Quick Start Guide

RA2L1 Group

Evaluation Kit for RA2L1 Microcontroller Group
EK-RA2L1
Quick Start Guide

Renesas RA Family
RA2 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.

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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.

Renesas RA Family

EK-RA2L1

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1. Introduction

This Quick Start Guide (QSG) provides:

- An overview of the Quick Start example project that the EK-RA2L1 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. The examples in this guide will use SEGGER RTT.
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-RA2L1 board, default jumper settings must be used. Refer to the EK-RA2L1 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. Kit Contents

The following components are included in the kit:

1. EK-RA2L1 board
2. Micro USB device cable (type-A male to micro-B male)

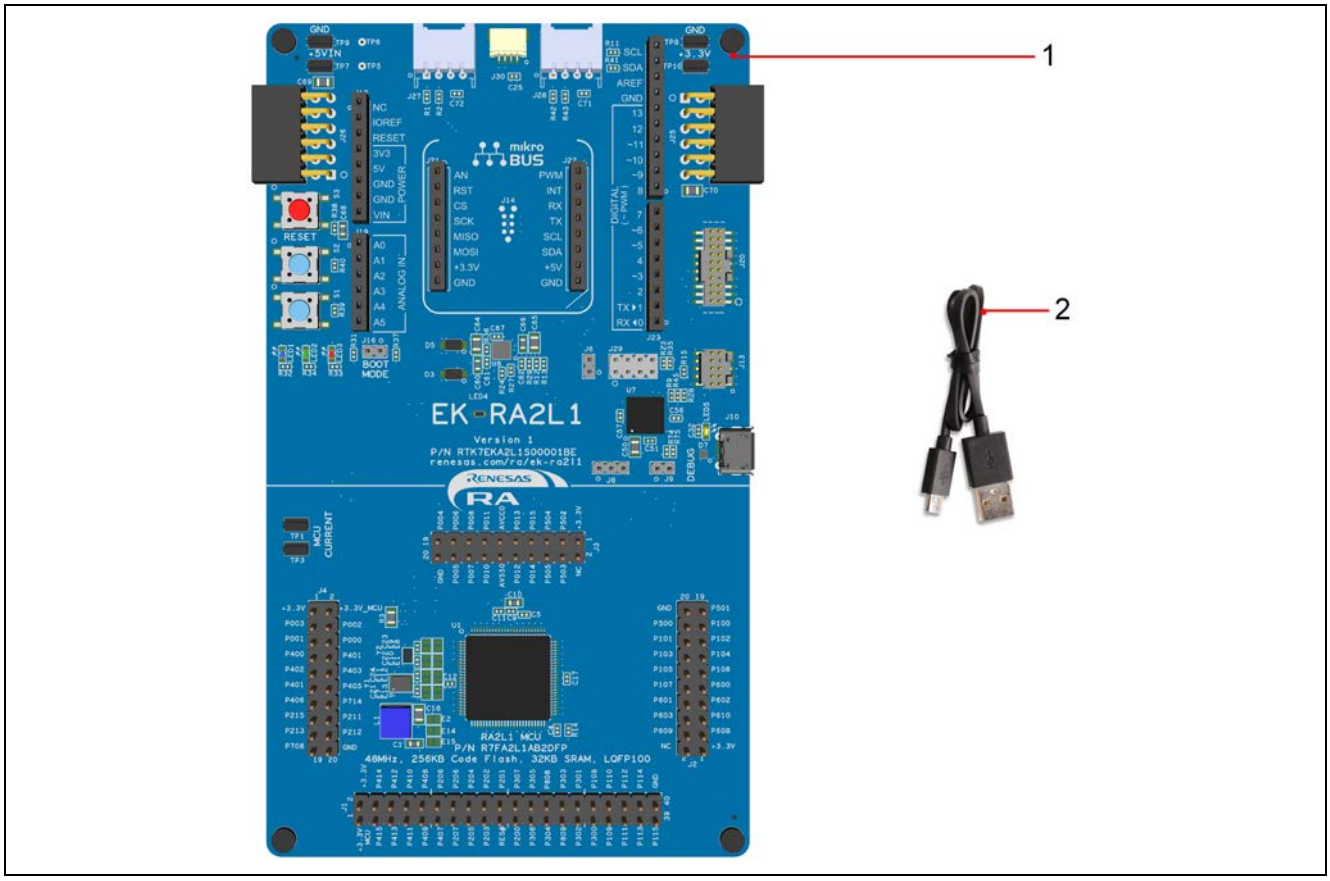

Figure 1. EK-RA2L1 Kit Contents

3. Overview of the Quick Start Example Project

The Quick Start example project allows the user to change the frequency and intensity of the on-board user LED1 (blue) using the user buttons (S1 and S2). The supported frequencies are 1 Hz, 5 Hz, and 10 Hz and the supported intensities are 10%, 50%, and 90%.

When the EK-RA2L1 board running the Quick Start example project is connected to a host PC via the debug USB, the kit information, MCU die temperature and user LED blinking frequency are displayed on a virtual terminal console.

3.1 Overview of the Quick Start Example Project

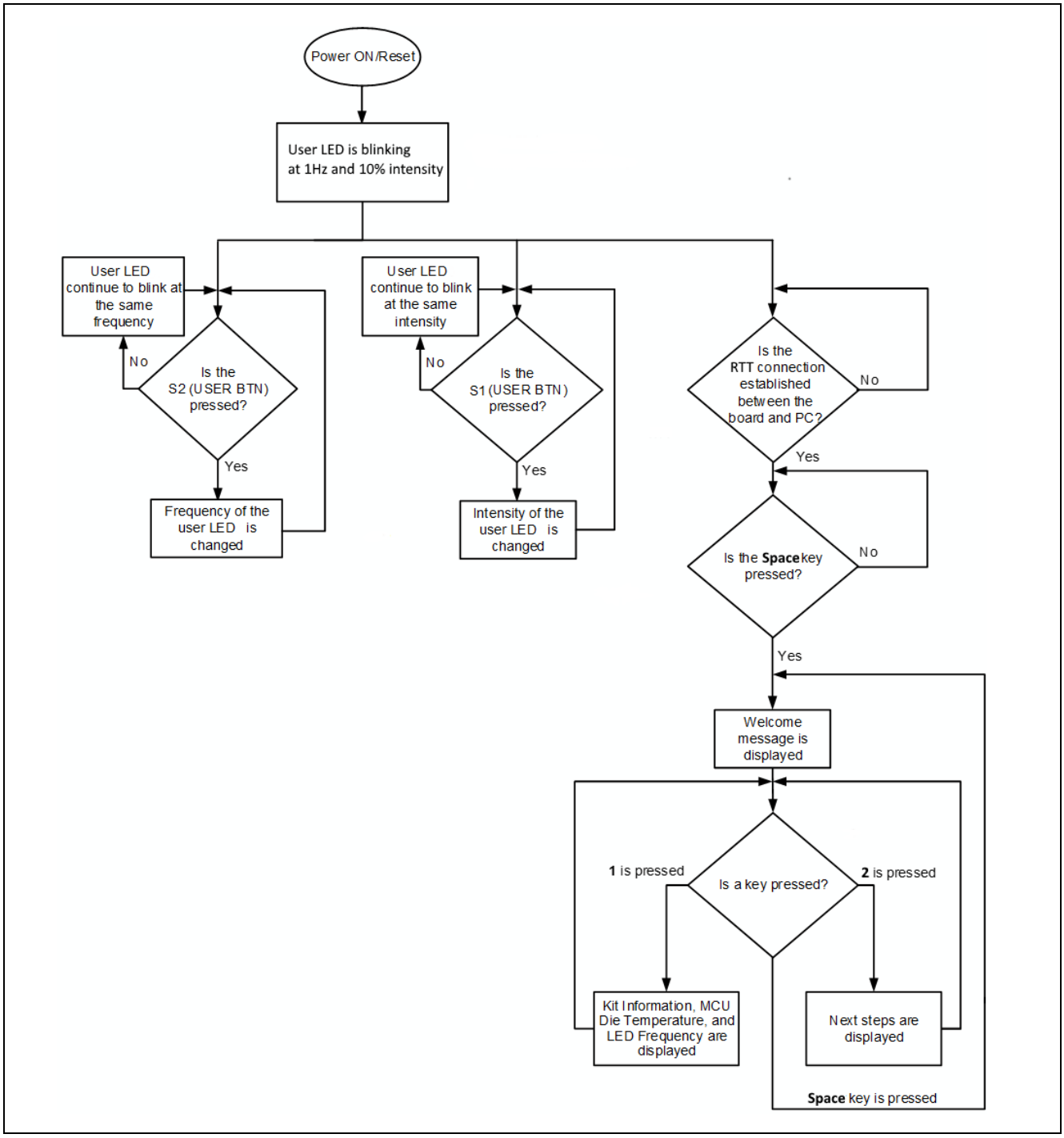

Figure 2. Quick Start Example Project Flow

4. Running the Quick Start Example Project

This section lists the requirements and instructions to power up the EK-RA2L1 board and run the Quick Start example project.

