

RA8D1 Group

Evaluation Kit for RA8D1 Microcontroller Group
EK-RA8D1
Quick Start Guide

Renesas RA Family
RA8 Series

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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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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.

Renesas RA Family

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1. Introduction

This Quick Start Guide (QSG) provides:

- An overview of the Quick Start example project that the EK-RA8D1 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. **Default jumper settings:** Prior to running the Quick Start example project or programming the EK-RA8D1 board, default jumper settings must be used. Refer to the EK-RA8D1 user's manual for the default jumper configuration.
4. **Screenshots:** 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-RA8D1 v1 board
2. Micro USB device cable (type-A male to micro-B male)
3. Micro USB host cable (type-A female to micro-B male)
4. Ethernet patch cable
5. Camera Expansion Board
6. MIPI Graphics Expansion Board
7. Nylon mounting stands (4x long, 2x short), nylon screws (6x)

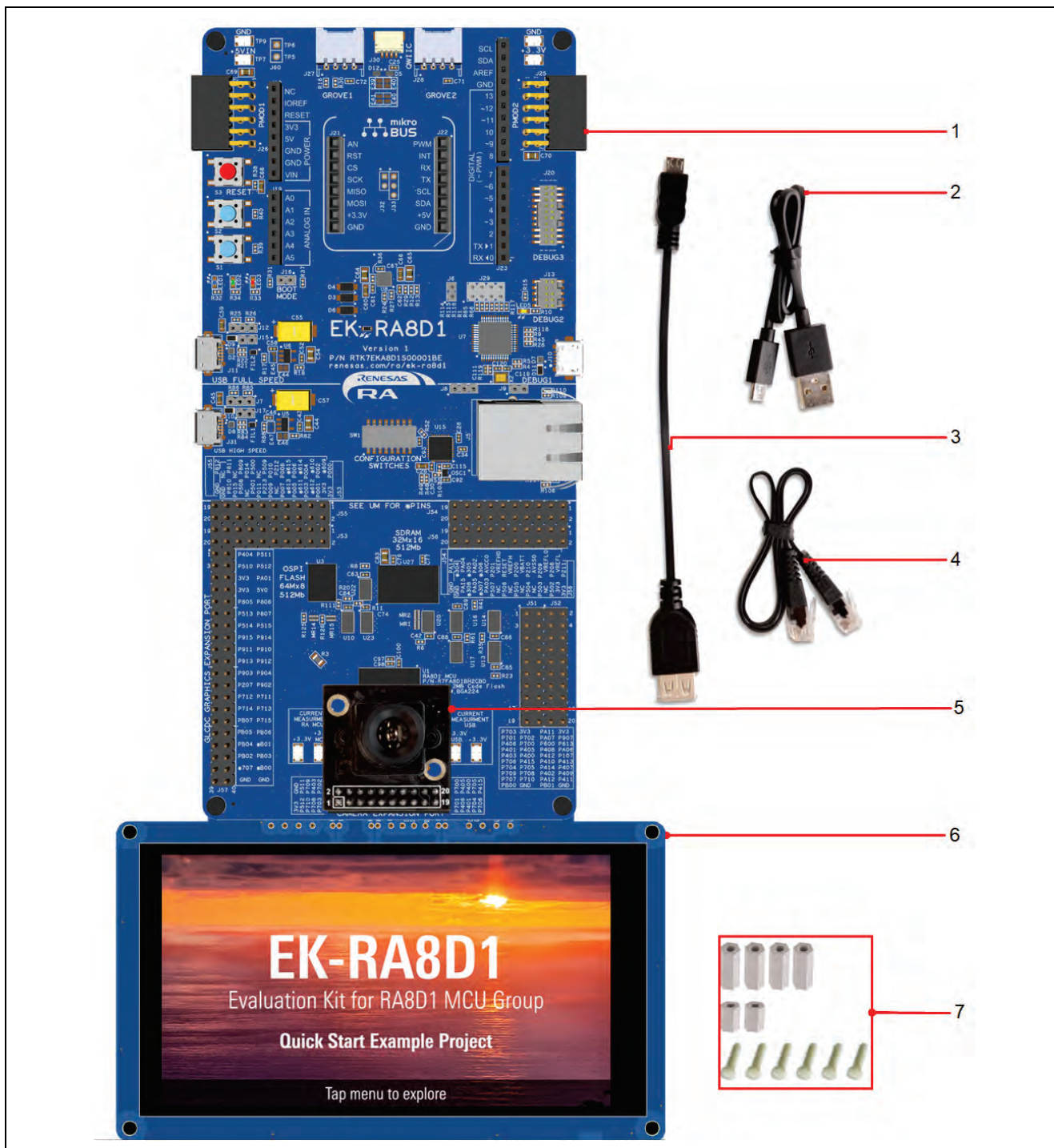


Figure 1. EK-RA8D1 Kit Contents

3. Kit Assembly

3.1 Nylon Screw Assembly

Attach the LCD Board to the PCB using the screws and spacers provided as shown below:

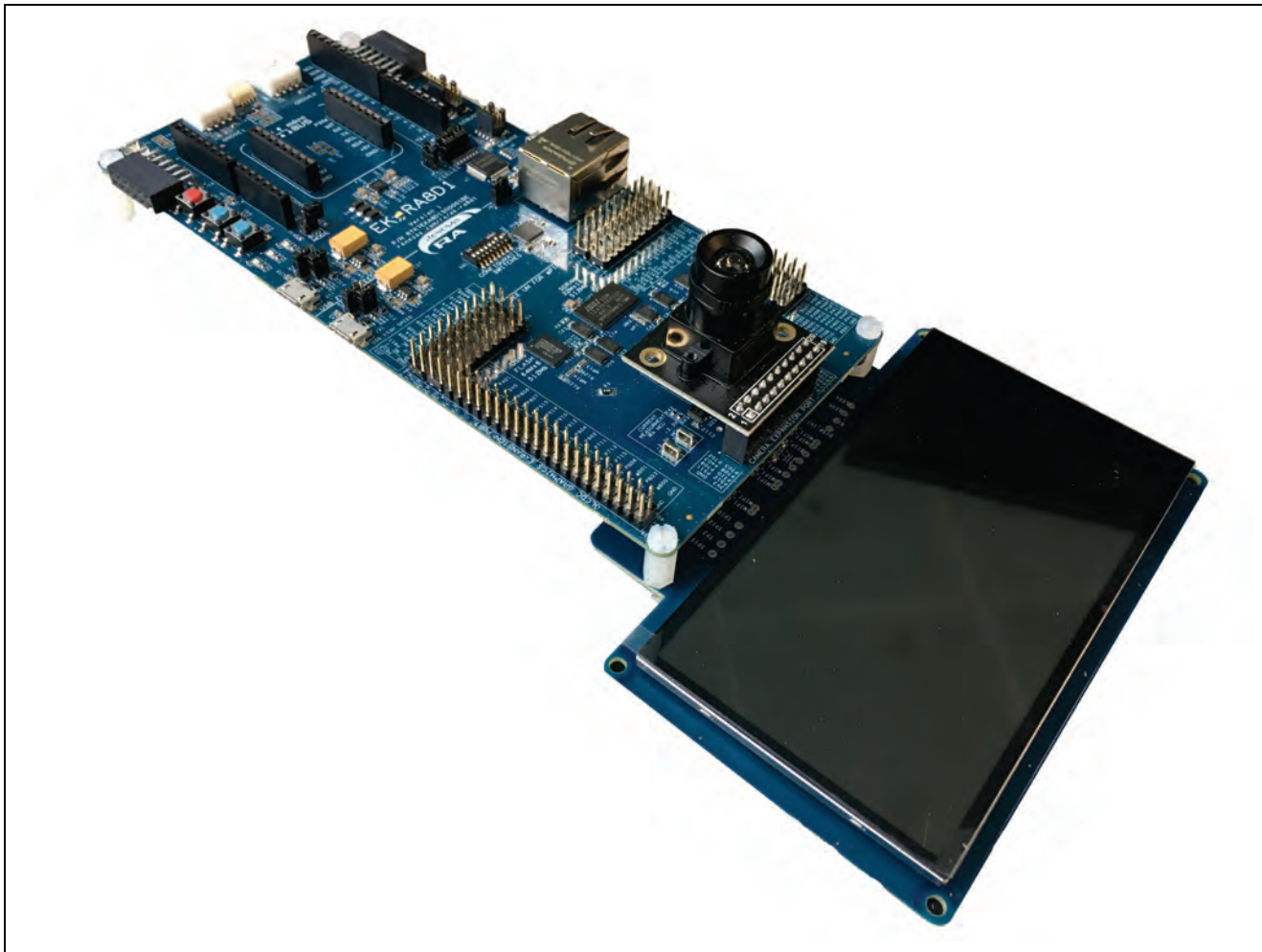


Figure 2. Kit Assembly

Please use the following steps for the installation of screws and spacers:

1. Remove the four rubber feet to expose the holes at each corner of the EK board.
2. There are 2 longer spacers for the EK board only, and two shorter spacers for connecting the MIPI LCD board. A further two long spacers are provided in case of using the EK-RA8D1 without the LCD board.

Note: To avoid damage to the delicate high-speed connector, the physical mounting screws and spacers must be used.

3.2 Camera Expansion Board

Please connect the Camera Expansion Board pin 2 to J59 pin 1 as the following figure shows.

Please do not connect the Camera Expansion Board as shown in Figure 4 and Figure 5.

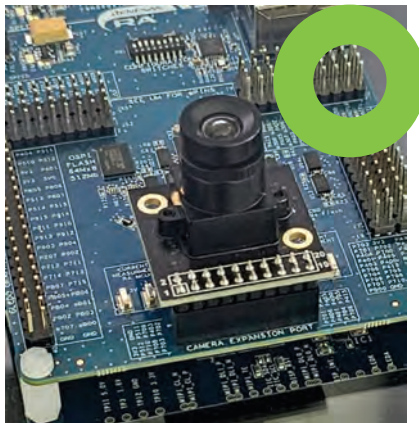


Figure 3. Correct Connection for Camera Expansion Board

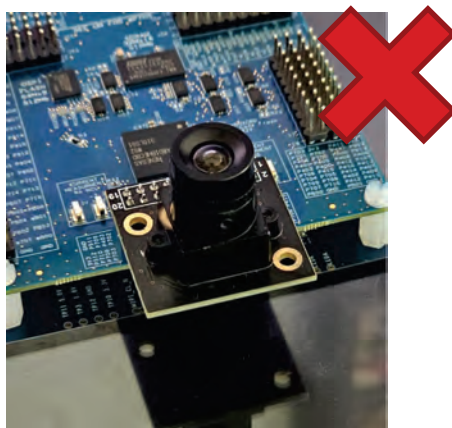


Figure 4. Incorrect Connection for Camera Expansion Board

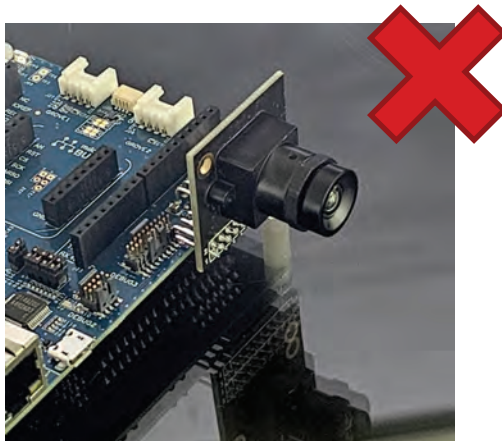


Figure 5. Incorrect Connection for Camera Expansion Board

4. 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-RA8D1 board running the Quick Start example project is connected to a host PC via USB as a Full Speed CDC Device, the kit information, MCU die temperature, and user LED blinking frequency are displayed on a terminal console.

4.1 Quick Start Example Project Flow

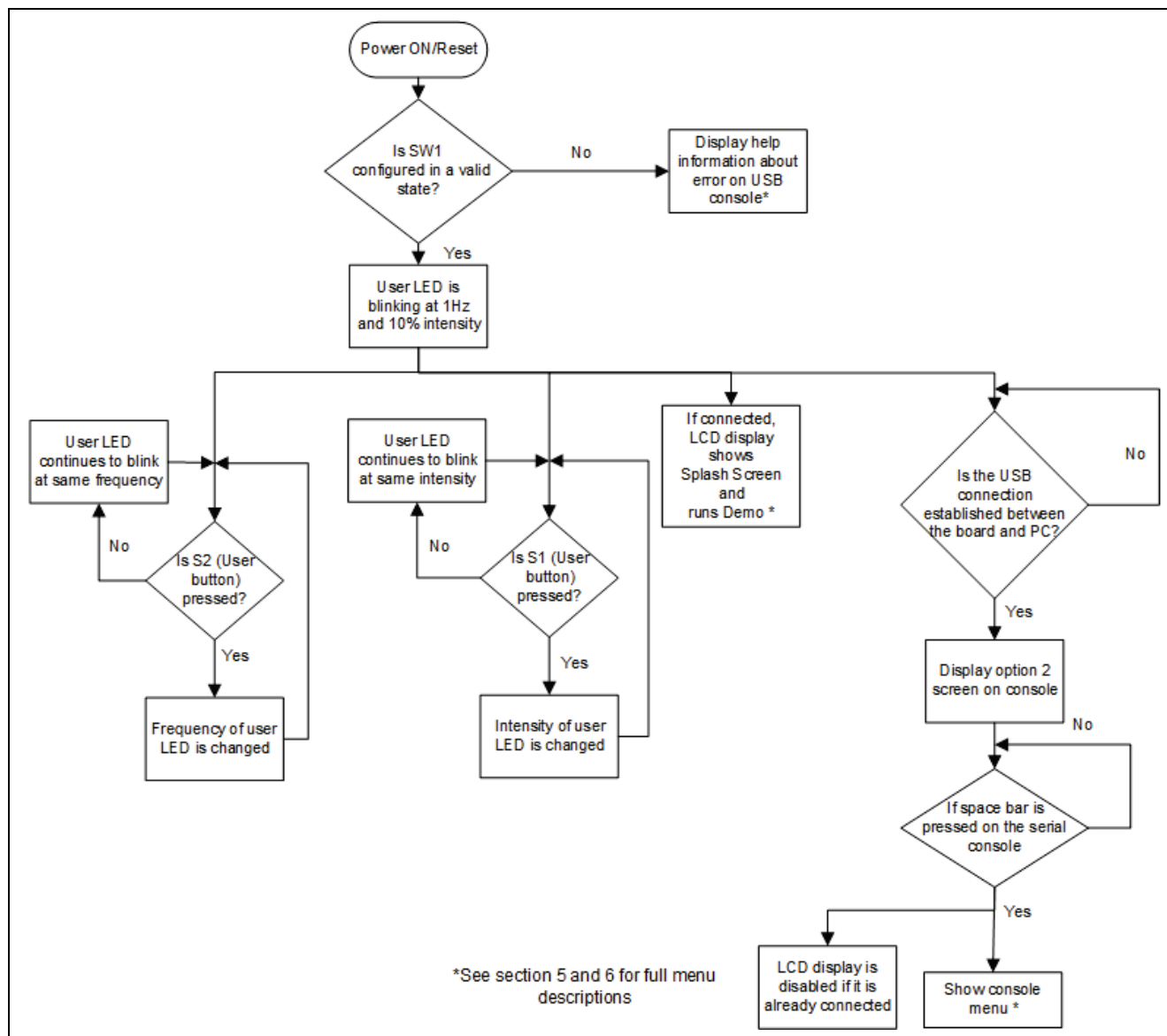


Figure 6. Quick Start Example Project Flow

5. Running the Quick Start Example Project on Display

This section lists the requirements and instructions to power up the EK-RA8D1 board and run the Quick Start example project.

Hardware Requirements

- EK-RA8D1 Board
- Micro USB device cable
- A PC with at least 1 USB port
- Camera Expansion Board
- MIPI Graphics Expansion Board

Software Requirements

- Windows® 10 operating system
- USB Serial Drivers (included in Windows 10)
- Tera Term (or similar) terminal console application

5.1 Connecting and Powering Up the EK-RA8D1 Board

Note: Due to the LCD being connected, the Interactivity and HMI demo (option 2) launches immediately.

1. Please follow the kit assembly instructions from section 3 before proceeding with the following steps.
2. Connect the micro USB end of the micro USB device cable to micro-AB USB Debug port (J10) of the EK-RA8D1 board.
3. Connect the other end of this cable to the USB port of the host PC. Power LED (LED4) on the EK-RA8D1 board lights up white, indicating that the EK-RA8D1 board is powered on.

