adapters, refer to the user's manuals for each of the products.

## 2. Names and Functions of the Synchronous Adapters

This chapter describes the names and functions of the synchronous adapters.

### 2.1 Synchronous Adapter for the E2 Emulator (RTE0T00020KCAA1000J)

The synchronous adapter for the E2 emulator (RTE0T00020KCAA1000J) is equipped with DIP switch blocks (DIP switches) for making operating mode settings. The adapter is connectable to other E2 emulators or IE850A units via the synchronous debugging cable so that the synchronous debugging function can be used. This product is for connection with the first E2 emulator or with the second or a subsequent E2 emulator. Note that the DIP-switch settings differ according to whether this product is for use with the first emulator or with the second or a subsequent emulator.



**Figure 2-1 Names of the Parts of the Synchronous Adapter for the E2 Emulator (RTE0T00020KCAA1000J)**

- (1) Connector for connecting the E2 emulator: CN1  
CN1 is connected to the E2 expansion interface (self-check connector) of the E2 emulator.
- (2) Connector for connecting the synchronous debugging cable: CN2  
CN2 is for connecting the synchronous debugging cable. Operation is the same whether the synchronous debugging cable is connected to (2) or (3).
- (3) Connector for connecting the synchronous debugging cable: CN3  
CN3 is for connecting the synchronous debugging cable. Operation is the same whether the synchronous debugging cable is connected to (2) or (3).
- (4) DIP switches for setting the operating mode: SW1  
SW1 is used to set the operating mode of the synchronous adapter.
- (5) DIP switches for setting the operating mode: SW2  
SW2 is used to set the operating mode of the synchronous adapter.

 **CAUTION**

Connection to the E2 emulator:



When connecting the synchronous adapter for the E2 emulator to the E2 emulator, align the pin 1 mark on the connector for the E2 emulator (CN1) with the pin 1 mark stamped on the casing of the E2 emulator.

Misalignment of the marks may cause the synchronous adapter for the E2 emulator and the emulator to emit smoke or catch fire or otherwise be damaged.

 **CAUTION**

DIP-switch settings:



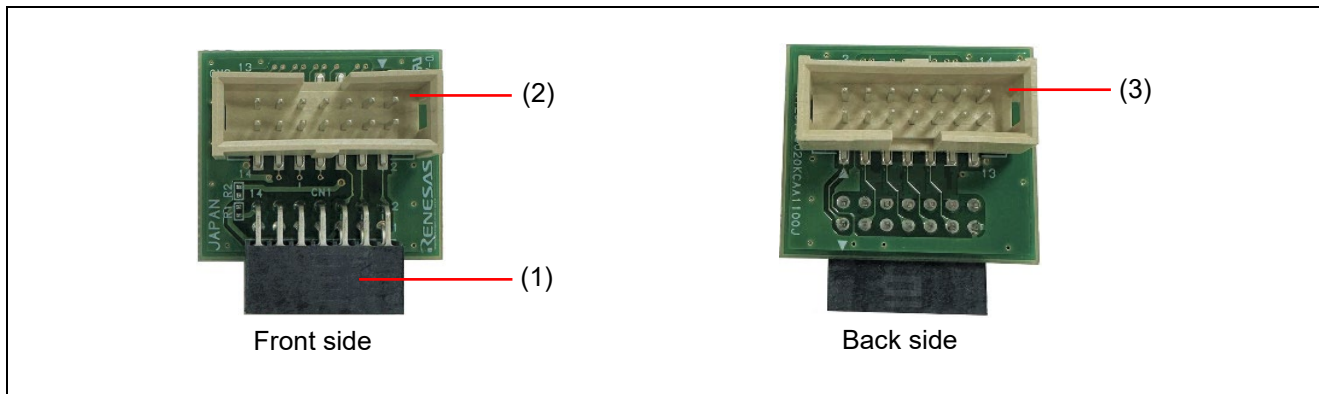
Note that the DIP-switch settings differ according to whether the synchronous adapter is for use with the first emulator or with the second or a subsequent emulator. Make the DIP-switch settings according to the instructions.

Note that incorrect DIP-switch settings may result in malfunctions or damage the synchronous adapter and the emulator.

## 2.2 Synchronous Adapter for Additional E2 Emulators (RTE0T00020KCAA1100J)

The synchronous adapter for additional E2 emulators (RTE0T00020KCAA1100J) is for connection of the second or a subsequent E2 emulator. The adapter is connectable to other E2 emulators or IE850A units via the synchronous debugging cable so that the synchronous debugging function can be used.

This product cannot be used with the first E2 emulator because it does not have DIP switches. Be sure to use it only as the synchronous adapter for a second or subsequent E2 emulator. Also, connecting multiple units of this product alone will not work.



**Figure 2-2 Names of the Parts of the Synchronous Adapter for Additional E2 Emulators (RTE0T00020KCAA1100J)**

- (1) Connector for connecting the E2 emulator: CN1  
CN1 is connected to the E2 expansion interface (self-check connector) of the E2 emulator.
- (2) Connector for connecting the synchronous debugging cable: CN2  
CN2 is for connecting the synchronous debugging cable. Operation is the same whether the synchronous debugging cable is connected to (2) or (3).
- (3) Connector for connecting the synchronous debugging cable: CN3  
CN3 is for connecting the synchronous debugging cable. Operation is the same whether the synchronous debugging cable is connected to (2) or (3).

