Quick Start Guide

Asset Movement Detection for EK-RA8P1

Quick Start Guide

Renesas RA Family
RA8P Series

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Precautions

This Evaluation Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.
The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:
• Ensure attached cables do not lie across the equipment.
• Reorient the receiving antenna.
• Increase the distance between the equipment and the receiver.
• Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
• Power down the equipment when not in use.
• Consult the dealer or an experienced radio/TV technician for help.
Note: It is recommended that wherever possible shielded interface cables are used.
The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:
• The user is advised that mobile phones should not be used within 10 m of the product when in use.
• The user is advised to take ESD precautions when handling the equipment.
The Evaluation Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

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.

Asset Movement Recognition

EK-RA8P1 – Quick Start Guide

Contents

Figures

1. Introduction

This Quick Start Guide (QSG) provides:

• An overview of the Quick Start example project that the EK-RA8P1 board comes pre-programmed with.

• Instructions for running the Quick Start example project.

• Instructions for importing, modifying, and building the Quick Start example project using Flexible Software Package (FSP) and e2 studio Integrated Development Environment (IDE)

1.1 Assumptions and Advisory Notes

1. Tool experience: It is assumed that the user has prior experience working with IDEs such as e2 studio and terminal emulation programs such as Tera Term.
2. Subject knowledge: It is assumed that the user has basic knowledge about microcontrollers, embedded systems, and FSP to modify the example project described in this document.
3. Prior to running the Quick Start example project or programming the EK-RA8P1 board, default jumper settings must be used. Refer to the EK-RA8P1 user's manual for the default jumper settings.
4. The screen shots provided throughout this document are for reference. The actual screen content may differ depending on the version of software and development tools used.

2. Hardware & Programming configuration

This demo operates with QCIOT-ICM42670POCZ attached at PMOD1 of the EK-RA8P1

3. Overview of the Quick Start Guide Project – Asset Movement Recognition (AMR)

The AMR project uses the accelerometer module to perform motion recognition as described in the table below:

No	Movement	LED Indicator
1	Drop	Red LED blinks
2	Motion	Cyan LED blinks
3	Circle	Yellow LED blinks
4	Wave	All LEDs blink
5	Idle	Green LED blinks

Power on the EK-RA8P1 Kit with any of the USB connectors that are available.

3.1 Quick Start Guide Project Flow

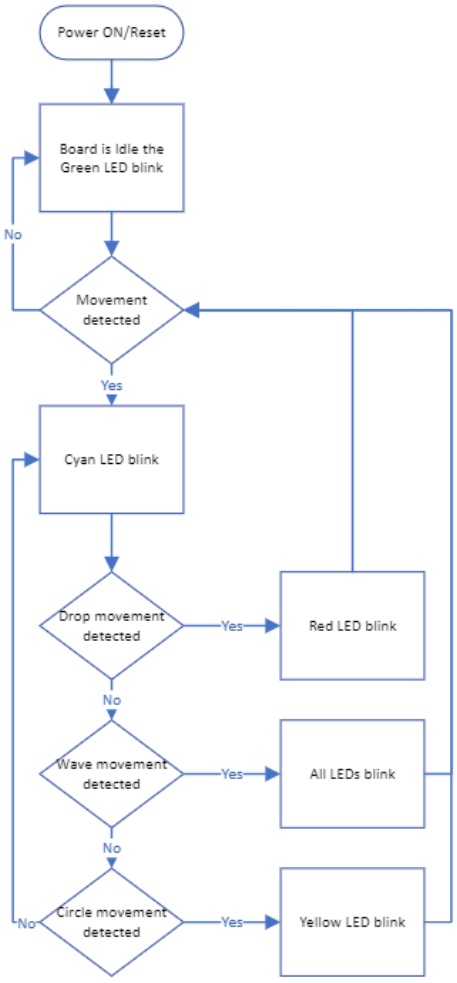

Figure 1. Quick Start Guide Project Flow

4. Running the Quick Start Example Project

This section lists the requirements and instructions to power up the EK-RA8P1 board and run the Quick Start Guide project.

Hardware Requirements

- EK-RA8P1 board
- Micro USB device cable
- A PC with at least 1 USB port

Software Requirements

- Windows® 10 operating system

4.1 Connecting and Powering Up the EK-RA8P1 Board

1. Attach the Accelerometer in the PMOD1
2. Switch SW4-PMOD1 to IIC
3. Connect the micro-USB end of the micro-USB device cable to USB-C Full Speed port (J10) of the EK-RA8P1 board.
4. Connect the other end of this cable to the USB port of the host PC. Power LED on the EK-RA8P1 board lights up blue, indicating that the EK-RA8P1 board is powered on.

