

QE for Display[RX,RA] V3.6.0, QE for Camera[RA] V1.1.0

Release Note

Thank you very much for your interest in QE for Display[RX,RA] V3.6.0, QE for Camera[RA] V1.1.0.

This document describes this product installation, restrictions and so on. Please read this document before using the product.

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1. About QE for Display[RX,RA] V3.6.0, QE for Camera[RA] V1.1.0

1.1 Summary

QE for Display[RX,RA] V3.6.0 and QE for Camera[RA] V1.1.0 are one of several Solution Toolkit which operate under the e2 studio integrated development environment.

In the following embedded system development, this product allows for easy initial adjustment of display connection (display timing adjustment and image quality adjustment) and create GUI. It also allows for easy initial adjustment of camera image capture (the size and starting position of the image capture) and display it on LCD. This shortens the development period.

- Display GUI on LCD using Graphic LCD Controller (a display controller mounted on the RX family and RA family* of MCUs) image display function, emWin GUI software package and Aeropoint GUI for RX. (* The standalone version does not support RA family of MCUs.)
- Display GUI on a serial-connected LCD using serial communication in the RX family and the emWin GUI software package.
- Capture external images using Capture Engine Unit (a capture module mounted on the RA family) and display them on LCD or save them in memory.

QE for Display[RX,RA] V3.6.0 and QE for Camera[RA] V1.1.0 are the same plug-in. Therefore, you can install both items by installing either one of the two. The software would be installed in e2 studio as "Renesas QE for Display[RX,RA]/QE for Camera[RA]".

1.2 New Functions / Changes

1.2.1 Support Graphics LCD Controller (GLCDC) for RA8E2 and RA8P1 MCU

This product supports the adjustment of Graphics LCD Controller (GLCDC) for RA8E2 and RA8P1 MCU. You can use the emWin GUI tool to create an image to display on the LCD, and adjust the GLCDC settings in real time to adjust the image display effect.

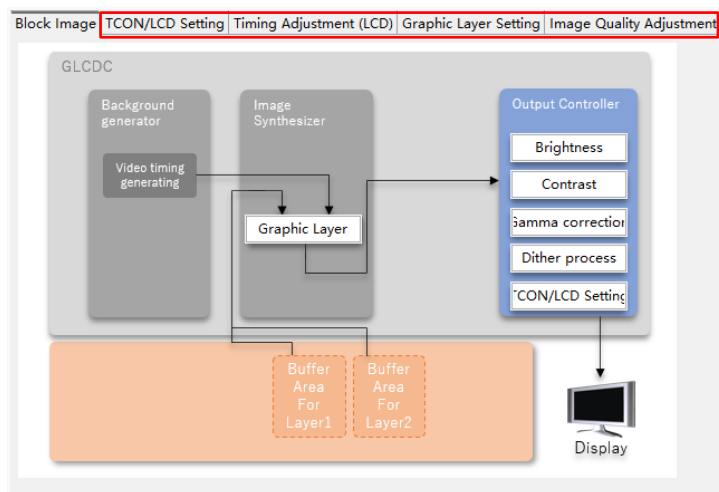


Figure 1-1 RA8E2 Graphics LCD Controller (GLCDC) Setting

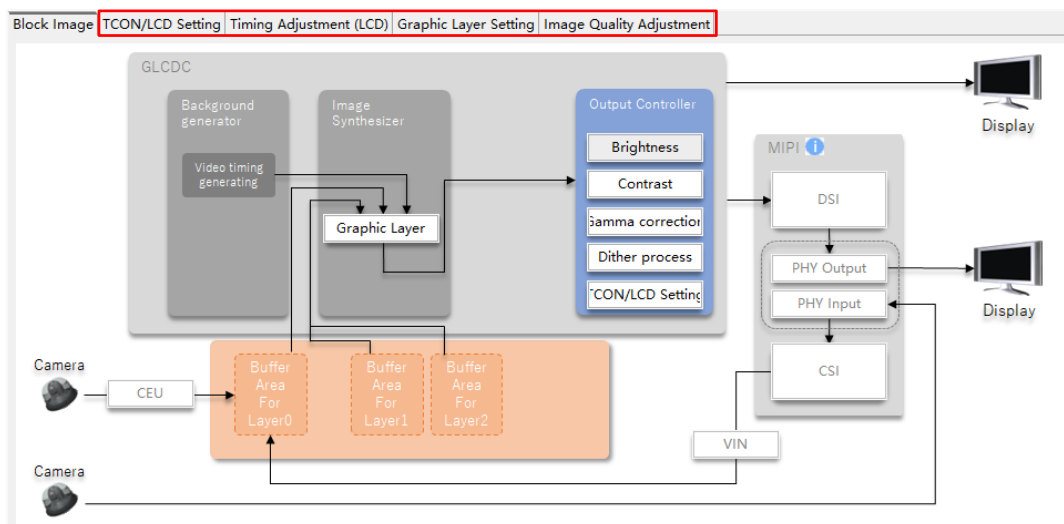


Figure 1-2 RA8P1 Graphics LCD Controller (GLCDC) Setting

1.2.2 Support Capture Engine Unit (CEU) for RA8P1 MCU

This product supports the adjustment of Capture Engine Unit (CEU) for RA8P1 MCU. You can use the camera to capture external image data through the CEU module within the RA8P1 MCU and store the image data into memory. The size and starting position of the captured image can be adjusted dynamically.

Block Image **Timing Adjustment (Camera)**

Timing Adjustment(CEU)

Signal Type : Type 1 (DE+DE)

VCS [line] 0

VCW [line] 640

HCS [pixel] 0 HCW [pixel] 480

Input Setting

Data Bus Size 8bit

HSYNC Polarity High

VSYNC Polarity High

Data Sample Point Rising edge of the camera clock

H-Sync Sample Point Rising edge of the camera clock

V-Sync Sample Point Rising edge of the camera clock

Capture Mode Data Synchronous Fetch Mode

Output Setting

☐ Swap 8-bit Units ☐ Swap 16-bit Units ☐ Swap 32-bit Units

Data Enable Buffer Size 0

Burst Transfer Mode Transfer in 256-byte units

Figure 1-3 RA8P1 Capture Engine Unit (CEU) Setting

1.2.3 Improvement on using emWin GUI

- When using EK-RA6M3G board, it is no longer necessary to make the following two configurations.
 - Set LCD backlight P603 as "Output mode (Initial High)" mode in the Pins page of FSP Configuration.
 - Change the "Section Name of Frame Buffer" value of Graphic Layer n * as ".bss" in the display adjustment view. (* n = 1, 2)
- When using RA devices, you can directly add the "SEGGER emWin" component to the "Display User Interface Application" component. An additional "SEGGER emWin" component is no longer necessary to add.

