

RX14T Group

MCB-RX14T User's Manual

Renesas RX Family
RX100 Series

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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.

MCB-RX14T User's Manual

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1. Overview

MCB-RX14T is a CPU board for motor control evaluation. By using this product in combination with an inverter board, motor control using RX14T can be easily performed.

1.1 Presupposition and precautions of this document

1. Experience of using tools: This document assumes that the user has used terminal emulation program of Integrated Development Environment (IDE) such as e² studio before.
2. Knowledge about the development subject: This document assumes that the user has a basic knowledge to modify the sample project regarding MCU and embedded system.
3. Before using this product, wear an antistatic wrist strap. If you touch this product with static charge on your body, a device failure may occur, or operation may become unstable
4. All screen shots provided in this document is for reference. Actual screen displays may differ depending on the software and development tool version which you use.

2. Product Contents

This kit consists of the following parts.

1. CPU Board (RTK0EMXH30C00000BJ) x1
2. Screw x4
3. Standoff x4



(1)CPU Board



(2)Screw
(3)Standoff

Figure 2-1 Product contents

3. Product Order Information


Product number to order MCB-RX14T : RTK0EMXH30C00000BJ

4. Hardware Configuration and Default Setting

4.1 Hardware configuration

The specifications of the CPU board are shown below.

Table 4-1 CPU board specification

item		Specification
Product name		CPU Board
Board part No.		RTK0EMXH30C00000BJ
Compatible inverter board		RTK0EM0000B12020BJ
External view		 <p>Note: The actual product may differ from this photo.</p>
Mounted MCU	Product group	RX14T group
	Product No.	R5F514T5AMFM
	CPU maximum operating frequency	48MHz
	Bit count	32 bit
	Package / Pin count	LFQFP / 64 pin
	ROM	128KB
MCU input clock		48MHz (Generate with on-chip oscillator)
Power supply		DC 5V,3.3V (selectable with jumper pin) Select one way automatically from the below <ul style="list-style-type: none"> • Power is supplied from compatible inverter board • Power is supplied from USB connector
Debugger		E2OB (Onboard debugger circuit)
Connector		<ul style="list-style-type: none"> • Inverter board connector • USB connector for E2OB • SCI connector for Renesas Motor Workbench communication • Through hole for SPI communication • Pmod connector and through hole
Switch		MCU reset switch
LED		User-controllable LED x5, Power LED x1
Board size		109 mm (W) x 109 mm (L)
Operating temperature		Room temperature
Operating humidity		No condensation allowed
EMC Directive		EN61326-1 : 2021 EMI : Class A EMS : Industrial Electromagnetic environment