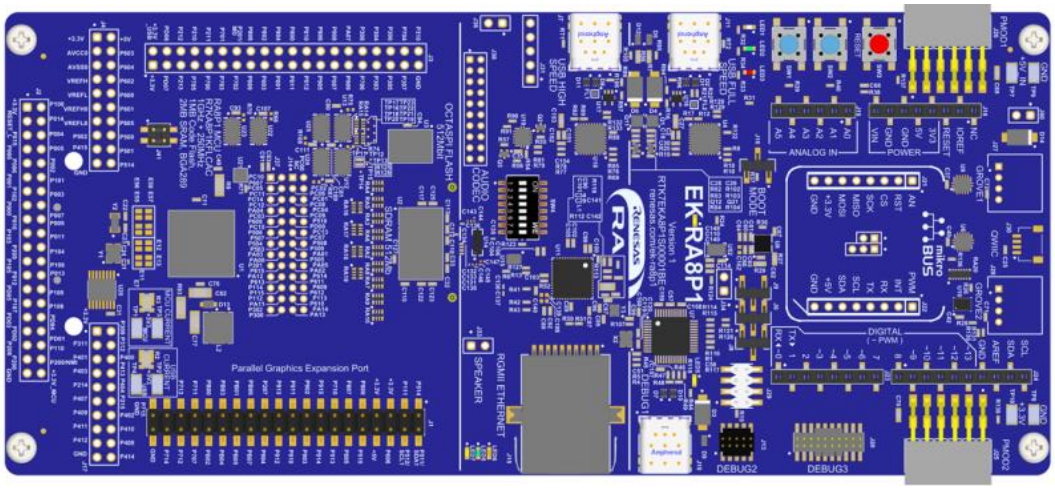

Figure 2. Connecting the EK-RA8P1 Board to the Host PC via USB Debug Port

4.2 Programming the application example

Flash the device with the binary that has been provided with this document.

In the folder Flasher you will find the following files:

- jlink_ra8p1_prog.bat
- _jlink_loc.bat ra8p1
- _flash.jlink
- AIK_RA8D1_Asset_Tracking.srec

Verify that the board is connected to the PC and run the jlink_ra8p1_prog.bat file, the project will be automatically downloaded to the DUT.

4.3 Running the Quick Start Guide Project

To run the Quick Start Guide project, use the following instructions:

1. On power up or RESET.

   Note: The debug LED (LED5) will blink or light up orange; this can be ignored for now.

2. LED turns green when idle.
3. Lightly move the board and LED turns Cyan, movement detected.
4. Fast move down the board and LED turns Red, drop movement detected.
5. Shake the board and LED blinks all colors, wave movement detected.
6. Rotate the board with ETH connector down LED turns yellow, circle movement detected.

5. Customizing the Quick Start Guide Project

This section lists the requirements and instructions for customizing the AMR project.

Hardware Requirements

- EK-RA8P1 board
- Renesas ICM-42670-P PMOD Board
- Micro USB device cable
- A PC with at least 1 USB port

Software Requirements

- Windows® 10 operating system
- e2 studio IDE
- FSP
- AMR project

5.1 Downloading and Installing Software and Development Tools

Before the Quick Start example project can be modified, it is necessary to download and install software and development tools on the host PC.

The FSP, J-Link USB drivers, and e2 studio are bundled in a downloadable platform installer available on the FSP webpage at renesas.com/ra/fsp. New users are recommended to use the **Quick Install** option provided in the installation wizard, to minimize the amount of manual configuration needed.

There is no need to download and install software, development tools, and drivers separately.

5.2 Downloading and Importing the Quick Start Example Project

1. Download and extract the AMR project to a local directory on the host PC.
    a. The AMR project (source code and project files) is available on request

    b. Download the AMR project to a local directory on the host PC.
2. Launch e2 studio.
3. Browse to the Workspace where the project file is to be imported. Enter the name in the Workspace dialog box to create a new workspace.