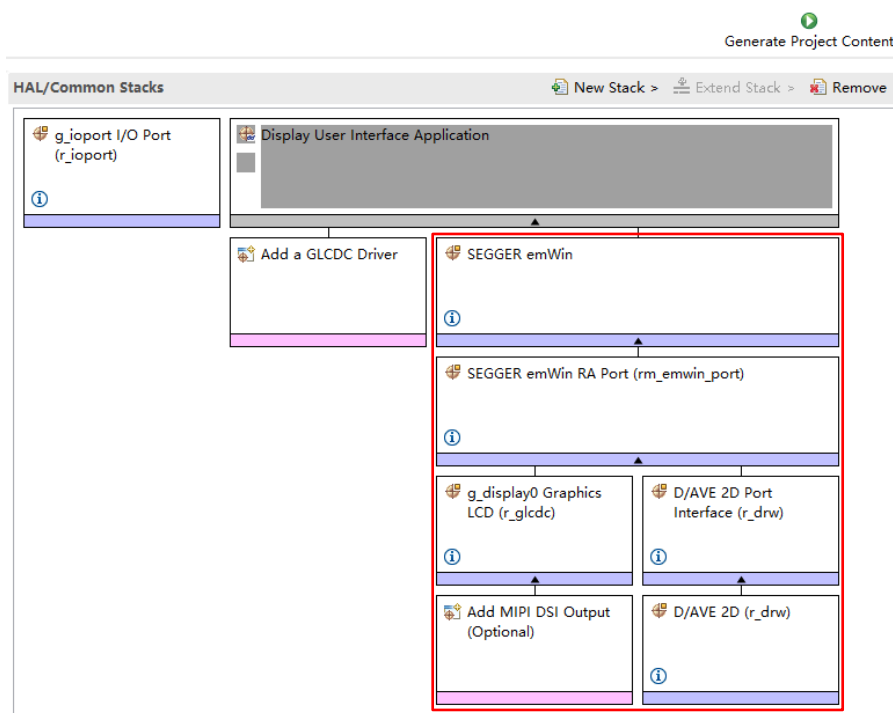


Figure 1-4 Add "SEGGER emWin" component

1.2.4 Fixed the issue that DE signal TCON GUI setting is disabled when using custom LCD

This product fixes the issue that the DE signal TCON GUI setting is disabled when using a custom LCD of type "Display Type 3".

Edit Custom Display Data

Maker/Type : Custom_Maker

Model Name/Size : Custom_Model1

☐ Display Type 1
☐ Display Type 2
☒ **Display Type 3**

CLK Vsync Hsync DE Data (DE=Data Enable)

Divert the existing data

Recommend input to the blank cell.

Parameter	Min.	Typ.	Max.
Panel Clock Frequency (PCF) [MHz]	5.0	9.0	12.0
Panel Clock Period (PCP) [ns]	83.33333333...	111.1111111...	200.0
Horizontal Frequency (HF) [KHz]	15.38461538...	16.66666666...	18.18181818...
Horizontal Period (HP) [us]	55.0	60.0	65.0
Horizontal Total Period (HTP) [Clock]	520	525	800
Horizontal Pulse Width (HPW) [Clock]	1	1	-
Horizontal Display Period (HDP) [Clock]	480	480	480
Horizontal Front Porch (HFP) [Clock]	4	5	65
Horizontal Back Porch (HBP) [Clock]	35	39	254
Vertical Frequency (VF) [Hz]	-	-	1000.0
Vertical Period (VP) [ms]	1.0	-	-
Vertical Total Period (VTP) [Line]	277	288	400
Vertical Pulse Width (VPW) [Line]	1	1	-
Vertical Display Period (VDP) [Line]	272	272	272
Vertical Front Porch (VFP) [Line]	2	8	97
Vertical Back Porch (VBP) [Line]	2	7	30

URL :

OK Cancel Help

Figure 1-5 Custom LCD with "Display Type 3"

MCU/MPU Package Developer Assist Browser *Display/Camera Tuning RX,RA (QE) X

Start Adjustment

LCD Maker/Type : Custom_Maker (Custom) Model Name/Size : Custom_Model1

Block Image TCON/LCD Setting Timing Adjustment (LCD) Graphic Layer Setting Image Quality Adjustment

Panel Driver Signal (TCON) Output Selection

Vsync: TCON0 High Active

Hsync: TCON1 High Active

DE: TCON2 High Active

LCD Setting

LCD Output Format: 24bit (GLCDC_OUT_FORMAT_24BITS_RGB888)

Timing of Output Data: Falling (GLCDC_SIGNAL_SYNC_EDGE_FALLING)

Background Color: 0x00 000000

Bit-endian of Output Data: Little Endian (GLCDC_ENDIAN_LITTLE)

Pixel Order of Output Data: BGR (GLCDC_COLOR_ORDER_BGR)

LCD Backlight Control

☒ Enable Control

Port Number: PORT0 Bit Position: BIT0 Low Active

LCD Reset Control

☒ Enable Control

Port Number: PORT0 Bit Position: BIT0 Low Active

Figure 1-6 DE signal TCON GUI setting

1.3 Supported Environment

- Windows 10, Windows 11
- Renesas e² studio 2025-04 (or later)
- CS+ for CC V8.12.00 (or later)
- IAR EW for Renesas RX V5.10.1 (or later)
- RX Smart Configurator V2.22.0 (or later)

1.4 Supported Microcontroller

The following table describes the supported microcontrollers and their functions.

Function	RX Family	RA Family
GLCDC	➤ RX600 Series RX65N groups*, RX651 groups*, RX66N groups (* ROM capacity: 1.5 MB to 2 MB only) ➤ RX700 Series RX72M groups*, RX72N groups (* 100-pin is not supported)	➤ RA6 Series RA6M3 groups ➤ RA8 Series RA8D1 groups, RA8E2 groups, RA8P1 groups
MIPI-PHY	-	➤ RA8 Series RA8D1 groups
MIPI-DSI	-	➤ RA8 Series RA8D1 groups
CEU	-	➤ RA8 Series RA8D1 groups, RA8P1 groups
Serial Connection	All RX family* (*Only microcontrollers supported by Smart Configurator)	-

Table 1-1 Supported Microcontrollers and Functions

1.5 Supported Software

- RX Firmware Integration Technology (FIT)
 - Graphic LCD Controller Module: r_glcdc_rx V1.60 (or later)
 - QE for Display Middleware Module: r_qe_display_rx V1.10 (or later)
 - emWin v6.34 Module: r_emwin_rx V1.20 (V6.34.g.1.20) (or later)
 - Aeropoint Module: r_aeropoint_rx V1.00 (or later)
- RA Flexible Software Package (FSP) V6.0.0 (or later)

1.6 Supported LCD Controller for Serial Connection

- ST7715
- ILI9341

1.7 Supported Evaluation Board

■ CEU Function

- Evaluation Kit for RA8D1
- Evaluation Kit for RA8P1

The following camera module is connected to the evaluation board.

- Evaluation Kit for RA8D1: ArduCam B0156
- Evaluation Kit for RA8P1: ArduCam CU450_OV5640

■ GLCDC Function

- Renesas Starter Kit+ for RX65N-2MB
- Renesas Starter Kit+ for RX72N
- RX65N Envision Kit
- RX72N Envision Kit
- Graphics Evaluation Kit for RA6M3
- Evaluation Kit for RA8D1
- Evaluation Kit for RA8E2
- Evaluation Kit for RA8P1

■ MIPI-PHY and MIPI-DSI Function

- Evaluation Kit for RA8D1

■ Serial Connection Function

- Renesas Starter Kit for RX130-512KB
- Renesas Starter Kit for RX140
- Renesas Starter Kit for RX231
- Renesas Solution Starter Kit for RX23W
- Renesas Starter Kit+ for RX64M
- Renesas Starter Kit for RX660
- Renesas Starter Kit+ for RX671
- Renesas Starter Kit+ for RX71M
- Target Board for RX130
- Target Board for RX231
- Target Board for RX23W
- Target Board for RX23W module
- Target Board for RX65N
- Target Board for RX660
- Target Board for RX671
- Evaluation Kit for RX261
- Fast Prototyping Board for RX261

The following LCD is connected to the evaluation board.