### CAUTION

Connection to the E2 emulator:

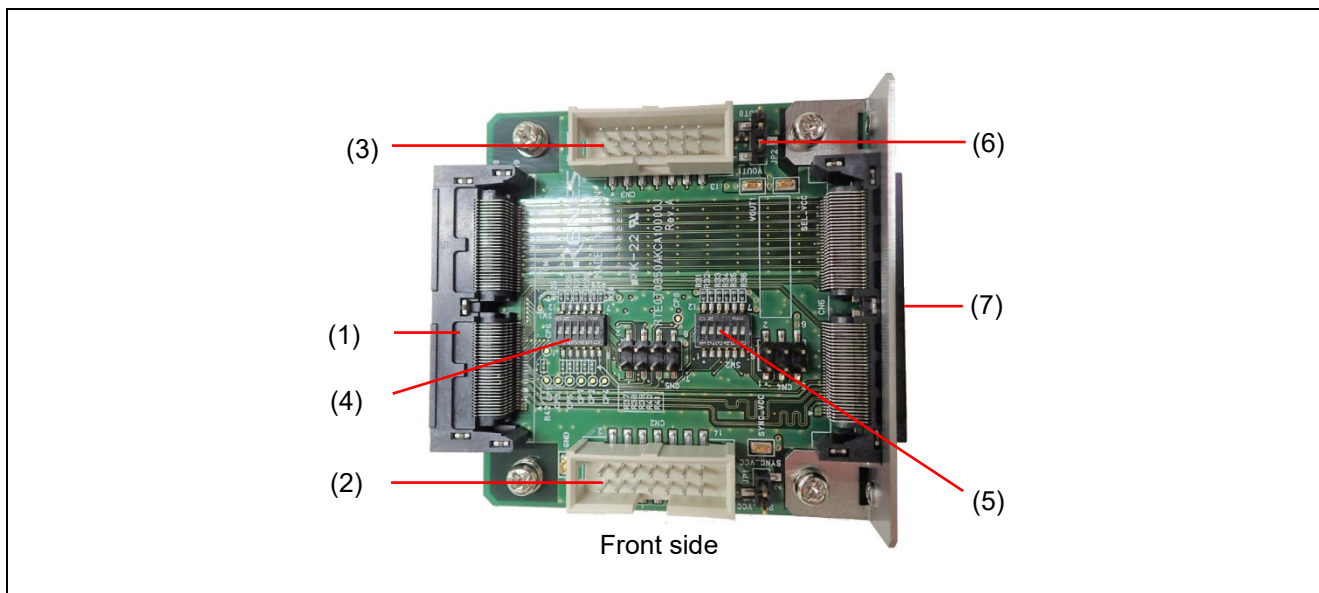


When connecting the synchronous adapter for additional E2 emulators to the E2 emulator, align the pin 1 mark on the connector for the E2 emulator (CN1) with the pin 1 mark stamped on the casing of the E2 emulator.

Misalignment of the marks may cause the synchronous adapter and the emulator to emit smoke or catch fire or otherwise be damaged.

### 2.3 Synchronous Adapter for the IE850A (RTE0T0850AKCA10000J)

The synchronous adapter for the IE850A (RTE0T0850AKCA10000J) is equipped with DIP switch blocks (DIP switches) for making operating mode settings. The adapter is connectable to other IE850A units or E2 emulators via the synchronous debugging cable so that the synchronous debugging function can be used. This product is for connection with the first E2 emulator or with the second or a subsequent E2 emulator. Note that the DIP-switch settings differ according to whether this product is for use with the first emulator or with the second or a subsequent emulator.



**Figure 2-3 Names of the Parts of the Synchronous Adapter for the IE850A (RTE0T0850AKCA10000J)**

- (1) Connector for connecting the IE850A: CN1  
CN1 is connected to the IE850A.
- (2) Connector for connecting the synchronous debugging cable: CN2  
CN2 is for connecting the synchronous debugging cable. Operation is the same whether the synchronous debugging cable is connected to (2) or (3).
- (3) Connector for connecting the synchronous debugging cable: CN3  
CN3 is for connecting the synchronous debugging cable. Operation is the same whether the synchronous debugging cable is connected to (2) or (3).
- (4) DIP switches for setting the operating mode: SW1  
SW1 is used to set the operating mode of the synchronous adapter.
- (5) DIP switches for setting the operating mode: SW2  
SW2 is used to set the operating mode of the synchronous adapter.
- (6) Jumper block for setting the operating voltage: JP2  
JP2 is used to set the voltage of the synchronous adapter. Set the same voltage as that for the other synchronous adapters.

JP2 (VOUT_SEL)	Specification
Open-circuit	Setting prohibited.
<b>VOUT1</b> 1-2 short-circuit (default)	Set the operating voltage of the synchronous adapter to 3.3 V.
VOUT0 2-3 short-circuit	Set the operating voltage of the synchronous adapter to 5.0 V.

## Synchronous Debugging of Multiple Devices (E2 Emulator and IE850A: Hardware)

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(7) Connector for connecting the IE850A trace cable: CN6

CN6 is for connecting the IE850A trace cable.

### CAUTION

Setting of JP2 (VOUT\_SEL):



If the emulators for use in synchronous debugging include an E2 emulator, set JP2 (VOUT\_SEL) to the same voltage as the ASPVCC setting in the debugger. If multiple synchronous adapters for the IE850A are connected, make the same setting of JP2 (VOUT\_SEL) for each synchronous adapter. Incorrect settings may cause the synchronous adapter and the emulator to emit smoke or catch fire or otherwise be damaged.

### CAUTION

DIP-switch settings:



Note that the DIP-switch settings differ according to whether the synchronous adapter is for use with the first emulator or with the second or a subsequent emulator. Make the DIP-switch settings according to the instructions. Note that incorrect DIP-switch settings may result in malfunctions or damage the synchronous adapter and the emulator.

### 3. Setting and Connecting the Synchronous Adapters

Setting of the switches and jumper blocks of the synchronous adapter is required before the adapter is connected to the emulator.

This chapter describes how to set up and connect the synchronous adapters for the E2 emulator and the IE850A.

#### 3.1 Setting the Synchronous Adapters for the E2 Emulator and the IE850A

Make the DIP-switch settings before connecting a synchronous adapter for the E2 emulator (RTE0T00020KCAA1000J) or for the IE850A (RTE0T0850AKCA10000J) to the emulator.

Note that in the case of the synchronous adapters that have DIP switches, the DIP-switch settings differ according to whether the synchronous adapter is for use with the first emulator or with the second or a subsequent emulator.

When multiple synchronous adapters equipped with DIP switches are to be connected to emulators, only set one of them with the settings for the first adapter. For another synchronous adapter that is equipped with DIP switches, make the settings for the adapter as the second or a subsequent adapter.