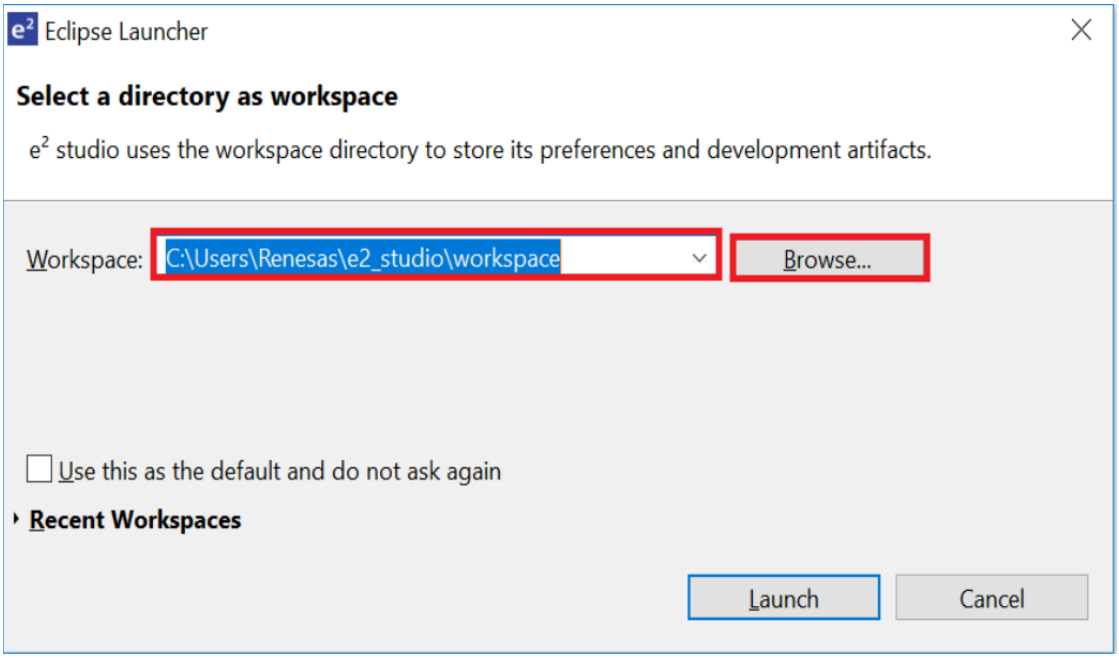

Figure 3. Creating a New Workspace

4. Click **Launch.**

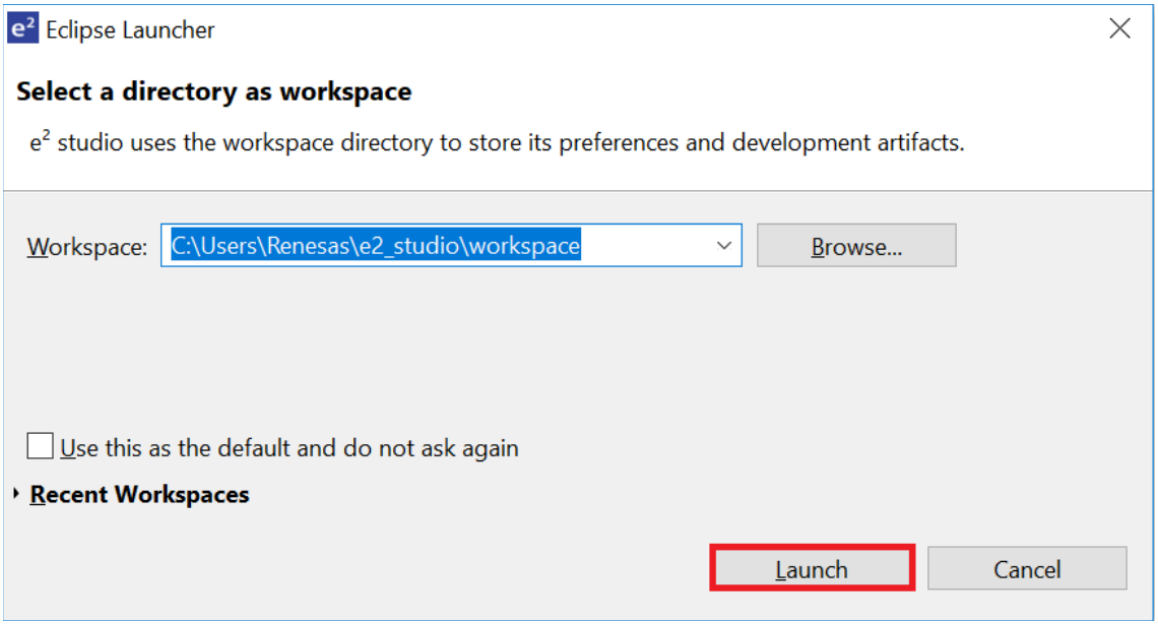

Figure 4. Launching the Workspace

5. Click Import from the File drop-down menu.

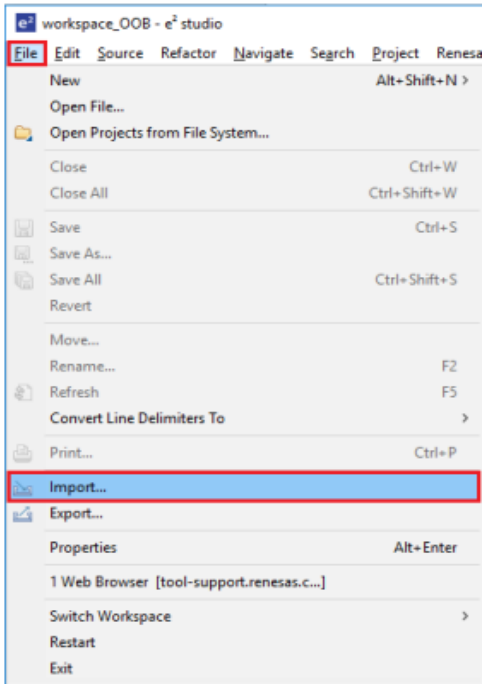

Figure 5. Importing the Project

6. In the **Import** dialog box, select **General**, and then select **Existing Projects into Workspace.**

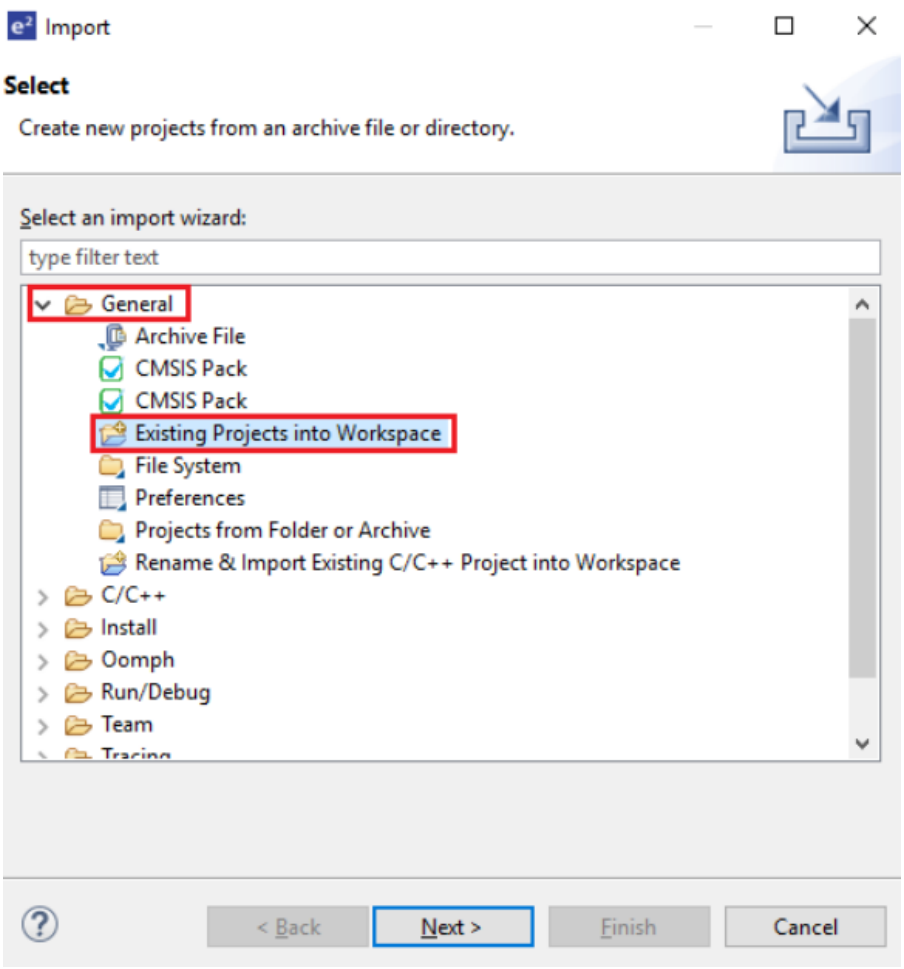

Figure 6. Importing Existing Projects into the Workspace

7. Click **Next.**

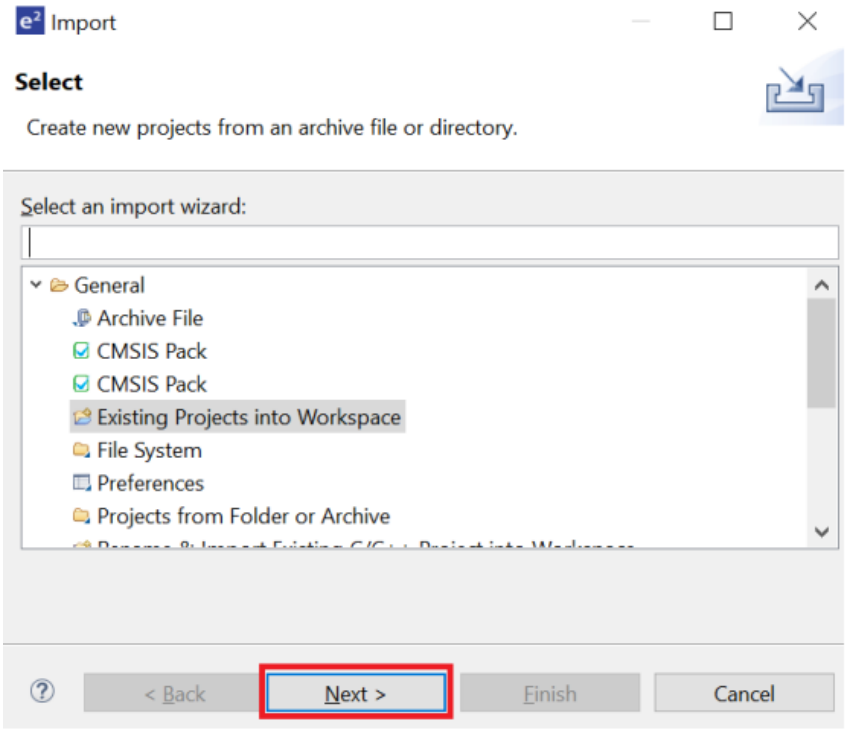