Hardware Requirements

- EK-RA2L1 board
- Micro USB device cable
- A PC with at least 1 USB port

Software Requirements

- Windows® 10 operating system
- SEGGER J-Link® USB Serial Drivers
- SEGGER J-Link Real-Time Transfer (RTT) Viewer, virtual terminal emulation application. It is included in J-Link Software and Documentation Pack which can be download from segger.com

4.1 Connecting and Powering Up the EK-RA2L1 Board

1. Connect the micro USB end of the micro USB device cable to micro-AB USB Debug port (J10, DEBUG1) of the EK-RA2L1 board.
2. Connect the other end of this cable to the USB port of the host PC. Power LED (LED4) on the EK-RA2L1 board lights up white, indicating that the EK-RA2L1 board is powered on.

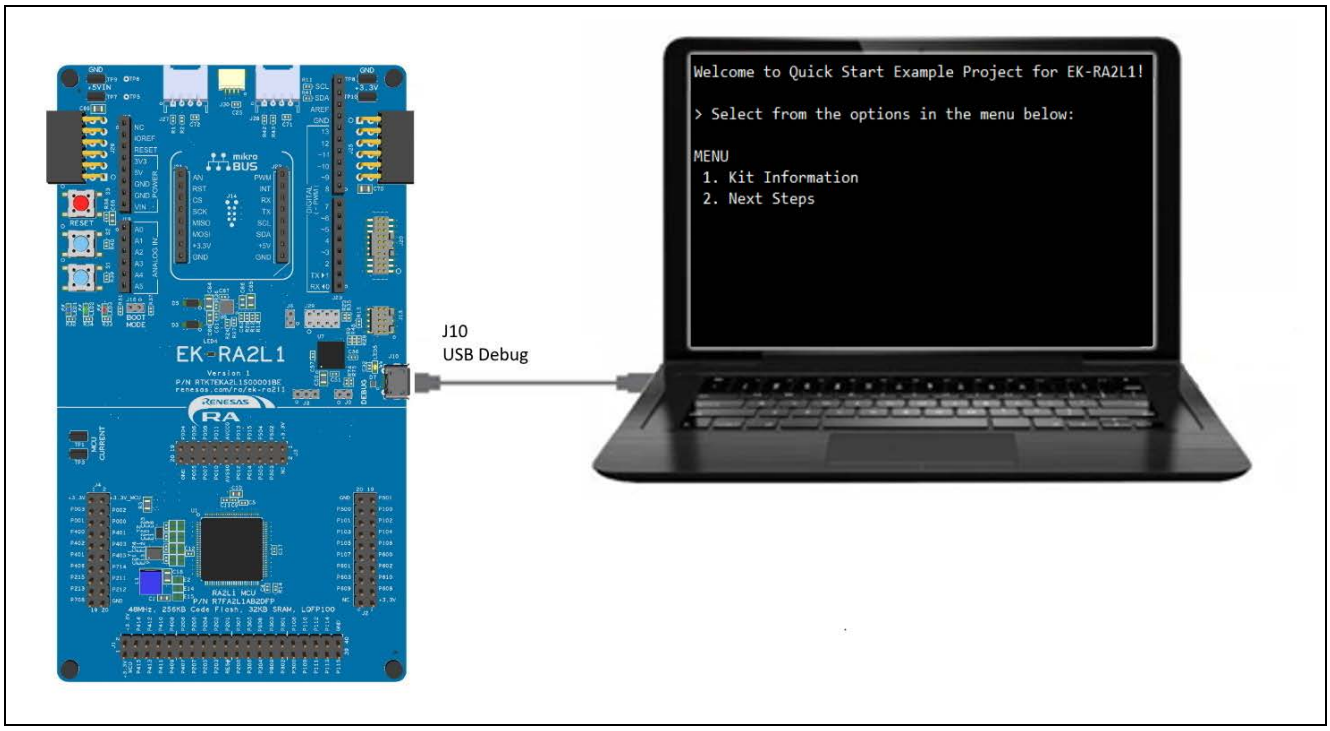

Figure 3. Connecting the EK-RA2L1 Board to the Host PC via USB Debug Port J10

4.2 Running the Quick Start Example Project

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

1. On power up or RESET, the three user LEDs will take on the following states:
   - LED3 Red – Off
   - LED2 Green – Steady, full intensity.
   - LED1 Blue - Blinking at 1 Hz frequency and at 10% intensity.

   Note: The debug LED (LED5) will blink or light up orange indicating communication between host and device.

2. Press the user button (S1) on the board to change the intensity of the user LED1. With every press of the user button (S1), the intensity will switch from 10% to 50% to 90% and cycle back.
3. Press the user button (S2) on the EK-RA2L1 board to change the blinking frequency of the user LED1 (blue). With every press of the first user button (S2), the frequency will switch from 1 Hz to 5 Hz to 10 Hz and cycle back.
4. On the host PC, open SEGGER J-Link RTT Viewer. This will provide a virtual COM port through the EK on-board debugger.
5. The RTT settings are shown in Figure 4.

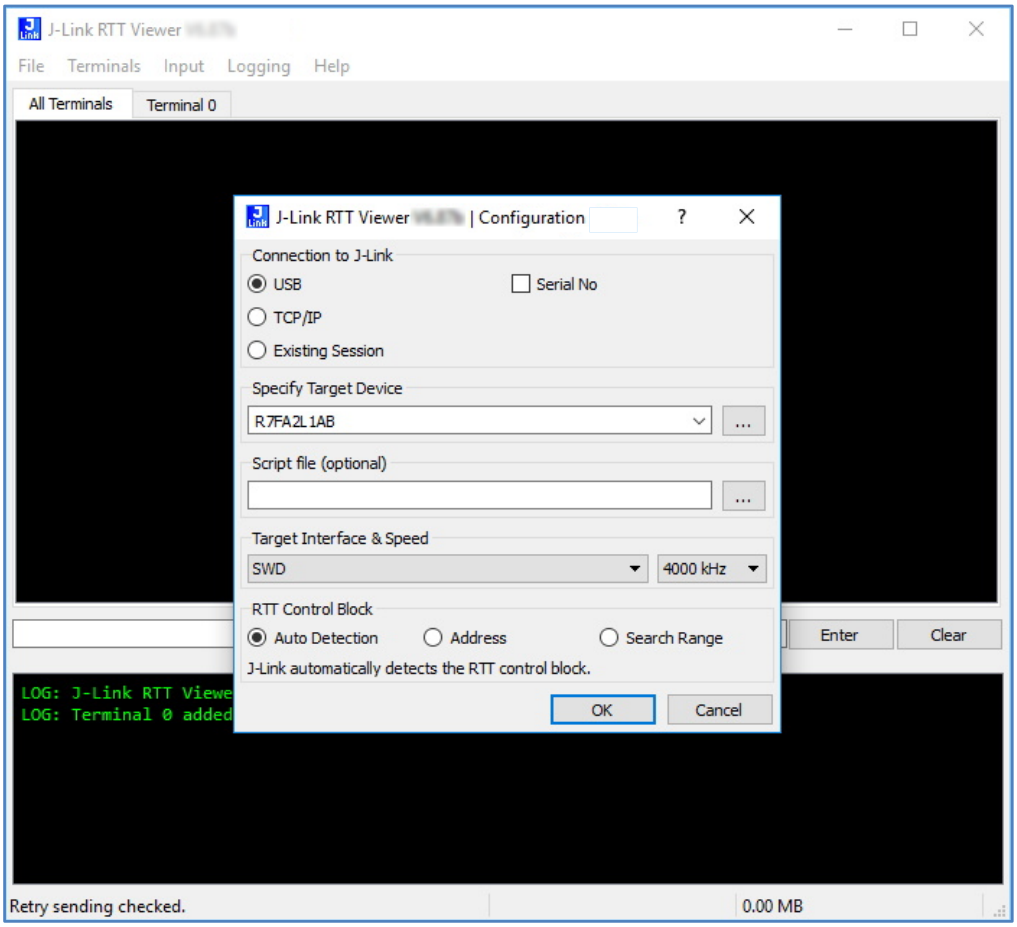

Figure 4. RTT Terminal Setup

6. Press **OK.**
7. If you are prompted to update the debugger firmware, follow the prompts to permit this.
8. Select the tab for **Terminal 0**.