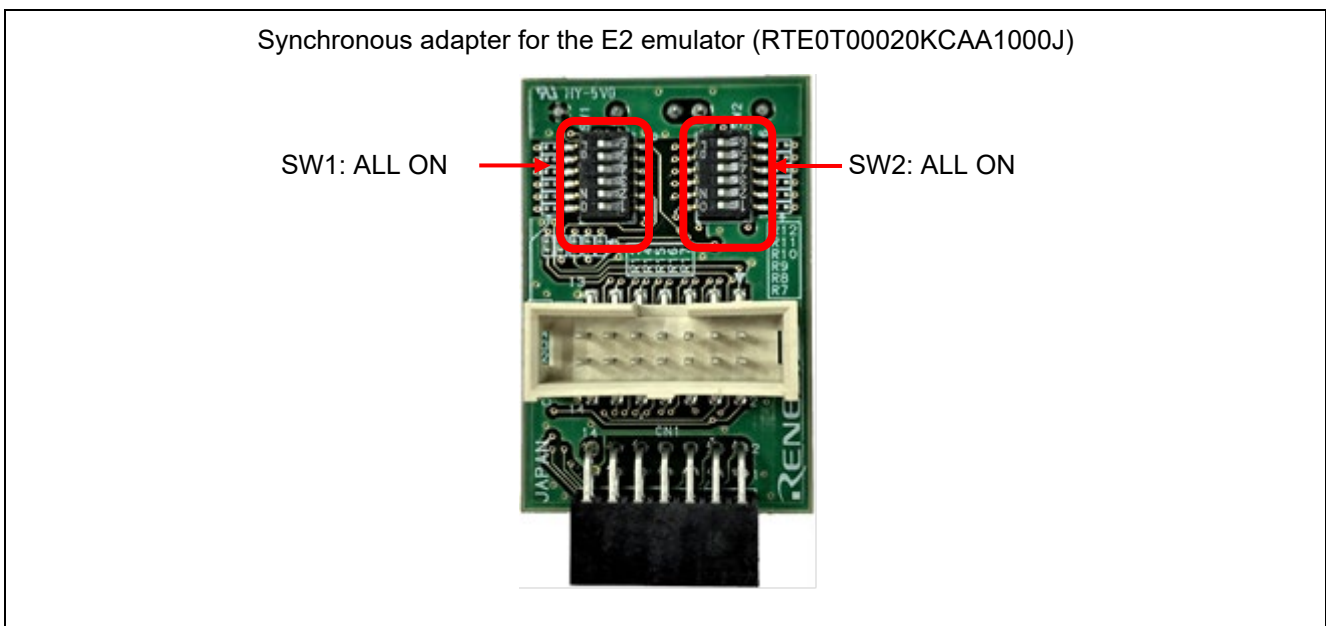


Figure 3-1 Configuration of the Synchronous Adapter for the E2 Emulator as the First Emulator



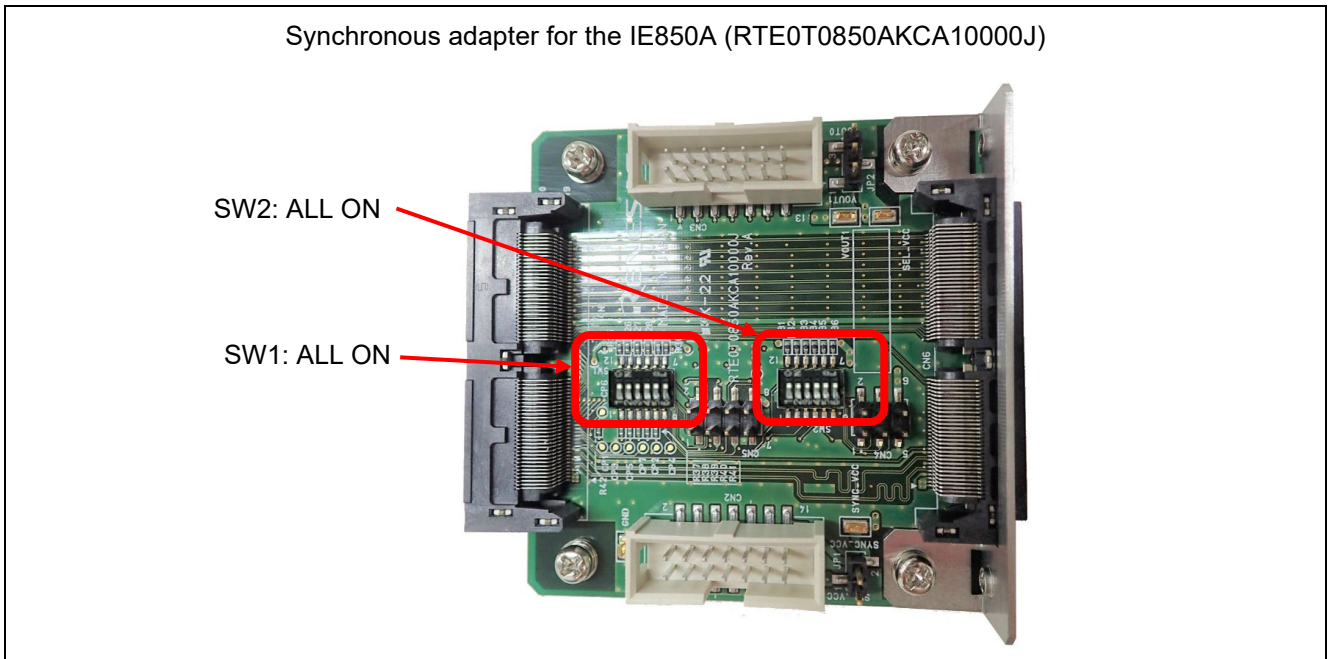


Figure 3-2 Configuration of the Synchronous Adapter for the IE850A as the First Emulator

