Quick Start Guide

RA2T1 Group

MCK-RA2T1 Quick Start Guide

Renesas RA Family
RA2 Series

All information contained in these materials, including products and product specifications, represents information on the product at the time of publication and is subject to change by Renesas Electronics Corp. without notice. Please review the latest information published by Renesas Electronics Corp. through various means, including the Renesas Electronics Corp. website (http://www.renesas.com).

Renesas Electronics
www.renesas.com

Rev.1.00 May 1, 2025

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.

© 2025 Renesas Electronics Corporation. All rights reserved.

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 or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving 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, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. 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 shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The intended 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; industrial robots; etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or 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 damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION (“Vulnerability Issues”). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, 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 and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall 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 shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.

© 2025 Renesas Electronics Corporation. All rights reserved.

Renesas RA Family

MCK-RA2T1 Quick Start Guide

Contents

1. Introduction....3
1.1 Presupposition and precautions of this document....3
2. Product Contents....4
3. Quick Start Sample Project Overview....5
3.1 Quick start sample project flow....5
4. Quick Start....6
4.1 Connect the board and supply power....6
4.1.1 Jumper pin setting....6
4.1.2 Connect the motor and the board....9
4.1.3 Supply power....10
4.2 Execute the quick start sample project....11
5. How to Write Sample Project into the CPU Board....12
6. Hardware Setup for Development Support Tool....16
7. Others....17
8. Website and Support....17
Revision History....18

Figure of contents

Figure 2-1 Product contents 4
Figure 3-1 Quick start sample project flow 5
Figure 4-1 Jumper pin setting of Inverter Board 6
Figure 4-2 Jumper pin setting of CPU Board 7
Figure 4-3 Jumper pin setting of Communication Board 8
Figure 4-4 Hardware configuration 9
Figure 4-5 Power Supply 10
Figure 4-6 Operating State 11
Figure 5-1 Connecting to PC 12
Figure 5-2 Import project 13
Figure 5-3 Toolchain configuration 13
Figure 5-4 Build project 14
Figure 5-5 Flash programming 15
Figure 5-6 Disconnect CPU board 15
Figure 6-1 Hardware Configuration 16

1. Introduction

This Quick Start Guide (QSG) describes the followings.

- Overview of the Quick Start Sample Project which has already been programmed into the CPU Board.
- Steps to execute the Quick Start Sample Project.
- Instructions for using sample projects which supports the Motor Control Development Support Tool

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 e2studio 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. Inverter Board (RTK0EM0000B12020BJ) x1
2. CPU Board (RTK0EMA810C00000BJ) x1
3. Communication board (RTK0EMXC90Z00000BJ) x1
4. Brushless DC Motor (R42BLD30L3) x1
5. Communication cable x1
6. Screw x12
7. Standoff x12