- Renesas Starter Kit / Renesas Solution Starter Kit: OKAYA - RH128128T-1X44WN-B2 (Included in Starter Kit.)
- Evaluation Kit / Fast Prototyping Board / Target Board: Kuongshun Electronic - MSP2807 (OEM products are also available.)

2. Installation and Uninstallation

2.1 Installing This Product

The following describes the installation methods of the plug-in version and the standalone version respectively.

2.1.1 Installing the Plug-in Version

Use either of the following procedures to install the plug-in version.

2.1.1.1 Install from the "Renesas Software Installer" menu of e2 studio

1. Start e² studio.
2. Select the [Renesas Views] – [Renesas Software Installer] menu of e² studio to open the [Renesas Software Installer] dialog box.
3. Select the [Renesas QE] and click the [Next>] button
4. Select the [QE for Display[RX,RA] (v3.6.0)/QE for Camera[RA] (v1.1.0)] check box, and click the [Finish] button.
5. Check that [Renesas QE for Display[RX,RA]/QE for Camera[RA]] is selected in the [Install] dialog box, and click the [Next>] button.
6. Check that [Renesas QE for Display[RX,RA]/QE for Camera[RA]] is selected as the target of installation, and click the [Next>] button.
7. After confirming the license agreements, if you agree to the license, select the [I accept the terms of the license agreements] radio button, and click the [Finish] button.
8. If the dialog of the trust certificate is displayed, check that certificate, and click the [OK] button to continue installation.
9. When prompted to restart e² studio, restart it.
10. Start this product from the [Renesas Views] - [Renesas QE] menu of e² studio. For details about how to use this product, see the [Help] menu of e² studio.

2.1.1.2 Install using QE (zip file) downloaded from the Renesas website

1. Start e² studio.
2. From the [Help] menu, select [Install New Software...] to open the [Install] dialog box.
3. Click the [Add...] button to open the [Add Repository] dialog box.
4. Click the [Archive] button, select "RenesasQE_Display_RXRA_V360.zip" or "RenesasQE_Camera_RA_V110.zip" in the opened dialog box, and click the [Open] button.
5. Click the [OK] button in the [Add Repository] dialog box.
6. Expand the [Renesas QE] item shown in the [Install] dialog box, select the [Renesas QE for Display[RX,RA] /QE for Camera[RA]] check box, and then click the [Next>] button.
* If you check off the [Contact all update sites during install to find required software] checkbox, you can shorten the installation time.
7. Check that [Renesas QE for Display[RX,RA]/QE for Camera[RA]] is selected as the target of installation, and click the [Next>] button.
8. After confirming the license agreements, if you agree to the license, select the [I accept the terms of the license agreements] radio button, and click the [Finish] button.
9. If the dialog of the trust certificate is displayed, check that certificate, and click the [OK] button to continue installation.
10. When prompted to restart e² studio, restart it.
11. Start this product from the [Renesas Views] - [Renesas QE] menu of e² studio. For details about how to use this product, see the [Help] menu of e² studio.

2.1.2 Installing the Standalone Version

1. Extract “.zip” file to a user-specified location on the PC.
Note: Please do not put the tool under OS program folder (C:\Program Files)
2. Start this product by double clicking “\QE-Display\eclipse\qe-display.exe”.
3. For the first time this product starts, there is a dialog of license agreement. After checking the license, you can select “Agree” or “Disagree”.

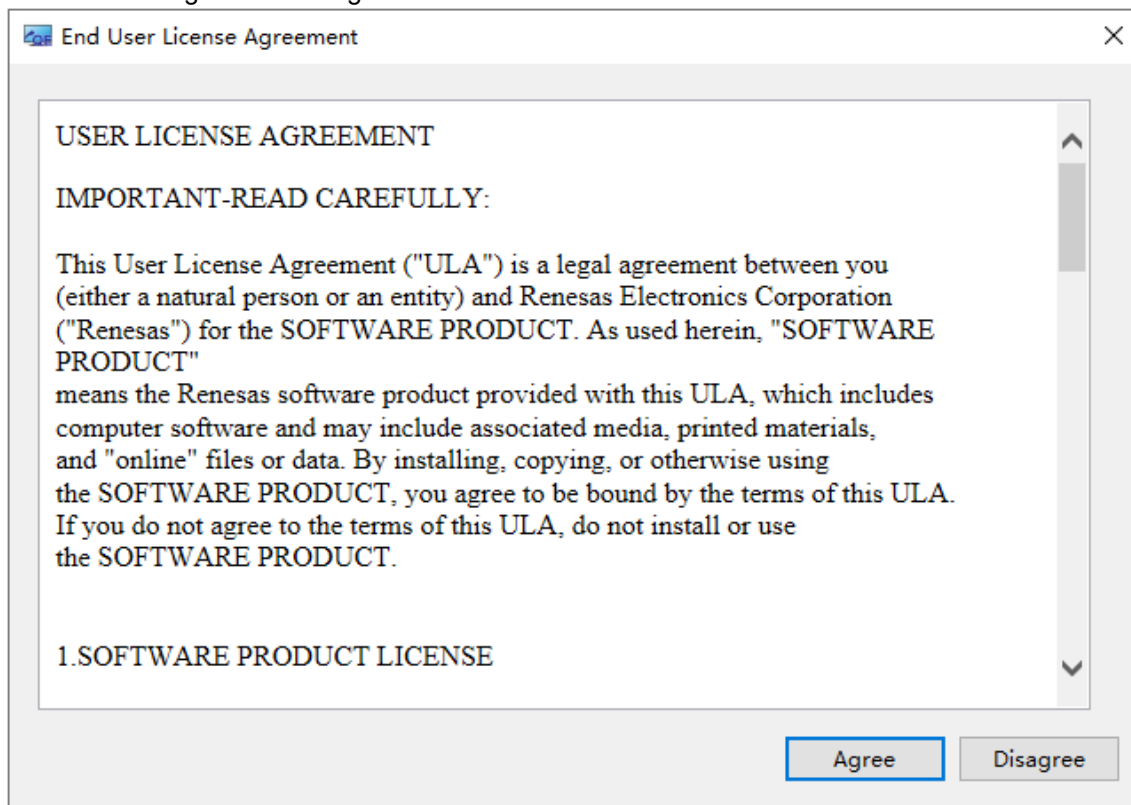


Figure 2-1 License Agreement Dialog

4. If “Agree” is selected in above step, the product is launched then you can use it; if “Disagree” is selected in above step, the product won’t be launched.

2.2 Updating This Product

If you have already installed the plug-in version, you can update it in the same way as the procedure for installation 2.1.1.2

If you have already installed the standalone version, you can update it in the same way as the procedure for installation 2.1.2

2.3 Uninstalling This Product

The following describes how to uninstall the plug-in version and the standalone version respectively.

2.3.1 Uninstalling the Plug-in Version

Use the following procedure to uninstall this product.

1. Start e² studio.
2. Select [Help -> About e² studio] to open the [About e² studio] dialog box.
3. Click the [Installation Details] button to open the [e² studio Installation Details] dialog box.
4. Select [Renesas QE for Display[RX,RA]/QE for Camera[RA]] displayed on the [Installed Software] tabbed page and click the [Uninstall...] button to open the [Uninstall] dialog box.
5. Check the displayed information and click the [Finish] button.
6. When prompted to restart e² studio, restart it.

2.3.2 Uninstalling the Standalone Version

Delete the entire folder which .zip package is extracted.