Figure 7. Clicking Next to Import Existing Projects into the Workspace

8. Click **Select root directory** and click **Browse** to go to the location of the Quick Start example project folder.

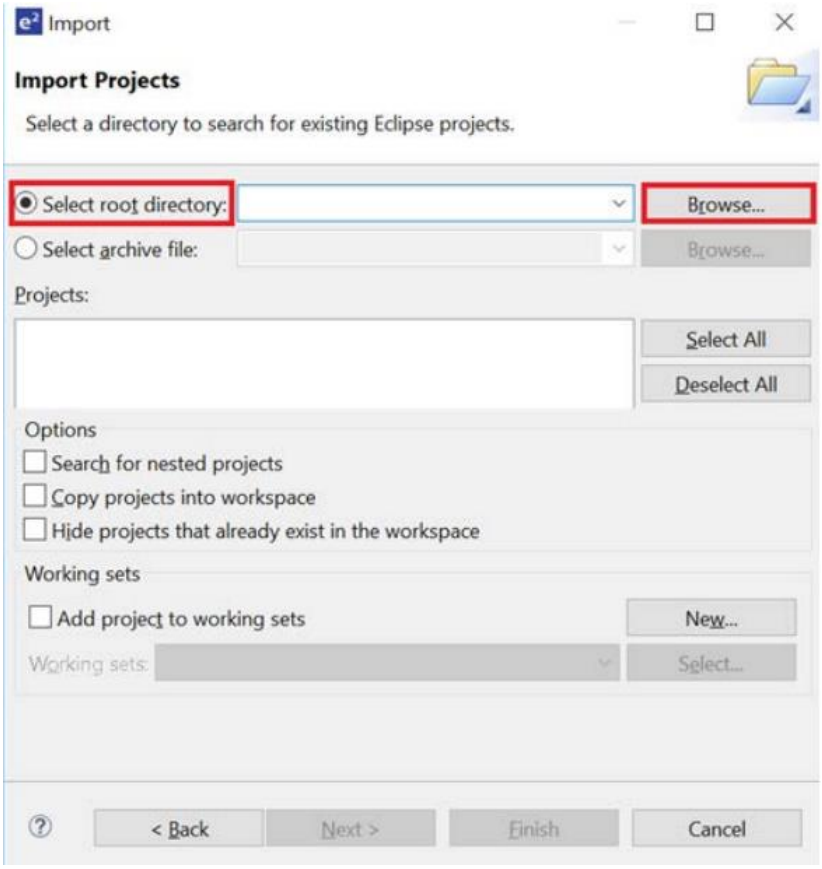

Figure 8. Selecting the Root Directory

9. Select the Quick Start Guide project and click **Finish**.

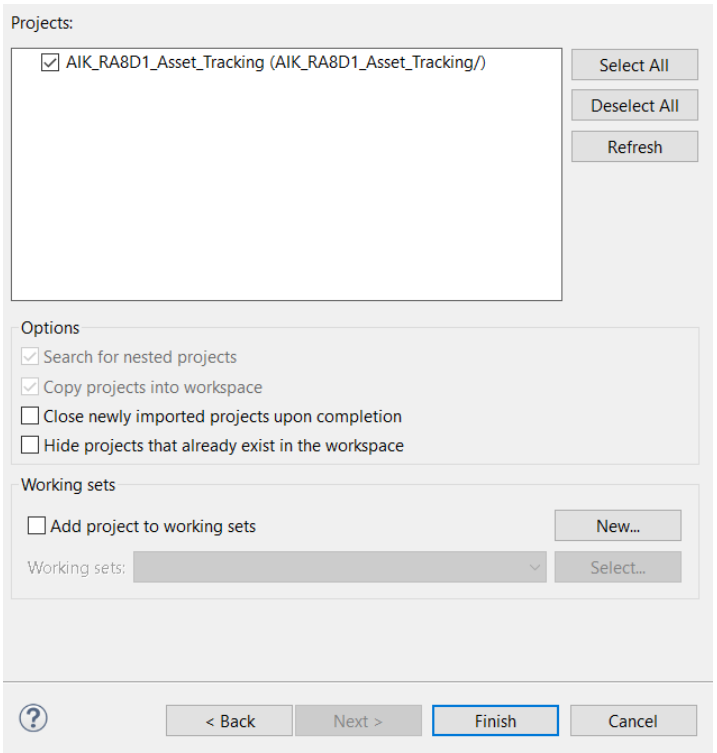

Figure 9. Finishing Importing the Quick Start Guide Project (indicative picture)

5.3 Modifying, Generating, and Building the Quick Start Guide Project

This section provides instructions to modify the AMR project. The AMR project can be modified by editing the source code and reconfiguring the properties of the MCU peripherals, pins, clocks, interrupts, and so forth.

Note: The specific modifications that can be performed to the AMR project are not prescribed in this QSG. User discretion is advised while modifying the AMR project.

1. Once AMR project is imported, click the configuration.xml file to open the configurator. The configurator provides an easy-to-use interface to configure the properties of MCU peripherals, pins, clocks, and so forth.