4.2 Block diagram

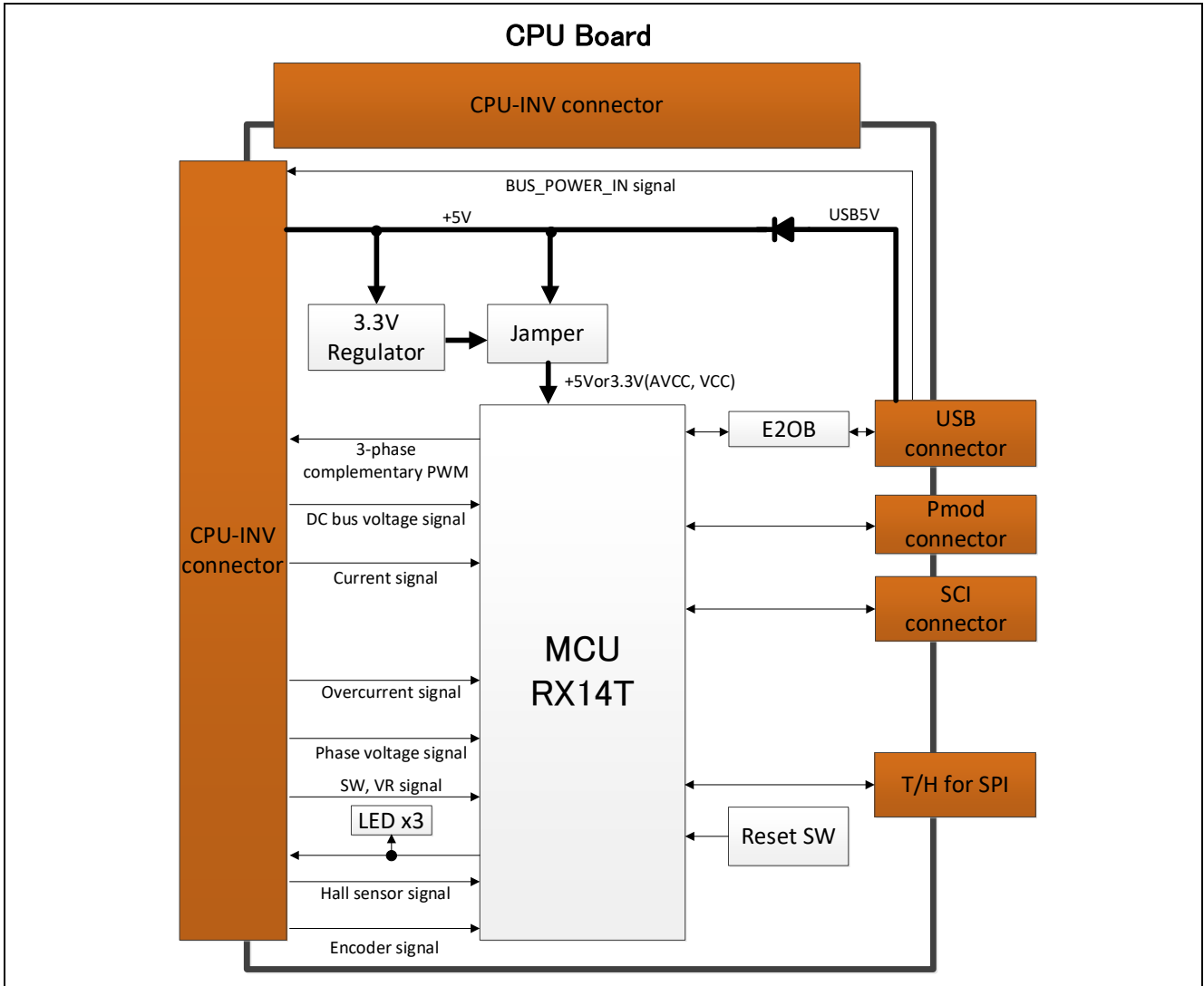


Figure 4-1 CPU board block diagram

4.3 Board Layout

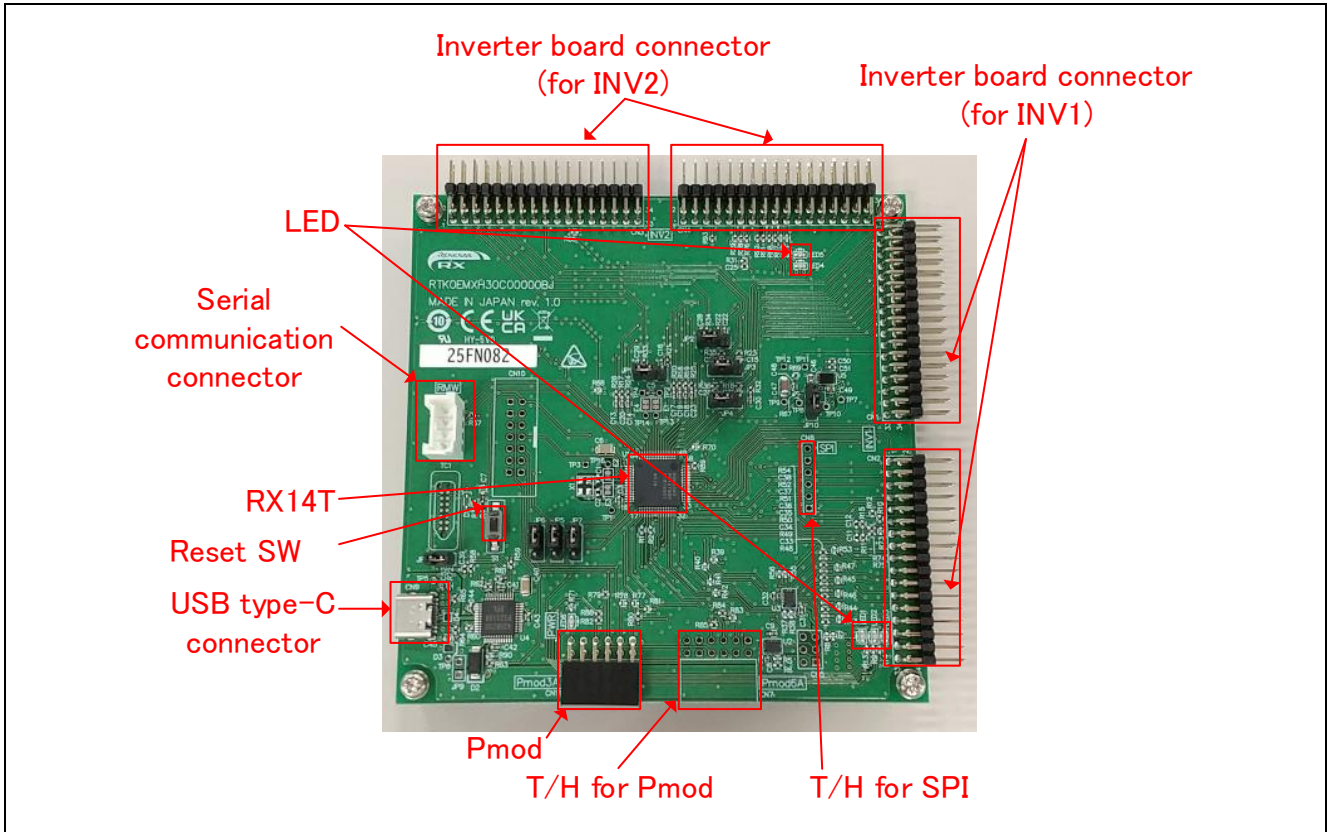


Figure 4-2 CPU Board Layout

4.4 Standoffs and Screws