Note: If the EK-RA8D1 board is not powered through micro-AB USB Debug port (J10) and the host PC, then USB CDC functionality of the Quick Start example project cannot be fully demonstrated because of the absence of a USB Full Speed Device connection with the host PC.



Figure 7. Connecting the EK-RA8D1 Board to the Host PC via USB Debug Port

5.2 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 take on the following states:
 - LED1 Blue – Blinking at 1 Hz frequency and at 10% intensity
 - LED2 Green – Steady, full intensity
 - LED3 Red – Off

Note: If the Red LED is flashing, please check the error from console by following instructions 4 to 6.

2. Press the user button (S1) on the EK-RA8D1 board to change the intensity of the user LED1. With every press of the user button (S1), the intensity switches from 10% to 50% to 90% and cycles back.
3. Press the user button (S2) on the EK-RA8D1 board to change the blinking frequency of the user LED1 (blue). With every press of the user button (S2), the frequency switches from 1 Hz to 5 Hz to 10 Hz and cycles back.
4. On the host PC, open Windows Device Manager. Expand **Ports (COM & LPT)**, locate **JLink CDC UART Port (COMxx)** and note down the COM port number for reference in the next step.

Note: USB Serial Device drivers are required to communicate between the EK-RA8D1 board and the terminal application on the host PC. When the board is connected to the PC for the first time, J-Link drivers are installed. If asked to restart the computer, please do so.

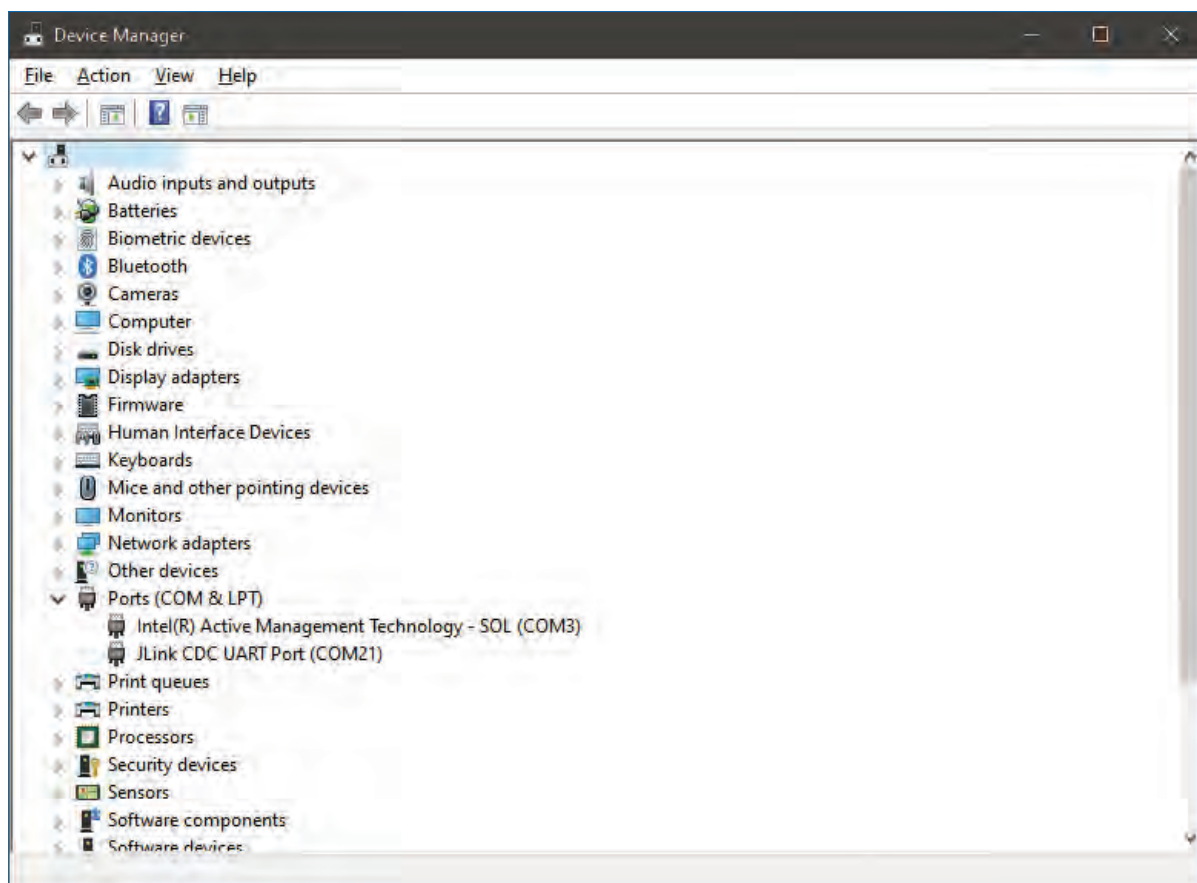


Figure 8. USB Serial (UART) Device in Windows Device Manager

5. Open Tera Term, select **Serial** and **COMxx: JLink CDC UART Port (COMxx)** and click **OK**.

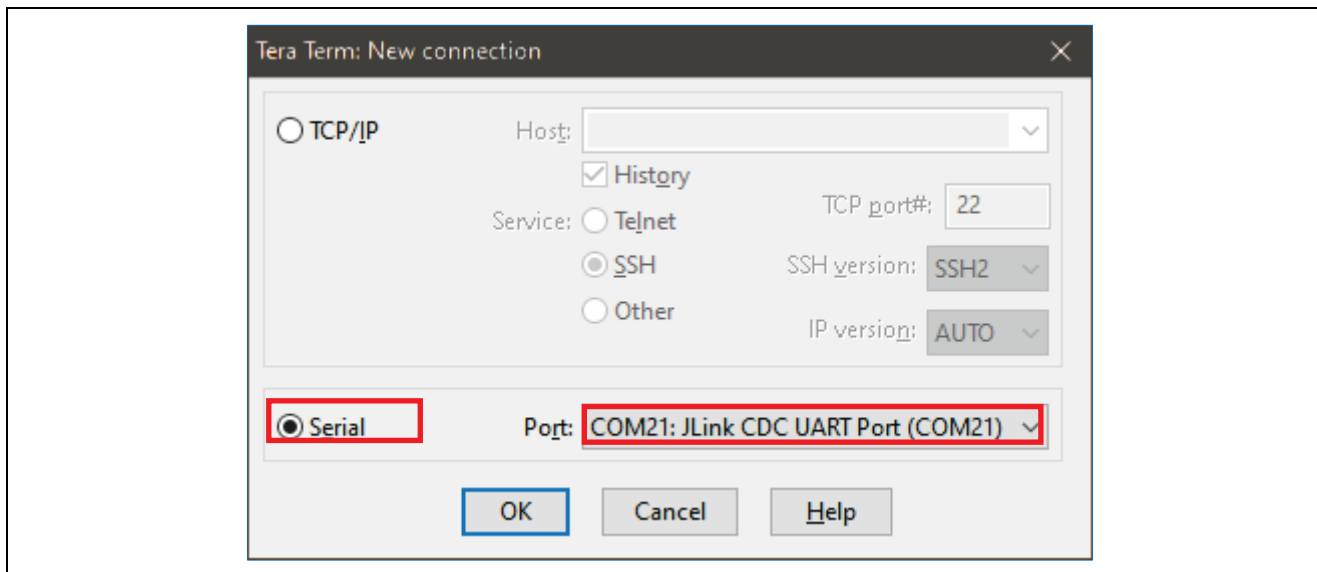


Figure 9. Selecting the Serial Port on Tera Term

6. Using the **Setup** menu pull-down, select **Serial port...** and ensure that the speed is set to **115200**, as shown below.

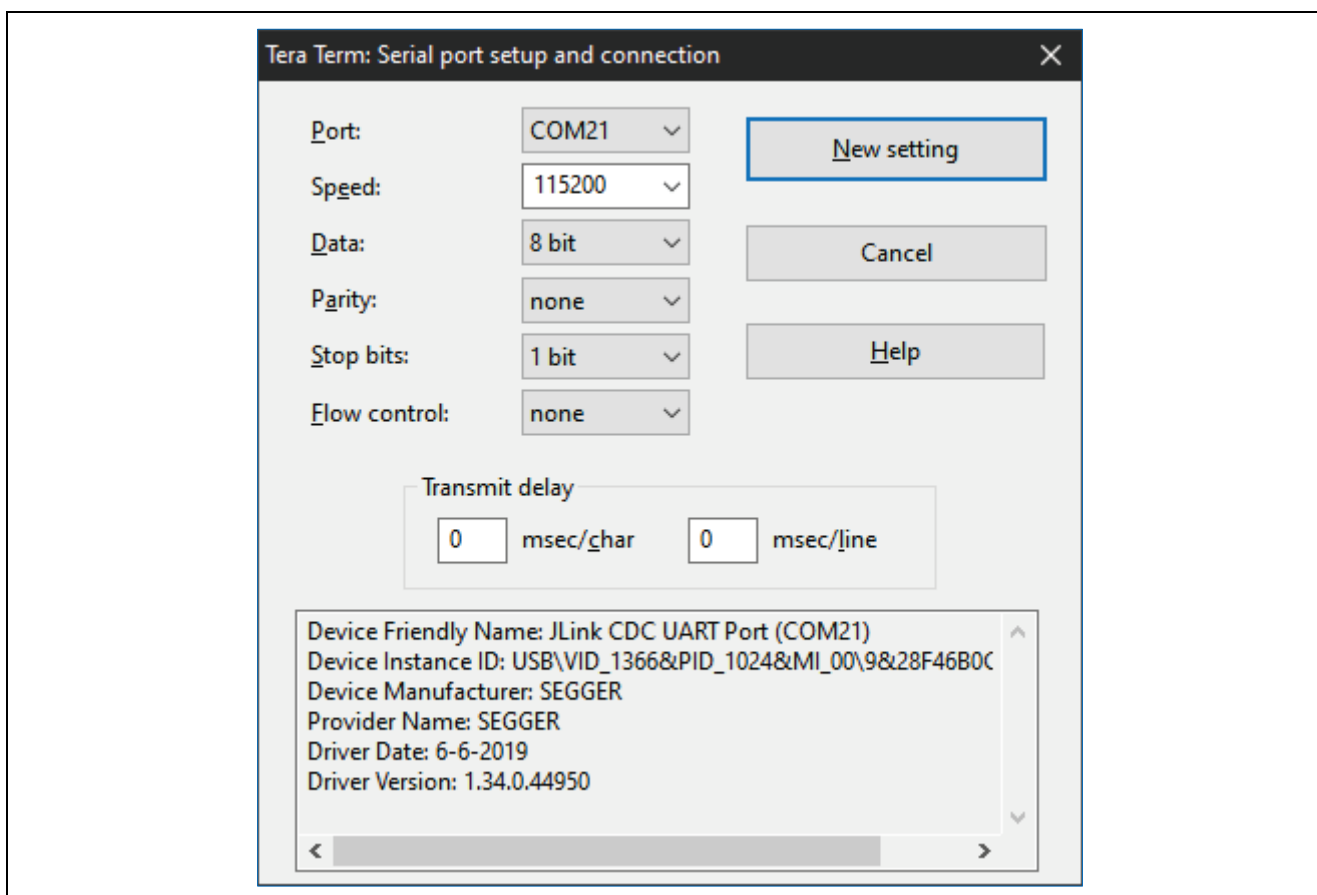


Figure 10. Select 115200 on the Speed Pulldown

Complete the connection. The 'Interactive AI, Connectivity & HMI Demos' screen is displayed and the MIPI graphics screen is displayed as shown in section 5.3.

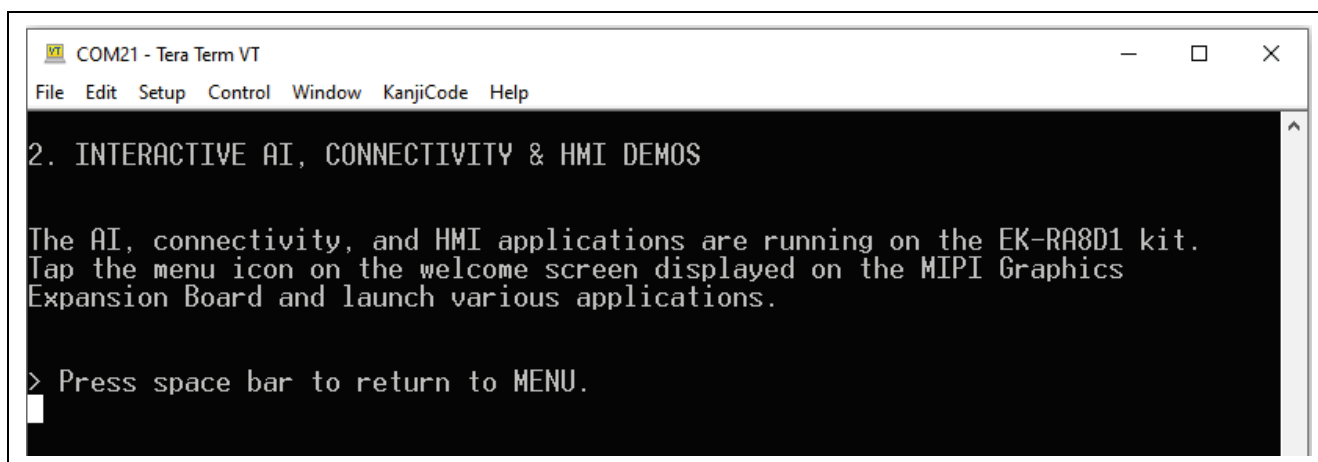


Figure 11. Various Interactive connectivity and HMI Demos

Note: If the required accessories and switch settings are not detected, then the following information is displayed. Please verify the settings by disconnecting the USB power and confirming the switch settings and connections and then re-connecting the USB power.

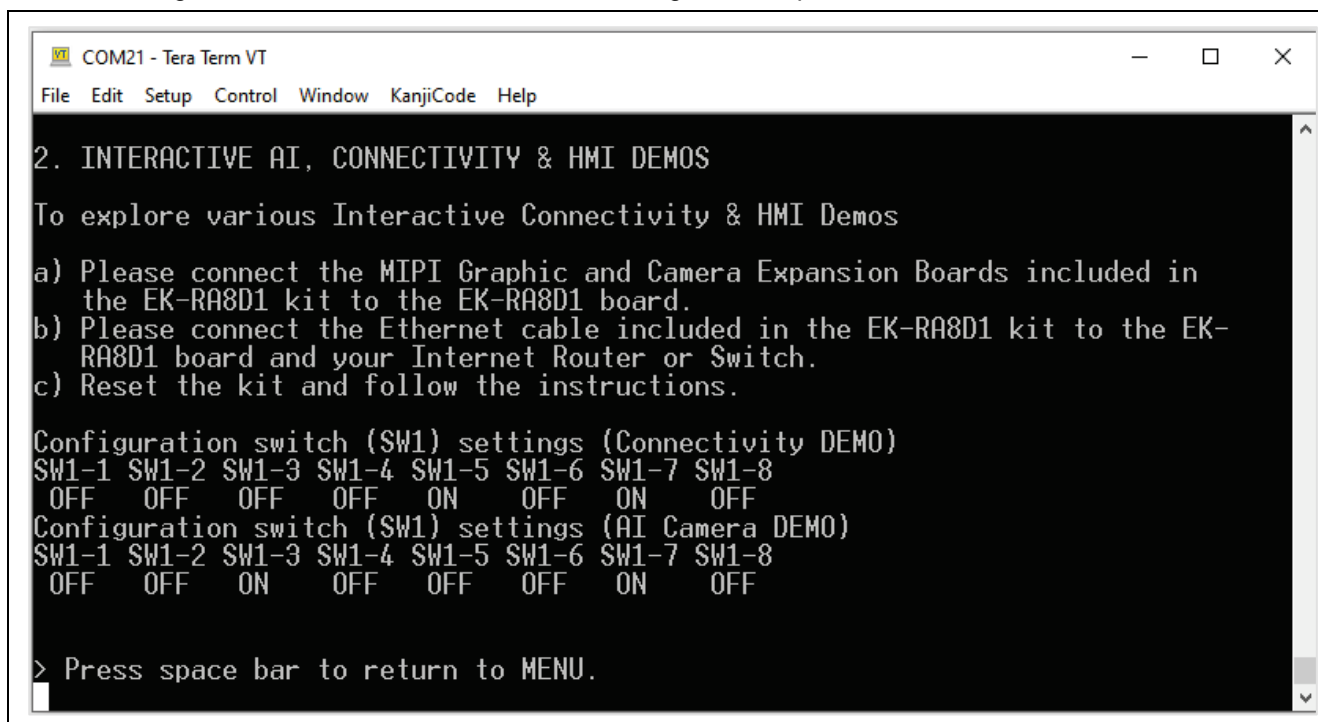


Figure 12. Unsuccessful Configuration

5.3 Common Application Details

1. On power up, the 'Splash' Screen is displayed on the MIPI Graphics Expansion Board momentarily.



Figure 13. Splash Screen

2. Then you will see the main screen.



Figure 14. Main Screen

- Pressing the Menu button at the top left displays the menu.