9. In the **Input** tab, select **Sending…. Send on Input**

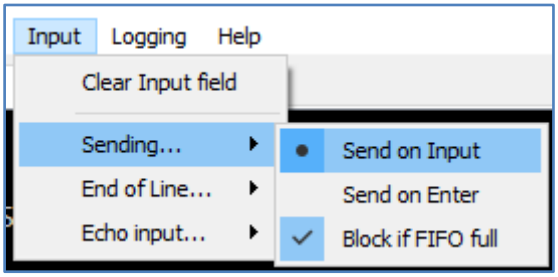

Figure 5. RTT Terminal Input Configuration

10. The console output from the EK_RA2L1 should appear on the terminal.

11. To type commands into the terminal, click to move focus to the data entry box, in the center of the RTT window, and click the **Enter** button to send. (Characters are sent as you type, so if an input does not require an Enter character, then clicking the **Enter** button will not be required.)

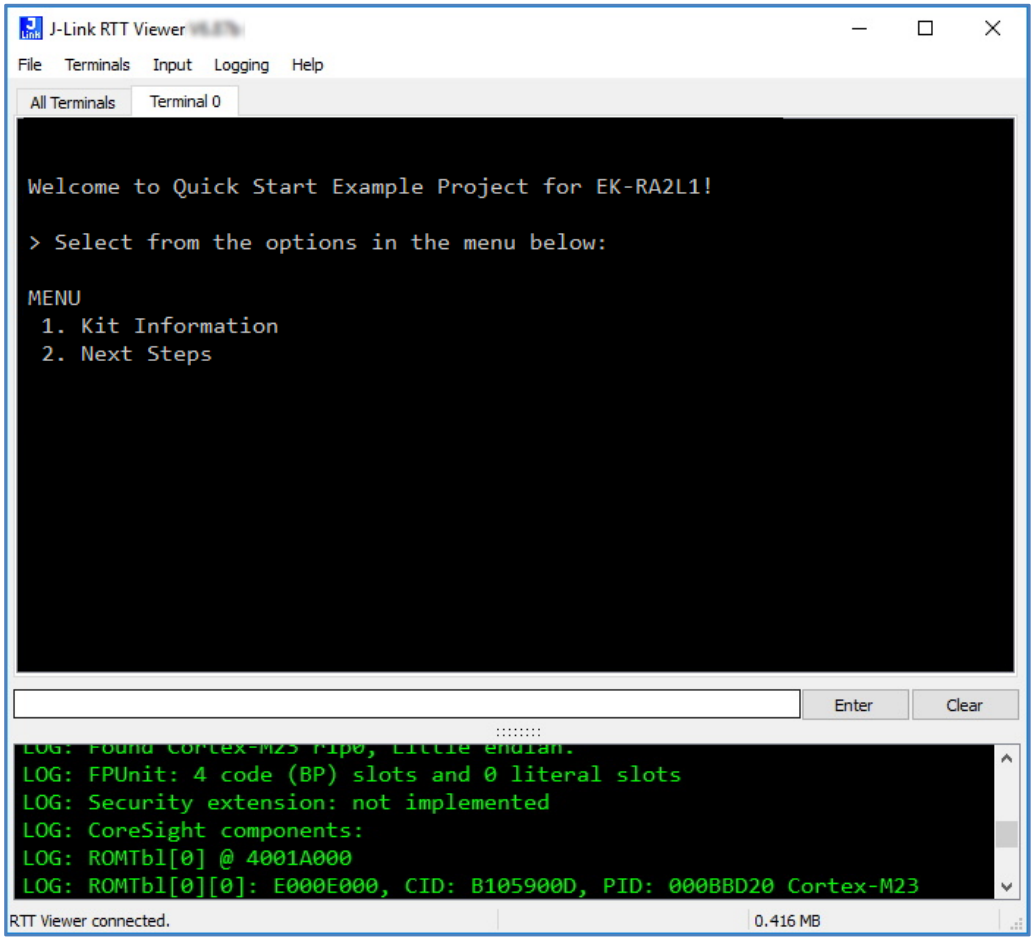

Figure 6. Welcome and Main Menu

12. Press **1** to display the kit name, part number, MCU ID, MCU die temperature, and the user LEDs' current intensity/blinking frequency.

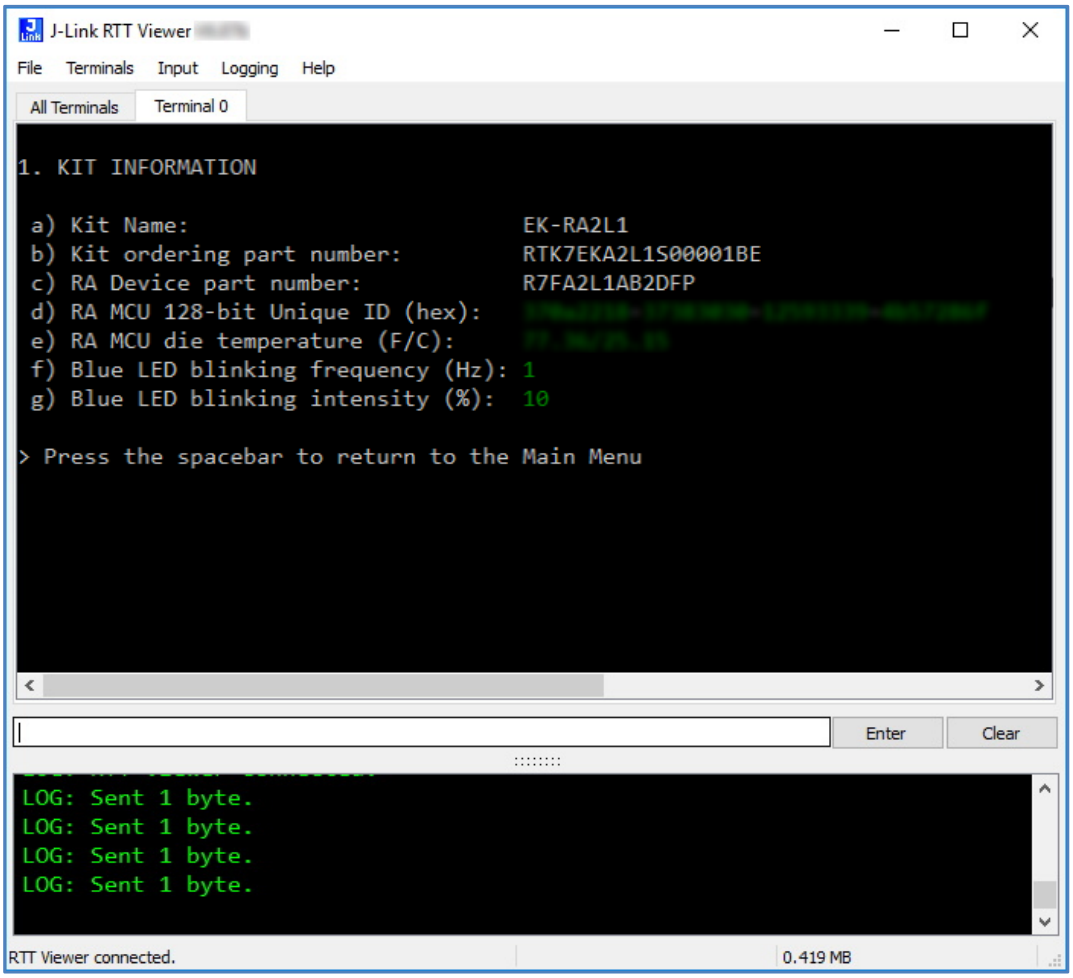

Figure 7. Kit Information

Press **space** to return to the 'welcome and main menu' screen.