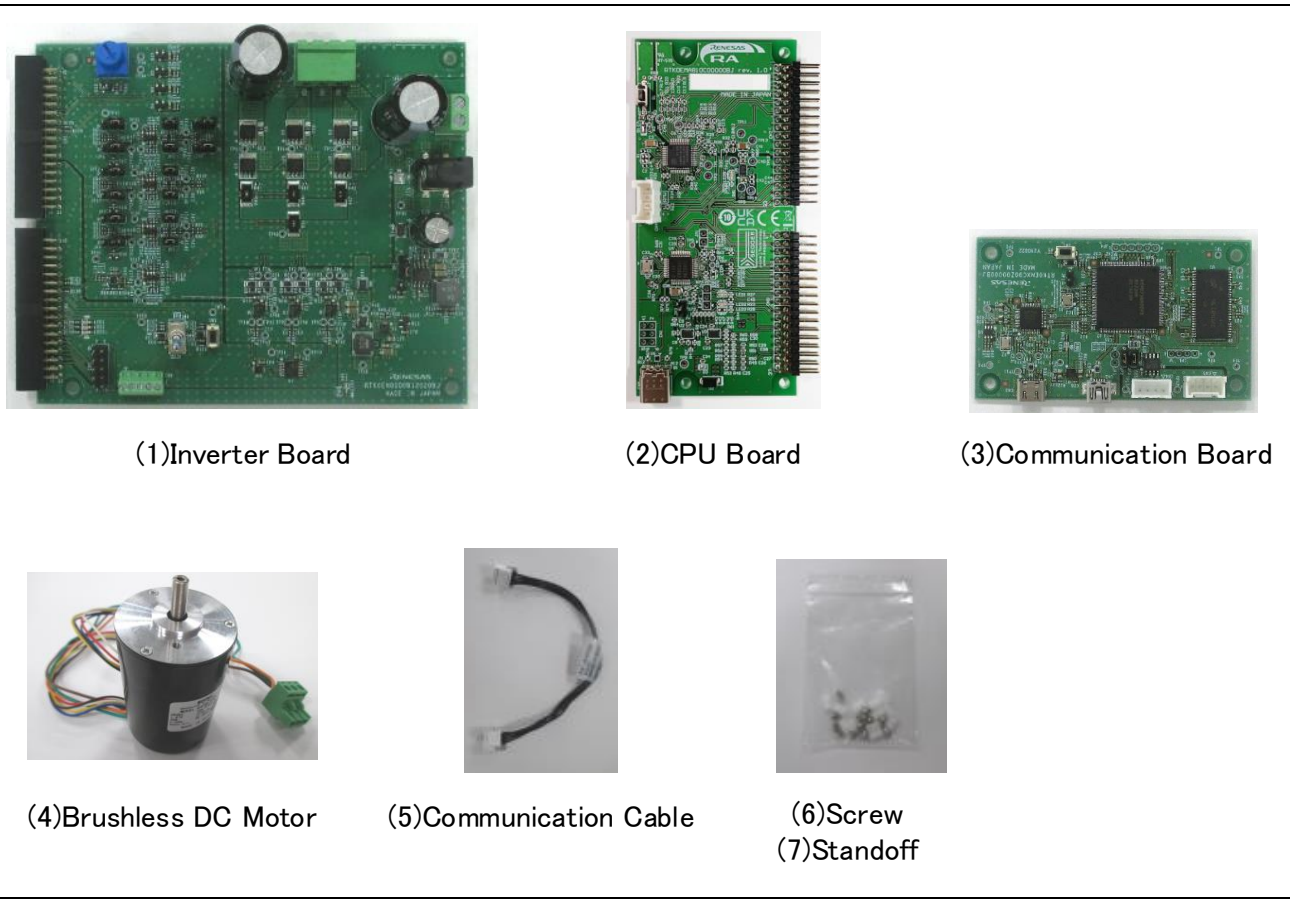


Figure 2-1 Product contents

3. Quick Start Sample Project Overview

In the Quick Start Sample Project, users can start/stop the rotation and change the rotation speed of the supplied Brushless DC motor by MOONS',"R42BLD30L3" (hereinafter called "Motor") with the toggle switch and the volume on the inverter board. When connecting the communication board, users can also use Renesas Motor Workbench for operation.

3.1 Quick start sample project flow

Figure 3-1 shows the flow of the sample project operation using the switch and volume on the board. For the flow of the operation using Renesas Motor Workbench, refer to the software manual.

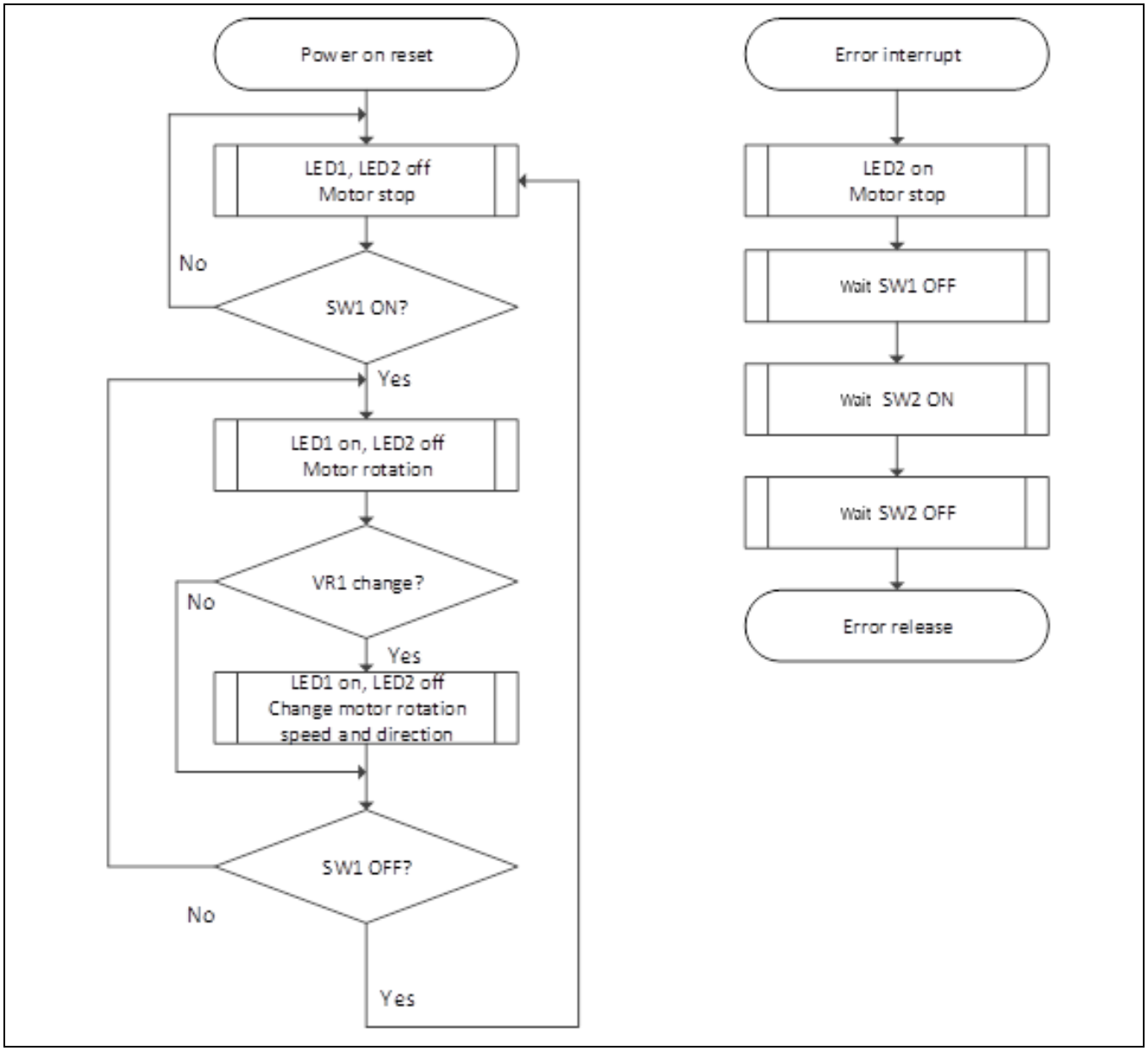


Figure 3-1 Quick start sample project flow

4. Quick Start

This chapter describes the requirements and steps to turn on MCK-RA2T1 and execute the Quick Start Sample Project using the switch and the volume on the board. The software to control sensorless vector is written in RA2T1.