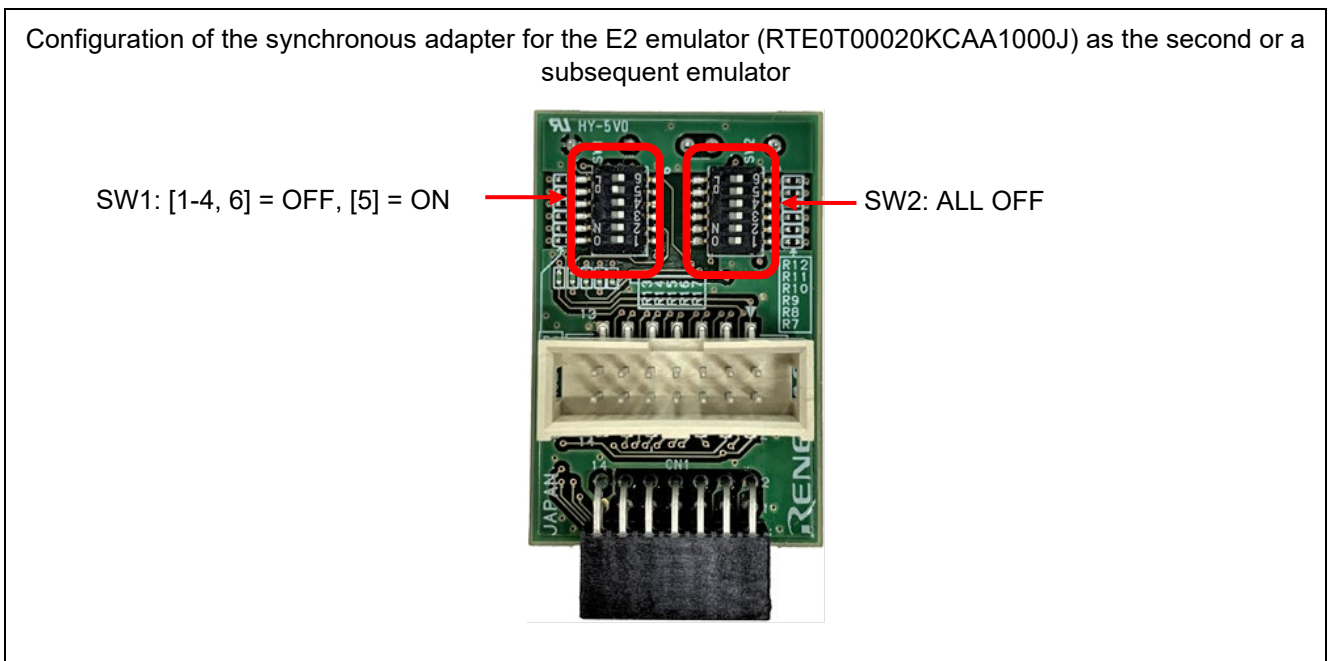
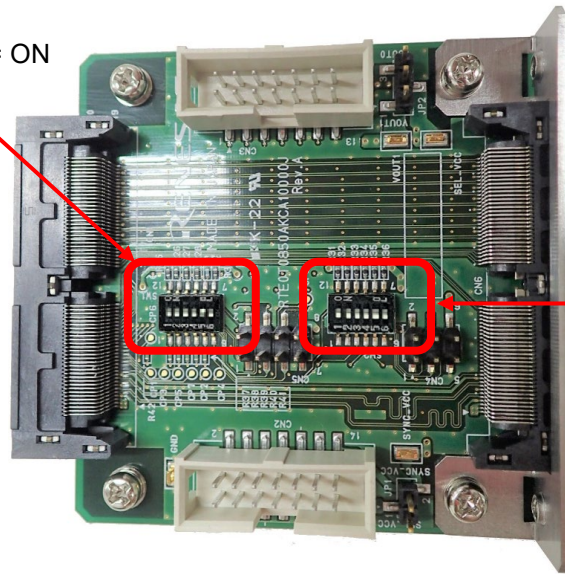


Figure 3-3 Configuration of the Synchronous Adapter for the E2 Emulator as the Second or a Subsequent Emulator

Configuration of the synchronous adapter for the IE850A (RTE0T0850AKCA10000J) as the second or a subsequent emulator

SW1: [1-4, 6] = OFF, [5] = ON



SW2: ALL OFF

Figure 3-4 Configuration of the Synchronous Adapter for the IE850A as the Second or a Subsequent Emulator

### 3.2 Connecting the Synchronous Adapter for the E2 Emulator to the E2 Emulator

Connect the synchronous adapter for the E2 emulator (RTE0T00020KCAA1000J) or the synchronous adapter for additional E2 emulators (RTE0T00020KCAA1100J) to the E2 expansion interface on the E2 emulator. The E2 expansion interface is the self-check connector on the E2 emulator main unit.

The number of synchronous adapters must be the same as the number of E2 emulators.