13. Press **2** to display the **Next Steps**.

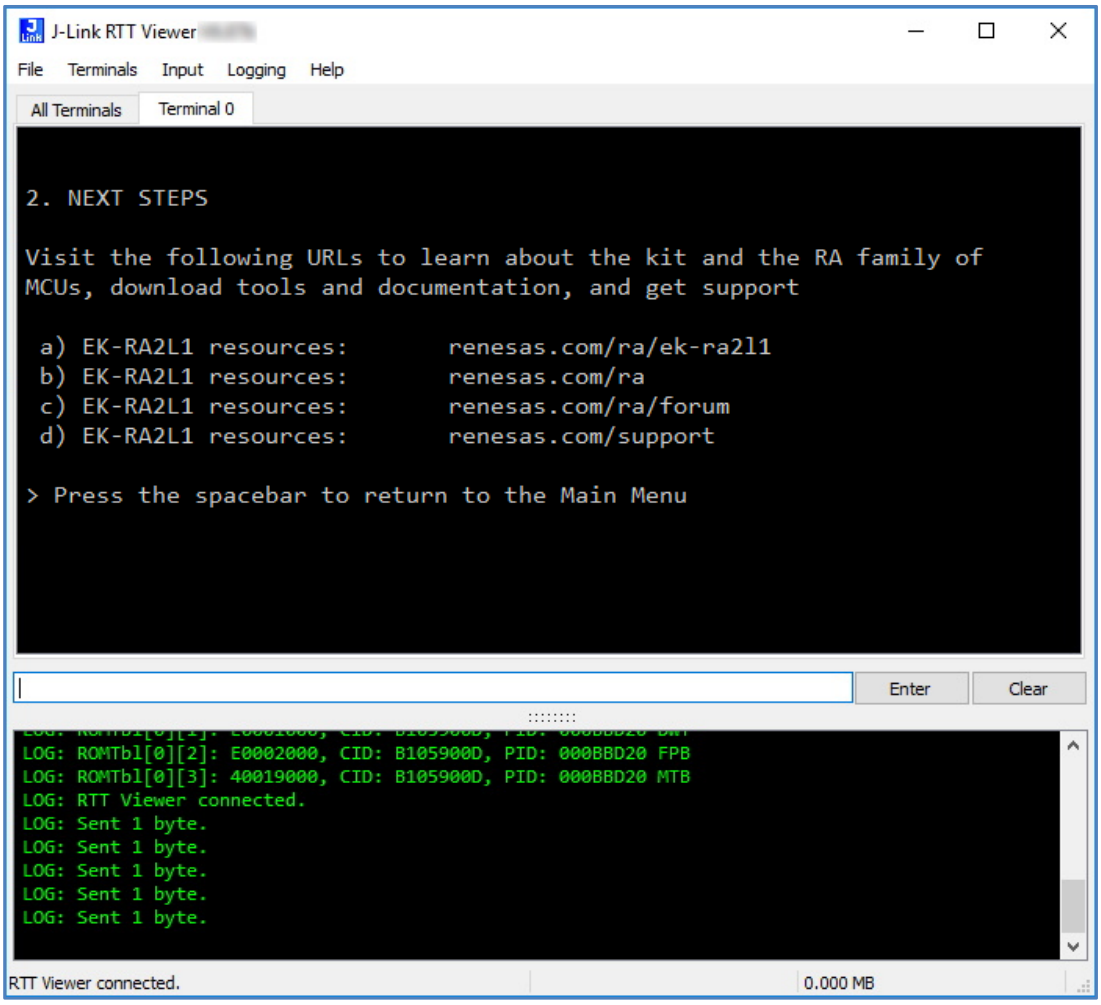

Figure 8. Next Steps

5. Customizing the Quick Start Example Project

This section lists the requirements and instructions for customizing the Quick Start example project.

Hardware Requirements

- EK-RA2L1 board
- Micro USB device cable
- A PC with at least 1 USB port

Software Requirements

- Windows® 10 operating system
- e² studio IDE
- SEGGER J-Link® USB drivers
- Flexible Software Package (FSP)
- Quick Start example 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 Quick Start example project to a local directory on the host PC.
   - The Quick Start example project (source code and project files) is available in the EK-RA2L1 Example Projects Bundle that is available in the **Downloads** tab of EK-RA2L1 webpage at renesas.com/ra/ek-ra2l1
   - Download and extract the example projects bundle (`xxxxxxxxxxxxxxx-ek-ra2l1-exampleprojects.zip`) to a local directory on the host PC.
   - Browse to the Quick Start example project at `xxxxxxxxxxxxxxx-ek-ra2l1-exampleprojects\ek_ra2l1\_quickstart\quickstart_ek_ra2l1_ep`
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.