4.1 Connect the board and supply power

4.1.1 Jumper pin setting

(1) Inverter Board

Check that the short jumpers are set as following. (Factory default setting)

JP1 : 2-3pin

JP8, JP11 : 2-3pin

JP2, JP3, JP4, JP6, JP12, JP13 : 2-3pin

JP5, JP7, JP9, JP10, JP14, JP15 : 1-2pin

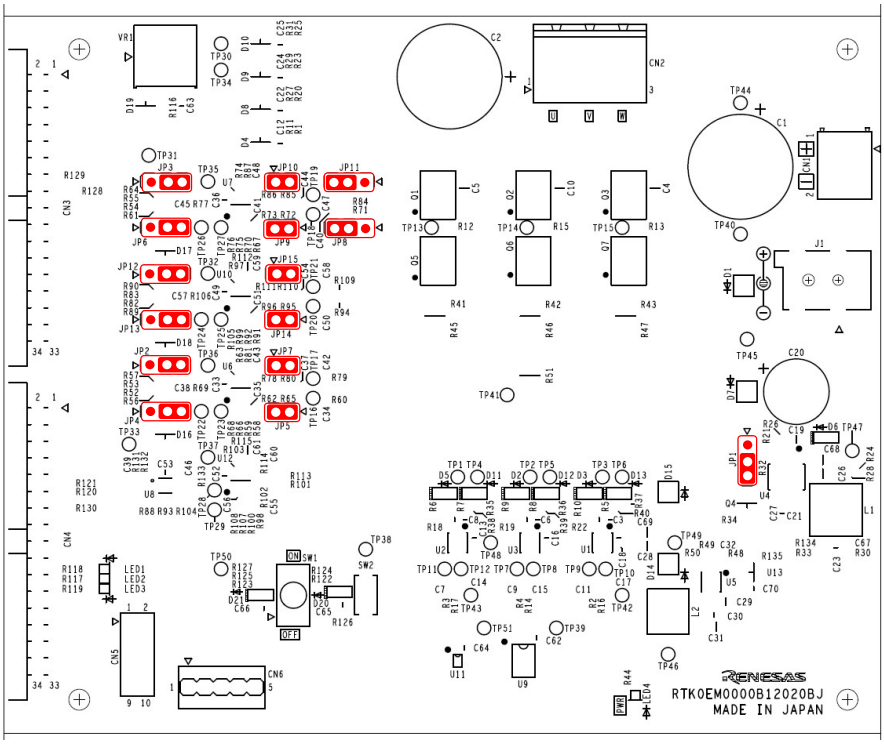
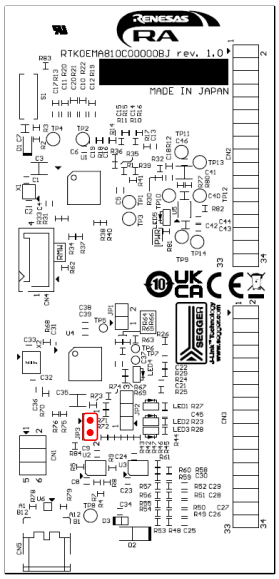


Figure 4-1 Jumper pin setting of Inverter Board

(2) CPU Board

Check that no short connector is attached to the CPU board. (Factory default setting)



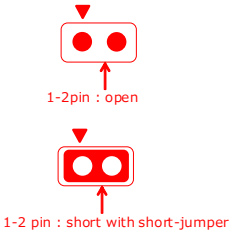


Figure 4-2 Jumper pin setting of CPU Board

(3) Communication Board

Check that the short jumpers are set as following. (Factory default setting)

JP2,JP3 : 1-2pin

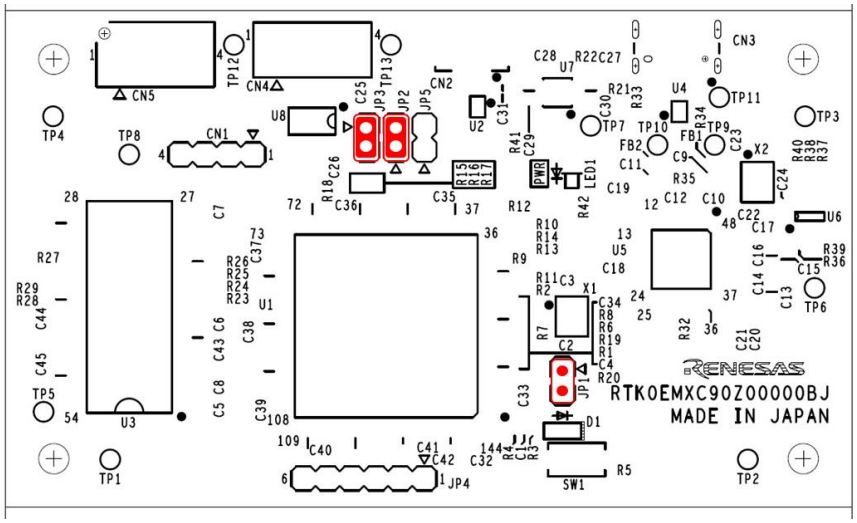


Figure 4-3 Jumper pin setting of Communication Board

4.1.2 Connect the motor and the board

Connect the supplied inverter board, CPU board and motor following Figure 4-4. Also, turn off SW1 on the inverter board and set VR1 to around the center. The motor is equipped with a Hall sensor signal cable, but since the Hall sensor signal is not used for quick start operation, it does not need to be connected.

