Quick Start Guide

RA6M5 Group

Cloud Kit for RA6M5 Microcontroller Group
CK-RA6M5 with RYZ014A Pmod
Quick Start Guide

Renesas RA Family
RA6 Series

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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

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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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This Cloud 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 Cloud Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

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Renesas RA Family

CK-RA6M5

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1. Introduction

This Quick Start Guide (QSG) provides:

- An overview of the Quick Start example project that the CK-RA6M5 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 CK-RA6M5 board, default jumper settings must be used. Refer to the CK-RA6M5 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. CK-RA6M5 v1 board
2. RYZ014A PMOD (CAT-M1 Cloud Kit)
3. SIM Card (CAT-M1 Cloud Kit)
4. Antenna (CAT-M1 Cloud Kit)
5. USB Micro B to USB A cable x2
6. USB Micro B to USB A adapter cable

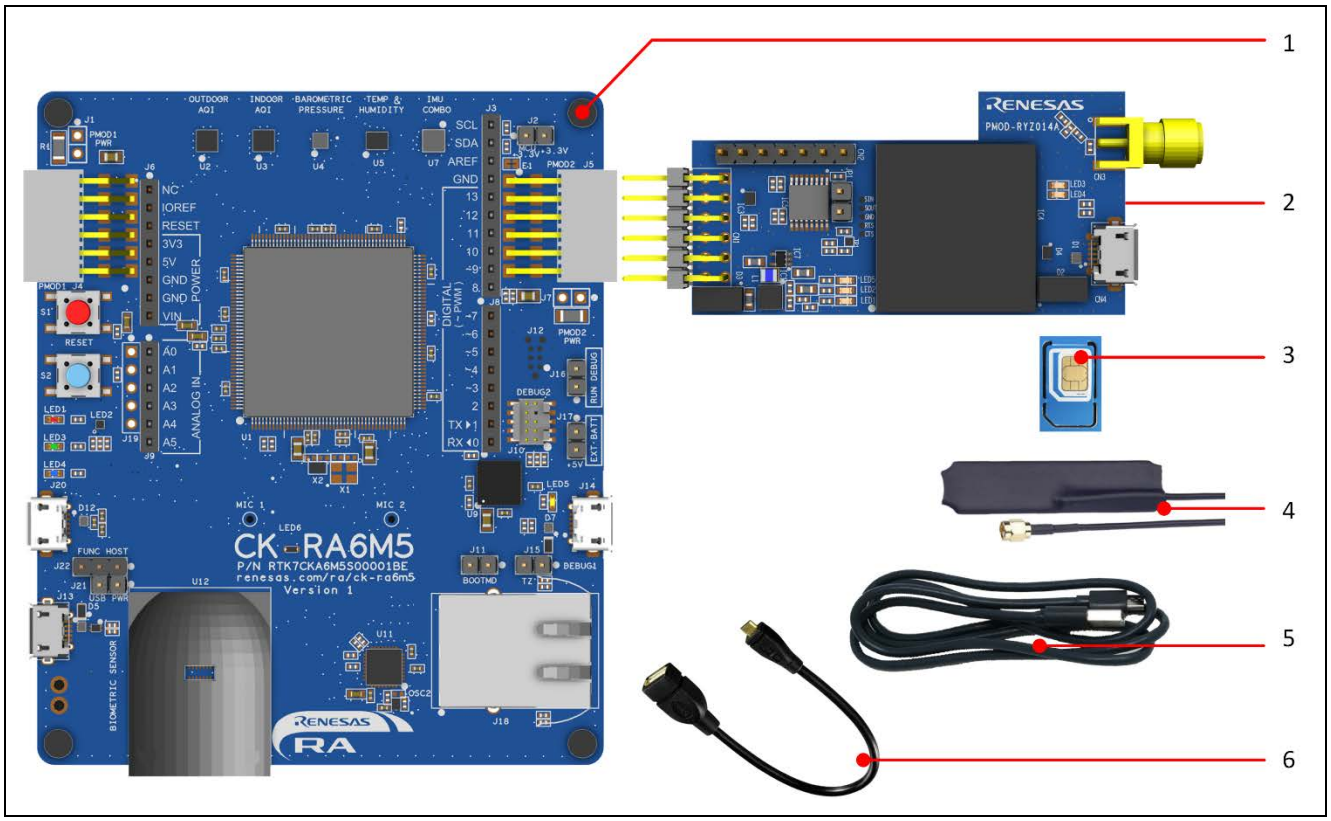


Figure 1. CK-RA6M5 Kit Contents

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3. Overview of the Quick Start Example Project

The Quick Start example project allows the user to change the frequency of the on-board user LED3 (blue) using the user button (S2). The supported frequencies are 1 Hz, 5 Hz, and 10 Hz.

When the CK-RA6M5 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.

3.1 Quick Start Example Project Flow

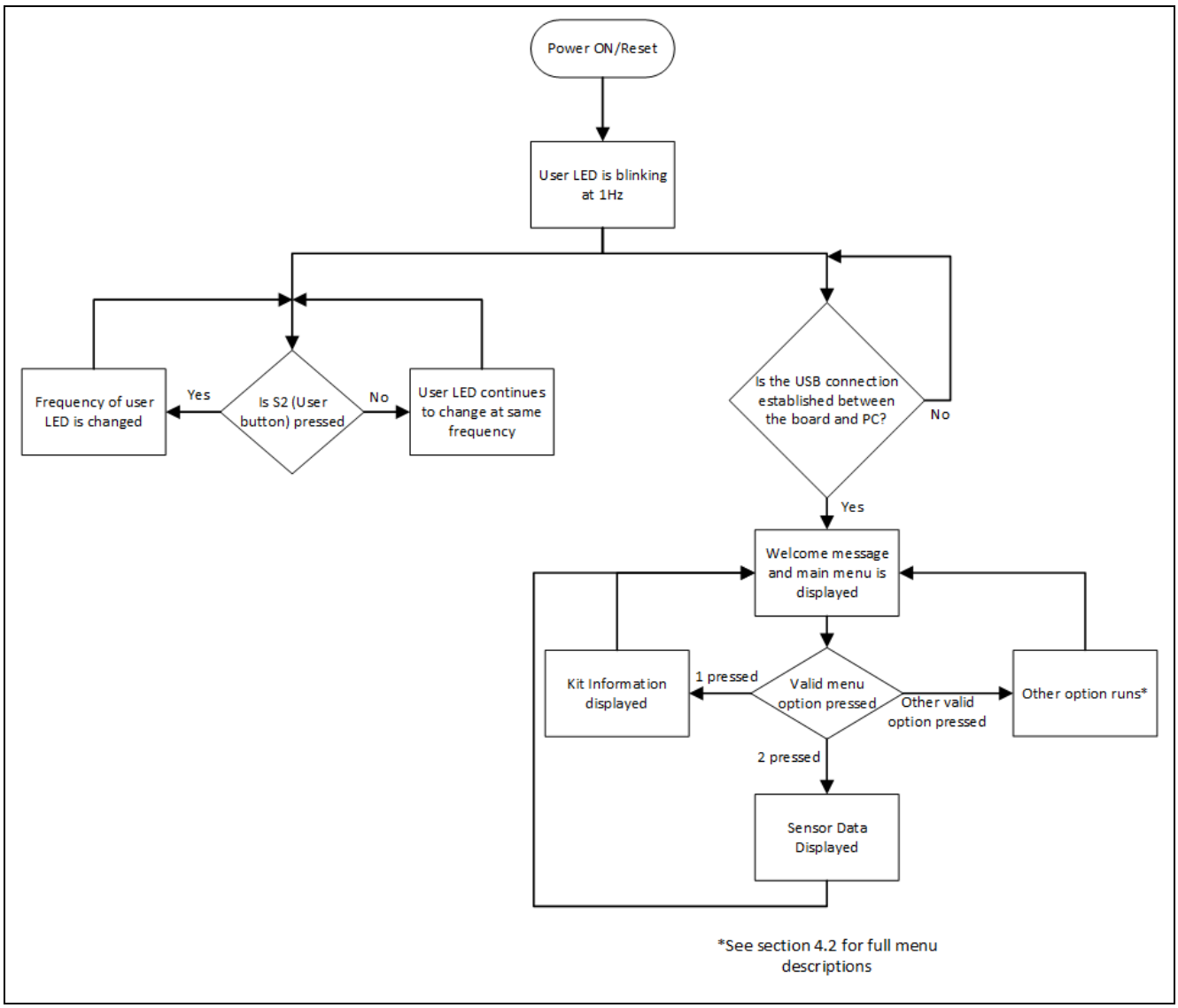


Figure 2. Quick Start Example Project Flow

4. Running the Quick Start Example Project

This section lists the requirements and instructions to power up the CK-RA6M5 board and run the Quick Start example project.

Hardware Requirements

- CK-RA6M5 board
- Micro USB device cable x2
- A PC with at least 2 USB ports
- A router with at least 1 available full duplex Ethernet port*
- Ethernet cable

* The PHY implemented on the Cloud Kit does not support half-duplex operation.

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Software Requirements

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

4.1 Connecting and Powering Up the CK-RA6M5 Board

1. Check that:
   A. J22 is set to link pins 2-3
   B. J21 link is closed
   C. J16 Link is open
2. Connect J14 and J20 on the CK-RA6M5 board to USB ports on the host PC using the 2 micro USB cables supplied.
3. Power LED (LED6) on the CK-RA6M5 board lights up white, indicating that the CK-RA6M5 board is powered on.

Note: If the CK-RA6M5 board is not powered through the Debug port (J14) the current available to the board may be limited to 100 mA.
When using the supplied PMOD-RYZ014A module with other code (found here: RYZ014A - LTE Cat-M1 Cellular IoT Module | Renesas) be aware that this Pmod has a maximum operating current of 480 mA dependent upon the LTE band, Tx/Rx settings, and network coverage. Please ensure that the host board can supply sufficient power or provide supplemental USB power via CN4 on the Pmod to avoid RF instability.

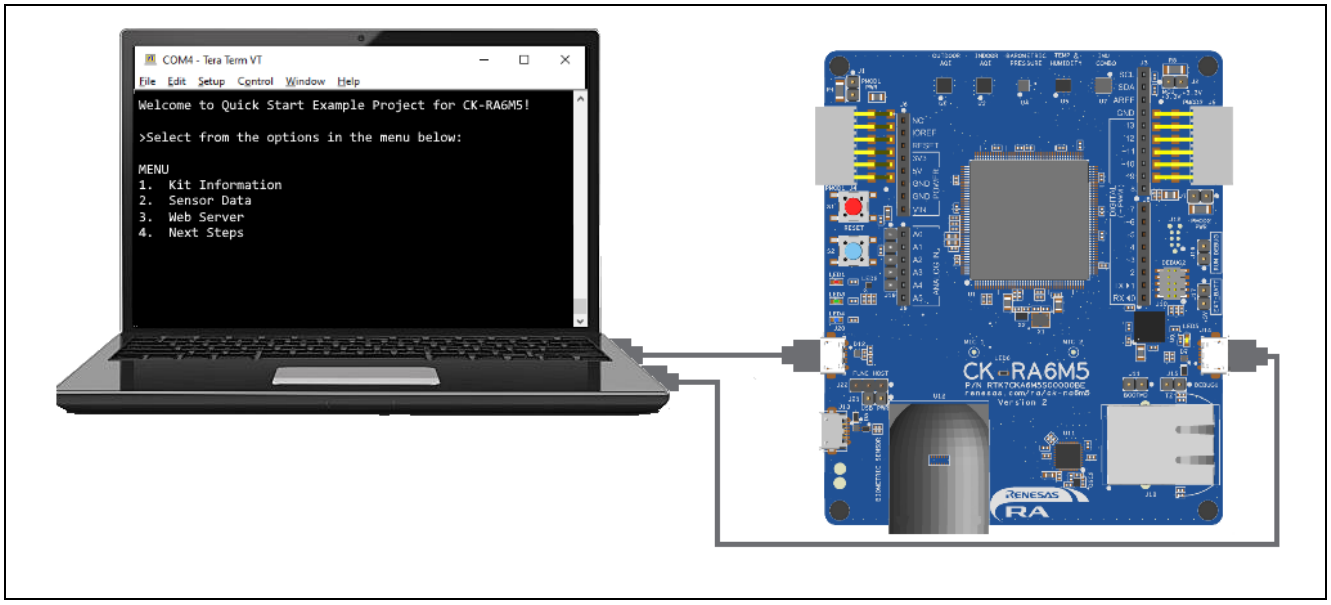


Figure 3. Connecting the CK-RA6M5 Board to the Host PC via USB Full Speed Port

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 four user LEDs will take on the following states:
   — LED1 Red – Off
   — LED2 RGB – Off
   — LED3 Green – Steady, full intensity
   — LED4 Blue – Blinking at 1 Hz frequency

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

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2. Press the user button (S2) on the CK-RA6M5 board to change the blinking frequency of the user LED4 (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.
3. On the host PC, open Windows Device Manager. Expand **Ports (COM & LPT)**, locate **USB Serial Device (COMxx)** and note down the COM port number for reference in the next step.