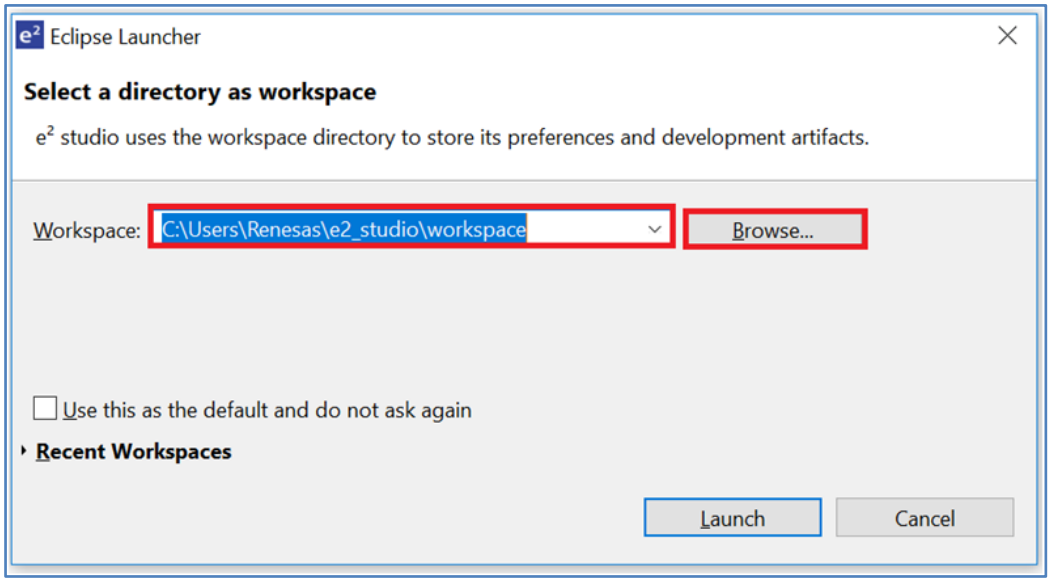

Figure 9. Creating a New Workspace

4. Click **Launch.**

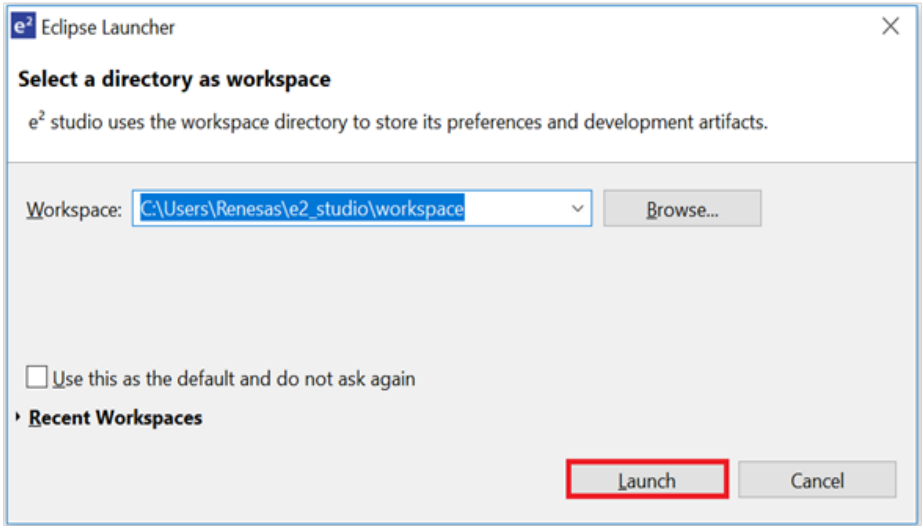

Figure 10. Launching the Workspace

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

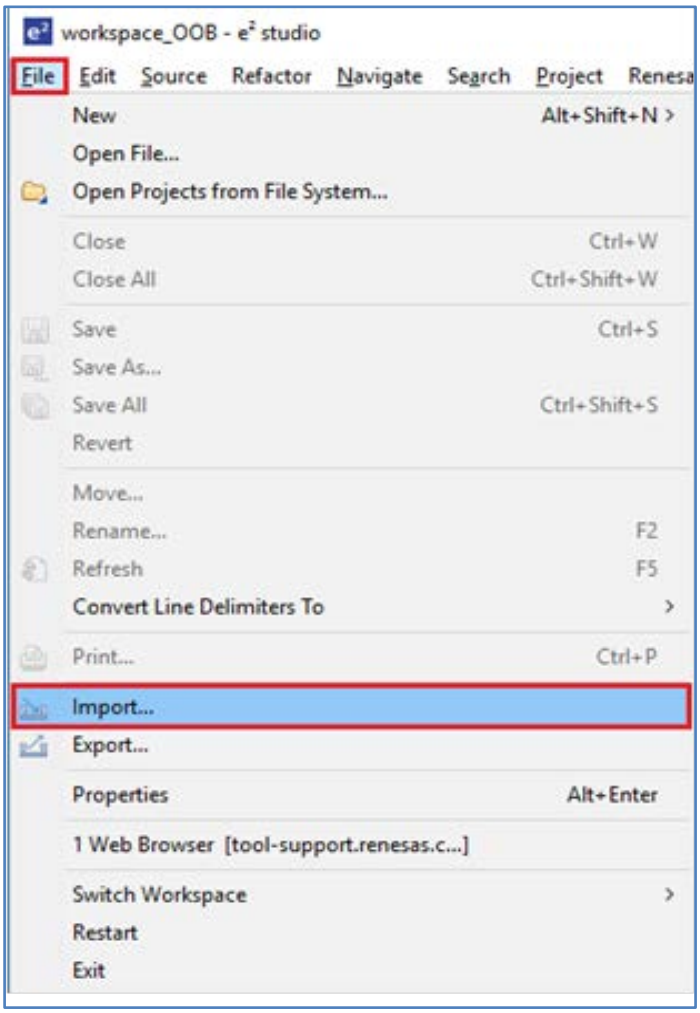

Figure 11. Importing the Project

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

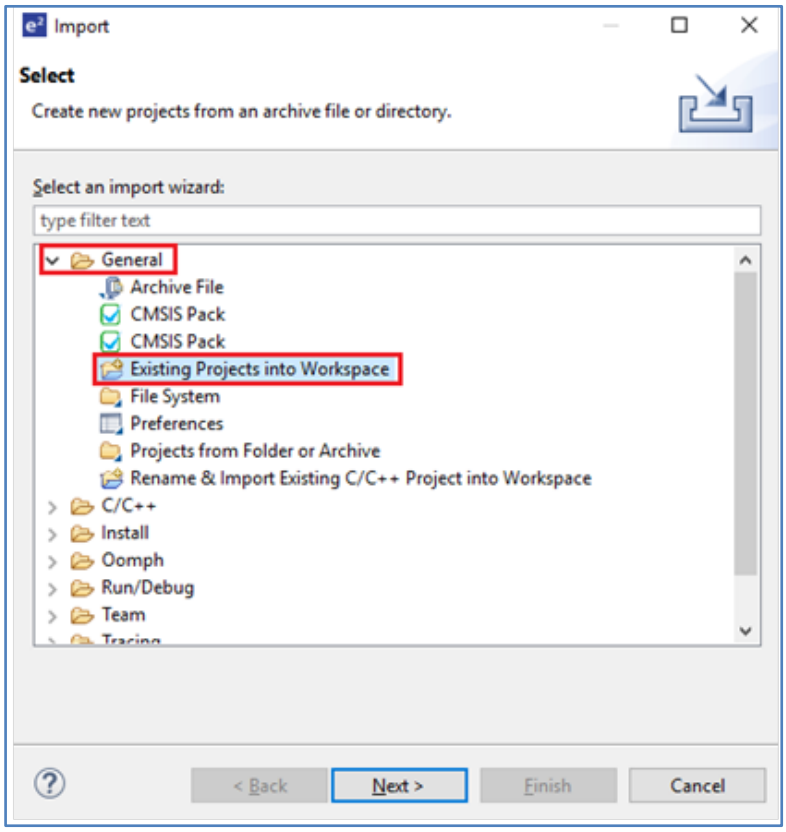

Figure 12. Importing Existing Projects into the Workspace

7. Click **Next**.

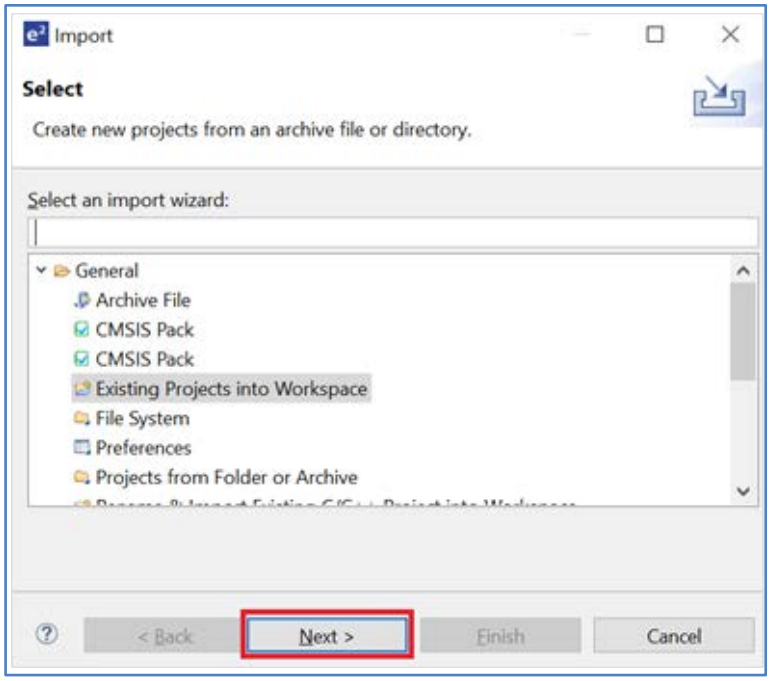

Figure 13. Clicking Next to Import Existing Projects into the Workspace

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

   Your location may differ from the example in Figure 13. The project directory should exist within the 'workspace' directory. If it does not exist to this location, then check the '**Copy projects into workspace'** option.

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

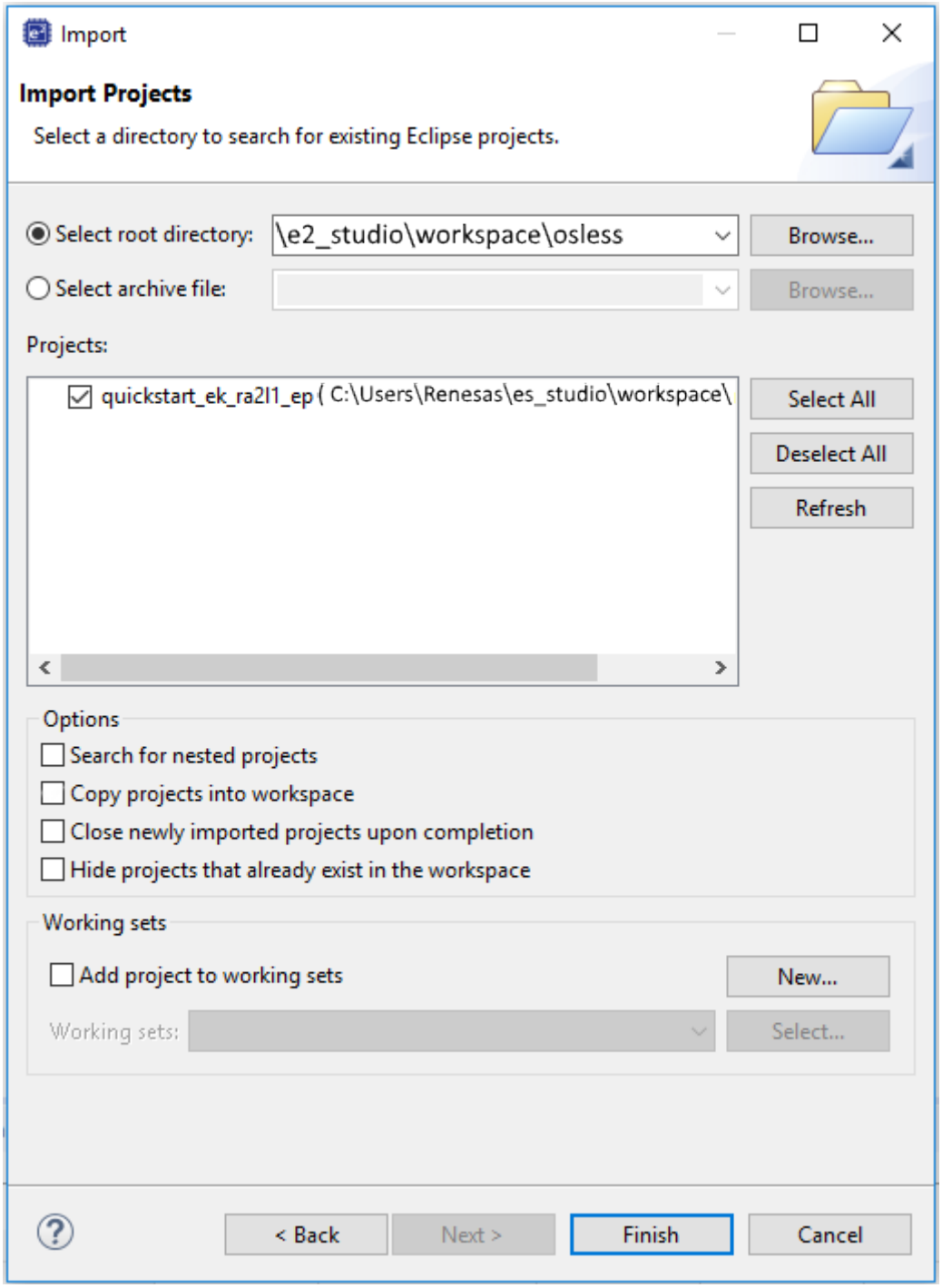

Figure 14. Finishing Importing the Quick Start Example Project

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

This section provides instructions to modify the Quick Start example project. The Quick Start example 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 Quick Start example project are not prescribed in this QSG. User discretion is advised while modifying the Quick Start example project.