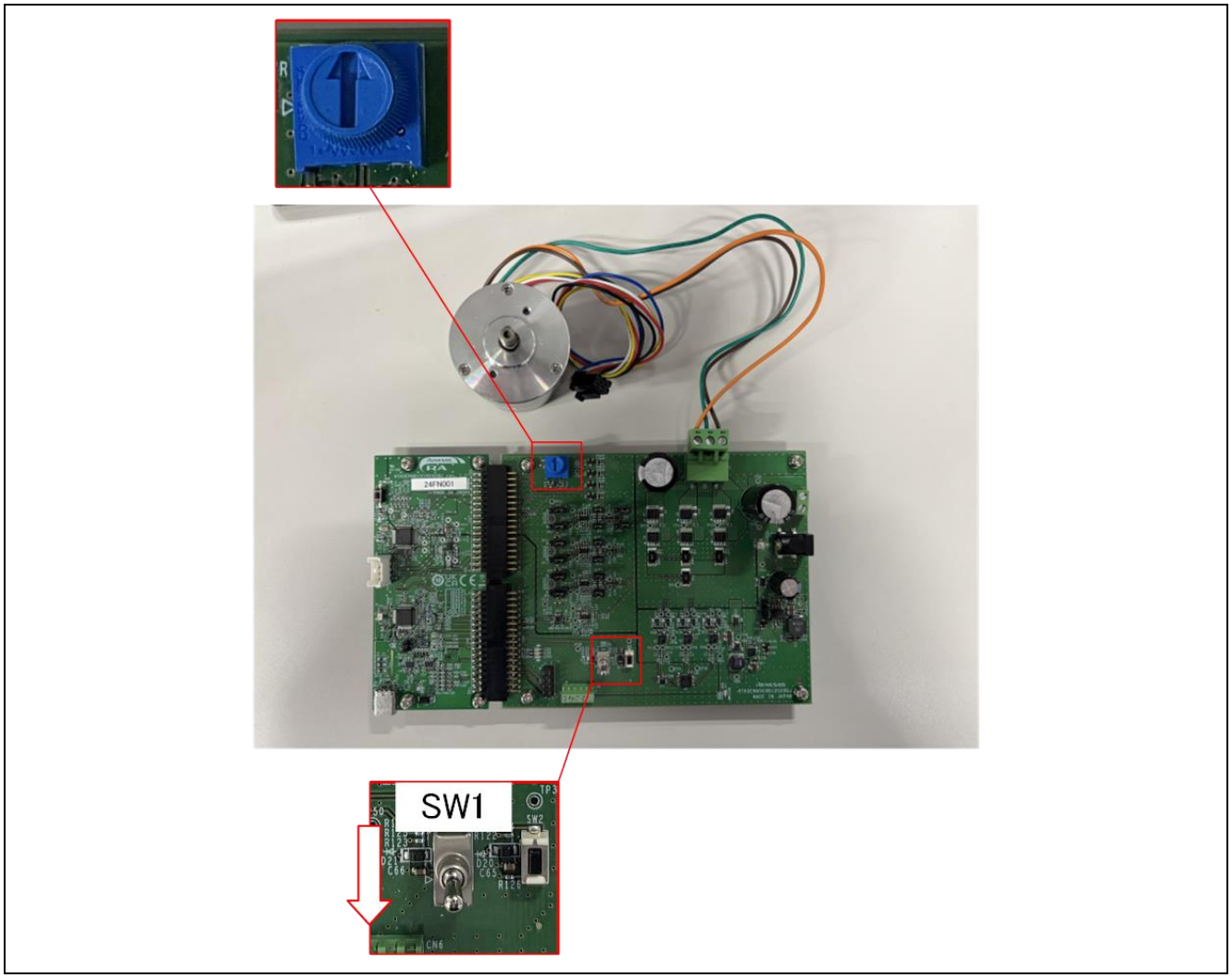


Figure 4-4 Hardware configuration

4.1.3 Supply power

There are two ways to supply power: from the terminals on the inverter board (CN1 or J1) or from the USB connector on the CPU board (CN5). In the Quick Start, power is supplied from the USB connector on the CPU board. For the USB power supply, please use a USB adapter capable of outputting 1A or more.