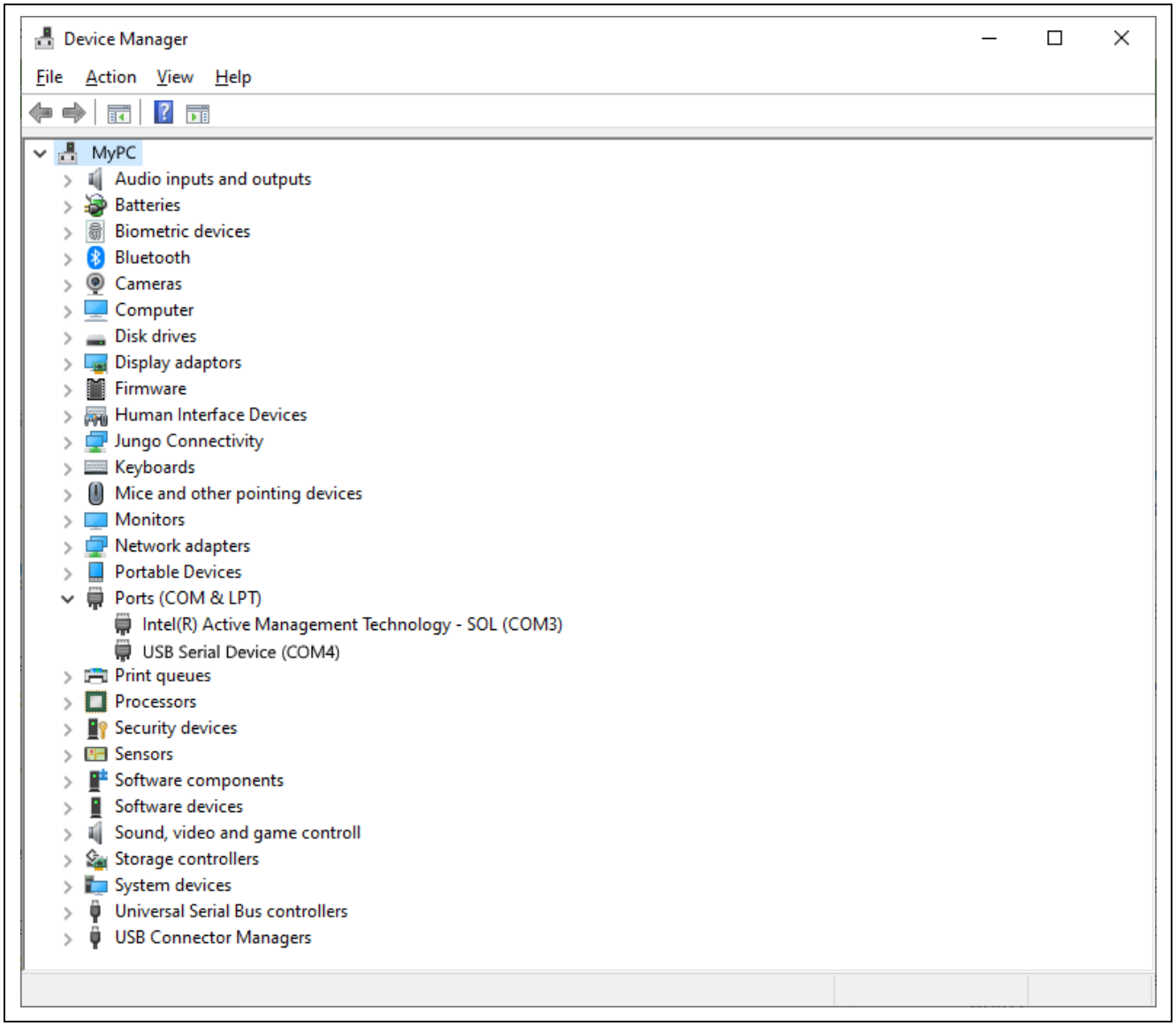


Figure 4. USB Serial Device in Windows Device Manager

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4. Open Tera Term, select **Serial** and **COMxx: USB Serial Device (COMxx)** and click **OK**.

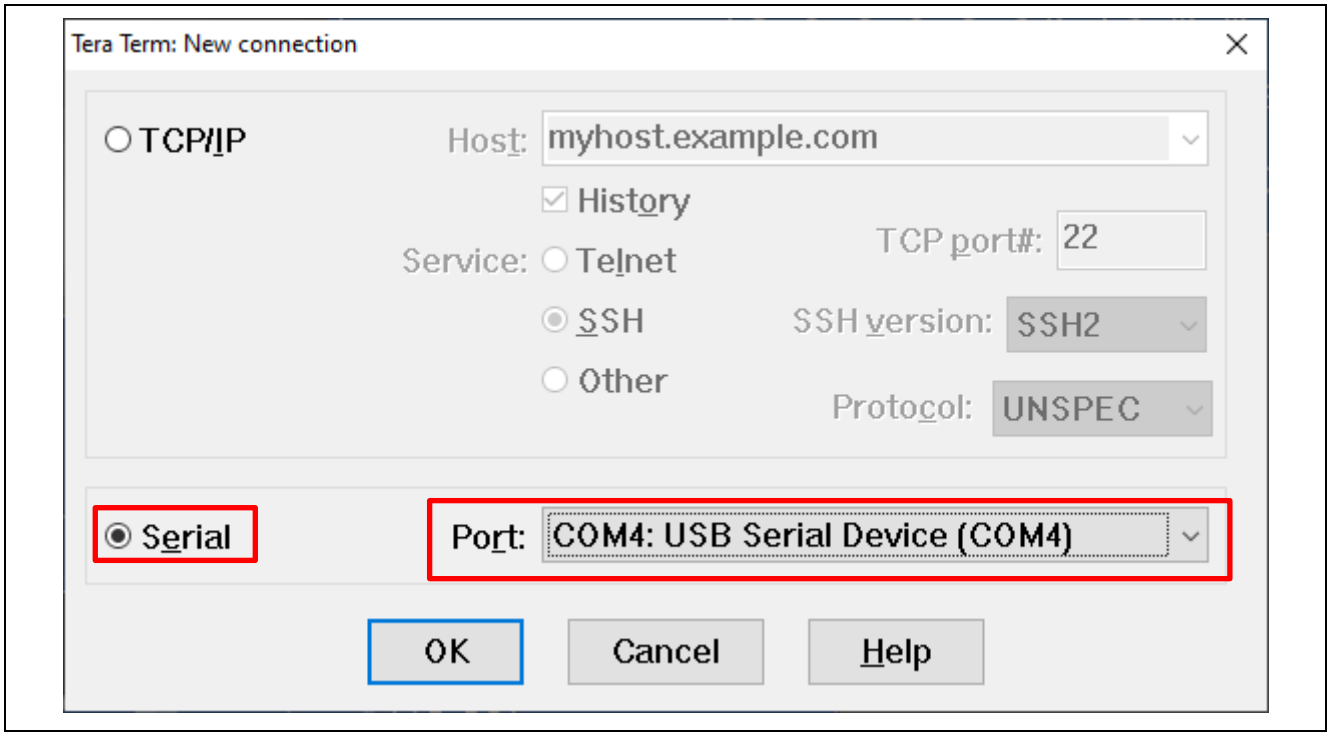


Figure 5. Selecting the Serial Port on Tera Term

5. Using the **Setup** menu pull-down, select **Serial port…** and ensure that the Baud rate is set to 115200, data is set to 8 bit, parity is set to none, and stop is set to 1 bit, as shown below.

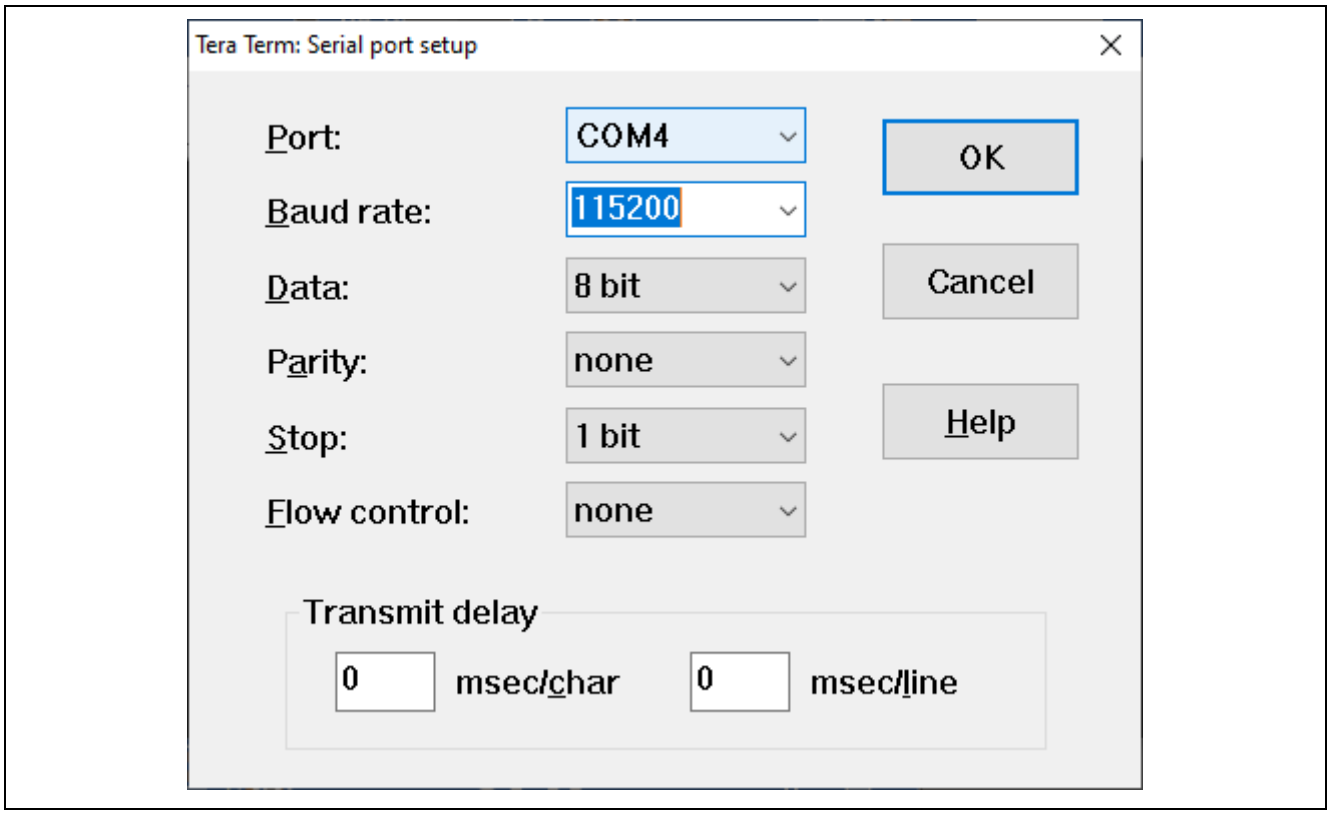


Figure 6. Select Communication Settings

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6. Complete the connection. The ‘welcome and main menu’ screen will be displayed.