Before using this product, assemble the included standoffs and screws as shown below.

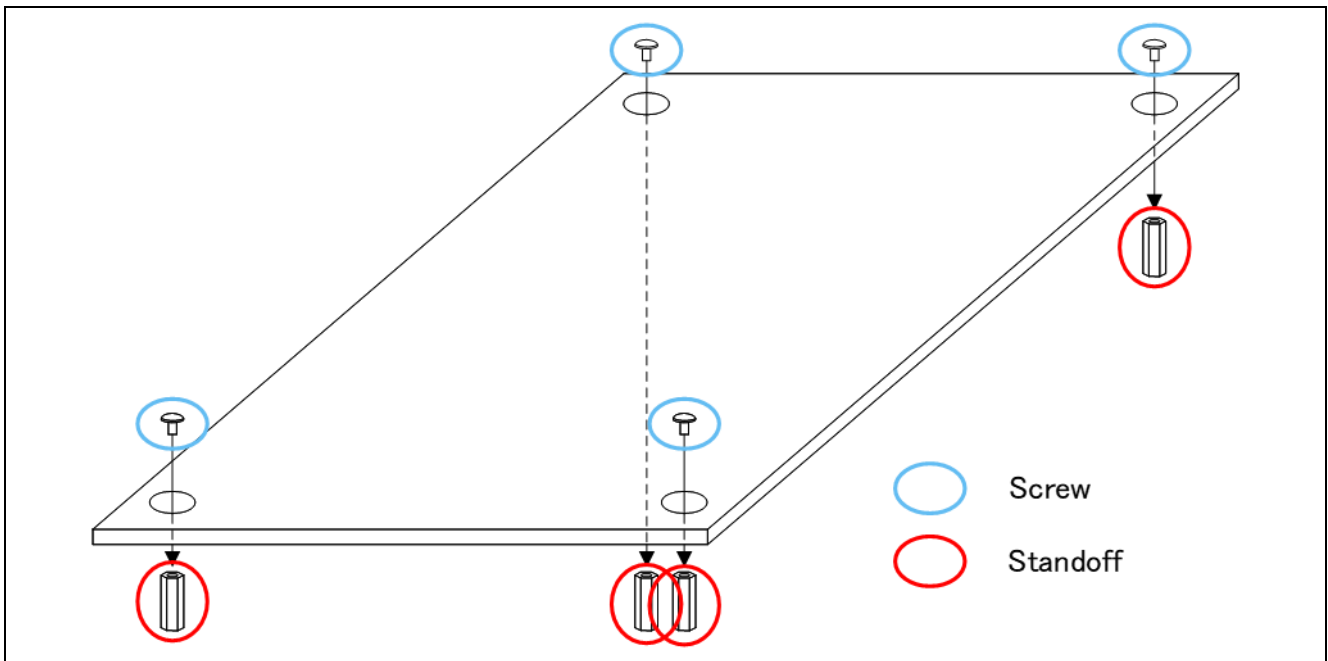


Figure 4-3 Standoffs and Screws assembly

4.5 Jumper pin setting

Default settings and functions of the jumper pins (JP1~JP10) are as follows.