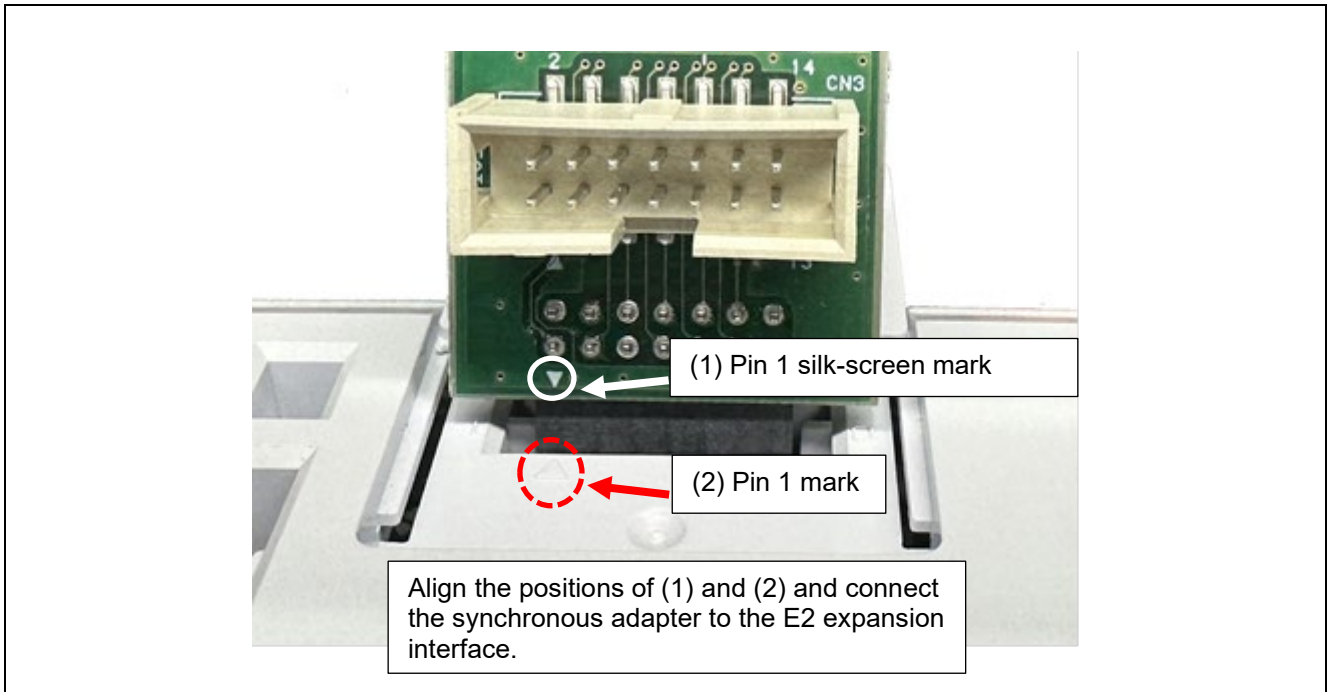


Figure 3-5 Connecting a Synchronous Adapter to the E2 Expansion Interface

### 3.3 Connecting the Synchronous Adapter for the IE850A to the IE850A and the IE850A Trace Cable

Connect the IE850A connector (CN1) of the synchronous adapter for the IE850A (RTE0T0850AKCA10000J) to the debug interface connector for the IE850A. After that, connect the IE850A trace cable to the connector for the trace cable (CN6) on the synchronous adapter for the IE850A.

The number of synchronous adapters for the IE850A must be the same as the number of IE850A units to be used.

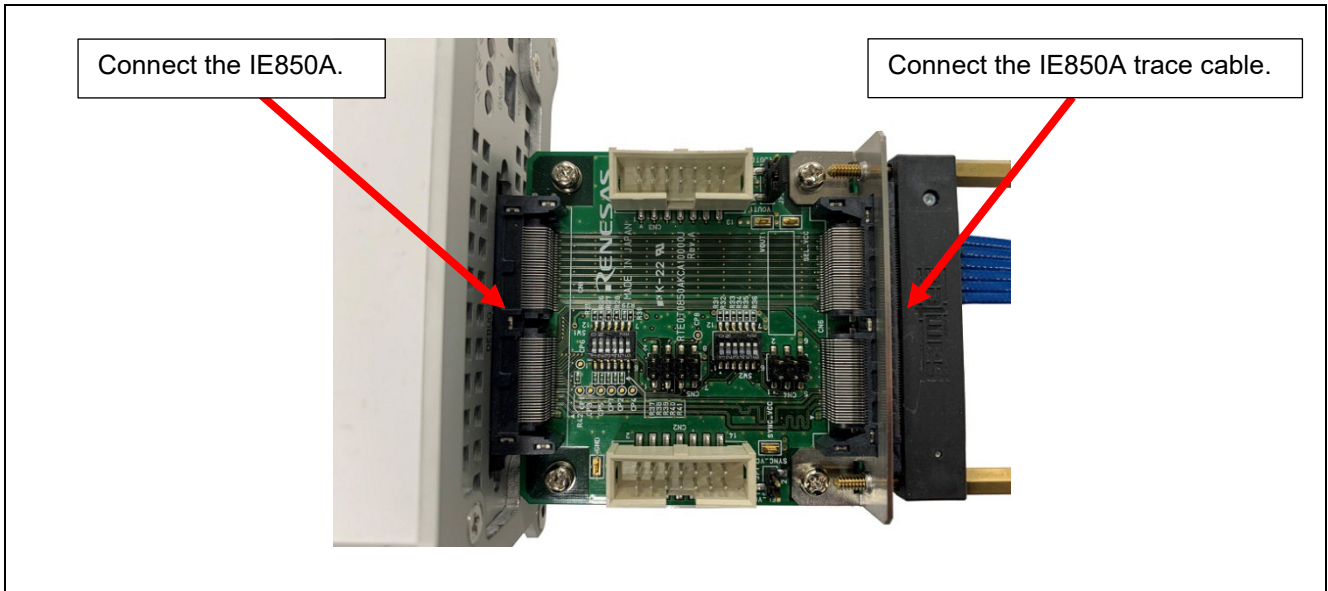


Figure 3-6 Connecting the IE850A and the IE850A Trace Cable

### 3.4 Connecting Multiple Synchronous Adapters

Multiple synchronous adapters are connected by the synchronous adapter cables provided with the adapters. Connect CN2 on the first synchronous adapter to CN3 on the second synchronous adapter with the synchronous adapter cable.

To connect a third synchronous adapter, connect CN2 on the second synchronous adapter to CN3 on the third synchronous adapter with the synchronous adapter cable.