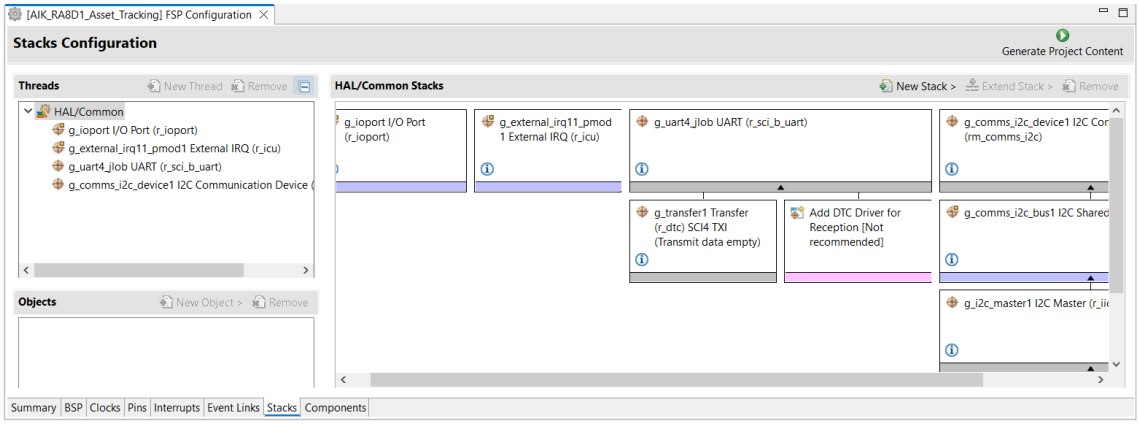

Figure 10. Opening the Configurator (indicative picture)

2. For example, in the **Stacks** tab of the configurator, the user can click to select modules to modify the configuration settings, as required. The following screen shot illustrates modifying the I2C Communication Device configuration.

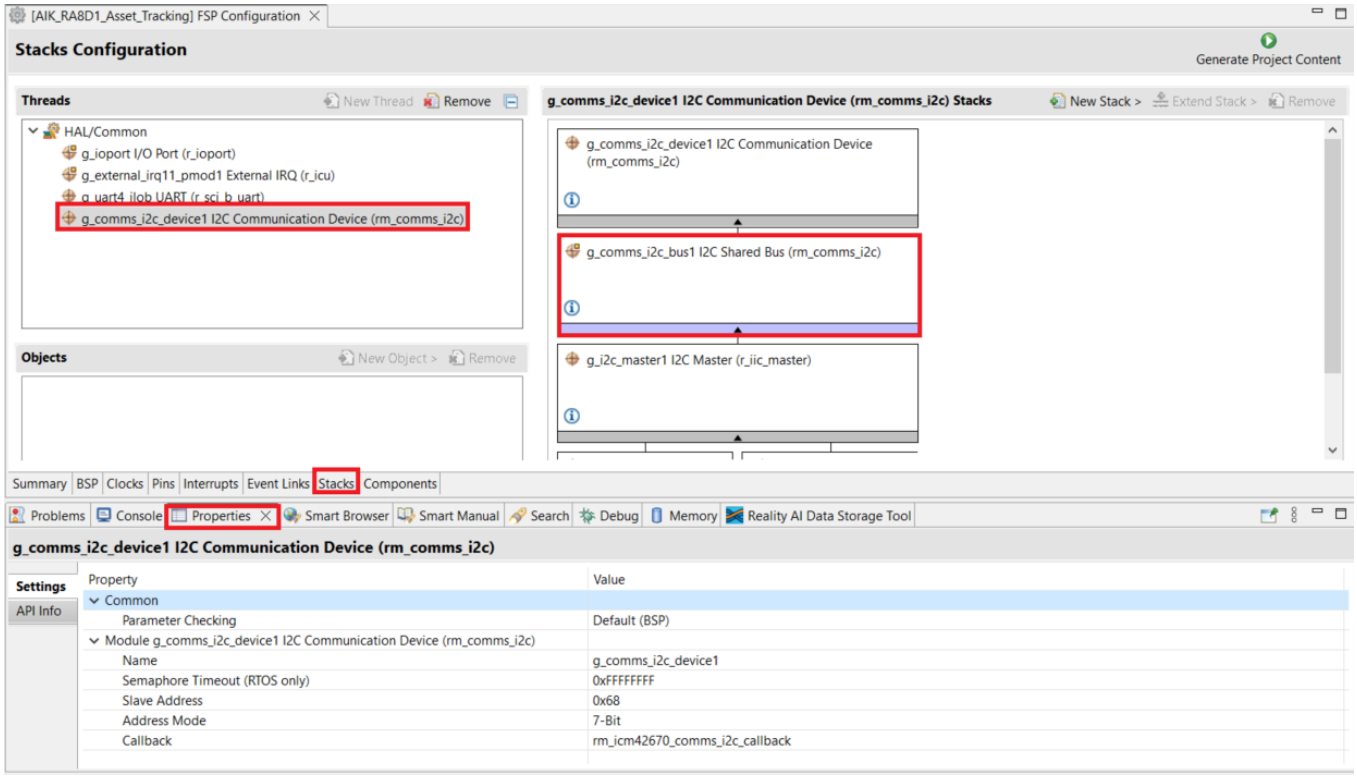

Figure 11. Modifying the Configuration Settings (indicative picture)

3. After the desired modifications are made, click **Generate Project**. A dialog box may appear with an option of saving the configuration changes. Click **Proceed**.

