RX Family

Guide to Using the Standalone Version of QE for Display [RX] with IAR EWRX

Summary

The standalone version of QE for Display [RX] (hereafter referred to as “standalone version of QE”) is a tool that provides a graphical interface for creating and adjusting LCD projects for CS+ or IDEs manufactured by third parties. This application note explains the procedures for development when using the IAR Embedded Workbench for Renesas RX (hereafter referred to as “EWRX”) as the IDE.

The emWin GUI, which is based on a high-performance graphics library from SEGGER Microcontroller, can be used as a GUI drawing tool. The emWin library is a high-reliability embedded GUI solution which has been adopted in various fields. It supports all kinds of displays, achieves high performance while minimizing the footprint in memory, and allows embedding of the GUIs in a great variety of systems. In addition, the emWin provides with AppWizard, which makes it easy to configure an excellent GUI through intuitive operations.

The standalone version of QE covers everything from the adjustment of the display to the creation of designs for screens. It can also be interlinked with various GUI development solutions to provide total support for the development of GUIs within short timeframes.

This application note describes the procedures for development with the use of the standalone version of QE and tools with which its operation can be interlinked.

Target Devices

- RX65N and RX651 groups (ROM capacity: 1.5 to 2 Mbytes)
- RX72N group
- RX72M group
- RX66N group

For the procedures described in this application note, operation in one of the following environments is assumed.

- Renesas Starter Kit+ for RX72N
- RX72N Envision Kit
- Renesas Starter Kit+ for RX65N-2MB
- RX65N Envision Kit

When you apply this application note with a different device or board, adjust the settings to be appropriate and thoroughly evaluate the results.

Contents

1. Overview

As shown in Figure 1.1, the graphic LCD controller (hereafter referred to as “GLCDC”) has multiple blocks, so simply checking the display attributes requires an understanding of the GLCDC specifications and a large number of settings. However, the standalone version of QE makes it possible to prepare an environment in which the connection of the display device can be checked in a short time without needing a full understanding of the GLCDC specifications. The standalone version of QE is a tool that provides a graphical interface for display control and a facility for adjusting the timing in real-time with the display device connected. After timing adjustment, a header file containing the corresponding information for display control is output. Settings for the GLCDC are then made on the basis of this header file.

When a serial LCD is used, follow the guide to section 4.4.1, Preparation, of Chapter 4, Procedures for Execution, then refer to the note for step 3.

The AppWizard GUI drawing tool allows you to design an interactive GUI in a short time by combining prepared resources and settings without having to spend a long time for reading manuals or coding programs. In contrast, using emWin’s API programming allows the efficient implementation of a design that satisfies various specific requirements.

The standalone version of QE can also be used with the Smart Configurator, which simplifies embedding of the Renesas drivers, and Firmware Integration Technology (FIT), which provides drivers and middleware for the RX family. These tools can further simplify display control and the creation and display of GUIs.

This application note mainly concerns the use of the standalone version of QE, the Smart Configurator, and the following FIT modules.

- QE for Display middleware module using Firmware Integration Technology (hereafter referred to as “QE Display FIT module”)
- Graphic LCD controller module using Firmware Integration Technology (hereafter referred to as “GLCDC FIT module”)
- emWin v.6.34 module using Firmware Integration Technology (hereafter referred to as “emWin FIT module”)

The flowchart on the following page describes the basic procedure for developing systems with the use of the standalone version of QE.

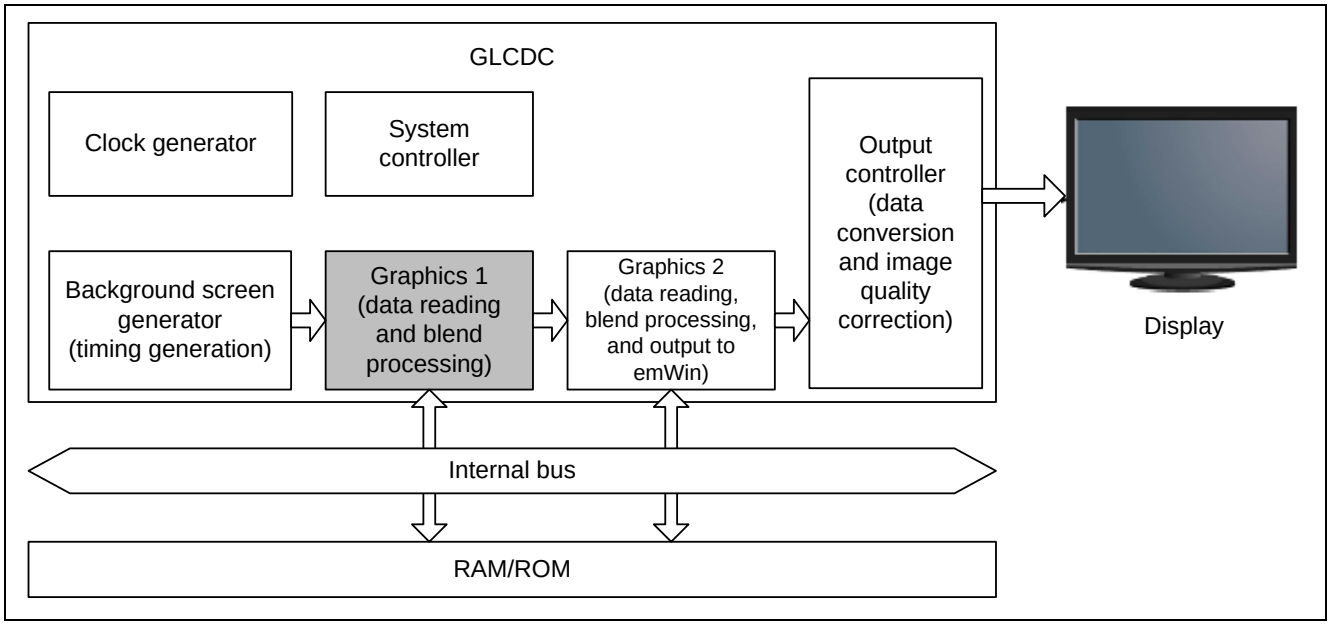


Figure 1.1 Block Configuration of the GLCDC

1.1 Flow of System Development with the Standalone Version of QE

Figure 1.2 shows a flow of system development with the use of the standalone version of QE.

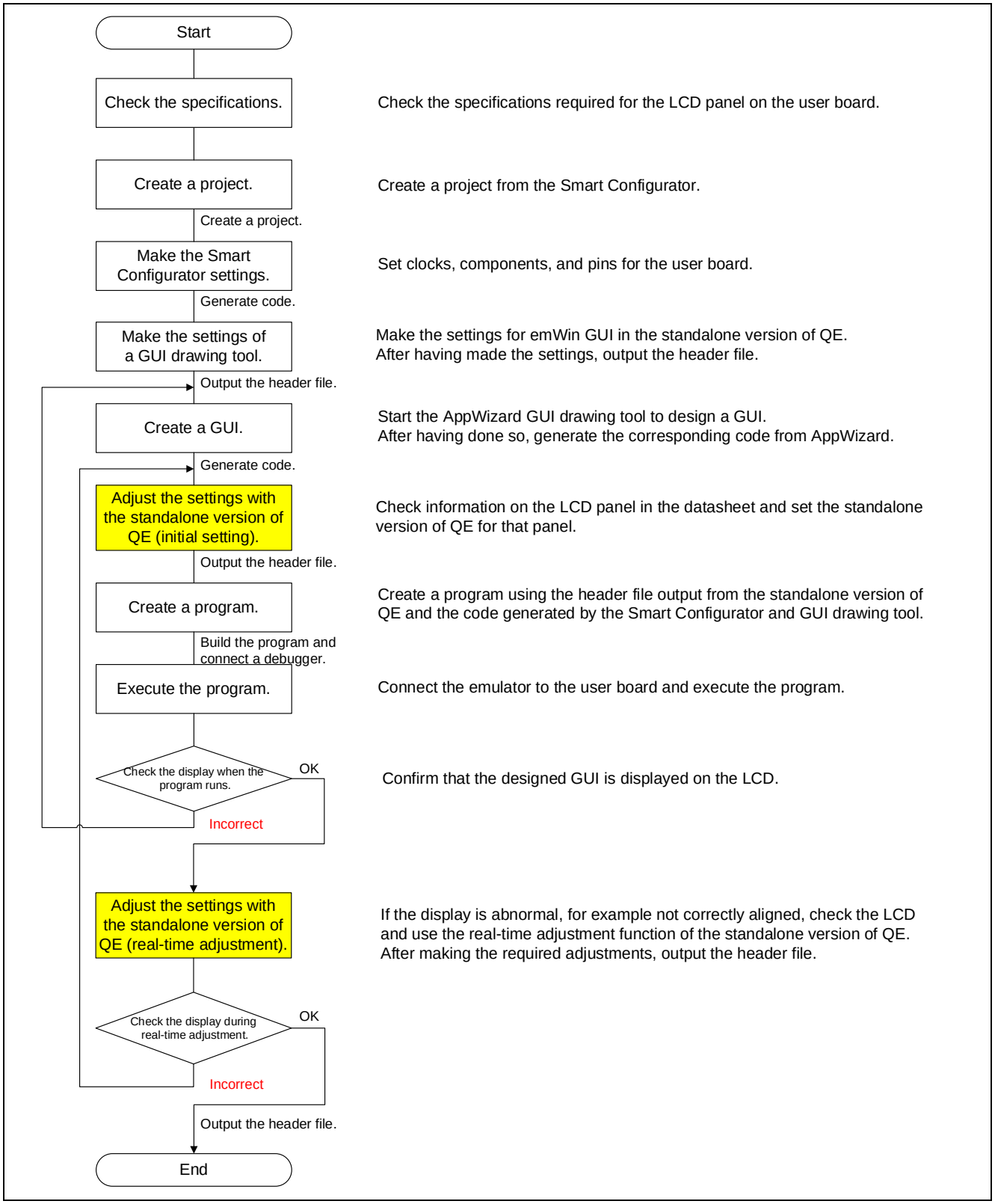


Figure 1.2 System Development by Using the Standalone Version of QE

2. Operating Environment

The procedures described in this application note assume operation on the Renesas Starter Kit+ for RX72N (hereafter referred to as “RSK RX72N”), the RX72N Envision Kit (hereafter referred to as “Envision RX72N”), the Renesas Starter Kit+ for RX65N-2MB (hereafter referred to as “RSK RX65N”) and the RX65N Envision Kit (hereafter referred to as “Envision RX65N”).

Table 2.1 shows the operating environment for this application note.

Table 2.1 Operating Environment

Item	Contents
Integrated development environment (IDE)	IAR Systems Embedded Workbench for Renesas RX Version 5.10.1
C compiler	IAR Systems IAR C/C++ Compiler for Renesas RX Version 5.10.1
Configuration tool	RX Smart Configurator Version 2.23.0
FIT modules for the RX family	• QE Display FIT module: r_qe_display_rx V1.10 • GLCDC FIT module: r_glcdc_rx V1.60 • emWin FIT module: r_emwin_rx V1.20 (V6.34.g.1.20)
Toolchain	IAR EWRX Toolchain
QE	Standalone version of QE for Display V3.4.0 or later

Note: Download tools from the following URLs in advance.

- URL for downloading the IAR Embedded Workbench for Renesas RX
  https://www.iar.com/products/architectures/renesas/iar-embedded-workbench-for-renesas-rx/
- URL for downloading the RX Smart Configurator
  https://www.renesas.com/en/software-tool/rx-smart-configurator
- URL for downloading the RX driver package
  https://www.renesas.com/en/software-tool/rx-driver-package
- URL for downloading QE for Display
  https://www.renesas.com/en/software-tool/qe-display-development-assistance-tool-display-applications

Table 2.2 to Table 2.5 list the conditions used in confirming operations on each of the boards.

Table 2.2 Conditions for Confirming Operation (RSK RX72N)

Item	Contents
MCU used	R5F572NNDDBD (RX72N Group)
Operating frequency	• Main clock: 24 MHz • PLL: 240 MHz (main clock x 1/1 x 10) • System clock (ICLK): 240 MHz (PLL x 1/1) • Peripheral module clock A (PCLKA): 120 MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4) • LCD panel clock (LCD_CLK): 10 MHz (PLL x 1/24)
Endian	Little endian or big endian
Emulator	E2 Lite
Connection type	JTAG or FINE
Board used	Renesas Starter Kit+ for RX72N

Table 2.3 Conditions for Confirming Operation (Envision RX72N)

Item	Contents
MCU used	R5F572NNHDFB (RX72N Group)
Operating frequency	• Main clock: 16 MHz • PLL: 240 MHz (main clock x 1/1 x 15) • System clock (ICLK): 240 MHz (PLL x 1/1) • Peripheral module clock A (PCLKA): 120 MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4) • LCD panel clock (LCD_CLK): 10 MHz (PLL x 1/24)
Endian	Little endian or big endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	FINE
Board used	RX72N Envision Kit (product No.: RTK5RX72N0C00000BJ)
Board settings (jumper/switch)	<SW1> Pin 1: don't care Pin 2: OFF (The debugger is used.) <Others> Default settings

Table 2.4 Conditions for Confirming Operation (RSK RX65N)

Item	Contents
MCU used	R5F565NEDDFC (RX65N Group)
Operating frequency	• Main clock: 24 MHz • PLL: 240 MHz (main clock x 1/1 x 10) • System clock (ICLK): 120 MHz (PLL x 1/2) • Peripheral module clock A (PCLKA): 120 MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4) • LCD panel clock (LCD_CLK): 10 MHz (PLL x 1/24)
Endian	Little endian or big endian
Emulator	E2 Lite
Connection type	JTAG or FINE
Board used	Renesas Starter Kit+ for RX65N-2MB
Board settings (jumper/switch)	<SW4> Pin 3: OFF Pin 4: ON (The LCD is used.) <Others> Default settings

Table 2.5 Conditions for Confirming Operation (Envision RX65N)

Item	Contents
MCU used	R5F565NEDDFB (RX65N Group)
Operating frequency	• Main clock: 12 MHz • PLL: 240 MHz (main clock x 1/1 x 20) • System clock (ICLK): 120 MHz (PLL x 1/2) • Peripheral module clock A (PCLKA): 120 MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4) • LCD panel clock (LCD_CLK): 10 MHz (PLL x 1/24)
Endian	Little endian or big endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	JTAG
Board used	RX65N Envision Kit (product No.: RTK5RX65N2C00000BR)
Board settings (jumper/switch)	<SW1> Pin 1: ON Pin 2: OFF (The debugger is used.) <SW4> Pin 1: OFF Pin 2: don't care (The debugger is used.) <Others> Default settings

3. Related Documents

Also refer to the following documents which are related to this application note. Please use the latest versions that are available. Visit the Renesas Electronics Web site to check and obtain the latest versions.

Table 3.1 Documents Related to FIT Modules

Document Title	Document No.
Firmware Integration Technology User's Manual	R01AN1833
RX Family Board Support Package Module Using Firmware Integration Technology	R01AN1685
RX Family Graphic LCD Controller Module Using Firmware Integration Technology	R01AN3609
RX Family emWin v.6.34 Module Firmware Integration Technology	R01AN7047
RX Family QE for Display Module Firmware Integration Technology	R01AN7283

- Firmware Integration Technology User's Manual
  https://www.renesas.com/en/document/apn/firmware-integration-technology-users-manual

Table 3.2 Document Related to Tools

Document Title	Document No.
RX Smart Configurator User’s Guide: IAREW	R20AN0535

- RX Smart Configurator User’s Guide: IAREW
  https://www.renesas.com/en/document/mat/rx-smart-configurator-users-guide-iarew

Table 3.3 Documents Related to Boards

Document Title	Document No.
RX65N Group Renesas Starter Kit+ for RX65N-2MB User’s Manual	R20UT3888
RX65N Group RX65N Envision Kit User's Manual	R01UH0761
RX72N Group Renesas Starter Kit+ for RX72N User’s Manual	R20UT4443
RX72N Group RX72N Envision Kit User's Manual	R20UT4788

- RX65N Group Renesas Starter Kit+ for RX65N-2MB User’s Manual
  https://www.renesas.com/en/document/mat/renesas-starter-kit-rx65n-2mb-users-manual
- RX65N Group RX65N Envision Kit User’s Manual
  https://www.renesas.com/en/document/mat/rx65n-envision-kit-users-manual
- RX72N Group Renesas Starter Kit+ for RX72N User’s Manual
  https://www.renesas.com/en/document/mat/renesas-starter-kit-rx72n-users-manual-rev100
- RX72N Group RX72N Envision Kit User's Manual
  https://www.renesas.com/en/document/mat/rx72n-envision-kit-users-manuals-rev101

Table 3.4 Documents Related to Devices

Document Title	Document No.
RX65N Group, RX651 Group User's Manual: Hardware	R01UH0590
RX72N Group User’s Manual: Hardware	R01UH0824

- RX65N Group, RX651 Group User's Manual: Hardware
  https://www.renesas.com/en/document/mah/rx65n-group-rx651-group-users-manual-hardware
- RX72N Group User's Manual: Hardware
  https://www.renesas.com/en/document/mah/rx72n-group-users-manual-hardware

4. Procedures for Execution

This chapter describes the procedures for creating a new project for the EWRX by using the RX Smart Configurator and for displaying a GUI design on the display and adjusting it in real-time by using the standalone version of QE.

The GLCDC or emWin (GUI drawing tool) is provided in the FIT format. These can be embedded in projects by using the Smart Configurator. Settings for the GLCDC or emWin can be made in the GUI of the standalone version of QE. You can easily proceed with GUI development by following the workflow of the standalone version of QE.

Before starting this project, be sure to make the jumper settings stated in chapter 2, Operating Environment, if this is required.

For the usage of the standalone version of QE, refer to chapter 6, Using the Standalone Version of QE.

Preparation

1. Installing the standalone version of QE

Procedure

2. Creating a new project
3. Making the clock settings
4. Making the initial settings according to the workflow of the standalone version of QE
5. Building the project
6. Connecting a debugger and executing the program
7. Adjusting the display in real-time by following the workflow of the standalone version of QE

4.1 Installing the Standalone Version of QE

Install the standalone version of QE. Use the following procedure to install this product.

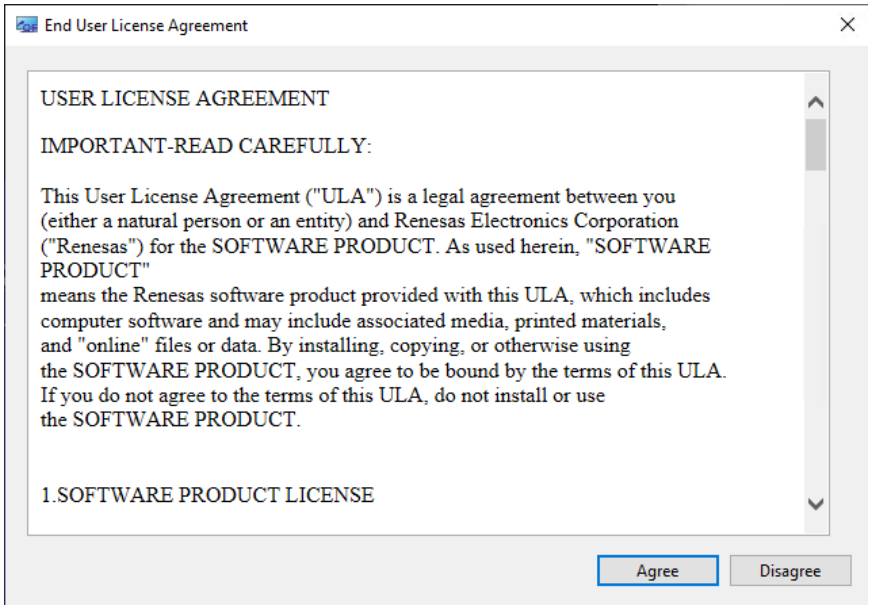
Download QE from the following URL and perform installation.

- QE for Display: Development Assistance Tool for Display Applications
  https://www.renesas.com/qe-display#downloads
  A QE for Display package of V3.4.0 or later

Note that the procedure for updating is the same as that for installation.

Method for Installation:

1. Unzip the zip file at a desired location on your PC.
   Note: Do not place it under the OS program folder (C:¥Program Files).
2. Double-click on “¥QE-Display¥eclipse¥qe-display.exe” to start the standalone version of QE.
3. The license agreement dialog box is displayed when you start the standalone version of QE for the first time. Confirm the contents of the license agreement and select “Agree” or “Disagree”.



4. If you select “Agree” in the above step, the standalone version of QE will be launched and ready to use. If you select “Disagree”, the standalone version of QE will not start.

To uninstall the standalone version of QE, follow the procedure below.

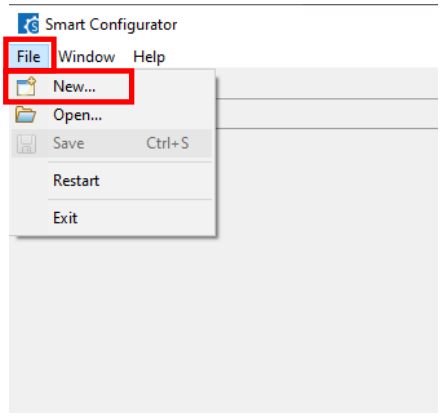
Method for Uninstallation:

Simply delete the folder where you unzipped the zip file.

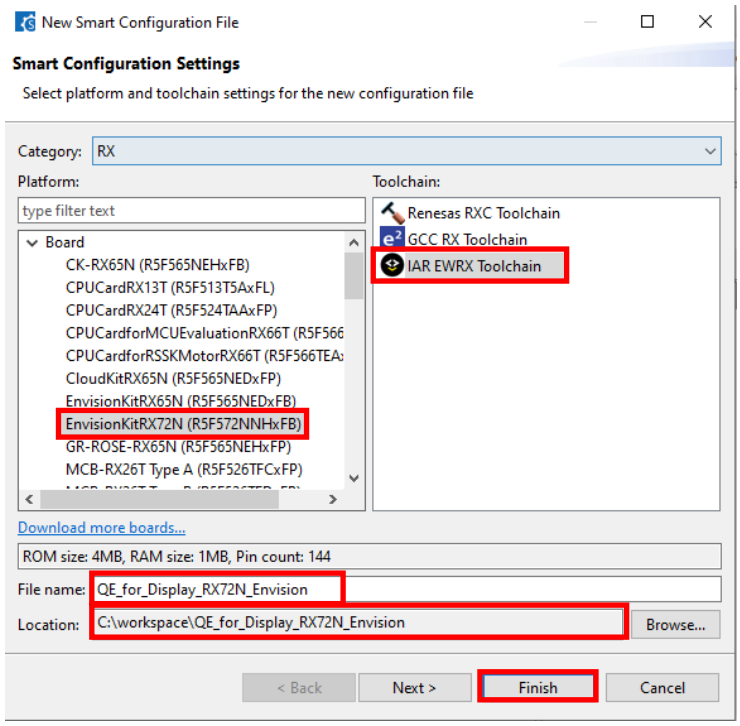
4.2 Creating a New Project

Launch the Smart Configurator.

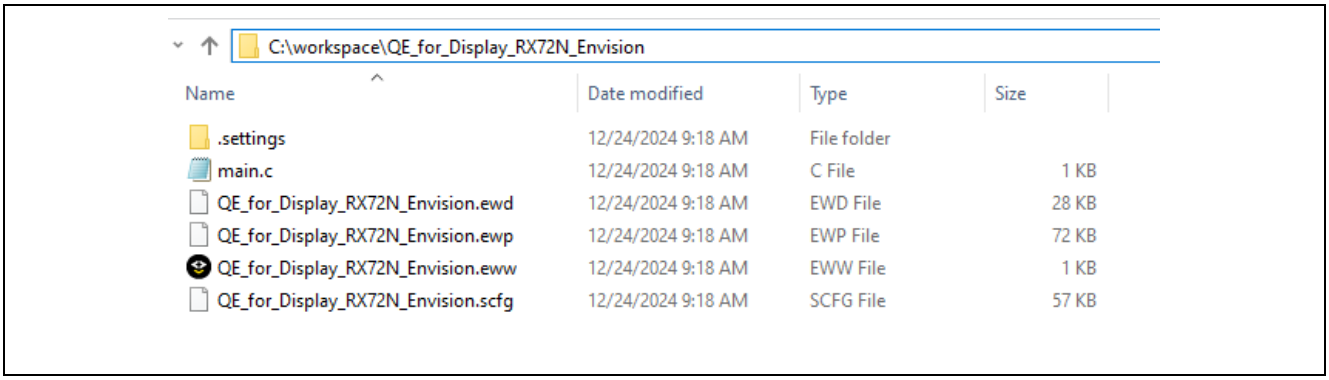
1. Click on “File” -> “New”.



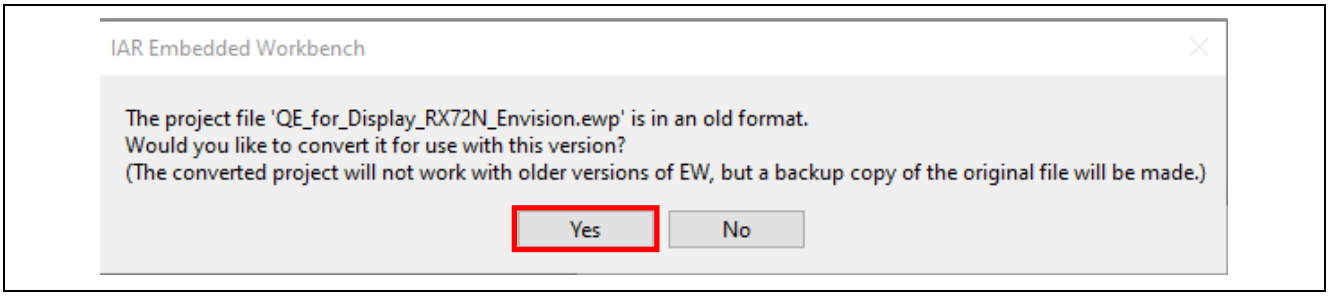
2. Make the Smart Configurator settings.
   — Select the platform (board to be used) and toolchain.
   — Enter the configuration file name.
   (An EWRX project file with the same name is generated.)
   — Specify the folder for saving the file.
   When all settings are completed, click on the “Finish” button.
   If the board to be used is not among the available selections, click on “Download more boards” to download the board description file (BDF) of the board to be used before making the settings.



A new project is created in the specified folder for saving the file.



3. Start the EWRX.
   Double-clicking on the .eww file starts the EWRX and opens a dialog box like that shown below. Select “Yes” to convert the format of the project file. A workspace for the created project is opened.



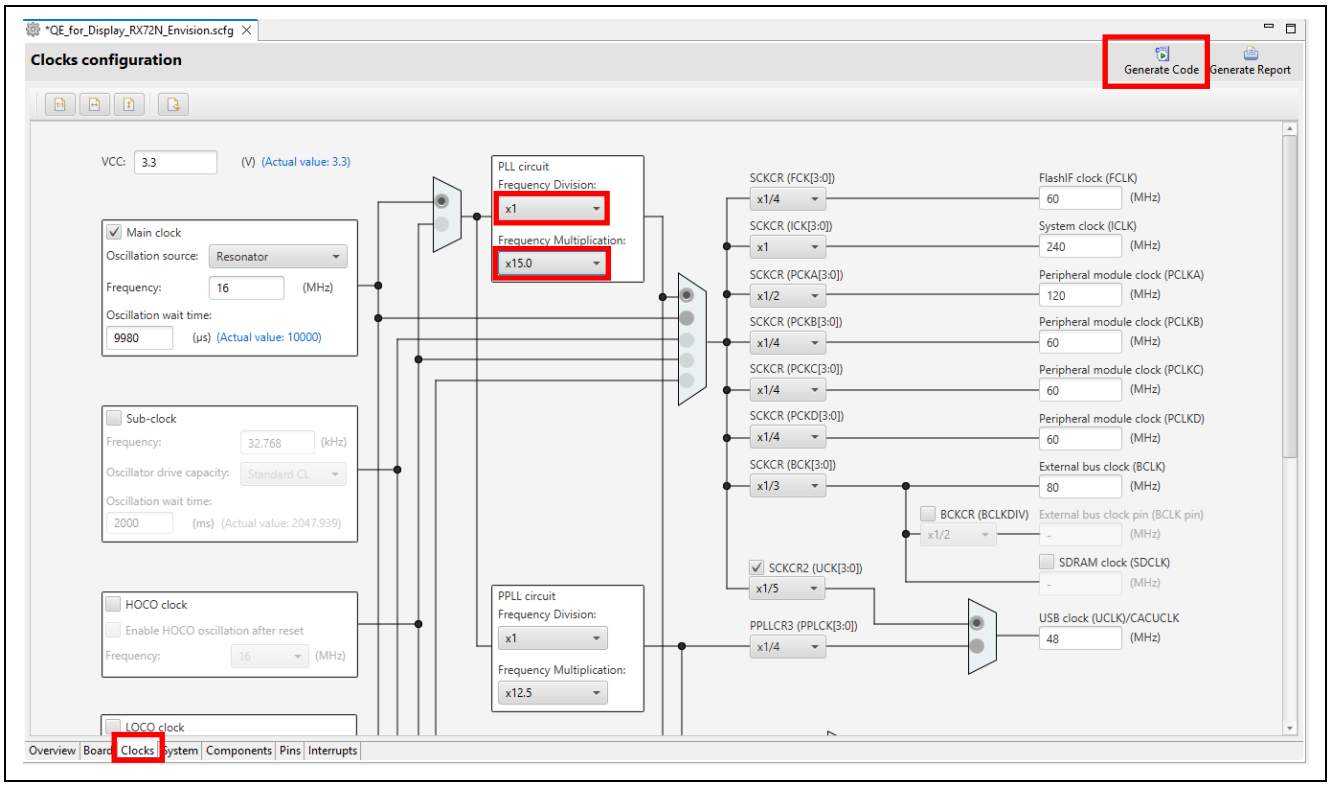
4.3 Making the Clock Settings

Make clock settings to suit the board to be used.

1. Select the “Clocks” tab of the Smart Configurator.
2. Set the clock to be suitable for the board to be used. The signal at the PLL operating frequency is the clock source for the LCD panel. Here, suppose that the main clock is to be the clock source and set “Frequency Division” and “Frequency Multiplication” for the PLL circuit so that the PLL operating frequency will be 240 MHz.
3. Click on the “Generate Code” button.

Table 4.1 Setting Clocks

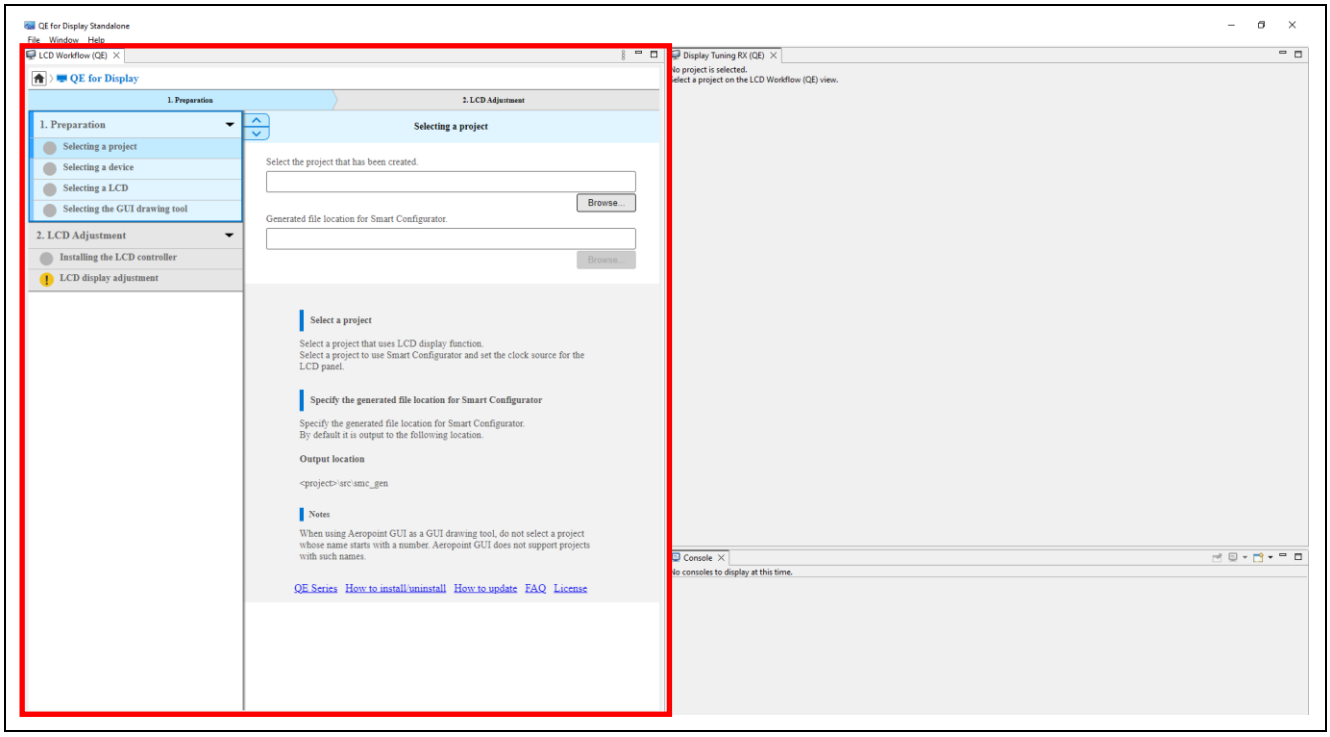
Evaluation Board	Frequency of the Main Clock	PLL Operating Frequency	Division and Multiplication to Obtain the PLL Frequency from the Main Clock
RSK RX72N	24 MHz	240 MHz	1/1 x 10
Envision RX72N	16 MHz	240 MHz	1/1 x 15
RSK RX65N	24 MHz	240 MHz	1/1 x 10
Envision RX65N	12 MHz	240 MHz	1/1 x 20



4.4 Making Settings According to the Workflow of the Standalone Version of QE

Double-click on “¥QE-Display¥eclipse¥qe-display.exe” to start the standalone version of QE.

Set the LCD in the order of “1. Preparation” and “2. LCD Adjustment” in the “LCD Workflow (QE)” view.



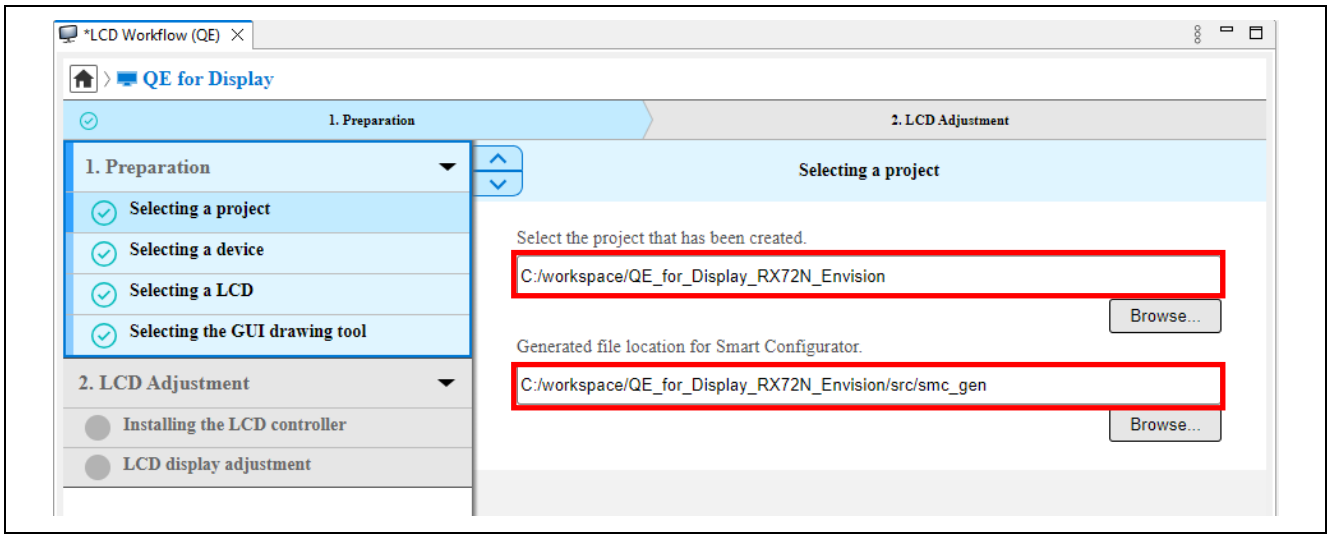
Note: In an environment where the WebView2 runtime is not installed in your PC, the workflow cannot be displayed. In this case, download and install WebView2 (x64 version) from the Microsoft web page.

- Renesas Customer Hub FAQ 3000670:
  https://en-support.renesas.com/knowledgeBase/20814216

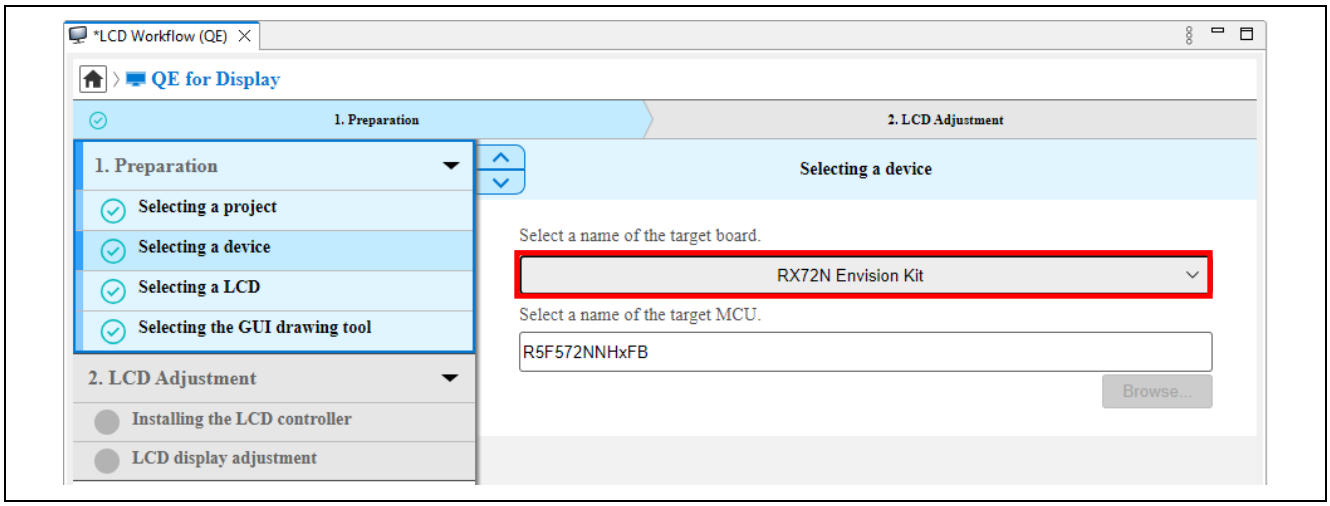
4.4.1 Preparation

Make the settings for “1. Preparation” in the workflow view of the standalone version of QE.

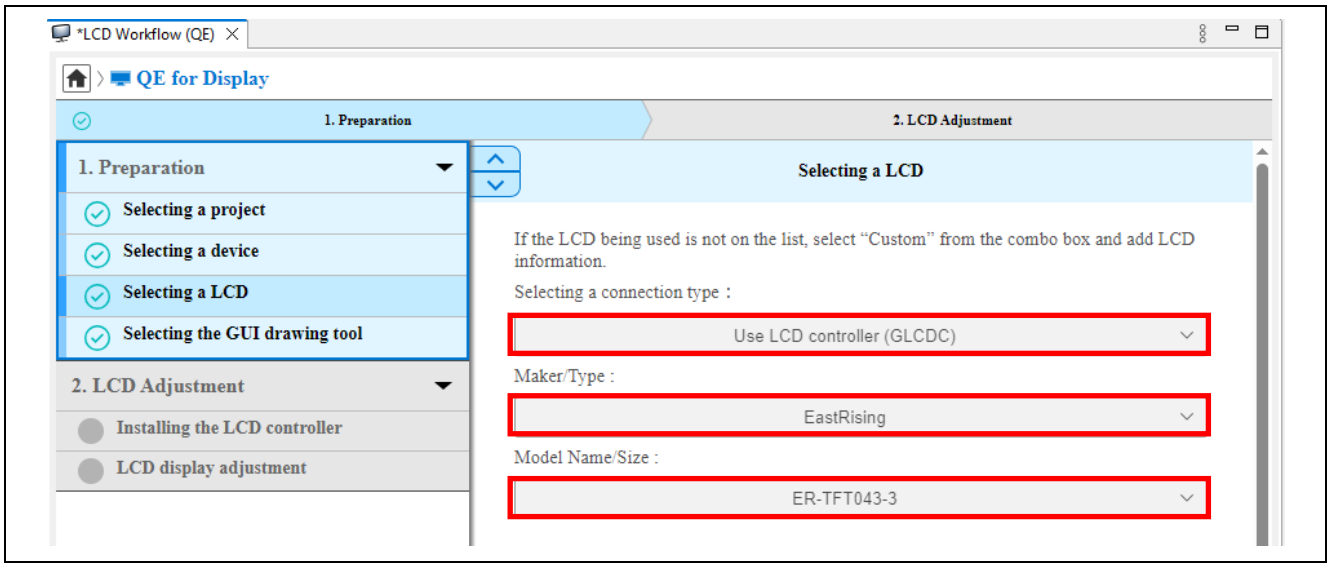
1. “Selecting a project”
   Select the project that was created. The path to the folder for the file that was generated by the Smart Configurator will automatically be entered. Confirm that the entered location is correct.