1. Once the Quick Start example 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 the MCU peripherals.

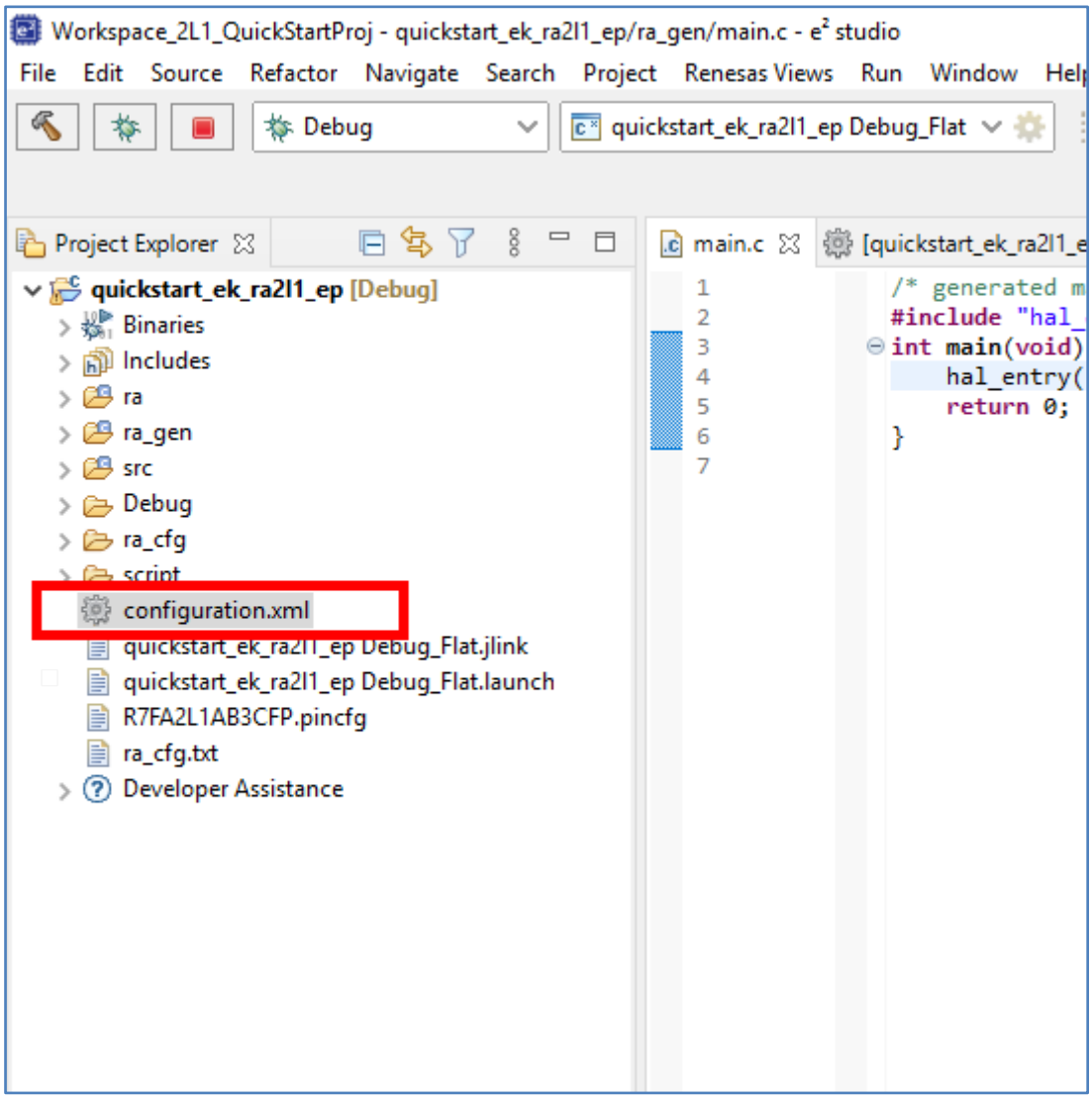

Figure 15. Opening the Configurator

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

   Note: To access the stack component properties, the view must be set to **FSP Configuration** perspective, by selecting the **View** button, which by default will appear at the top right or the IDE.

   If not visible, it may be invoked using the **Open Perspectives** button.

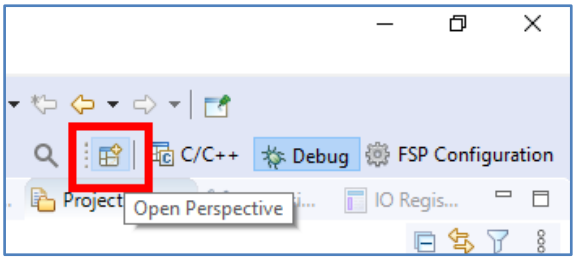

Figure 16. Switch to the FSP Configurator view

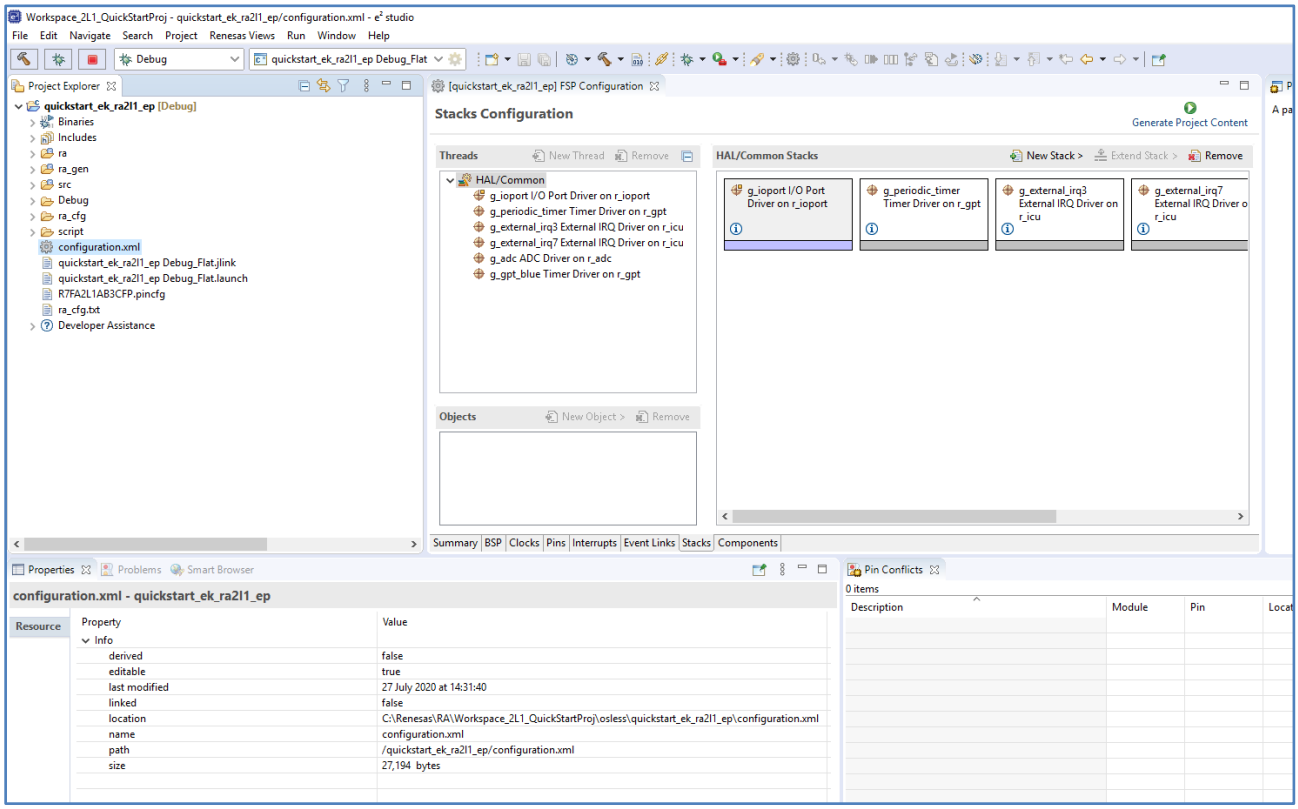

Figure 17. Modifying the Configuration Settings

3. After the desired modifications are made, click **Generate Project**. This will produce the auto-generated code within the project.