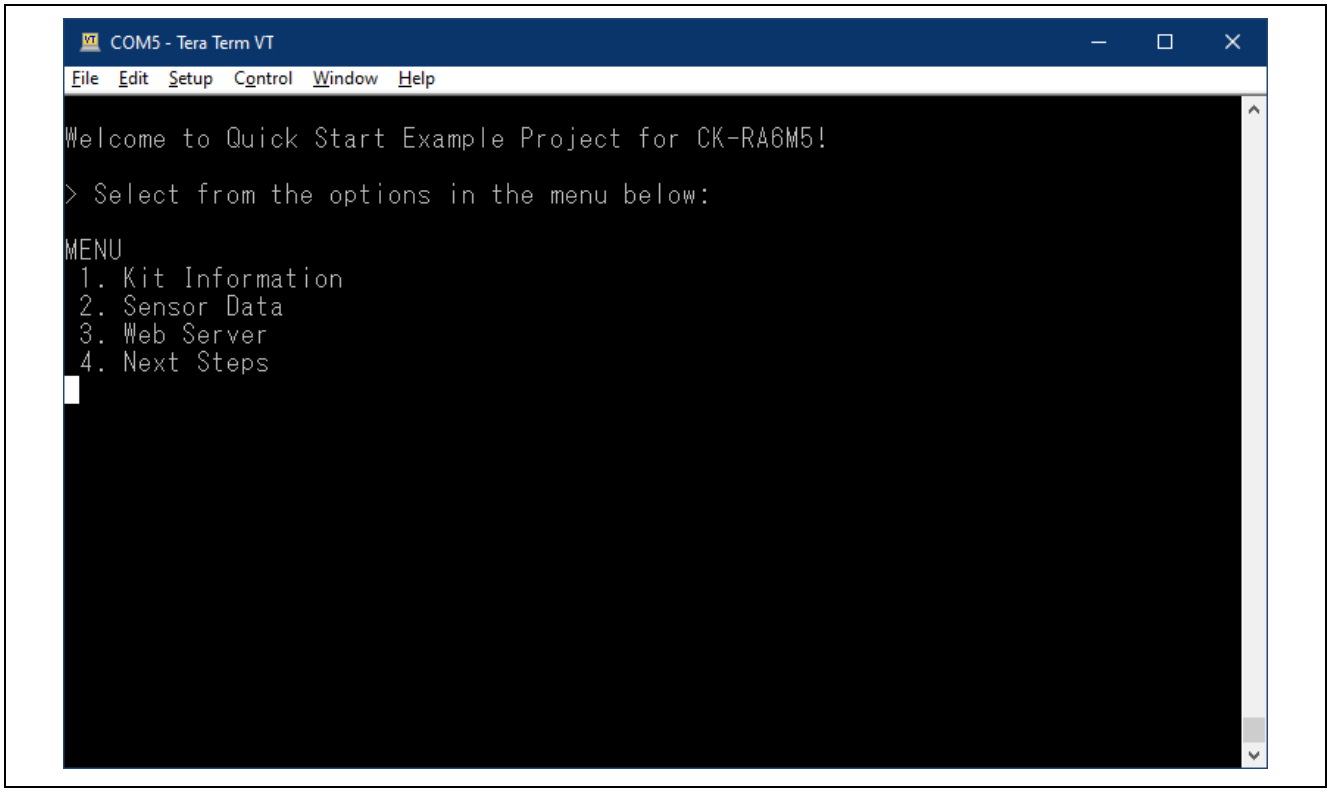


Figure 7. Welcome and Main Menu

7. Press **1** to display the **Kit Information** including the kit name, part number, MCU ID, MCU die temperature, the user LED’s current blinking frequency.

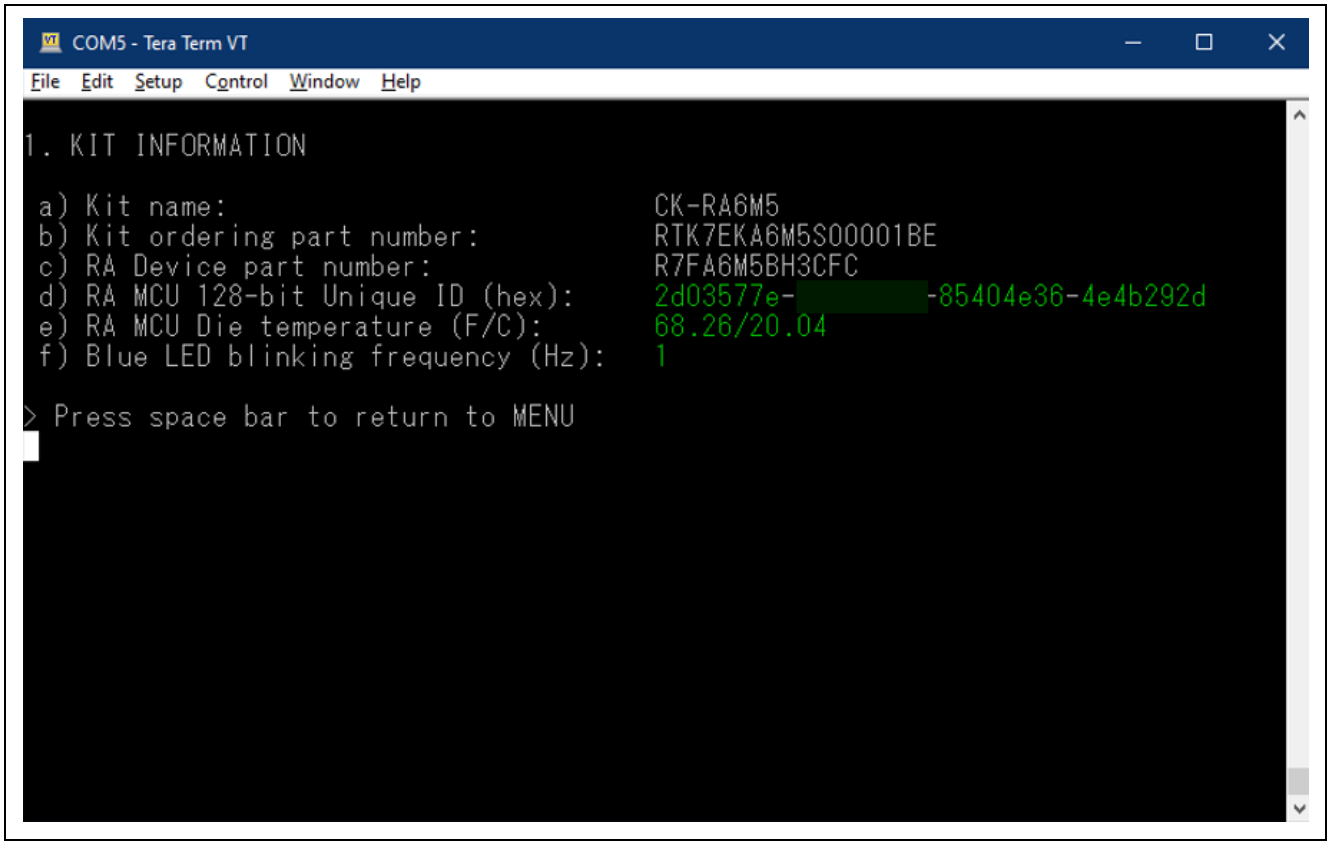


Figure 8. Kit Information

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8. Press **space** to return to the 'welcome and main menu' screen.
9. Press **2** to display the **Sensor Data**. It will display a list of all of the on board sensors along with their readings. Some of these sensors may take some time to provide data, the data will be output as soon as it is available.

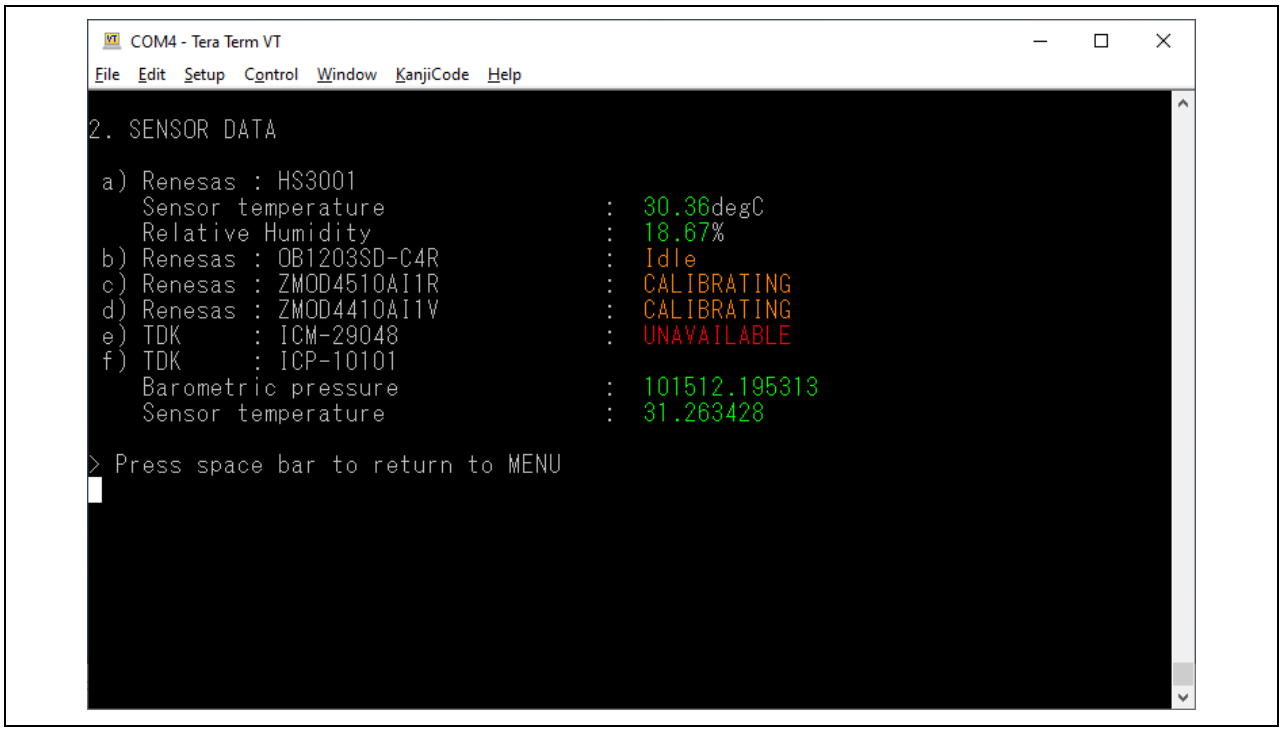


Figure 9. Loading Sensor List

Some sensors like ZMOD4510 require longer periods of training time when the kit is powered the first time. Refer to the Cloud Application Notes for training data and stabilization information of the sensors

The following figure shows the output when all data is available.

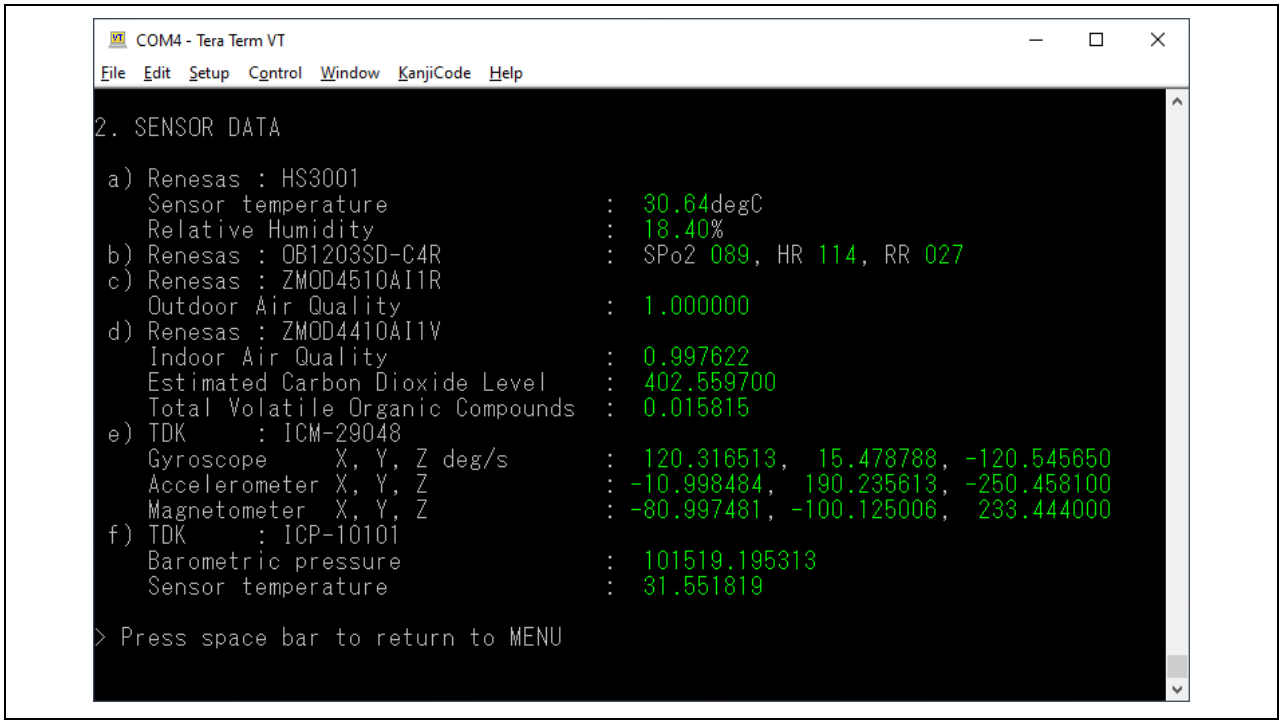


Figure 10. Sensor List with All Data

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10. Press **space** to return to the 'welcome and main menu' screen.
11. Press **3** to display the **Web Server**. This application hosts a web server on the CK-RA6M5 kit showing communication with the host PC as a remote client.