Figure 15. Main Menu

- Select the options you want to see. Each menu is described as follows. Pressing the X on the top right on any page takes you back to the Main screen.
- The Kit Information screen duplicates the information available from the serial terminal option 1.

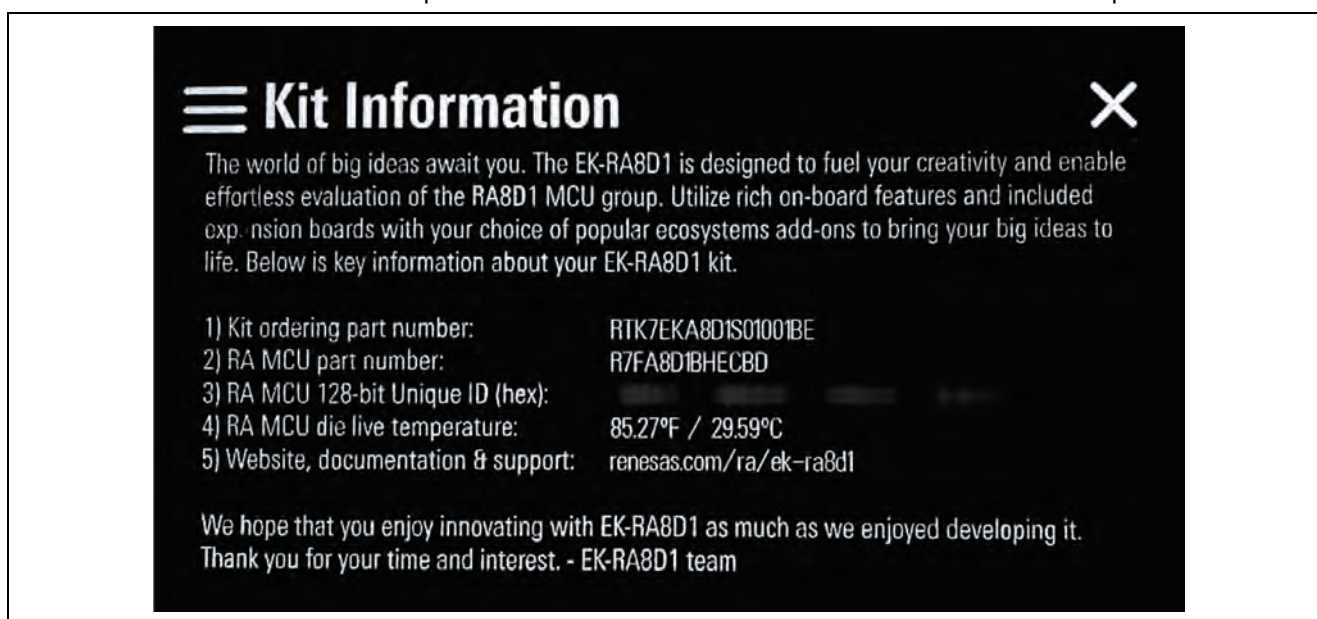


Figure 16. Kit Information

6. The Getting Started screen gives summary information and refers the user to this document.

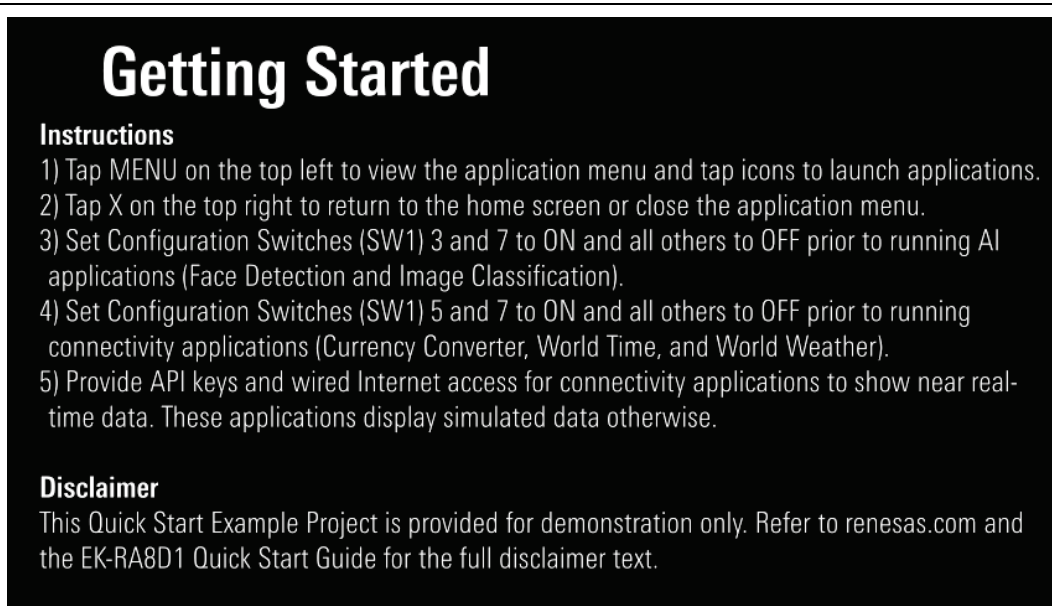


Figure 17. Getting Started

7. The User LED Control changes the operation of the LEDs.
8. Use the sliders to change the intensity and speed of the flashing LEDs on the board.

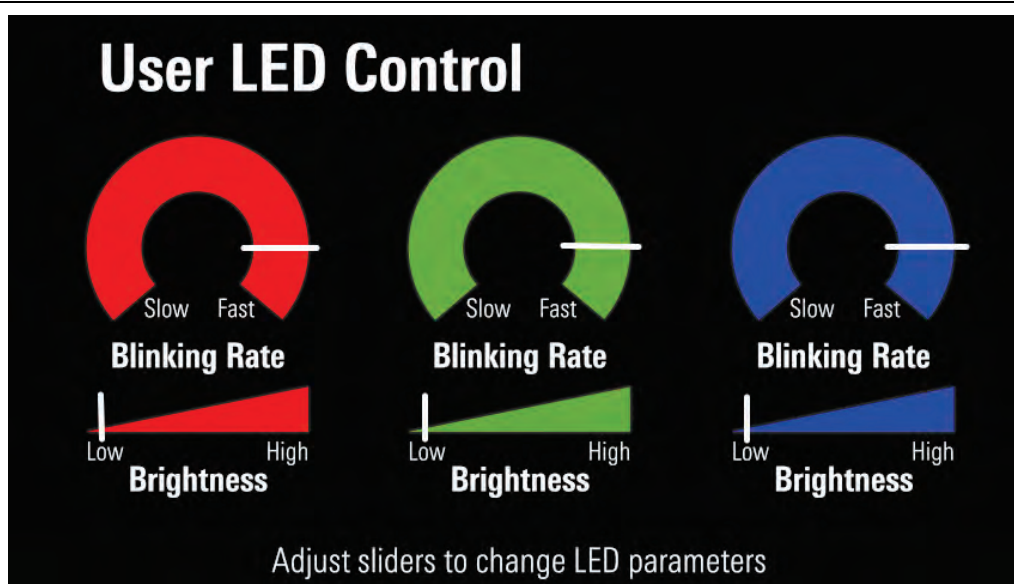


Figure 18. User LED Control

5.4 Connectivity Application Details

- The Demo is provided with some default data for the Weather and Currency screens. These can be updated by the application from two online services.
Please note that these services are not in any way affiliated with Renesas and future operation cannot be relied on. To use these services, you need to obtain a FREE valid API key from each service using your email address.
- Please go to the following websites and obtain a valid API key for each.
www.weatherapi.com
(1,000,000 free requests / month: Each session causes 14 requests.)
www.currencyapi.com
(300 free requests / month: Each session causes 10 requests, allowing for 30 free sessions.)
- To perform the update, please follow the instructions in section 6.1.

5.4.1 Currency Converter

The Currency Converter Screen allows you to use the retrieved data (if available) to compare various currencies shown as follows:

1. Press the Currency Converter Menu option.
2. Tap any flag to set this as the base currency to be compared to.
3. Tap another flag to view the currency conversion rate at the bottom of the screen.
4. Press the 'RESTART' button to restart the conversion by selecting a new base currency to compare to.

Note: If the Connectivity API Keys are not valid then static demonstration data is used.

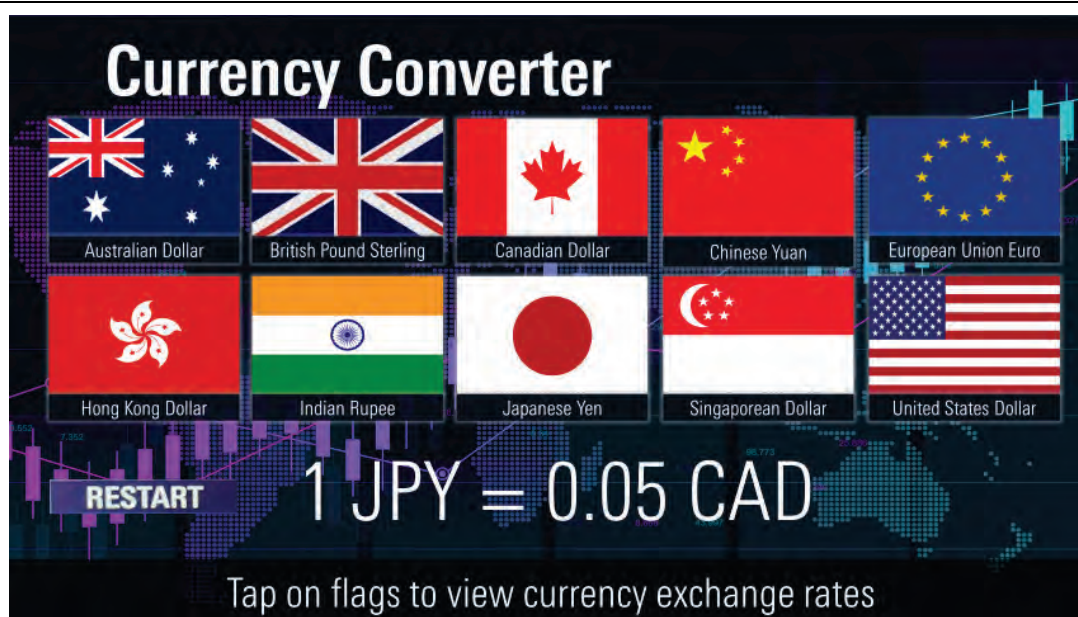


Figure 19. Currency Conversion Screen

5.4.2 World Time Zones

The World Time Zones screen allows you to use the retrieved data (if available) to show the time in a variety of regions.

1. Press the World Time Zones Menu option.
2. Press the small dot at a city location to see the name and time at that location.

Note: If the Connectivity API Keys are not valid, then time from power on, with 12:00 pm in the United Kingdom, is used.

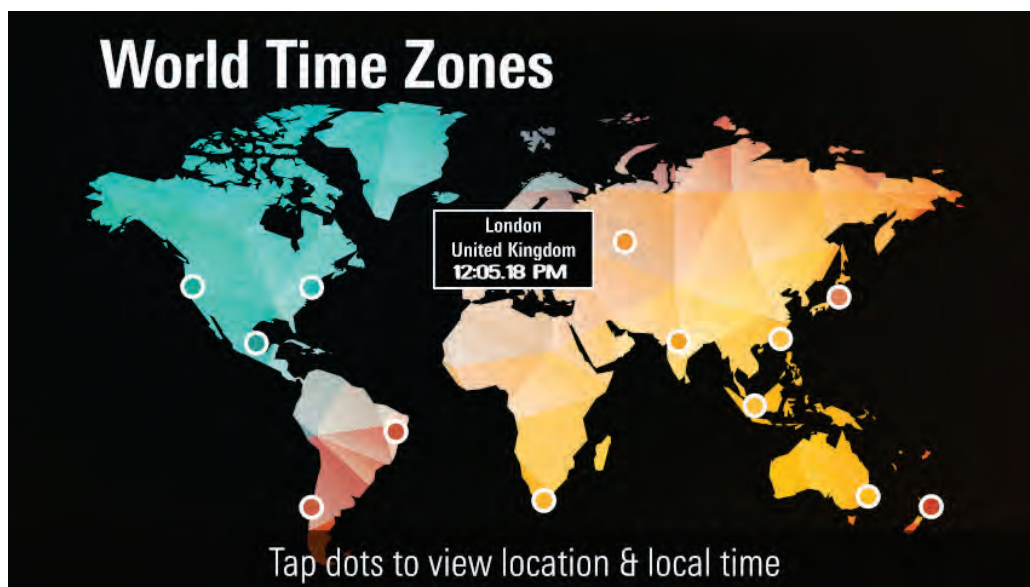


Figure 20. World Time Zone Screen

5.4.3 World Weather

The World Weather screen allows you to use the retrieved data (if available) to show the weather in a variety of regions as follows:

1. Press the World Weather Menu option.
2. Swipe from the center to the left or right of the screen to swap between regions.

Note: If the Connectivity API Keys are not valid, then, static demonstration data is used.

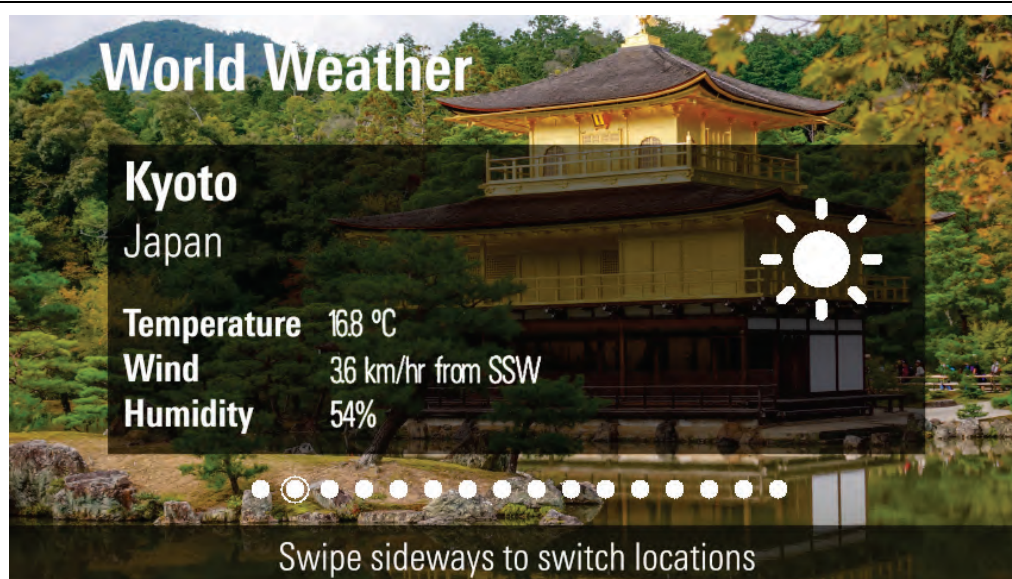


Figure 21. World Weather

5.5 AI Application Details

- If the settings are not correct, the application screen is displayed without a picture and the text guidance is shown as follows:

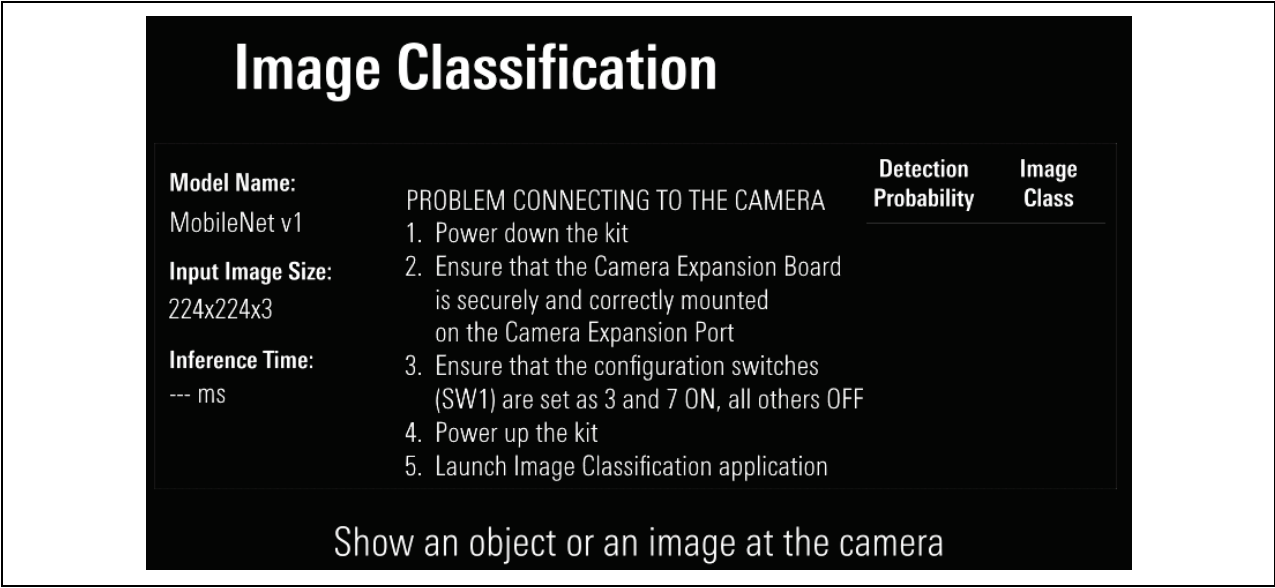


Figure 22. Invalid Configuration Example

5.5.1 Face Detection

Face Detection application uses the AI engine to detect one or more faces in the camera view. Either face the camera or present a picture with one or more faces to be detected.