   A dialog box may appear with an option of saving the configuration changes. Click **Proceed**.

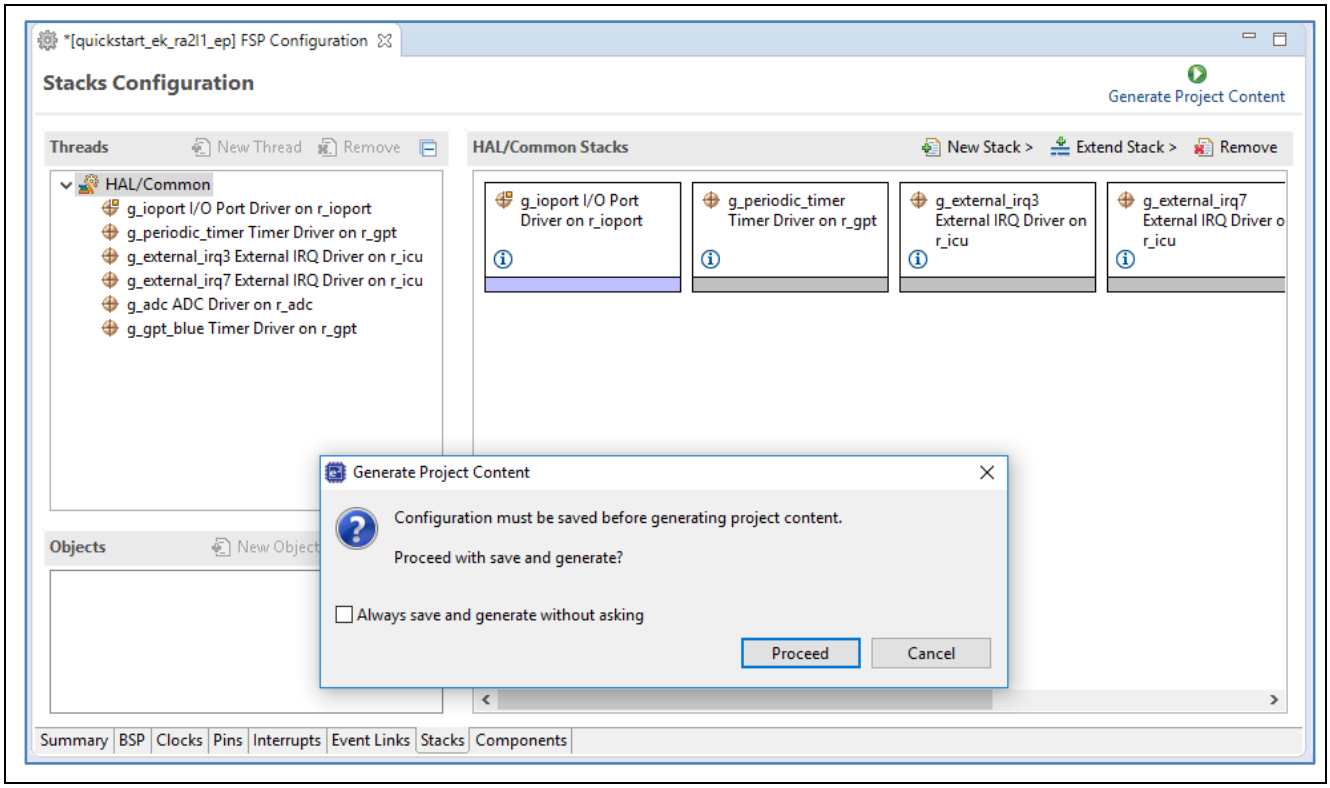

Figure 18. **Saving the Configuration Changes**

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

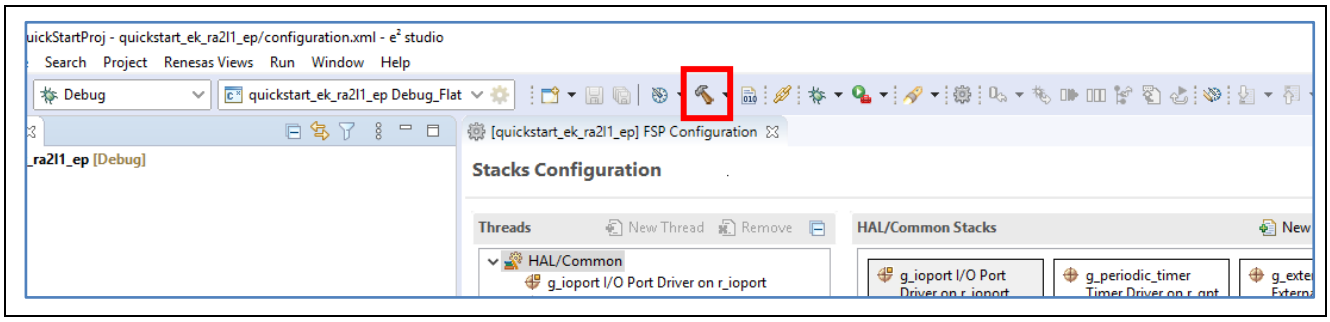

Figure 19. Building the Project

6. A successful build produces an output as follows.

```
Problems   Console   Smart Browser
CDT Build Console [quickstart_ek_ra2l1_ep]
make -j4 all
'Invoking: GNU ARM Cross Print Size'
arm-none-eabi-size --format=berkeley "quickstart_ek_ra2l1_ep.elf"
   text    data     bss     dec     hex filename
  19956     148    4204   24308    5ef4 quickstart_ek_ra2l1_ep.elf
'Finished building: quickstart_ek_ra2l1_ep.siz'
' '

16:06:23 Build Finished. 0 errors, 0 warnings. (took 762ms)
```

Figure 20. Successful Build Output

5.4 Setting Up Debug Connection Between the EK-RA2L1 Board and Host PC

To program the modified Quick Start example project on to the EK-RA2L1 board, a debug connection is necessary between the EK-RA2L1 board and host PC.

1. Connect the USB cable from the PC to the micro-B USB debug port (J10) of the EK-RA2L1 board. As shown earlier in Figure 3.

   Note: The EK-RA2L1 board supports 3 debugging modes. In this section and the following sections, default debugging mode, Debug On-Board, is used. More information on debugging modes is available in EK-RA2L1 user's manual.

2. Verify that the debug LED (LED5) stops blinking and lights up orange indicating that the J-Link drivers are detected by the EK-RA2L1 board.

   Note: The debug LED (LED5) continues to blink when J-Link drivers are not detected by the EK-RA2L1 board. In that case, make sure that the EK-RA2L1 board is connected to the host PC through the micro-B USB 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 Configurations** option.

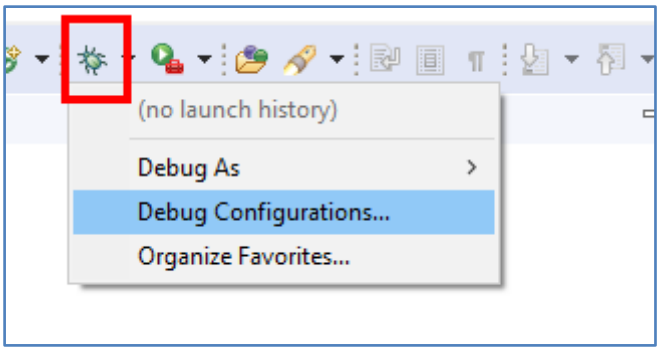

Figure 21. Selecting the Debug Option

2. In the dialogue, on the left-hand pane, expand the **Renesas GDB Hardware Debugger** and select the built image to debug. In this case, the **quickstart_ek_ra2l1_ep**.