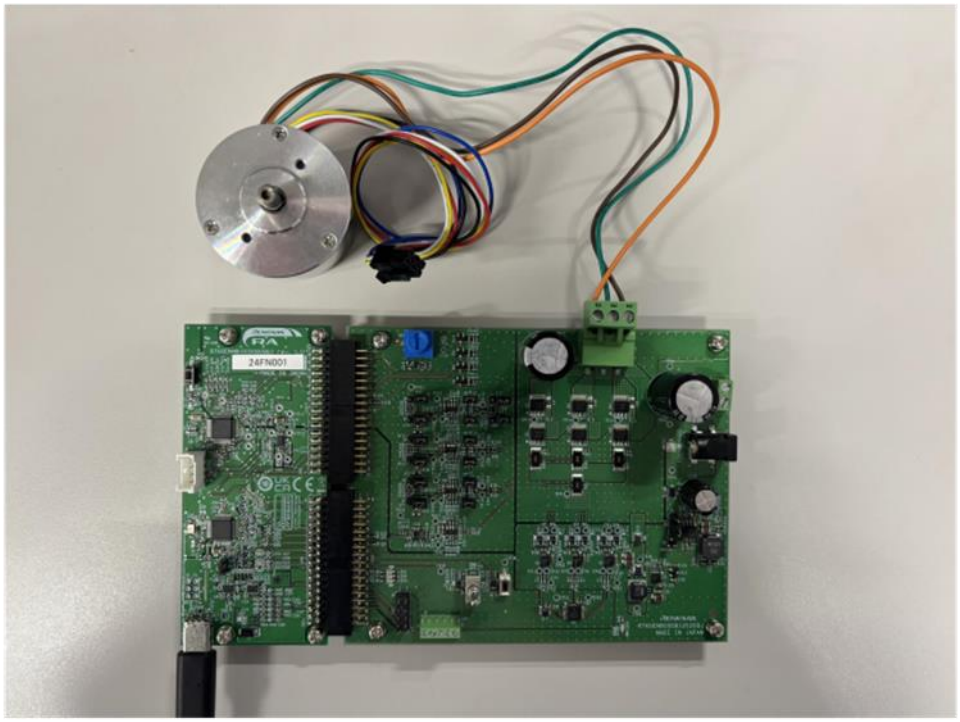


Figure 4-5 Power Supply

4.2 Execute the quick start sample project

Follow the below steps to execute the quick start sample project.

1. After turning on power supply or executing reset, LED1 and LED2 on the inverter board are both off and the motor stopped.
2. IF the toggle switch（SW1) on the inverter board is turned on, the motor starts to rotate. When it is turned off, the motor stops. If the motor rotates normally, LED1 on the inverter board is ON. However, if LED2 on the inverter board is ON, error is occurring.
3. In order to change the direction of rotation of the motor, use the volume resistor (VR1) on the inverter board.
   - Turn the variable resistor (VR1) right : the motor rotates clockwise
   - Turn the variable resistor (VR1) left : The motor rotates counterclockwise
4. If error occurs, LED2 on the inverter board is ON, and the motor rotation stops. To recover from the error state, turn off the toggle switch (SW1) on the inverter board and push the push switch (SW2) once.
5. In order to quit the operation, make sure that the motor has stopped rotating and disconnect the USB cable from the USB connector (CN5) on the CPU board.

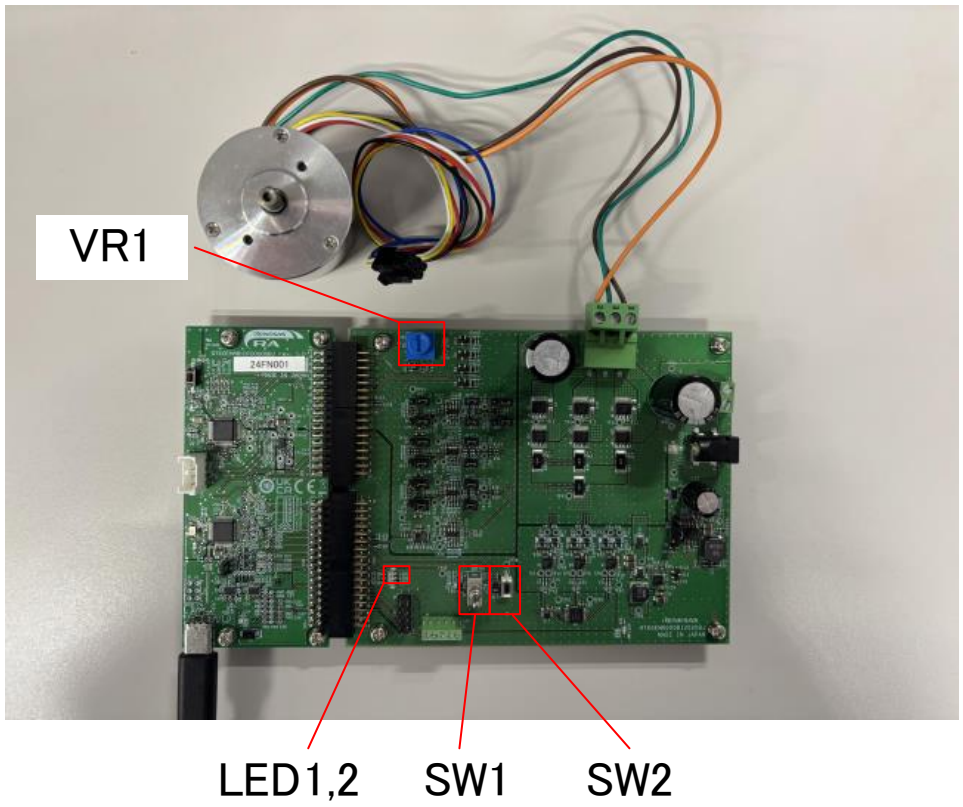


Figure 4-6 Operating State

5. How to Write Sample Project into the CPU Board

In this product, sample projects can be written using the on-board debugger circuit (J-Link OB) on the CPU board. This section describes the writing method using the integrated development environment e2studio.

(1) Connect CPU board to PC

Connect the CPU board to the PC using the Commercially available USB cable(Type-C).



Figure 5-1 Connecting to PC

(2) Launch e2studio and import sample project

Import the sample project (for e2studio) into e2studio.