Table 4-2 Jumper pin setting of CPU board

JP No.	Function	Setting (function in use)			Default setting
		open	1-2 short	2-3 short	
1	IU(INV2)/VU(INV1) select	N/A	IU(INV2)	VU(INV1)	1-2 short
2	IV(INV2)/VV(INV1) select	N/A	IV(INV2)	VV(INV1)	1-2 short
3	IW(INV2)/VW(INV1) select	N/A	IW(INV2)	VW(INV1)	1-2 short
4	VR(INV2)/HV temp select	N/A	VR(INV2)	HV temp	1-2 short
5	UN(INV2)/PFCPWM1 select	N/A	UN(INV2)	PFCPWM1	1-2 short
6	VN(INV2)/PFCPWM2 select	N/A	VN(INV2)	PFCPWM2	1-2 short
7	SMOSI6(INV1)/PFCPWM2 select	N/A	SMOSI6(INV1)	PFCPWM2	1-2 short
8	E2OB (Onboard debugger)	E2OB enable	E2OB disable	N/A	1-2 short
9	blocking diode	D2 enable	D2 disable	N/A	JP9 unmounted part
10	MCU voltage select	N/A	5V	3.3V	1-2 short

PFC : Power Factor Correction

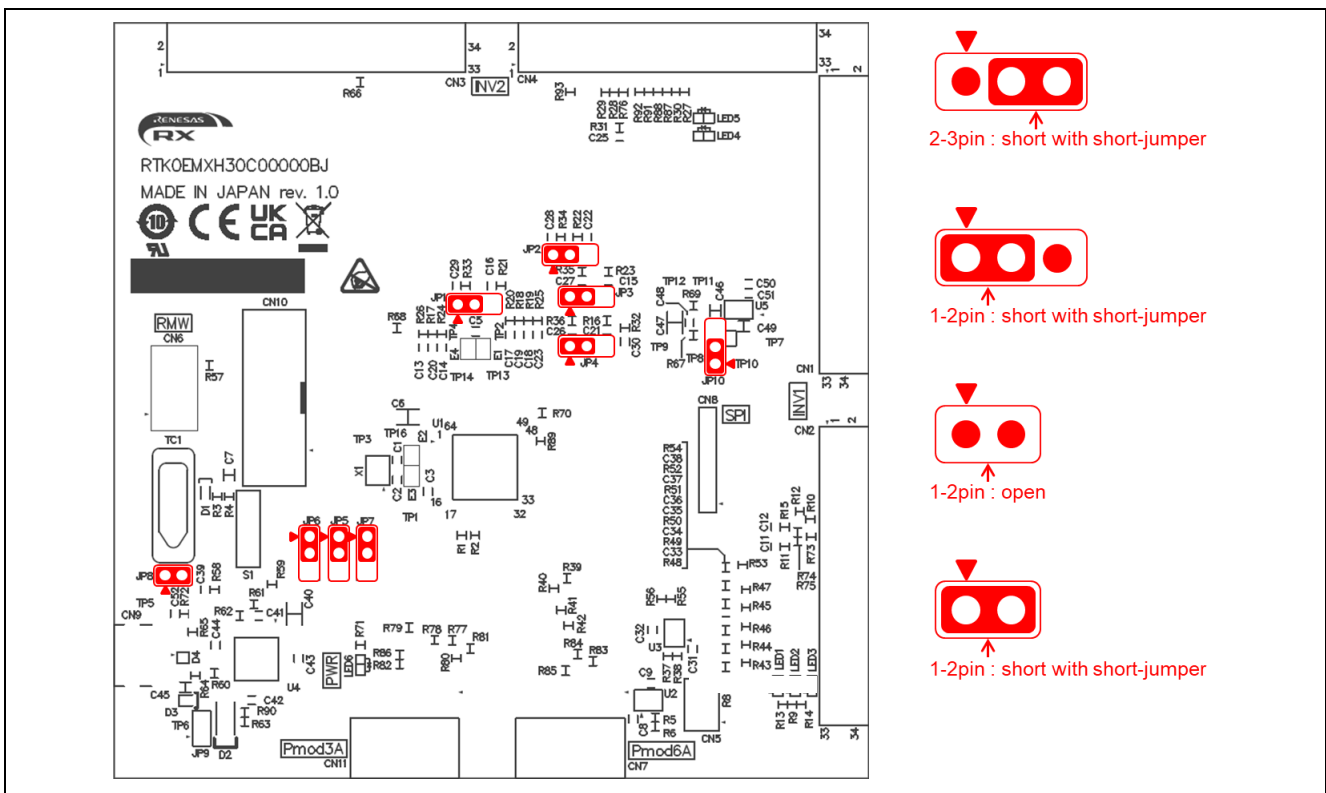


Figure 4-4 Default jumper pin setting

4.6 Hardware Setup

Figure 4-5 show a connection example when using this product with the inverter board kit (product name: MCI-LV-1, model name: RTK0EM0000S04020BJ) and the communication board (product name: MC-COM, model name: RTK0EMXC90S00000BJ).