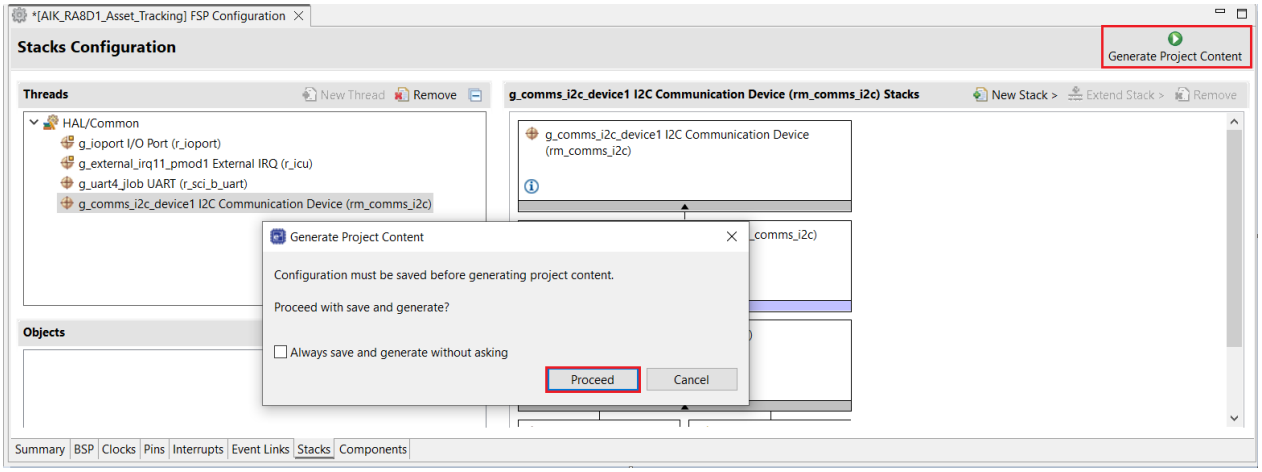

Figure 12. Saving the Configuration Changes (indicative picture)

4. Modify the source files in the ***/src*** folder as needed and save the changes.
5. Build the project by clicking the build icon.

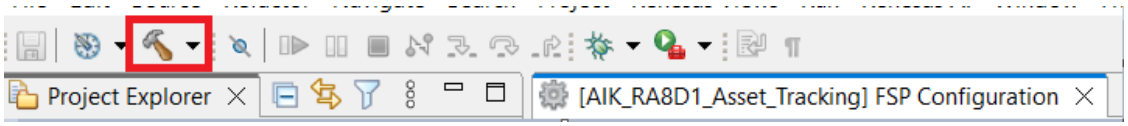

Figure 13. Building the Project (indicative picture)

6. A successful build produces an output as follows.

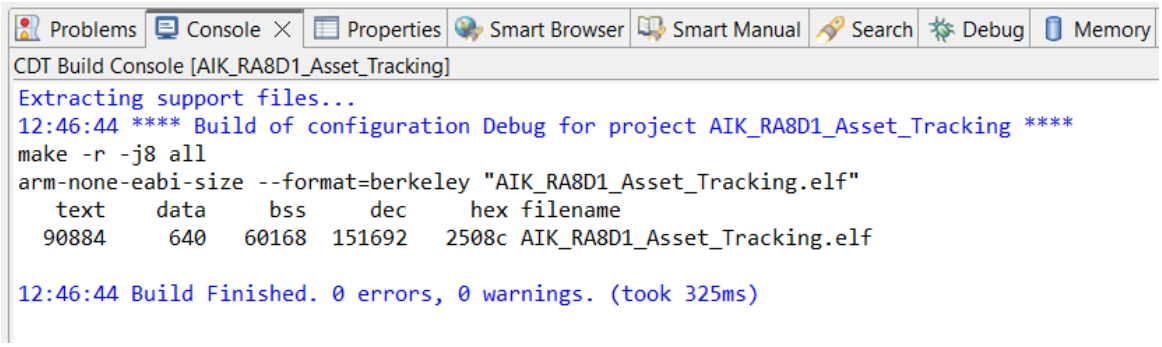

Figure 14. Successful Build Output (indicative picture)

5.4 Setting Up Debug Connection between the EK-RA8P1 board and Host PC

To program the modified AMR project on to the EK-RA8P1 board, a debug connection is necessary between the EK-RA8P1 board and host PC.

1. Connect the USB cable in the USB-C debug port (J10) of the EK-RA8P1 board.
2. Verify that the debug LED (LED5) stops blinking and lights up orange indicating that the J-Link drivers are detected by the EK-RA8P1 board.

Note: The debug LED (LED5) continues to blink when J-Link drivers are not detected by the EK-RA8P1 board. In that case, make sure that the EK-RA8P1 board is connected to the host PC through the USB-C debug port (J10) and that J-Link drivers are installed on the host PC by checking in the Windows Device Manager (expand **Universal Serial Bus controller**, and locate **J-Link driver**)

5.5 Downloading and Running the Modified Quick Start Example Project

1. In e2 studio, click the drop-down menu for the debug icon, select Debug As option, and choose Renesas GDB Hardware Debugging.