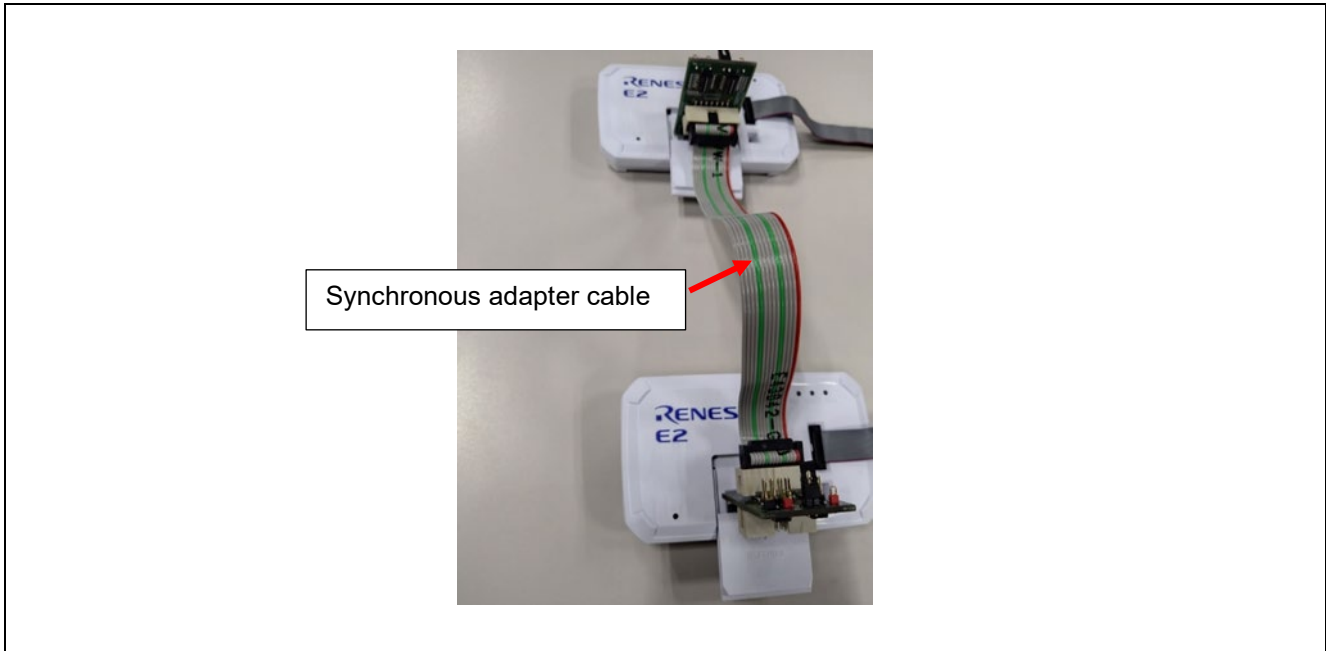


Figure 3-7 Connection of the Synchronous Adapter Cable (Case of Connecting Two E2 Emulators)

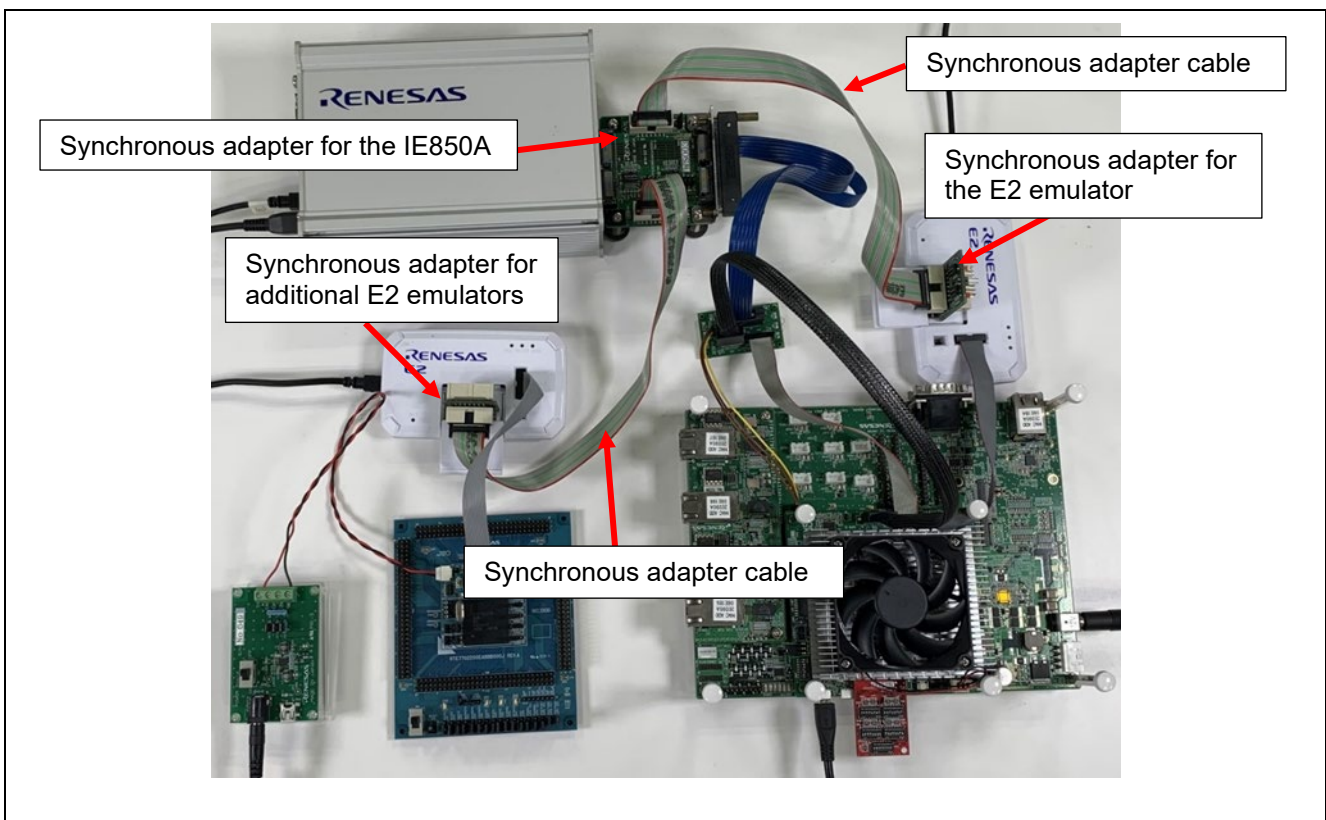


Figure 3-8 Connection of the Synchronous Adapter Cables (Case of Connecting an IE850A and Two E2 Emulators)

#### 4. Connecting the User System to the Emulator

This chapter describes how to connect the user system to the emulator.

##### 4.1 Examples of Connection between the Emulators and User Systems with R-Car S4 and RH850 Devices Mounted

Figure 4-1 and Figure 4-2 show how to connect the hardware environment of user systems with R-Car S4 and RH850 devices mounted to the emulators.