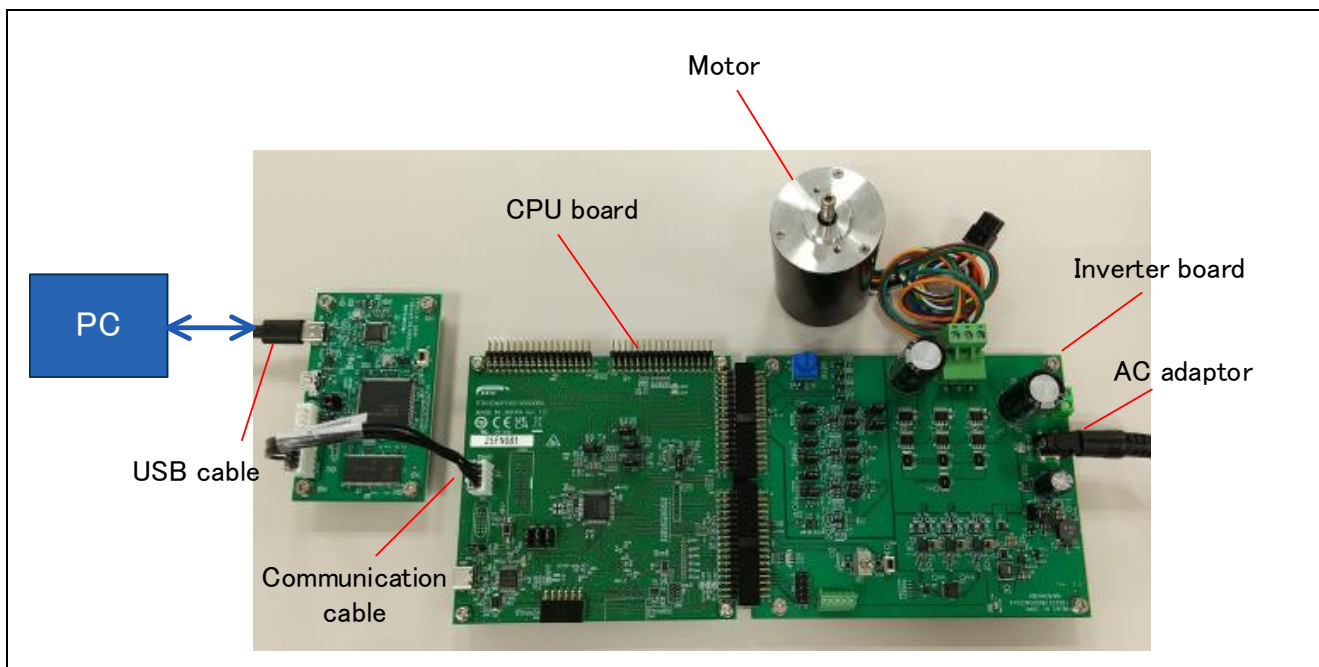


Figure 4-5 Board connection example

5. CPU Board Specification

This section describes the specification of the CPU Board.

5.1 Functions

5.1.1 Power supply

When not connected to the inverter board, power should be supplied from the USB connector(CN9). When connecting to the inverter board, power supply from the USB connector or from the inverter board will be automatically selected. USB power supply has priority. The MCU operation voltage can be selected at either 5 V or 3.3 V for this product. The operation voltage is switched with JP10 as shown in Table 4-2.

5.1.2 On-board debugger

This product has the on-board debugger circuit, E2 On-Board (hereinafter called “E2OB”). You can write a program (firmware) of RX14T with it. When you write a program, open (remove) JP8 and connect the CPU board to PC with USB cable. E2OB operates as debugger equivalent to E2 emulator Lite. If connecting from Integrated Development Environment (e.g. e² studio) or flash programming tool (e.g. Renesas Flash Programmer), set the type of debugger (tool) to “E2 emulator Lite”. After writing a program, short JP8 for CPU board operation.