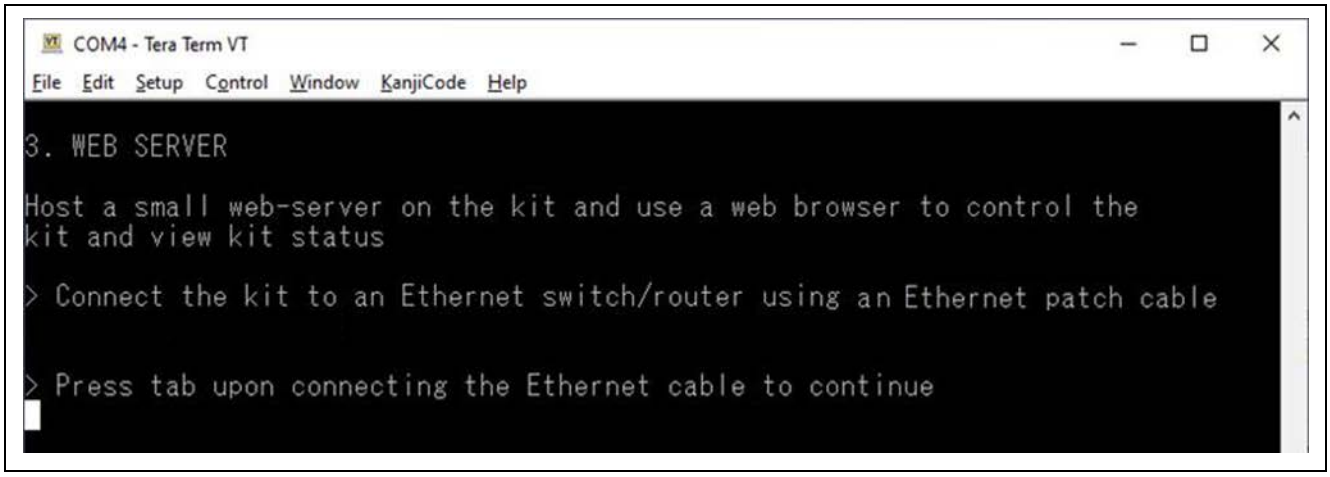


Figure 11. Web Server

12. Connect the Ethernet cable and press **tab**.
    The CK-RA6M5 as supplied, is configured to use DHCP for IP address resolution. Upon successful connection the following is displayed.

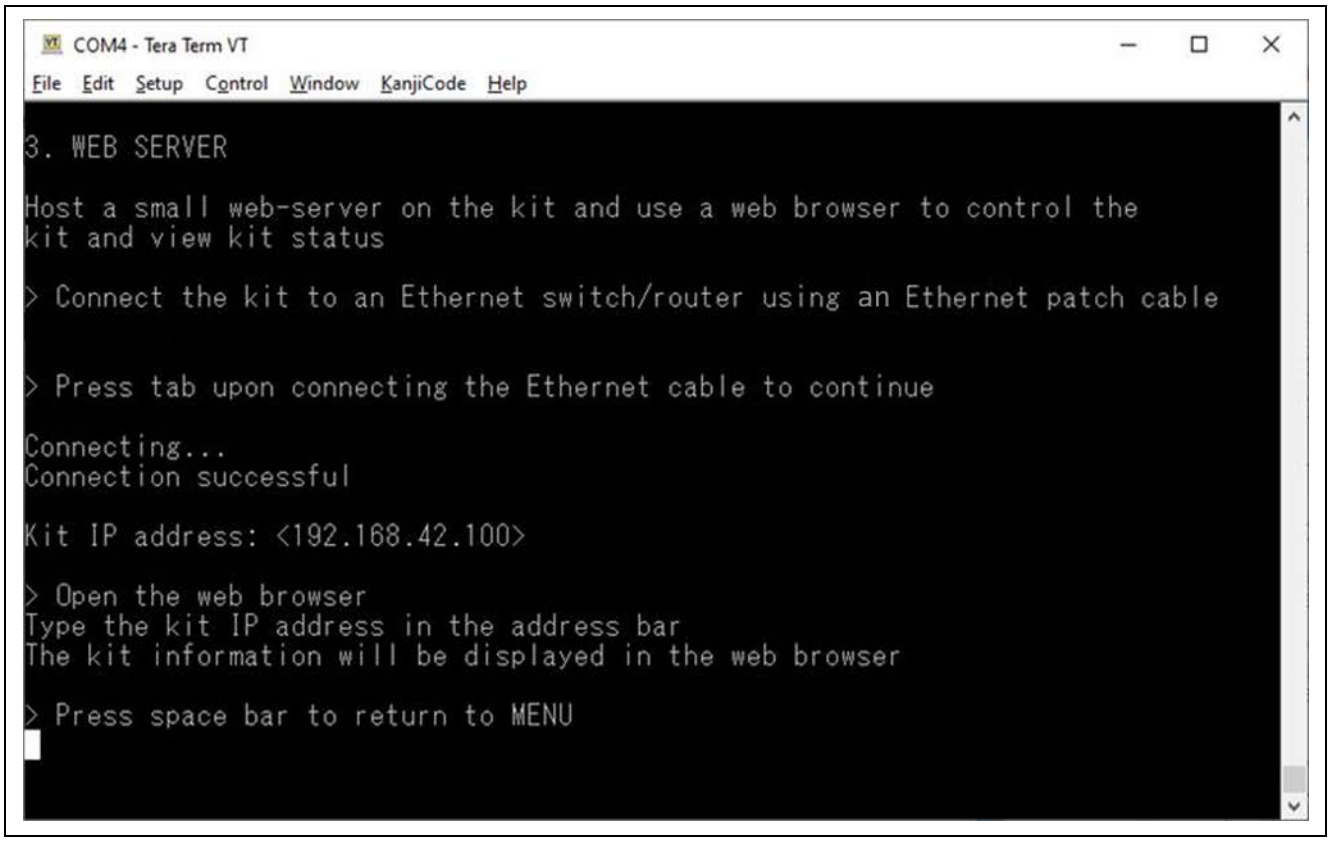


Figure 12. Using DHCP

If the DHCP fails to resolve a route or the DHCP server has been disabled, the application uses the static IP defined in the project. The following should be displayed.

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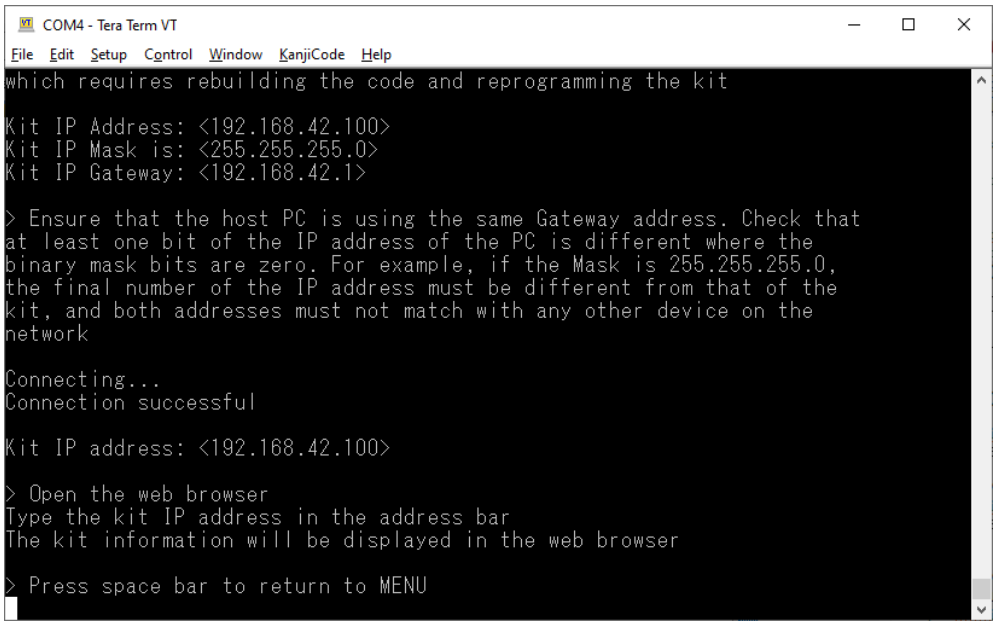


Figure 13. Using Static IP

Note: If desired, the user may configure DHCP/static IP and MAC address using the project configuration (see section 5.4). Save the configuration and re-build, download the project to see the effects of the changes.

13. Once a successful network connection is established, open the web browser on the host PC. Type the IP address of the CK-RA6M5 kit as shown in the Tera Term window in the address bar of the web browser. The following should be displayed in the web browser.

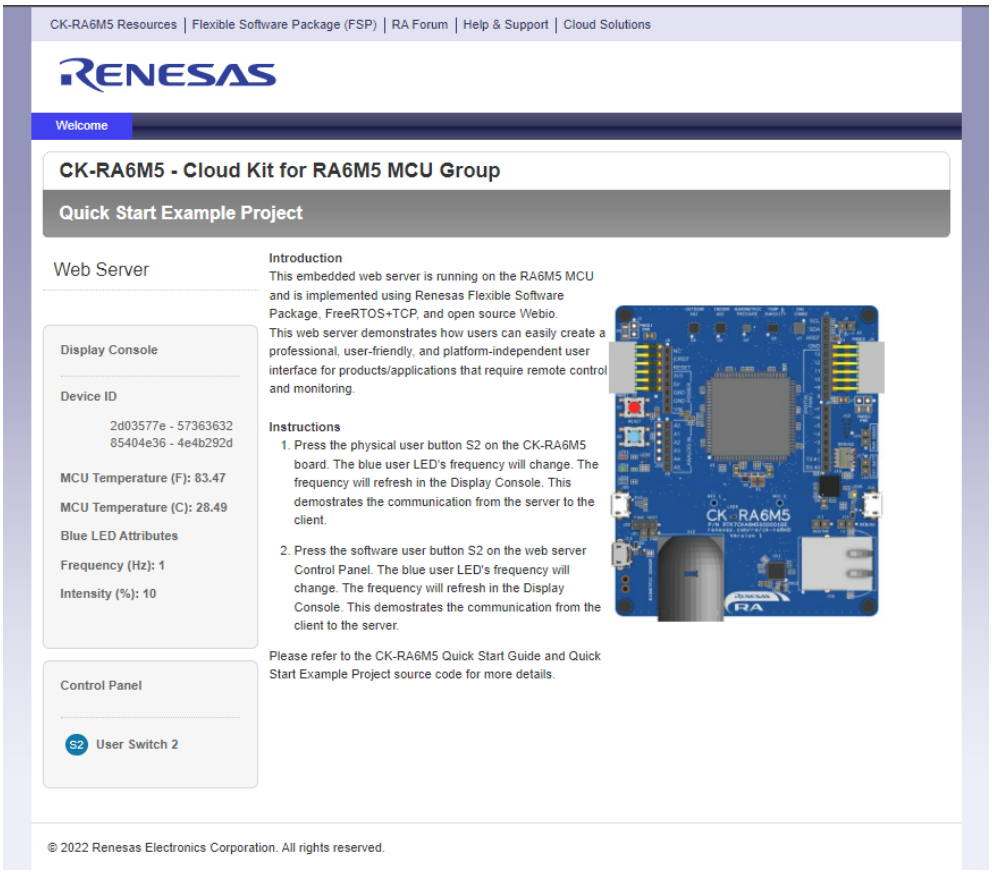


Figure 14. Browser View

Downloaded from Arrow.com.

Pressing the software user switch S2 on the web page control panel adjusts the flash frequency of the blue LED (LED4).

14. In Tera Term, press **space** to return to the 'welcome and main menu' screen.
15. Press **4** to display **Next Steps**.