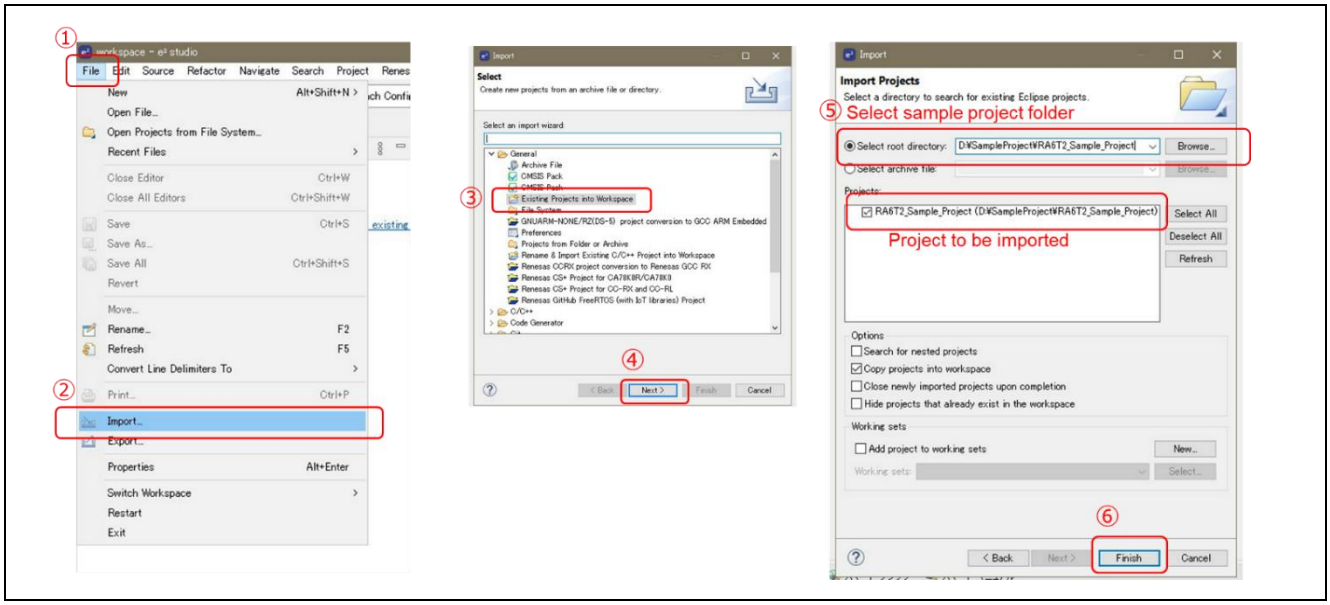


Figure 5-2 Import project

(3) Configure Toolchain

Click the property of the project and configure the toolchain for your environment. The toolchains and versions you can select depend on the installed toolchain in your e2studio.