3. Notes / Restrictions

3.1 Usage Considerations

3.1.1 About additional installation of the RA family environment

If you wish to install the RA family environment additionally to your e2 studio development environment, please uninstall this product once and install it again after the RA family environment installation is completed

3.1.2 About compatibility with the previous version of sample program

V2.0.0 or later is not compatible with the previous version (QE for Display[RX] V1.1.0 or below) of the sample program because V2.0.0 or later has many new items to set and macros to output to the header file. When updating to V2.0.0 or later, also update the Graphic LCD Controller Module (r_glcdc_rx) to V1.40 or later.

For your information, the relationship between the previous version of QE for Display[RX] and the Graphic LCD Controller Module is as follows.

- QE for Display[RX] V1.0.0 : r_glcdc_rx V1.00 - V1.30
- QE for Display[RX] V1.1.0 : r_glcdc_rx V1.30

3.1.3 How to transfer the data of the previous version (when using plug-in version)

To transfer the configuration data from the previous version, copy the configuration file from the workspace location below to the project-specific location.

- Storage location of the previous version's configuration data

<workspace>/metadata/.plugins/com.renesas.apltool.glcdc

- Storage location of the V2.0.0 or later configuration data

<project>/settings/.plugin/com.renesas.apltool.glcdc

3.1.4 How to transfer the data from plug-in version to standalone version

To transfer the configuration data from the plug-in version, copy the configuration file from the plug-in version project's storage location below to the standalone version project's storage location.

Plug-in version side:

- Storage location of the previous version's configuration data

<workspace>/metadata/.plugins/com.renesas.apltool.glcdc

- Storage location of the V2.0.0 or later configuration data

<project>/settings/.plugin/com.renesas.apltool.glcdc

Standalone version side:

- Storage location of configuration data

<project>/settings/.plugin/com.renesas.apltool.glcdc

3.1.5 About the preset values of the evaluation board

When using the evaluation board, preset values are set for each setting item in QE for Display [RX,RA]/QE for Camera[RA].

Please configure the GLCDC input clock frequency according to the following requirements.

- RX evaluation boards: Set PLL circuit frequency to 240MHz
- RA evaluation boards: Set LCDCLK value according to the prompts

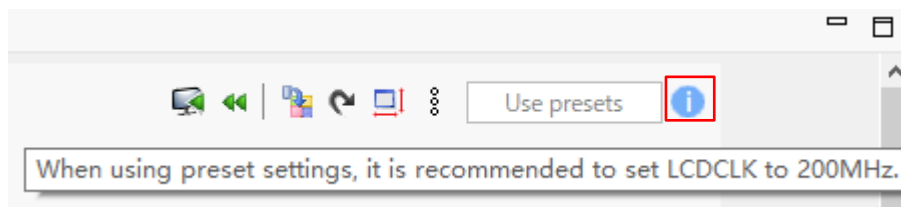


Figure 3-1 LCDCLK Setting Value Prompt

Please configure GPT input clock frequency according to the following requirements.

- EK-RA8D1 board: Set PCLKD frequency to 100MHz
- EK-RA8P1 board: Set GTCLK frequency to 250MHz

3.1.6 About PLLCLK and panel clock frequency setting of standalone version

In the standalone version, you need to enter the value of "PLL Circuit Frequency [MHz]" in the "Timing Adjustment" page according to the setting in the Smart Configurator clock page. Also, select the value of "Panel Clock Frequency [MHz]" according to the prompt after the control.

3.1.7 Note on using the Aeropoint GUI (Library Setting)

When you use the RXv2 instruction set architecture on RX66N, RX72M, and RX72N, change the library set in the linker options to the following.

1. libcri_AeropointLite_RXv2_CCRX.lib
2. libcri_Atom_Multiplayer_RXv3_CCRX.lib

3.1.8 Note on parameter setting (when using RA family)

The maximum values of the following parameters differ between QE and FSP, if the maximum value is set in QE, it cannot be reflected in FSP

- QE : HTP (Max 2048) -> FSP : Horizontal total cycles (Max 2047)
- QE : VTP (Max 2048) -> FSP : Vertical total lines (Max 2047)
- QE : VDP (Max 2044) -> FSP : Vertical active video lines (Max 2043)

3.1.9 Note on TrustZone projects usage (when using RA family)

When selecting RA projects, the real-time display adjustment result of TrustZone projects is not guaranteed. It is recommended to use Non-TrustZone project.

3.1.10 Note on display settings of PC monitor

If the GUI text is overlapped or blocked as shown in the figure below on your PC, please set up your PC monitor according to the following recommended settings.

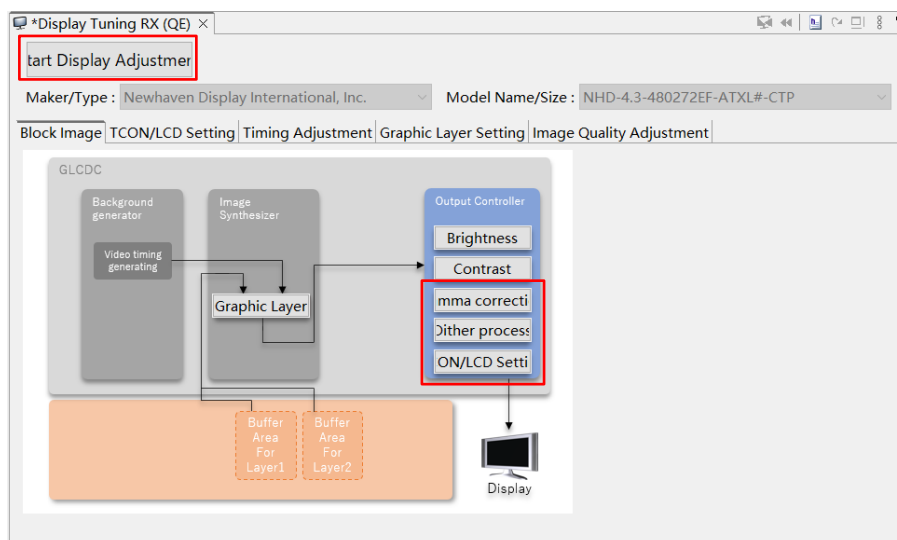


Figure 3-2 GUI with Overlapped or Blocked Text

Recommended monitor settings:

- Scale: 100%
- Display resolution: 1920 x 1080

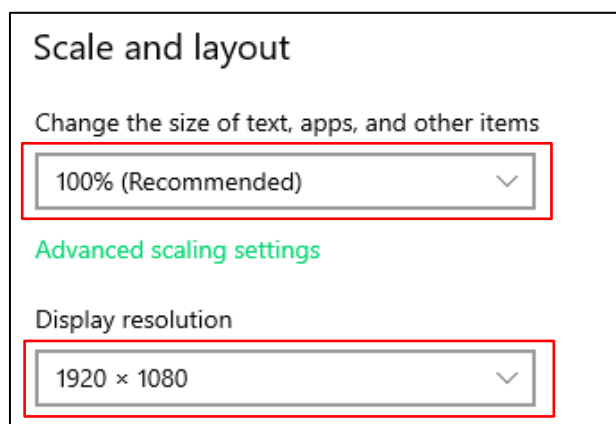


Figure 3-3 Recommended Monitor Settings

3.1.11 Note on LCD/Camera Workflow (QE) view

1. If you press the "Maximize"/"Restore" button in the e2 studio window while playing a tutorial video with the video window maximized, you will not be able to maximize the video window again.