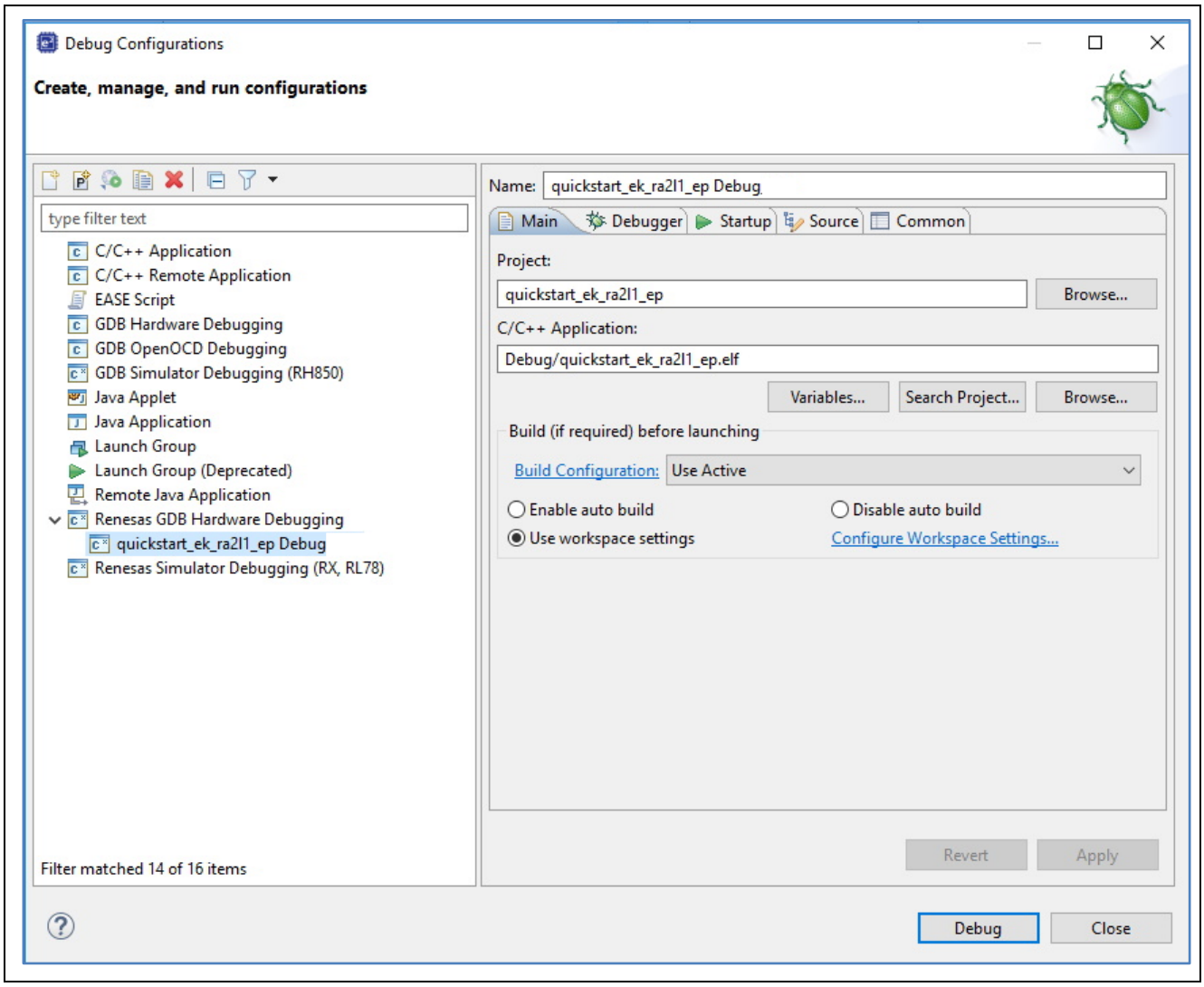

Figure 22. Selecting the Debug Image

5.6 Firewall Dialogue

1. A firewall warning may be displayed for **'e2- server-gdb.exe**'. Check the '**Private networks, such as my home or work network**' box and click '**Allow access**'.
2. A user account control dialog may be displayed. Enter the administrator password and click **Yes**.
3. A dialog box may appear. Click **Yes**.

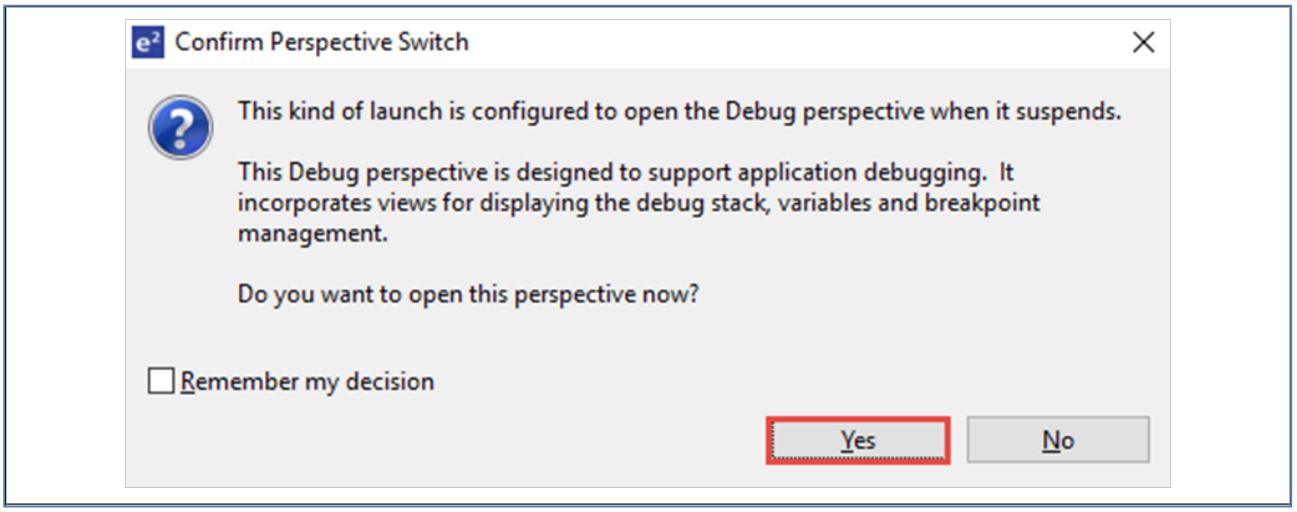

Figure 23. Opening the Debug Perspective

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

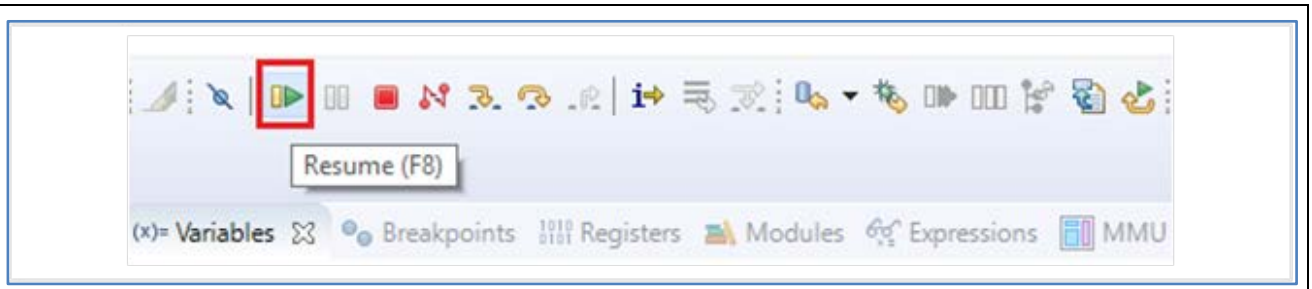

Figure 24. Executing the Project

5. The modified Quick Start example project is programmed into the EK-RA2L1 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-RA2L1 kit, refer to the EK-RA2L1 user's manual and design package available in the Documents and Download tabs respectively of the EK-RA2L1G webpage at renesas.com/ra/ek-ra2l1.
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 the EK-RA2L1 kit are available in the EK-RA2L1 Example Projects Bundle. The example projects bundle is available in the **Downloads** tab of EK-RA2L1 webpage.
   - Download and extract the example projects bundle (`xxxxxxxxxxxxxxx-ek-ra2l1-exampleprojects.zip`) to a local directory on the host PC.
   - Refer to the list of all example projects (`xxxxxxxxxxxxxxx-ek-ra2l1-exampleprojects.pdf`) available inside the example projects bundle.
   - Browse to the desired example project (for example: adc_ek_RA2L1_ep) in the example projects bundle (`xxxxxxxxxxxxxxx-ek-ra2l1-exampleprojects\ek_RA2L1\adc\adc_ek_ra2l1_ep`)
   - For help on using example projects, refer to `Example Project Usage Guide.pdf` in the RA Example Repository on GitHub at : github.com/renesas/ra-fsp- examples/tree/master/example_projects.
   - The archived versions of the source code of the example projects are available the example project repository.

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-RA2L1 Resources	renesas.com/ra/ek-ra2l1
RA Product Information	renesas.com/ra
RA Product Support Forum	renesas.com/ra/forum
Renesas Support	renesas.com/support

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