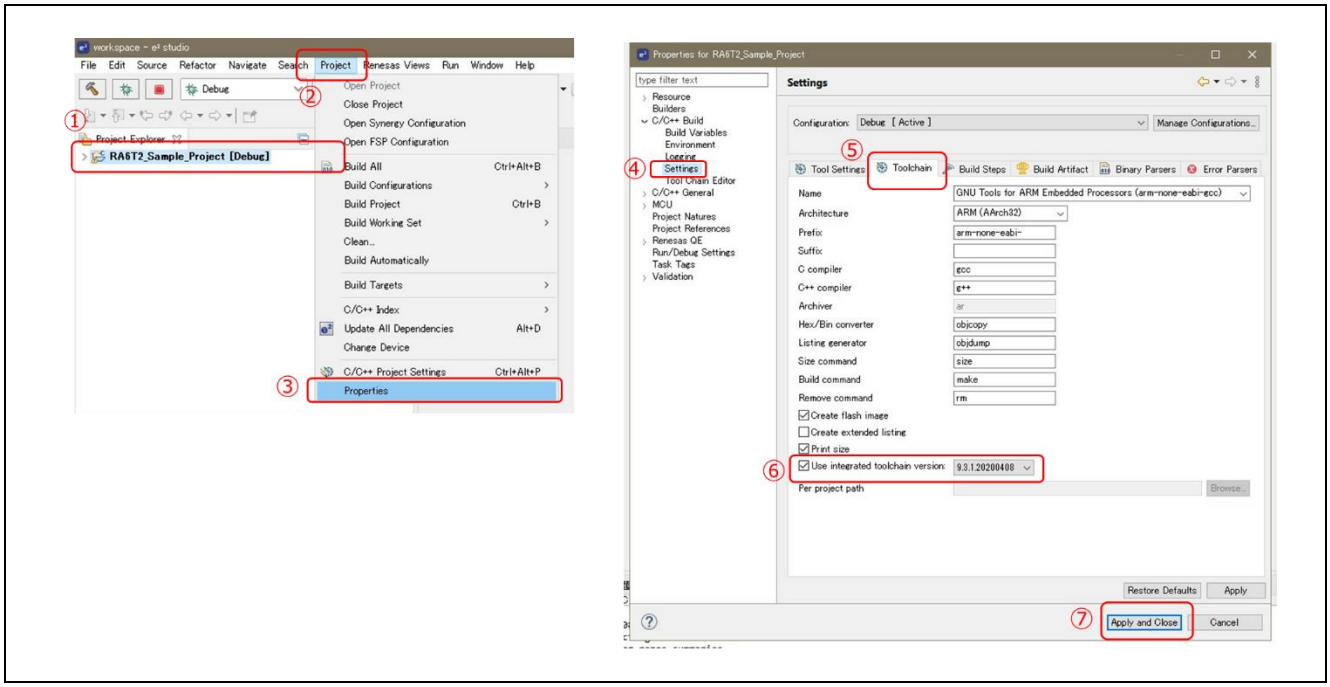


Figure 5-3 Toolchain configuration

(4) Build project

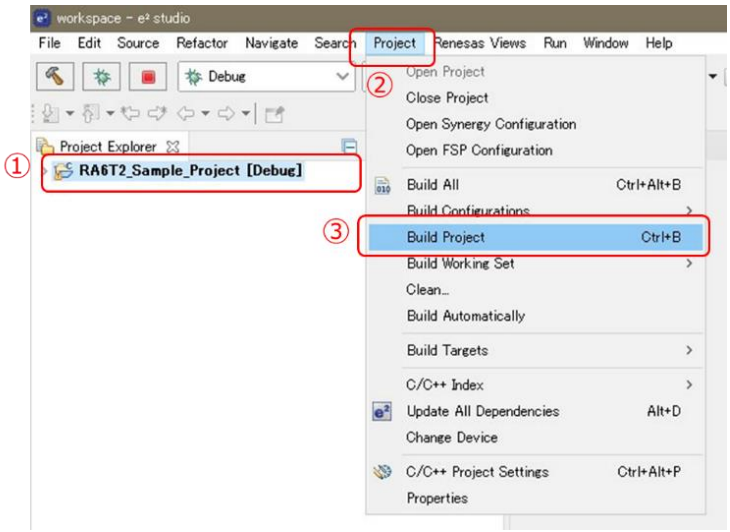


Figure 5-4 Build project

(5) Write the program into CPU board

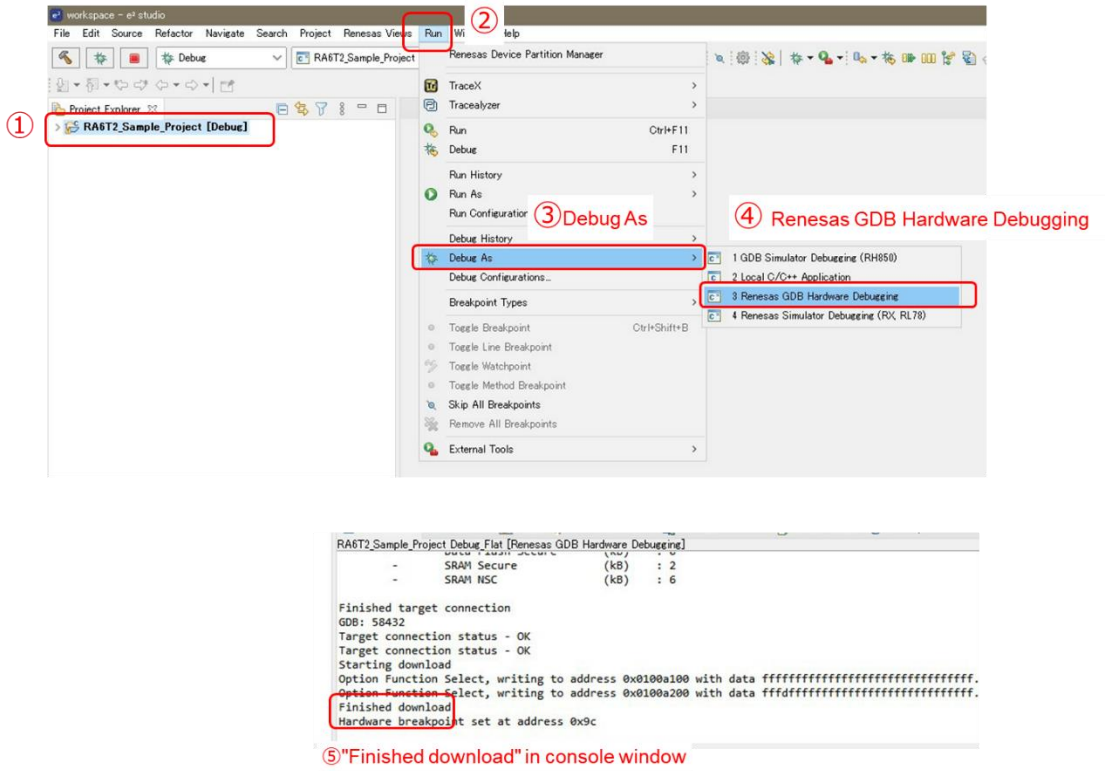


Figure 5-5 Flash programming

(6) Disconnect CPU board from PC

Click disconnect and detach USB cable from the CPU board.

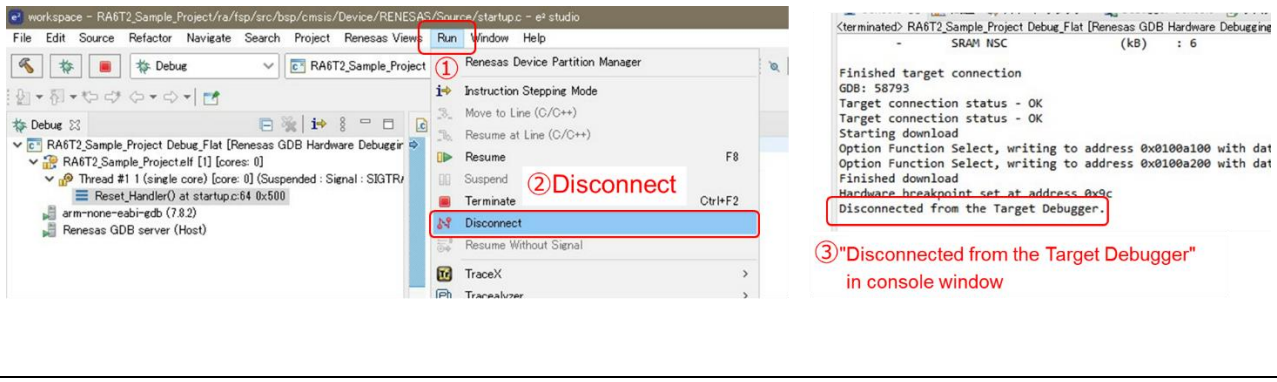


Figure 5-6 Disconnect CPU board

6. Hardware Setup for Development Support Tool

By downloading and writing a sample project that is compatible with the Renesas Motor Workbench, a motor control development support tool, to the CPU board, you can control motor using Renesas Motor Workbench. This chapter explains how to setup the hardware. For details on how to actually control the motor using Renesas Motor Workbench, please refer to the application note attached to the downloaded sample project and the manual of Renesas Motor Workbench.