[Workaround]

Close and re-open the LCD/Camera Workflow (QE) view

2. The workflow cannot be opened if WebView2 Runtime is not installed on your PC.

[Workaround]

Download and install WebView2 (x64 version) from the Microsoft web page.(FAQ:[3000670](#))

3.1.12 Note on baud rate setting when using standalone version

Due to the limitation of the communication speed of the USB-to-serial IC (RL78G1C) installed on the Renesas Starter Kit and Envision Kit boards, for projects using these two types of Evaluation boards, if you use the USB-to-serial resources on the board, the maximum communication baud rate set in the standalone version cannot exceed 115200.

3.1.13 Note on pin configuration settings of FSP modules (EK-RA8D1 board setting)

When using camera module, you need to do the following pin configuration settings.

1. Set the "Operation Mode" of "ETHER_RMII" as "Disabled" in the Pins page of FSP Configuration. *

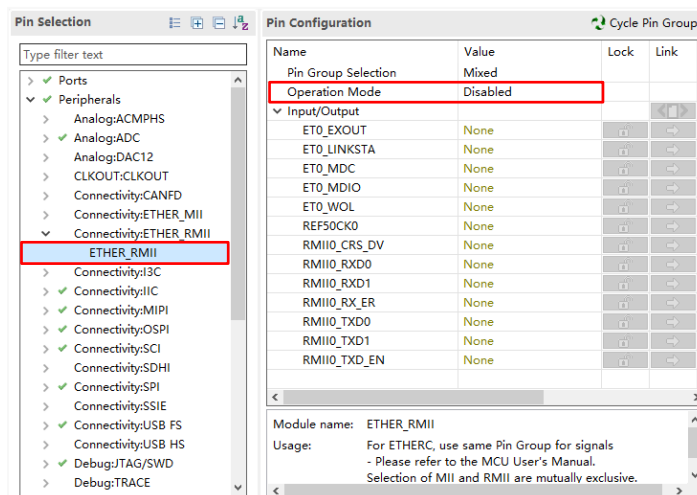


Figure 3-4 ETHER_RMII Pin Configuration for EK-RA8D1

* Due to the conflict with CEU pin resources, the pins of ETHER_RMII are not used.

2. Set the pin configuration of “CEU” in the Pins page of FSP Configuration. *

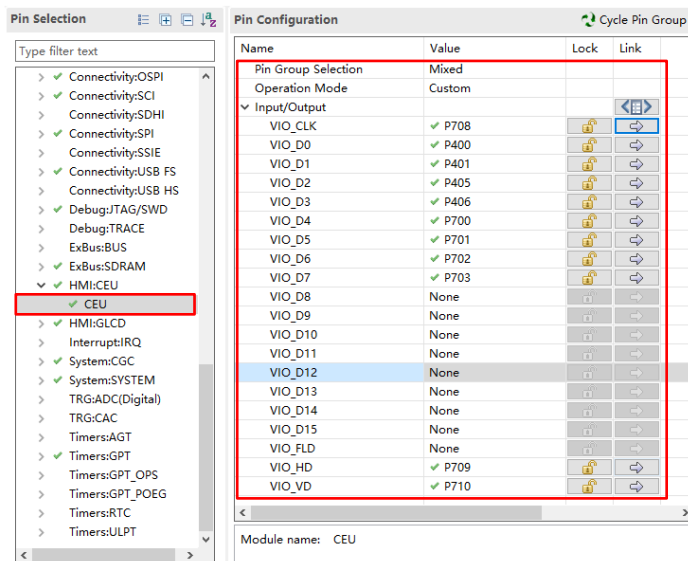


Figure 3-5 CEU Pin Configuration for EK-RA8D1

* Due to the conflict with SDRAM pin resources, the upper 8-bit data pins of CEU are not used.

3. Set the pin configuration of “GPT3” in the Pins page of FSP Configuration.

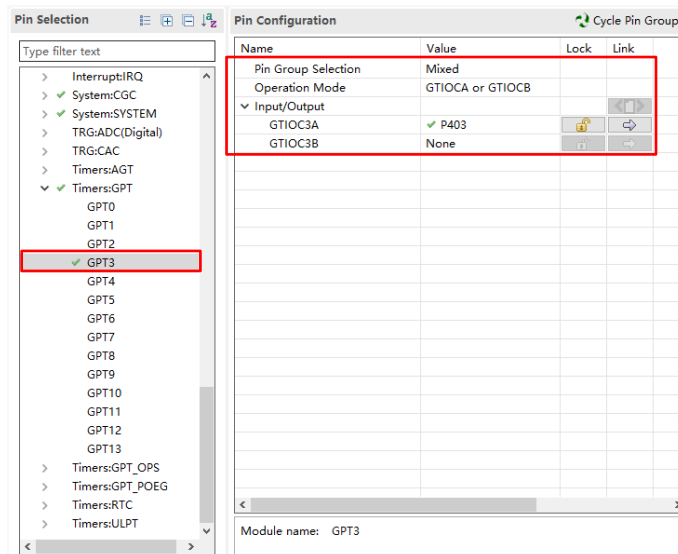


Figure 3-6 GPT3 Pin Configuration for EK-RA8D1

3.1.14 Note on pin configuration settings of FSP modules (EK-RA8E2 board setting)

When using LCD module, you need to do the following pin configuration settings.