2. “Selecting a device”
   — Select the target board to be used.
   — If you are not using an evaluation board manufactured by Renesas, select “Custom” and manually specify the target microcontroller.
   — If you are using an evaluation board manufactured by Renesas, the microcontroller will automatically be selected.



3. When “Custom” is selected in “Selecting a device”, select the LCD information to be used in “Selecting a LCD”. When an evaluation board manufactured by Renesas is selected in “Selecting a device”, the LCD information is fixed.



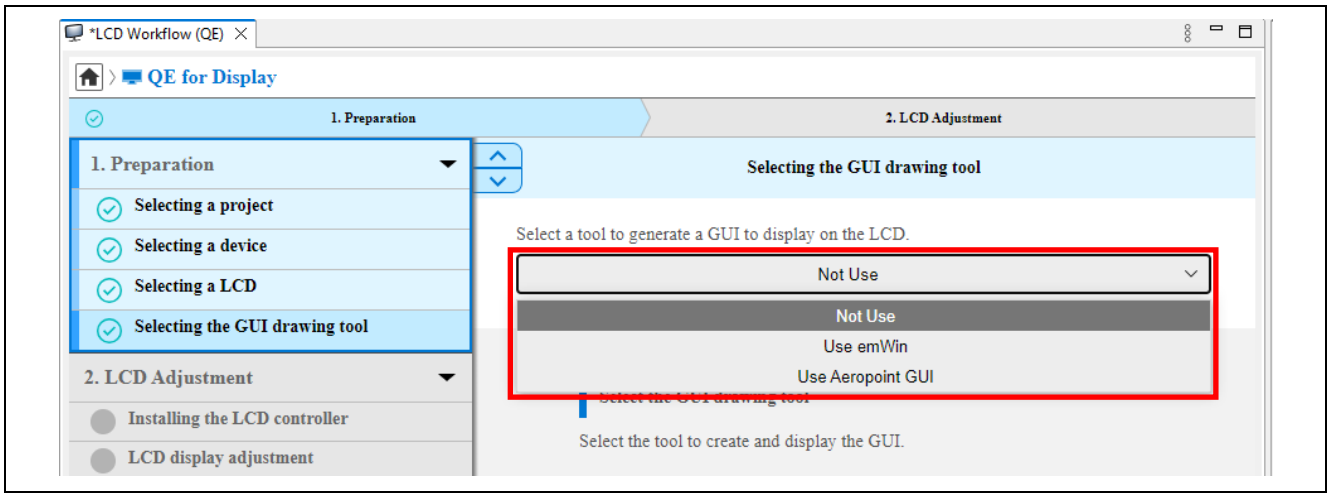
Note: When using a serially connected LCD, select “Use serial connection (emWin)” for “Selecting a connection type”. The steps after that are the same as those for the plug-in version of QE for Display. Refer to the application note for the plug-in version.

- RX Family
  QE for Display GUI Display Application Development Guide using Serial Connection LCD
  https://www.renesas.com/en/document/apn/rx-family-qe-display-gui-display-application-development-guide-using-serial-connection-lcd

However, the following steps have to be added when building a project.

1. Add the following files to the workspace of the project as the target files for building. Also, add the paths to these files to “Project” -> “Options” -> “C/C++ Compiler” -> “Preprocessor” -> “Additional include directories” of the EWRX. The files under aw¥Simulation will not be added.
   — qe_emwin_config.h
   — Files under aw¥Resource
   — Files under aw¥Source
2. Add the following definition to “Project” -> “Options” -> “C/C++ Compiler” -> “Preprocessor” -> “Defined symbols” of the EWRX.
   — QE_EMWIN_CONFIGURATION

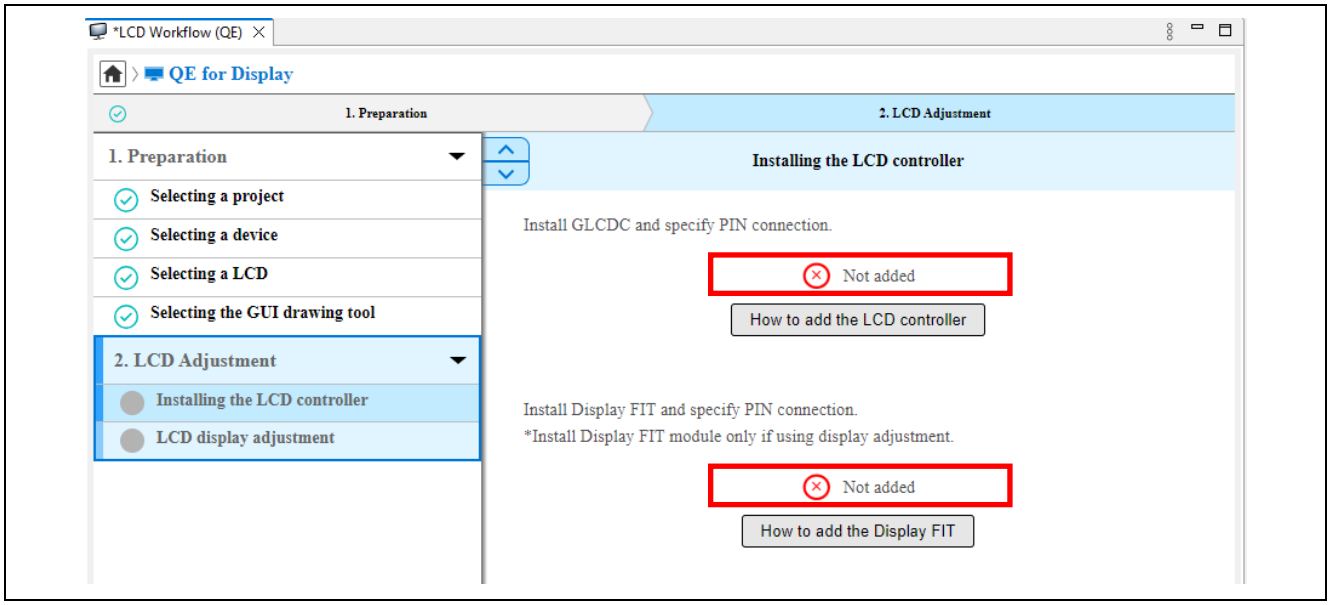
4. Select the drawing tool to be used in “Selecting the GUI drawing tool”.
   When only adjustment by the LCD controller (GLCDC) is to be performed without creating a GUI, select “Not Use” and proceed to section 4.4.2, Adjusting the LCD (without the Drawing Tool).
   When a GUI is to be created, select “Use emWin” and proceed to section 4.4.3, Adjusting the LCD (with Use of the Drawing Tool).
   Note: The Aeropoint GUI does not support the IAR C/C++ Compiler for Renesas RX.



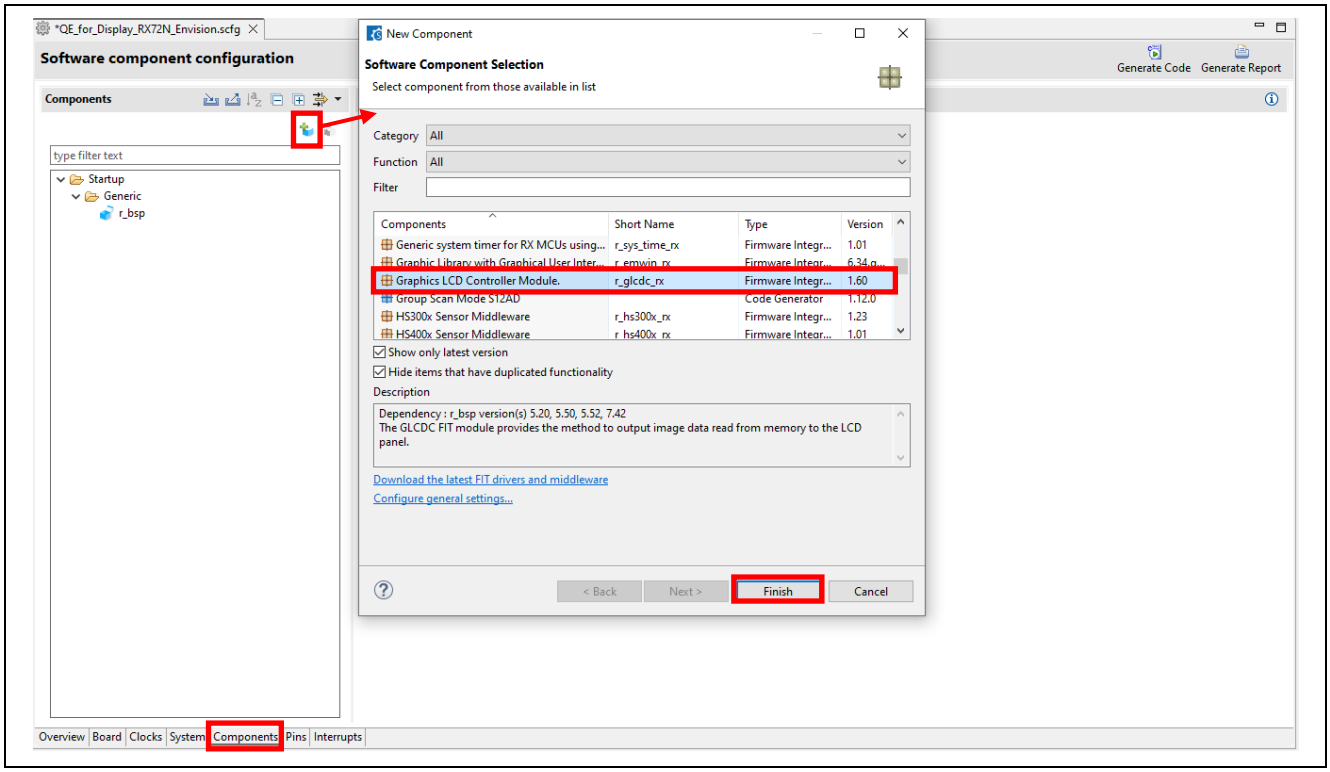
4.4.2 Adjusting the LCD (without the Drawing Tool)

Adjust the LCD without creating a GUI by using the drawing tool.

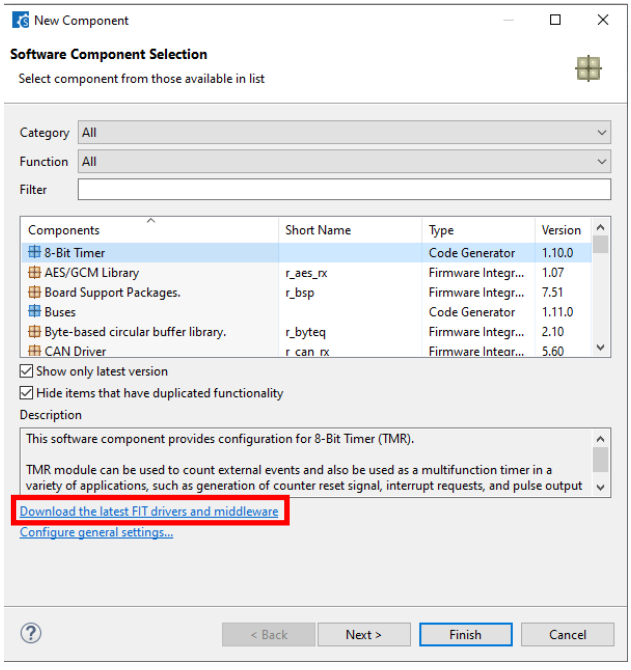
1. Installation status of the LCD controller
   — Select “Installing the LCD controller” in the “LCD Workflow (QE)” view.
   — If the GLCDC or QE Display FIT module is not installed, the following error message will be displayed.



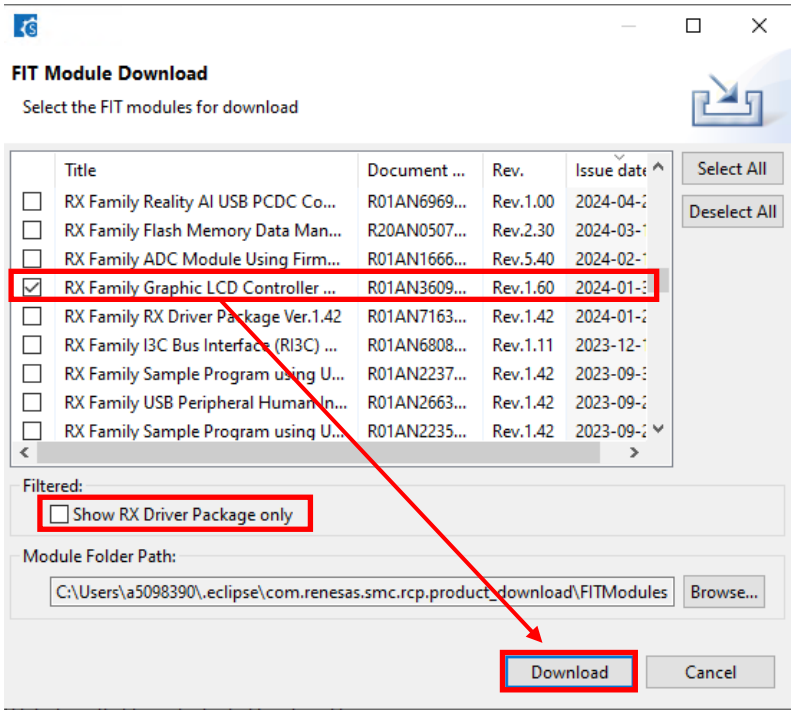
2. Install the GLCDC and QE Display FIT modules.
   — Open the “Components” tab of the Smart Configurator and click on the “Add component” icon.
   — In the “New Component” dialog box that is displayed, select the following components and click on the “Finish” button.
     - “Graphics LCD Controller Module. (r_glcdc_rx)” (version 1.60 or a later version)
     - “QE for Display middleware module (r_qe_display_rx)” (version 1.10 or a later version)



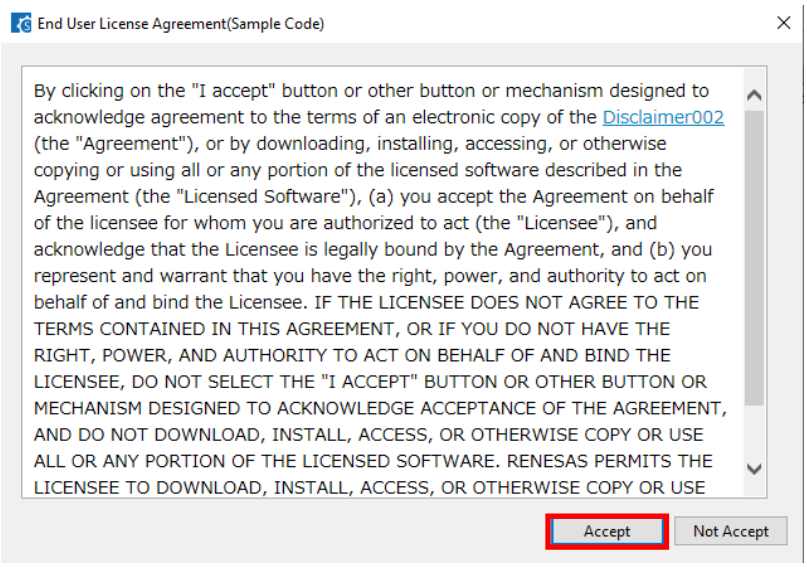
3. If the GLCDC and QE Display FIT modules are not displayed in the list of components in the “New Component” dialog box, click on “Download the latest FIT drivers and middleware”.



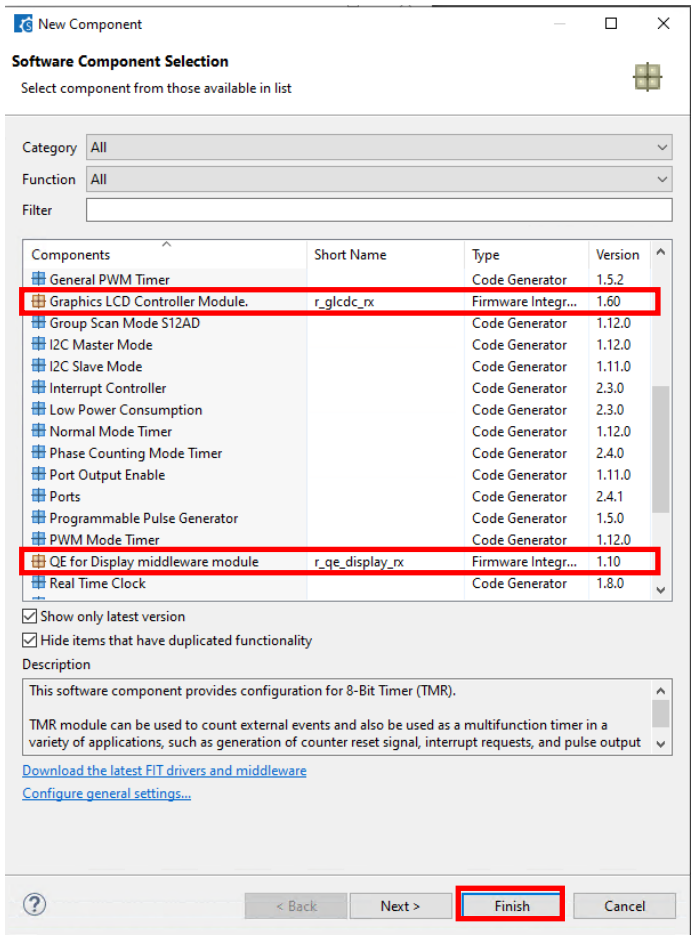
4. In the “FIT Module Download” dialog box, remove the check against “Show RX Driver Package only”, select the FIT modules corresponding to the components that were not displayed, and click on “Download”.
   The correspondence between the components and FIT modules are as follows:
   — “Graphics LCD Controller Module. (r_glcdc_rx)”
   “RX Family Graphic LCD Controller Module” (Rev. 1.60 or a later revision)
   — “QE for Display middleware module (r_qe_display_rx)”
   “RX Family QE for Display Module” (Rev. 1.10 or a later revision)



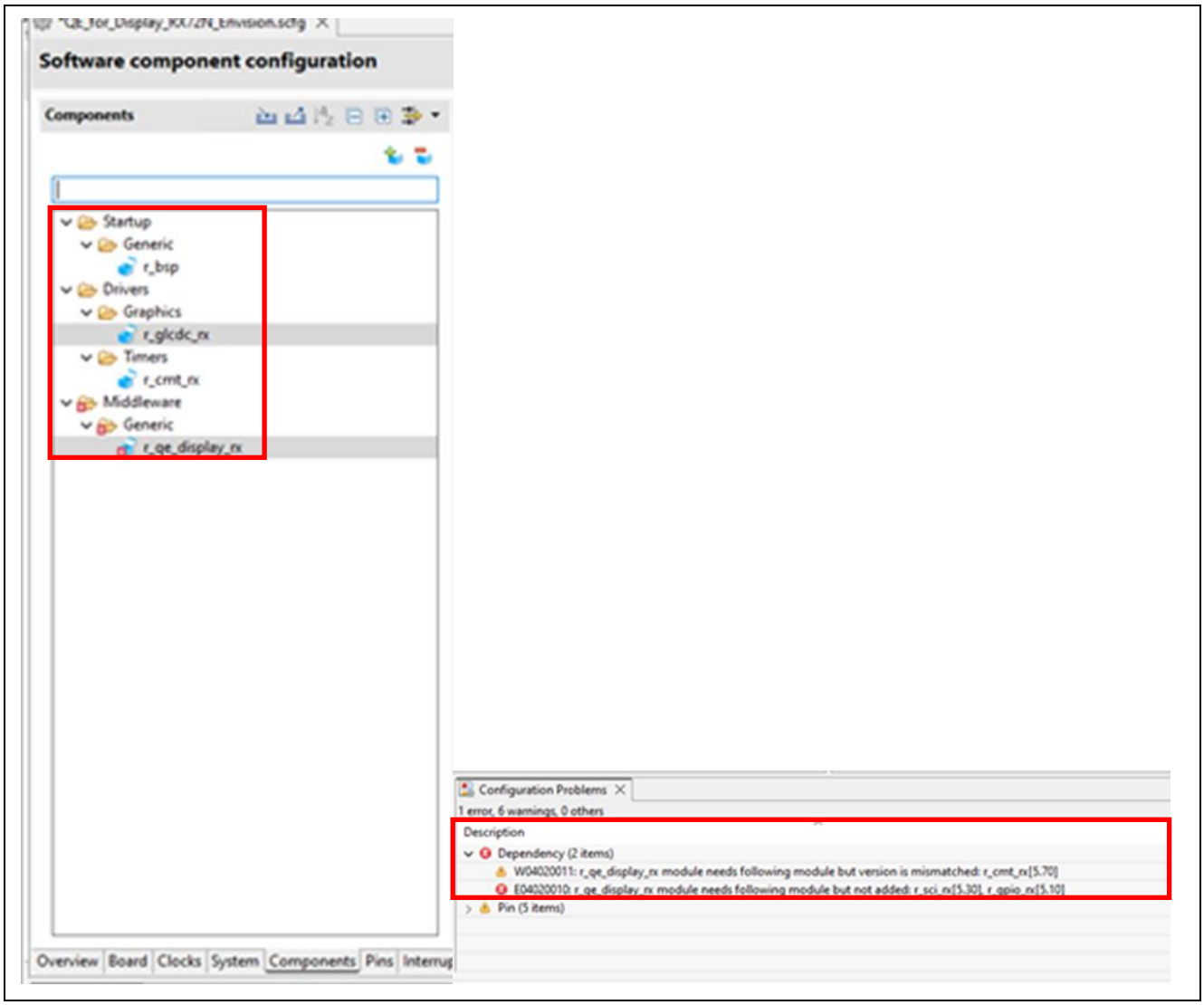
5. Read the description in the “End User License Agreement (Sample Code)” dialog box. If you agree, click on “Accept”.



6. Since the list of components will be updated, add the required components and click on the “Finish” button.

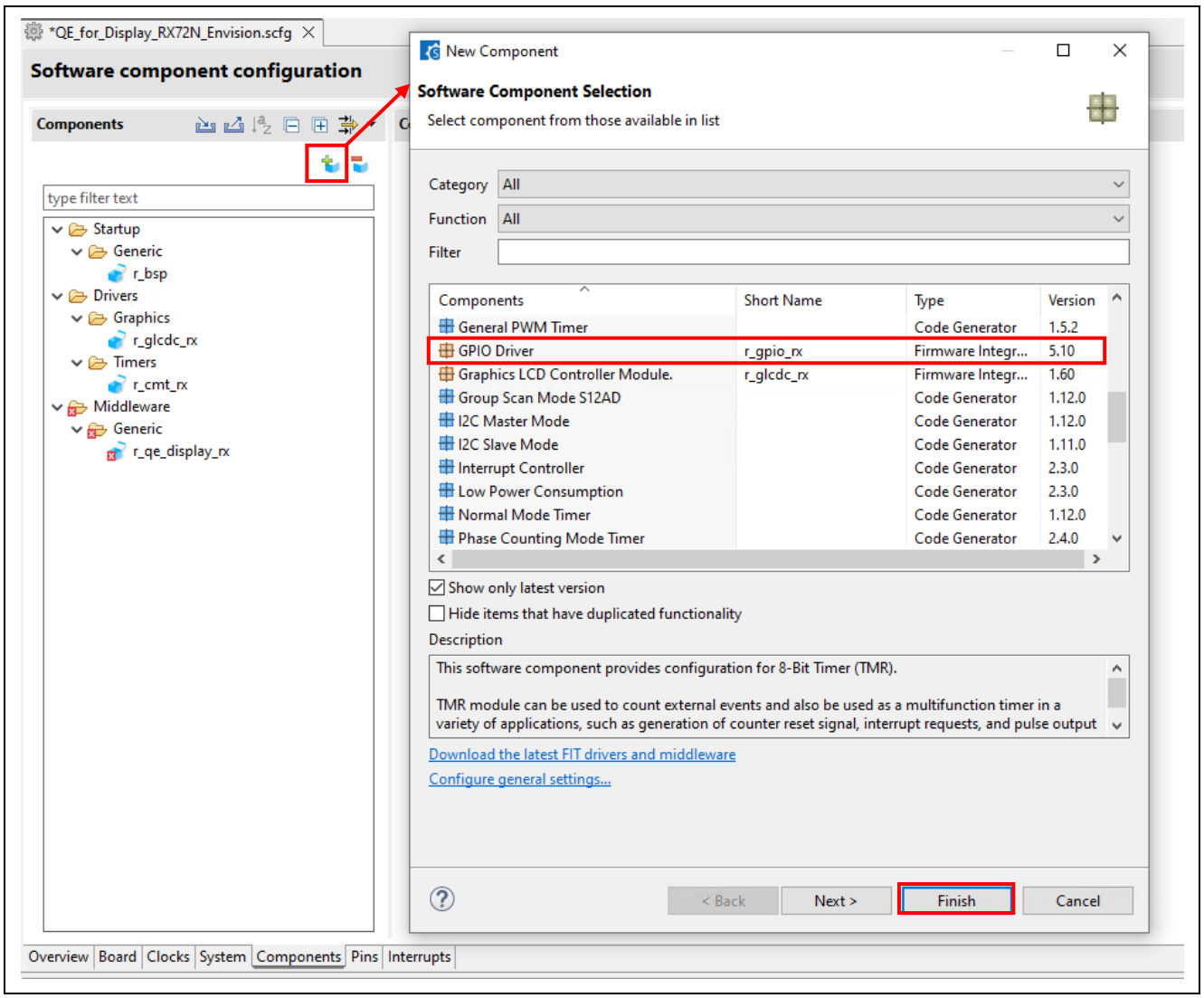


7. Components having dependencies with the added components are automatically added. However, a component that has not been added or a component with a version that differs from the required one will lead to an error message or a warning.
   In such cases, add the required component or update the version.
   The following shows an error message for the “r_sci_rx” and “r_gpio_rx” components that have not been added and a warning message regarding the version of the “r_cmt_rx” component.



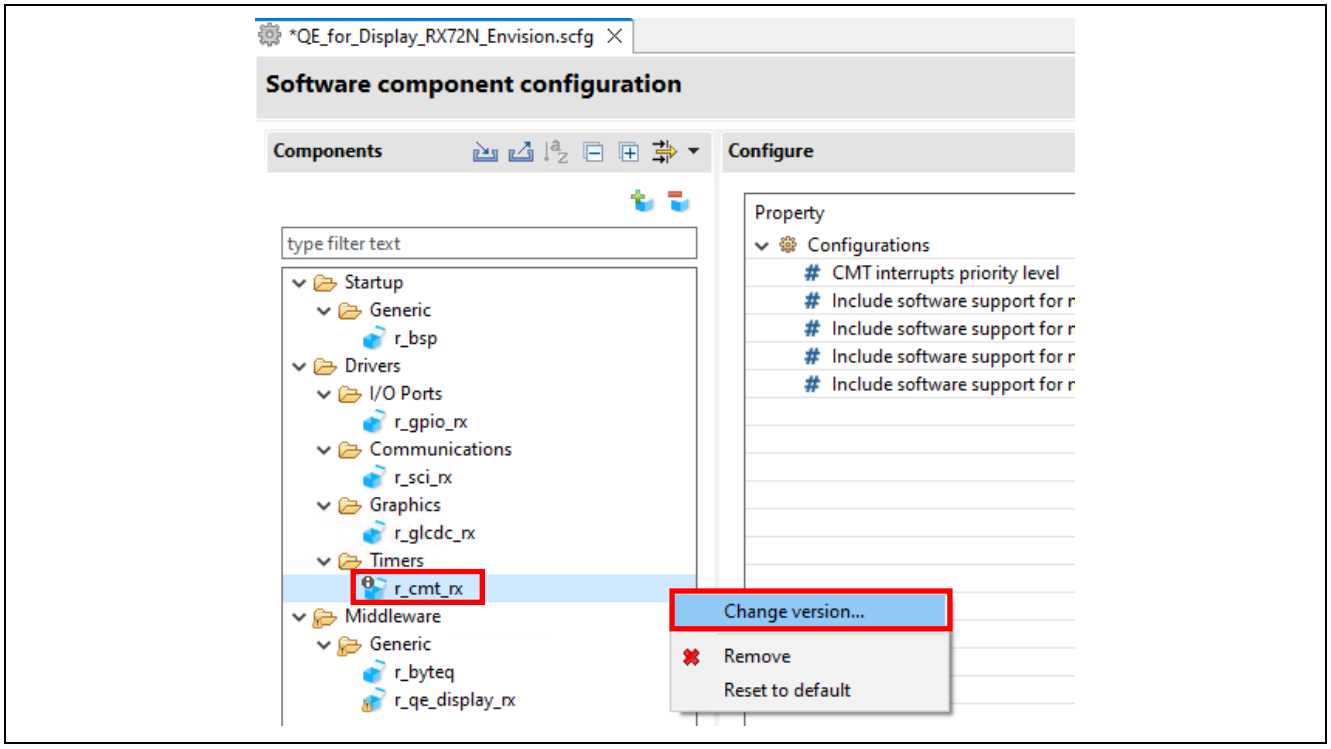
8. Add the “r_sci_rx” and “r_gpio_rx” components that are missing.
   — Click on the “Add component” icon.
   — In the “New Component” dialog box that is displayed, select the following components and click on the “Finish” button.
     - “SCI Driver” (r_sci_rx)
     - “GPIO Driver” (r_gpio_rx)

   If the components have not been added to the list of components, click on “Download the latest FIT drivers and middleware” and download the components from the list of available components. Since, depending on the component, it may be included in “RX Driver Package”, download the latest version of “RX Driver Package”.
   Note that a component may not be displayed if the checkbox for “Hide items that have duplicated functionality” is selected.

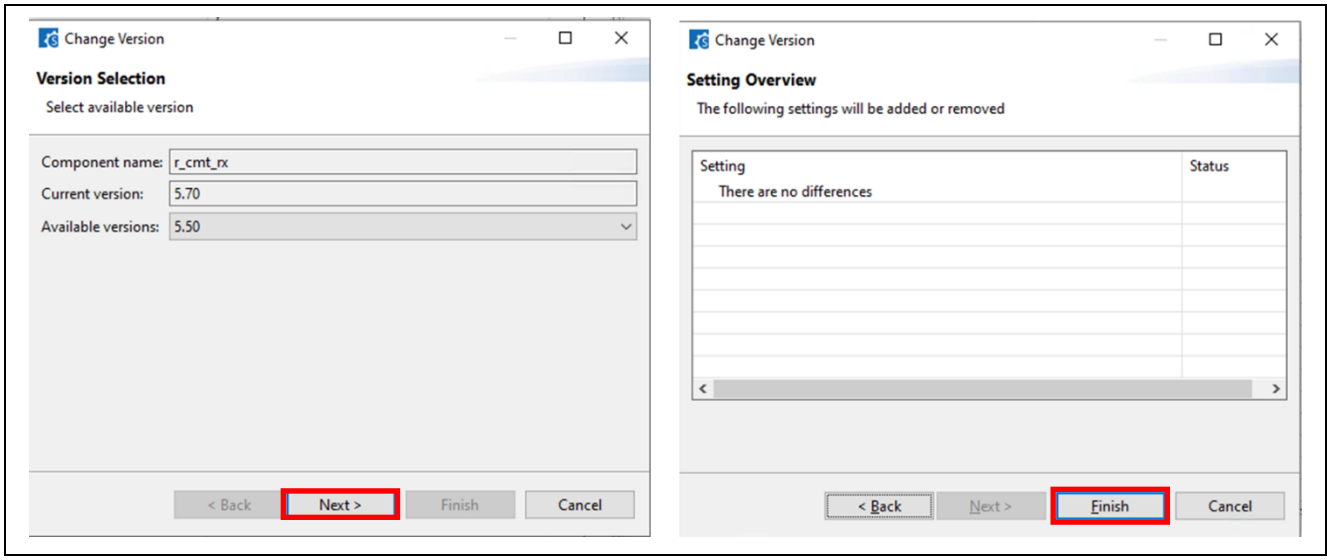


Update “r_cmt_rx” to the required version.

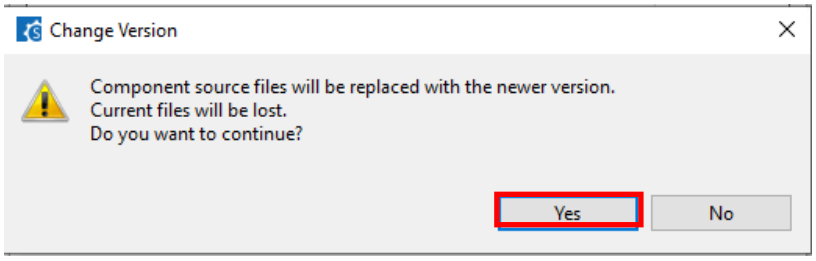
9. Right-click on the “r_cmt_rx” component and select “Change version”.



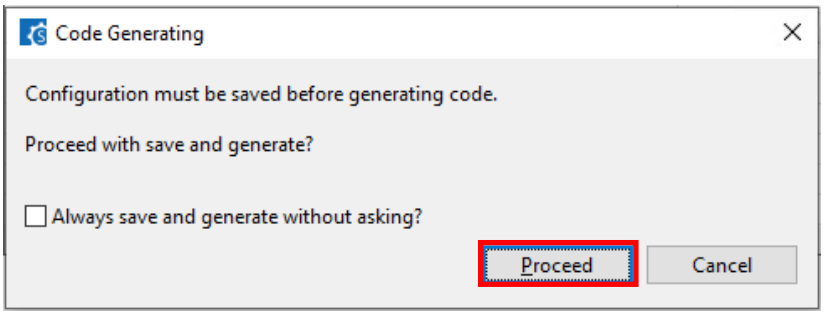
10. Confirm “Available versions” in the “Change Version” dialog box and click on the “Next” button.
11. Confirm the changes in the settings and click on the “Finish” button.



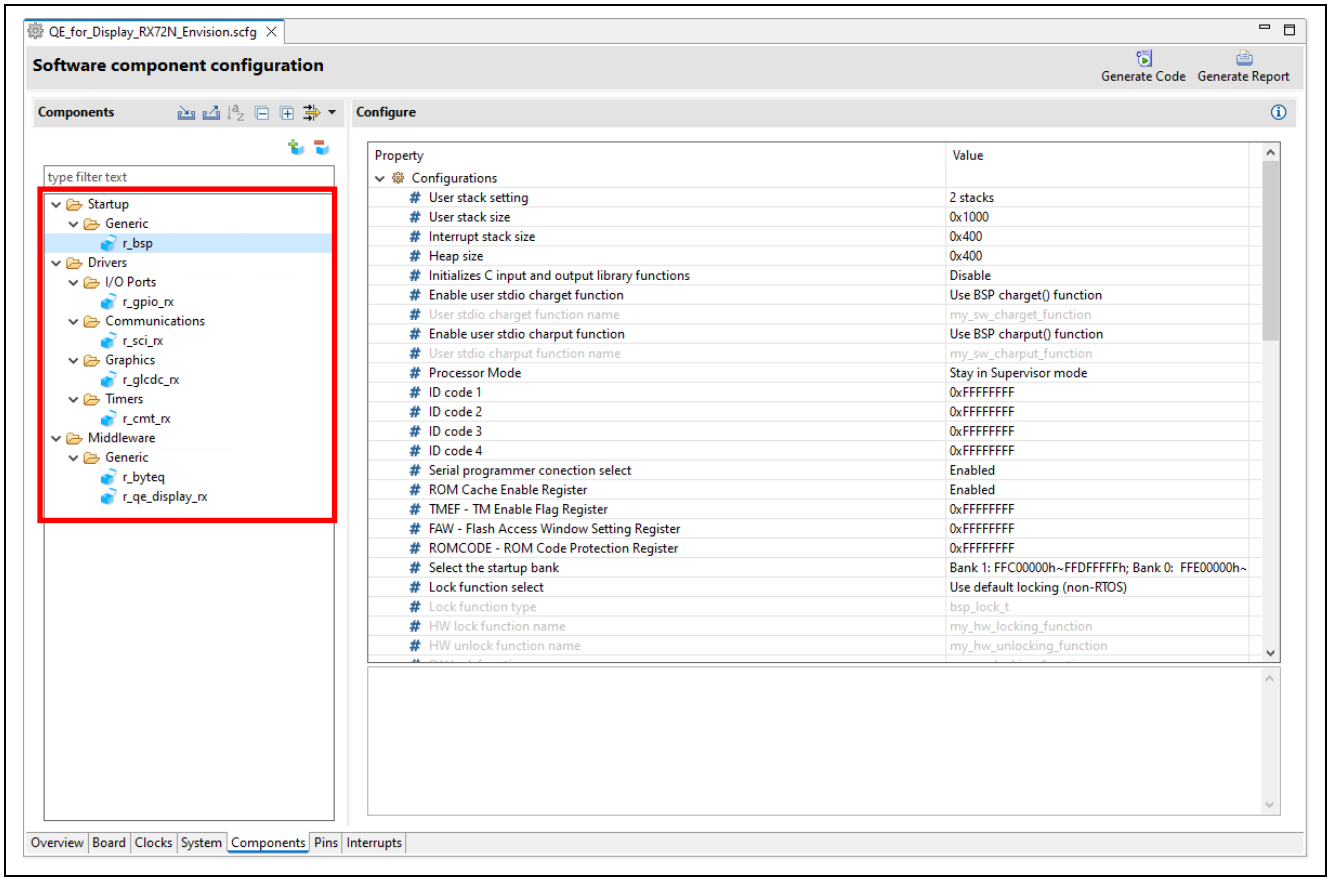
12. When the confirmation message is displayed in the “Change Version” dialog box, click on “Yes”.



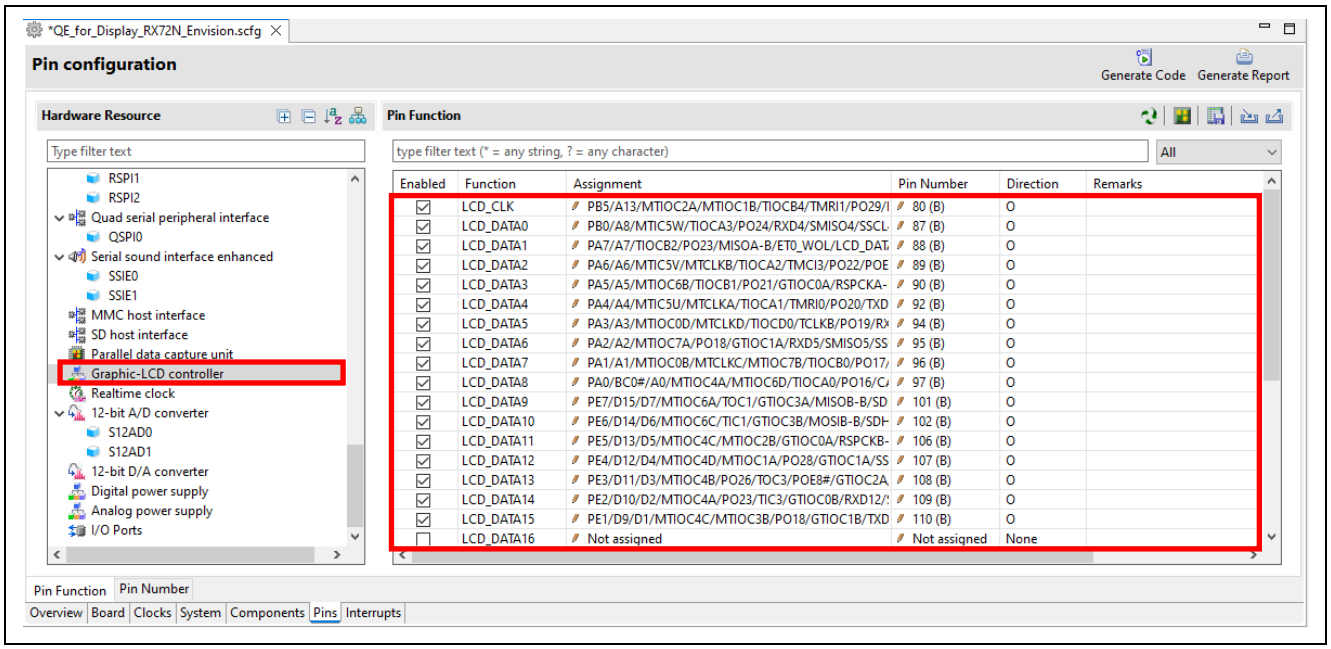
13. When the confirmation message is displayed in the “Code Generating” dialog box, click on “Proceed”.