1. The inference engine runs continuously to show the number of faces detected and draws a red box around the detection area.

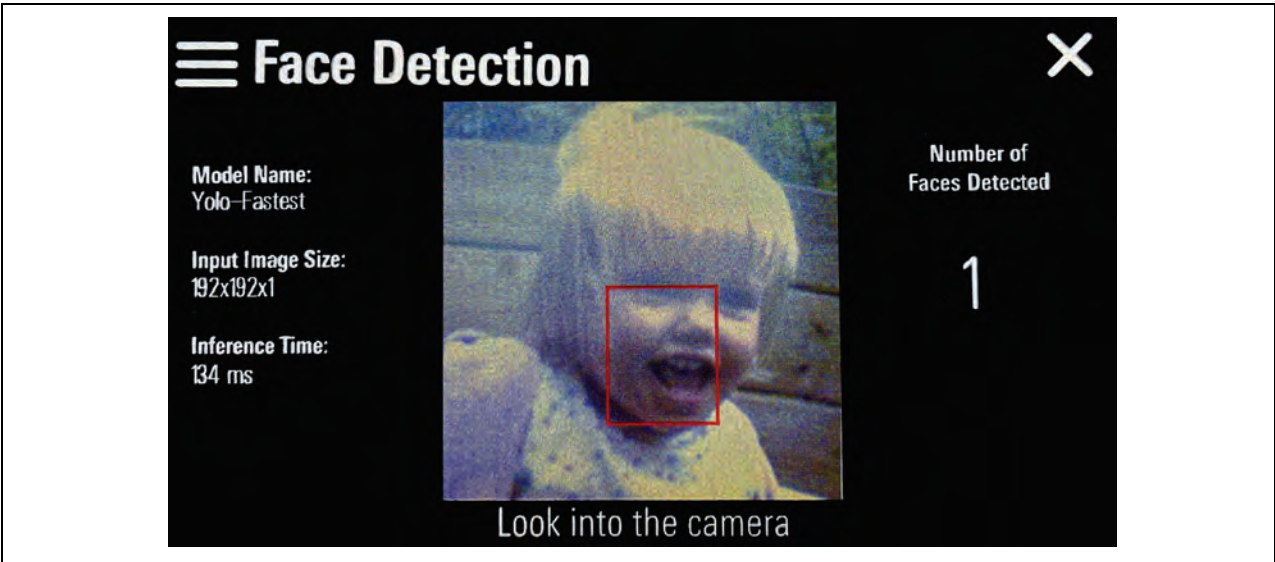


Figure 23. Face Detection

5.5.2 Image Classification

Image Classification uses the AI inference engine to detect objects in the camera view.

1. Place a selection of objects or pictures in front of the camera.
The inference engine runs continuously to show the top 5 possible items detected.

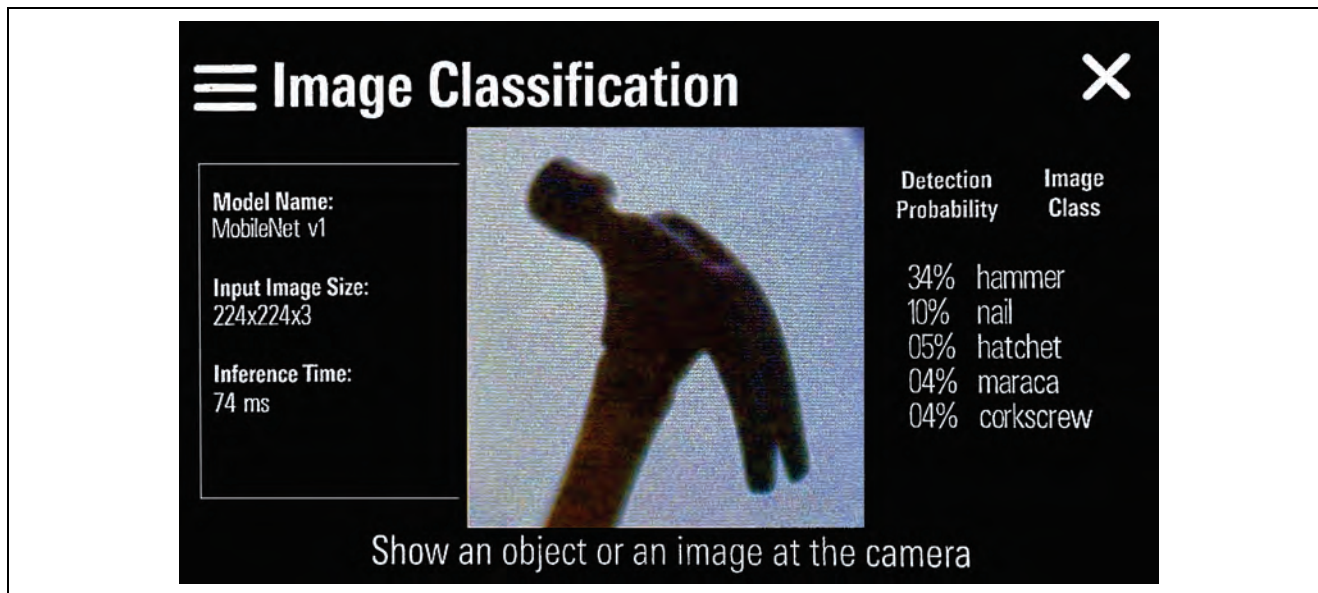


Figure 24. Image Classification Example

6. Running the Quick Start Example Project on Console

1. Return to the serial console.
2. Press **space** to return to the 'welcome and main menu' screen.

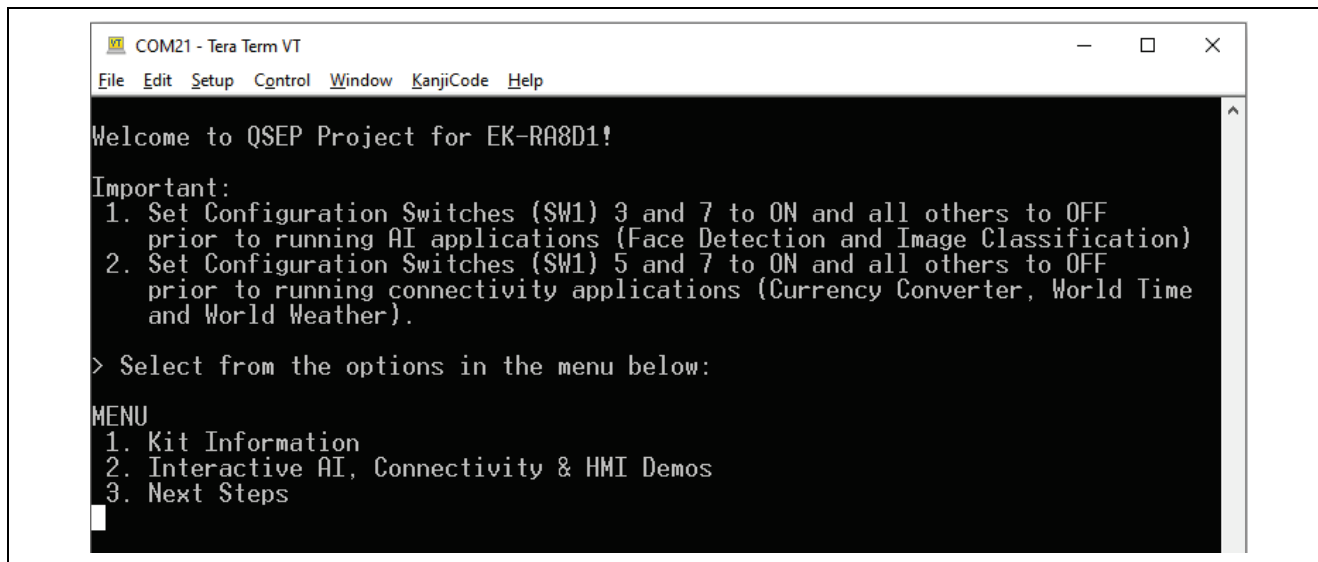


Figure 25. Welcome and Main Menu

- Press **1** to display the **Kit Information** including the kit name, ordering part number, device part number, MCU ID, MCU die temperature, and the user LED's current blinking frequency and intensity.

```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help

1. KIT INFORMATION

a) Kit name: EK-RA8D1
b) Kit ordering part number: RTK7EKA8D1S01001BE
c) RA Device part number: R7FA8D1BHECBD
d) RA MCU 128-bit Unique ID (hex):
e) RA MCU Die temperature (F/C): 86.72/30.40
f) Blue LED blinking frequency (Hz): 1
g) Blue LED blinking intensity (%): 10

> Press space bar to return to MENU

```

Figure 26. Kit Information

- Press **space** to return to the 'welcome and main menu' screen.
- Press **2** to run the **Interactive AI, Connectivity & HMI Demos**.

```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help

2. INTERACTIVE AI, CONNECTIVITY & HMI DEMOS

The AI, connectivity, and HMI applications are running on the EK-RA8D1 kit.
Tap the menu icon on the welcome screen displayed on the MIPI Graphics
Expansion Board and launch various applications.

> Press space bar to return to MENU.

```

Figure 27. Interactive AI, Connectivity & HMI Demos

- The 'Interactive AI, Connectivity & HMI Demos' run on the MIPI Graphic Expansion Board. Please see section 5 for more information.

Note: Depending on the setting of SW1-3 and SW1-5, either Camera functionality or Ethernet functionality is enabled.

In either mode, by default, stored data is used until valid API keys have been entered for third party services. This is covered in the following section where the operation of each screen is described.

6.1 Connectivity Application API Keys

Note: Due to the LCD being connected, the Interactivity and HMI demo (option 2) launches immediately. To update the connectivity application on the board, the following steps are required:

- Disconnect the micro USB end of the micro USB device cable from micro-AB USB Debug port (J10) of the EK-RA8D1 board.
- Please configure the board for ethernet functionality, setting SW1-5 ON and SW1-7 ON and all other switches on SW1 OFF.
- Please ensure an internet connected ethernet cable is attached to the board ethernet port.
- Reconnect the micro USB end of the micro USB device cable to micro-AB USB Debug port (J10) of the EK-RA8D1 board. Power LED (LED4) on the EK-RA8D1 board lights up white, indicating that the EK-RA8D1 board is powered on.

Note: If the EK-RA8D1 board is not powered through micro-AB USB debug port (J10) and the host PC, then USB CDC functionality of the Quick Start example project cannot be fully demonstrated because of the absence of a USB Full Speed Device connection to the host PC.

Hardware Requirements

- EK-RA8D1 kit
- Micro USB device cable
- A PC with at least 1 USB port
- Ethernet cable
- A router that can connect to the internet.

Software Requirements

- Windows® 10 operating system
- USB Serial Drivers (included in Windows 10)
- Tera Term (or similar) terminal console application

Note: In corporate settings where root certificates are managed, the connection to the web services may fail due to the website root certificate failing the certificate checks. The Trusted Root certificate for these sites as of October 2023 is stored in the code. If this changes, then the certificates need to be replaced and the code re-built (file: `root_ca.h`).

Using the console options 3 (Currency), 4 (Time) and 5 (Weather), please enter your API key into the terminal relating to the service selected. The API keys are stored in the device Data Flash and do not need to be re-entered unless the keys are deleted using option 6 or the key becomes invalid. Sample instructions are shown in the following section.

6.1.1 Currency Converter Refresh

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

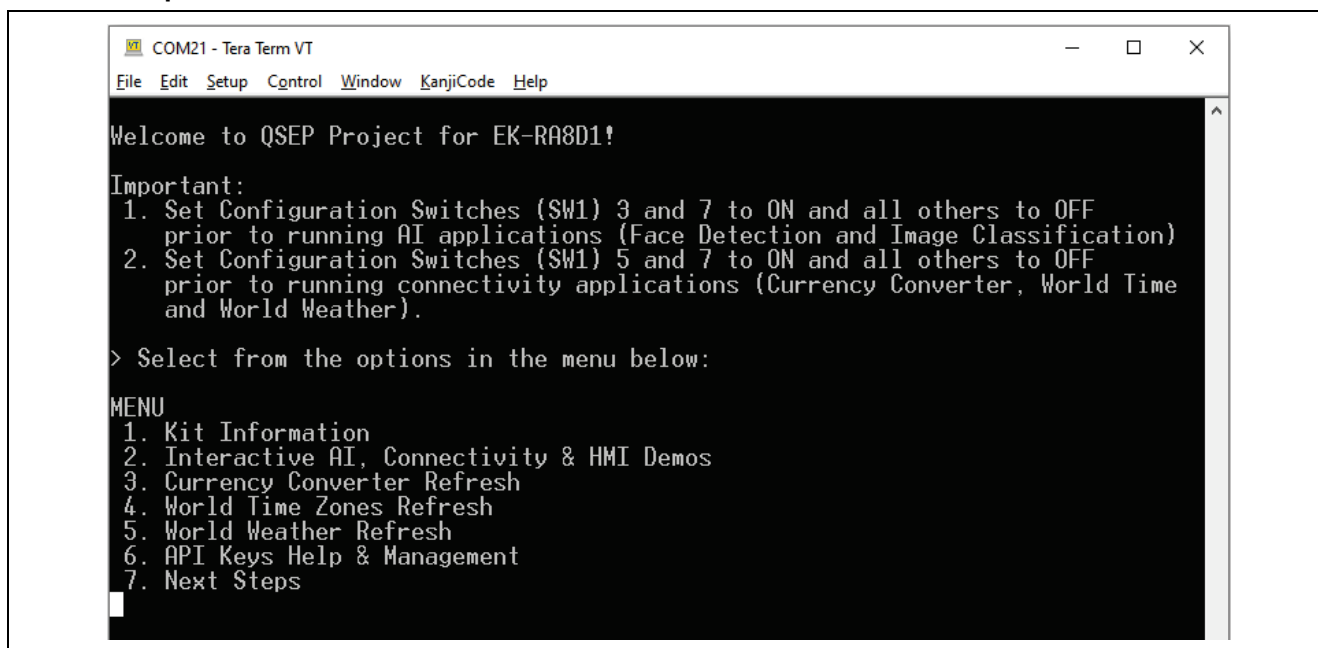


Figure 28. Welcome and Main Menu

2. Press **3** to **Currency Converter Refresh**.

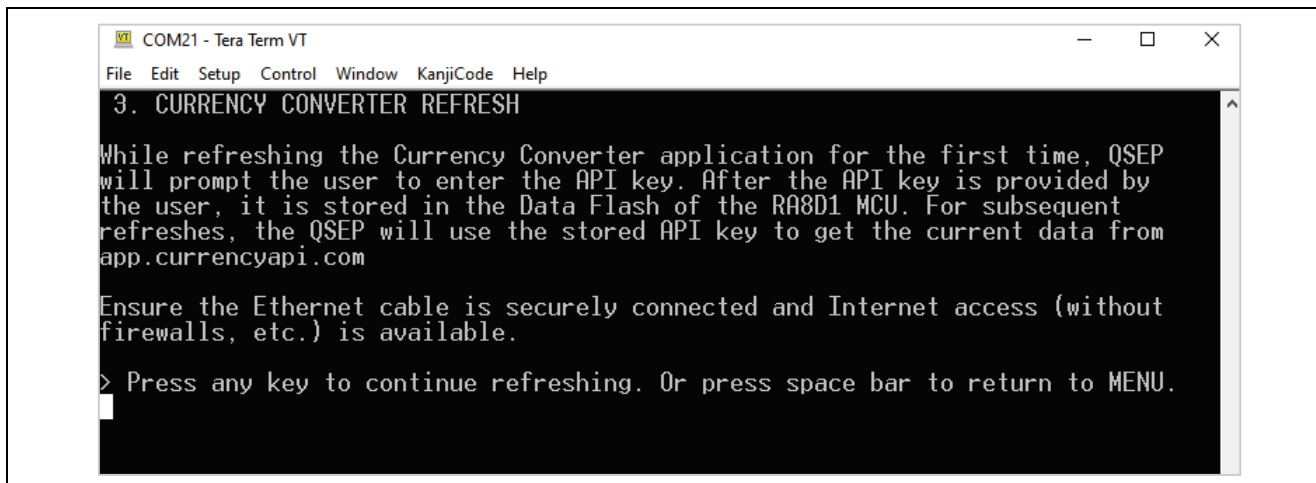


Figure 29. Currency Converter Refresh

3. Press **any key** to refresh the data for currency converter.
4. If the API key does not exist, the console display is as shown in Figure 30.
5. Press **any key** to update the API key.
6. Paste the API key into the console.
7. Press **Enter**.