1. Set "LCD_TCON3" pin of "GLCD" module as "None" in the Pins page of FSP Configuration.

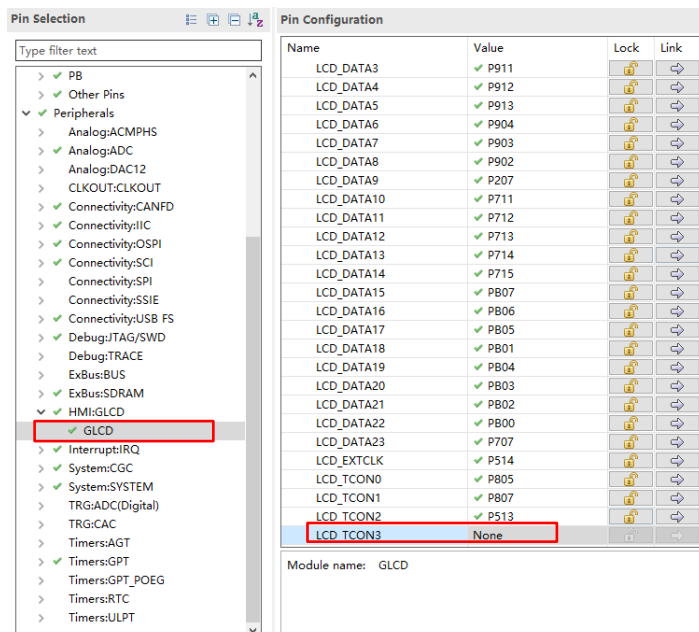


Figure 3-7 GLCD Pin Configuration for EK-RA8E2

2. Set "P515" pin of "Ports" module as "Output mode (Initial High)" in the Pins page of FSP Configuration.

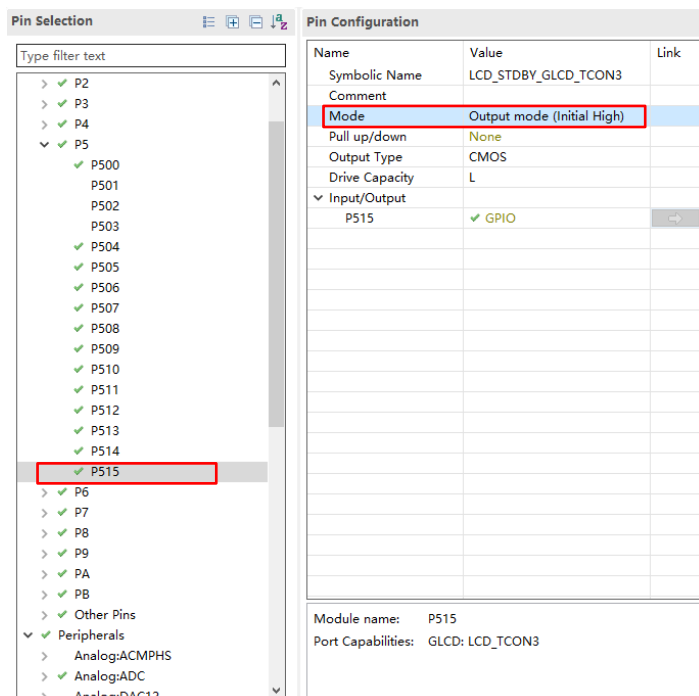


Figure 3-8 "LCD_TCON3" Pin Configuration for EK-RA8E2

3.1.15 Note on pin configuration settings of FSP modules (EK-RA8P1 board setting)

When using LCD module, you need to do the following pin configuration settings.

1. Set "P514" pin of "Ports" module as "Output mode (Initial High)" in the Pins page of FSP Configuration.

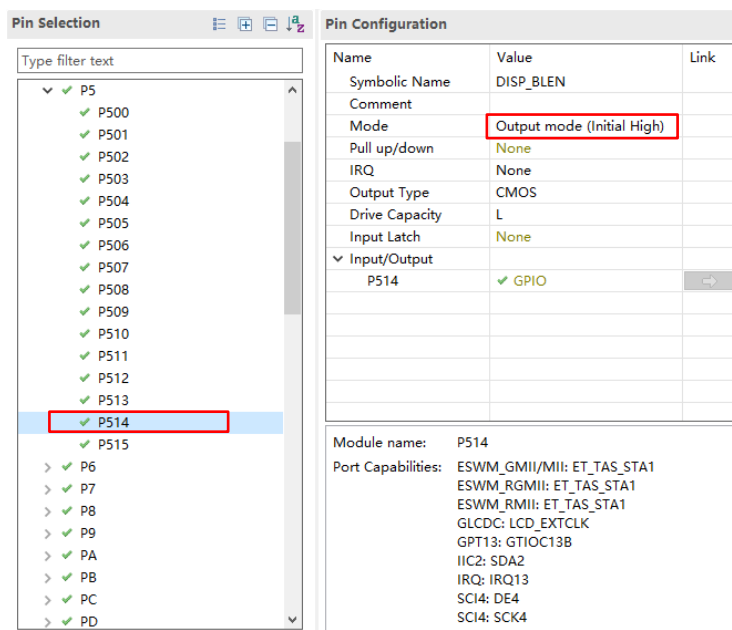


Figure 3-9 "DISP_BLEN" Pin Configuration for EK-RA8P1

2. Set "P606" pin of "Ports" module as "Output mode (Initial High)" in the Pins page of FSP Configuration.

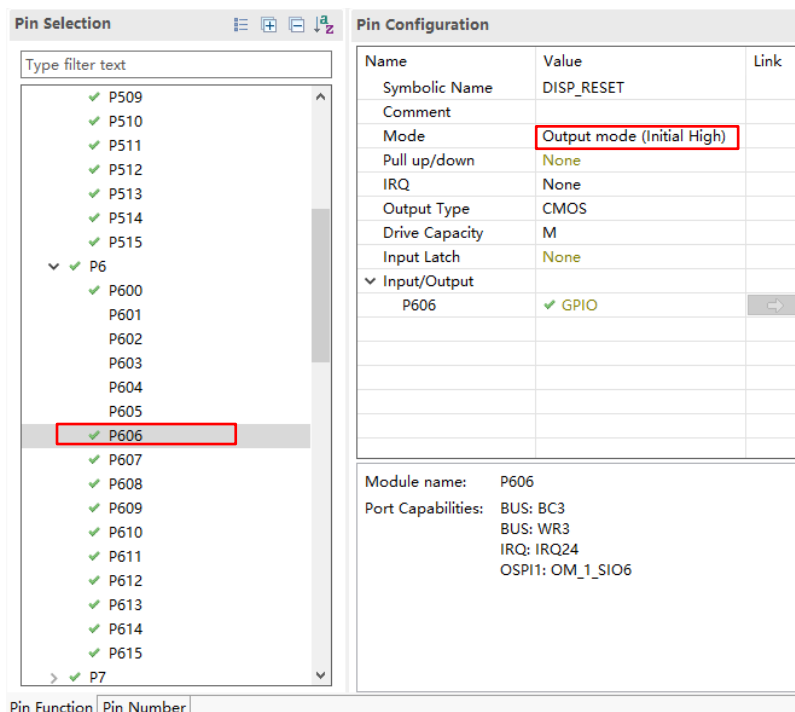


Figure 3-10 "DISP_RESET" Pin Configuration for EK-RA8P1

When using camera module, you need to do the following pin configuration settings.

1. Set the “Operation Mode” of “I3C0” as “Disabled” in the Pins page of FSP Configuration. *

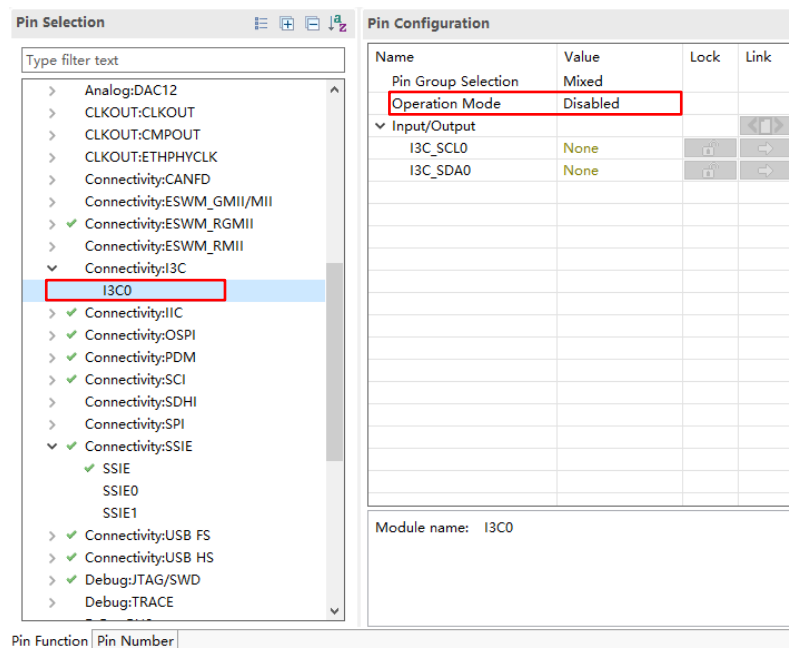


Figure 3-11 I3C0 Pin Configuration for EK-RA8P1

* Due to the conflict with CEU pin resources, the pins of I3C0 are not used.