14. The error and warning regarding the dependencies of components have now been resolved.



15. If you have selected a board when creating the project, pins for use by the GLCDC are also set in response to adding the component for the GLCDC. You can confirm the settings of pins by selecting “Graphic-LCD controller” on the “Pins” tabbed page. If you are using a custom board, make the settings of pins on this tabbed page.



16. Additionally set the components and SCI pins to suit the board to be used. (Table 4.2 to Table 4.5)

Table 4.2 Settings when the RSK RX72N is to be Used

Component or SCI Pin	Item	Value
r_qe_display_rx	UART channel	UART9
r_sci_rx	Include software support for channel 9	Include
	SCI9	Checked
	RXD9/SMISO9/SSCL9 Pin	Used
	TXD9/SMOSI9/SSDA9 Pin	Used
SCI9 pin	RXD9	Pin Number J10
	TXD9	Pin Number P12

Table 4.3 Settings when the Envision RX72N is to be Used

Component or SCI Pin	Item	Value
r_qe_display_rx	UART channel	UART2
r_sci_rx	Include software support for channel 2	Include
	SCI2	Checked
	RXD2/SMISO2/SSCL2 Pin	Used
	TXD2/SMOSI2/SSDA2 Pin	Used
SCI2 pin	RXD2	Pin Number 45
	TXD2	Pin Number 44

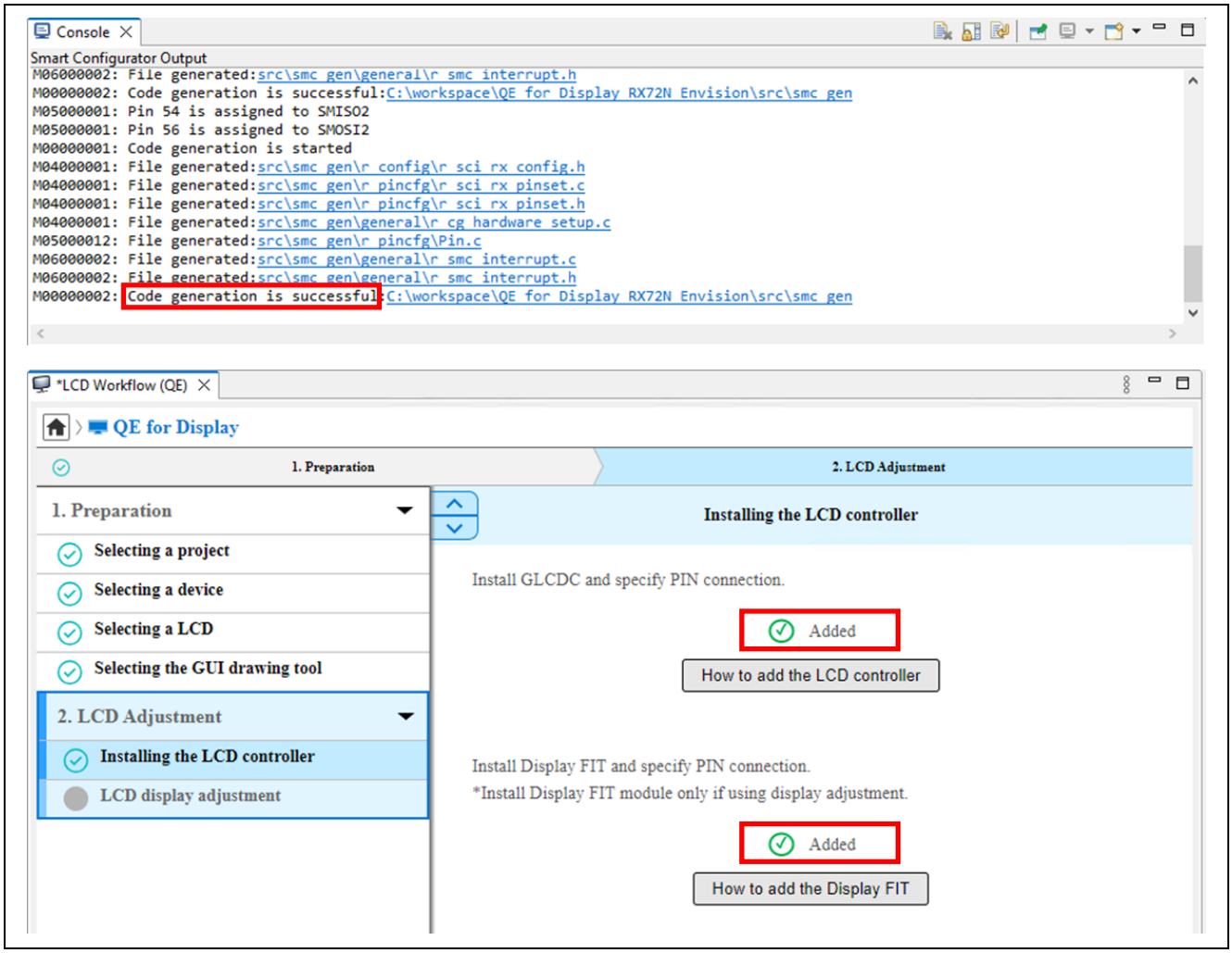
Table 4.4 Settings when the RSK RX65N is to be Used

Component or SCI Pin	Item	Value
r_qe_display_rx	UART channel	UART8
r_sci_rx	Include software support for channel 8	Include
	SCI8	Checked
	RXD8/SMISO8/SSCL8 Pin	Used
	TXD8/SMOSI8/SSDA8 Pin	Used
SCI8 pin	RXD8	Pin Number 59
	TXD8	Pin Number 58

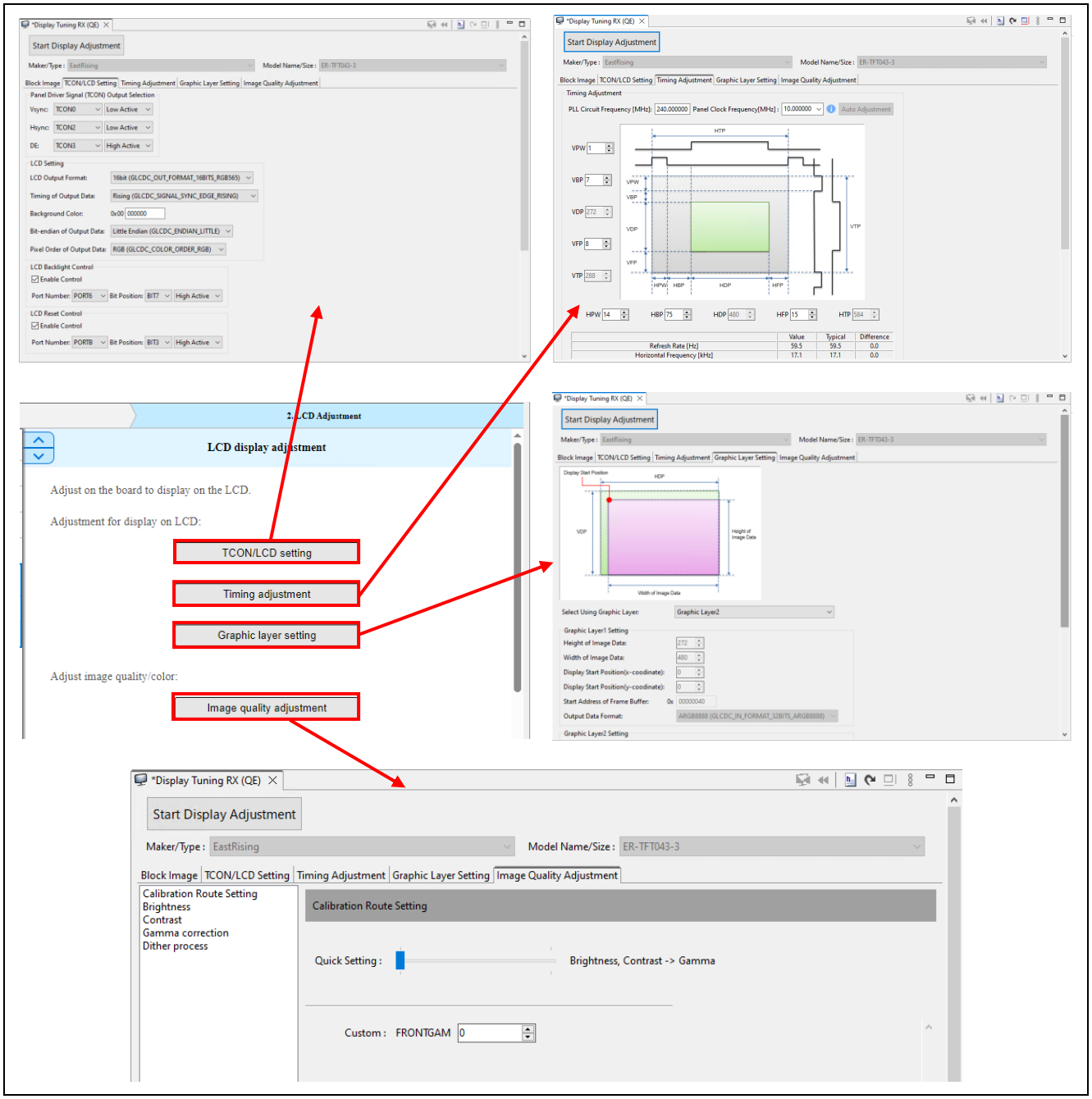
Table 4.5 Settings when the Envision RX65N is to be Used

Component or SCI Pin	Item	Value
r_qe_display_rx	UART channel	UART5
r_sci_rx	Include software support for channel 5	Include
	SCI5	Checked
	RXD5/SMISO5/SSCL5 Pin	Used
	TXD5/SMOSI5/SSDA5 Pin	Used
SCI5 pin	RXD5	Pin Number 70
	TXD5	Pin Number 67

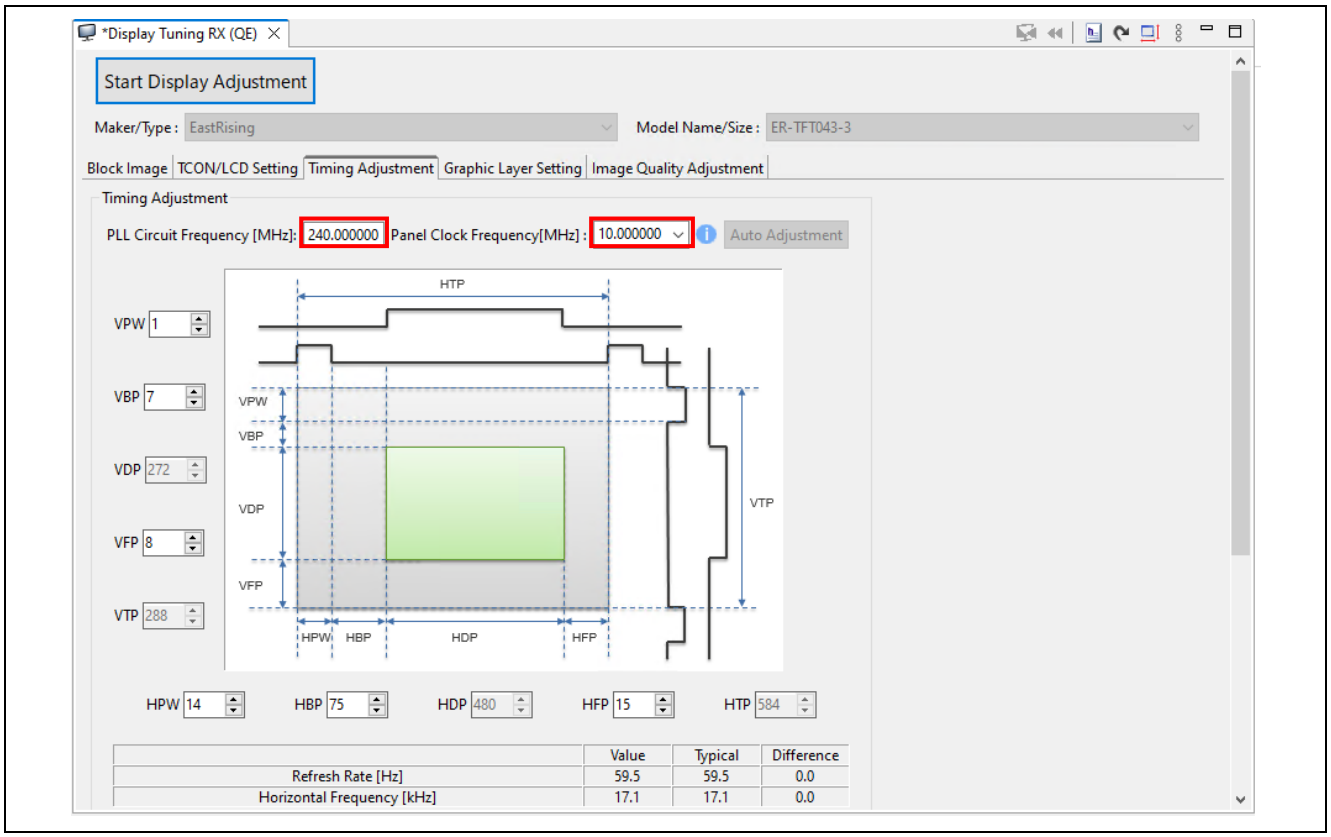
17. Click on the “Generate Code” button in the upper-right corner of the Smart Configurator window. The code is generated according to the settings.
    After code generation has finished, the state indicators for the GLCDC and QE Display FIT modules are changed to “Added”.



18. Select “LCD display adjustment” in the “LCD Workflow (QE)” view.
    Adjust the LCD.
    Clicking on the “TCON/LCD setting”, “Timing adjustment”, “Graphic layer setting”, and “Image quality adjustment” buttons opens the “Display Tuning RX (QE)” views of the standalone version of QE which correspond to each button and allows changing of the settings. When an evaluation board is in use, settings do not have to be made because the default settings will be reflected.
    In addition, clicking on the “Start Display Adjustment” button in each “Display Tuning RX (QE)” view allows adjustment of the display with real-time confirmation on the actual display.
    For details, refer to the help system entries for the “Display Tuning RX (QE)” views.



19. In the standalone version of QE, a value has to be entered in “PLL Circuit Frequency [MHz]” on the “Timing Adjustment” tabbed page, according to the setting on the “Clocks” tabbed page of the Smart Configurator. Also, select the value of “Panel Clock Frequency [MHz]” following the prompt.



The following values are automatically set when the panel clock frequency is 10 MHz in the RSK RX72N, RSK RX65N, Envision RX72N, or Envision RX65N.

Table 4.6 Example of Timing Settings when the Panel Clock Frequency is 10 MHz (for RSK RX72N and RSK RX65N)

Connected Device	Item	Value
NHD-4.3-480272EF-ATXL#-CTP	VPW	10
	VBP	2
	VDP	272
	VFP	2
	VTP	286
	HPW	41
	HBP	29
	HDP	480
	HFP	34
	HTP	584

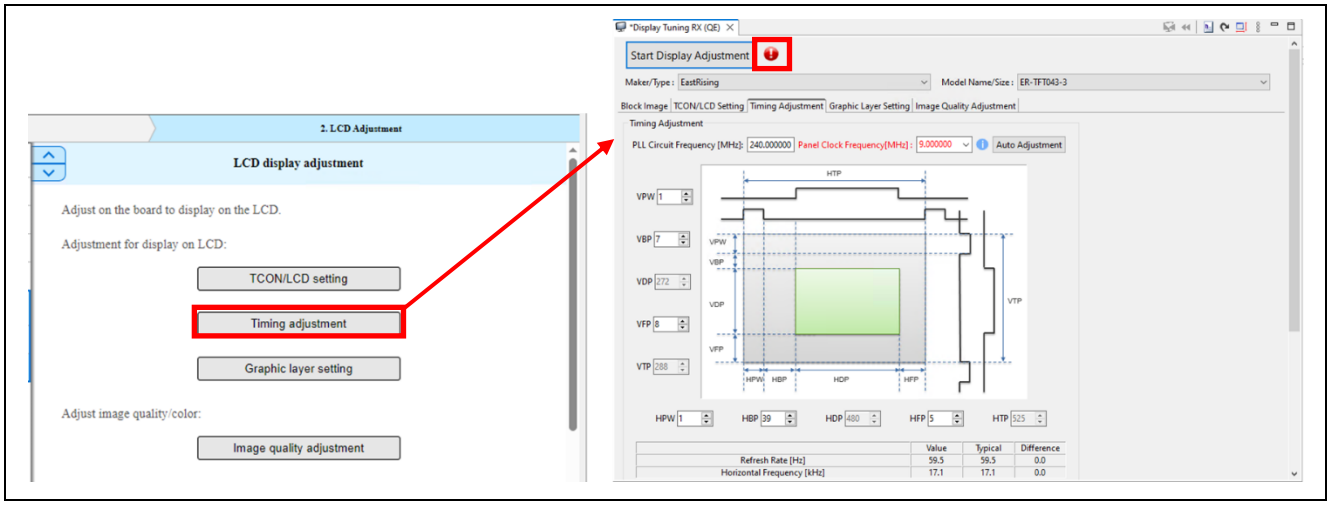
Table 4.7 Example of Timing Settings when the Panel Clock Frequency is 10 MHz (for Envision RX72N and Envision RX65N)

Connected Device	Item	Value
ER-TFT043-3	VPW	1
	VBP	7
	VDP	272
	VFP	8
	VTP	288
	HPW	14
	HBP	75
	HDP	480
	HFP	15
	HTP	584

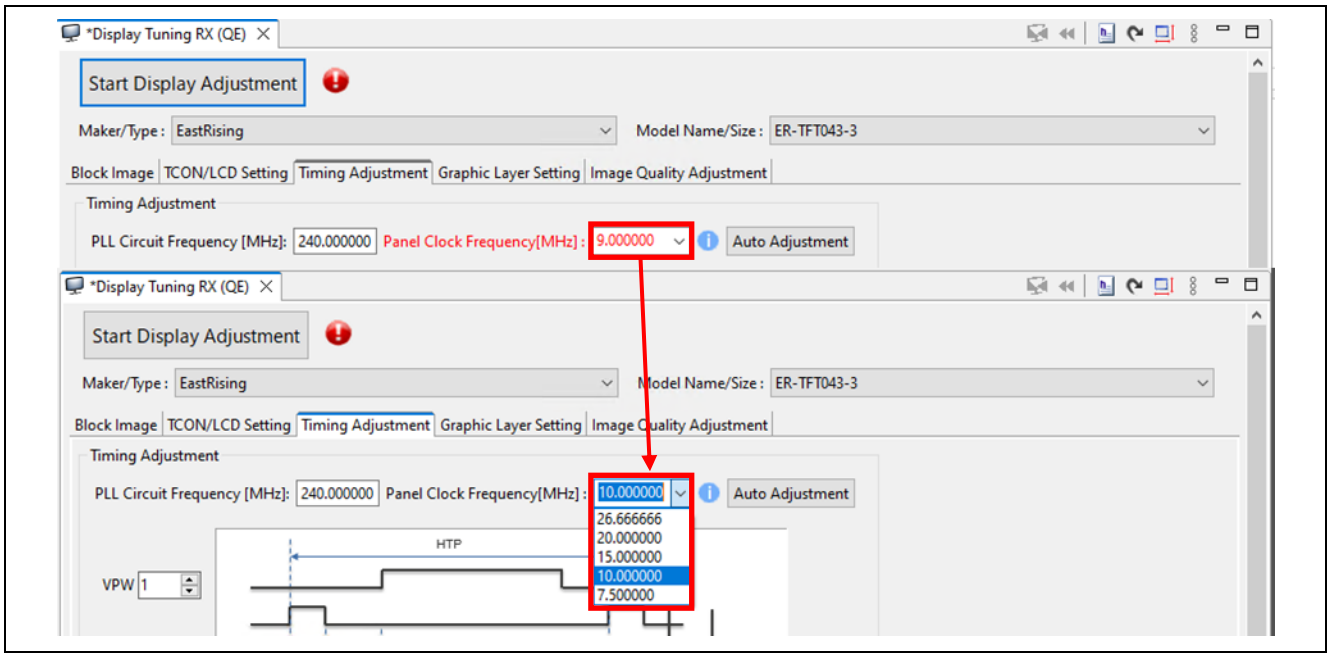
If you are using a custom board, set the values on the “Timing Adjustment” tabbed page such that no errors appear in the display.

Here, modify the values so that values for the horizontal frequency that are in error produce normal results after having modifying the value for the panel clock frequency.

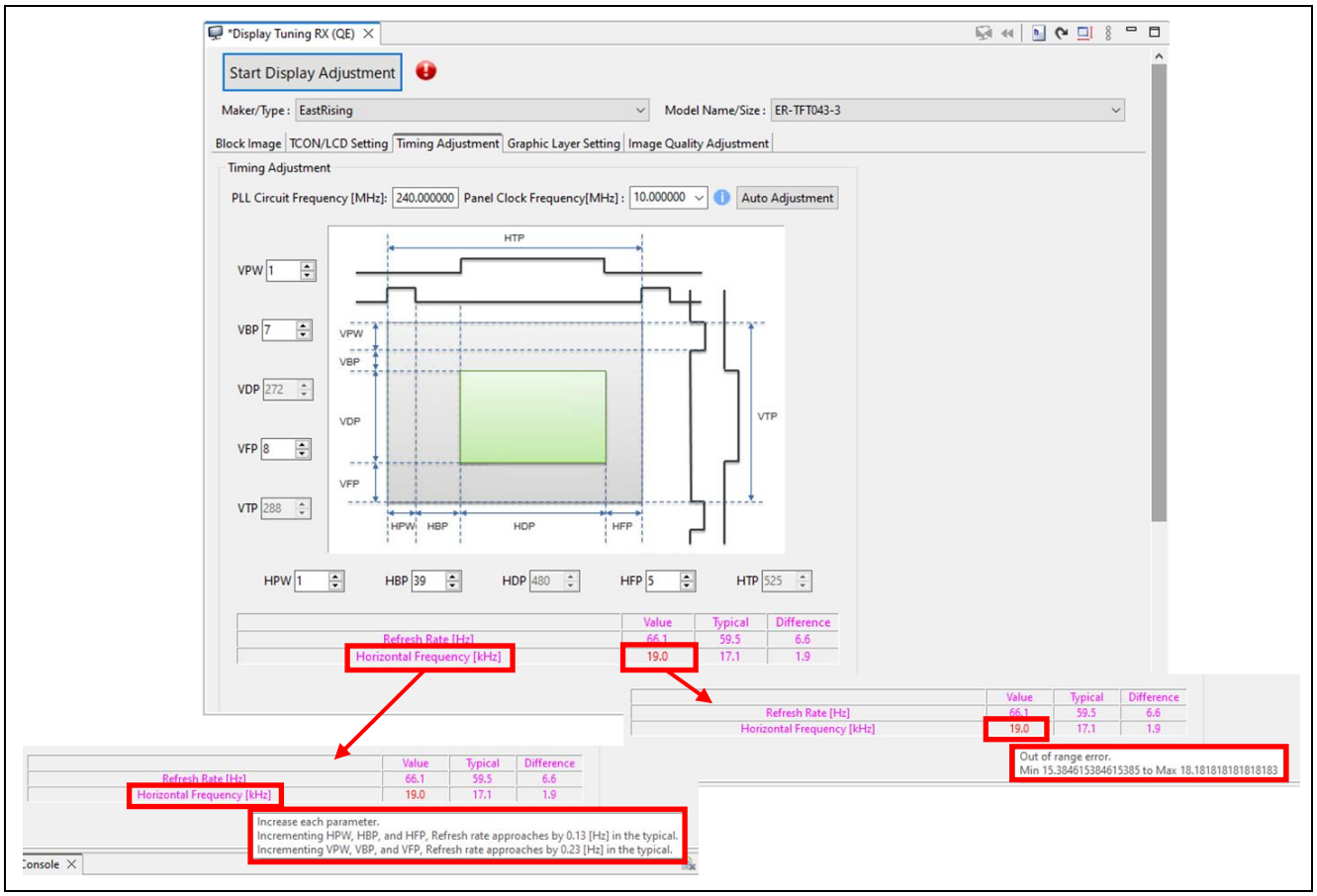
20. Click on “Timing adjustment”.
21. The “Display Tuning RX (QE)” view of the standalone version of QE opens. If a value has an error, an error mark is displayed. Modify the value so this error mark disappears.



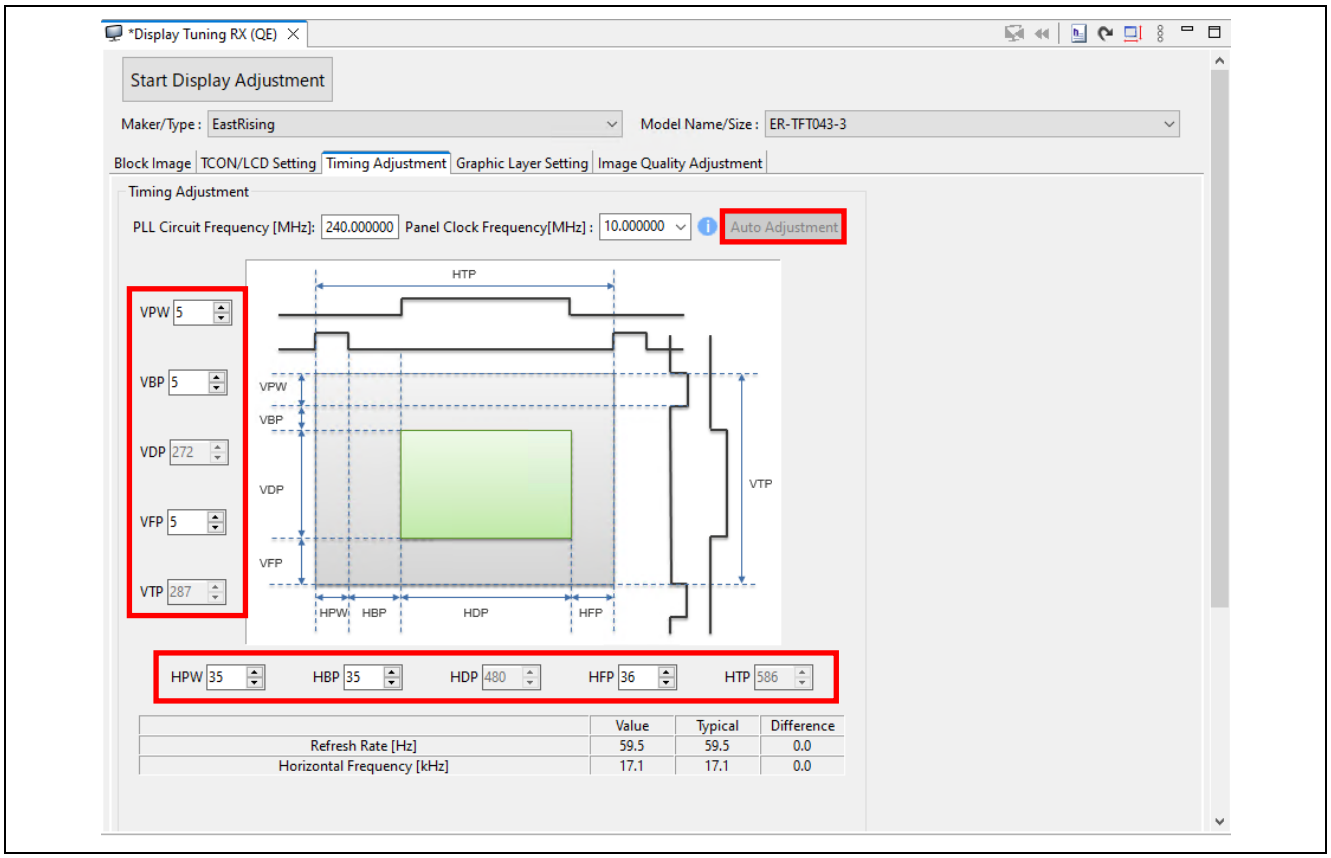
22. Adjust the value of “Panel Clock Frequency [MHz]”, which is displayed in red to indicate that it is in error. Here, select “10.000000”, which is the nearest available value to the 9.0 MHz panel clock frequency for the LCD, from the combo box.



23. Setting the value of the panel clock frequency to 10.0 MHz makes the value of “Horizontal Frequency [kHz]” incorrect, so it is displayed in red.
    Hovering the mouse cursor over the erroneous value (the value of “Horizontal Frequency [kHz]”) displayed in red produces a display of the range of specifiable values.
    Hovering the mouse cursor over the label (“Horizontal Frequency [kHz]”) for the erroneous value produces a display of a description of how to eliminate the error.

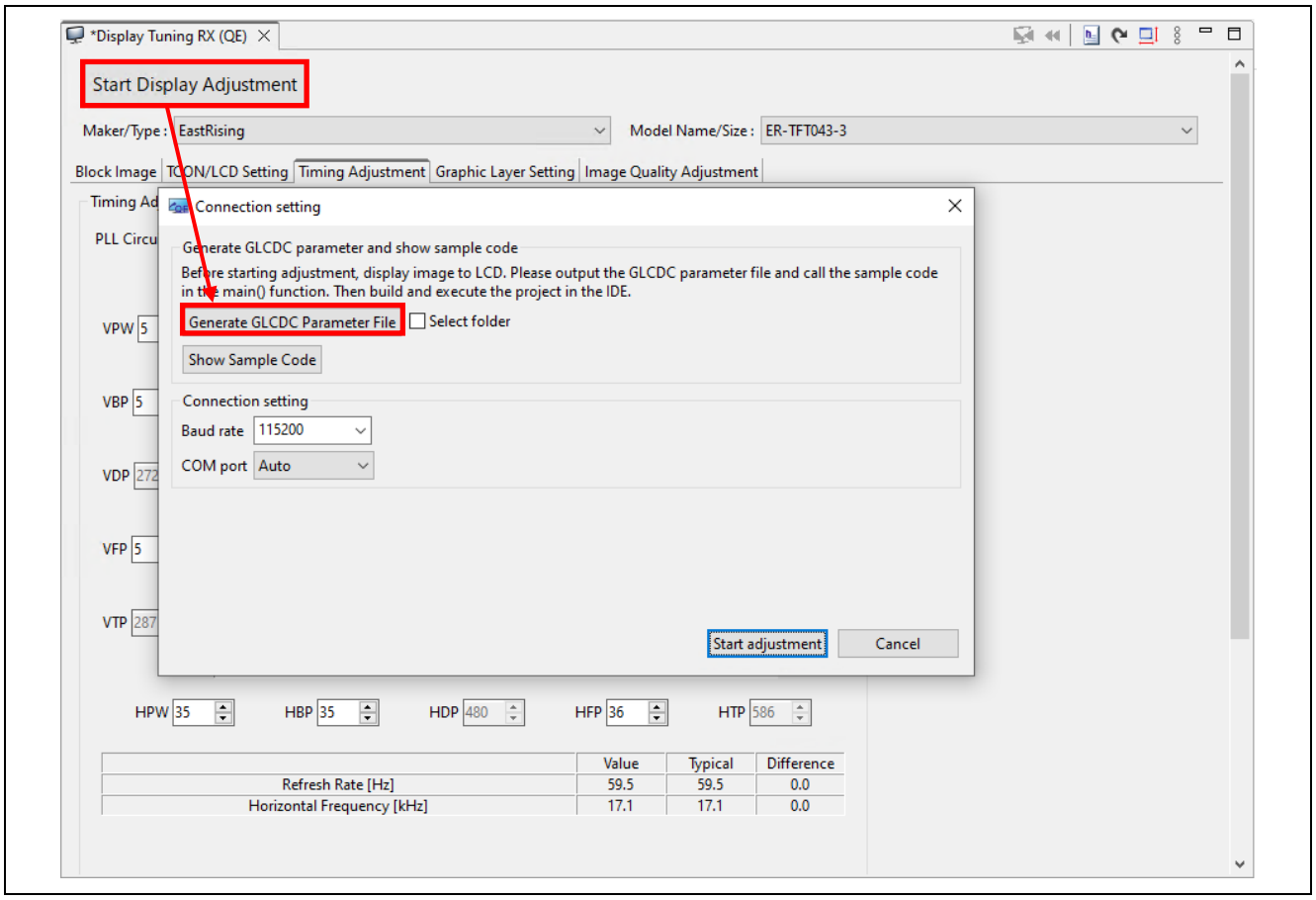


24. Clicking on the “Auto Adjustment” button to the right of “Panel Clock Frequency [MHz]” automatically sets each value so that the refresh rate and the horizontal frequency are within the range of specifiable values at the specified panel clock frequency. Once there are no errors, the “Auto Adjustment” button becomes inactive.

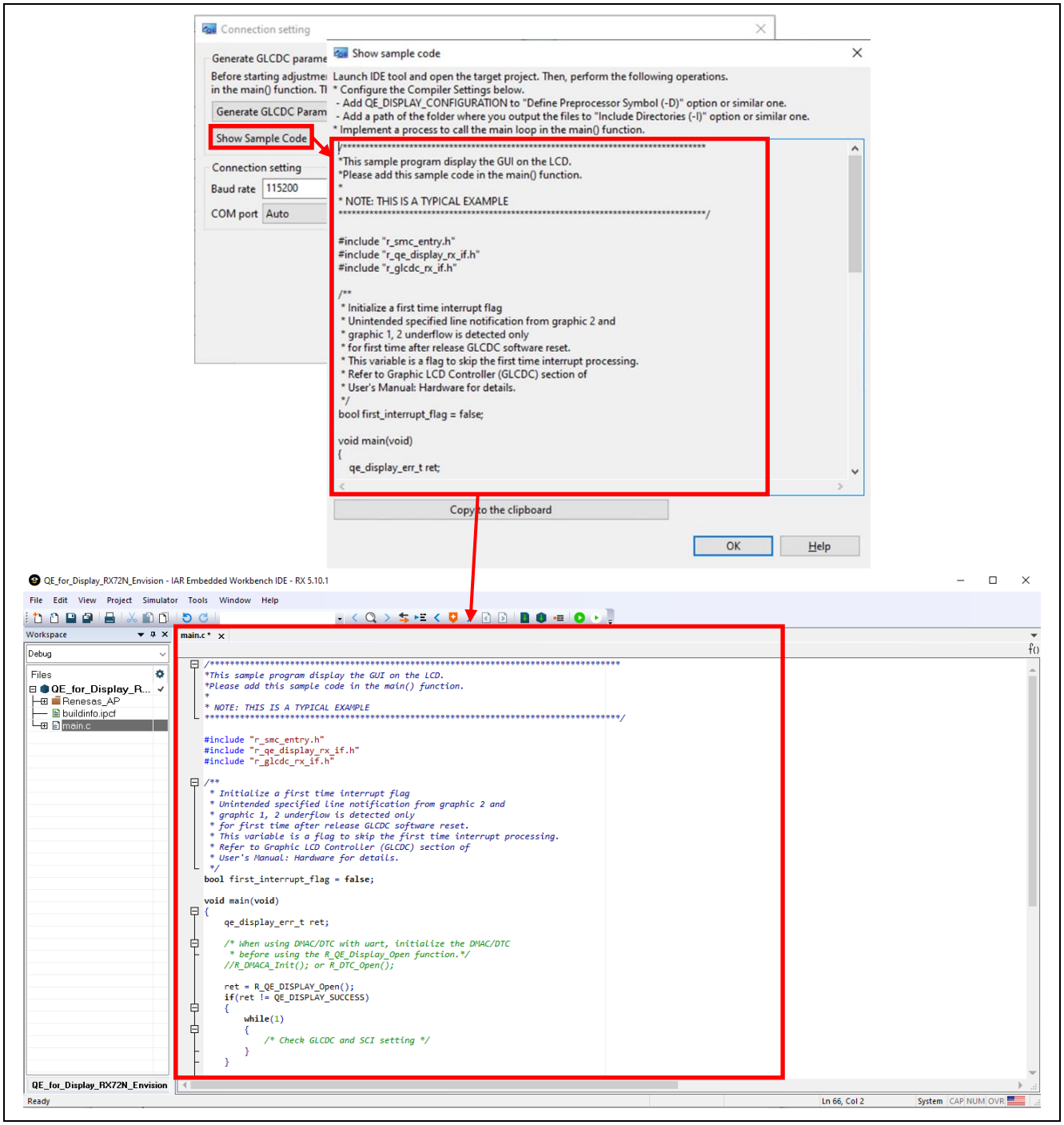


The settings of the LCD can be adjusted by the GUIs for the display adjustment facilities while confirming the results on the actual display. The following shows an example of the adjustment of brightness from the “Image Quality Adjustment” tabbed page.

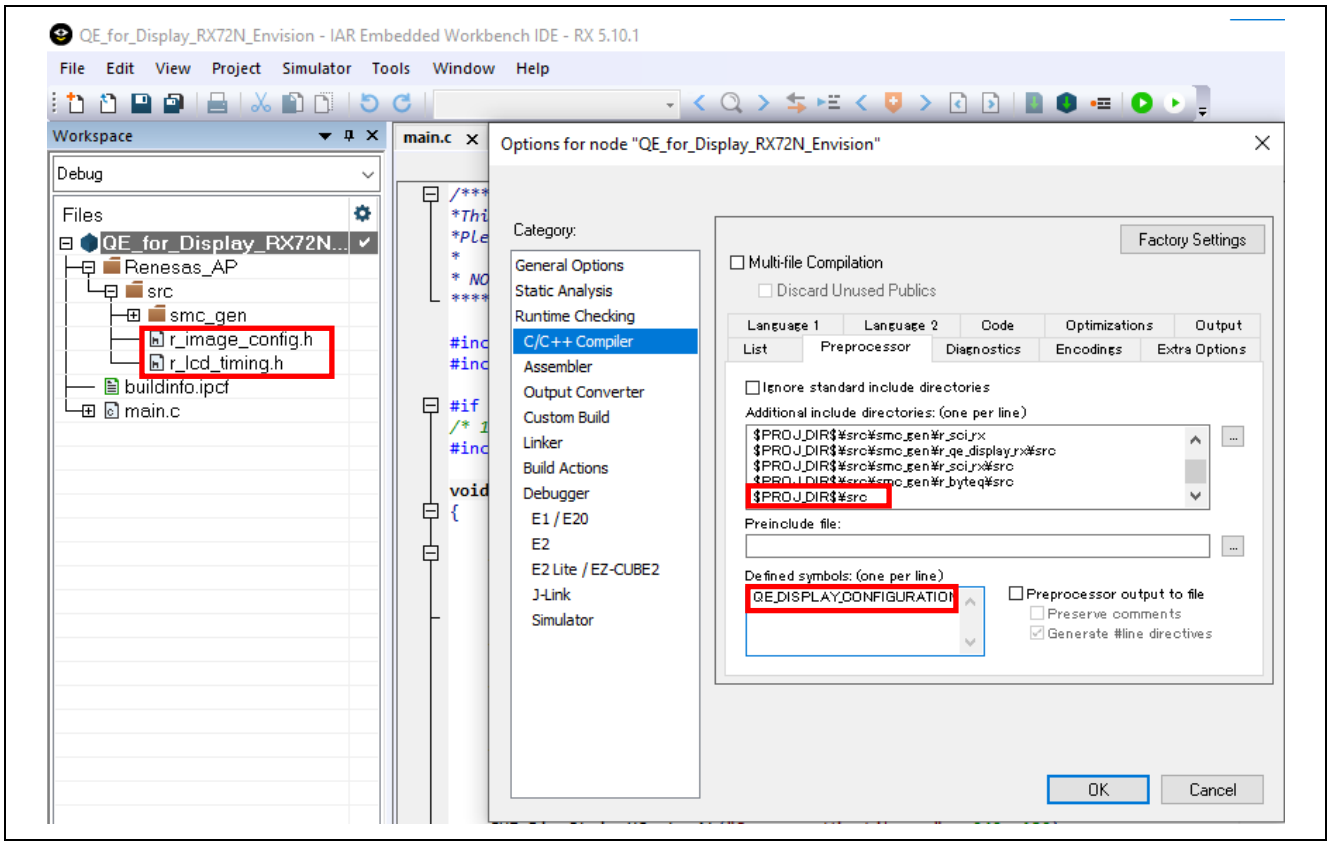
25. Click on the “Start Display Adjustment” button to open the “Connection setting” dialog box.
26. Click on the “Generate GLCDC Parameter File” button to output the settings that have been made so far.