If the API key is valid, the update starts as shown in the following figure.

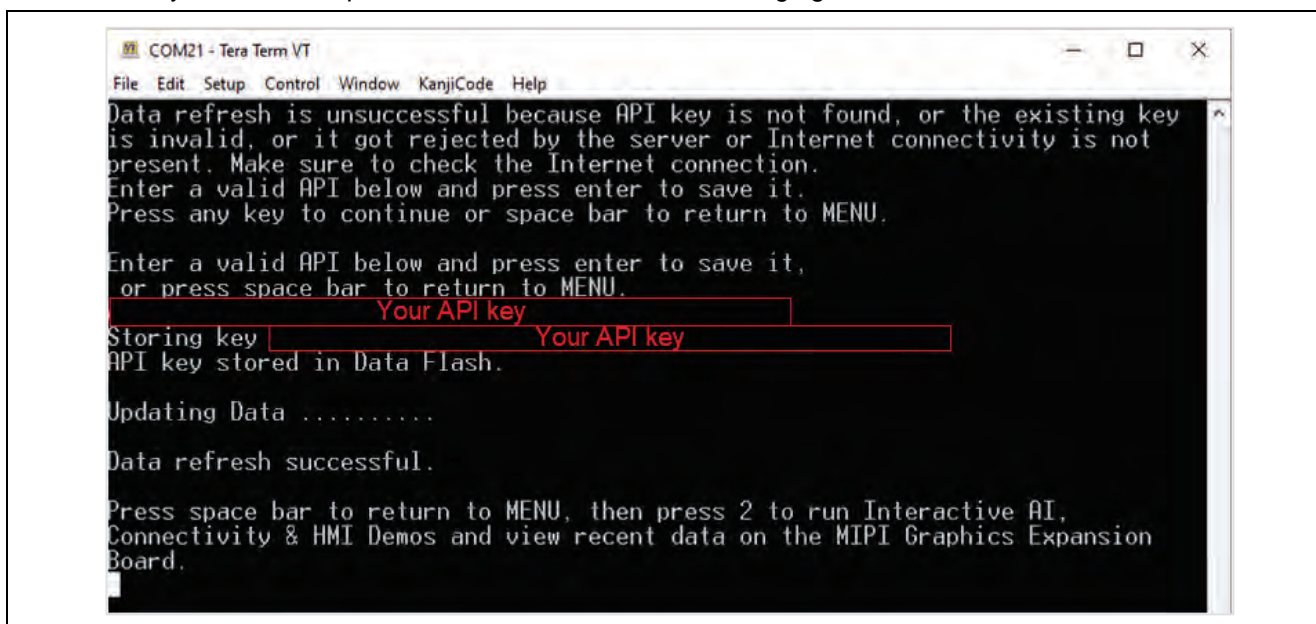
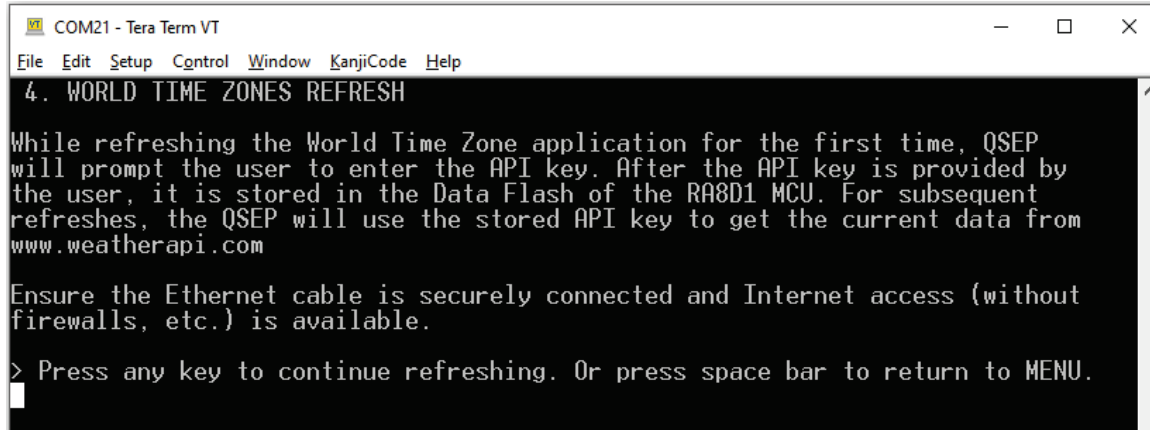


Figure 30. Entering Currency API keys for the first time

6.1.2 World Time Zones Refresh

1. Press **space** to return to the 'welcome and main menu' screen.
2. Press **4** to **World Time Zones Refresh**.



```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
4. WORLD TIME ZONES REFRESH

While refreshing the World Time Zone application for the first time, QSEP
will prompt the user to enter the API key. After the API key is provided by
the user, it is stored in the Data Flash of the RA8D1 MCU. For subsequent
refreshes, the QSEP will use the stored API key to get the current data from
www.weatherapi.com

Ensure the Ethernet cable is securely connected and Internet access (without
firewalls, etc.) is available.

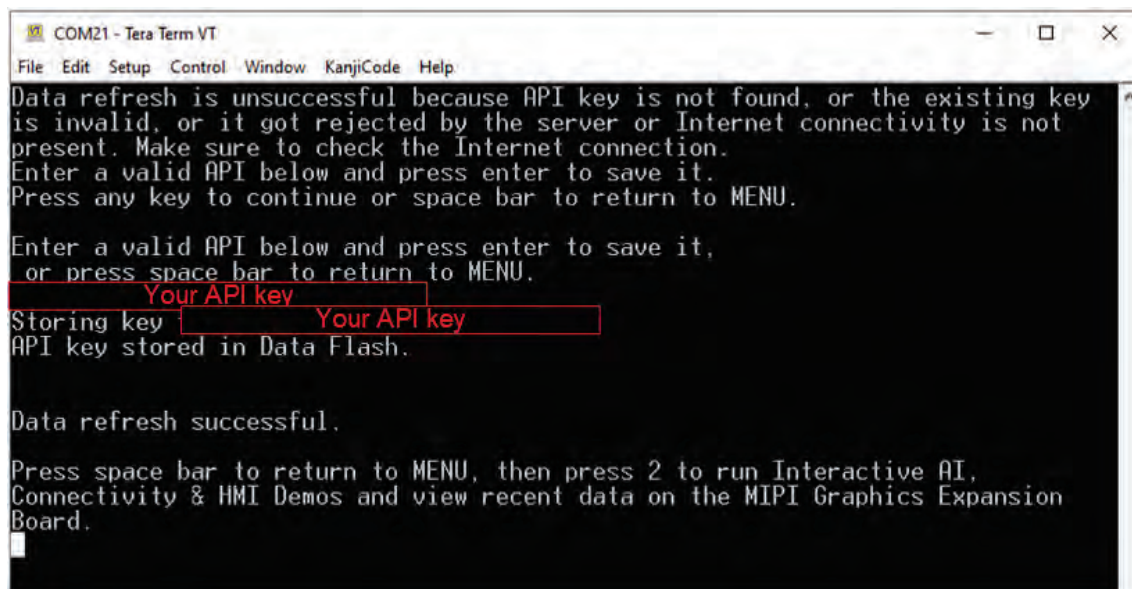
> Press any key to continue refreshing. Or press space bar to return to MENU.

```

Figure 31. World Time Zones Refresh

3. Press **any key** to refresh the data for world time zones application.
4. If the API key does not exist, the console display is as shown in Figure 32.
5. Press **any key** to update the API key.
6. Paste the API key into the console.
7. Press **Enter**.

If the API key is valid, the update starts as shown in the following figure.



```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
Data refresh is unsuccessful because API key is not found, or the existing key
is invalid, or it got rejected by the server or Internet connectivity is not
present. Make sure to check the Internet connection.
Enter a valid API below and press enter to save it.
Press any key to continue or space bar to return to MENU.

Enter a valid API below and press enter to save it,
or press space bar to return to MENU.
Your API key
Storing key Your API key
API key stored in Data Flash.

Data refresh successful.

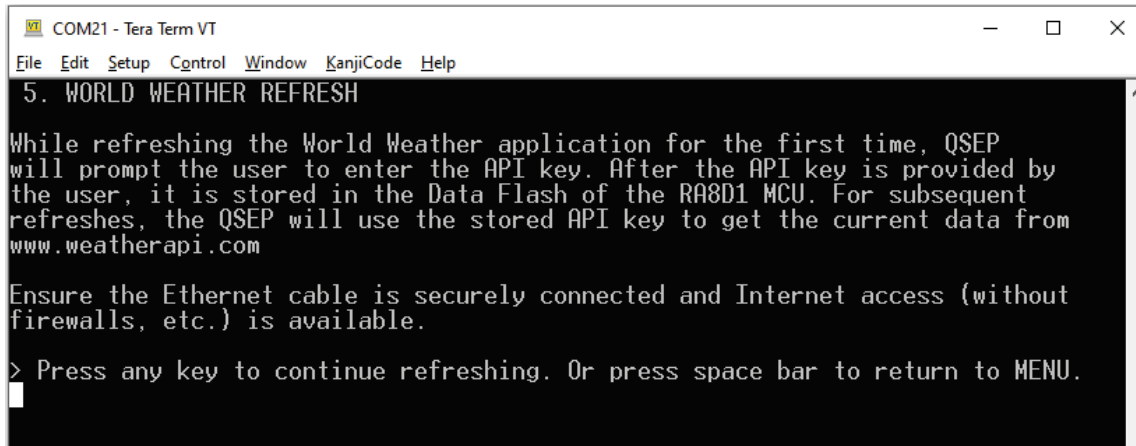
Press space bar to return to MENU, then press 2 to run Interactive AI,
Connectivity & HMI Demos and view recent data on the MIPI Graphics Expansion
Board.

```

Figure 32. Entering Time Zone API Keys for the First Time

6.1.3 World Weather Refresh

1. Press **space** to return to the 'welcome and main menu' screen.
2. Press **5** to **World Weather Refresh**.



```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
5. WORLD WEATHER REFRESH

While refreshing the World Weather application for the first time, QSEP
will prompt the user to enter the API key. After the API key is provided by
the user, it is stored in the Data Flash of the RA8D1 MCU. For subsequent
refreshes, the QSEP will use the stored API key to get the current data from
www.weatherapi.com

Ensure the Ethernet cable is securely connected and Internet access (without
firewalls, etc.) is available.

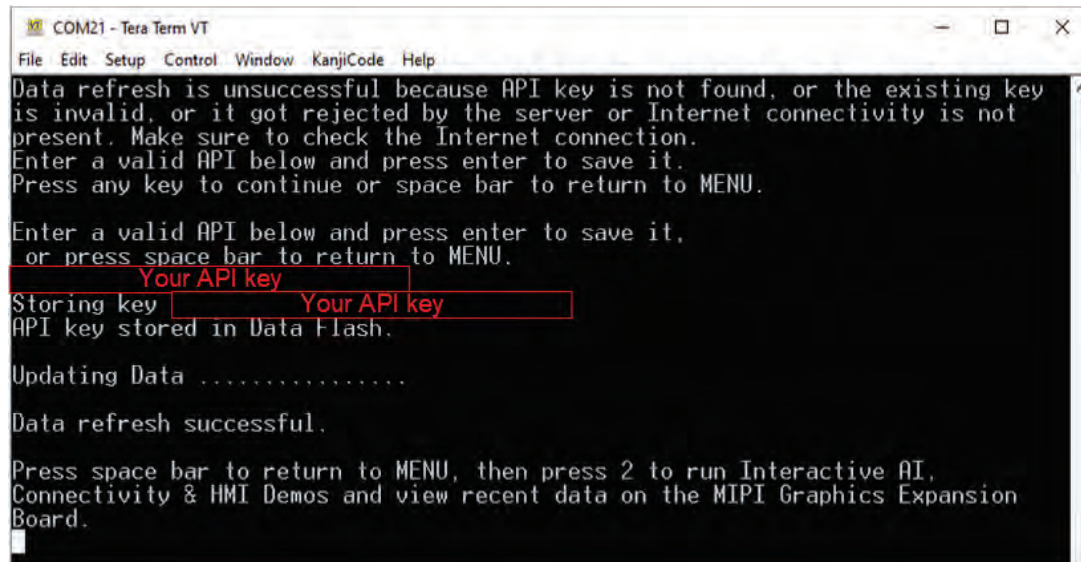
> Press any key to continue refreshing. Or press space bar to return to MENU.

```

Figure 33. World Weather Refresh

3. Press **any key** to refresh the data for world weather application.
4. If the API key does not exist, the console display is as shown in Figure 34.
5. Press **any key** to update the API key.
6. Paste the API key into the console.
7. Press **Enter**.

If the API key is valid, the update starts as shown in the following figure.



```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
Data refresh is unsuccessful because API key is not found, or the existing key
is invalid, or it got rejected by the server or Internet connectivity is not
present. Make sure to check the Internet connection.
Enter a valid API below and press enter to save it.
Press any key to continue or space bar to return to MENU.

Enter a valid API below and press enter to save it,
or press space bar to return to MENU.
Your API key
Storing key Your API key
API key stored in Data Flash.

Updating Data .....
Data refresh successful.

Press space bar to return to MENU, then press 2 to run Interactive AI,
Connectivity & HMI Demos and view recent data on the MIPI Graphics Expansion
Board.

```

Figure 34. Entering Weather API keys for the First Time

6.1.4 API Keys Help and Management

To update the API key stored in the flash, API Keys Help & Management must be run to erase the API key.

1. Press **space** to return to the 'welcome and main menu' screen.
2. Press **6** to **API Keys Help & Management**.

```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
6. API KEYS HELP & MANAGEMENT

API keys are required by the connectivity applications to obtain near
real-time data from third-party services. The users are required to sign
up/create an account with the service providers to get the API keys.

1. World Weather and World Time Zones applications require an API key
   from weatherapi.com
2. Currency Converter application requires an API key
   from app.currencyapi.com

While refreshing the connectivity applications for the first time,
this QSEP will prompt the user to enter the API keys. After the API keys are
provided by the user, they are stored in the Data Flash of the RA8D1 MCU.
Upon subsequent refreshes, the QSEP will look for the APIs stored in the MCU
and, if found, will use them to get the current data from third parties.
> Press 'E' to erase the existing API keys (if present)
   or press space bar to return to MENU

```

Figure 35. API Keys Help and Management

3. Press **E** to erase all existing API keys.

Note: Due to the limited number of free requests, the keys are not used on power up unless the above menu options 3, 4 and 5 are selected.

To check the result on board, please follow section 5.4 to open the respective page.

6.2 Next Steps

1. Press **space** to return to the 'welcome and main menu' screen.
2. Press **7** to display **Next Steps**.

Note: The Next Steps section number will change depending on the SW setting. For SW 1-3 and SW 1-7 ON, the number will be 3. For SW1-5 and SW1-7 ON the number will be 7.

```

COM21 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
7. NEXT STEPS

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

a) EK-RA8D1 resources:      renesas.com/ra/ek-ra8d1
b) RA kits information:    renesas.com/ra/kits
c) RA product information: renesas.com/ra
d) RA product support forum: renesas.com/ra/forum
e) Renesas support:        renesas.com/support

> Press space bar to return to MENU

```

Figure 36. Next Steps

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

7. Customizing the Quick Start Example Project

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

Hardware Requirements

- EK-RA8D1 board
- Micro USB device cable
- A PC with at least 1 USB port

Software Requirements

- Windows® 10 operating system
- e² studio IDE 2023-10 (or later)
- SEGGER J-Link® USB drivers
- FSP v5.1.0 (or later)
- Quick Start example project

7.1 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.