2. Set the “Operation Mode” of “SSIE0” as “Disabled” in the Pins page of FSP Configuration. *

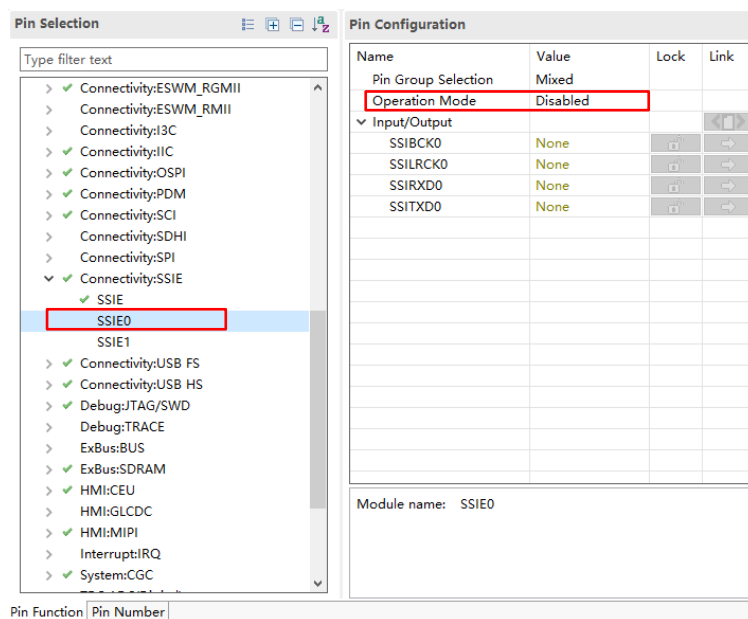


Figure 3-12 SSIE0 Pin Configuration for EK-RA8P1

* Due to the conflict with CEU pin resources, the pins of SSIE0 are not used.

3. Set the “Operation Mode” of “GLCDC” as “Disabled” in the Pins page of FSP Configuration. *

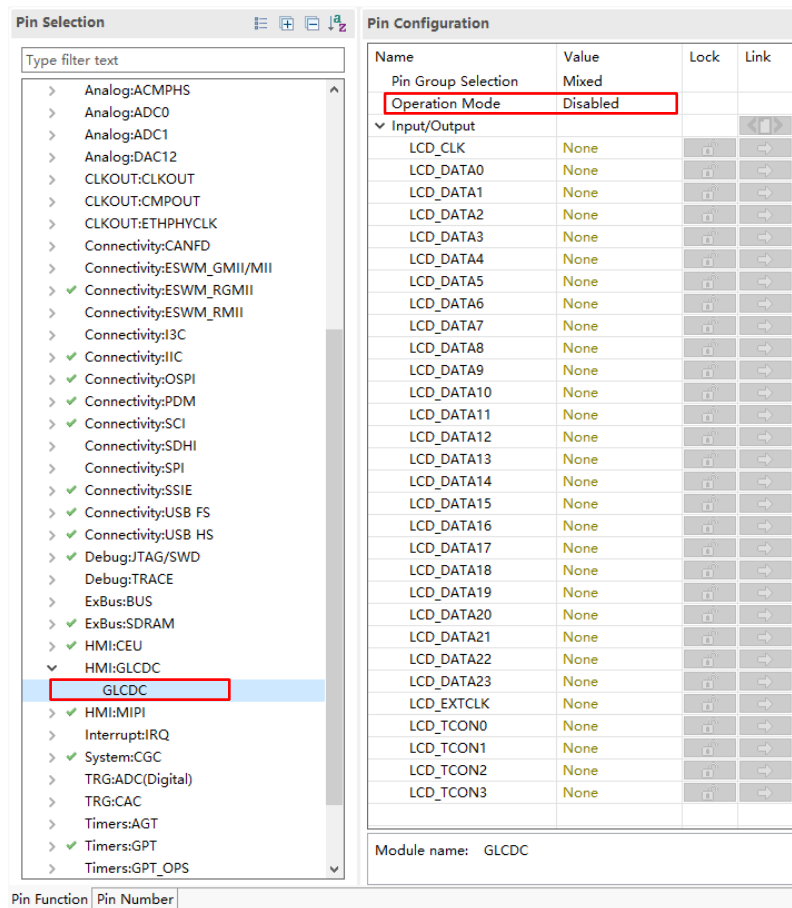


Figure 3-13 GLCDC Pin Configuration for EK-RA8P1

* Due to the conflict with CEU pin resources, the pins of GLCDC are not used.

4. Set the pin configuration of “CEU” in the Pins page of FSP Configuration.

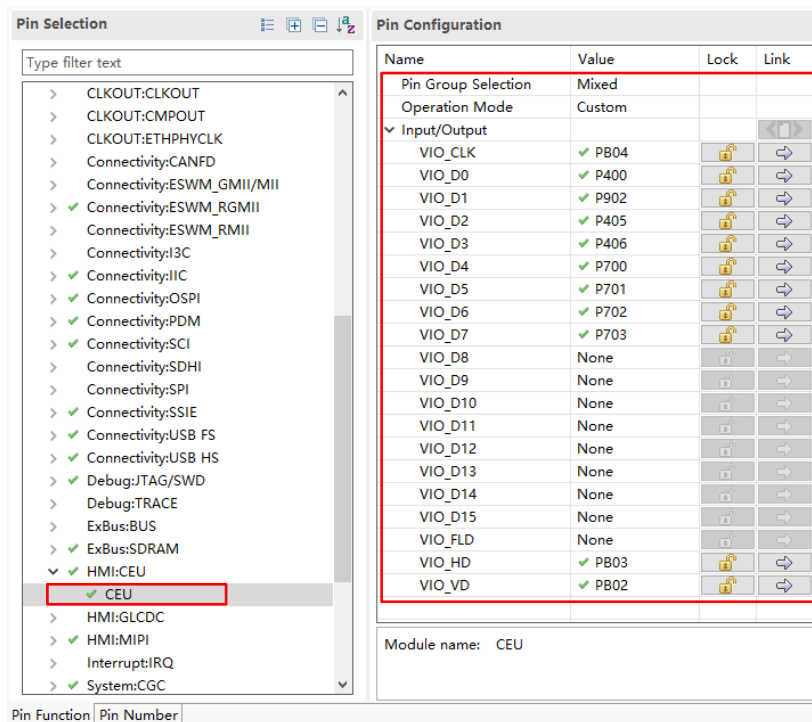


Figure 3-14 CEU Pin Configuration for EK-RA8P1

3.1.16 Note on settings of captured image size

When using CEU to capture camera images, please set the captured image size according to the following table.

Evaluation Board	Use Case	Maximum Captured Image Size
EK-RA8D1	Only Use Camera Function	1280*960 pixels
	Use Display and Camera Function	480*852 pixels
EK-RA8P1	Only Use Camera Function	480*640 pixels

Table 3-1 CEU Maximum Captured Image Size

3.1.17 Note on settings of “Graphic Layer Setting” for camera (EK-RA8D1 board setting)

When selecting the “Use Display and Camera Function” use case, please make the following settings in “Graphic Layer Setting”.

- Please use “Graphic Layer1” to make real time adjustments to the captured image.
- Set the value of “Width of Image Data” of “Graphic Layer1” to be no less than the width of the captured image.
- Set the selection of “Output Data Format” of “Graphic Layer1” as “RGB888 (GLCDC_IN_FORMAT_32BITS_RGB888)”.

3.1.18 Note on opening adjustment view

When creating an RA device project using QE for Display[RX,RA] V3.5.0, QE for Camera[RA] V1.0.0 or later, the adjustment view will not be displayed even if the “r_glcdc” component is selected. The “Display User Interface Application” component needs to be added to open adjustment view.