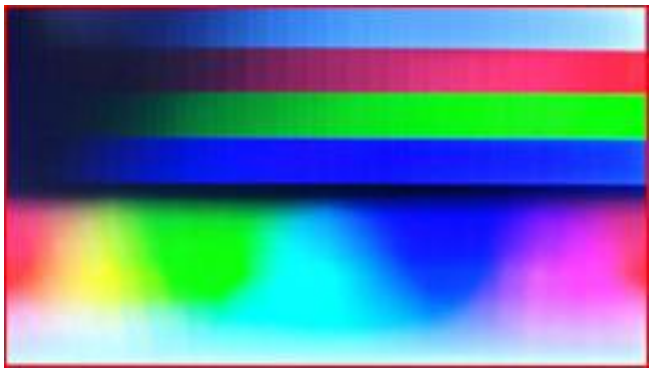
27. Click on the “Show Sample Code” button and implement the programs used to display the window for adjusting the LCD in the main() function.



28. Add the following files to the workspace of the project as the target files for building. Also, add the paths to these files to “Project” -> “Options” -> “C/C++ Compiler” -> “Preprocessor” -> “Additional include directories” of the EWRX.
    - r_lcd_timing.h
    - r_image_config.h
29. Add the following definition to “Project” -> “Options” -> “C/C++ Compiler” -> “Preprocessor” -> “Defined symbols” of the EWRX.
    - QE_DISPLAY_CONFIGURATION

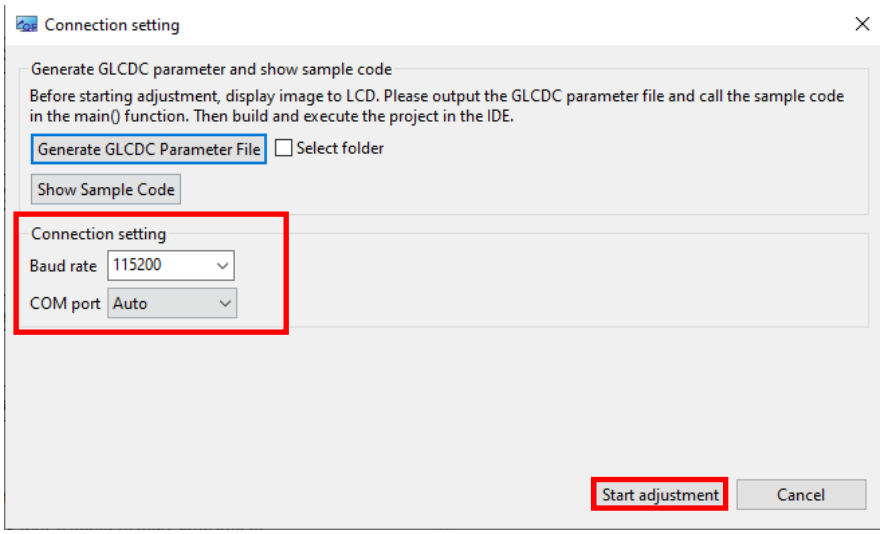


30. Build a project with reference to section 4.5, Building the Project.
31. Make the settings for the debugger and execute the project with reference to section 4.6, Connecting a Debugger and Executing the Program. A demonstration image is displayed on the display.

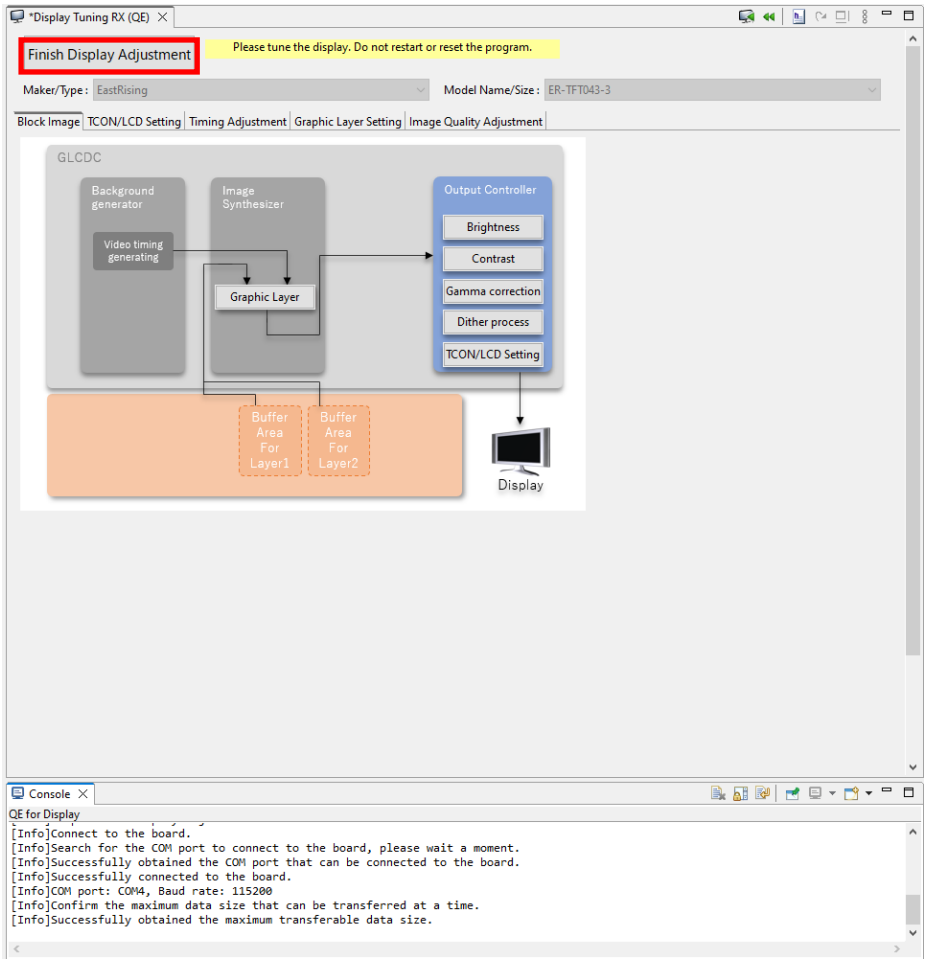


Demonstration image

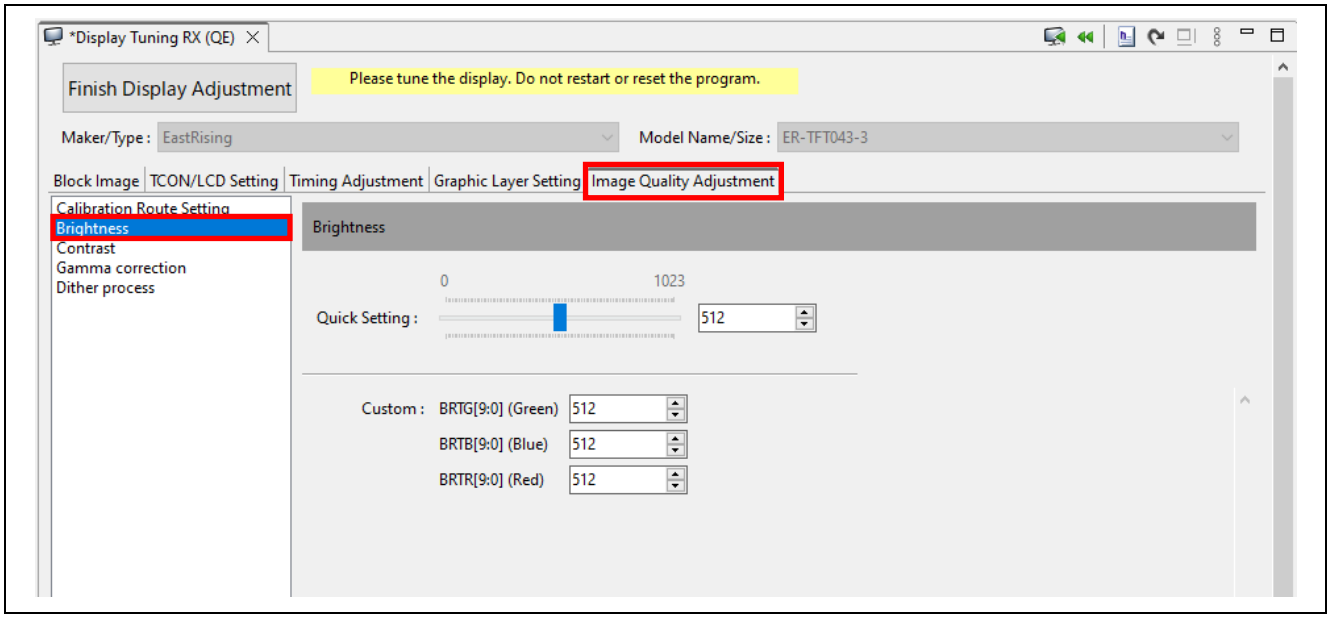
32. Make the following settings in the “Connection setting” dialog box and click on “Start adjustment”.
    — Baud rate: 115200
    — COM port: Auto



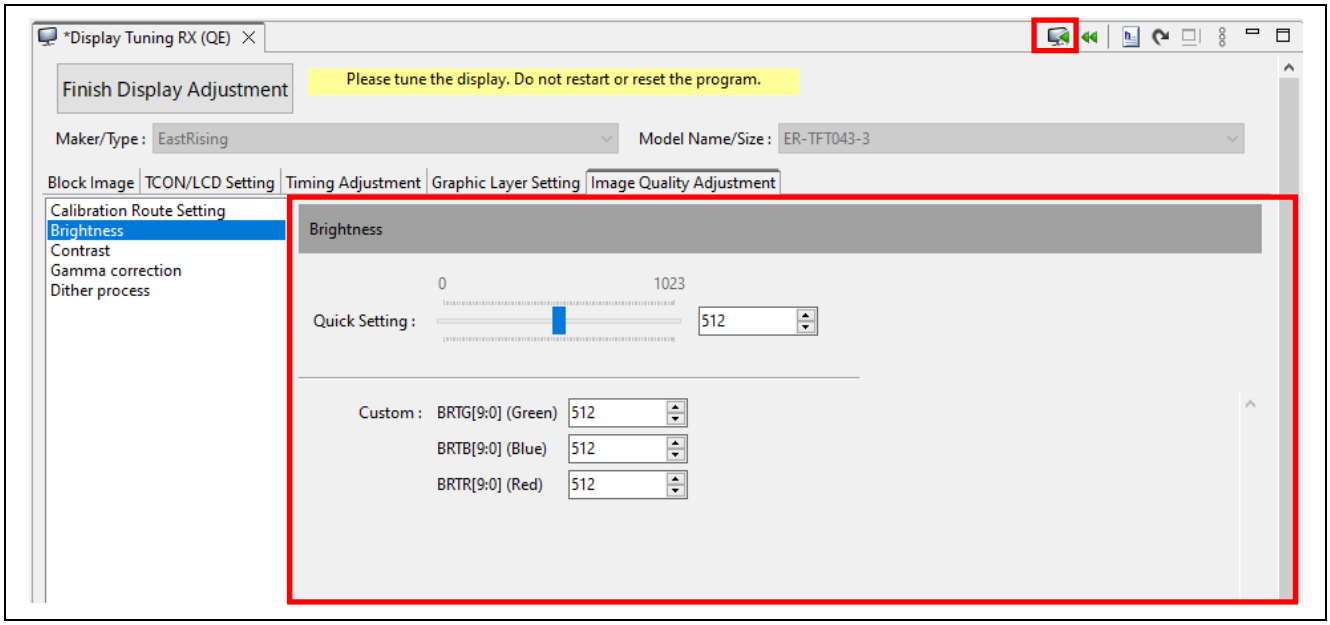
33. When the board is connected to the device and adjustment of the display is started, the “Start Display Adjustment” button is replaced by the “Finish Display Adjustment” button.



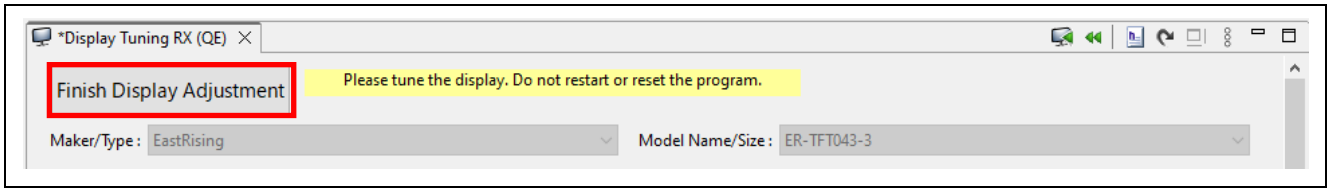
34. Select the “Image Quality Adjustment” tabbed page in the “Display Tuning RX (QE)” view, then select “Brightness” from the menu to the left.



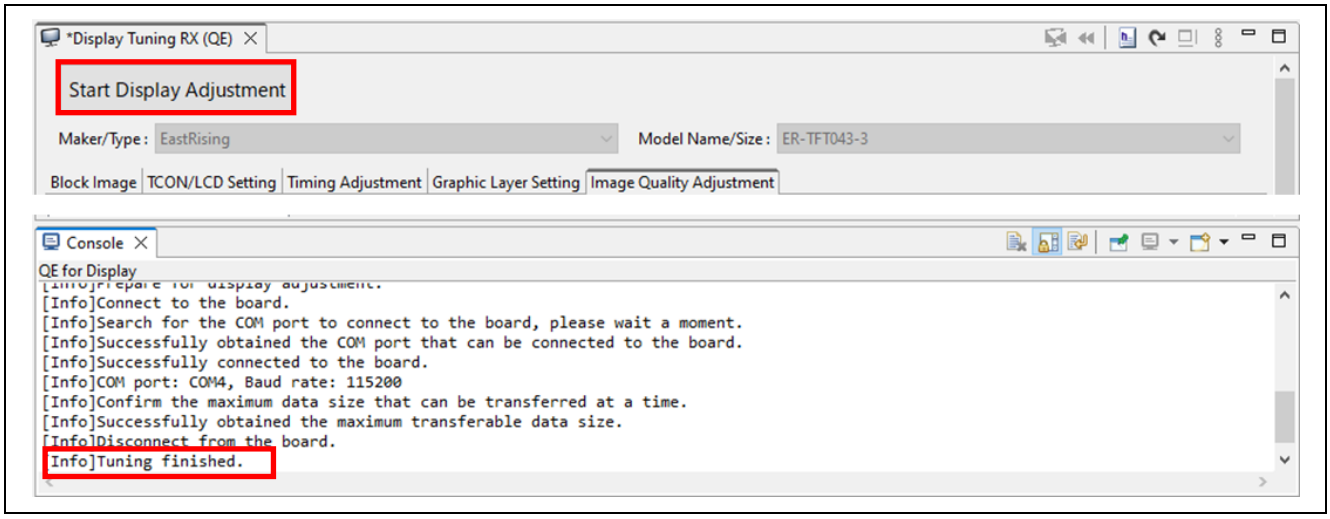
35. Modify the value for the gauge of “Quick Setting” or the values of “Custom” and click on the “Set the Register” icon ( ).
The values are set in the registers and can be confirmed on the display of the connected board.
Repeat modification of the values and settings of the registers until the display is as expected.



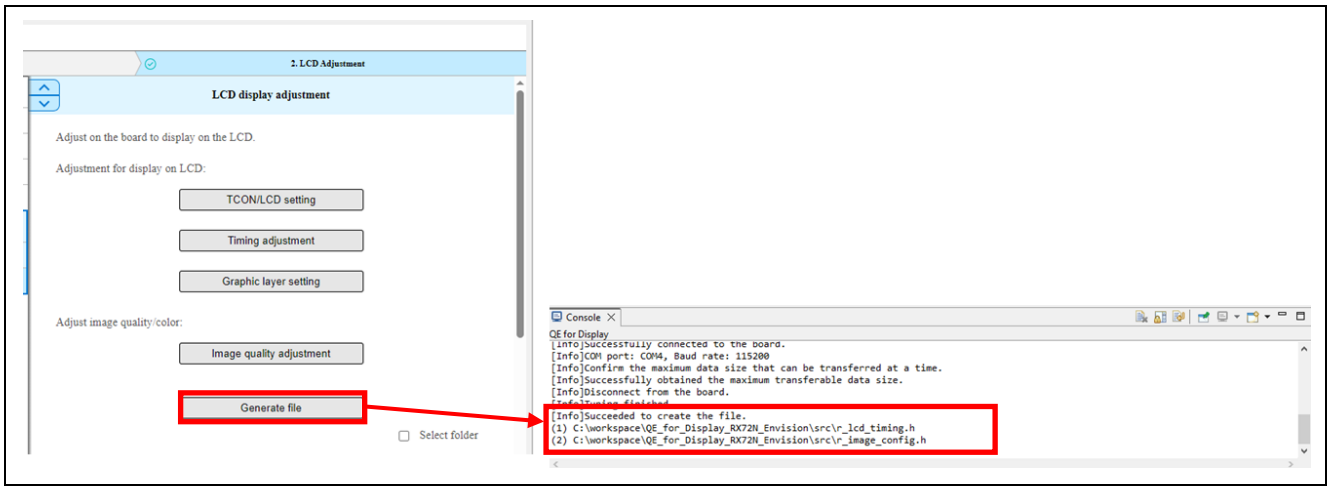
36. After you have finished adjusting the values, click on the “Finish Display Adjustment” button.



37. The board is disconnected from the device and the “Start Display Adjustment” button is restored to replace the “Finish Display Adjustment” button.
The message “Tuning finished.” appears in the console of QE for Display.



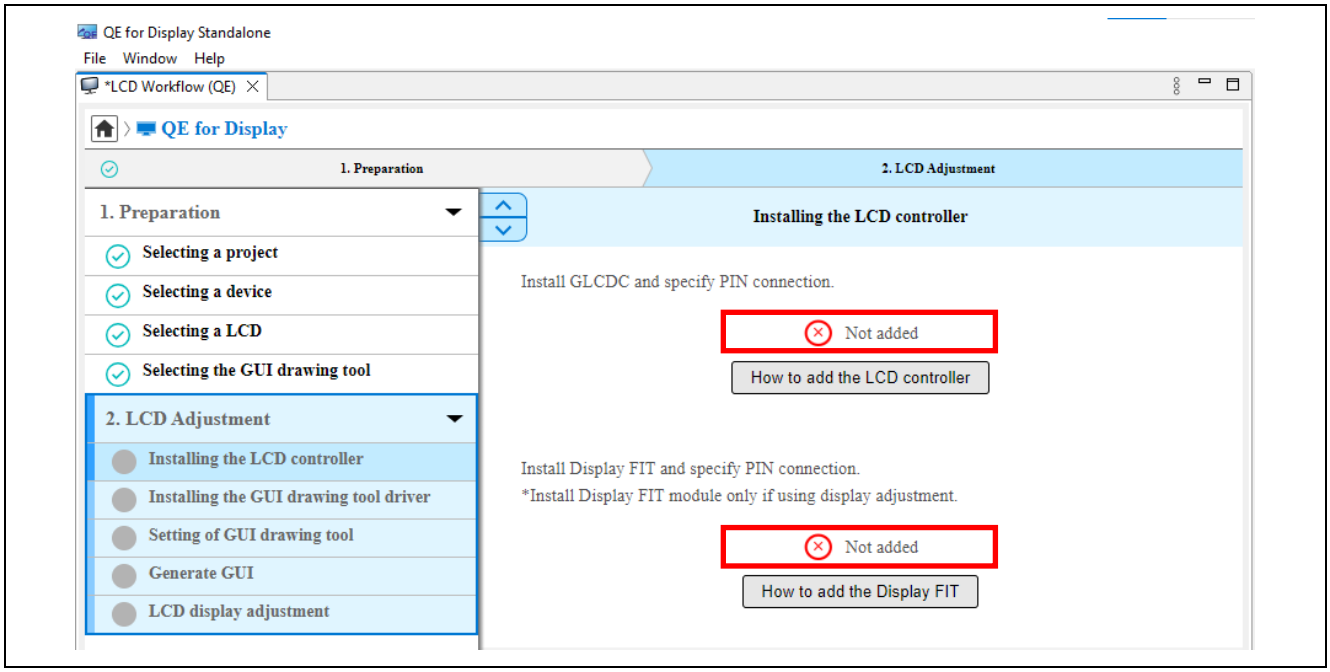
38. Header files reflecting the results of adjusting the display are then output.
Click on the “Generate file” button to output r_image_config.h and r_lcd_timing.h. They are output to src immediately under the project folder by default. The output destination folder can be changed by selecting the “Select folder” checkbox.



4.4.3 Adjusting the LCD (with Use of the Drawing Tool)

Create a GUI by using the drawing tool and use it to adjust the LCD.

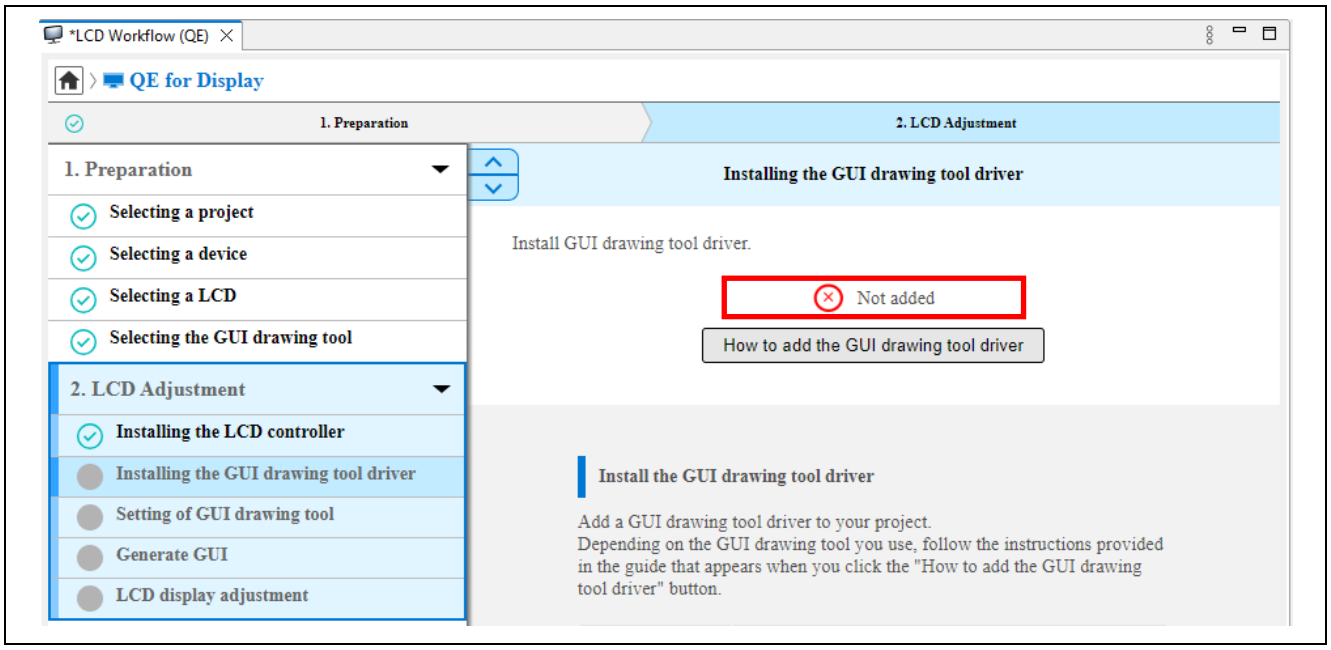
1. Installation status of the LCD controller
   — Select “Installing the LCD controller” in the “LCD Workflow (QE)” view.
   — If the GLCDC or QE Display FIT module is not installed, the following error message will be displayed.



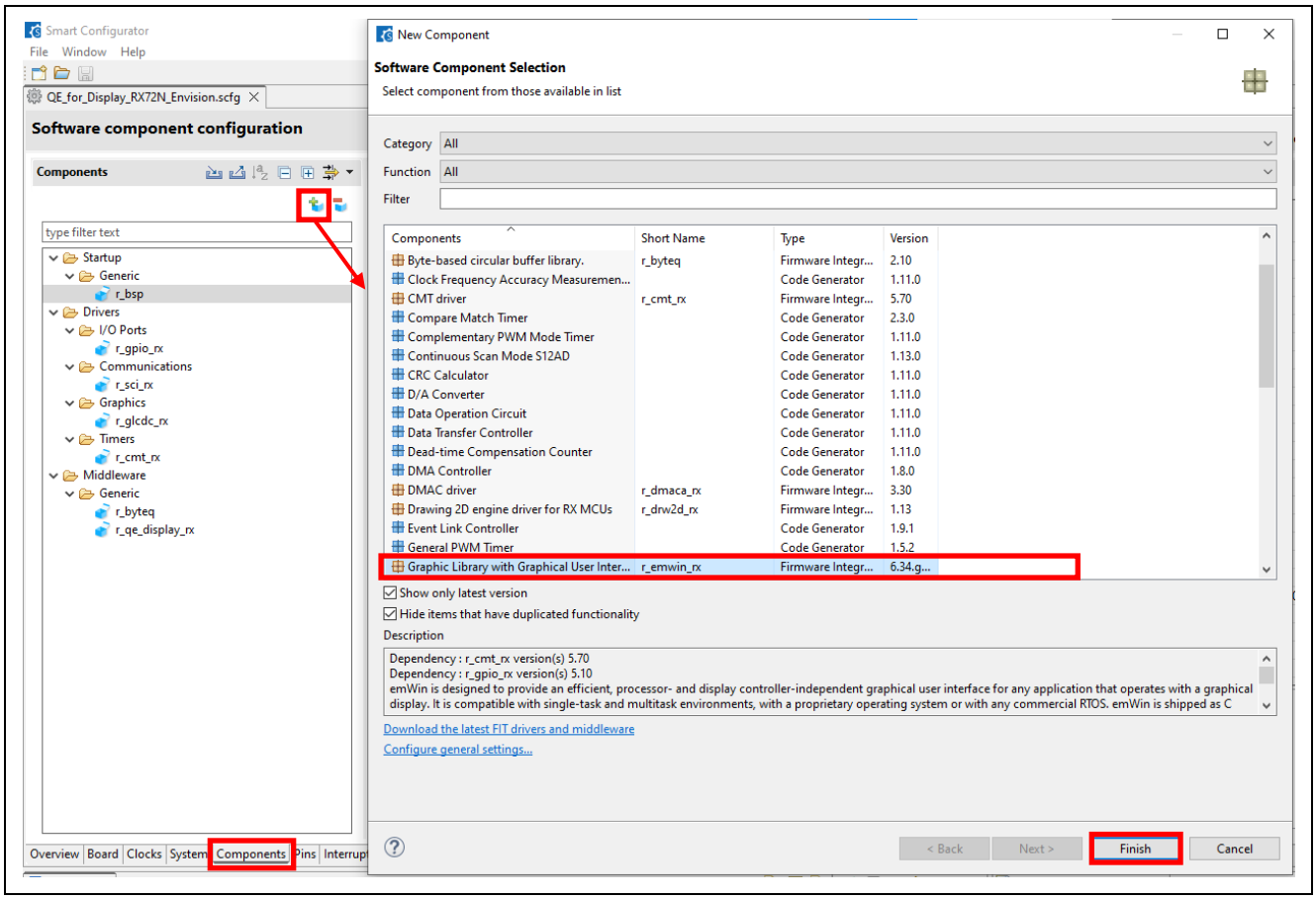
2. Install the GLCDC and QE Display FIT modules by using the Smart Configurator.
   For the installation procedure, refer to steps 2 to 17 in section 4.4.2, Adjusting the LCD (without the Drawing Tool).
   Note: If you are only creating and displaying a GUI without adjusting the display, you need not install the QE Display FIT module.

The GLCDC and QE Display FIT modules are installed (only the GLCDC FIT module is installed when the display is not to be adjusted).

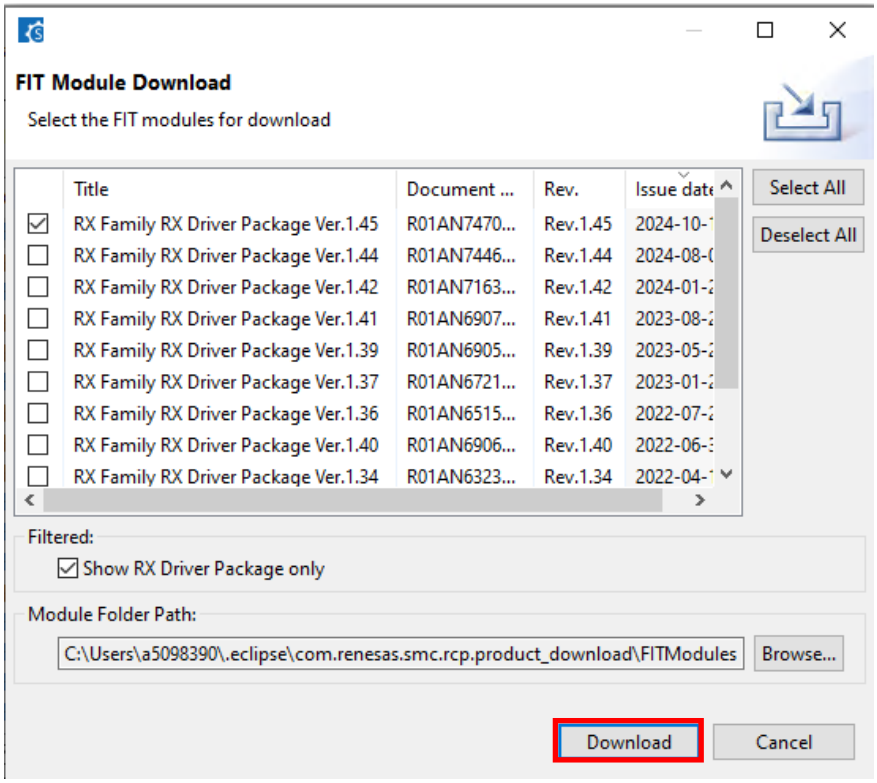
3. Installation status of the GUI drawing tool
   — Select “Installing the GUI drawing tool driver” in the “LCD Workflow (QE)” view.
   — If the drawing tool is not installed, the following error message will be displayed.



4. Select the “Components” tab of the Smart Configurator and click on the “Add component” icon.
5. In the “New Component” dialog box, select “Graphic Library with Graphical User Interface (r_emwin_rx)” (version 6.34.g.1.20 or a later version) and click on the “Finish” button.

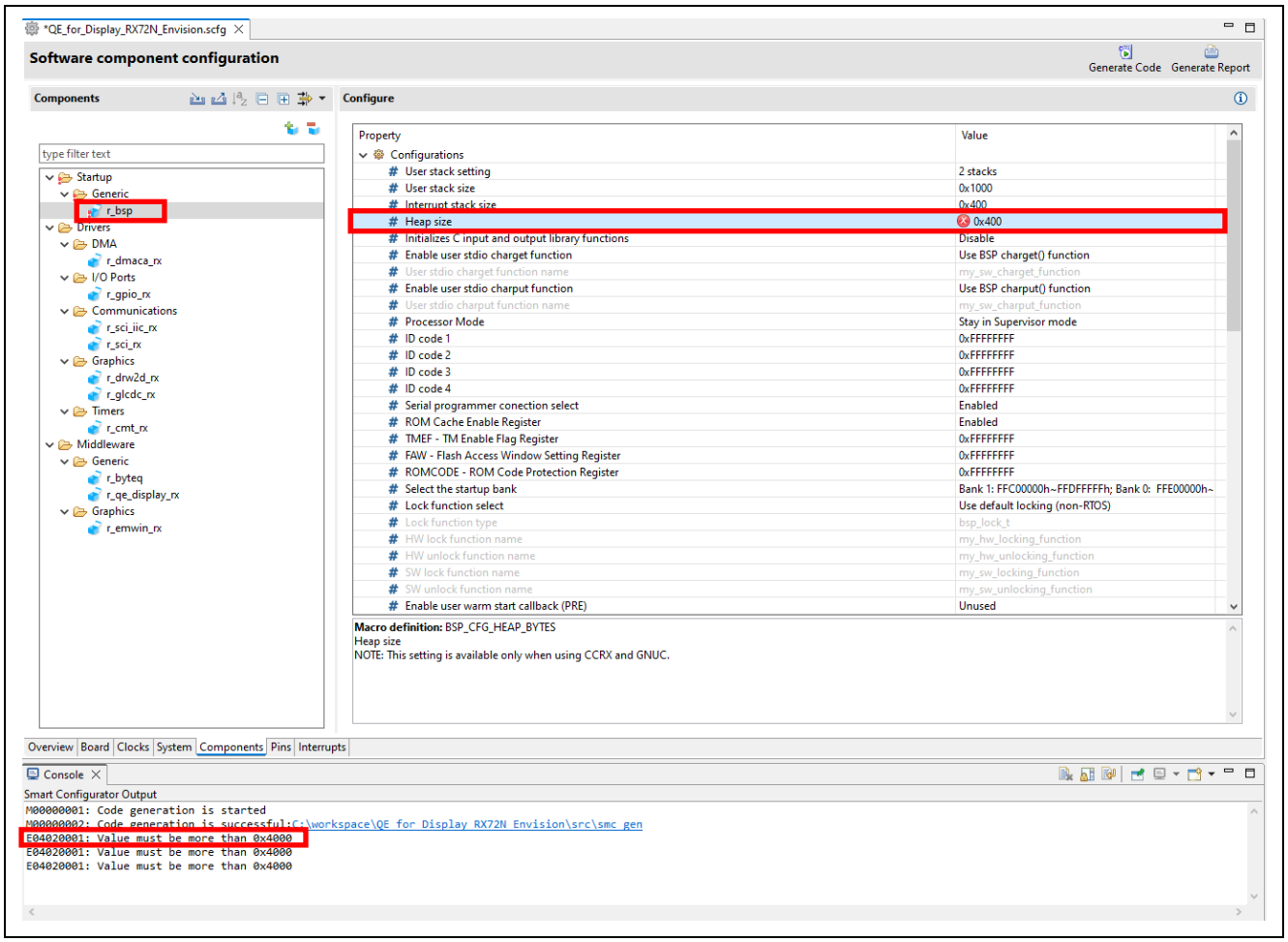

Smart Configurator
File Window Help
QE_for_Display_RX72N_Envision.scfg
Software component configuration
Components
type filter text
Startup
Generic
r_bsp
Drivers
I/O Ports
r_gpio_rx
Communications
r_sci_rx
Graphics
r_glcdc_rx
Timers
r_cmt_rx
Middleware
Generic
r_byteq
r_qe_display_rx
Overview Board Clocks System Components Pins Interrupt
New Component
Software Component Selection
Select component from those available in list
Category All
Function All
Filter
Components Short Name Type Version
Byte-based circular buffer library. r_byteq Firmware Integr... 2.10
Clock Frequency Accuracy Measuremen... Code Generator 1.11.0
CMT driver r_cmt_rx Firmware Integr... 5.70
Compare Match Timer Code Generator 2.3.0
Complementary PWM Mode Timer Code Generator 1.11.0
Continuous Scan Mode S12AD Code Generator 1.13.0
CRC Calculator Code Generator 1.11.0
D/A Converter Code Generator 1.11.0
Data Operation Circuit Code Generator 1.11.0
Data Transfer Controller Code Generator 1.11.0
Dead-time Compensation Counter Code Generator 1.11.0
DMA Controller Code Generator 1.8.0
DMAC driver r_dmaca_rx Firmware Integr... 3.30
Drawing 2D engine driver for RX MCUs r_drw2d_rx Firmware Integr... 1.13
Event Link Controller Code Generator 1.9.1
General PWM Timer Code Generator 1.5.2
Graphic Library with Graphical User Inter... r_emwin_rx Firmware Integr... 6.34.g...
Show only latest version
Hide items that have duplicated functionality
Description
Dependency : r_cmt_rx version(s) 5.70
Dependency : r_gpio_rx version(s) 5.10
emWin is designed to provide an efficient, processor- and display controller-independent graphical user interface for any application that operates with a graphical display. It is compatible with single-task and multitask environments, with a proprietary operating system or with any commercial RTOS. emWin is shipped as C
Download the latest FIT drivers and middleware
Configure general settings...
< Back
Next >
Finish
Cancel

6. If the drawing tool is not displayed in the list of components in the “New Component” dialog box, click on “Download the latest FIT drivers and middleware” and download the latest version of “RX Driver Package”.



7. When “Graphic Library with Graphical User Interface (r_emwin_rx)” is displayed in the list of components, select it and click on the “Finish” button.

8. When the “r_emwin_rx” component is added, an error occurs in the heap size used by the drawing tool. Since the heap size must be at least 0x4000, enter the value 0x4000 here.