7.2 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-RA8D1 Example Projects Bundle that is available in the **Downloads** tab of EK-RA8D1 webpage at renesas.com/ra/ek-ra8d1
 - Download and extract the example projects bundle (xxxxxxxxxxxxxxxx-ek-ra8d1-exampleprojects.zip) to a local directory on the host PC.
 - Browse to the Quick Start example project at xxxxxxxxxxxxxxxxxxx-ek-ra8d1-exampleprojects\ek_ra8d1_quickstart\quickstart_ek_ra8d1_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.

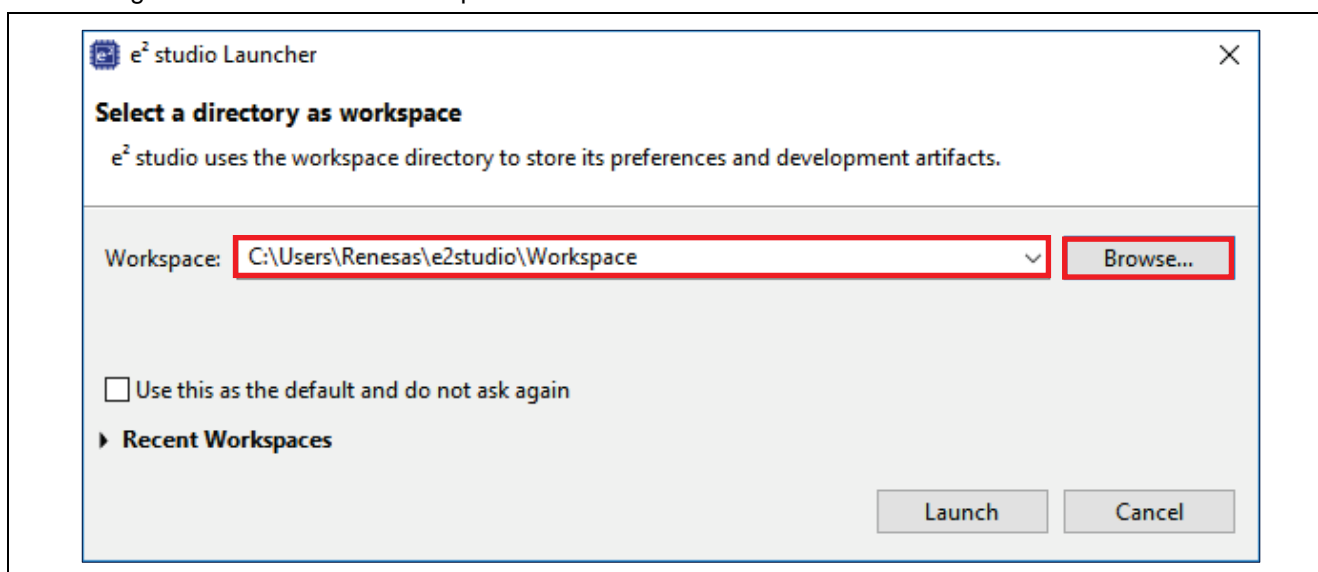


Figure 37. Creating a New Workspace

4. Click **Launch**.

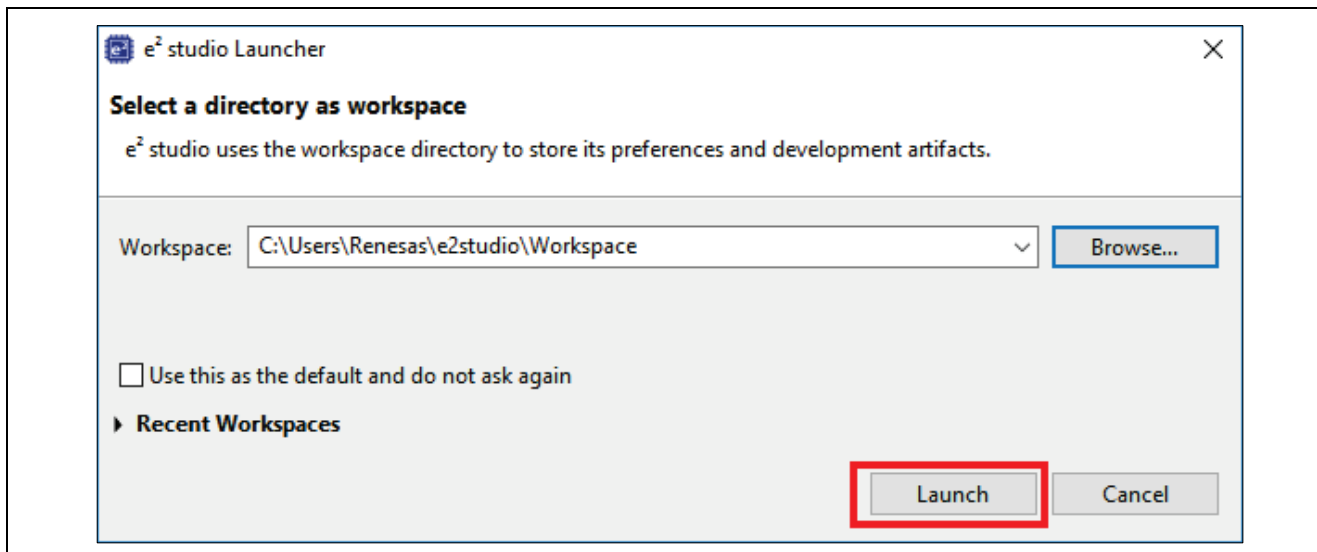


Figure 38. Launching the Workspace

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

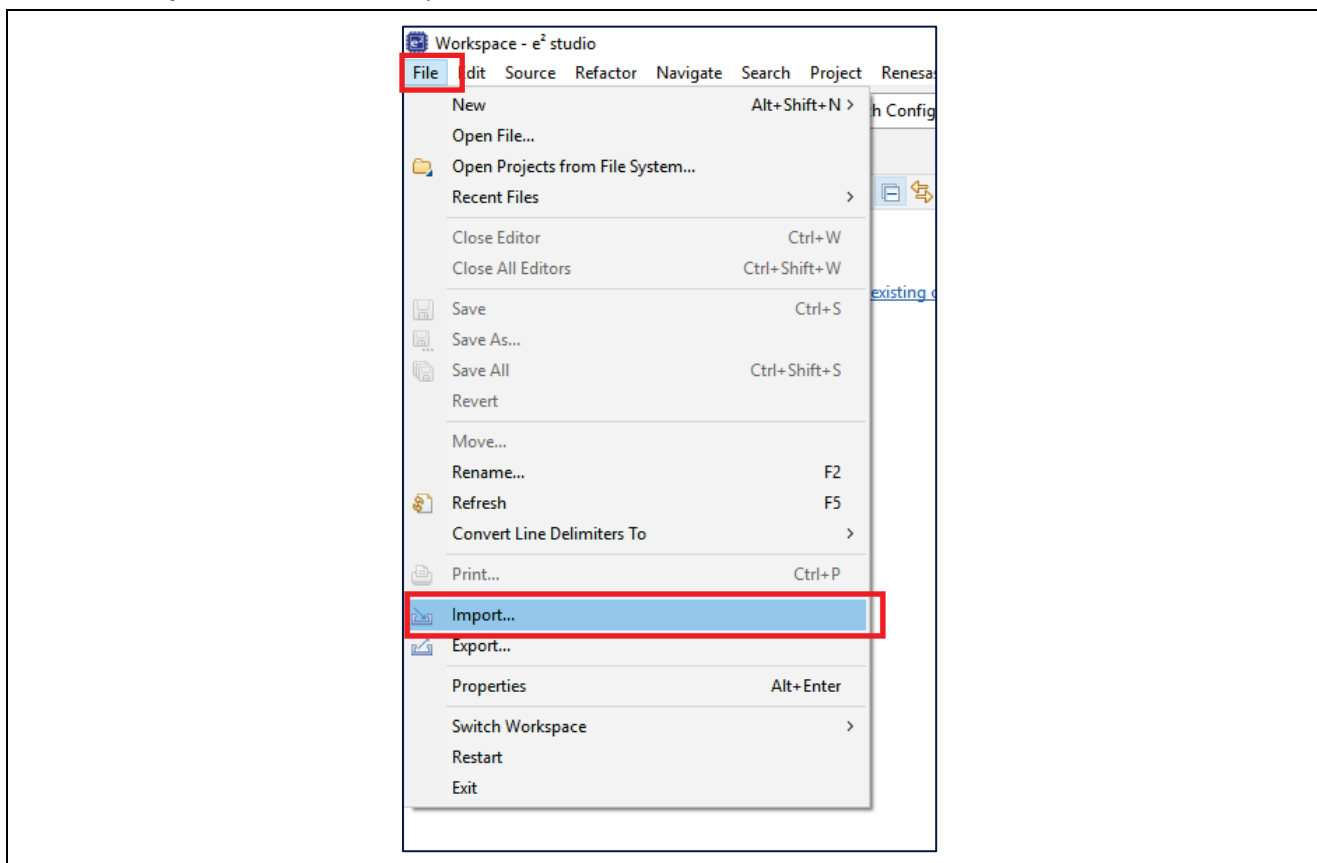


Figure 39. Importing the Project

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

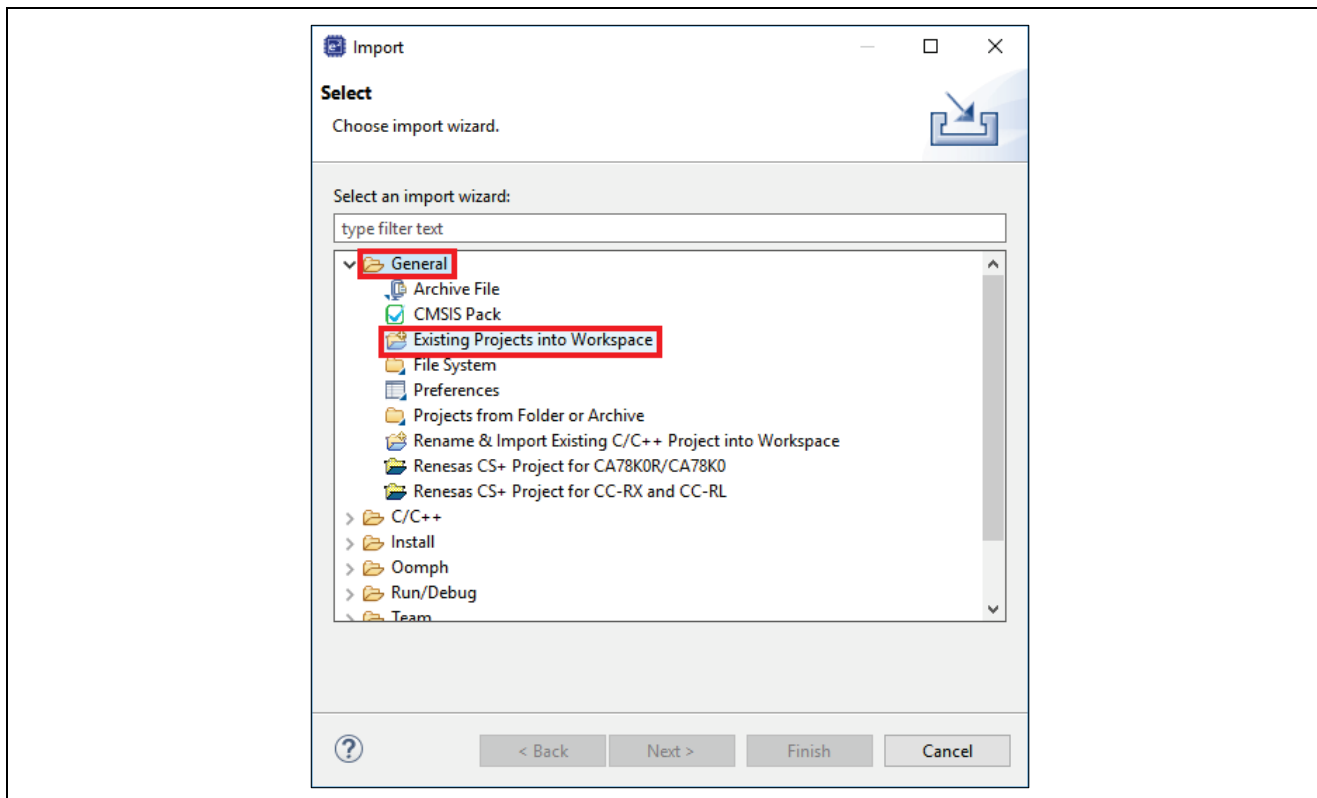


Figure 40. Importing Existing Projects into the Workspace

7. Click **Next**.

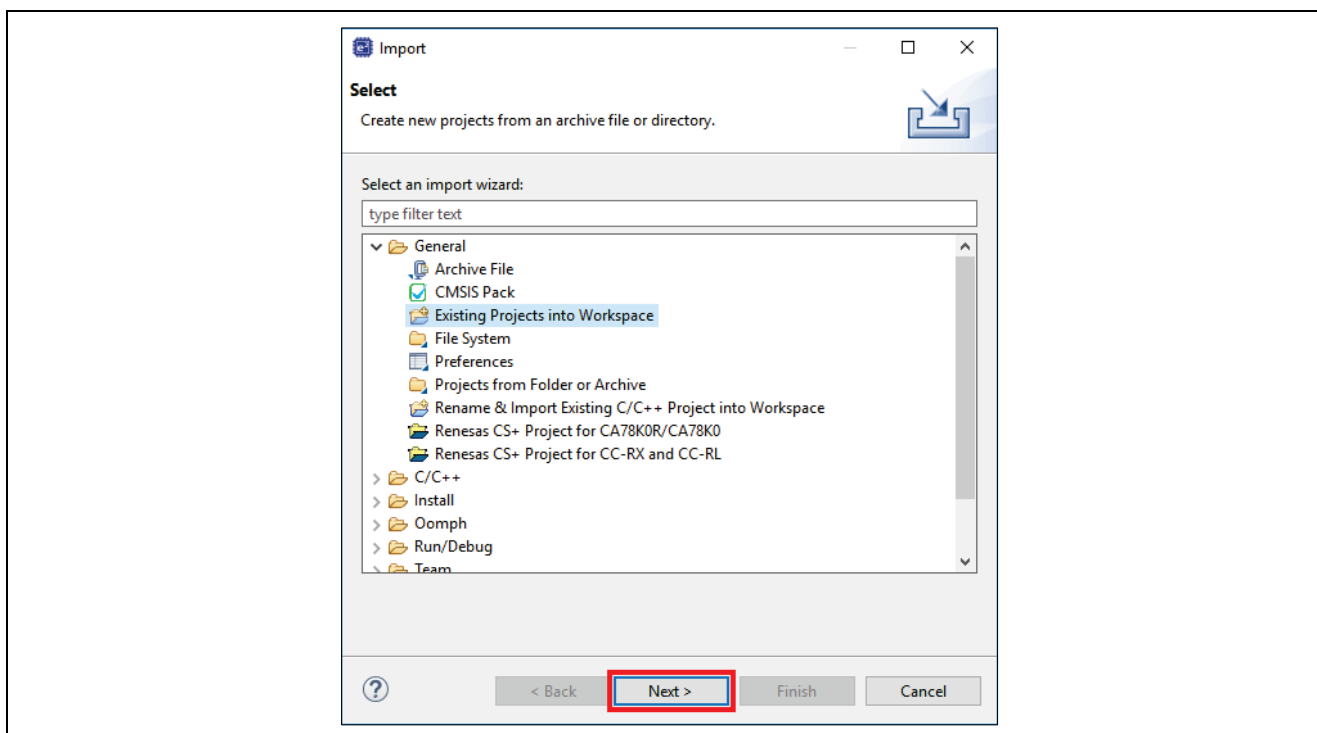


Figure 41. Clicking Next to Import Existing Projects into the Workspace

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

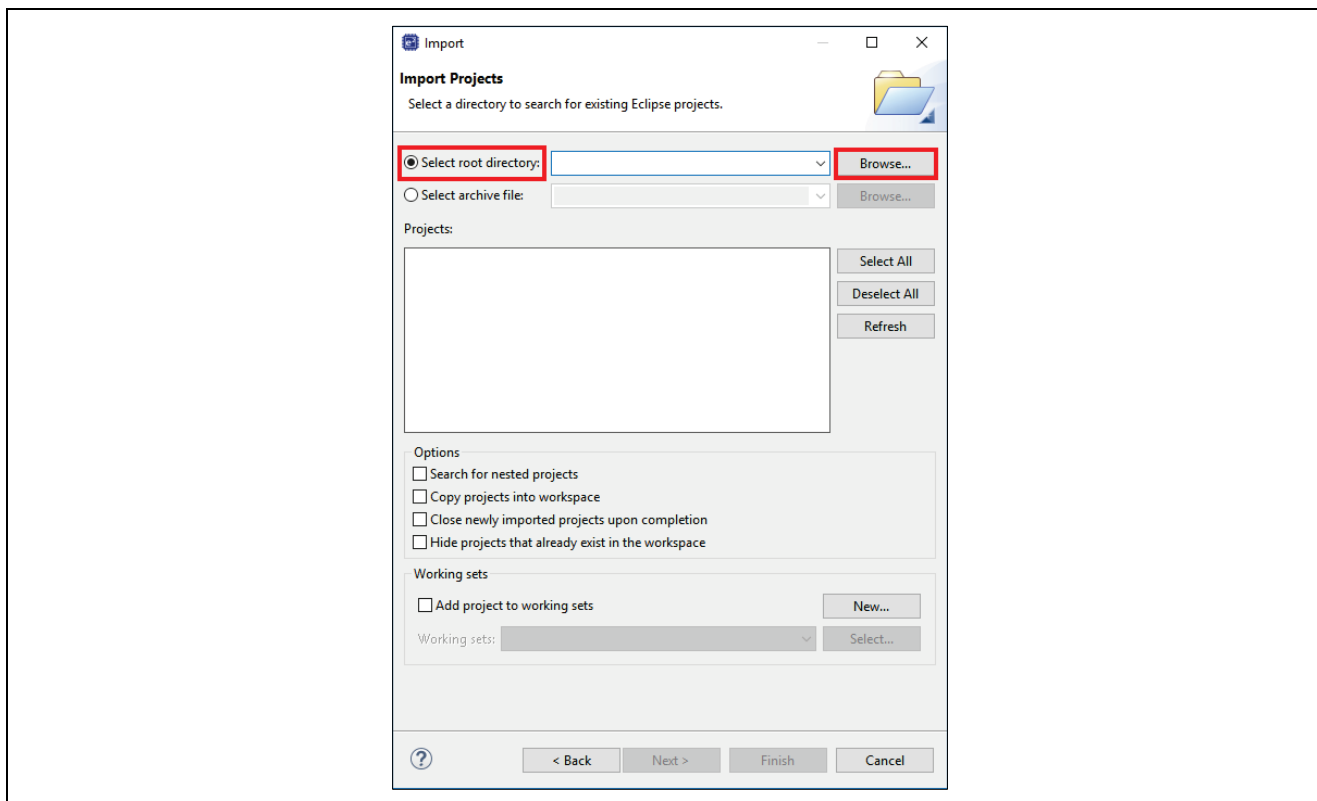