Connect this product to your PC as shown below.

(1) Connect the inverter board and CPU board

Connect CN3,CN4 on the inverter board and CN2,CN3 on the CPU board. Connect CN2 on the inverter board with the Motor's cable.

(2) Connect the communication board and CPU board with communication cable

Connect CN5 on the communication board and CN4 on the CPU board with the communication cable included in this product.

(3) Connect the USB cable

Connect the USB type-C connector CN3 on the CPU board to your PC threw the USB isolator.

(4) Supply power

Supply DC12~48V to J1 or CN1 on the inverter board. In this section, power is supplied to J1 using an AC adapter. Note the polarity of the power supply. J1 is center positive.

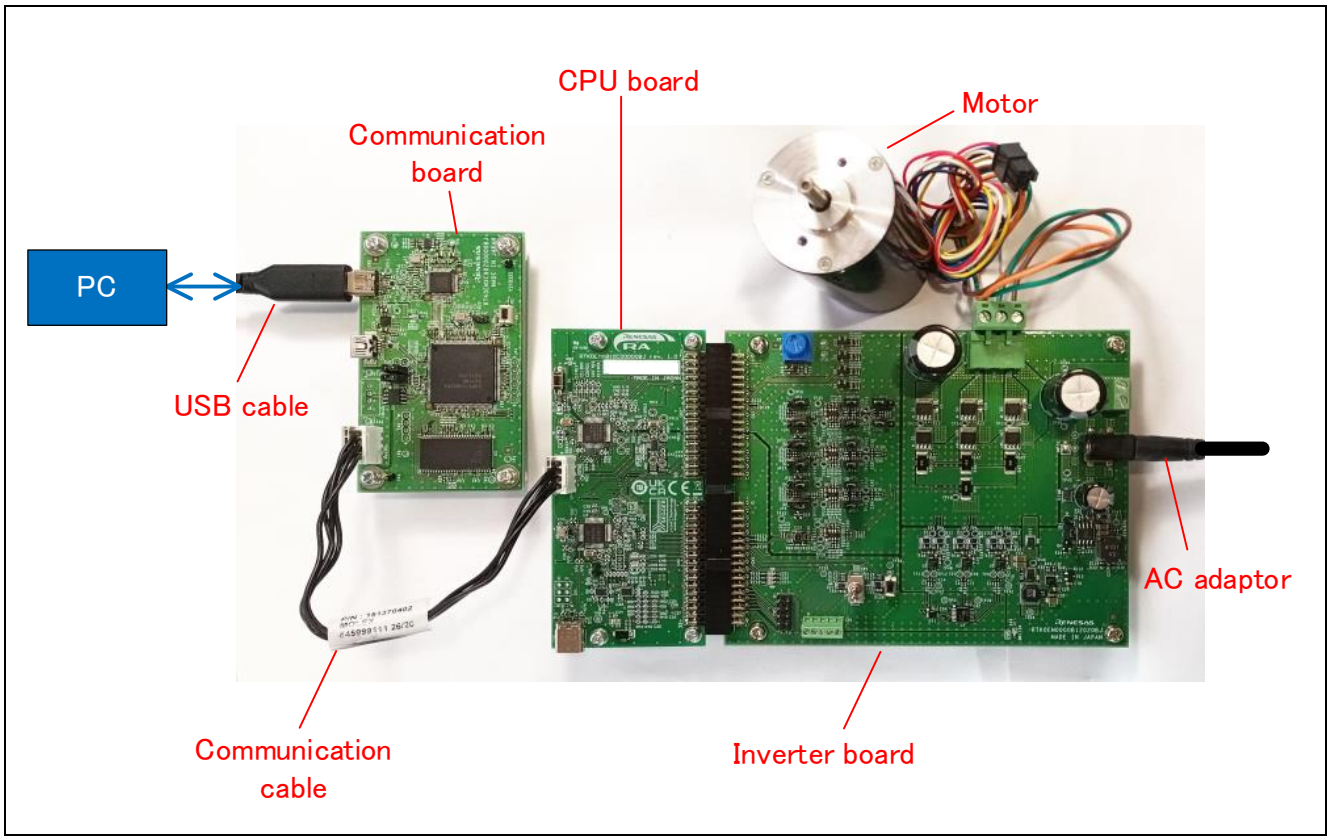


Figure 6-1 Hardware Configuration

7. Others

1. As for more details about this product, refer to the user's manual, design information and application notes which are available in its web page.
2. Renesas provides some sample projects to conduct demonstration for RA MCU's various functions. These sample projects can be used as good reference materials to start application development. The sample projects for the RA kit are available in the Renesas GitHub Web page.
3. All sample projects provide project file and readme file. In order to enable to write them into this product, after these files are downloaded, the project needs to be built using corresponding tool chain and FSP.

8. Website and Support

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

· RA Product Information renesas.com/ra

· Renesas Support renesas.com/support

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	May 1, 2025	-	First edition

MCK-RA2T1 Quick Start Guide

Publication Date: May 1, 2025

Published by: Renesas Electronics Corporation

MCK-RA2T1 Quick Start Guide

Renesas Electronics Corporation

R12QS0087EJ0100