9. Make the following settings for the “r_emwin_rx” component.

Table 4.8 Settings of the “r_emwin_rx” Component

Item	Value
LCD_Interface	LCD_IF_GLCDC
Use Touch function	Checked
Touch interface	TOUCH_IF_SCI_IIC

10. Additionally set the components and SCI pins to suit the board to be used. The IIC is used by touch facilities of emWin (see step 9). (Table 4.9 to Table 4.12)

Table 4.9 Settings when the RSK RX72N is to be Used

Component or SCI Pin	Item	Value
r_sci_iic_rx	MCU supported channels for CH11	Supported
	SCI11	Checked
	SSCL11 Pin	Checked
	SSDA11 Pin	Checked
SCI11 pin	SSCL11	Pin Number E8
	SSDA11	Pin Number G8

Table 4.10 Settings when the Envision RX72N is to be Used

Component or SCI Pin	Item	Value
r_sci_iic_rx	MCU supported channels for CH6	Supported
	SCI6	Checked
	SSCL6 Pin	Checked
	SSDA6 Pin	Checked
SCI6 pin	SSCL6	Pin Number 26
	SSDA6	Pin Number 27

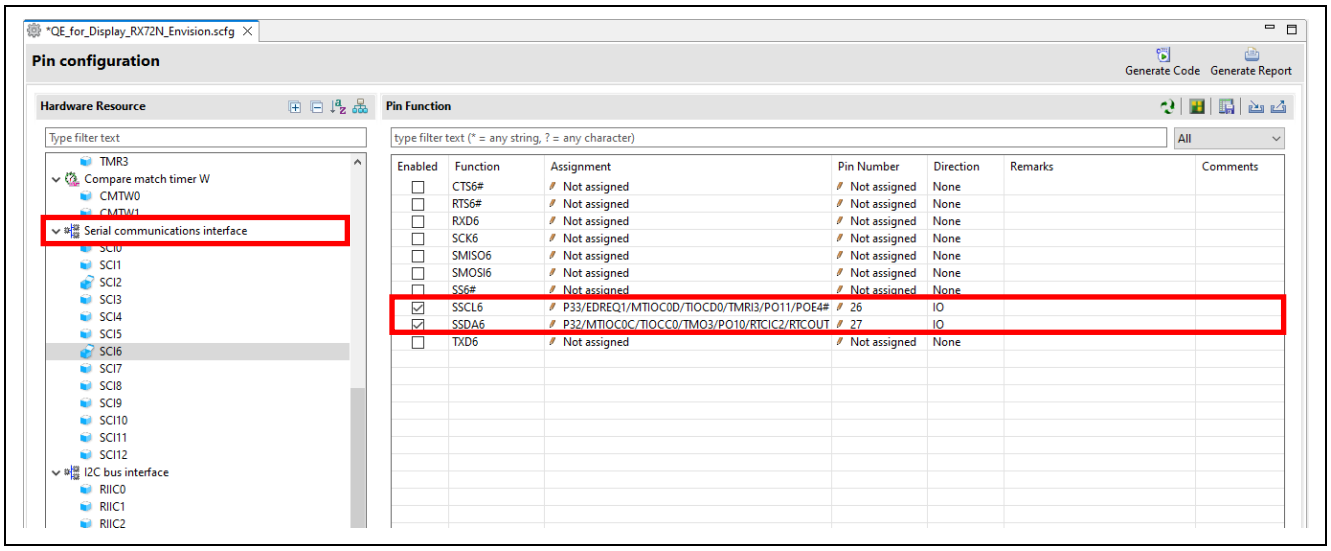
Table 4.11 Settings when the RSK RX65N is to be Used

Component or SCI Pin	Item	Value
r_sci_iic_rx	MCU supported channels for CH7	Supported
	SCI7	Checked
	SSCL7 Pin	Checked
	SSDA7 Pin	Checked
SCI7 pin	SSCL7	Pin Number 160
	SSDA7	Pin Number 163

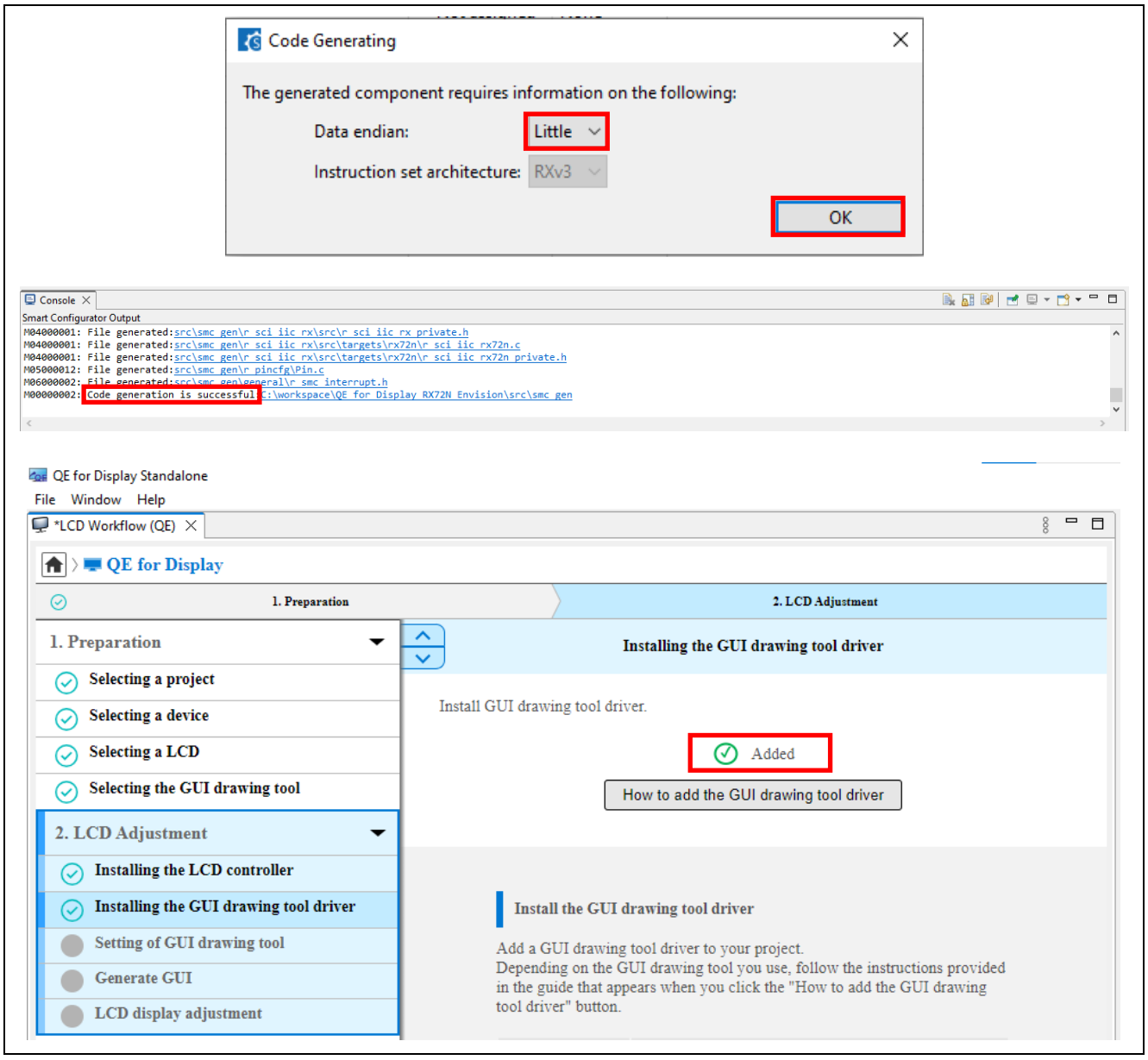
Table 4.12 Settings when the Envision RX65N is to be Used

Component or SCI Pin	Item	Value
r_sci_iic_rx	MCU supported channels for CH6	Supported
	SCI6	Checked
	SSCL6 Pin	Checked
	SSDA6 Pin	Checked
SCI6 pin	SSCL6	Pin Number 7
	SSDA6	Pin Number 8

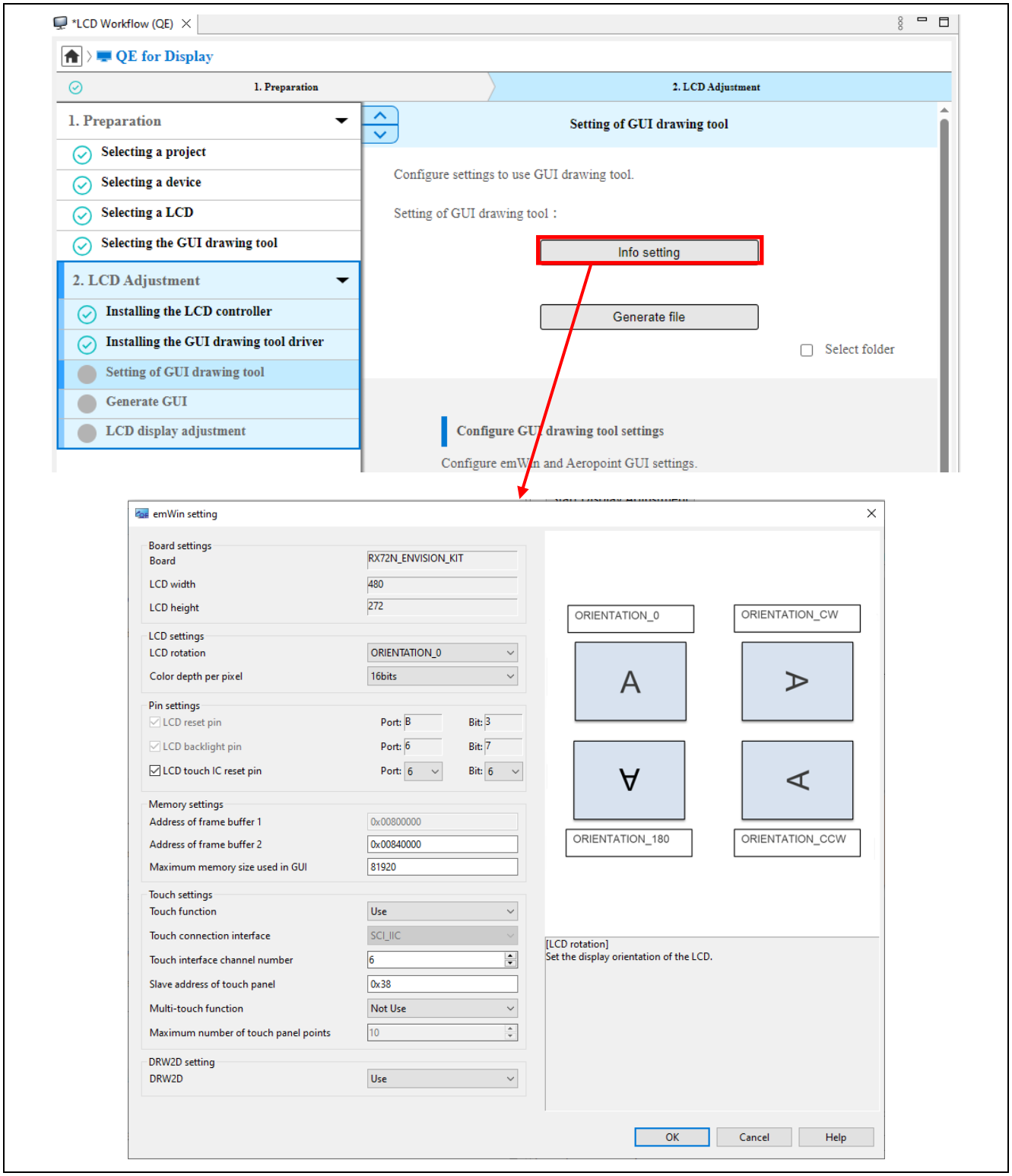
11. When a board is selected in the creation of a project, setting the IIC channel to be used with emWin also sets the pins for use with the channel. Select “Serial communications interface” on the “Pins” tabbed page to confirm the settings of the pins. Set the pins here if you are using a custom board.



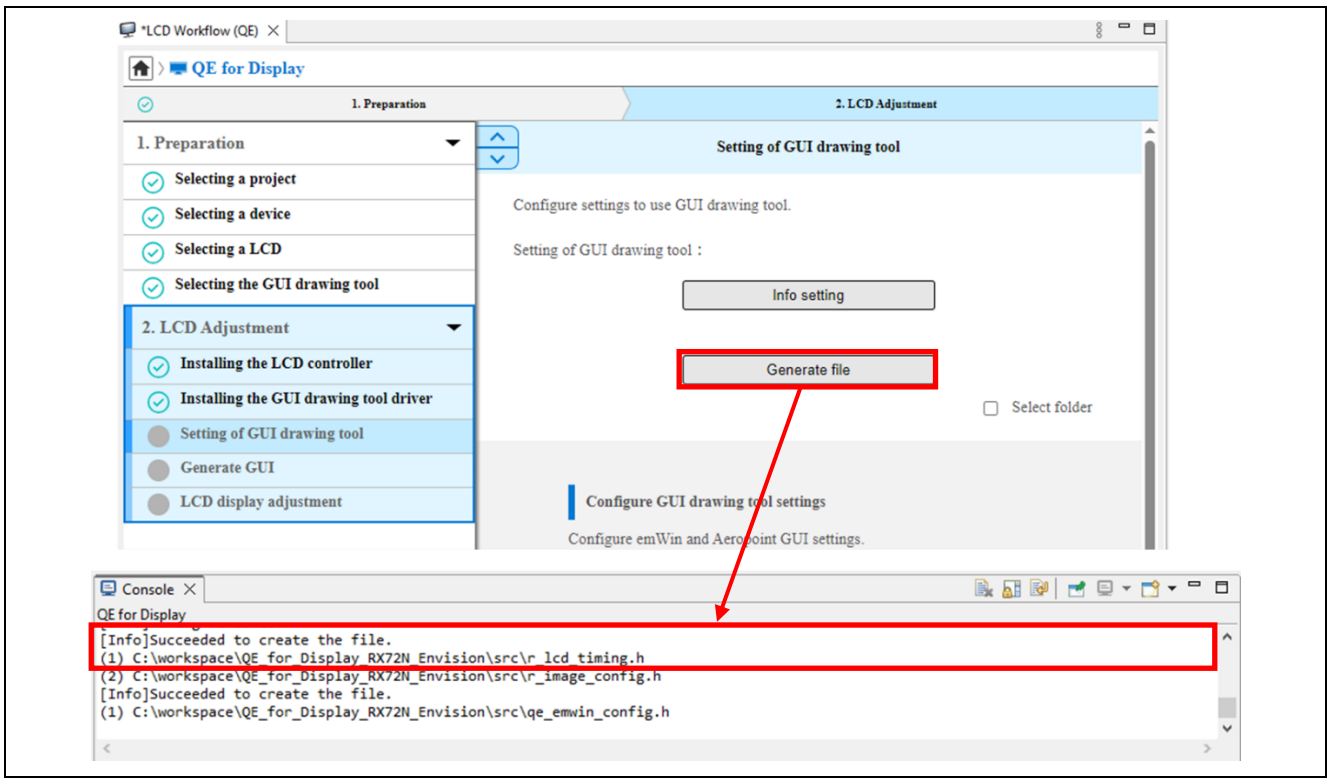
12. Click on the “Generate Code” button in the upper-right corner of the Smart Configurator window. The code is generated according to the settings.
13. In the “Code Generating” dialog box, set the data endian and click on the “OK” button.
    The code is generated according to the settings.
    After code generation has finished, the state indicator for the drawing tool is changed to “Added”.



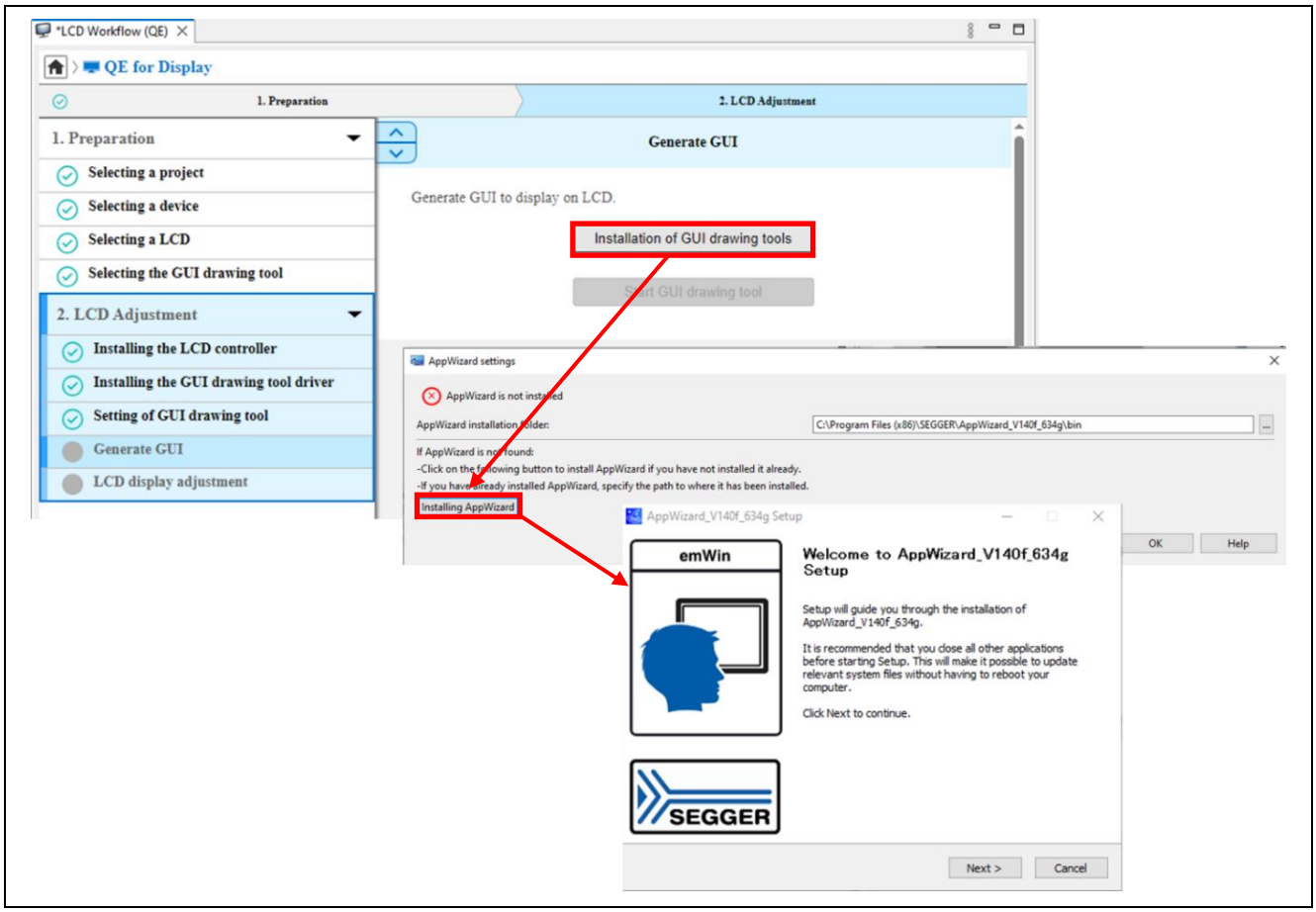
14. Select “Setting of GUI drawing tool” in the “LCD Workflow (QE)” view.
15. Select “Info setting” and make the settings for the drawing tool in the dialog box that is displayed.
    When an evaluation board is used, settings do not have to be made because the default settings will be reflected.



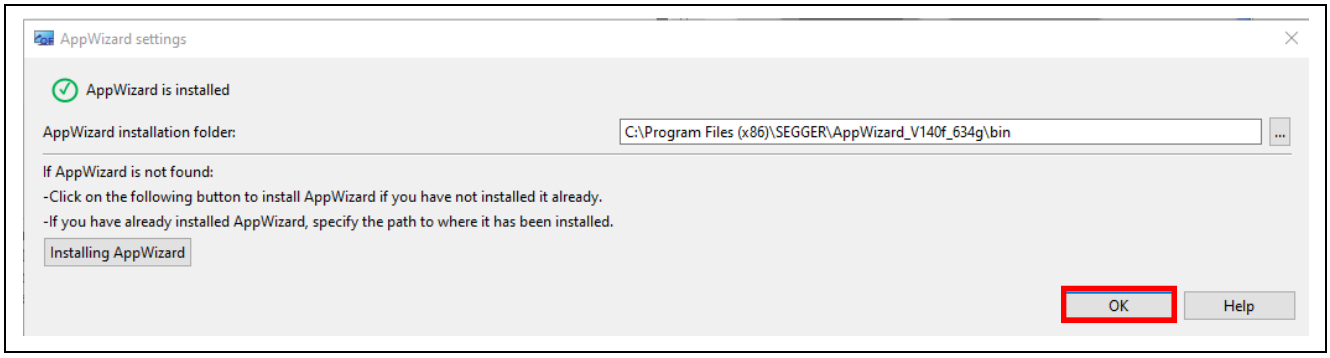
16. After completing making the settings, click on the “Generate file” button to output qe_emwin_config.h. It is output to src immediately under the project folder by default. The output destination folder can be changed by selecting the “Select folder” checkbox.



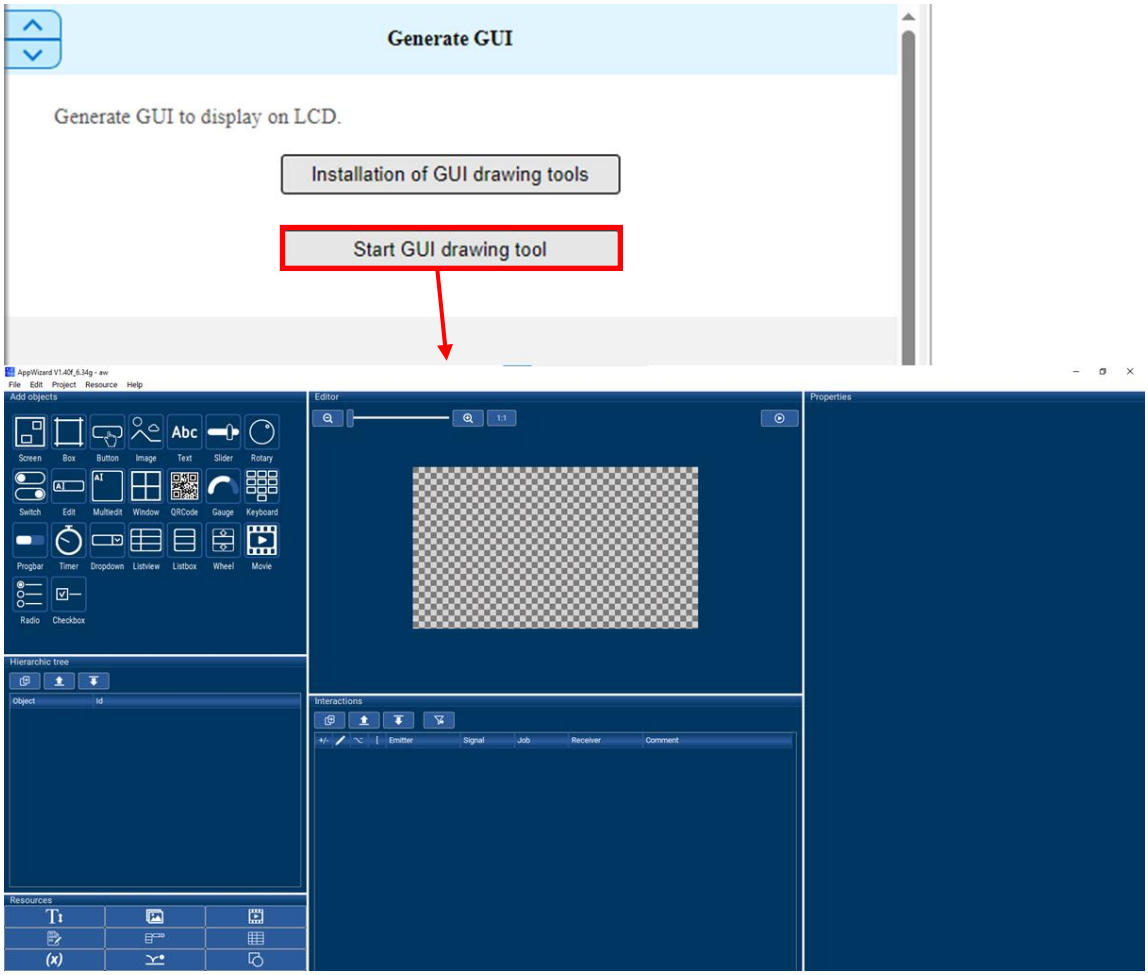
17. Select “Generate GUI” in the “LCD Workflow (QE)” view.
18. After clicking on “Installation of GUI drawing tools”, click on the “Installing AppWizard” button to install AppWizard by following the instructions of the AppWizard setup wizard that is displayed.



19. After having installed AppWizard, the state indicator of the “AppWizard settings” dialog box is changed to “AppWizard is installed”. Click on the “OK” button to close the “AppWizard settings” dialog box.

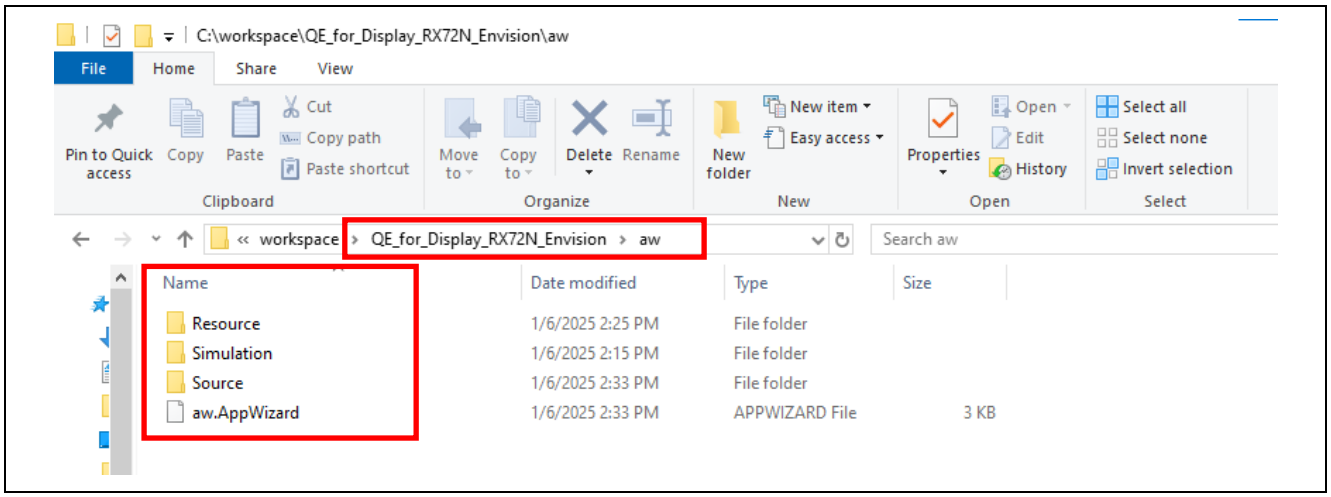


20. Select “Start GUI drawing tool” to start AppWizard.

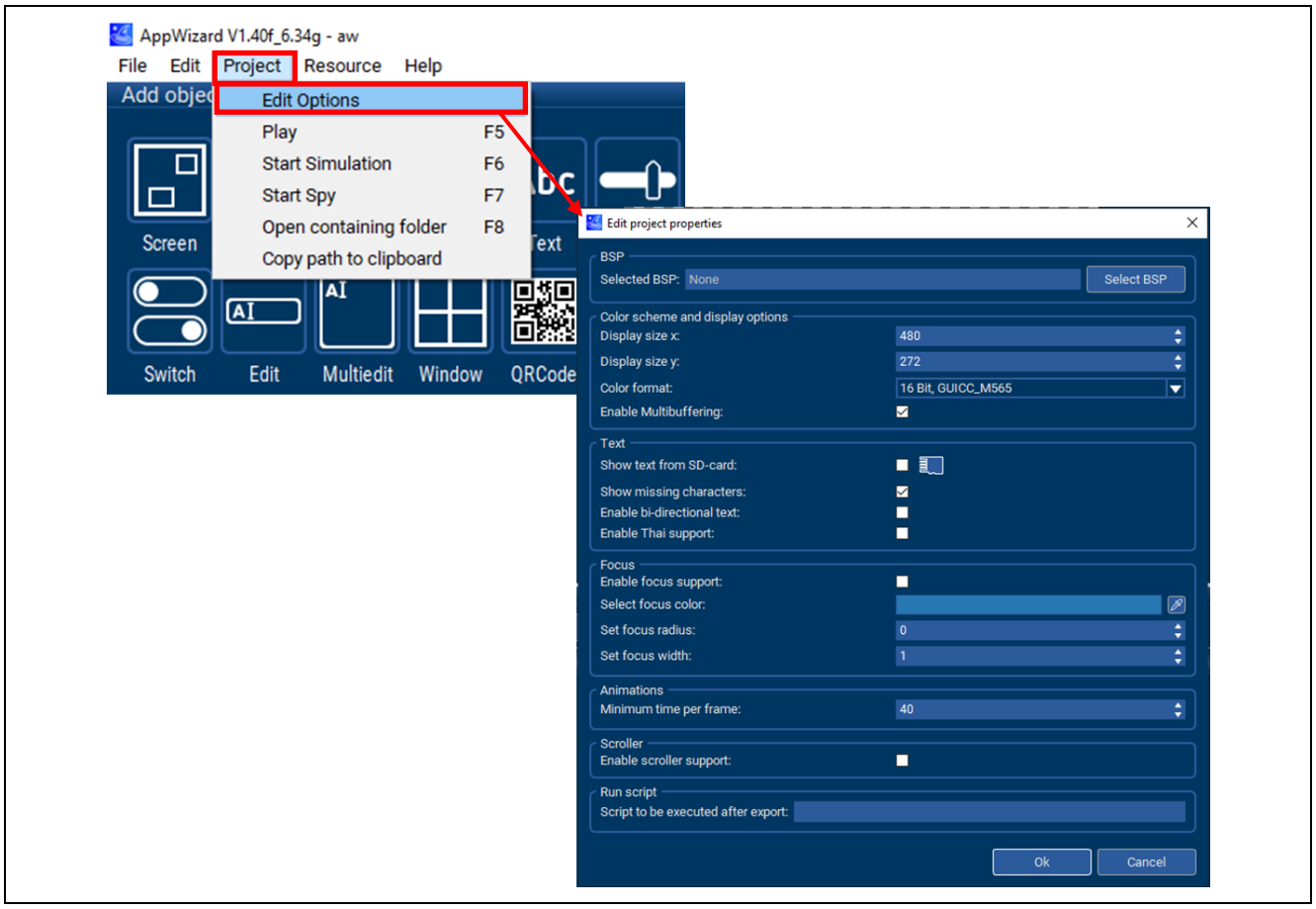


Note: The usage of AppWizard may differ from the way which is described in this application note due to changes to the specifications. For the usage of AppWizard, refer to its help system.

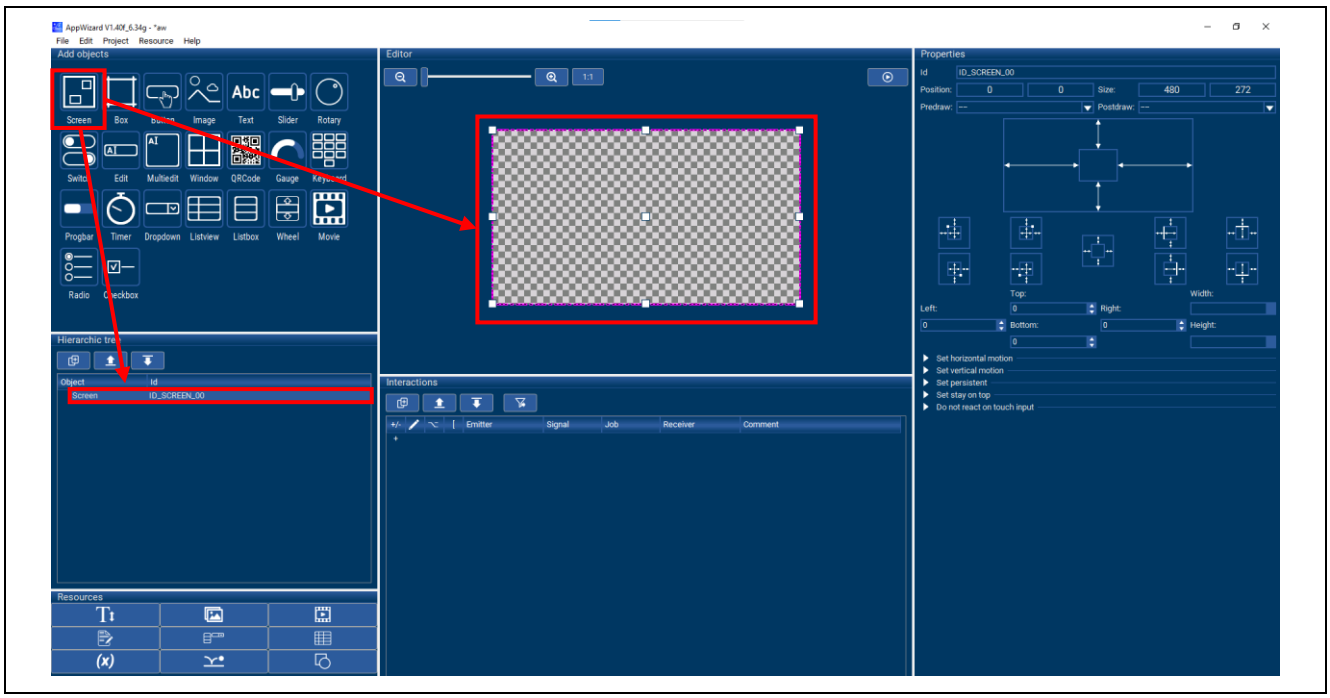
21. When AppWizard is started, the “aw” project folder of AppWizard is automatically created immediately under the project. This folder contains Resource, Simulation, and Source folders and the project file for AppWizard (aw.AppWizard).



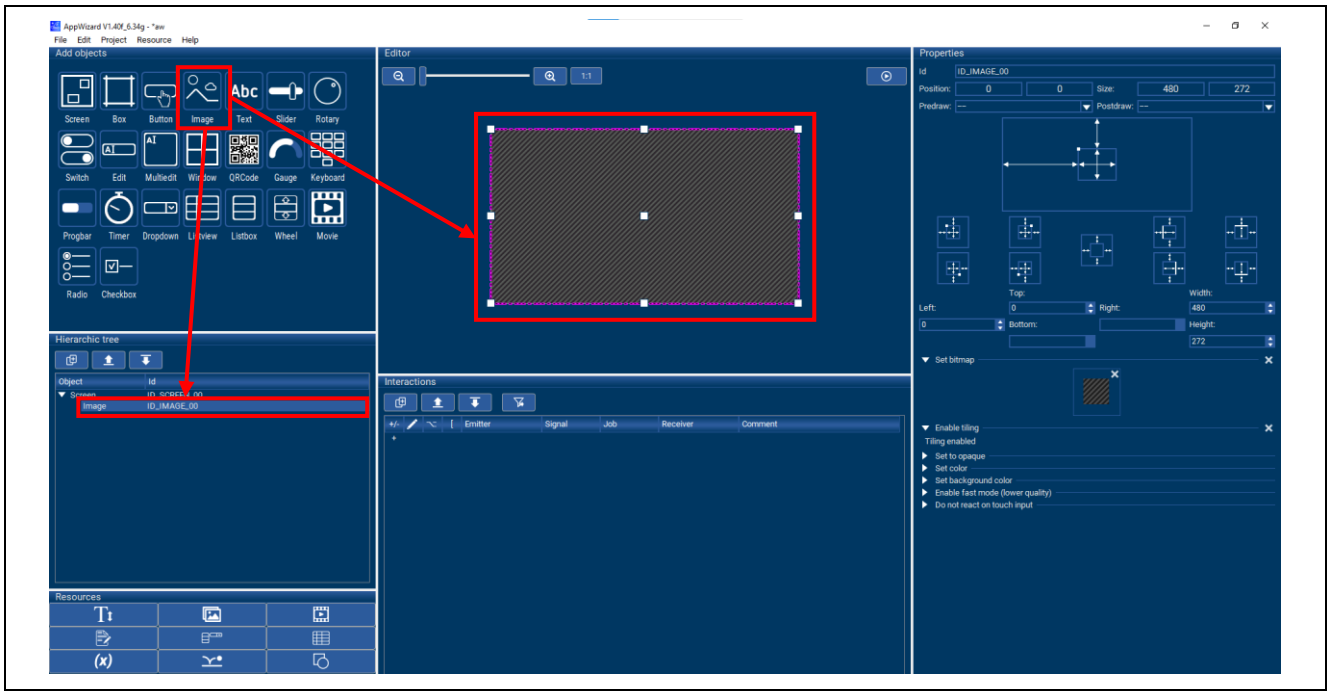
22. In the AppWizard project, the board to be used, display size, and color depth per pixel have automatically been specified.
The setting values can be confirmed in the “Edit project properties” dialog box which is opened from the “Edit Options” item of the “Project” menu.



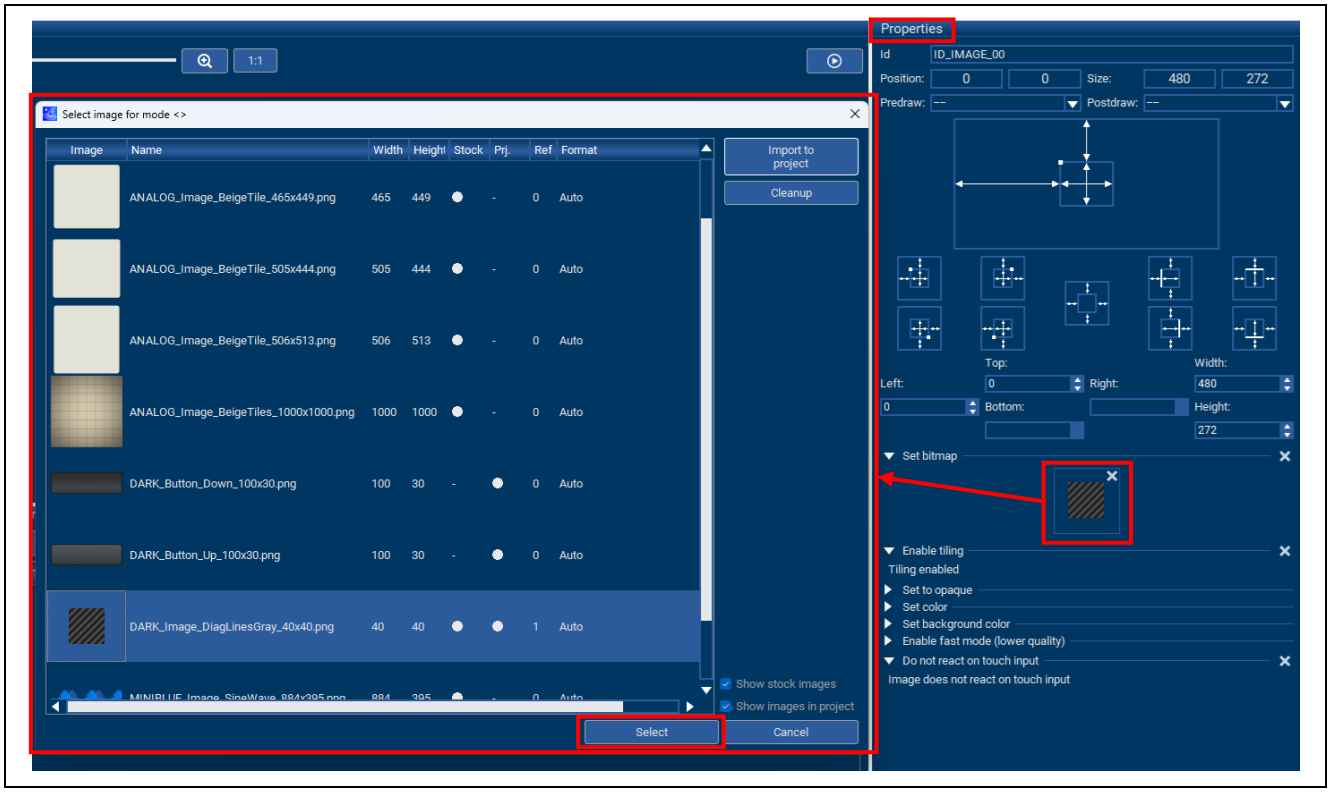
23. Create a GUI with AppWizard.
    Start by adding a screen. Clicking on the “Screen” button adds the screen of “ID_SCREEN_00”. Multiple screens can be set and this allows switching between their displays.



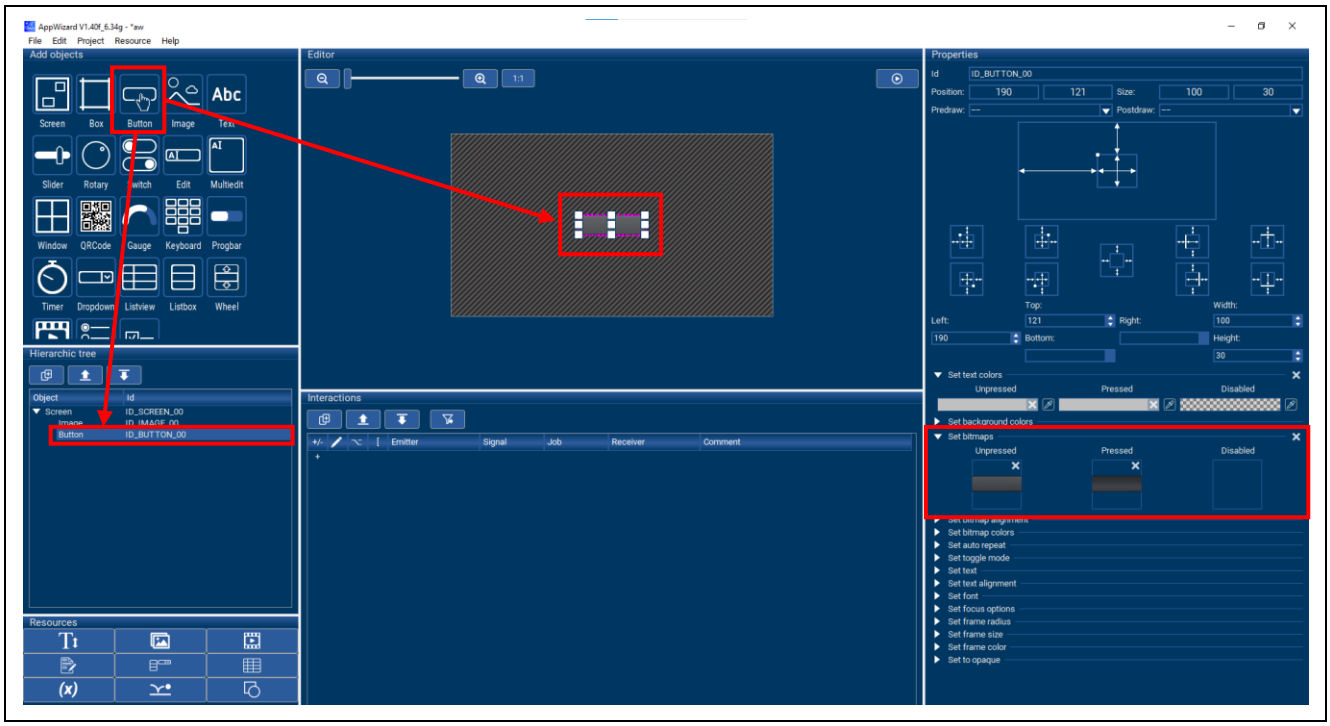
24. After that, add an image. Clicking on the “Image” button adds the image of “ID_IMAGE_00”. The position and size are adjusted in “Editor” or “Properties”. In this case, use “Editor” to expand the image to fill the LCD screen.