Figure 42. Selecting the Root Directory

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

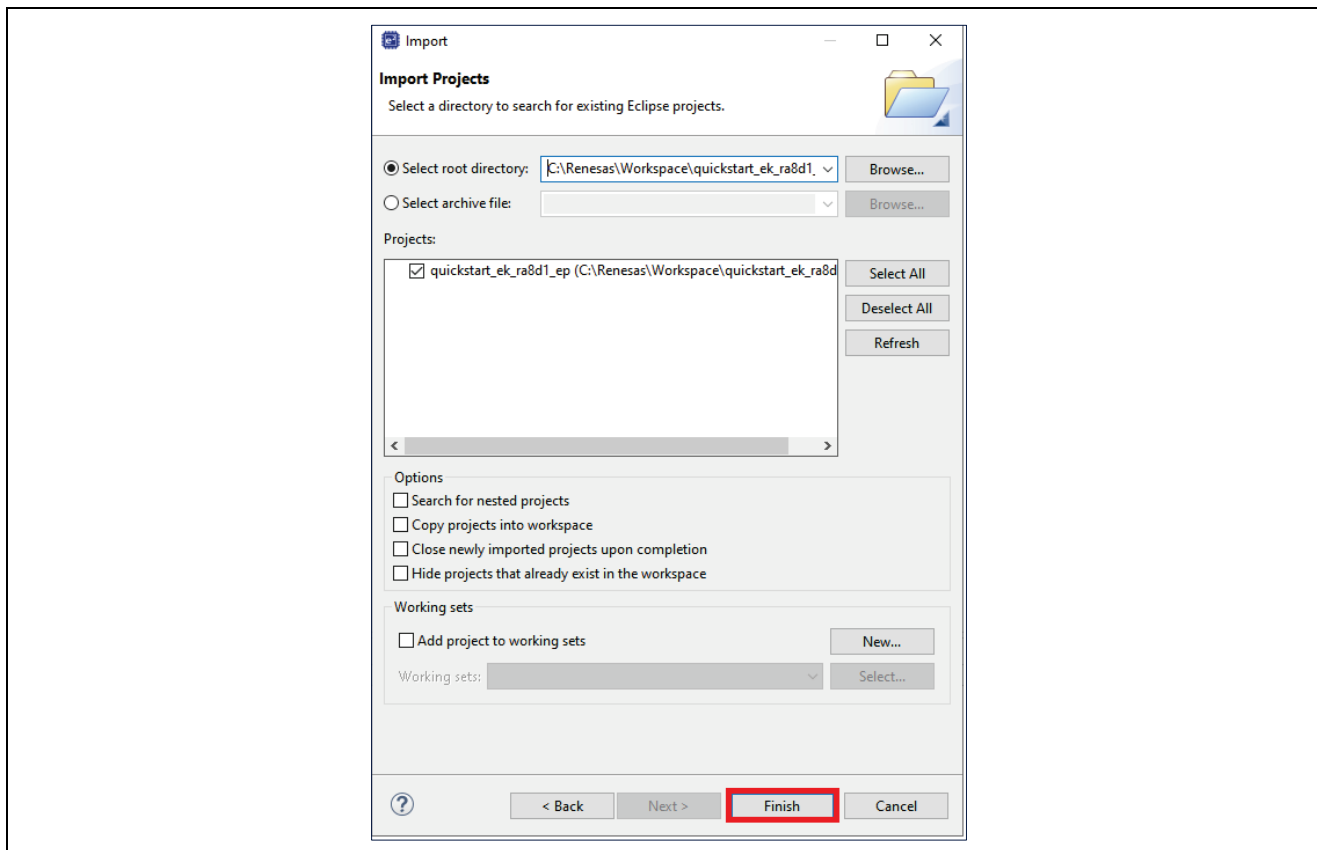


Figure 43. Finishing Importing the Quick Start Example Project

7.3 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 made 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.

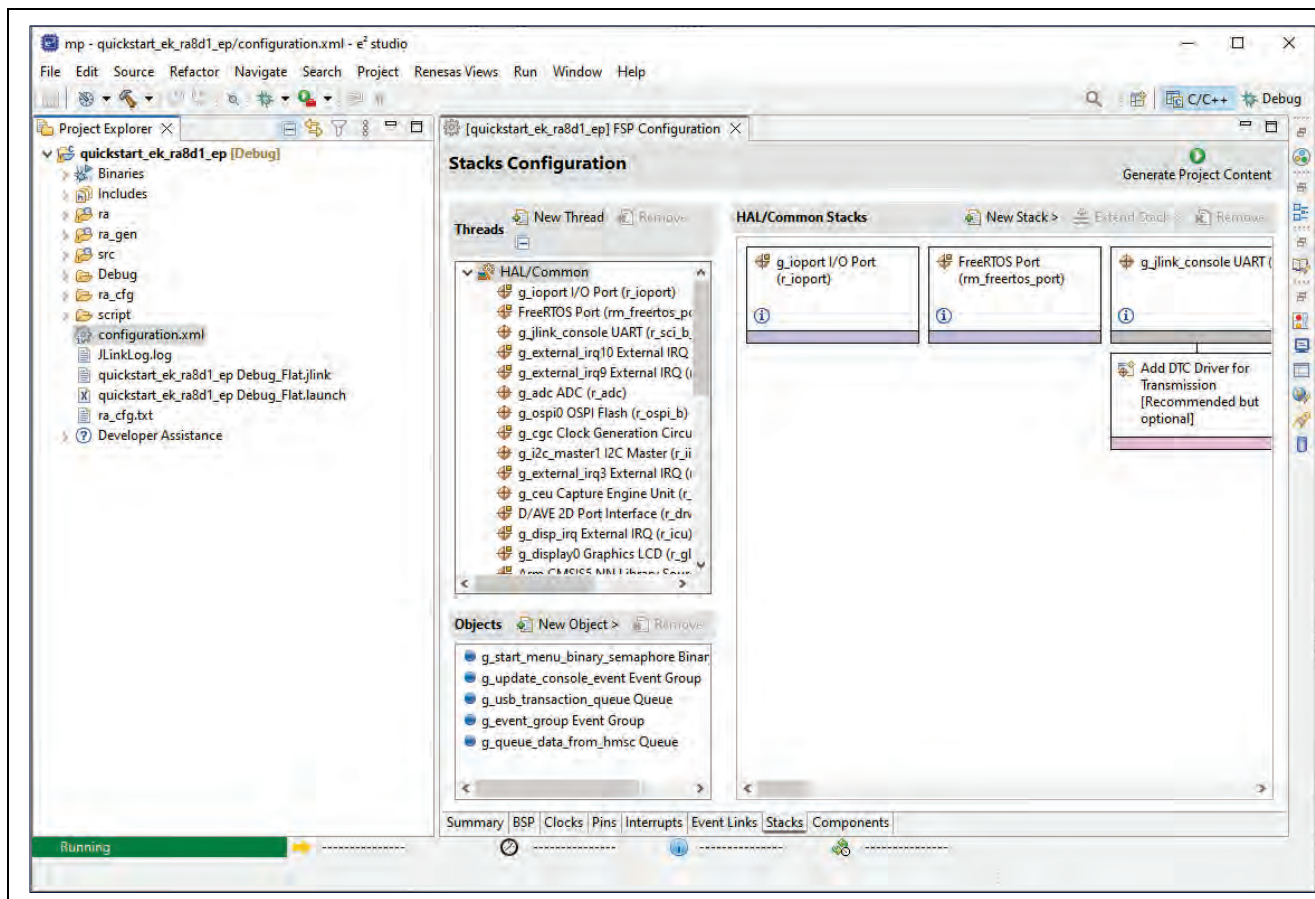


Figure 44. Opening the Configurator

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. Figure 46 illustrates modifying the Configuration Settings.

Note: To access the stack component properties, the **view** must be set to **FSP Configuration**. Use the **Open Perspective** button, if necessary.

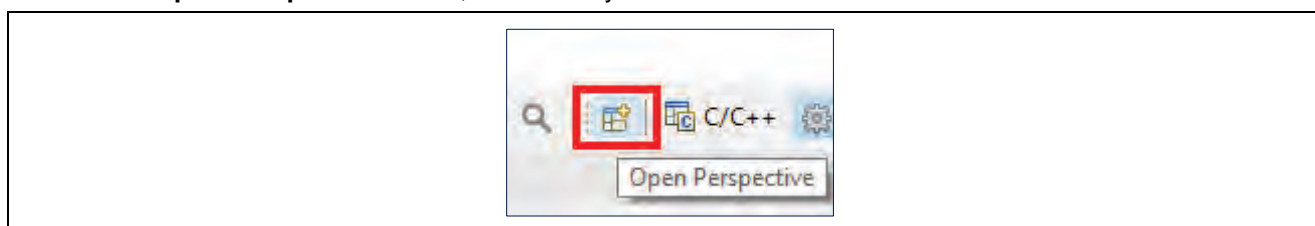


Figure 45. Open Perspective

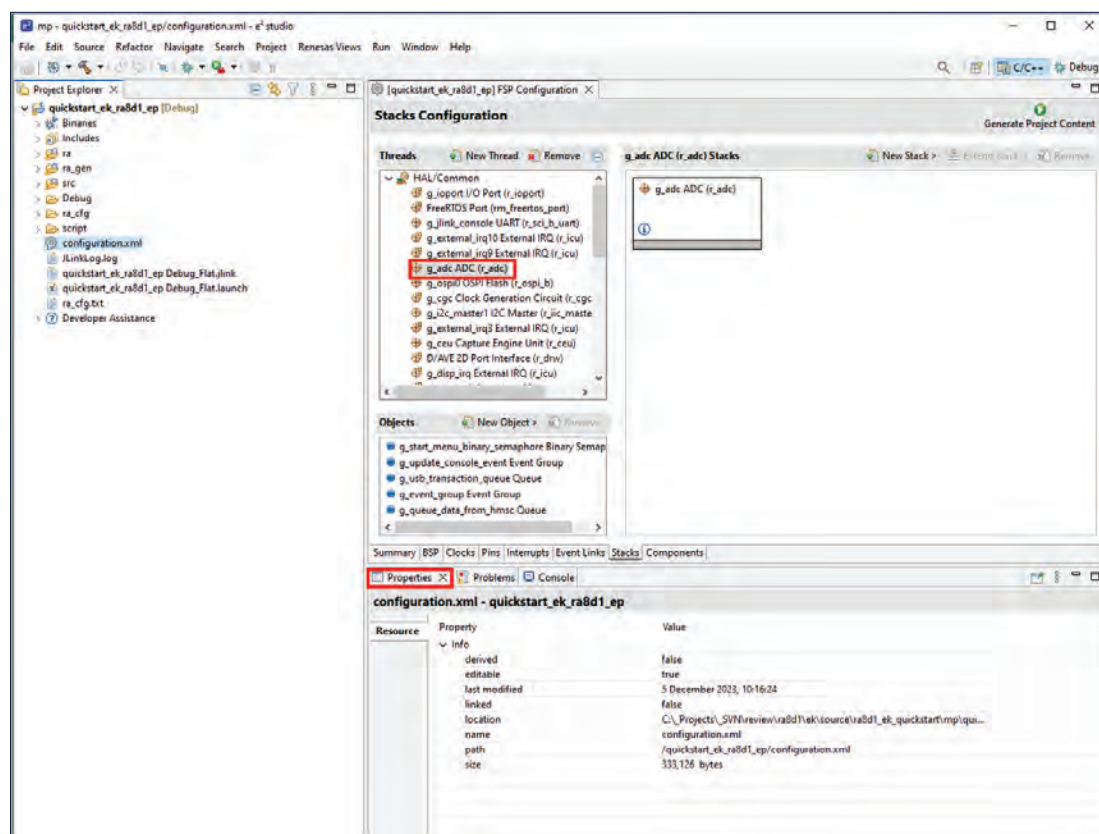


Figure 46. Modifying the Configuration Settings

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

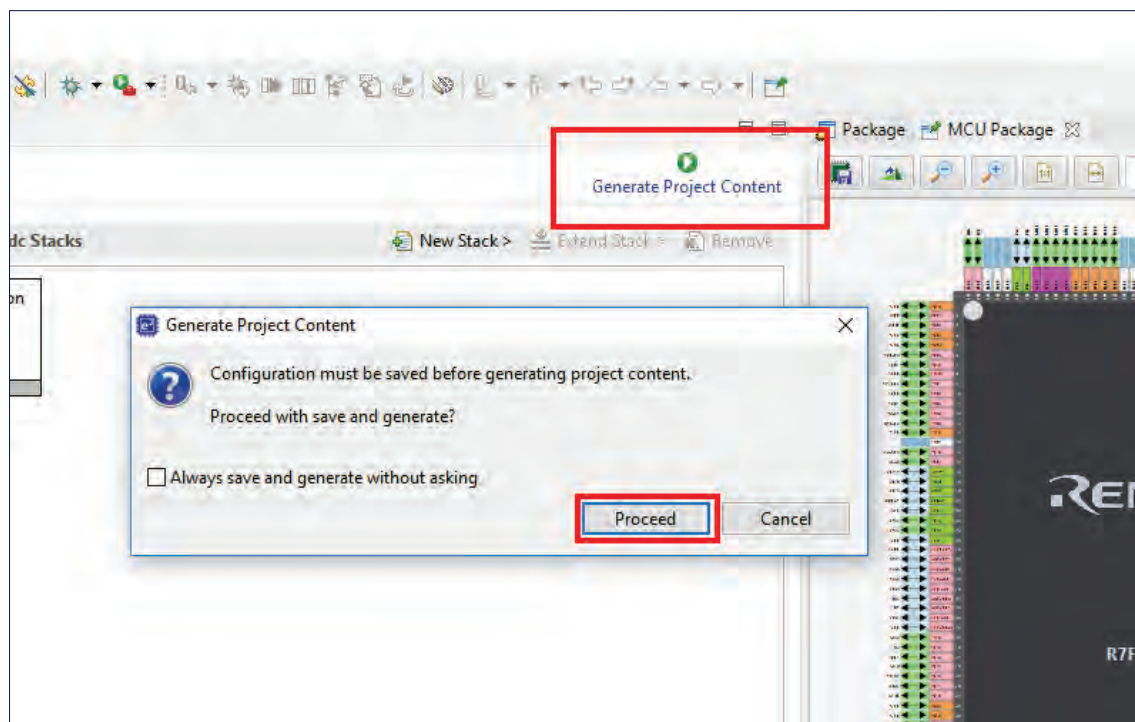


Figure 47. Saving the Configuration Changes

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

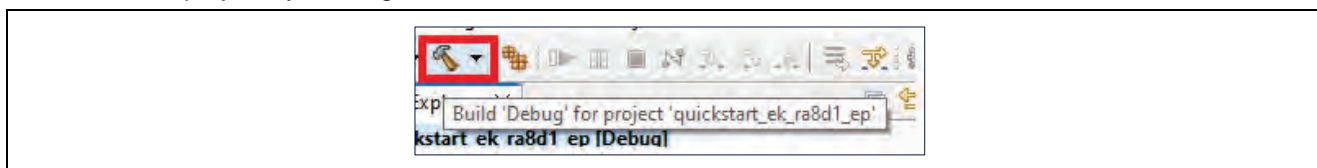


Figure 48. Building the Project

6. A successful build produces an output as follows.

Note: Warnings are acceptable for a successful build whereas errors are not.