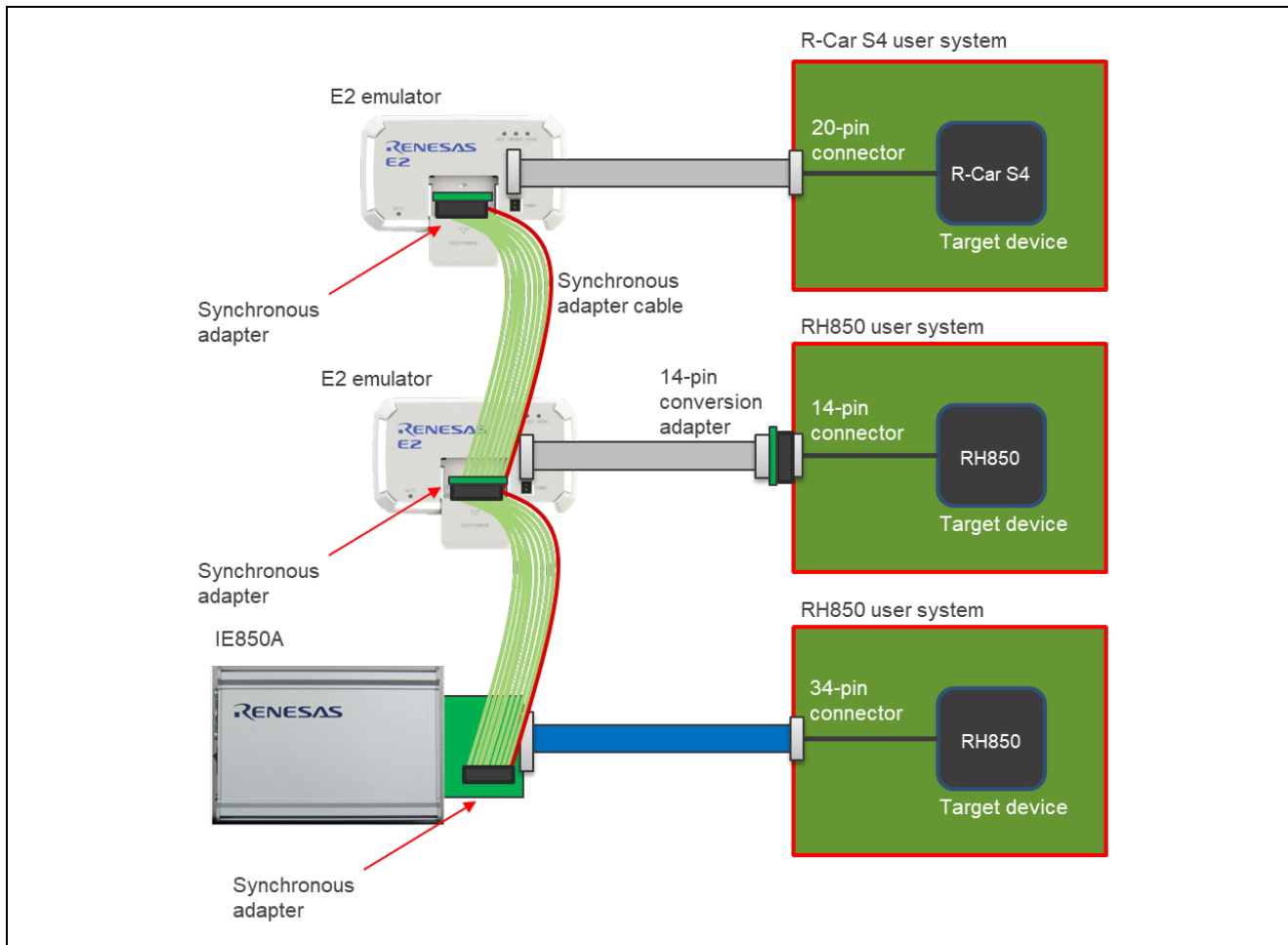


Figure 4-1 Example of Connection between the Emulators and User Systems with R-Car S4 and RH850 Devices Mounted (1)