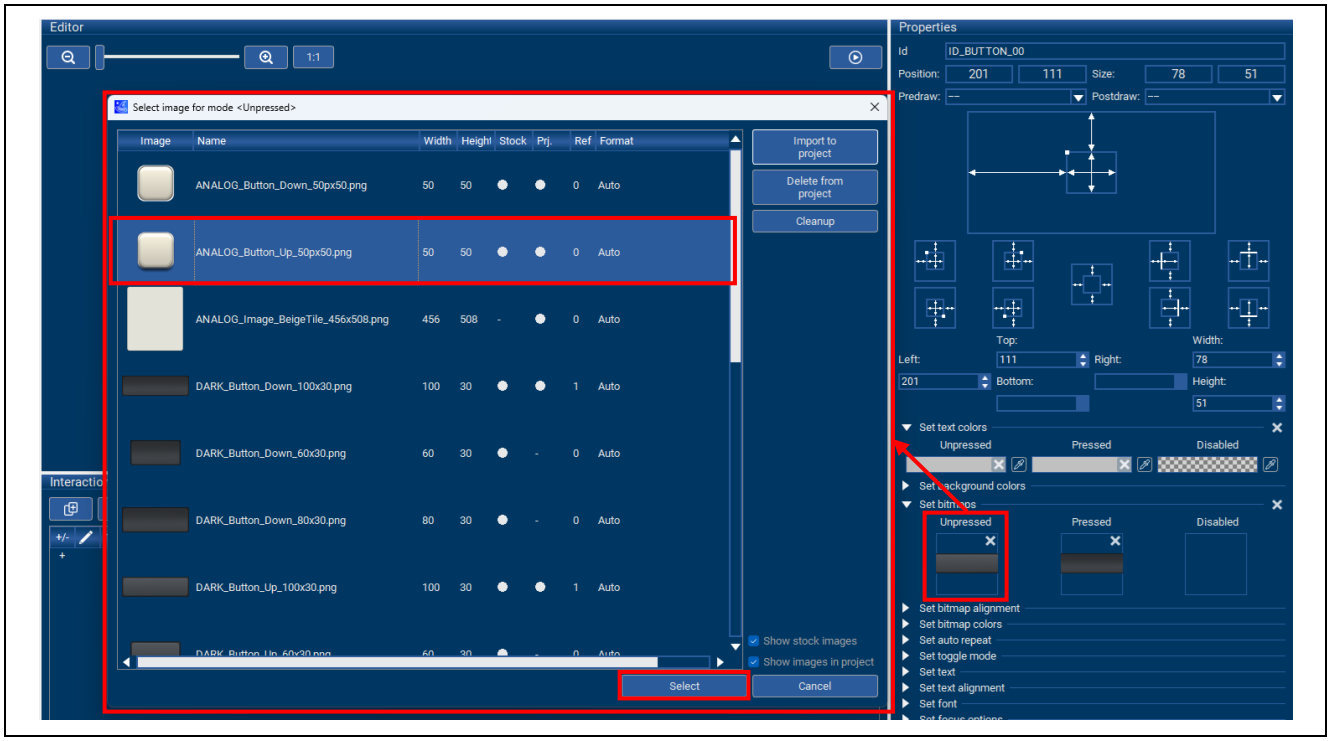
25. To change the image, click on “Set bitmap” in “Properties” and click on the rectangle below the label. Select a desired image from “Select image for mode <>” and click on “Select”.



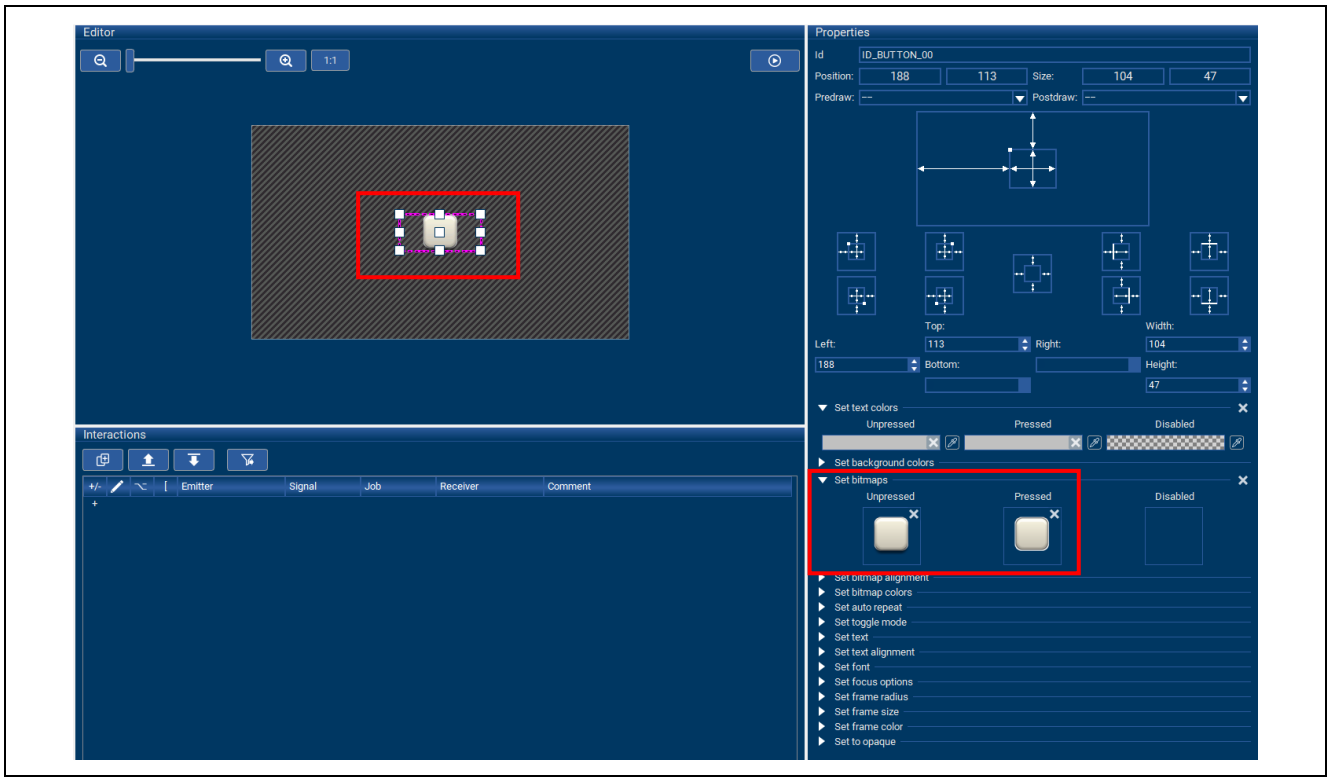
26. Add a button. Clicking on the “Button” button adds the button of “ID_BUTTON_00”. The position and size are adjusted in “Editor” or “Properties”.



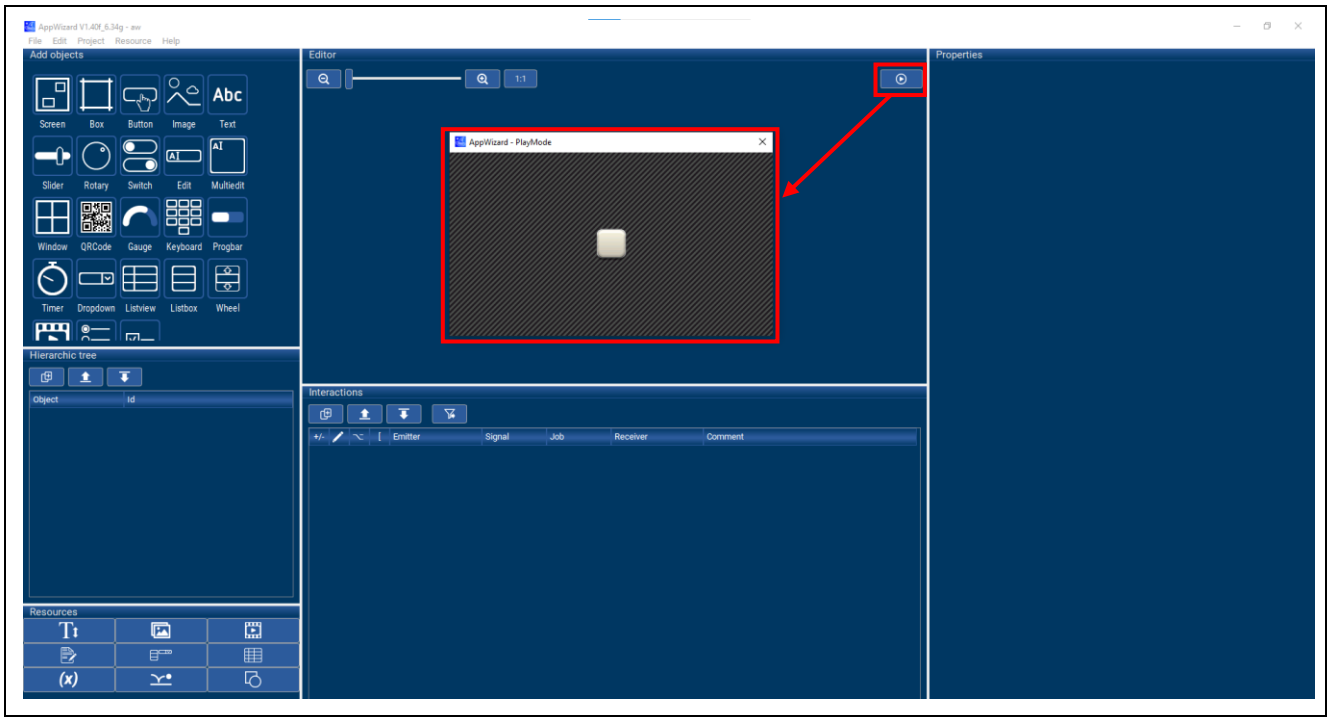
27. To change images to indicate when the button is and is not being pressed, in the same manner as when changing the image, click on the button image in “Set bitmaps” of “Properties”.



28. The button image is changed.

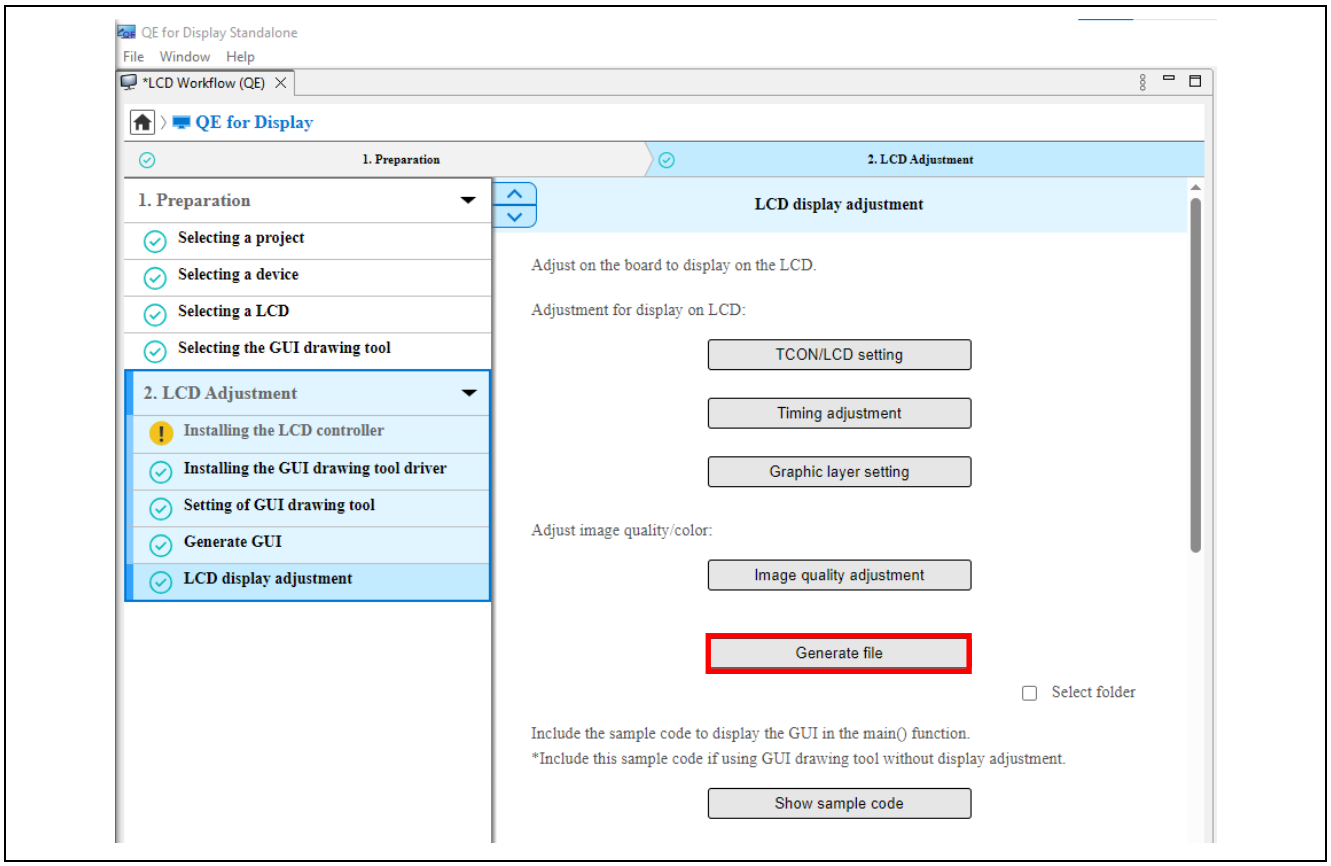


29. Clicking on the “Start play mode” button located at the upper right in “Editor” confirms the operation of the created GUI in the preview. By clicking on the button in the preview, you can confirm that the image changes according to the settings made for “Unpressed” and “Pressed”. Clicking on the “Esc” button closes the preview.



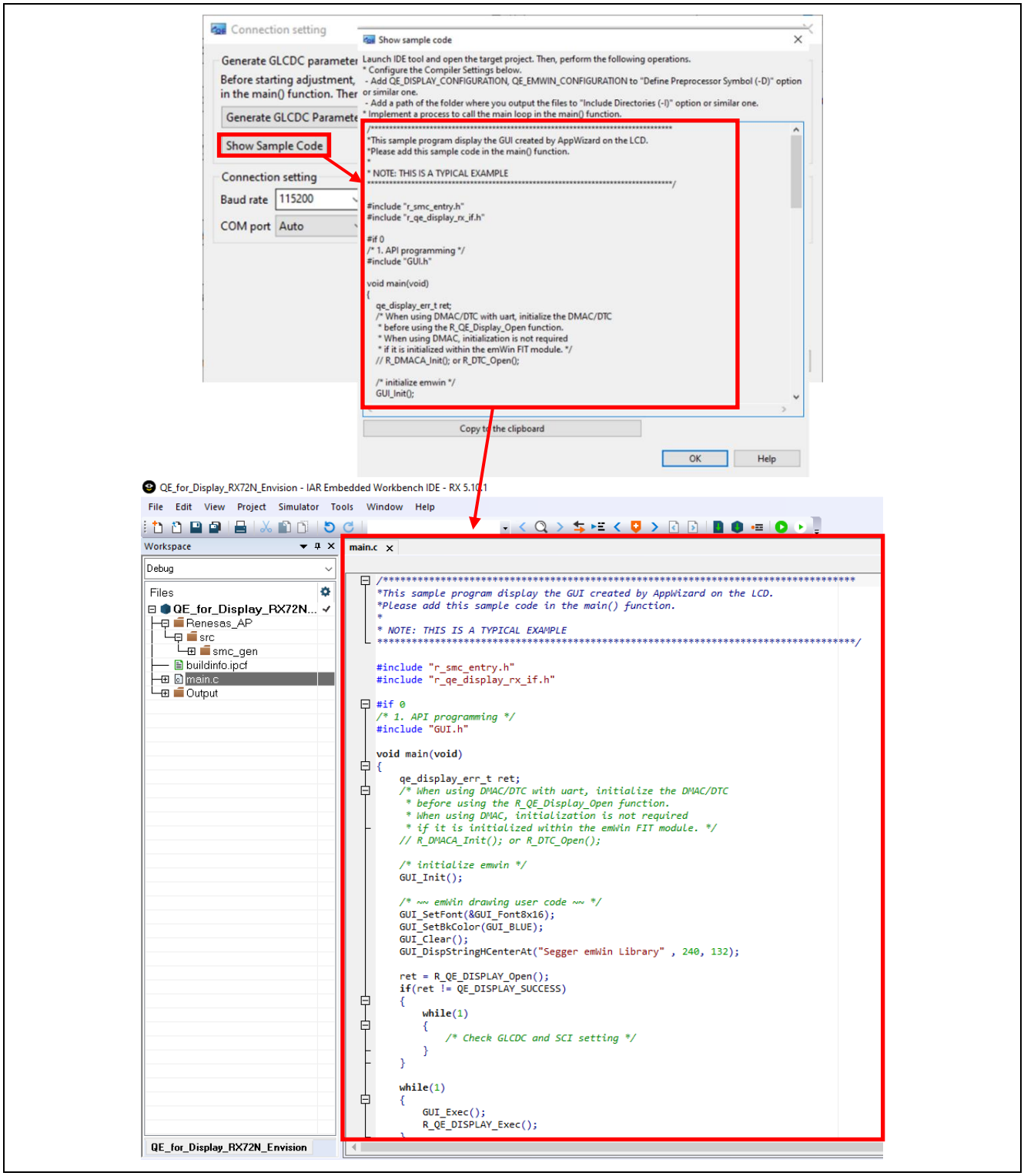
30. Output code from AppWizard.
Select the “Export & Save” item from the “File” menu of AppWizard.
Code is output in the “Source” and “Resource” folders under the “aw” project folder of AppWizard.

31. Select “LCD display adjustment” in the “LCD Workflow (QE)” view.
    Adjust the LCD.
    For the adjustment procedure, refer to steps 18 to 26 in section 4.4.2, Adjusting the LCD (without the Drawing Tool).
    If you are not going to adjust the LCD, just click on “Generate file”.

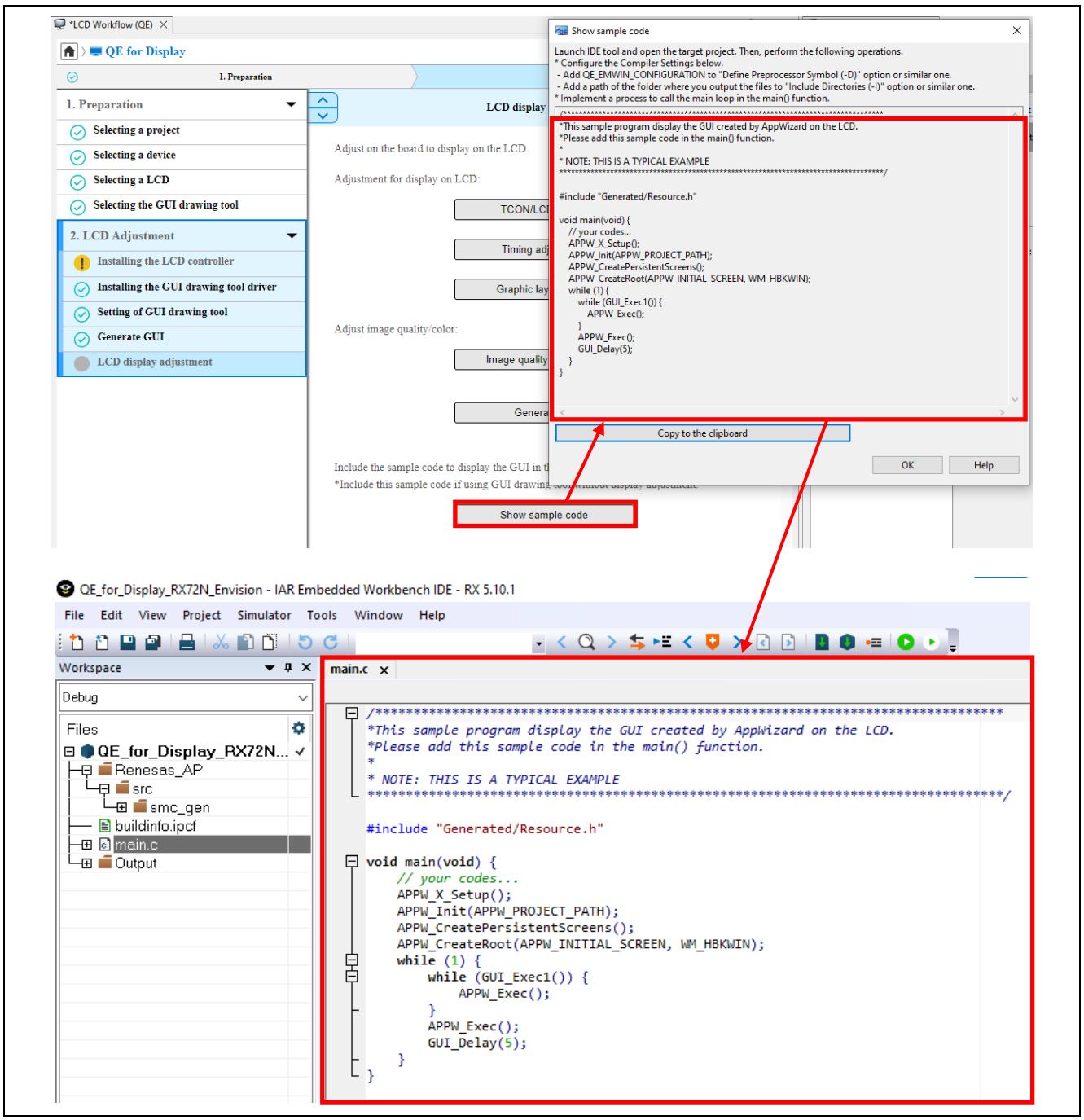


32. Click on the “Show Sample Code” button and implement the programs used to display the GUI that was created with AppWizard in the main() function.

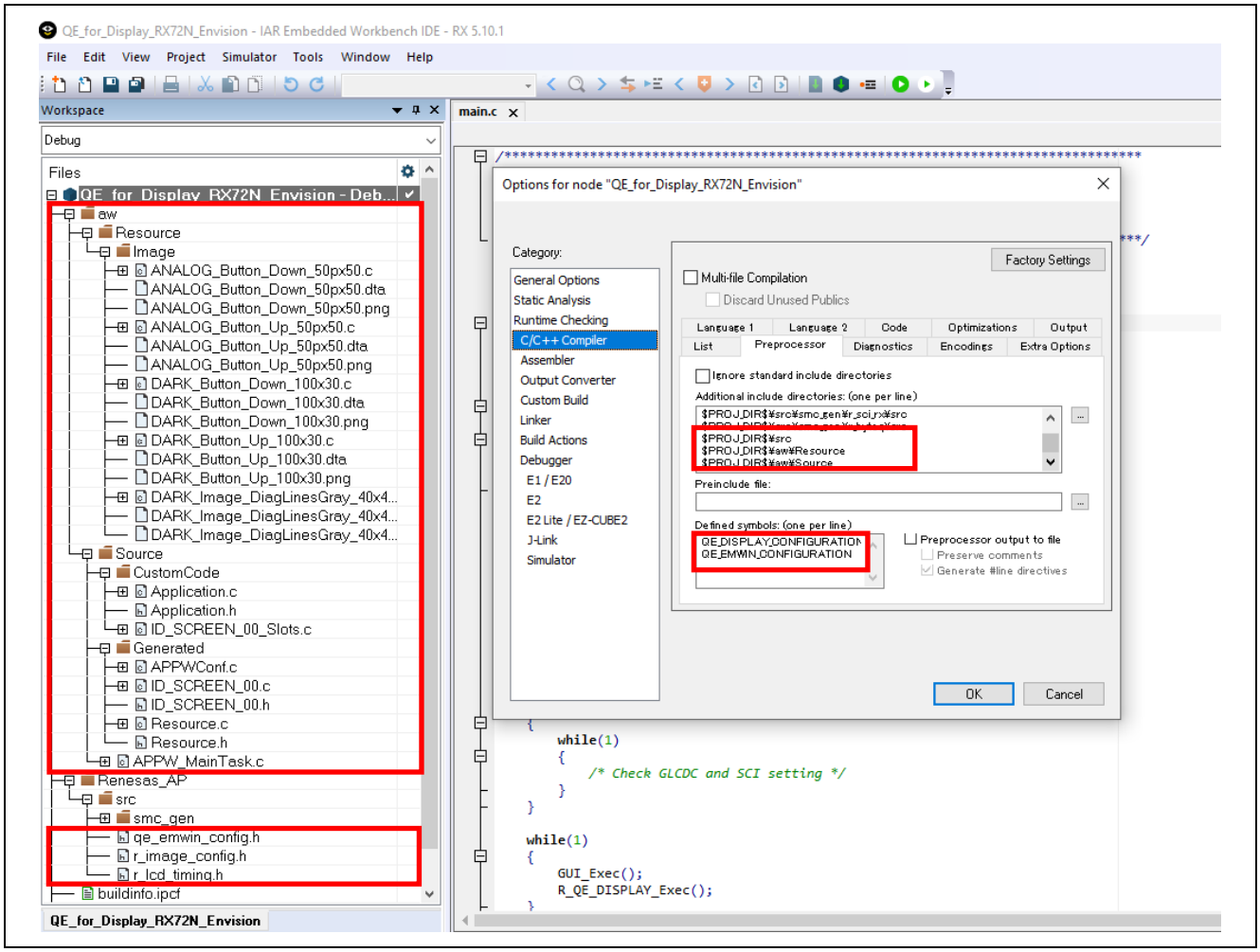
— When adjusting the display



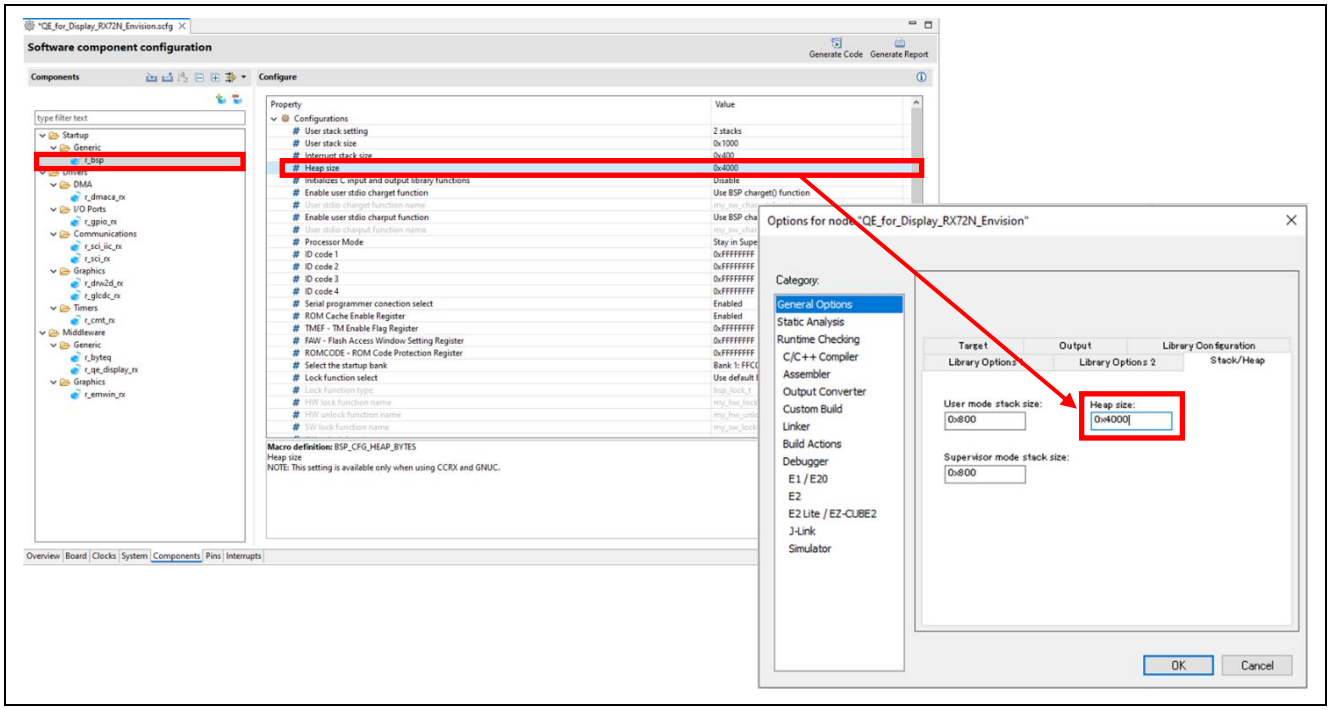
— When not adjusting the display
The “Show Sample Code” button in the figure below is disabled when the QE Display FIT module has been installed in step 2.



33. Add the following files to the workspace of the project as the target files for building. Also, add the paths to these files to “Project” -> “Options” -> “C/C++ Compiler” -> “Preprocessor” -> “Additional include directories” of the EWRX. The files under aw¥Simulation will not be added.
    - r_lcd_timing.h
    - r_image_config.h
    - qe_emwin_config.h
    - Files under aw¥Resource
    - Files under aw¥Source
34. Add the following definitions to “Project” -> “Options” -> “C/C++ Compiler” -> “Preprocessor” -> “Defined symbols” of the EWRX.
    - QE_DISPLAY_CONFIGURATION
    - QE_EMWIN_CONFIGURATION

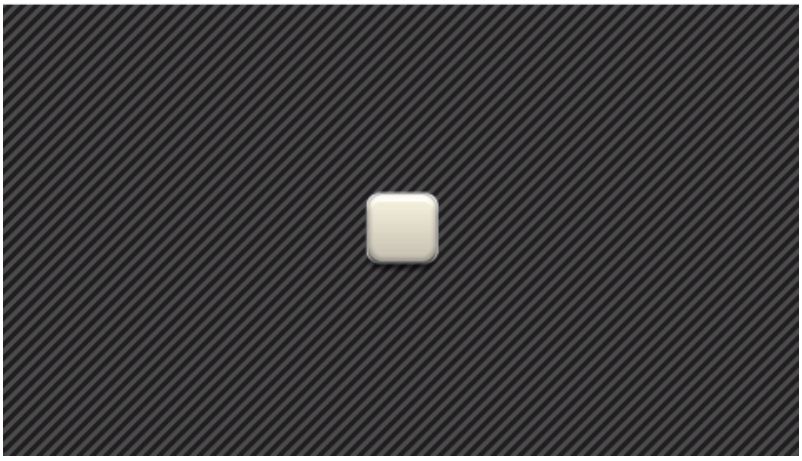


35. Change the value of “Project” -> “Options” -> “General Options” -> “Stack/Heap” -> “Heap size” of the EWRX to the value set for “Heap size” of the “r_bsp” component in the Smart Configurator.



36. When “Used” is set for DRW2D in “Info setting” in “Setting of GUI drawing tool” in the “LCD Workflow (QE)” view (step 15), the image data has to be located to an address aligned with a 4-byte boundary. Specify the alignment of the image data with reference to the following FAQ.
    — Renesas Customer Hub FAQ 2001488:
    https://en-support.renesas.com/knowledgeBase/20940283

37. Build a project with reference to section 4.5, Building the Project.
38. Make the settings for the debugger and execute the project with reference to section 4.6, Connecting a Debugger and Executing the Program. The screen that was created with the GUI drawing tool is displayed on the panel. Touch the button and confirm that the image changes according to your settings.

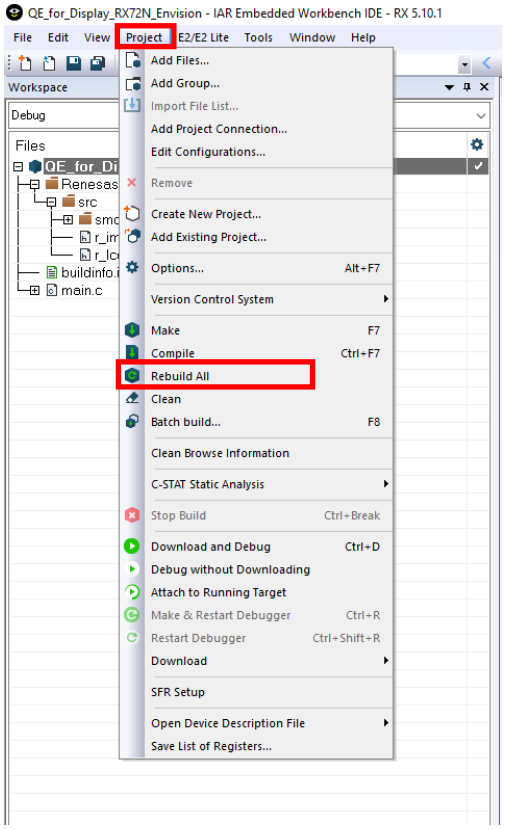


39. When the QE Display FIT module has been installed, the LCD can be adjusted in real-time while the created screen continues to be displayed.
    For the adjustment procedure, refer to steps 32 to 38 in section 4.4.2, Adjusting the LCD (without the Drawing Tool).

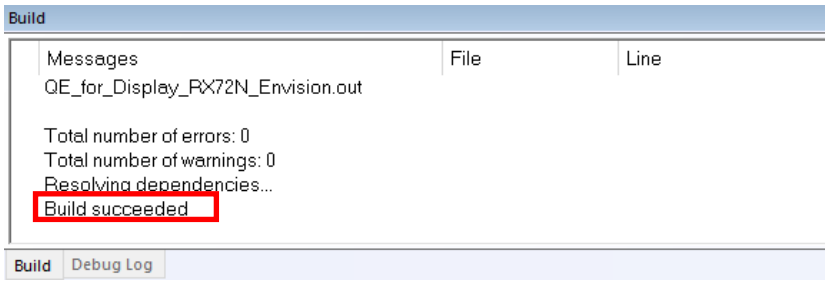
4.5 Building the Project

Build the project and create debugger session according to the following procedure.

1. Click on “Project” -> “Rebuild All”.

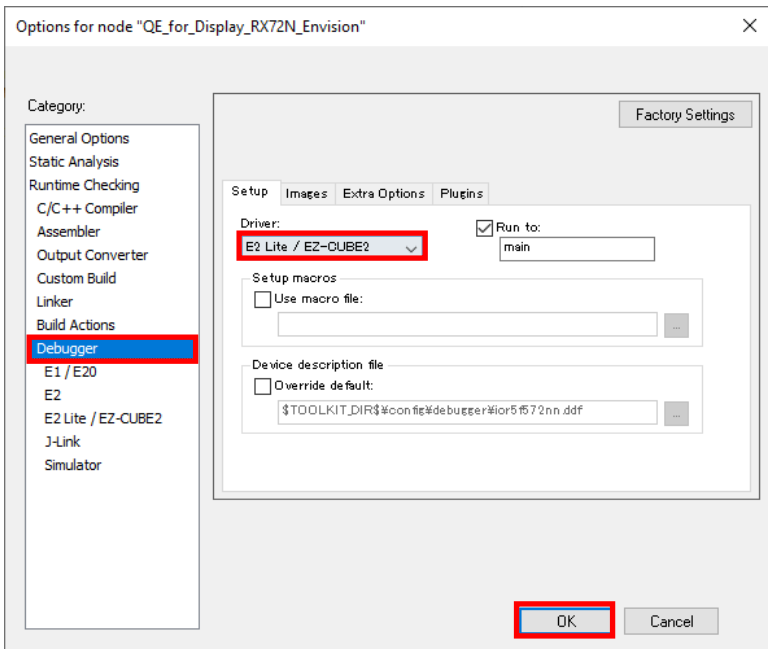


2. When “Build succeeded” is displayed in the “Build” panel, the build operation is complete.

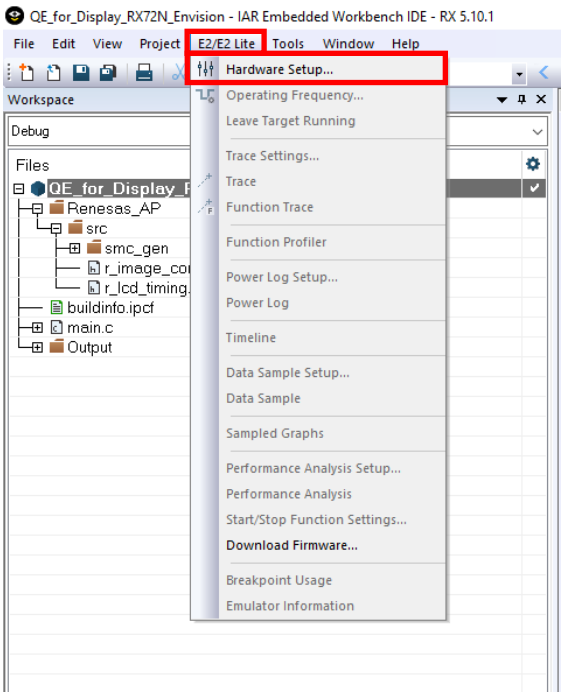


4.6 Connecting a Debugger and Executing the Program

1. Click on “Project” -> “Options” of the EWRX.
2. Select “Debugger” in the “Options” dialog box, set the debugger (example: E2 Lite) to be used in “Driver”, and click on “OK”.



3. Since “E2/E2 Lite” will be added as a menu, click on the “Hardware Setup” item of the “E2/E2 Lite” menu.



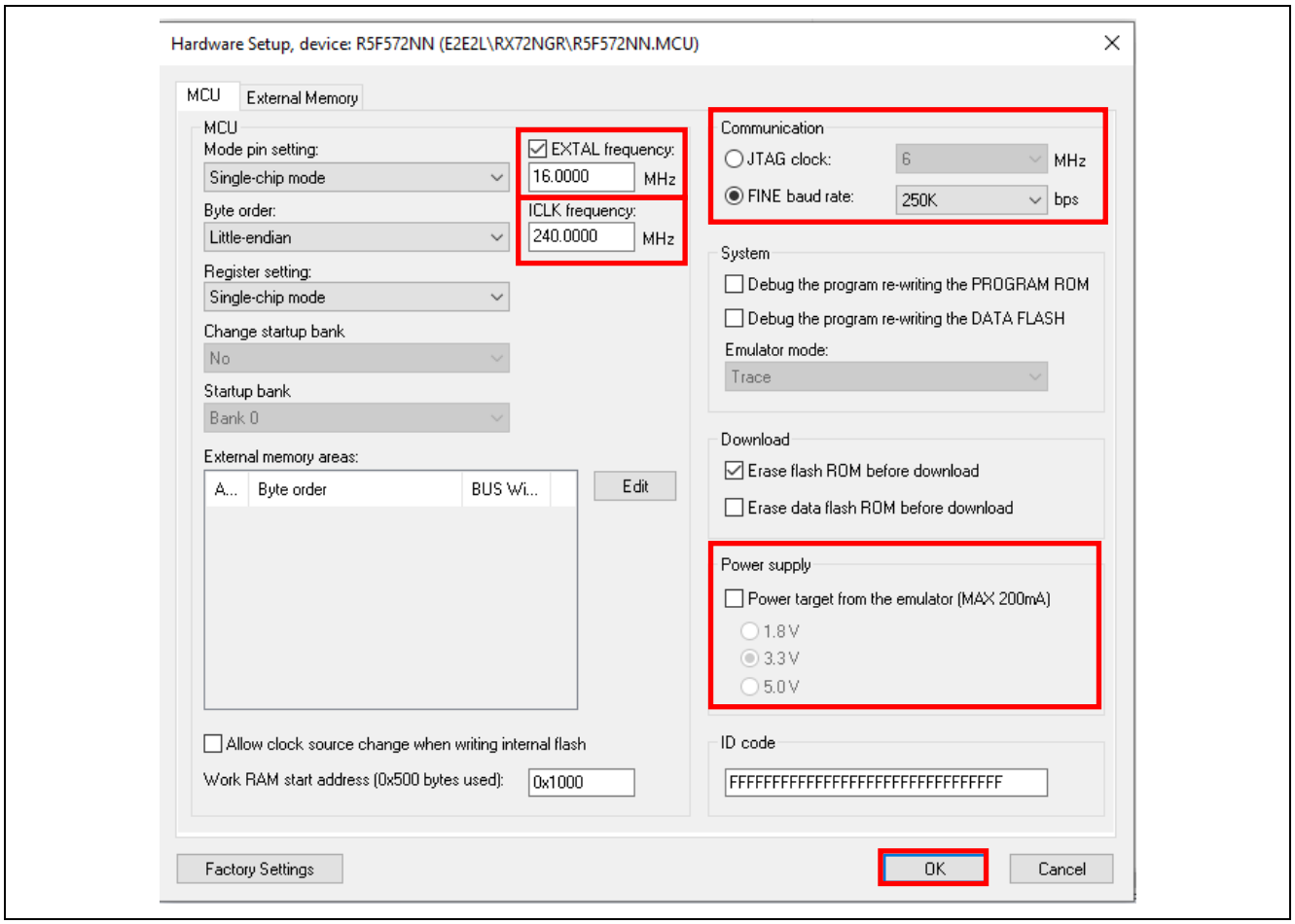
4. Select the “MCU” tab in the “Hardware Setup” dialog box.
5. Change the settings and values for “EXTAL frequency”, “ICLK frequency”, and “Communication” to suit the board. For setting the board, refer to chapter 2, Operating Environment.
6. Change the setting and value for “Power target from the emulator (MAX 200mA)” to suit the board.