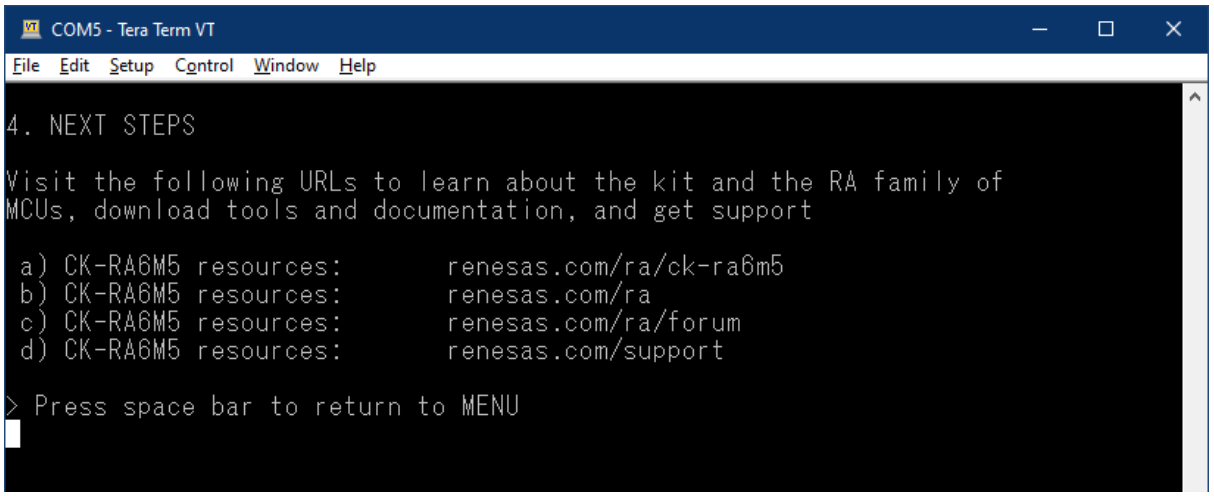


Figure 15. Next Steps

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

5. Customizing the Quick Start Example Project

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

Hardware Requirements

- CK-RA6M5 board
- Micro USB device cable x2
- A PC with at least 2 USB ports
- A router with at least 1 available full duplex Ethernet port*
- Ethernet cable

Software Requirements

- Windows® 10 operating system
- e² studio IDE
- SEGGER J-Link® USB drivers
- 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.

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

Downloaded from Arrow.com.

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 CK-RA6M5 Example Projects Bundle that is available in the Downloads tab of CK-RA6M5 webpage at renesas.com/ra/ck-ra6m5
   - Download and extract the example projects bundle (`r20an0678eu0100-ck-ra6m5-exampleprojects.zip`) to a local directory on the host PC.
   - Browse to the Quick Start example project at `r20an0678eu0100-ck-ra6m5-exampleprojects\ck_ra6m5\_quickstart\quickstart_ck_ra6m5_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.

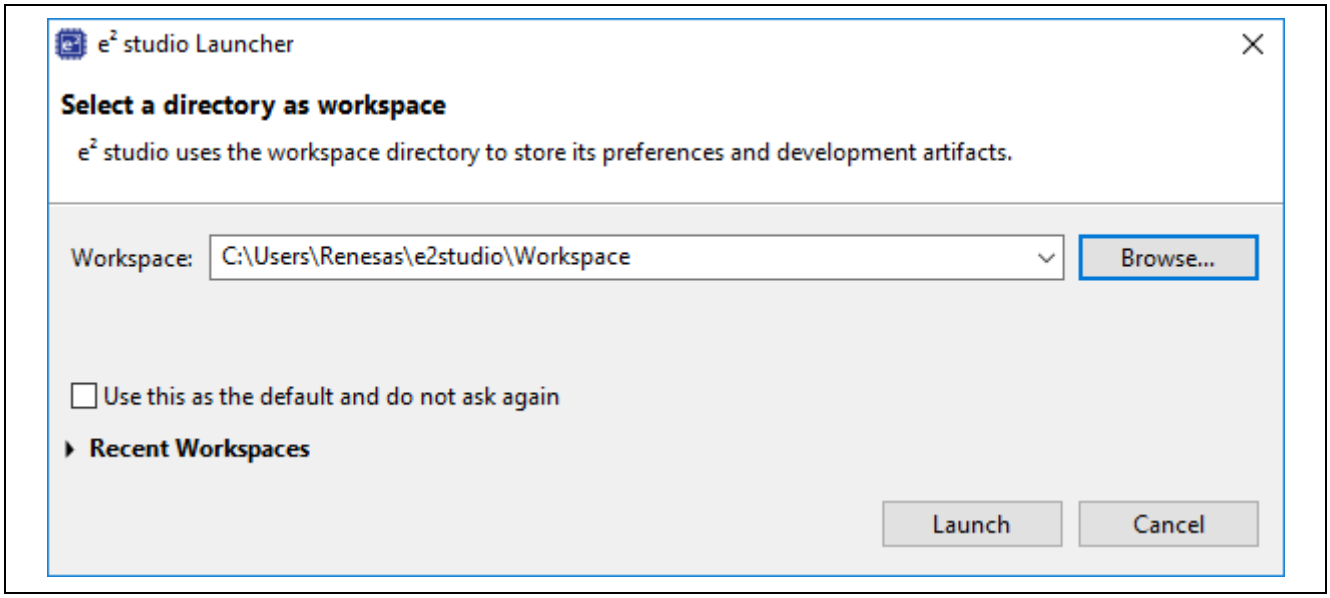


Figure 16. Creating a New Workspace

4. Click **Launch.**

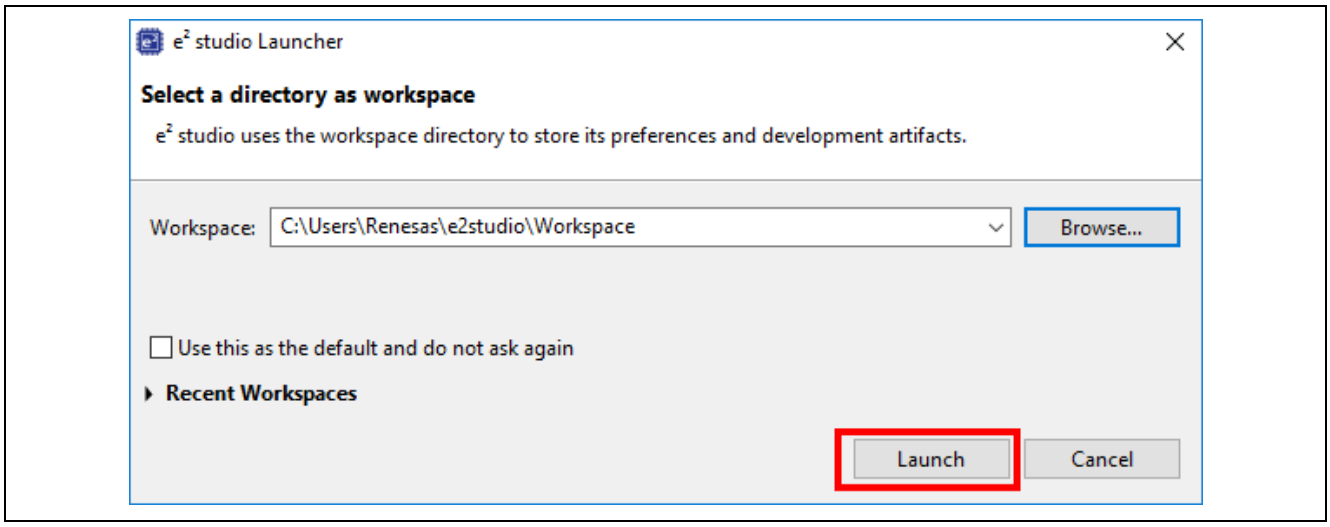


Figure 17. Launching the Workspace

Downloaded from Arrow.com.

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

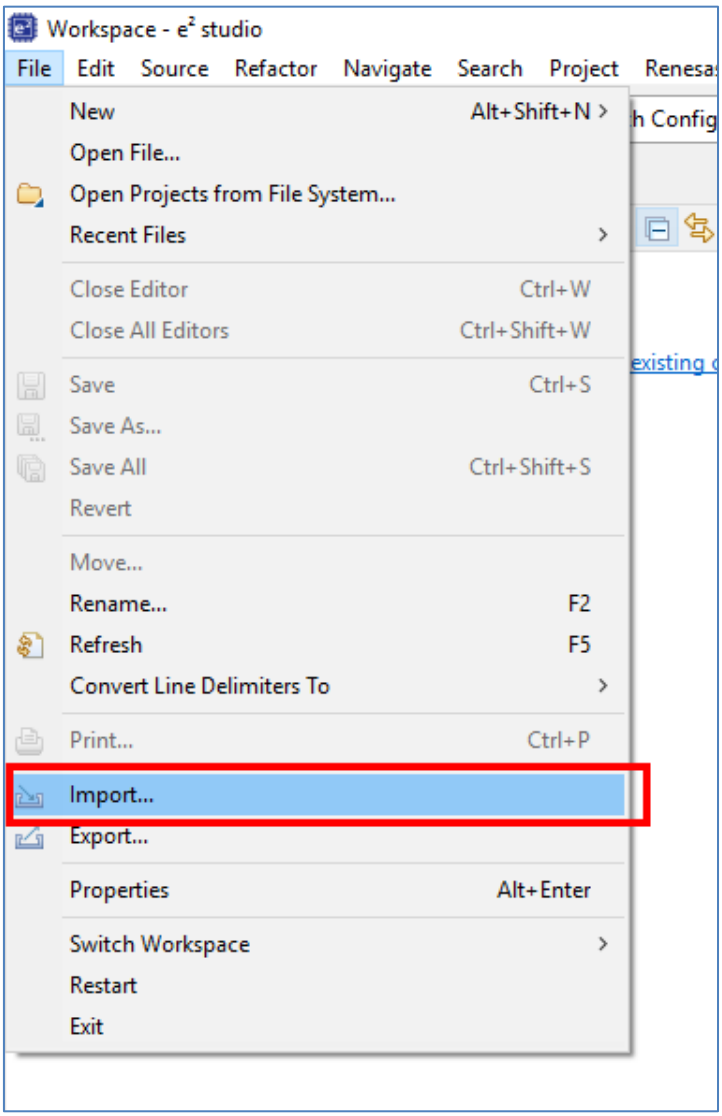


Figure 18. Importing the Project

Downloaded from Arrow.com.