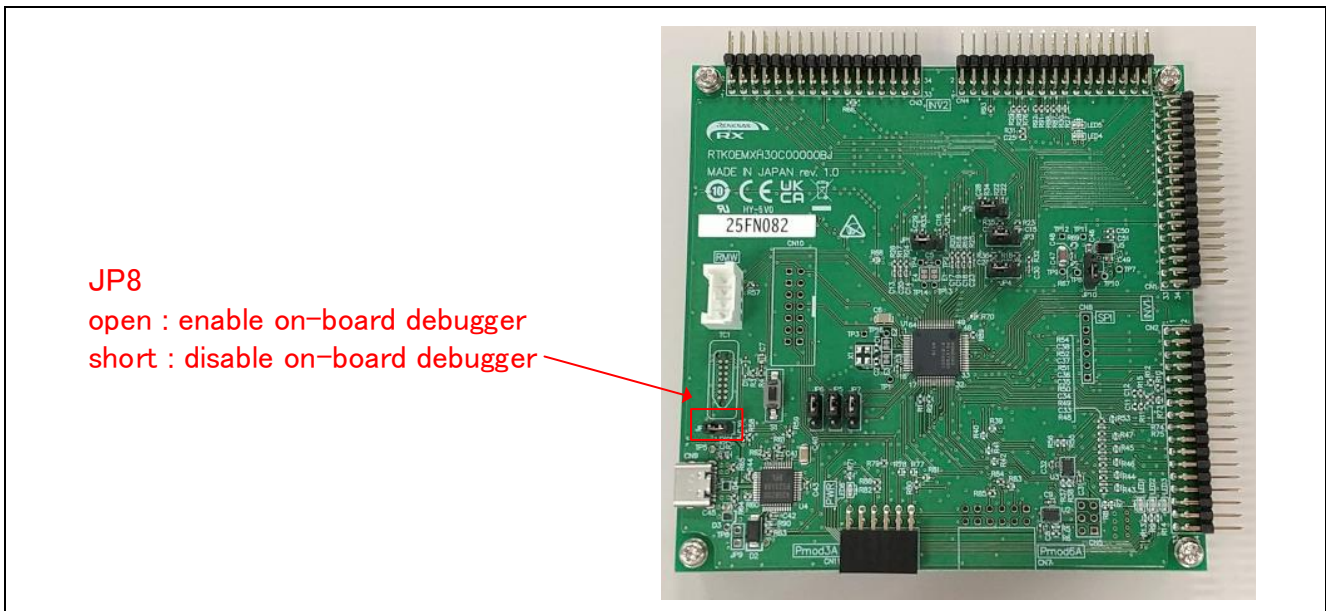


Figure 5-1 JP8 setting

5.1.3 Inverter board connector

Max 2 inverter boards can be connected to this product. 1st inverter board is connected with CN1 and CN2, and 2nd inverter board is connected with CN3 and CN4. The pin assignments of the connectors are shown in Table 5-1, Table 5-2, Table 5-3, Table 5-4.

Table 5-1 1st inverter board connector (CN1) pin assignment

Pin No.	Pin Function	RX14T Pin	Pin No.	Pin Function	RX14T Pin
1	HVtemp	P46/AN006(*)	2	AGND	-(VSS/AVSS0)
3	VBUS	P11/AN102	4	AGND	-(VSS/AVSS0)
5	IU	P41/AN001	6	NC	-
7	IV	P42/AN002	8	NC	-
9	IW	P40/AN000	10	NC	-
11	VU	P15/AN107(*)	12	VV	P44/AN004(*)
13	VW	P45/AN005(*)	14	AGND	-(VSS/AVSS0)
15	VAC	P12/AN104	16	IPFC	P43/AN003
17	VR	P10/AN103	18	AGND	-(VSS/AVSS0)
19	AVCC	-(VCC/AVCC0)	20	AVCC	-(VCC/AVCC0)
21	AGND	-(VSS/AVSS0)	22	AGND	-(VSS/AVSS0)
23	VCC	-(VCC/AVCC0)	24	VCC	-(VCC/AVCC0)
25	GND	-(VSS/AVSS0)	26	GND	-(VSS/AVSS0)
27	UN	P76/MTIOC4D	28	GND	-(VSS/AVSS0)
29	UP	P73/MTIOC4B	30	GND	-(VSS/AVSS0)
31	VN	P75/MTIOC4C	32	GND	-(VSS/AVSS0)
33	VP	P72/MTIOC4A	34	GND	-(VSS/AVSS0)

(*) Exclusively assigned by jumper pin and jumper register setting

Table 5-2 1st inverter board connector (CN2) pin assignment

Pin No.	Pin Function	RX14T Pin	Pin No.	Pin Function	RX14T Pin
1	WN	P74/MTIOC3D	2	GND	-(VSS/AVSS0)
3	WP	P71/MTIOC3B	4	GND	-(VSS/AVSS0)
5	DRV_SCK	PB2/SCK6	6	PFCPWM2/ DRV_RXD	PB0/GTIOC1B(*) PB3/SMOSI6(*)
7	DRV_TXD	PB4/SMISO6	8	DRV_CS	PB7/SS6#
9	BUS_POWER_IN	-	10	INV_CONNECTED	-
11	SAFE_LOCK	-	12	OCINV	P30/POE11#
13	OCPFC/DRV_nFault	P36/IRQ3	14	PFCPWM1/DRV_EN	PB1/GTIOC2B(*)
15	Relay/CON_MOT_SEL	P91	16	SW1	PD7
17	SW2	PE2	18	LED1	PD3
19	LED2	PD4	20	LED3	PD6
21	HALL_U	P92/IRQ0	22	HALL_V	P93/IRQ1
23	HALL_W	P90/IRQ6	24	NC	-
25	NC	-	26	ENC_Z	P70/IRQ5
27	ENC_A	P33/MTCLKA	28	NC	-
29	ENC_B	P32/MTCLKB	30	NC	-
31	GND	-(VSS/AVSS0)	32	GND	-(VSS/AVSS0)
33	+5V	-	34	+5V	-