Table 4.13 Power Supplied from the Emulator

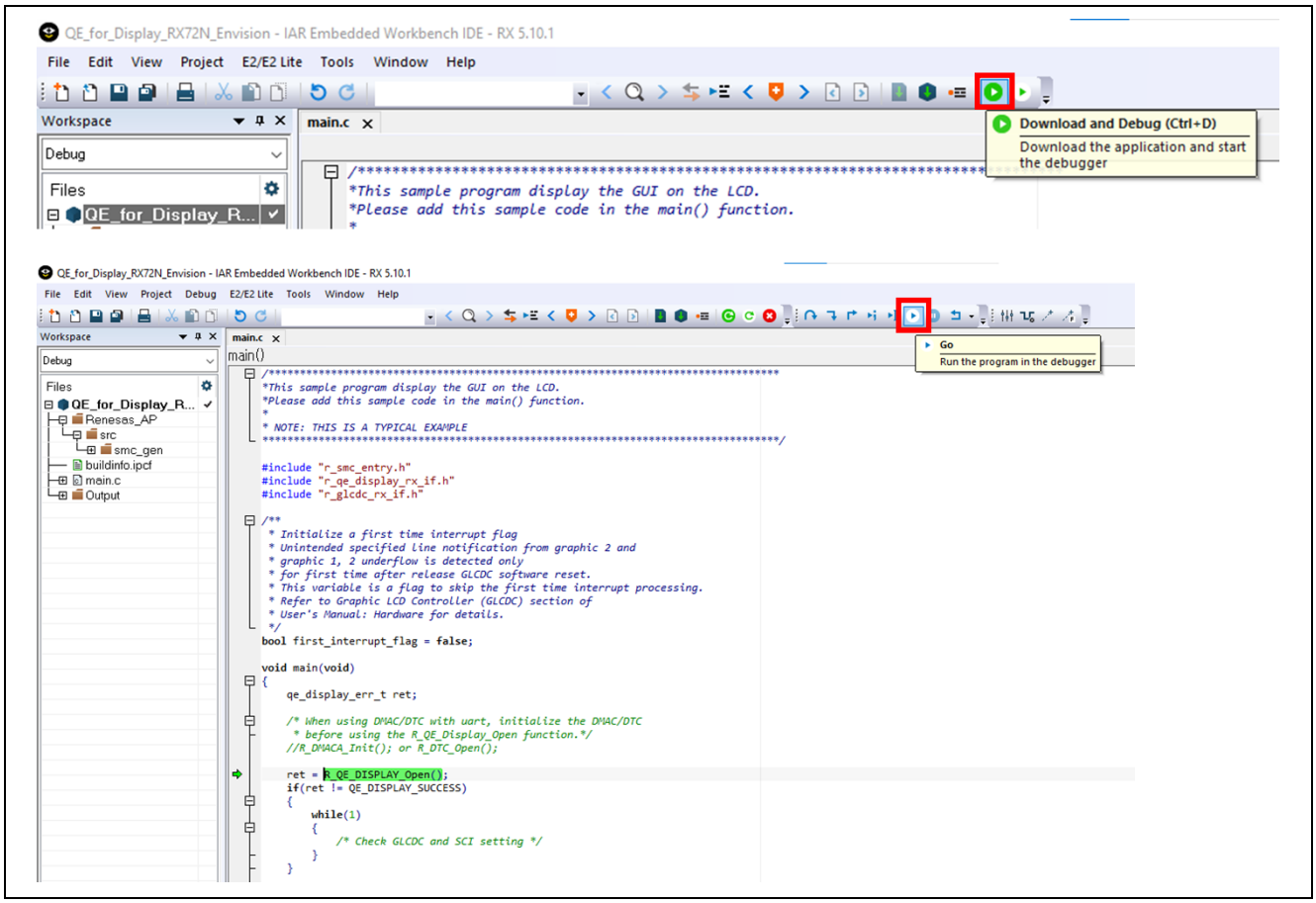
Evaluation Board	Power Supplied from the Emulator
RSK RX72N RSK RX65N	No
Envision RX72N Envision RX65N	No

Note: To supply power to the RSK RX72N and RSK RX65N, use an external power source having a stable DC output (min. 10 W) and center-positive connector.

7. When the settings have been made, click on “OK”.



8. Click on “Download and Debug” on the toolbar.
9. The program is executed and breaks at the beginning of the main function. Click on “Go” on the toolbar.



5. Hardware

5.1 Configuration of Hardware

Table 5.1 shows the LCD panel used in this application note.

Table 5.1 LCD Panel Used in the Sample

Board	Information on the LCD Panel Product
RSK RX72N RSK RX65N	Manufacturer: Newhaven Display Co. Part number: NHD-4.3-480272EF-ATXL#-CTP Display size:480 x 272 Synchronization signal: VS, HS, DE (three signals) Built-in touch controller
Envision RX72N Envision RX65N	Manufacturer: EastRising Co. Part number: ER-TFT043-3 Display size:480 x 272 Synchronization signal: VS, HS, DE (three signals) Built-in touch controller

5.2 Pin Functions

The following shows pins used on each RSK and Envision and describes the pin functions used. Select the pins according to the product you are using. Pin functions are automatically set by using the Smart Configurator and the standalone version of QE.

Table 5.2 Pins and Functions to be Used (RSK RX72N)

Connected Device	Pin Name	Input/Output	Description
NHD-4.3-480272EF-ATXL#-CTP	P14/LCD_CLK-B	Output	Outputs the panel clock.
	P13/LCD_TCON 0-B	Output	Outputs the synchronization signal (VSYNC).
	PJ2/LCD_TCON 2-B	Output	Outputs the synchronization signal (HSYNC).
	PB1/LCD_TCON 3-B	Output	Outputs the synchronization signal (DE).
	PC5/LCD_DATA 0-B	Output	Outputs the LCD signal R[3].
	P82/LCD_DATA 1-B	Output	Outputs the LCD signal R[4].
	P81/LCD_DATA 2-B	Output	Outputs the LCD signal R[5].
	P80/LCD_DATA 3-B	Output	Outputs the LCD signal R[6].
	PC4/LCD_DATA 4-B	Output	Outputs the LCD signal R[7].
	P55/LCD_DATA 5-B	Output	Outputs the LCD signal G[2].
	P54/LCD_DATA 6-B	Output	Outputs the LCD signal G[3].
	P11/LCD_DATA 7-B	Output	Outputs the LCD signal G[4].
	P83/LCD_DATA 8-B	Output	Outputs the LCD signal G[5].
	PC7/LCD_DATA 9-B	Output	Outputs the LCD signal G[6].
	PC6/LCD_DATA 10-B	Output	Outputs the LCD signal G[7].
	PJ0/LCD_DATA 11-B	Output	Outputs the LCD signal B[3].
	P85/LCD_DATA 12-B	Output	Outputs the LCD signal B[4].
	P84/LCD_DATA 13-B	Output	Outputs the LCD signal B[5].
	P57/LCD_DATA 14-B	Output	Outputs the LCD signal B[6].
	P56/LCD_DATA 15-B	Output	Outputs the LCD signal B[7].
	PQ1/SSCL11	Input/output	Inputs or outputs for the clock of the I^2C interface connected to the touch controller.
	PQ2/SSDA11	Input/output	Inputs or outputs for the data of the I^2C interface connected to the touch controller.
	P27/general-purpose input/output port	Output	Backlight
	PK4/general-purpose input/output port	Output	Panel reset
	PL3/general-purpose input/output port*	Output	Touch controller reset

Note: When PL3 is to be used, a resistor must be changed. For details, refer to the user's manual of the evaluation board.

Table 5.3 Pins and Functions to be Used (Envision RX72N)

Connected Device	Pin Name	Input/Output	Description
ER-TFT043-3	PB5/LCD_CLK-B	Output	Outputs the panel clock.
	PB4/LCD_TCON 0-B	Output	Outputs the synchronization signal (VSYNC).
	PB2/LCD_TCON 2-B	Output	Outputs the synchronization signal (HSYNC).
	PB1/LCD_TCON 3-B	Output	Outputs the synchronization signal (DE).
	PB0/LCD_DATA 0-B	Output	Outputs the LCD signal B[3].
	PA7/LCD_DATA 1-B	Output	Outputs the LCD signal B[4].
	PA6/LCD_DATA 2-B	Output	Outputs the LCD signal B[5].
	PA5/LCD_DATA 3-B	Output	Outputs the LCD signal B[6].
	PA4/LCD_DATA 4-B	Output	Outputs the LCD signal B[7].
	PA3/LCD_DATA 5-B	Output	Outputs the LCD signal G[2].
	PA2/LCD_DATA 6-B	Output	Outputs the LCD signal G[3].
	PA1/LCD_DATA 7-B	Output	Outputs the LCD signal G[4].
	PA0/LCD_DATA 8-B	Output	Outputs the LCD signal G[5].
	PE7/LCD_DATA 9-B	Output	Outputs the LCD signal G[6].
	PE6/LCD_DATA 10-B	Output	Outputs the LCD signal G[7].
	PE5/LCD_DATA 11-B	Output	Outputs the LCD signal R[3].
	PE4/LCD_DATA 12-B	Output	Outputs the LCD signal R[4].
	PE3/LCD_DATA 13-B	Output	Outputs the LCD signal R[5].
	PE2/LCD_DATA 14-B	Output	Outputs the LCD signal R[6].
	PE1/LCD_DATA 15-B	Output	Outputs the LCD signal R[7].
	P33/SSCL6	Input/output	Inputs or outputs for the clock of the I^2C interface connected to the touch controller.
	P32/SSDA6	Input/output	Inputs or outputs for the data of the I^2C interface connected to the touch controller.
	P67/general-purpose input/output port	Output	Backlight
	PB3/general-purpose input/output port	Output	Panel reset
	P66/general-purpose input/output port	Output	Touch controller reset

Table 5.4 Pins and Functions to be Used (RSK RX65N)

Connected Device	Pin Name	Input/Output	Description
NHD-4.3-480272EF-ATXL#-CTP	PB5/LCD_CLK-B	Output	Outputs the panel clock.
	PB4/LCD_TCON 0-B	Output	Outputs the synchronization signal (VSYNC).
	PB2/LCD_TCON 2-B	Output	Outputs the synchronization signal (HSYNC).
	PB1/LCD_TCON 3-B	Output	Outputs the synchronization signal (DE).
	PB0/LCD_DATA 0-B	Output	Outputs the LCD signal R[3].
	PA7/LCD_DATA 1-B	Output	Outputs the LCD signal R[4].
	PA6/LCD_DATA 2-B	Output	Outputs the LCD signal R[5].
	PA5/LCD_DATA 3-B	Output	Outputs the LCD signal R[6].
	PA4/LCD_DATA 4-B	Output	Outputs the LCD signal R[7].
	PA3/LCD_DATA 5-B	Output	Outputs the LCD signal G[2].
	PA2/LCD_DATA 6-B	Output	Outputs the LCD signal G[3].
	PA1/LCD_DATA 7-B	Output	Outputs the LCD signal G[4].
	PA0/LCD_DATA 8-B	Output	Outputs the LCD signal G[5].
	PE7/LCD_DATA 9-B	Output	Outputs the LCD signal G[6].
	PE6/LCD_DATA 10-B	Output	Outputs the LCD signal G[7].
	PE5/LCD_DATA 11-B	Output	Outputs the LCD signal B[3].
	PE4/LCD_DATA 12-B	Output	Outputs the LCD signal B[4].
	PE3/LCD_DATA 13-B	Output	Outputs the LCD signal B[5].
	PE2/LCD_DATA 14-B	Output	Outputs the LCD signal B[6].
	PE1/LCD_DATA 15-B	Output	Outputs the LCD signal B[7].
	P01/SSCL6	Input/output	Inputs or outputs for the clock of the I^2C interface connected to the touch controller.
	P00/SSDA6	Input/output	Inputs or outputs for the data of the I^2C interface connected to the touch controller.
	PB7/general-purpose input/output port	Output	Backlight
	P97/general-purpose input/output port	Output	Panel reset

Table 5.5 Pins and Functions to be Used (Envision RX65N)

Connected Device	Pin Name	Input/Output	Description
ER-TFT043-3	PB5/LCD_CLK-B	Output	Outputs the panel clock.
	PB4/LCD_TCON 0-B	Output	Outputs the synchronization signal (VSYNC).
	PB2/LCD_TCON 2-B	Output	Outputs the synchronization signal (HSYNC).
	PB1/LCD_TCON 3-B	Output	Outputs the synchronization signal (DE).
	PB0/LCD_DATA 0-B	Output	Outputs the LCD signal B[3].
	PA7/LCD_DATA 1-B	Output	Outputs the LCD signal B[4].
	PA6/LCD_DATA 2-B	Output	Outputs the LCD signal B[5].
	PA5/LCD_DATA 3-B	Output	Outputs the LCD signal B[6].
	PA4/LCD_DATA 4-B	Output	Outputs the LCD signal B[7].
	PA3/LCD_DATA 5-B	Output	Outputs the LCD signal G[2].
	PA2/LCD_DATA 6-B	Output	Outputs the LCD signal G[3].
	PA1/LCD_DATA 7-B	Output	Outputs the LCD signal G[4].
	PA0/LCD_DATA 8-B	Output	Outputs the LCD signal G[5].
	PE7/LCD_DATA 9-B	Output	Outputs the LCD signal G[6].
	PE6/LCD_DATA 10-B	Output	Outputs the LCD signal G[7].
	PE5/LCD_DATA 11-B	Output	Outputs the LCD signal R[3].
	PE4/LCD_DATA 12-B	Output	Outputs the LCD signal R[4].
	PE3/LCD_DATA 13-B	Output	Outputs the LCD signal R[5].
	PE2/LCD_DATA 14-B	Output	Outputs the LCD signal R[6].
	PE1/LCD_DATA 15-B	Output	Outputs the LCD signal R[7].
	P01/SSCL6	Input/output	Inputs or outputs for the clock of the I^2C interface connected to the touch controller.
	P00/SSDA6	Input/output	Inputs or outputs for the data of the I^2C interface connected to the touch controller.
	P66/general-purpose input/output port	Output	Backlight
	P63/general-purpose input/output port	Output	Panel reset
	P07/general-purpose input/output port	Output	Touch controller reset

6. Using the Standalone Version of QE

This chapter describes the usage of the standalone version of QE according to the actual flow of display adjustment. For details on the facilities of the standalone version of QE, refer to the help file which comes with the standalone version of QE.

6.1 Starting the Standalone Version of QE

Start the standalone version of QE by double-clicking on “¥QE-Display¥eclipse¥qe-display.exe” (Figure 6.1).

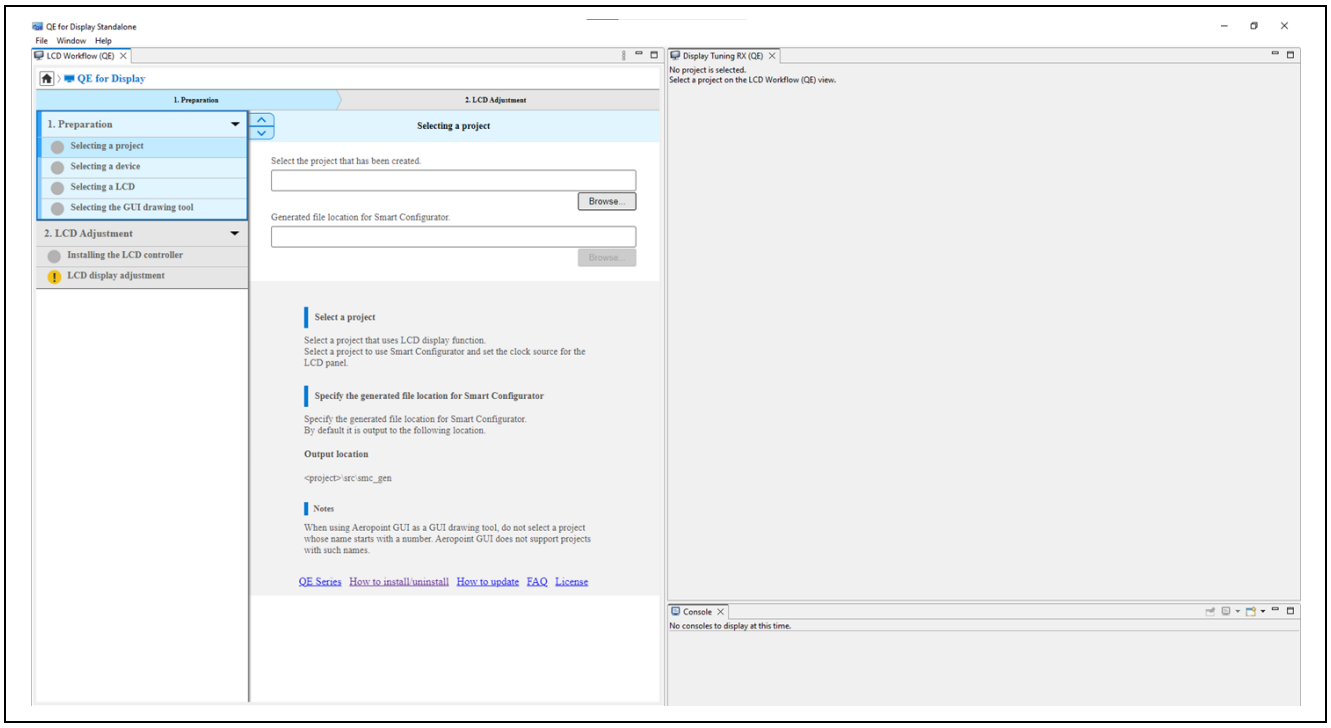


Figure 6.1 Initial State of the Standalone Version of QE

Note: In an environment where the WebView2 runtime is not installed in your PC, the workflow cannot be displayed. In this case, download and install WebView2 (x64 version) from the Microsoft web page.

- Renesas Customer Hub FAQ 3000670: https://en-support.renesas.com/knowledgeBase/20814216

Select “1. Preparation” -> “Selecting a project” in the workflow of the standalone version of QE. Then select a project to open the “Display Tuning RX (QE)” view (Figure 6.2).

Figure 6.2 is the display of a block diagram of the hardware of the GLCDC, showing the path for the output of image data and the relationships between the positions where images are to be corrected. Clicking on “Brightness” or “Contrast” for the adjustment of image quality produces the “Image Quality Adjustment” tabbed page, which allows various adjustments.

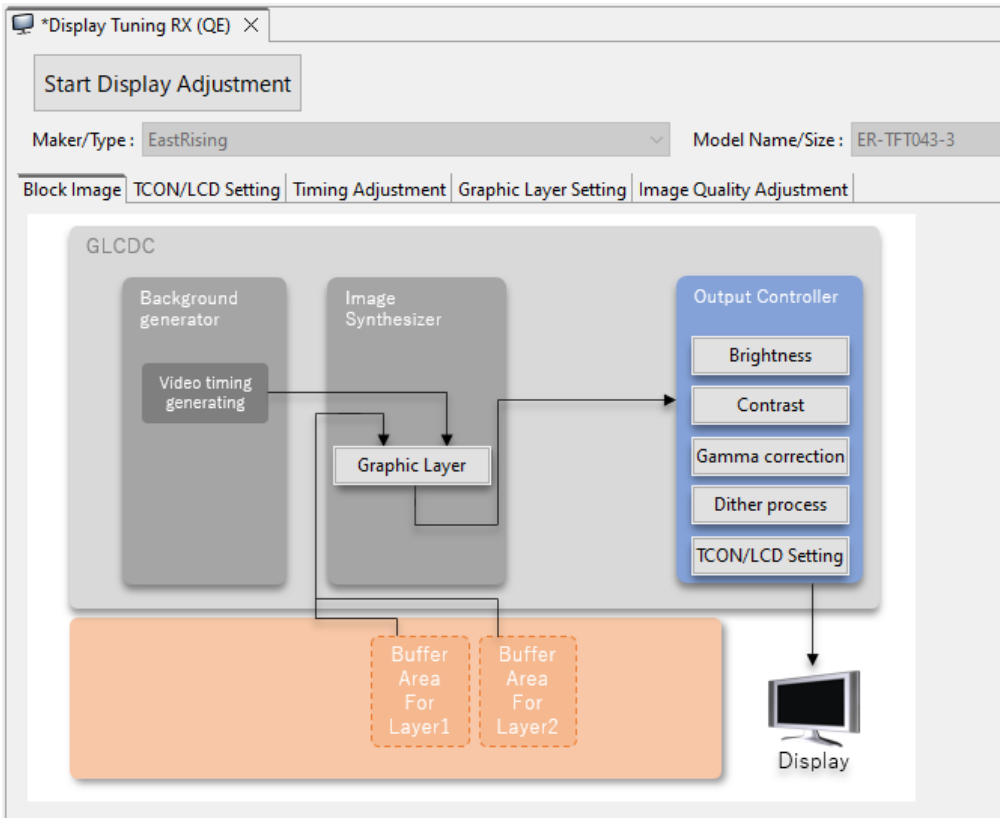


Figure 6.2 “Display Tuning RX (QE)” View

6.2 Setting Data on the LCD Panel

Information on the LCD panel which is connected to the user system is specified. When the display is connected to a system under development, you need to compare and adjust the specifications of the LCD panel and the display controller and find specifiable and appropriate settings. Information that has been specified is used in comparison.

The LCD mounted on the RSK is an NHD-4.3-480272EF-ATXL#-CTP manufactured by Newhaven Display International. The LCD mounted on the Envision is an ER-TFT043-3 manufactured by EastRising Technology Co., Ltd.

Selecting a project for which the board to be used has been specified in the “LCD Workflow (QE)” view displays information on the LCD panel.

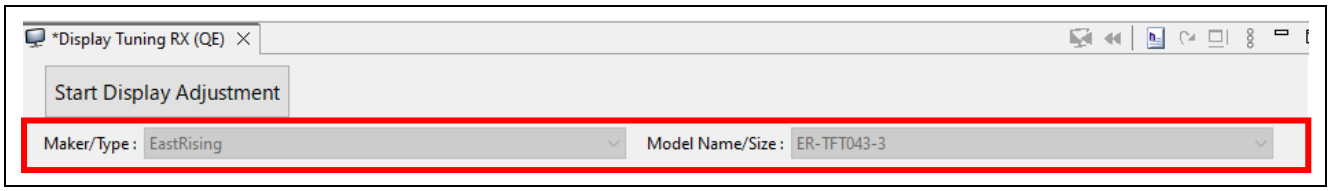


Figure 6.3 Selecting the LCD Panel

When information on the LCD panel is set, the display type can be specified by selecting from among three patterns. The display type adopted is 3 (the method of using Vsync, Hsync, and DE signals) for the LCD panel mounted on the RSK and Envision.

For details on setting information on the LCD panel, refer to chapter 7, Setting Detailed Data on the LCD Panel.

6.3 Setting the Output of Control Signals

Select the “TCON/LCD Setting” tabbed page in the “Display Tuning RX (QE)” view and specify the settings for the output of control signals (Figure 6.4).

The following settings for the output of control signals are available on this page.

[Panel Driver Signal (TCON) Output Selection]
- Selection of output pins:
  - Output to the LCD_TCON0 to LCD_TCON3 pins (TCON0 to TCON3)
- Active sense of control signals:
  - Positive sense: [High Active]
  - Negative sense: [Low Active]

[LCD Setting]
- [LCD Output Format]
  - 24-bit RGB888 output: [24bit (GLCDC_OUT_FORMAT_24BITS_RGB888)]
  - 18-bit RGB666 output: [18bit (GLCDC_OUT_FORMAT_18BITS_RGB666)]
  - 16-bit RGB565 output: [16bit (GLCDC_OUT_FORMAT_16BITS_RGB565)]
- [Timing of Output Data]
  - Output on rising edges of the panel clock: [Rising (GLCDC_SIGNAL_SYNC_EDGE_RISING)]
  - Output on falling edge of the panel clock: [Falling (GLCDC_SIGNAL_SYNC_EDGE_FALLING)]
- [Background Color]
  - 0x00000000 to 0x00FFFFFF
- [Bit-endian of Output Data]
  - Little Endian (GLCDC_ENDIAN_LITTLE)
  - Big Endian (GLCDC_ENDIAN_BIG)
- [Pixel Order of Output Data]
  - RGB (GLCDC_COLOR_ORDER_RGB)
  - BGR (GLCDC_COLOR_ORDER_BGR)

[LCD Backlight Control]
- Selection of control
- Selection of port number:
  - PORT0 to PORTJ
- Selection of bit position:
  - BIT0 to BIT7
- Active sense of control signals:
  - Negative sense: [Low Active]
  - Positive sense: [High Active]

[LCD Reset Control]
- Selection of control
- Selection of port number:
  - PORT0 to PORTJ
- Selection of bit position:
  - BIT0 to BIT7
- Active sense of control signals:
  - Negative sense: [Low Active]
  - Positive sense: [High Active]

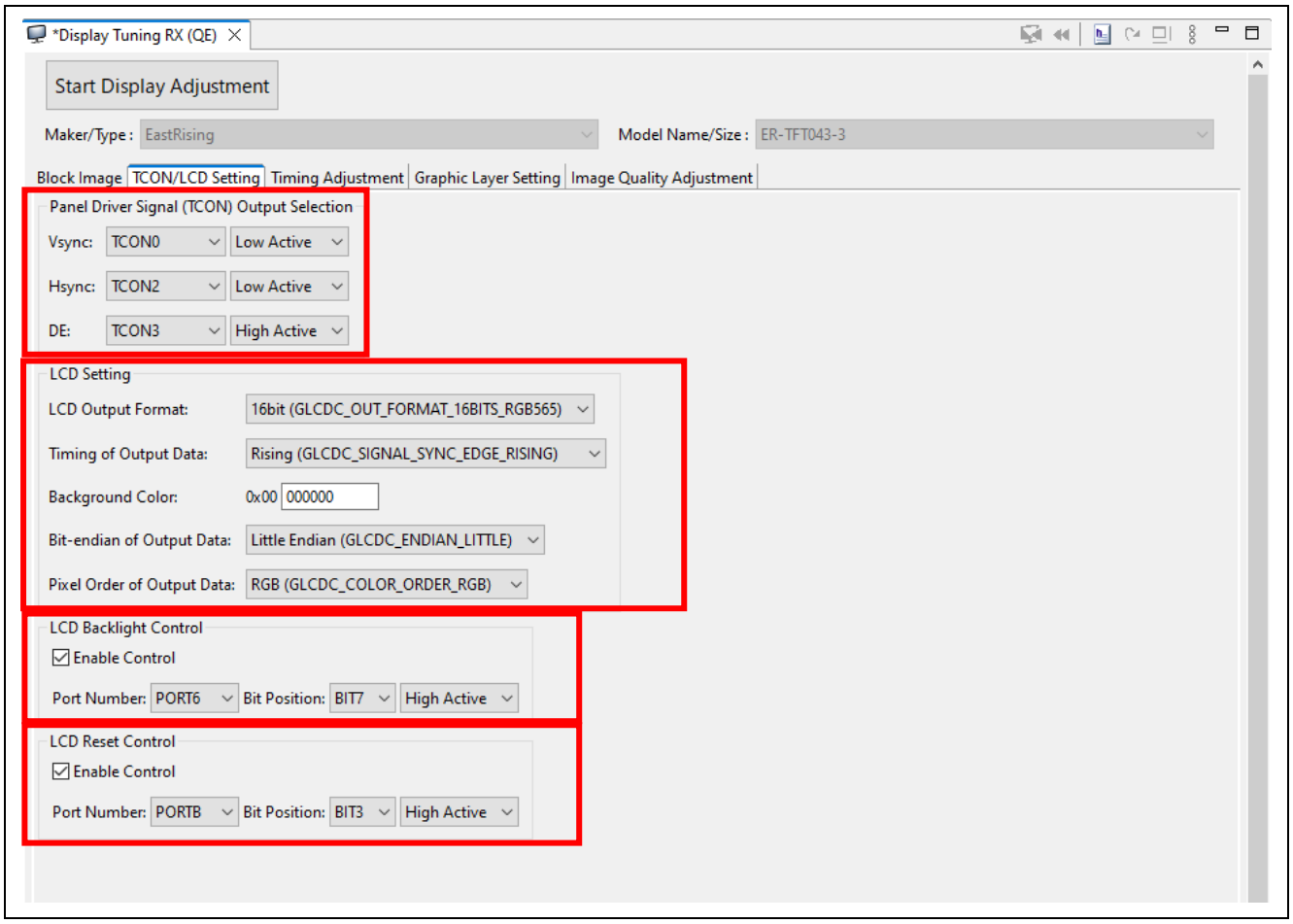


Figure 6.4 “TCON/LCD Setting” Tabbed Page

The following lists the settings that match the specifications of RSK and Envision boards.

Table 6.1 Settings of TCON and the LCD Panel Used for the Application

	RSK RX72N	RSK RX65N	Envision RX72N	Envision RX65N
Selection of output pins				
Vsync	TCON0		TCON0	
Hsync	TCON2		TCON2	
DE	TCON3		TCON3	
Active sense of control signals				
Vsync	Negative sense: [Low Active]		Negative sense: [Low Active]	
Hsync	Negative sense: [Low Active]		Negative sense: [Low Active]	
DE	Positive sense: [High Active]		Positive sense: [High Active]	
[LCD Output Format]	16-bit RGB565 output [16bit (GLCDC_OUT_FORMAT_16 BITS_RGB565)]		16-bit RGB565 output [16bit (GLCDC_OUT_FORMAT_16 BITS_RGB565)]	
[Timing of Output Data]	Output on rising edges of the panel clock [Rising (GLCDC_SIGNAL_SYNC_ EDGE_RISING)]		Output on rising edges of the panel clock [Rising (GLCDC_SIGNAL_SYNC_ EDGE_RISING)]	
[Background Color]	0x00000000		0x00000000	
[Bit-endian of Output Data]	Little Endian (GLCDC_ENDIAN_LITTLE)		Little Endian (GLCDC_ENDIAN_LITTLE)	
[Pixel Order of Output Data]	BGR (GLCDC_COLOR_ORDER_BGR)		RGB (GLCDC_COLOR_ORDER_RGB)	
[LCD Backlight Control]				
Selection of control	Enabled		Enabled	
[Port Number]	PORT2	PORTB	PORT6	PORT6
[Bit Position]	BIT7	BIT7	BIT7	BIT6
Active sense of control signals	Positive sense: [High Active]		Positive sense: [High Active]	
[LCD Reset Control]				
Selection of control	Enabled		Enabled	
[Port Number]	PORTK	PORT9	PORTB	PORT6
[Bit Position]	BIT4	BIT7	BIT3	BIT3
Active sense of control signals	Positive sense: [High Active]		Positive sense: [High Active]	

6.4 Setting the Graphics Layers

Select the “Graphic Layer Setting” tabbed page in the “Display Tuning RX (QE)” view and specify the settings for the graphics.

The following settings for graphics are available on this page.

[Select Using Graphic Layer]
- Graphic layer 1
- Graphic layer 2
- Graphic layers 1 and 2

[Graphic Layer 1 Setting]
- [Height of Image Data]
  - 16 to the value of VDP on the [Timing Adjustment] tabbed page
- [Width of Image Data]
  - 16 to the value of HDP on the [Timing Adjustment] tabbed page
- [Display Start Position (x-coordinate)]
  - 0 to the value of “VDP – 16” on the [Timing Adjustment] tabbed page
- [Display Start Position (y-coordinate)]
  - 0 to the value of “HDP – 16” on the [Timing Adjustment] tabbed page
- [Start Address of Frame Buffer]
  - 0x00000040 to 0xFFFFFFC0
- [Output Data Format]
  - ARGB8888 (GLCDC_IN_FORMAT_32BITS_ARGB8888)
  - RGB888 (GLCDC_IN_FORMAT_32BITS_RGB888)
  - RGB565 (GLCDC_IN_FORMAT_16BITS_RGB565)
  - ARGB1555 (GLCDC_IN_FORMAT_16BITS_ARGB1555)
  - ARGB4444 (GLCDC_IN_FORMAT_16BITS_ARGB4444)
  - CLUT8 (GLCDC_IN_FORMAT_CLUT8)
  - CLUT4 (GLCDC_IN_FORMAT_CLUT4)
  - CLUT1 (GLCDC_IN_FORMAT_CLUT1)

[Graphic Layer 2 Setting]
- The same settings as those for [Graphic Layer 1 Setting]

[Interrupts Setting]
- Selection of enabling VPOS detection
- Selection of enabling VPOS interrupts
- Selection of the use of a callback function
- [Callback Function Name]
  - Desired character string

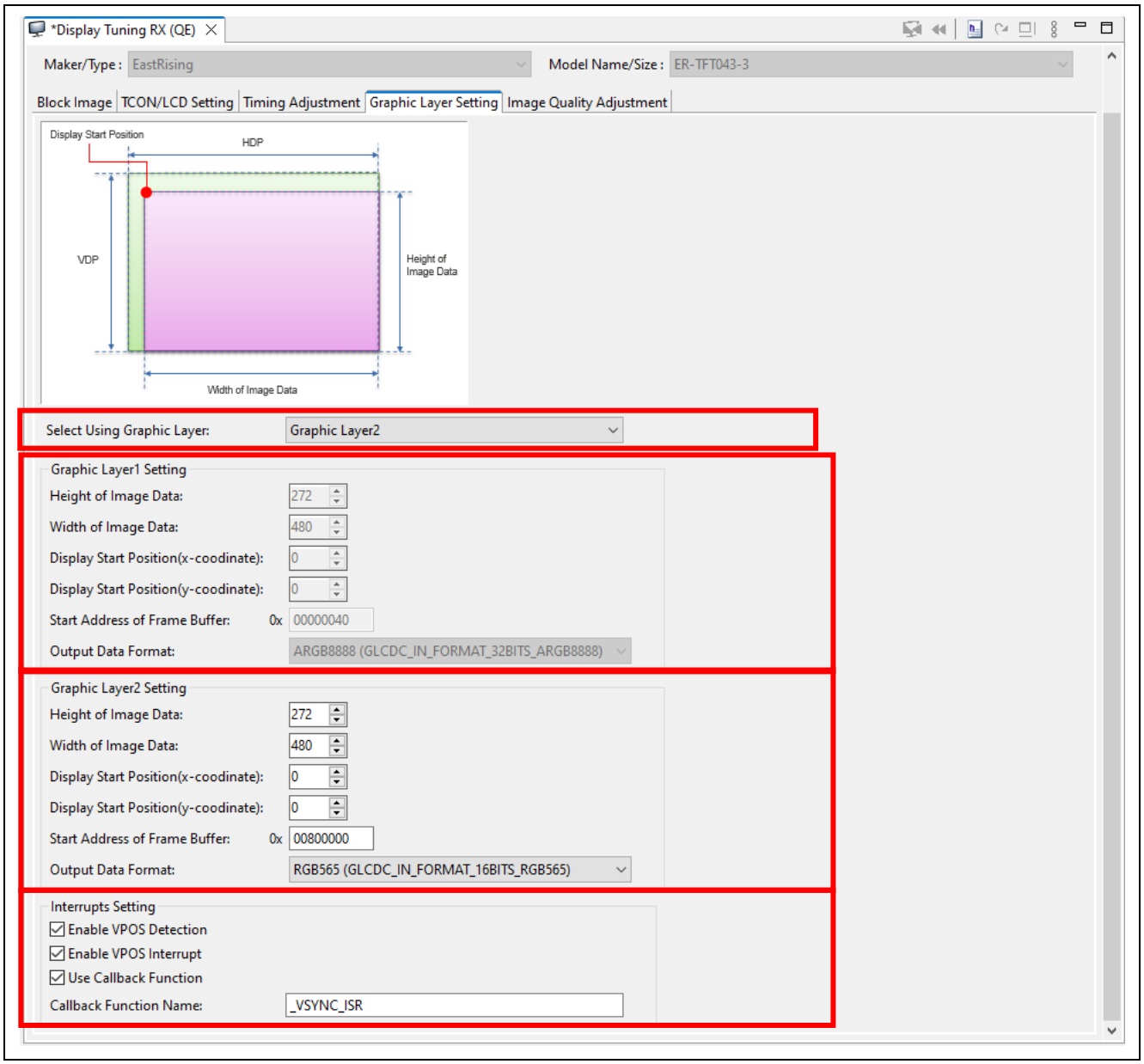


Figure 6.5 “Graphic Layer Setting” Tabbed Page

The following lists the settings that match the specifications of RSK and Envision board.

Table 6.2 Settings of Graphics Layers Used for the Application

	RSK RX72N	**Envision RX72N**	**RSK RX65N**	**Envision RX65N**
[Select Using Graphic Layer]	Graphic layer 2	Graphic layer 2	Graphic layer 2	Graphic layer 2
[Graphic Layer 1 Setting]				
All items	Disabled	Disabled	Disabled	Disabled
[Graphic Layer 2 Setting]				
[Height of Image Data]	272	272	272	272
[Width of Image Data]	480	480	480	480
[Display Start Position (x-coordinate)]	0	0	0	0
[Display Start Position (y-coordinate)]	0	0	0	0
[Start Address of Frame Buffer]	0x00800000	0x00800000	0x00800000	0x00800000
[Output Data Format]	RGB565 (GLCDC_IN_FORMAT_16BITS_RGB565)	RGB565 (GLCDC_IN_FORMAT_16BITS_RGB565)	RGB565 (GLCDC_IN_FORMAT_16BITS_RGB565)	RGB565 (GLCDC_IN_FORMAT_16BITS_RGB565)
[Interrupts Setting]				
[Enable VPOS Detection]	Enabled	Enabled	Enabled	Enabled
[Enable VPOS Interrupt]	Enabled	Enabled	Enabled	Enabled
[Use Callback Function]	Used	Used	Used	Used
[Callback Function Name]	_VSYNC_ISR	_VSYNC_ISR	_VSYNC_ISR	_VSYNC_ISR

6.5 Adjusting the Timing of Control Signals for the LCD Panel

Clicking on the “Start Display Adjustment” button after the debugger is connected opens the “Connection setting” dialog box. Generate the GLCDC parameter file and execute the program in which the sample code has been implemented. Selecting values for “Baud rate” and “COM port” and clicking on the “Start adjustment” button starts adjustment of the display.