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

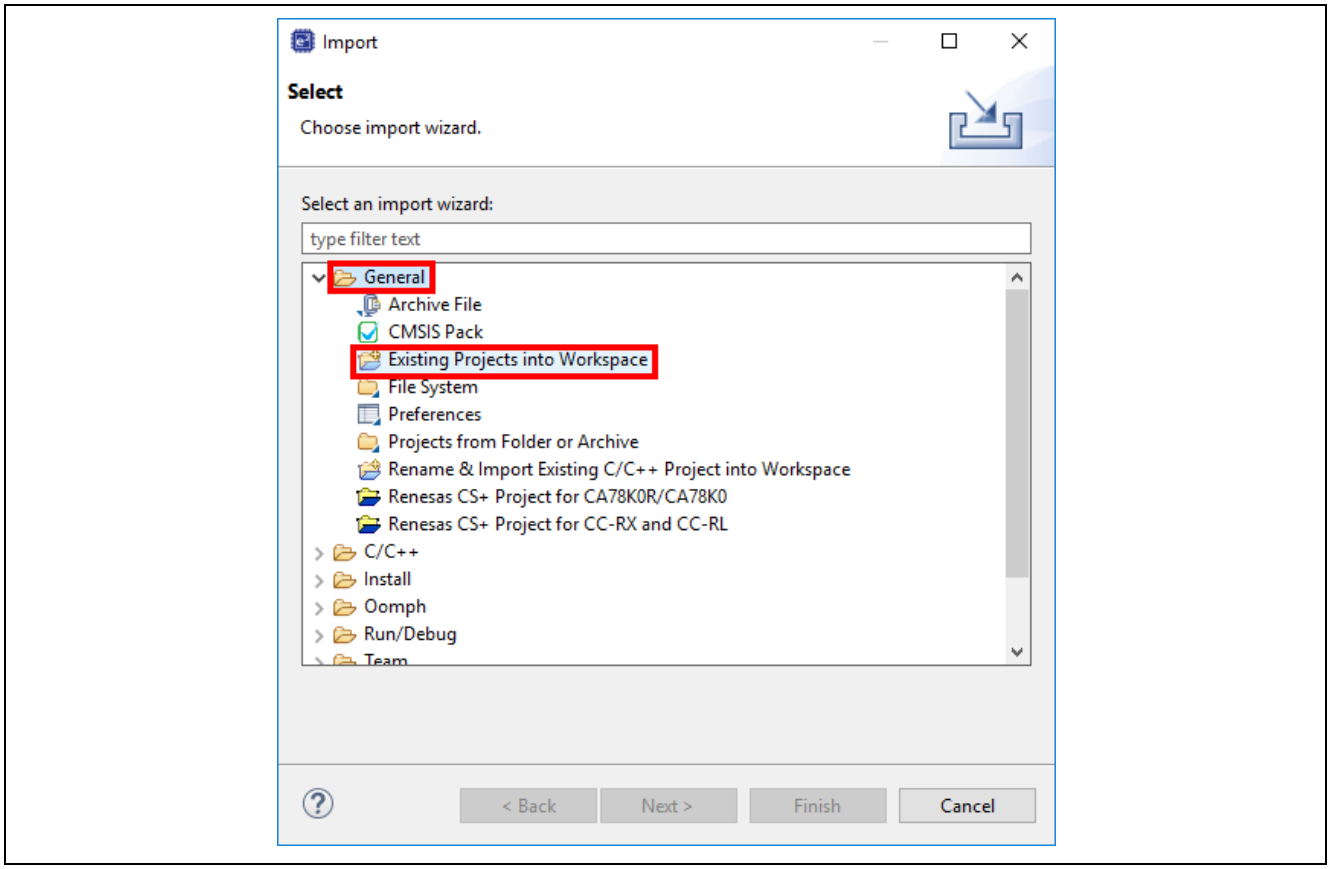


Figure 19. Importing Existing Projects into the Workspace

7. Click **Next**.

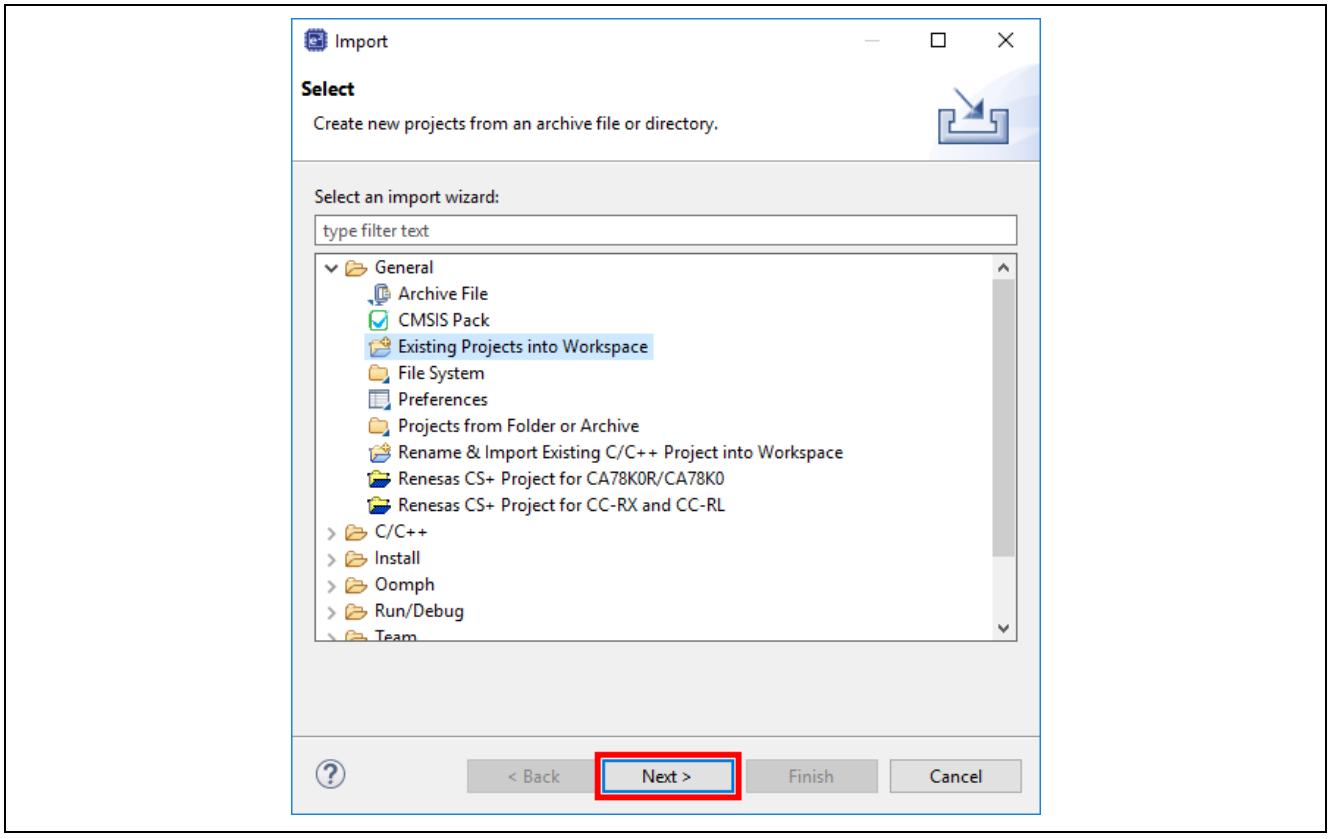


Figure 20. Clicking Next to Import Existing Projects into the Workspace

Downloaded from Arrow.com.

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

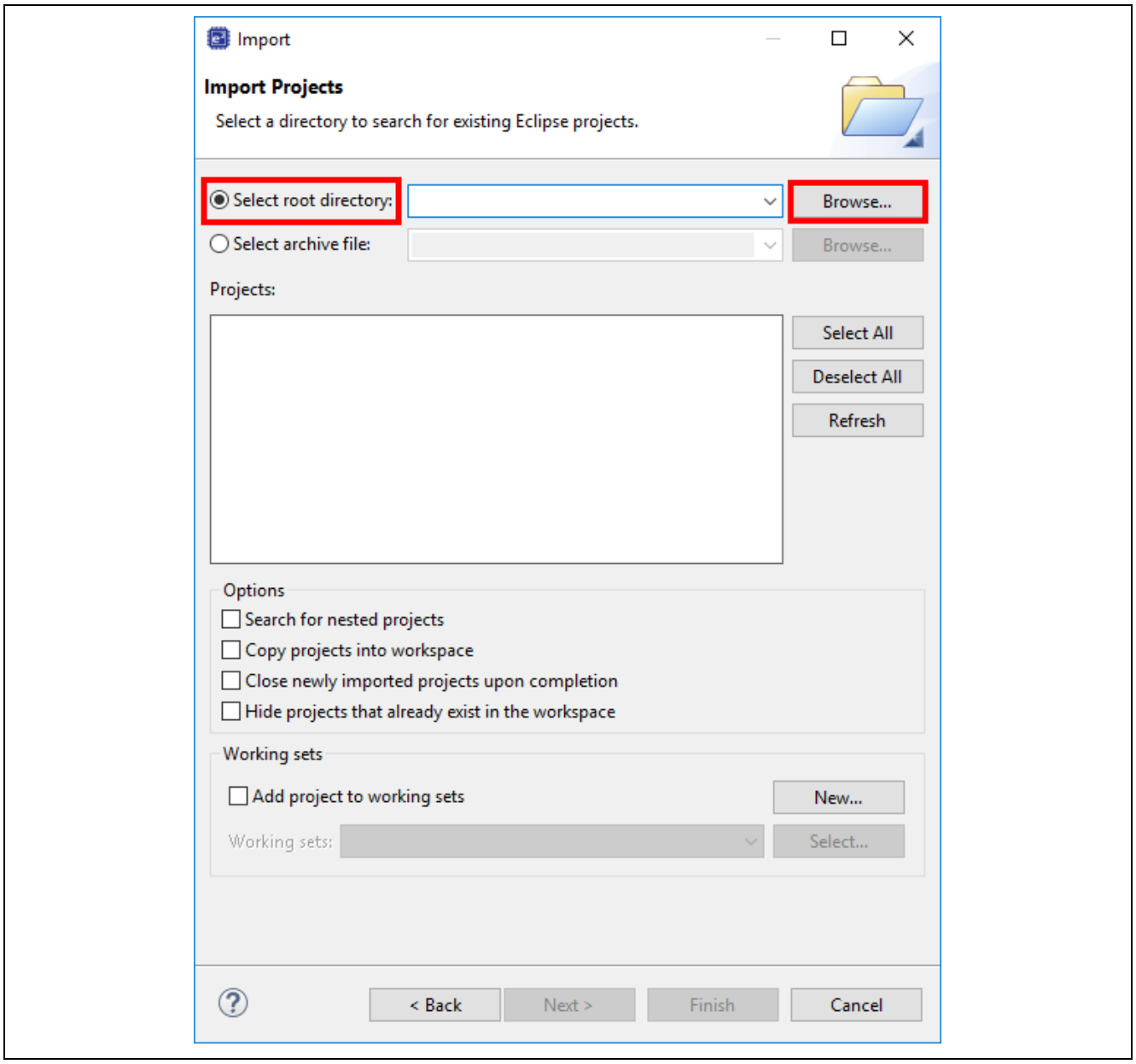


Figure 21. Selecting the Root Directory

Downloaded from Arrow.com.

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

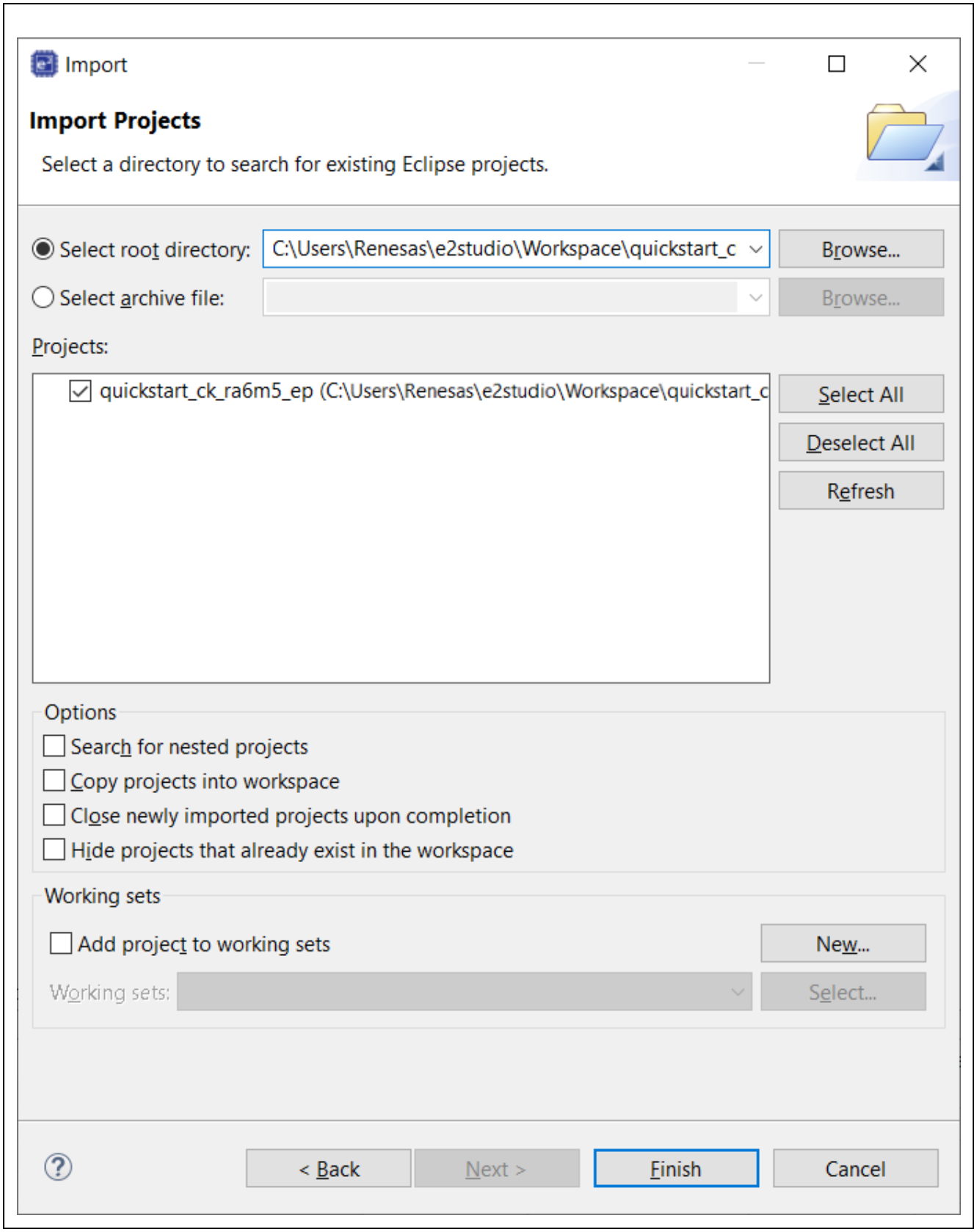


Figure 22. Finishing Importing the Quick Start Example Project

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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.