(*) Exclusively assigned by jumper pin and jumper register setting

Table 5-3 2nd inverter board connector (CN3) pin assignment

Pin No.	Pin Function	RX14T Pin	Pin No.	Pin Function	RX14T Pin
1	NC	-	2	AGND	-(VSS/AVSS0)
3	VBUS	P47/AN007	4	AGND	-(VSS/AVSS0)
5	IU	P15/AN107	6	NC	-
7	IV	P44/AN004	8	NC	-
9	IW	P45/AN005	10	NC	-
11	NC	-	12	NC	-
13	NC	-	14	AGND	-(VSS/AVSS0)
15	NC	-	16	NC	-
17	VR	P46/AN006(*)	18	AGND	-(VSS/AVSS0)
19	AVCC	-(VCC/AVCC0)	20	AVCC	-(VCC/AVCC0)
21	AGND	-(VSS/AVSS0)	22	AGND	-(VSS/AVSS0)
23	VCC	-(VCC/AVCC0)	24	VCC	-(VCC/AVCC0)
25	GND	-(VSS/AVSS0)	26	GND	-(VSS/AVSS0)
27	UN	PB1/GTIOC2B(*)	28	GND	-(VSS/AVSS0)
29	UP	P96/GTIOC2A	30	GND	-(VSS/AVSS0)
31	VN	PB0/GTIOC1B(*)	32	GND	-(VSS/AVSS0)
33	VP	P95/GTIOC1A	34	GND	-(VSS/AVSS0)

(*) Exclusively assigned by jumper pin and jumper register setting

Table 5-4 2nd inverter board connector (CN4) pin assignment

Pin No.	Pin Function	RX14T Pin	Pin No.	Pin Function	RX14T Pin
1	WN	P97/GTIOC0B	2	GND	-(VSS/AVSS0)
3	WP	P94/GTIOC0A	4	GND	-(VSS/AVSS0)
5	NC	-	6	Pull Down	-(VSS/AVSS0)
7	NC	-	8	NC	-
9	BUS_POWER_IN	-	10	INV_CONNECTED	-
11	SAFE_LOCK	-	12	OCINV	P25/GTETRGA
13	NC	-	14	Pull Down	-(VSS/AVSS0)
15	Pull Down	-(VSS/AVSS0)	16	SW1	PB2
17	SW2	PB7/SS6#	18	LED1	P00
19	LED2	P01	20	NC	-
21	NC	-	22	NC	-
23	NC	-	24	NC	-
25	NC	-	26	NC	-
27	NC	-	28	NC	-
29	NC	-	30	NC	-
31	GND	-(VSS/AVSS0)	32	GND	-(VSS/AVSS0)
33	+5V	-	34	+5V	-

Figure 5-2 show a connection example when using this product with the inverter board and the communication board.