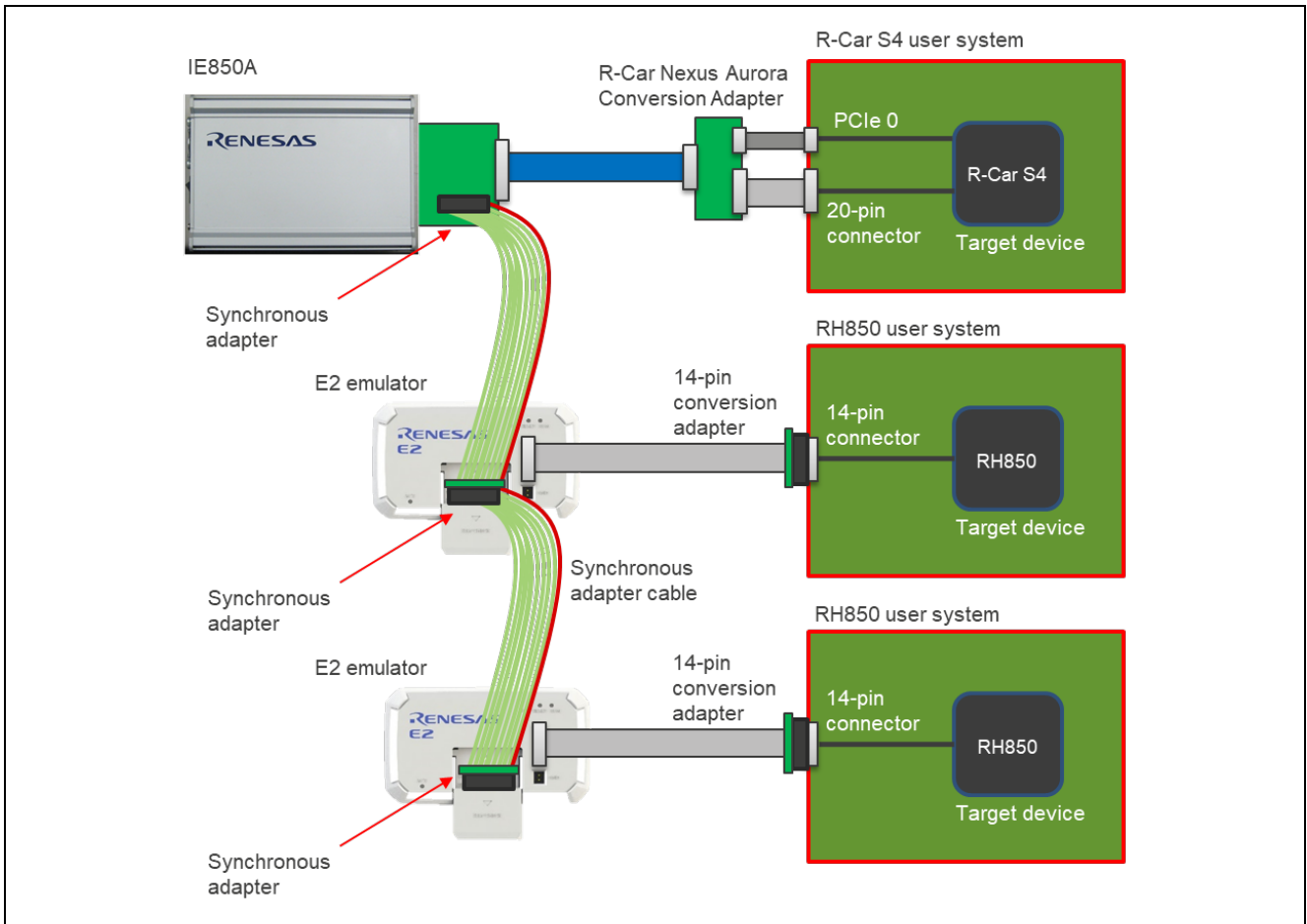


Figure 4-2 Example of Connection between the Emulators and User Systems with R-Car S4 and RH850 Devices Mounted (2)

## 4.2 Example of Connection between the Emulators and User Systems with R-Car V4H and RH850 Devices Mounted

Figure 4-3 shows how to connect the hardware environment of user systems with R-Car V4H and RH850 devices mounted to the emulators.

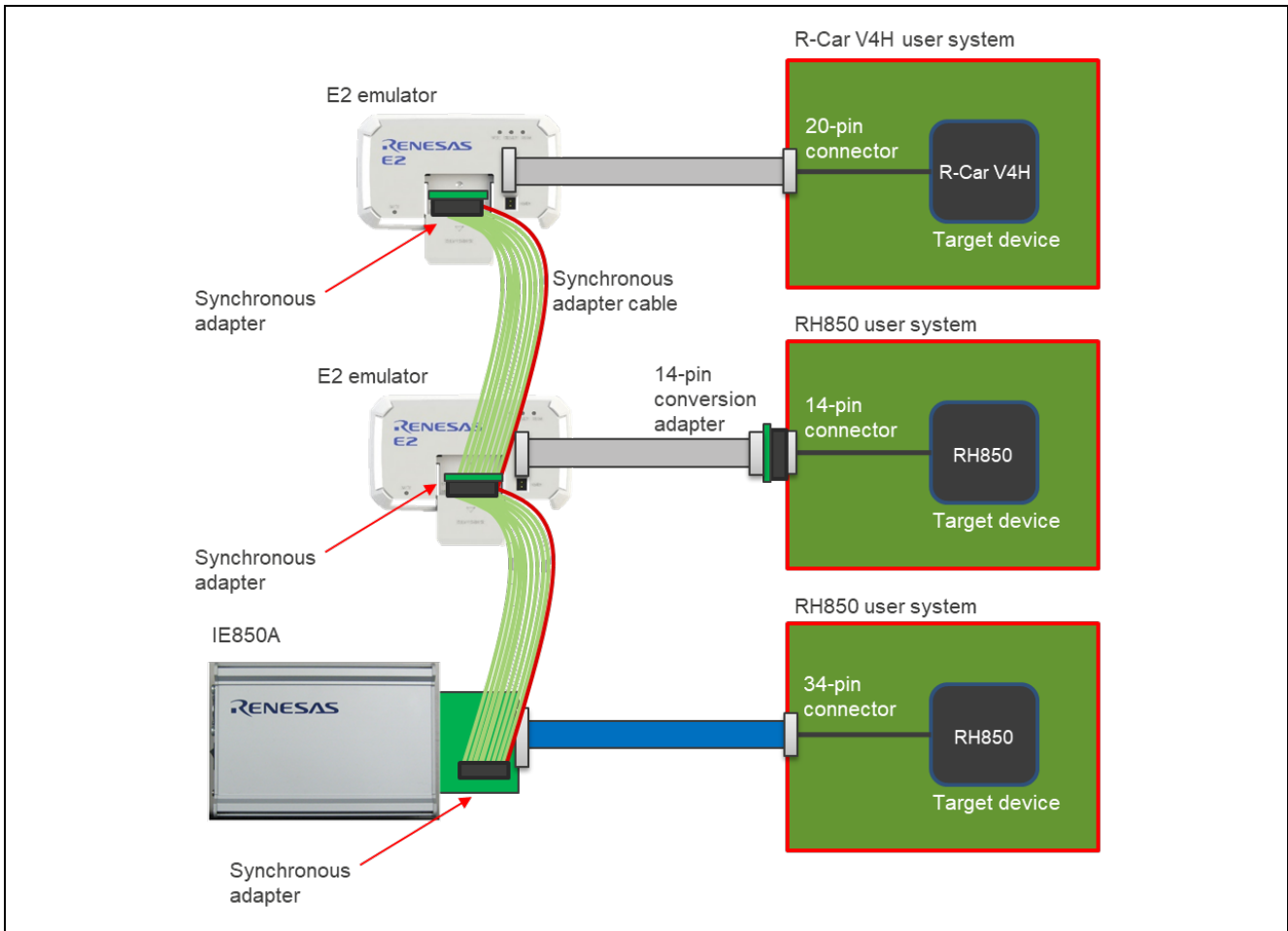


Figure 4-3 Example of Connection between the Emulators and User Systems with R-Car V4H and RH850 Devices Mounted



## Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Nov.30.22	-	First Edition issued
1.10	Dec.22.23	2	Terminology was newly added.
		3, 4	User's manuals were added to Configuration of Manuals.
		10	Descriptions in chapter 1, Outline, were modified.
		11	A statement was added to chapter 2.
		16	A statement was added to chapter 3.
		22	Chapter 4 was newly added.

# General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

## 1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity.

Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

## 2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

## 3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

## 4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

## 5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

## 6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.).

## 7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

## 8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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