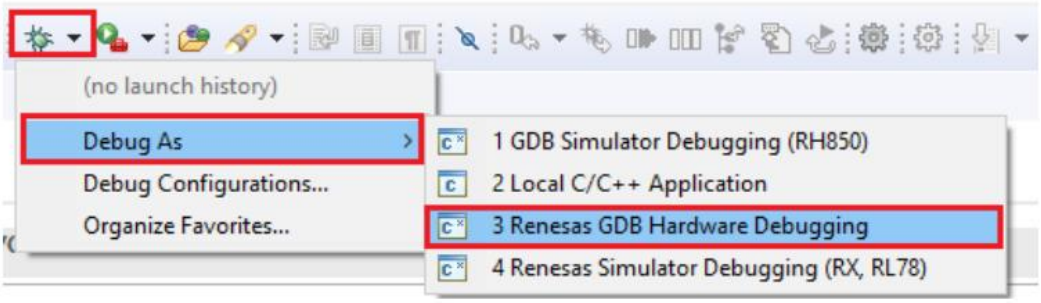

Figure 15. Selecting the Debug Option

2. A dialog box may appear. Click **Yes**.

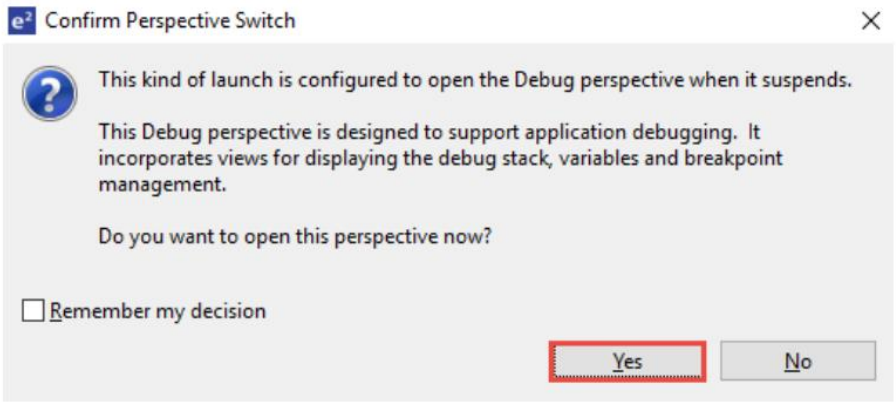

Figure 16. Opening the Debug Perspective

3. Press **F8** or click the **Resume** icon to begin executing the project.

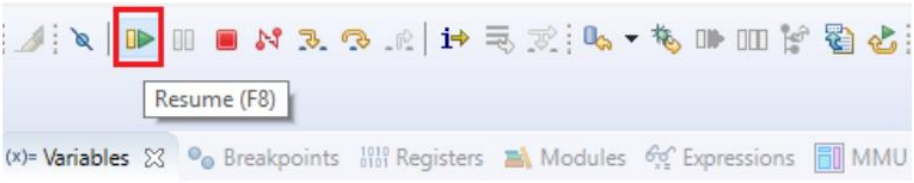

Figure 17. Executing the Project

4. The modified AMR project is programmed into the EK-RA8P1 board and is running. The project can be paused, stopped, or resumed using the debug controls.

6. Next Steps

1. To learn more about the EK-RA8P1 kit, refer to the EK-RA8P1 user's manual and design package available in the Documents and Download tabs respectively of the EK-RA8P1 webpage at renesas.com/ek-ra8p1.

2. Renesas provides several example projects that demonstrate different capabilities of the RA MCUs. These example projects can serve as a good starting point for users to develop custom applications. Example projects (source code and project files) for other kits with RA8P1 are available in the Example Project Bundle and can be reused with EK-RA8P1. The example projects bundle is available in the Downloads tab of MCU Evaluation Kit webpage.

3. To learn how to create a new e2 studio project from scratch, refer to Chapter 2 Starting Development in the FSP User Manual (renesas.com/ra/fsp). To learn how to use e2 studio, refer to the User Manual provided on the e2 studio webpage (renesas.com/software-tool/e-studio)

7. Website and Support

Visit the following URLs to learn about the kit and the RA family of microcontrollers, download tools and documentation, and get support.

EK-RA8P1 Resources	www.renesas.com/aik-ra8d1
RA Product Information	www.renesas.com/ra
RA Product Support Forum	www.renesas.com/ra/forum
Renesas Support	www.renesas.com/support
Reality AI Explorer Tier	www.renesas.com/software-tool/reality-ai-explorer-tier

For further information and inquiries, please request a demo from Reality AI | Renesas Electronics

Provide Feedback/ Request a Feature

Renesas aims to provide the best microcontroller kit experience to help jumpstart customer innovation with RA family of microcontrollers and take products to market faster. The Renesas RA microcontroller kits have been designed with a lot of attention-to-detail and customer-centric thinking at every aspect of design. Renesas aims to exceed customer expectations.

Renesas looks forward to hearing your feedback and knowing how we can enhance your experience. Please share your feedback at renesas.com/ra/kitfeedback

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jul.01.25	—	Initial release

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