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.

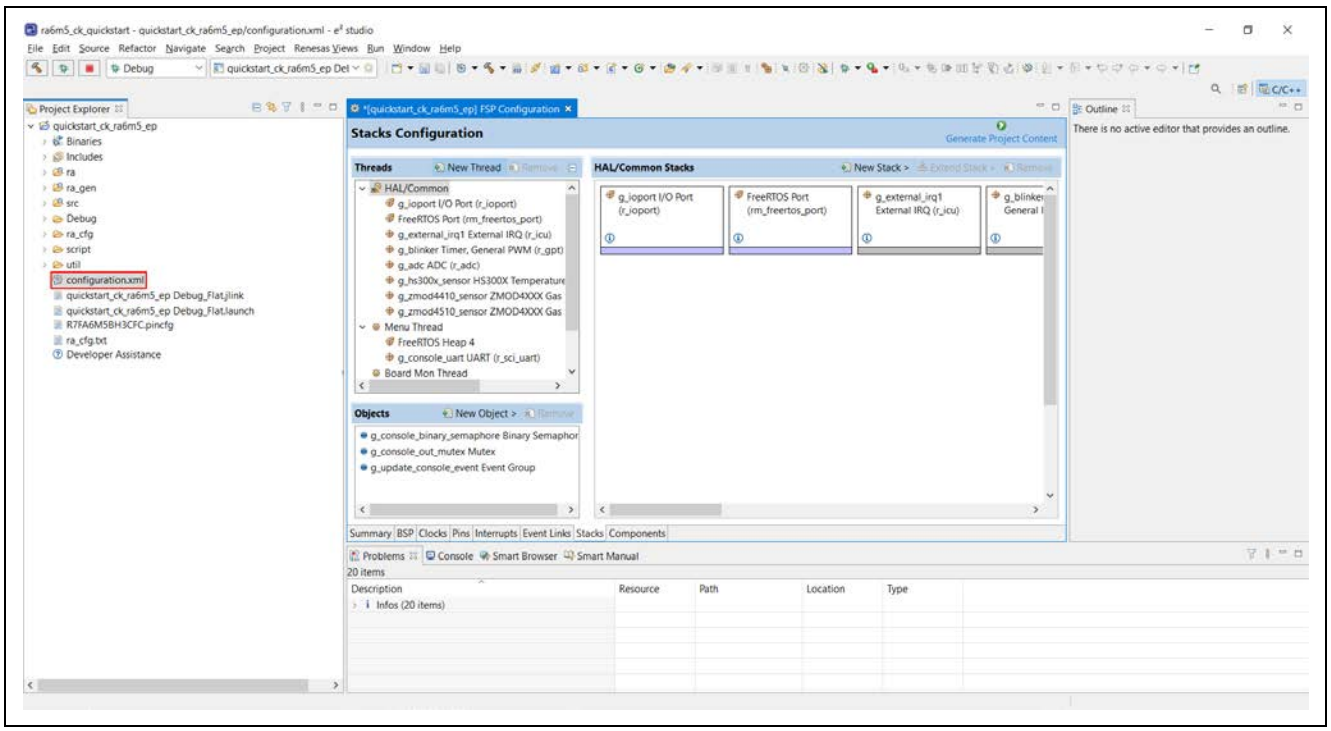


Figure 23. Opening the Configurator

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 25 illustrates modifying the **ADC** driver configuration.

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

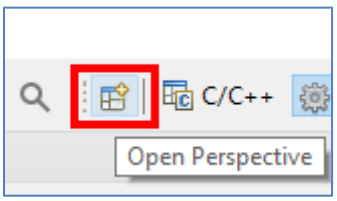


Figure 24. Change Perspective

Downloaded from Arrow.com.

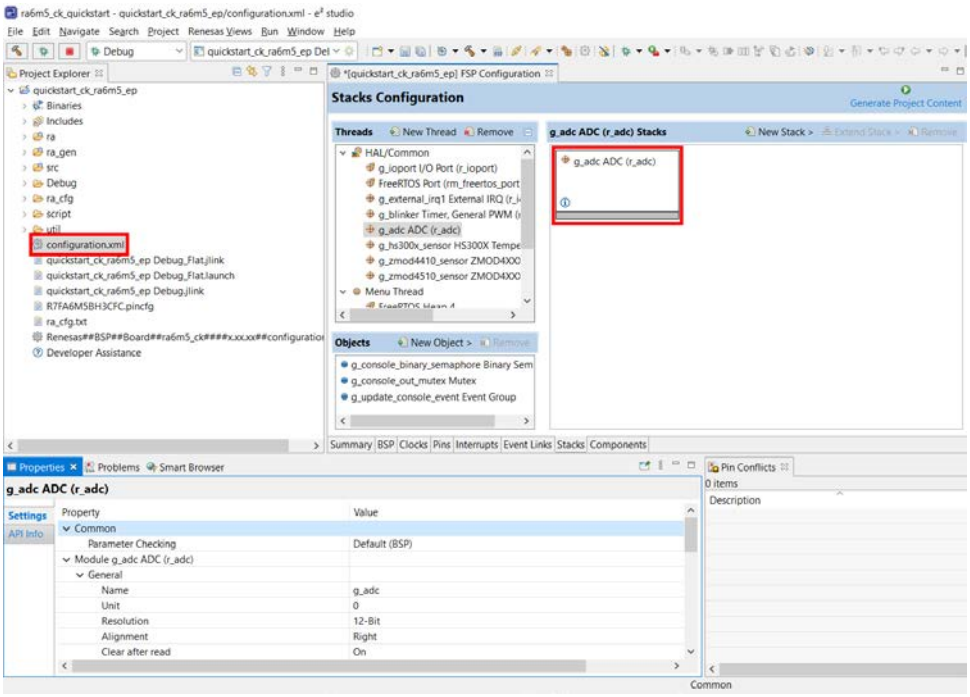


Figure 25. Modifying the Configuration Settings

3. 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**.

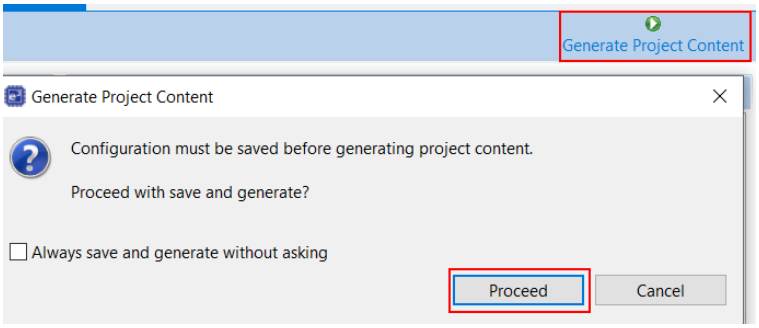


Figure 26. Saving the Configuration Changes

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

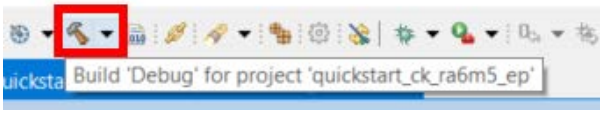


Figure 27. Building the Project

6. A successful build produces an output as follows.

```
 271392     452  523820  795664   c2410 quickstart_ck_ra6m5_ep.elf
'Finished building: quickstart_ck_ra6m5_ep.srec'
'Finished building: quickstart_ck_ra6m5_ep.siz'
' '
' '

12:04:10 Build Finished. 0 errors, 0 warnings. (took 7s.754ms)
```

Figure 28. Successful Build Output

Downloaded from Arrow.com.

5.4 DHCP and Static IP settings

To modify the Ethernet based sample to enable/disable DHCP use the **FreeRTOS+TCP** setting in the stack. The **FSP Configuration** view must be active to access the stack items properties.

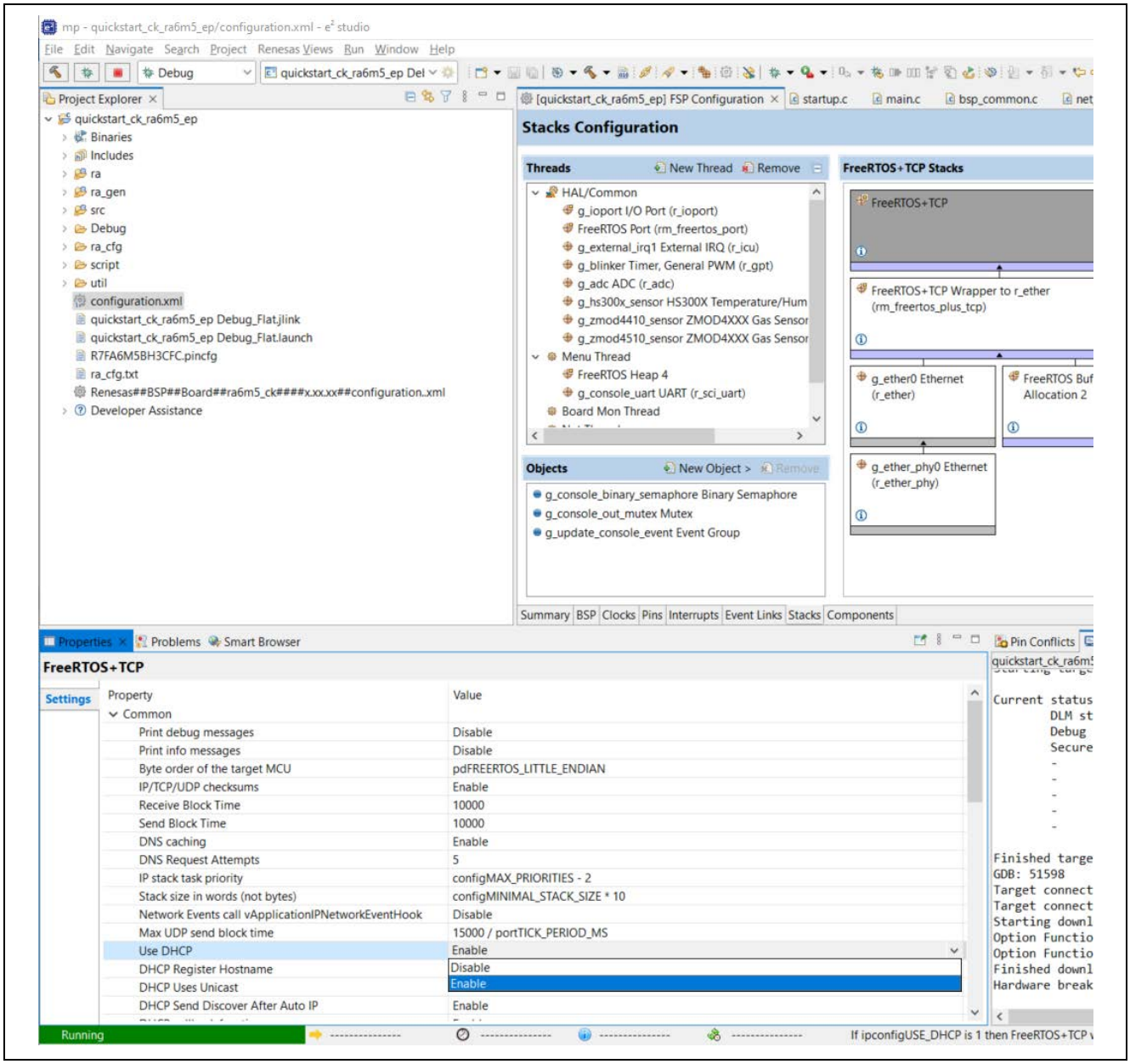


Figure 29. DHCP Setting in FreeRTOS + TCP Stack

If DHCP is disabled, set the static IP address, net-mask and gateway address, to suit your local network.
In File: `src\net_thread_entry.c`

```
/* Static IP configuration, when DHCP mode is not used for the Example Project.
 * Must be populated by the user according to the Network Settings of your LAN.
 * “HOST-PC” and TARGET must be in the same “SUBNET” to access the web browser.
 * This sample address taken from the LAN where it is tested.
 */
#define STATIC_IP_MAC_ADDRESS        {0x00, 0x11, 0x22, 0x33, 0x44, 0x55}
#define STATIC_IP_ADDRESS            {192, 168,   0,  10}
#define STATIC_IP_NET_MASK           {255, 255, 255,   0}
#define STATIC_IP_GATEWAY_ADDRESS    {192, 168,   0,   1}
#define STATIC_IP_DNS_SERVER_ADDRESS {194, 168,   0,   1}
```


Downloaded from Arrow.com.