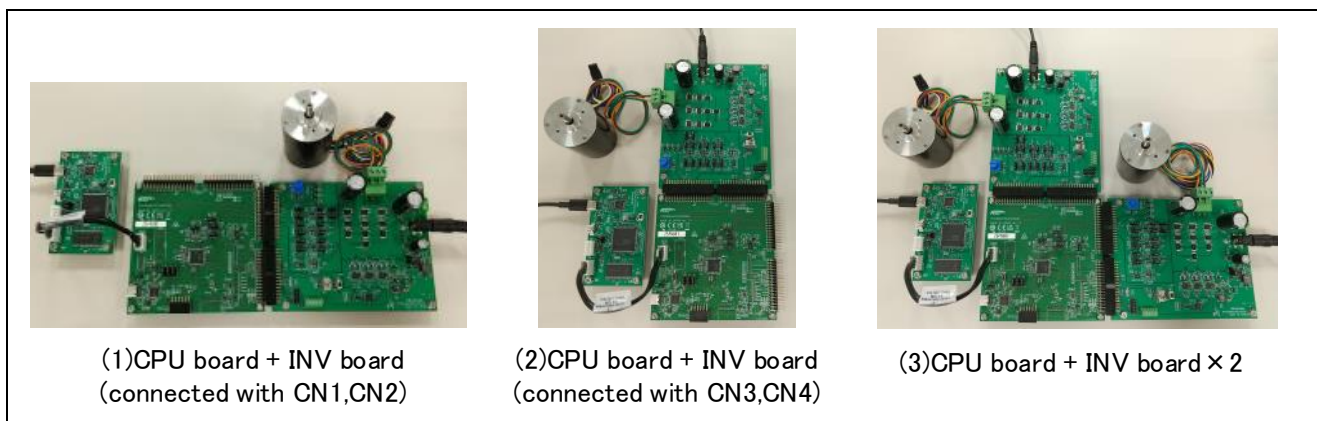


Figure 5-2 Board connection of CPU board, INV board and COM board

5.1.4 Serial communication

For serial communication using Renesas Motor Workbench, the CPU board has SCI connector. Pin assignment for SCI connector is listed in Table 5-5.

Table 5-5 SCI connector (CN6) pin assignment

Pin No.	Pin Function	RX14T Connection Pin
1	GND	- (VSS/AVSS0)
2	MCU RXD	P24/RXD5
3	MCU TXD	P23/TXD5
4	VCC	- (VCC/AVCC0)

5.1.5 Reset circuit

This product has a reset circuit to enable power-on reset or external reset on MCU. Push the reset switch (S1) to externally reset MCU.

5.1.6 LED

This product has 5 controllable LEDs, so that they can be used for program debug and the system. LED switches on when output from the corresponding port is "LOW" and switches off when output is "HIGH". Pin assignment for corresponding LEDs is listed in Table 5-6.

Table 5-6 LED pin assignment

RX14T pin output		LED1	LED2	LED3	LED4	LED5
PD3	HIGH	OFF	-	-	-	-
	LOW	ON	-	-	-	-
PD4	HIGH	-	OFF	-	-	-
	LOW	-	ON	-	-	-
PD6	HIGH	-	-	OFF	-	-
	LOW	-	-	ON	-	-
P00	HIGH	-	-	-	OFF	-
	LOW	-	-	-	ON	-
P01	HIGH	-	-	-	-	OFF
	LOW	-	-	-	-	ON

5.1.7 SPI Communication

This product has through holes for SPI communication. Pin assignment for SPI communication connector is listed in Table 5-7.

Table 5-7 SPI communication pin assignment (CN8)

Pin No.	RX14T pin
1	PB7/SS6#
2	PB3/SMOSI6
3	PB4/SMISO6
4	PB2/SCK6
5	-(VSS/AVSS0)
6	-(VCC/AVCC0)

5.1.8 Pmod

This product has one connector and one connector through hole for Pmod module connection. Pin assignments are shown in Table 5-8 and Table 5-9.

Table 5-8 Pmod Type 3A connector pin assignment (CN11)

No.	RX14T port	No.	RX14T port
1	P02	7	P22/IRQ2
2	PB5/TXD1	8	P03
3	PB6/RXD1	9	P04
4	PD6/LED3	10	PD5
5	-(VSS/AVSS0)	11	-(VSS/AVSS0)
6	-(VCC/AVCC0)	12	-(VCC/AVCC0)

Table 5-9 Pmod Type 6A connector through hole pin assignment (CN7)

No.	RX14T port	No.	RX14T port
1	P22/IRQ2	7	P02
2	PB4/SMISO6	8	P03
3	P26/SCL0	9	P04
4	P31/SDA0	10	PD5
5	-(VSS/AVSS0)	11	-(VSS/AVSS0)
6	-(VCC/AVCC0)	12	-(VCC/AVCC0)

6. Regulatory information

This product meets the following standards. See page 2 of this user's manual for the precautions.

6.1 EMC Directive



This product is herewith confirmed to comply with the requirements set out in the Council Directives on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive 2014/30/EU.



This product is in conformity with the following relevant UK Statutory Instrument(s) (and its amendments): 2016 No. 1091 Electromagnetic Compatibility Regulations 2016.

Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures to correct this interference.

6.2 Material Selection, Waste, Recycling and Disposal Standards

- China SJ/T 113642014, 10-year environmental protection use period.
- WEEE Directive (2012/19/EU) & The Waste Electrical and Electronic Equipment Regulations 2013



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 UK and European Union.

This product (including all accessories) is not intended for household use. After use the product 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 product. Register for this service at; <https://www.renesas.com/form/weee-questionnaire>

7. Design and Manufacture Information

You can obtain information on the design and manufacture of this product from [renesas.com](https://www.renesas.com).

8. Website and Support

In order to learn, download tools and documents, apply technical support for RX family MCU and its kit, visit the below Web site.

- RX Product Information [renesas.com/rx](https://www.renesas.com/rx)
- Renesas Support [renesas.com/support](https://www.renesas.com/support)

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