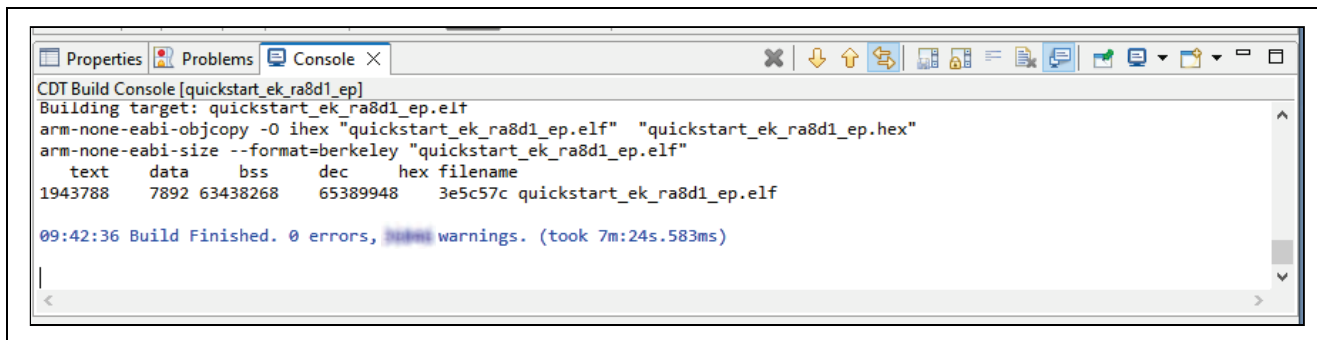


Figure 49. Successful Build Output

7.4 Setting Up Debug Connection between the EK-RA8D1 board and Host PC

To program the modified Quick Start example project on to the EK-RA8D1 board, a debug connection is necessary between the EK-RA8D1 board and host PC. This is provided via J10 that has been used for the serial terminal, so no connection changes are needed.

1. Connect micro USB cable to the debug port (J10) of the EK-RA8D1 board to your PC.

Note: The EK-RA8D1 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-RA8D1 user's manual.

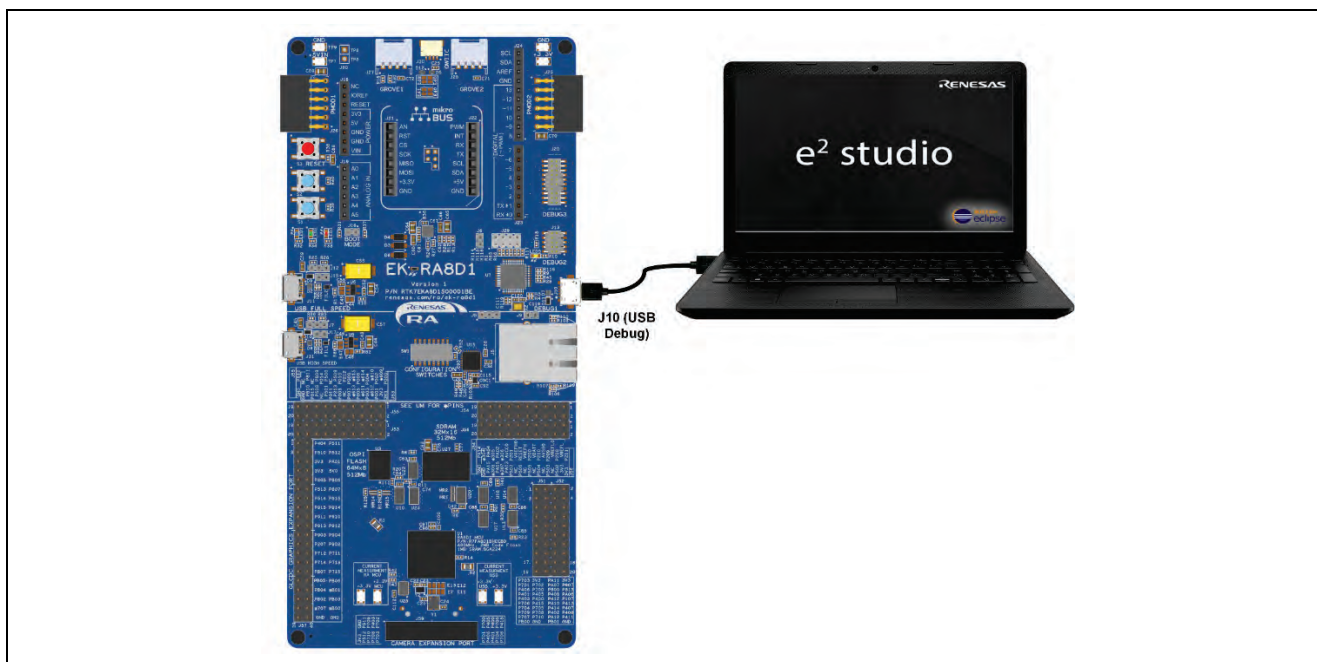


Figure 50. Connecting the EK-RA8D1 Board to the Host PC via USB Debug Port

2. Verify that the debug LED (LED5) stops blinking and lights up orange indicating that the J-Link drivers are detected by the EK-RA8D1 board.

Note: The debug LED (LED5) continues to blink when J-Link drivers are not detected by the EK-RA8D1 board. In that case, make sure that the EK-RA8D1 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**).

7.5 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.

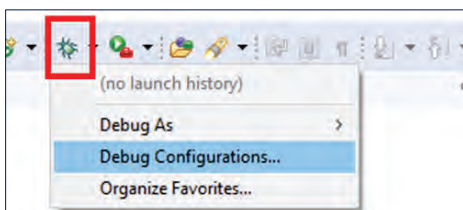


Figure 51. Selecting the Debug Option

2. In the dialog on the left-hand pane, expand the **Renesas GDB Hardware Debugging** and select the built image to debug. In this case, the **quickstart_ek_ra8d1_ep Debug_Flat**.

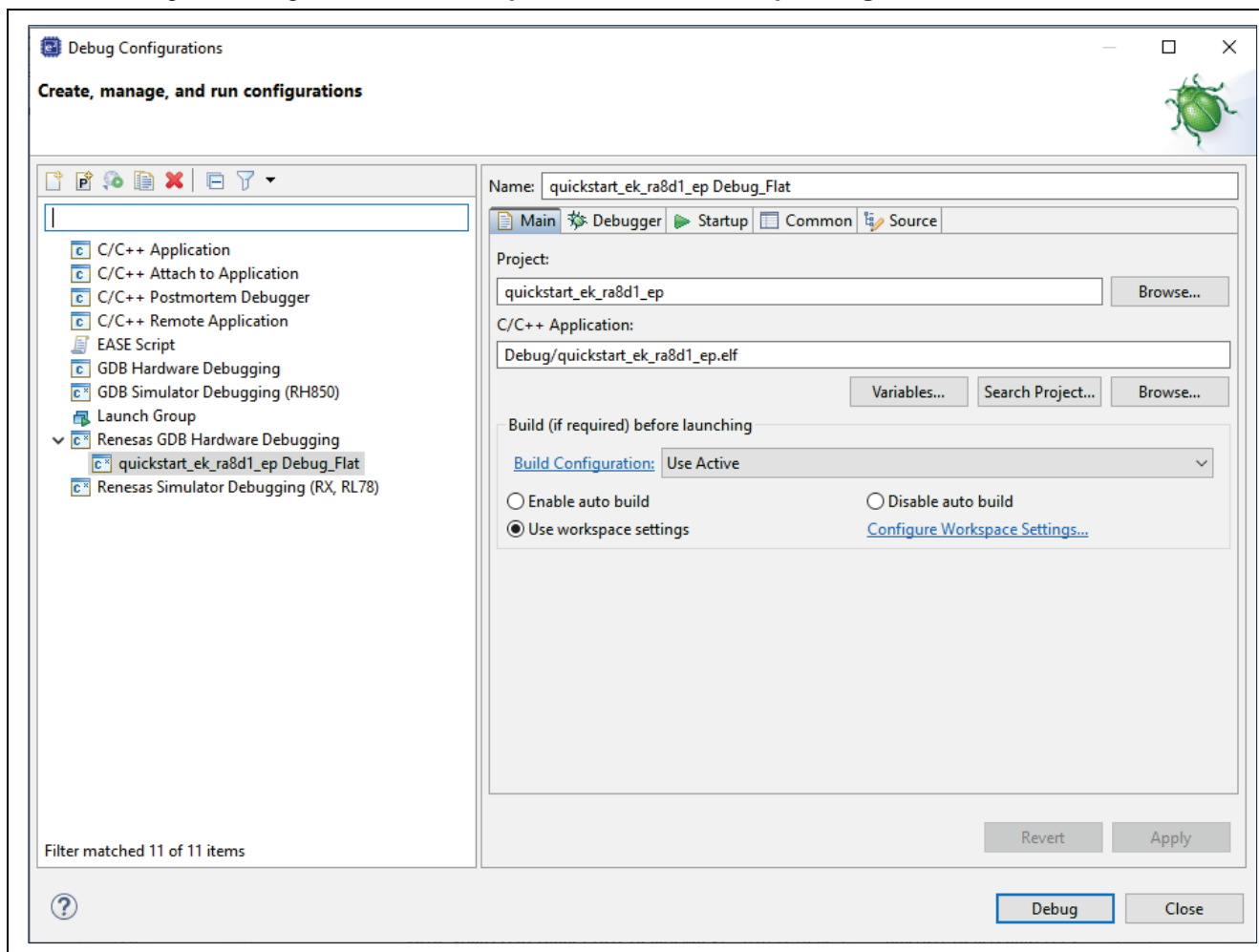


Figure 52. Selecting the Debug Image

3. Click **Debug**.

7.6 Firewall Dialog

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 **Switch**.

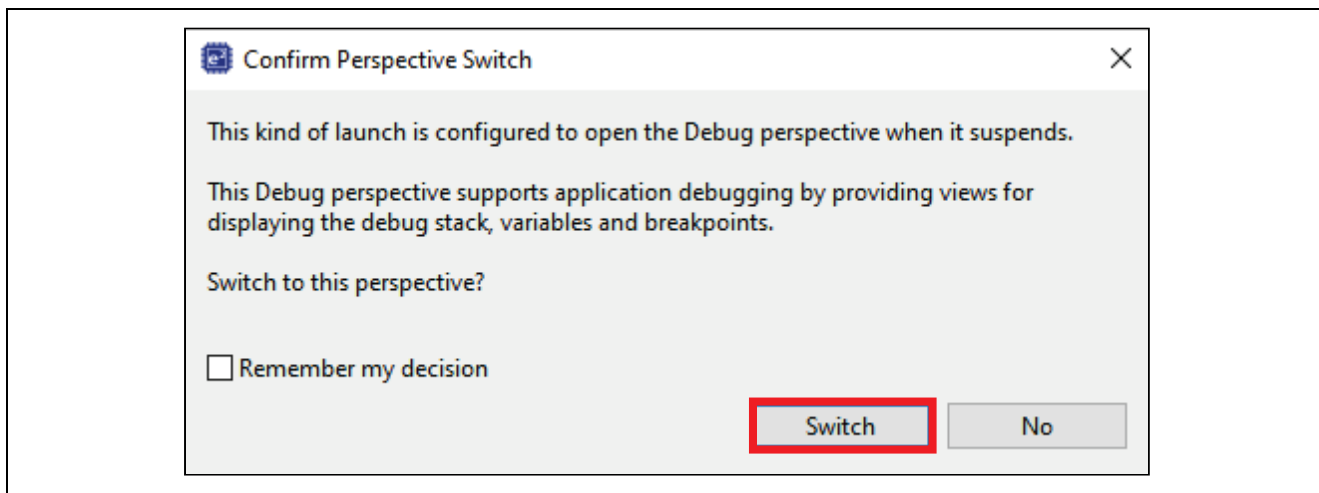


Figure 53. Opening the Debug Perspective

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

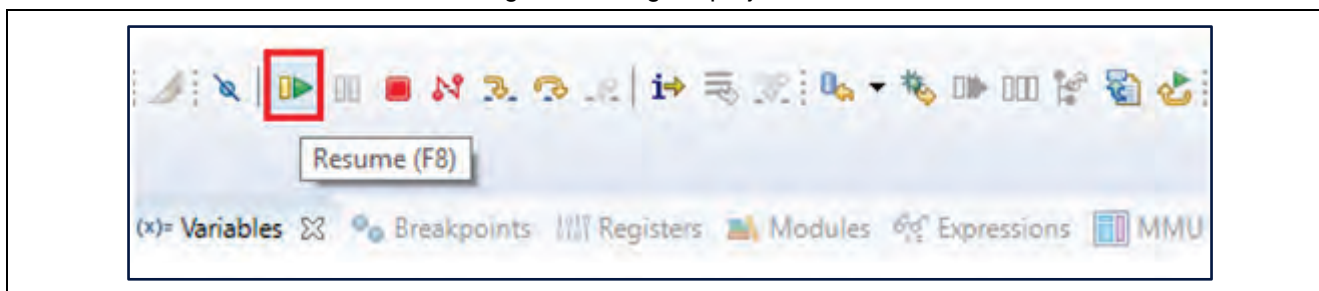


Figure 54. Executing the Project

5. The modified Quick Start example project is programmed into the EK-RA8D1 board and is running. The project can be paused, stopped, or resumed using the debug controls.

8. Next Steps

1. To learn more about the EK-RA8D1 kit, refer to the EK-RA8D1 user's manual and design package available in the Documents and Download tabs respectively of the EK-RA8D1 webpage at renesas.com/ra/ek-ra8d1
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 EK-RA8D1 kit are available in the EK-RA8D1 Example Projects Bundle. The example projects bundle is available in the Downloads tab of EK-RA8D1 webpage.
 - Download and extract the example projects bundle (xxxxxxxxxxxxxxxx-ek-ra8d1-exampleprojects.zip) to a local directory on the host PC.
 - Refer to the list of all example projects (xxxxxxxxxxxxxxxx-ek-ra8d1-exampleprojects.pdf) available inside the example projects bundle.
 - Browse to the desired example project (for example: adc_ek_ra8d1_ep) in the example projects bundle (xxxxxxxxxxxxxxxx-ek-ra8d1-exampleprojects\ek_ra8d1\adc\adc_ek_ra8d1_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 in the example project repository.

9. 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-RA8D1 Resources	renesas.com/ra/ek-ra8d1
RA kits information	renesas.com/ra/kits
RA Product Information	renesas.com/ra
RA Product Support Forum	renesas.com/ra/forum
RA Videos	renesas.com/ra/videos
RA Kit Feedback and Feature Request	renesas.com/ra/kitfeedback
Renesas Support	renesas.com/support

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