3.1.19 Note on changing board operation

To use a different evaluation board, it is advised not to change the board selection in FSP or Smart Configurator within the current project. Instead, please create a new project for the new target board.

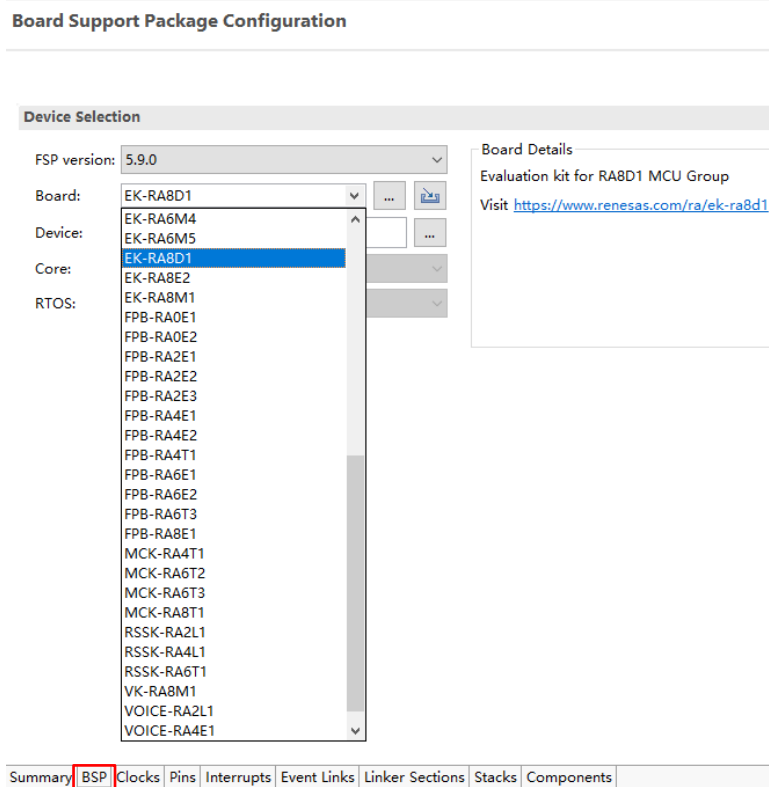


Figure 3-15 [Change Board] Operation in FSP

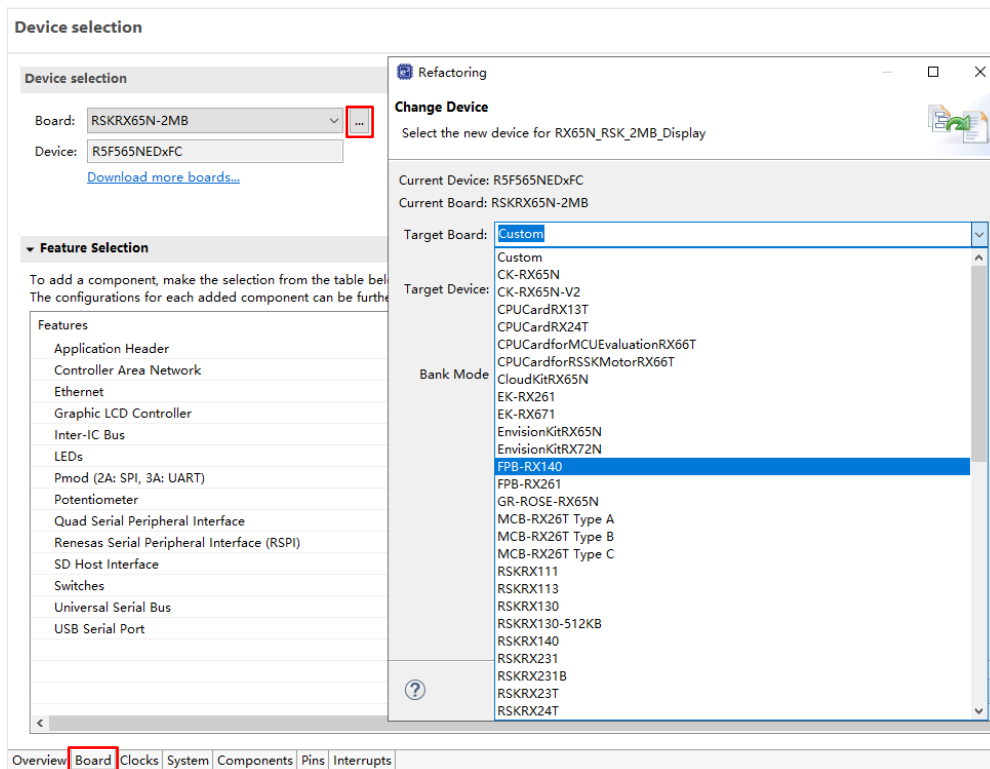


Figure 3-16 [Change Board] Operation in Smart Configurator

3.1.20 Note on Renesas e2 studio environment

This product recommends using e2 studio 2025-04. If you use e2 studio 2025-07, the "LCD/Camera Workflow (QE)" view and help content may not open properly.

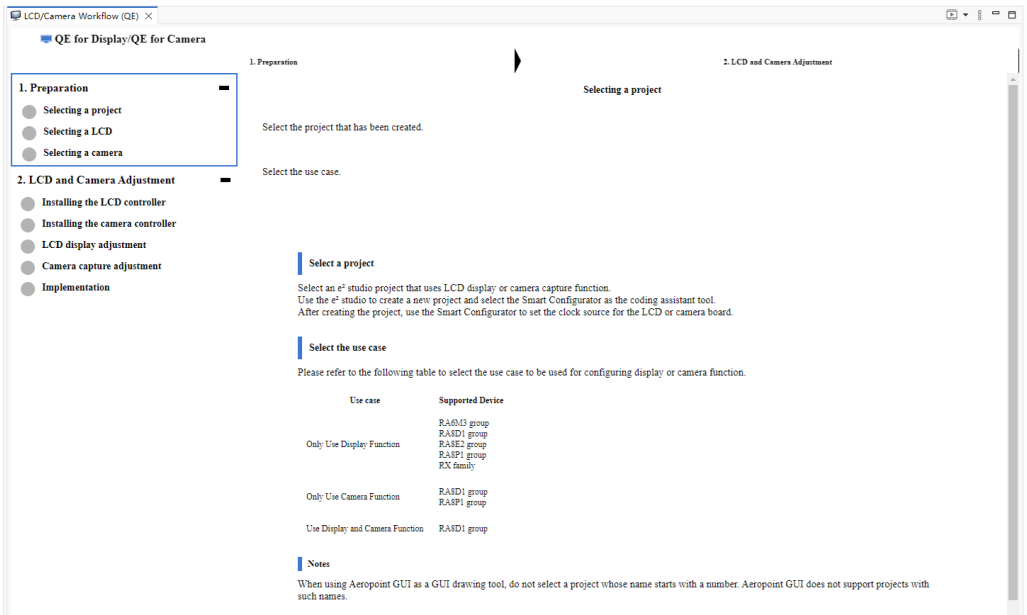


Figure 3-17 Theme Color is Missing in Workflow



Figure 3-18 Help Content Can't Open Properly

3.2 Functional Restrictions

There is no restriction in QE for Display[RX,RA] V3.6.0, QE for Camera[RA] V1.1.0.

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jul.1.25	-	First edition issued.

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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(Rev.5.0-1 October 2020)

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