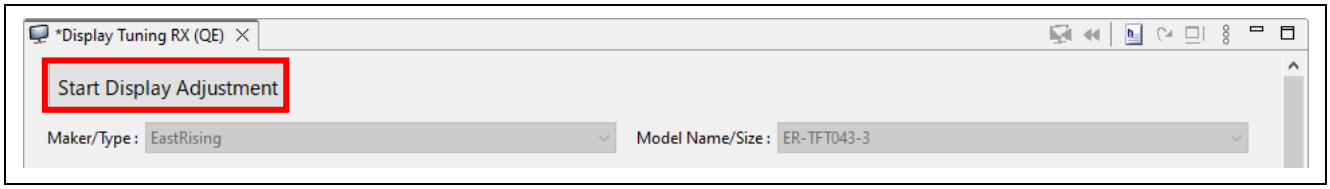


Figure 6.6 “Start Display Adjustment” Button

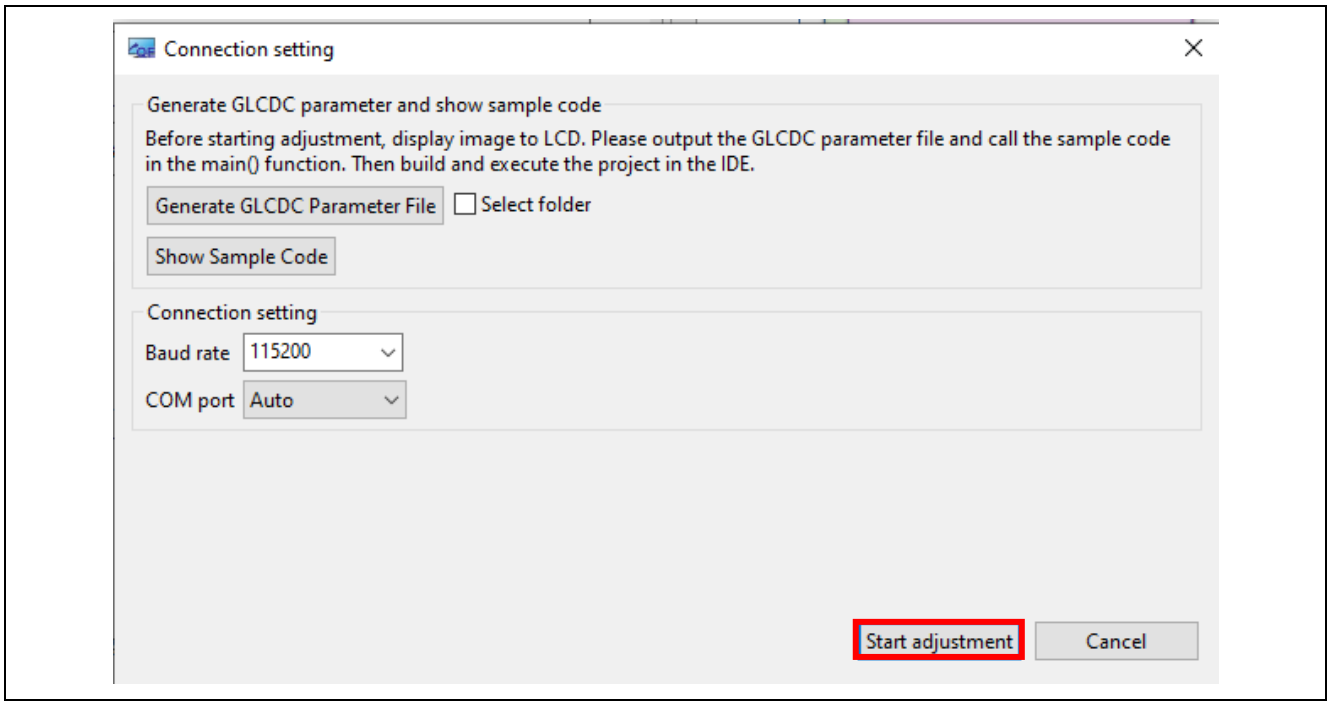
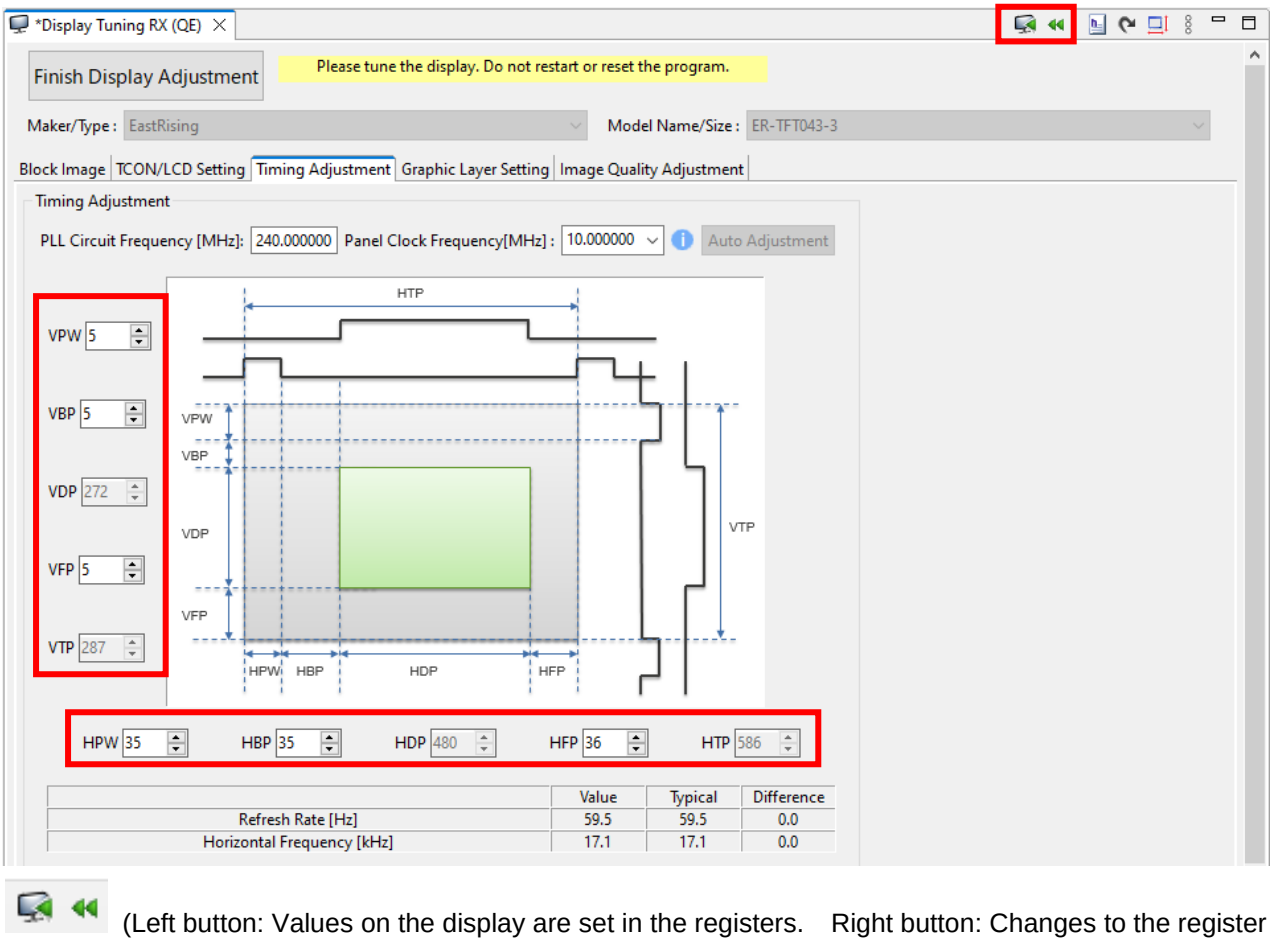


Figure 6.7 “Connection setting” Dialog Box

During adjustment of the display, the message “Please tune the display. Do not restart or reset the program.” is displayed and the “Start Display Adjustment” button is replaced by the “Finish Display Adjustment” button. Changing the values shown in Figure 6.8 changes the timing of the control signals. This tool writes the changed values to registers of the GLCDC so that they will be reflected in the operation of the LCD panel on the board.



(Left button: Values on the display are set in the registers. Right button: Changes to the register settings are made in real-time.)

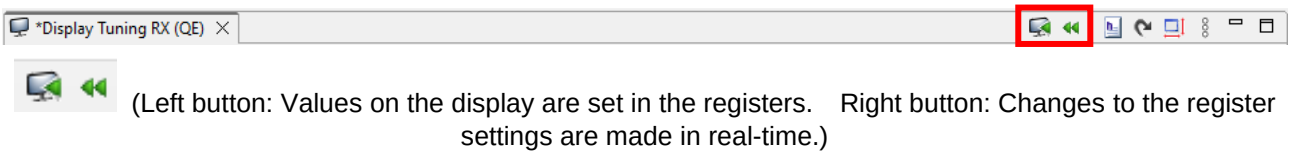
Figure 6.8 Adjusting the Timing of Control Signals

Select the frequency of the panel clock from the combo box. The selected frequency is used to calculate the refresh rate, which is indicated at the bottom of the page, along with a value for any difference from the recommended value for the LCD panel. The value recommended for the LCD panel will have been specified as the initial value.

Adjust the individual parameters in the spin boxes. The result of adjustment being shown in red numerals means that the value is out of the range of the specifications of the GLCDC or of the LCD panel. In such cases, adjust the value so that it is within the range of the specifications of the GLCDC and of the LCD panel. Check the range of values which are allowable in the specifications of the GLCDC by hovering the mouse over the value for adjustment that is being shown in red.

In an RSK, if a value being adjusted is restored to its default (the specifications of the LCD panel mounted on the RSK) with the “Restore the Displayed Settings to the Default” button, the recommended value for the horizontal front porch (HFP) of the LCD panel will be two, and this must be modified since it is out of the range of the specifications of the GLCDC. Modify the value to three or greater to satisfy the specifications of both the LCD panel and GLCDC. After that, the display of the adjusted value is changed from red to black.

After you have determined the adjusted values, you can write the values from this tool to the registers of the GLCDC and check the results.



(Left button: Values on the display are set in the registers. Right button: Changes to the register settings are made in real-time.)

Figure 6.9 Buttons for Setting Registers

The following two methods are used to set or make changes to values in the registers.

Table 6.3 Facilities for Setting or Making Changes to Values in Registers

Button	Name	Description
	Set the Register	The settings are written to the registers. This button is only effective during adjustment of the display.
	Set the Registers in Real-time when the Parameters are Changed	When this button is active, changes are automatically written to registers every time the setting is changed. This button is not active by default. Writing to the registers only proceeds when the display is being adjusted; no operation proceeds if the display is not being adjusted.

Note: Due to the display type and specifications of the LCD panel, fine changes to setting values (e.g. moving by several pixels) or changes to particular settings may not appear on the LCD panel. For example, the LCD panels mounted on the RSK and Envision are of display type 3, which does not allow the movement of positions in response to changes to the settings for the back porches and so on.

6.6 Reflecting the Output of Control Signals, Setting of Graphic Layers, and the Results of Timing Adjustment

The output of control signals, setting of graphic layers, and the results of timing adjustment can be reflected in a program through the output of a header file. Clicking on the “Generating Header File” button of the standalone version of QE (Figure 6.10) generates a header file that reflects the specified items.

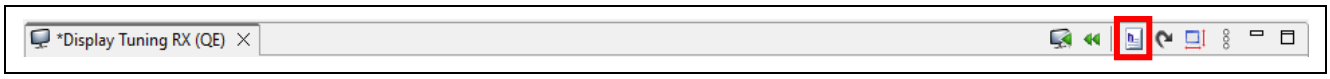


Figure 6.10 “Generating Header File” Button

When you select “For Display Settings” only and click on “Generate”, a header file is generated at the specified destination for output. The name of the header file and the output destination can be specified as desired.

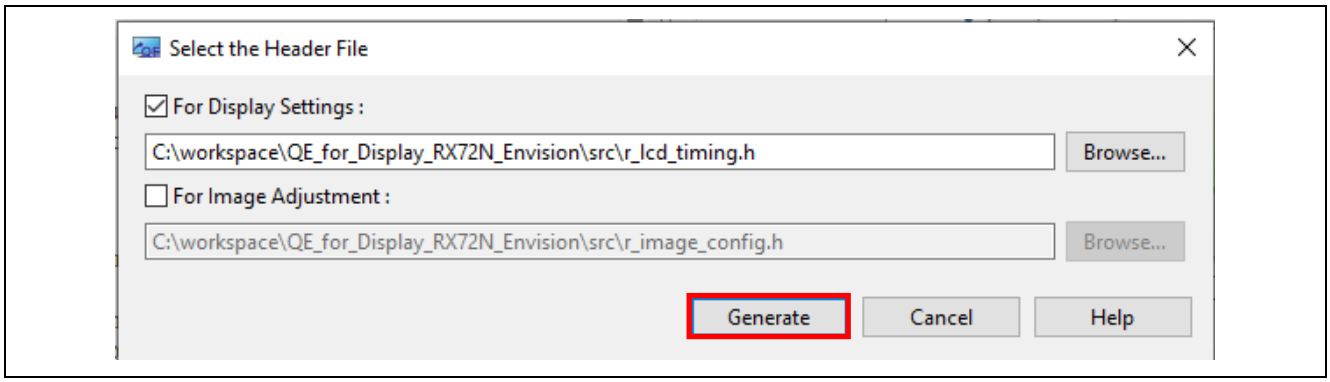


Figure 6.11 Selecting “For Display Settings”

To reflect the timing of the project, output the header file with the name 'r_lcd_timing.h' in the following directory, and clean and build the project.

Directory:

<*workspace folder*>¥<*project folder*>¥src

6.7 Adjusting the Image Quality

Clicking on the items for image quality adjustment enclosed by red frames in Figure 6.12 on the “Block Image” tabbed page makes the “Image Quality Adjustment” tabbed page appear, enabling the adjustment of image quality.

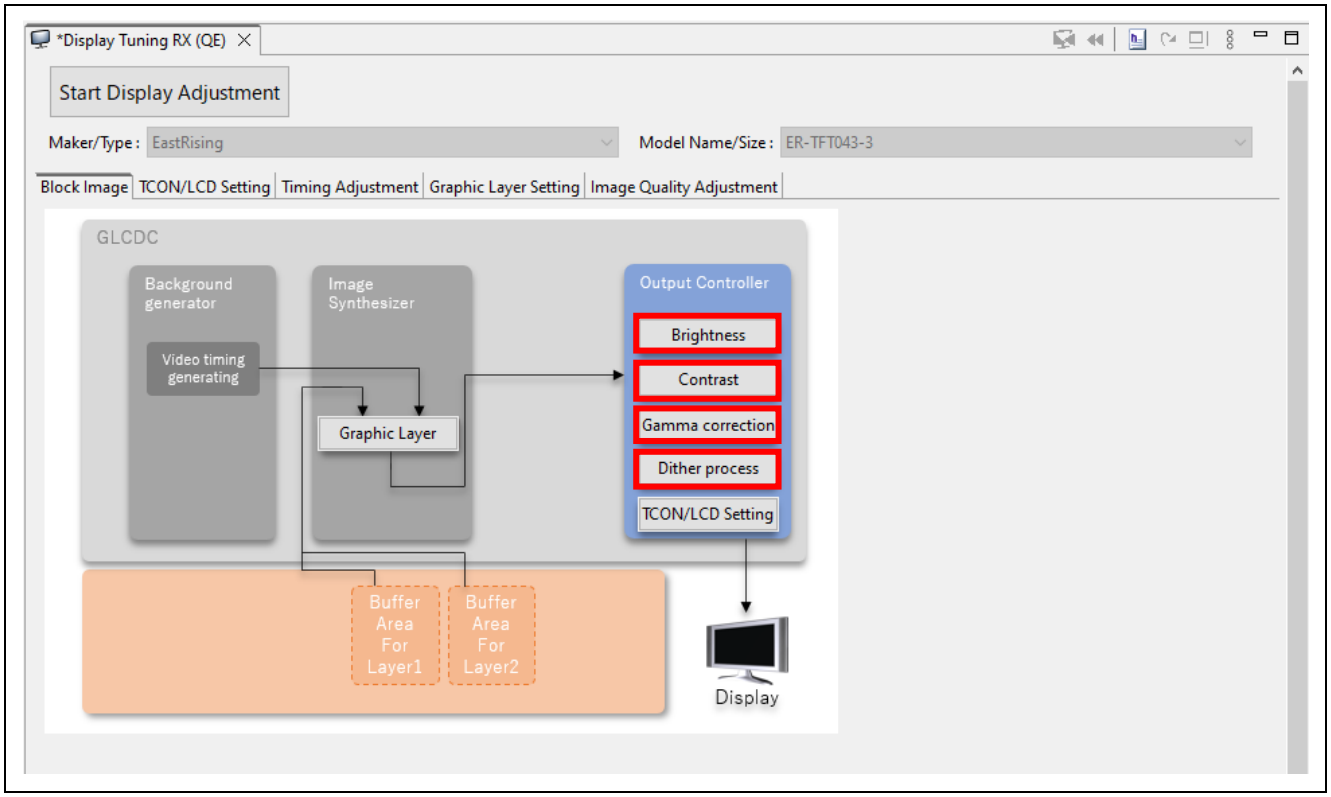


Figure 6.12 Buttons for Selecting the Adjustment of Image Quality

The “Image Quality Adjustment” tabbed page enables the adjustment of image quality. The standalone version of QE supports “Calibration Route Setting” and four facilities for adjusting image quality: “Brightness”, “Contrast”, “Gamma correction”, and “Dither process”.

Changes to these settings will be reflected in real-time, allowing the adjustment of image quality with reference to the display on the LCD panel.

Image quality is adjusted by using “Quick Setting” or “Custom”. If you select “Custom”, refer to the RX65N Group, RX651 Group User's Manual: Hardware (R01UH0590), RX72N Group User’s Manual: Hardware (R01UH0824) and the RX Family Graphic LCD Controller Module Using Firmware Integration Technology (R01AN3609), check the meanings of the settings made in each of the registers and the specifiable values, and adjust the image quality accordingly.

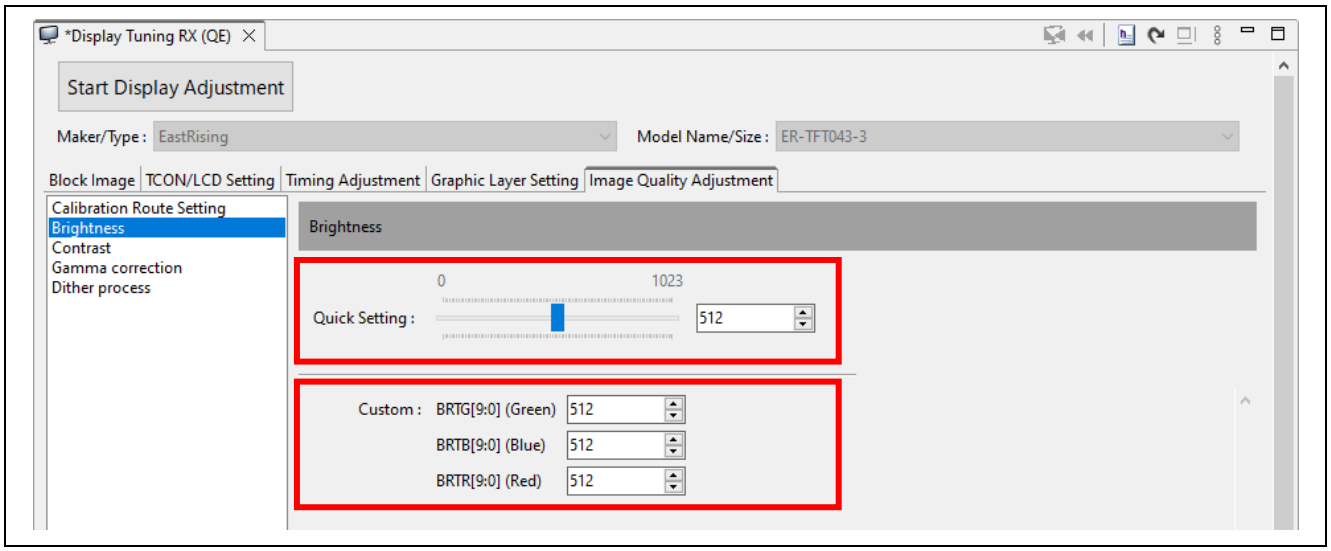


Figure 6.13 “Image Quality Adjustment” Tabbed Page

6.8 Generating a Header File with the Results of Adjusting the Image Quality

Click on the “Generating Header File” icon of the standalone version of QE to generate a header file that reflects the results of image quality adjustment which have been specified (see Figure 6.14).

When you select “For Image Adjustment” only and click on “Generate”, a header file is generated at the specified destination for output. The name of the header file and the output destination can be specified as desired.

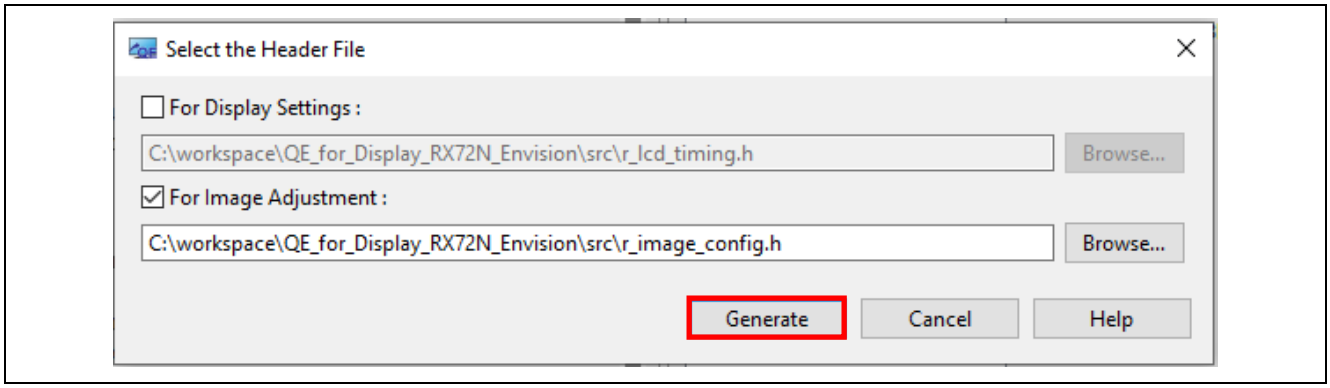


Figure 6.14 Selecting “For Image Adjustment”

To reflect the settings of image quality adjustment in the project, output the header file with the name 'r_image_config_.h' in the following directory, and clean and build the project.

Directory:

<*workspace folder*>¥<*project folder*>¥src

7. Setting Detailed Data on the LCD Panel

If you select “Custom” from the “Maker/Type” pull-down list in the upper section of the dialog box shown in Figure 6.2, the “Edit Custom Display Data” dialog box (Figure 7.1) appears. Enter information on the LCD panel in this dialog box.

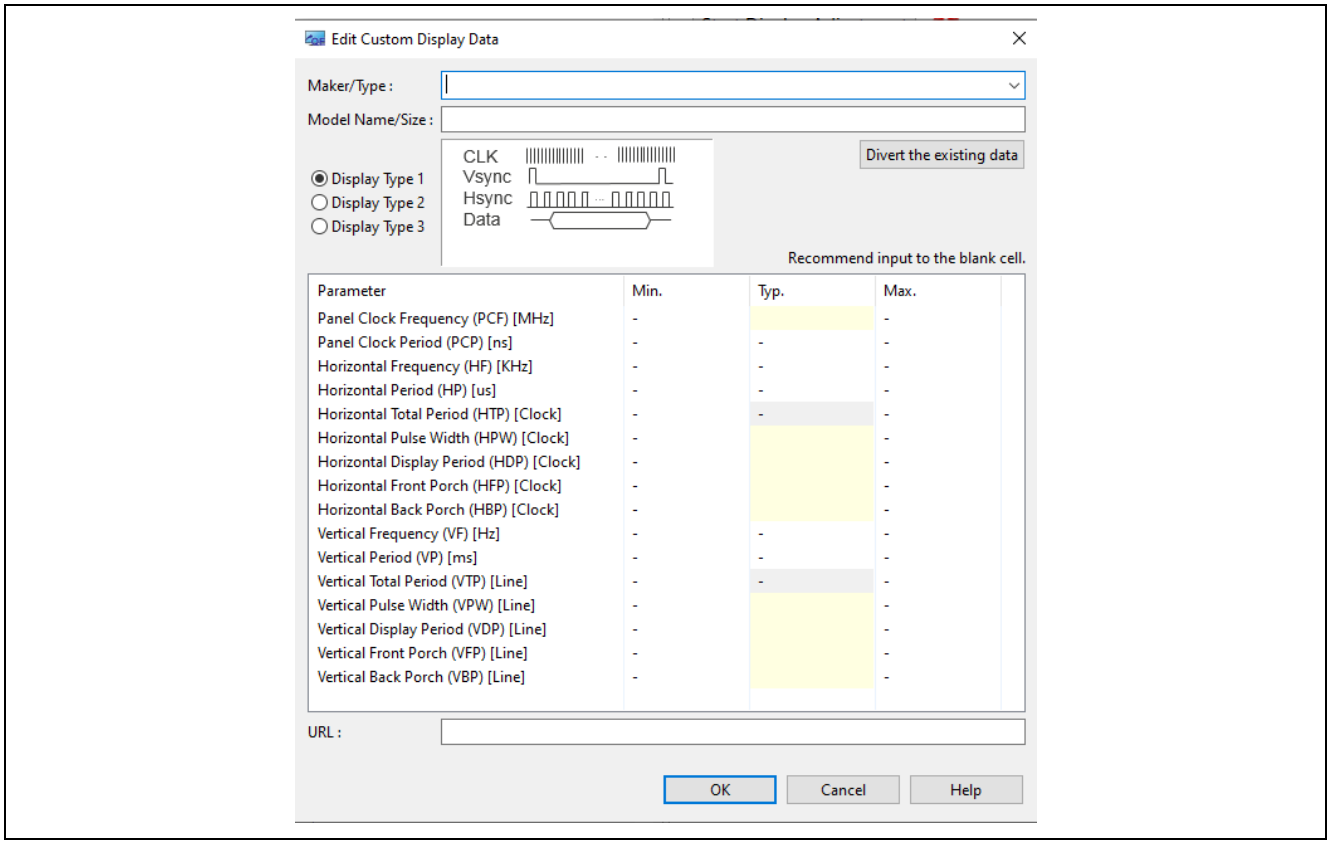


Figure 7.1 “Edit Custom Display Data” Dialog Box

7.1 Entering Names for Registration

Enter the desired names in “Maker/Type” and “Model Name/Size” in the “Edit Custom Display Data” dialog box (Figure 7.2). These names will be registered in the drop-down list for selection.

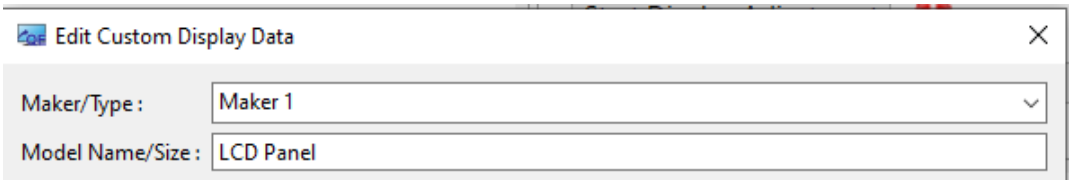


Figure 7.2 Registering a Name

7.2 Selecting the Display Type

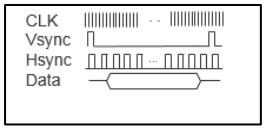
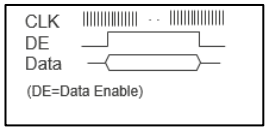
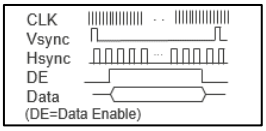
Table 7.1, Main Control Signals, lists the control signals required for connecting an LCD panel. The standalone version of QE supports devices which have three display types with a combination of those control signals.

Table 7.1 Main Control Signals

Name	Outline of Facility
Horizontal synchronization signal (Hsync)	The signal that generates the timing for one line to be displayed
Vertical synchronization signal (Vsync)	The signal that generates the timing for one screen to be displayed
Panel clock (CLK)	The signal that drives the sampling of pixels to be displayed
Display enable (DE)	The signal indicating that valid data are being output
Data (Data)	Data to be displayed

The user must check which control signals are required in the specifications of the LCD panel in use and select the appropriate one from among the three display types shown in Table 7.2, Display Types and Control Signals to be Used.

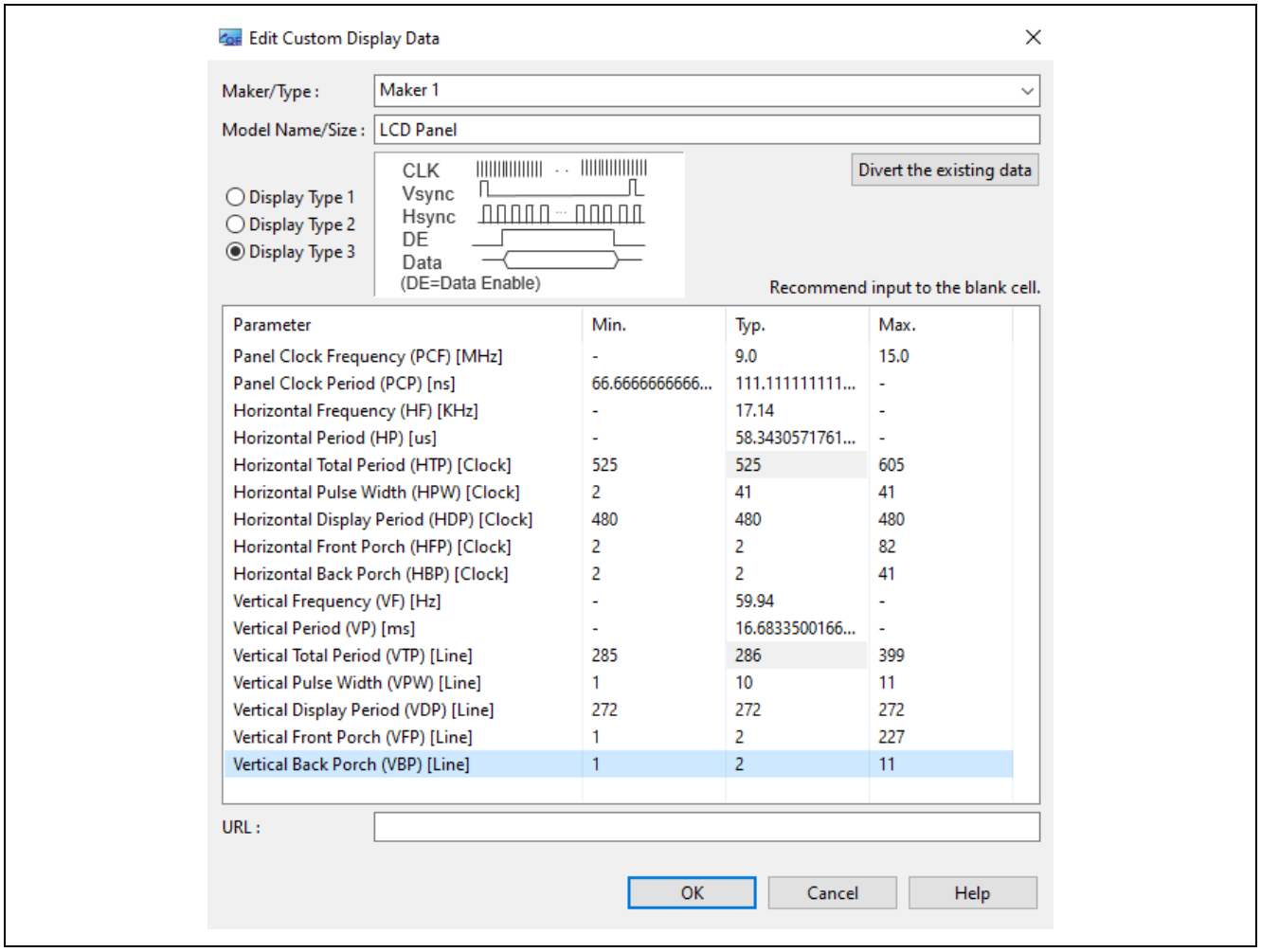
Table 7.2 Display Types and Control Signals to be Used

Name	Display type 1	Display type 2	Display type 3
			
Horizontal synchronization signal (Hsync)	Used	Unused	Used
Vertical synchronization signal (Vsync)	Used	Unused	Used
Panel clock (CLK)	Used	Used	Used
Display enable (DE)	Unused	Used	Used
Data (Data)	Used	Used	Used

7.3 Entering the Control Timing

Enter the control timing with reference to the datasheet for the LCD panel. Values entered under Typ. are used as the initial values for timing control. Values entered under Min. and Max. are used to check whether or not the timing as adjusted by using the standalone version of QE GUI is within the range.

Figure 7.3 shows the result of data input for the LCD panel mounted on the RSK. Enter values with reference to Table 7.3, Excerpt from the Datasheet for the LCD Panel on the RSK.



Parameter	Min.	Typ.	Max.
Panel Clock Frequency (PCF) [MHz]	-	9.0	15.0
Panel Clock Period (PCP) [ns]	66.6666666666...	111.111111111...	-
Horizontal Frequency (HF) [KHz]	-	17.14	-
Horizontal Period (HP) [us]	-	58.3430571761...	-
Horizontal Total Period (HTP) [Clock]	525	525	605
Horizontal Pulse Width (HPW) [Clock]	2	41	41
Horizontal Display Period (HDP) [Clock]	480	480	480
Horizontal Front Porch (HFP) [Clock]	2	2	82
Horizontal Back Porch (HBP) [Clock]	2	2	41
Vertical Frequency (VF) [Hz]	-	59.94	-
Vertical Period (VP) [ms]	-	16.6833500166...	-
Vertical Total Period (VTP) [Line]	285	286	399
Vertical Pulse Width (VPW) [Line]	1	10	11
Vertical Display Period (VDP) [Line]	272	272	272
Vertical Front Porch (VFP) [Line]	1	2	227
Vertical Back Porch (VBP) [Line]	1	2	11

Figure 7.3 Result of Control Timing Input

Table 7.3 Excerpt from the Datasheet for the LCD Panel on the RSK

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock cycle	fclk	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/th	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp	2	41	41	CLK
Horizontal back porch	thb	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	399	H
Vertical display period	tvd	272	272	272	H
Vertical front porch	tvf	1	2	227	H
Vertical pulse width	tvp	1	10	11	H
Vertical back porch	rvb	1	2	11	H

7.4 Editing the Created Display Data

When the “Edit and Delete the Custom Display...” menu item is executed after clicking on the menu button on the toolbar, the created display data can be re-edited.

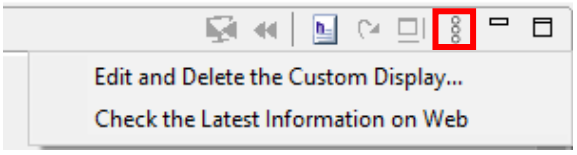


Figure 7.4 “Edit and Delete the Custom Display...” Menu Item

8. Details of Settings

This chapter gives supplementary explanations and notes for each of the procedures described in section 1.1, Flow of System Development with the Standalone Version of QE.

8.1 Setting the GLCDC FIT Module Not Supported by the Standalone Version of QE

The Smart Configurator can be used to change the settings of the GLCDC FIT module which are not supported by the standalone version of QE. However, changing the settings from the default values may lead to an error. Confirm the specifications of the GLCDC FIT module.

For the specifications of the GLCDC FIT module, refer to the RX Family Graphic LCD Controller Module Using Firmware Integration Technology Application Note.

8.2 From Execution to the End of Adjustment

After the program has been created, start the debugger and execute the program. If the initial screen is not correctly displayed, the settings are not correct. Check the values adjusted by the standalone version of QE and the settings of parameters of the GLCDC FIT module.

Figure 8.1 shows the flow of troubleshooting.

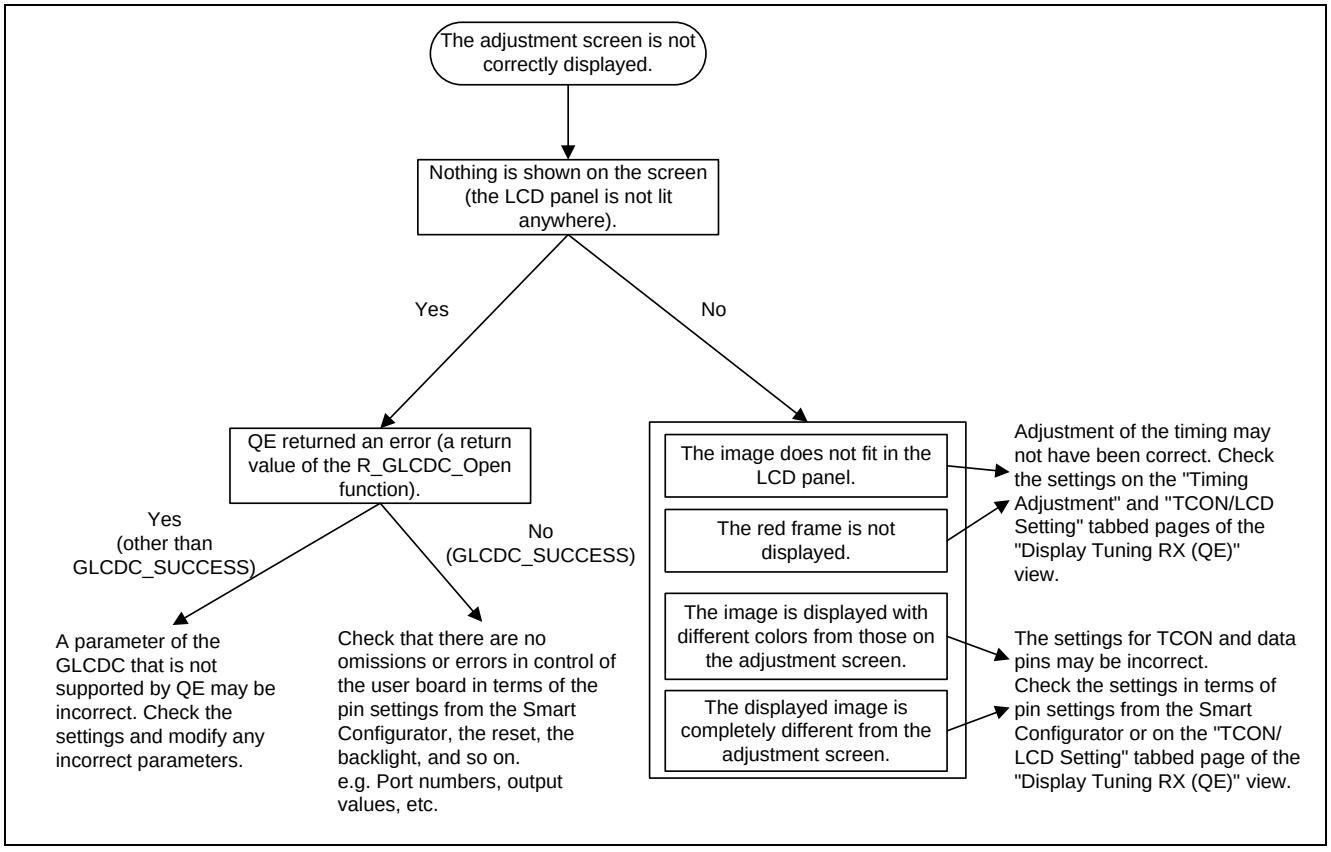


Figure 8.1 Troubleshooting

8.3 Setting the Maximum Memory Size for Use with the GUI

If a created GUI contains many widgets, the GUI may not work properly when they are displayed on the screen with the memory settings at the time. In this case, increase the value of “Maximum memory size used in GUI” in the “emWin setting” dialog box. The default setting is 80 KB (1024 * 80 = 81920). Set a value, such as 100 KB, that is suitable for the GUI you have created.

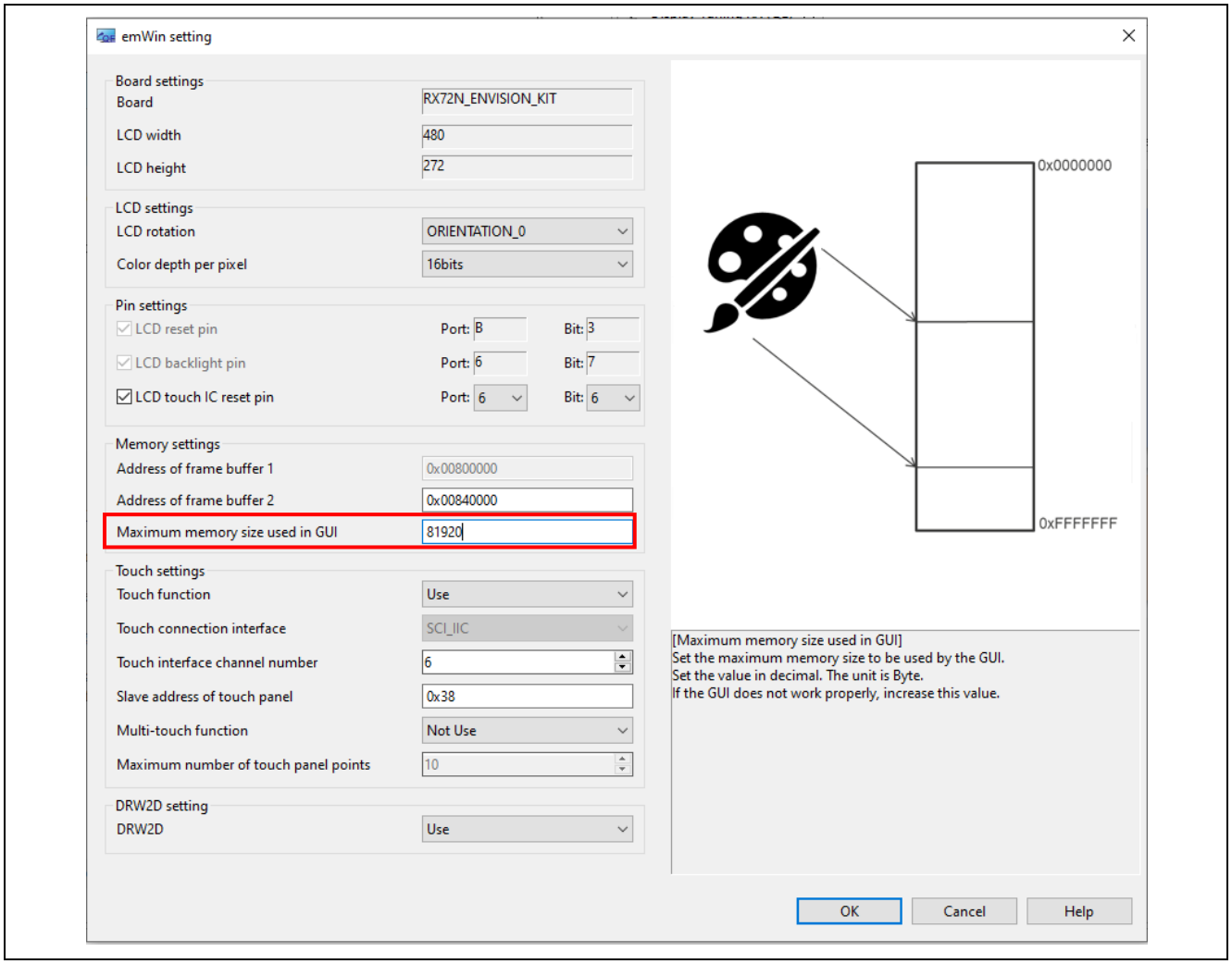


Figure 8.2 “emWin setting” Dialog Box

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Apr.15.25	—	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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