5.5 Setting Up Debug Connection between the CK-RA6M5 board and Host PC

To program the modified Quick Start example project on to the CK-RA6M5 board, a debug connection is necessary between the CK-RA6M5 board and host PC.

1. connect the USB cable to micro-B USB debug port (J14) of the CK-RA6M5 board.

Note: The CK-RA6M5 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 CK-RA6M5 user's manual.

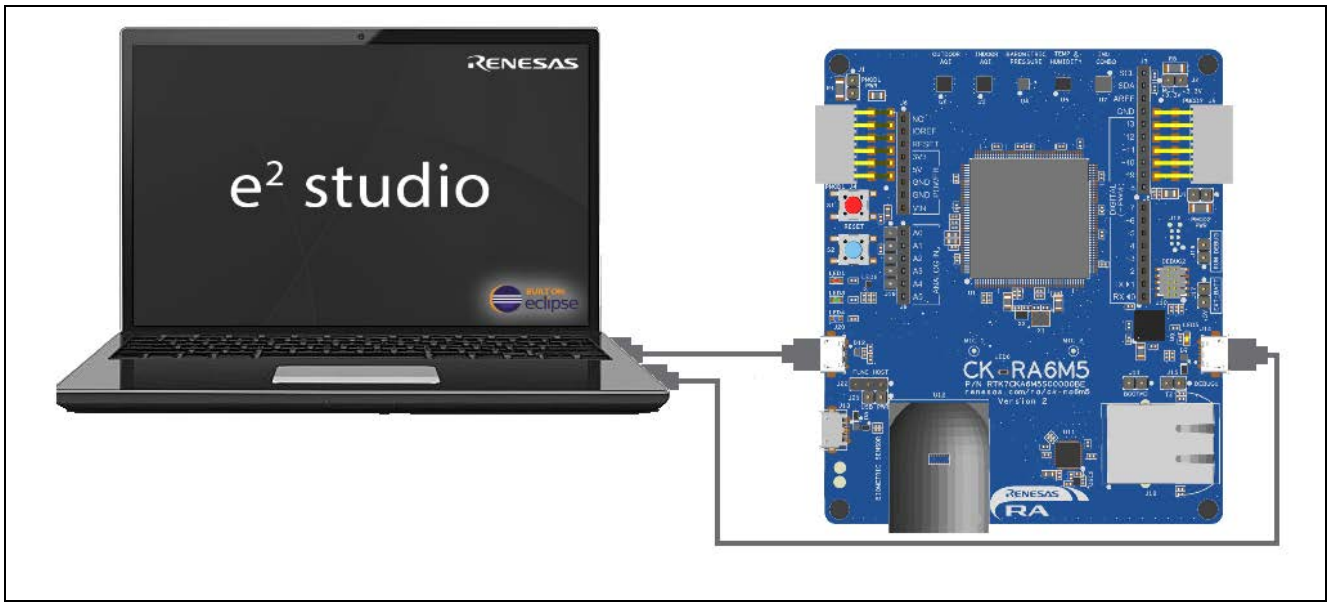


Figure 30. Connecting the CK-RA6M5 Board to the Host PC via USB Debug Port

2. Verify that the debug LED (LED5) stops blinking and lights up orange indicating that the J-Link drivers are detected by the CK-RA6M5 board.

Note: The debug LED (LED5) continues to blink when J-Link drivers are not detected by the CK-RA6M5 board. In that case, make sure that the CK-RA6M5 board is connected to the host PC through the micro-B USB debug port (J14) 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**).

Downloaded from Arrow.com.

5.6 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.

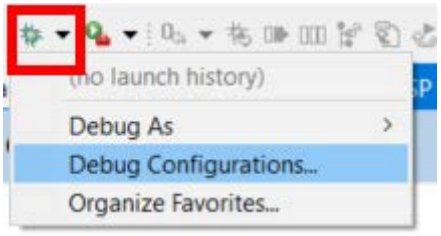


Figure 31. Selecting the Debug Option

2. In the dialogue, on the left-hand pane, expand the **Renesas GDB Hardware Debugging** and select the built image to debug. In this case, the **quickstart_ck_ra6m5_ep Debug_Flat**.

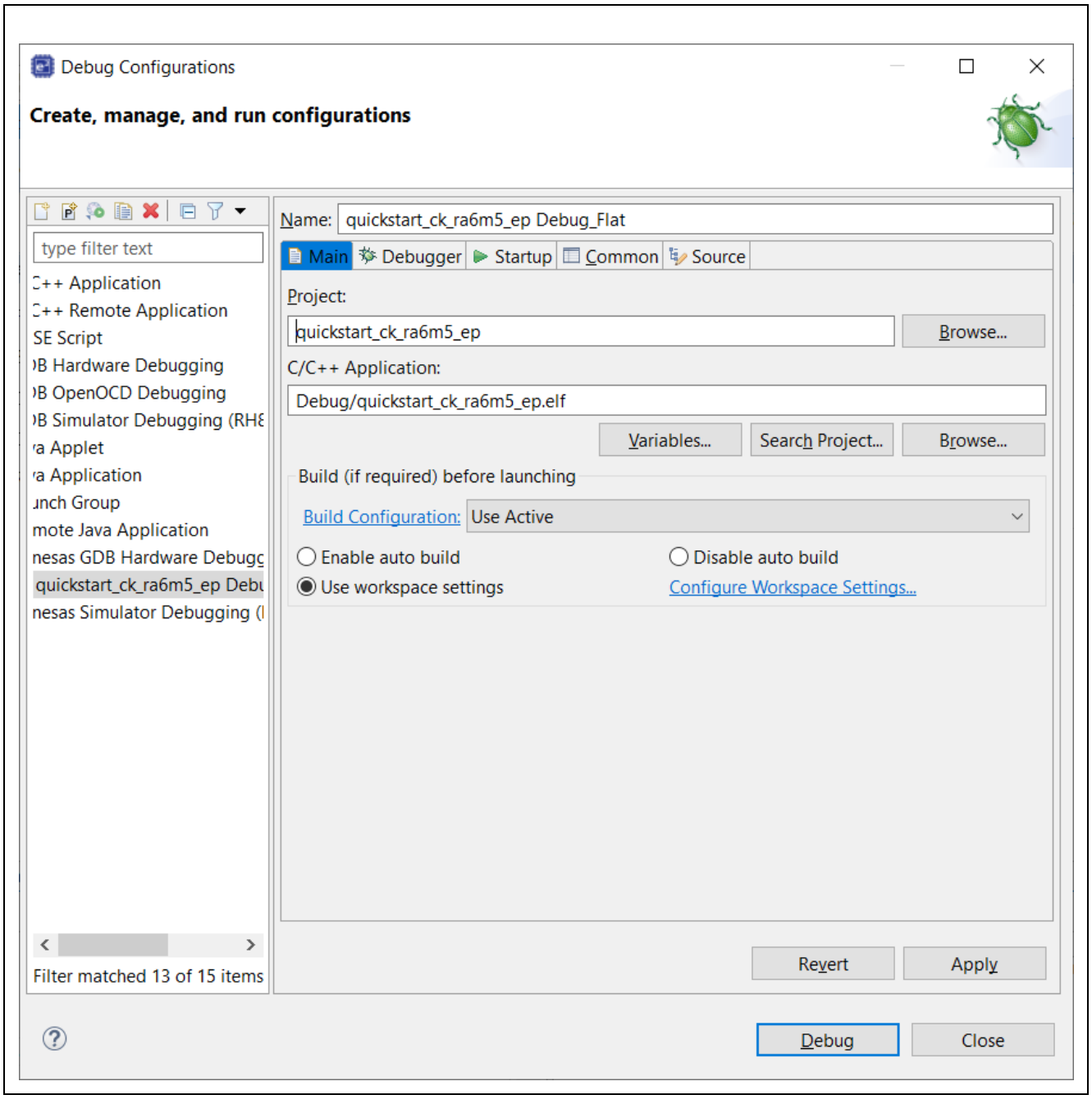


Figure 32. Selecting the Debug Image

Downloaded from Arrow.com.

5.7 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 "Confirm Perspective Switch" dialog box may appear. Click **Yes**.

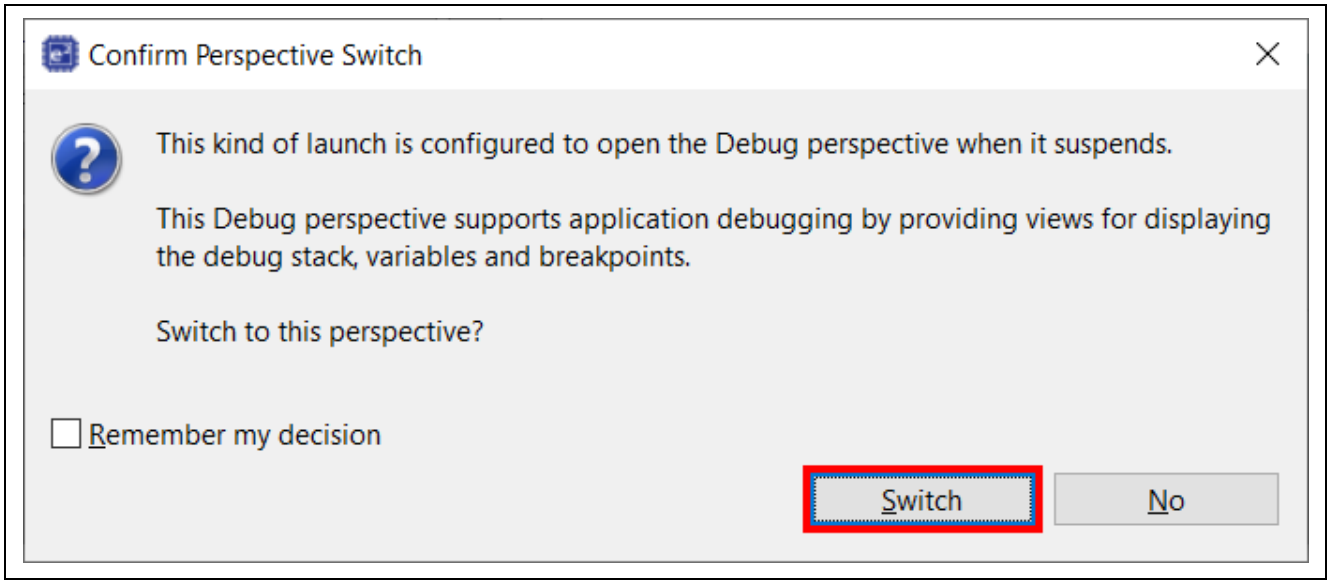


Figure 33. Opening the Debug Perspective

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



Figure 34. Executing the Project

5. The modified Quick Start example project is programmed into the CK-RA6M5 board and is running. The project can be paused, stopped, or resumed using the debug controls.

Downloaded from Arrow.com.

6. Next Steps

1. To learn more about the CK-RA6M5 kit, refer to the CK-RA6M5 user's manual and design package available in the Documents and Download tabs respectively of the CK-RA6M5 webpage at renesas.com/ra/ck-ra6m5
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 CK-RA6M5 kit are available in the CK-RA6M5 Example Projects Bundle. The example projects bundle is available in the Downloads tab of CK-RA6M5 webpage.
   - Download and extract the example projects bundle (`r20an0678eu0100-ck-ra6m5-exampleprojects.zip`) to a local directory on the host PC.
   - Refer to the list of all example projects (`r20an0678eu0100-ck-ra6m5-exampleprojects.pdf`) available inside the example projects bundle.
   - Browse to the desired example project (for example: adc_ck_ra6m5_ep) in the example projects bundle (`r20an0678eu0100-ck-ra6m5-exampleprojects\ck_ra6m5\adc\adc_ck_ra6m5_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.
3. To learn how to create a new e² studio project from scratch, refer to Chapter 2. Starting Development in the *FSP User's Manual* (renesas.com/ra/fsp). To learn how to use e² studio, refer to the User's 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.

CK-RA6M5 Resources	renesas.com/ra/ck-ra6m5
RA Kit 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

Provide Feedback/Request a Feature

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

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

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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	May.27.22	—	Initial release
1.01	Aug.18.22	9	Corrected reference to J14.

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