QE for AFE V2.4.0

Release Note

Thank you very much for using the QE for AFE V2.4.0, a QE (Quick and Effective Tool Solution) product of Renesas Solution Toolkit - Development Support Tool for Various Applications.

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

Contents

1. About QE for AFE

1.1 Summary

QE for AFE is an evaluation tool for embedded system development that performs graphical tuning with an integrated analog front end (AFE). Using this tool, you can configure AFE registers, write registers into the evaluation board, and monitor the AFE tuning results in a waveform.

To use this tool, you must have a board that supports QE for AFE. QE for AFE is connected between PC and the board through a USB cable and communicates with the board.

1.2 Functions

The main functions are listed below:

1. Connect and operate the evaluation board
2. Config AFE-related registers with GUI
3. Display graphics of the AFE tuning results and digital filter frequency response
4. Display graphics of the user application measurement values
5. Generate code with RX SmartConfigurator or RA FSP when working as e^2 studio plug-in

1.3 New Functions

1.3.1 Optimization on adjustment program write operation

In previous version, the adjustment program to be written was selected using two combo boxes. From V2.4.0, previous 2 combo boxes have been replaced with a new dialog interface, offering a more intuitive interface and richer information about the adjustment program.

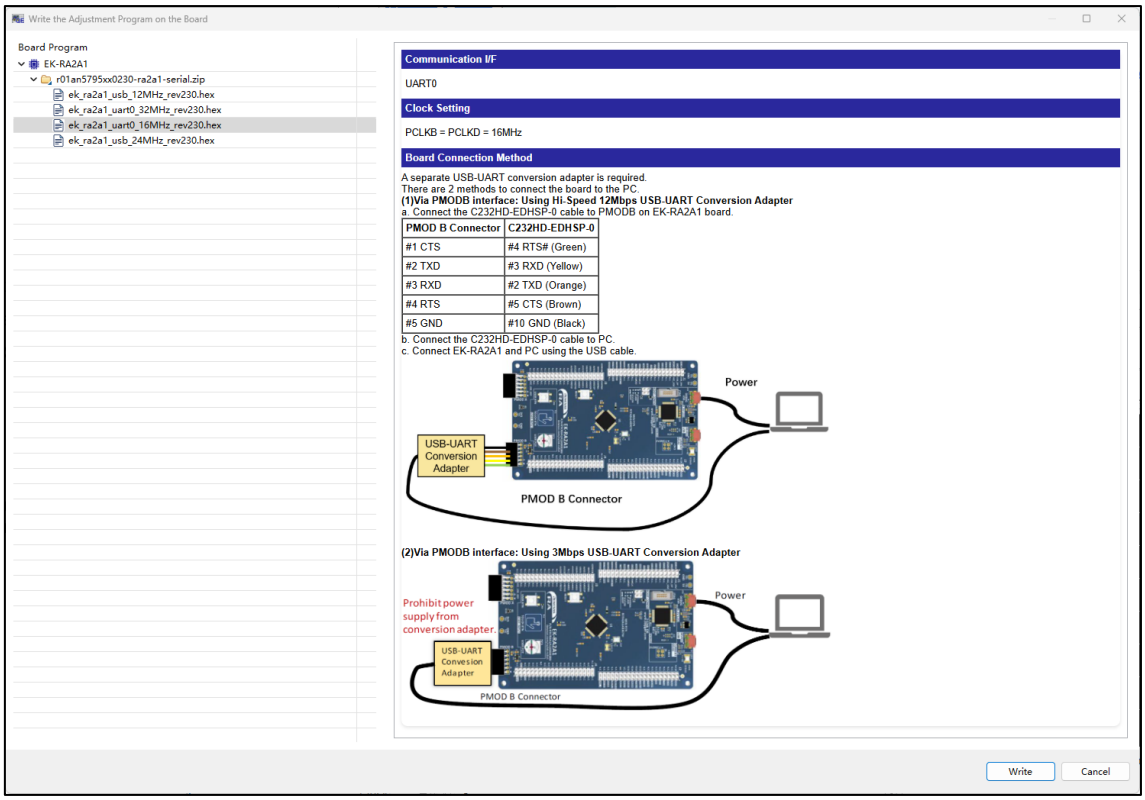

Figure 1-1. [Write the Adjustment Program on the Board] dialog box

1.3.2 Optimization on waveform by adding vertical axis values

In previous version, the vertical axis values are not displayed on the waveform. From V2.4.0, support displaying the vertical axis values of two channels on the waveform chart, which can improve data readability.

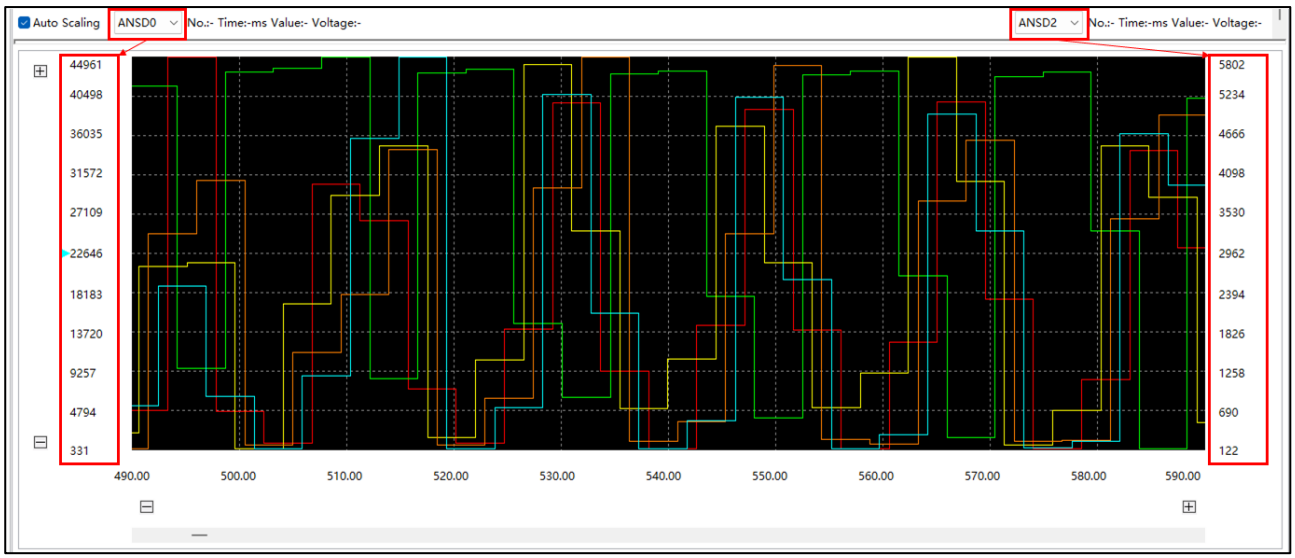

Figure 1-2. Waveform with vertical axis values

1.3.3 Improve [Channel setting] of RA2A2-SDADC24 monitor setting

From V2.4.0, using toggle button batch select or deselect channels.

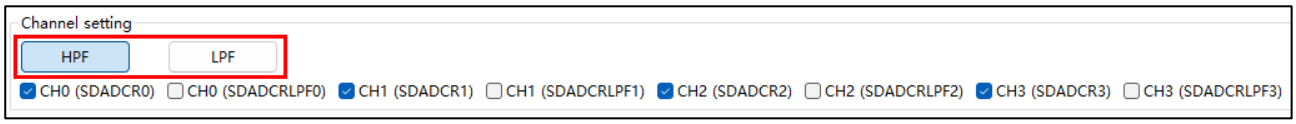

Figure 1-3. RA2A2-SDADC24's [Channel setting] on AFE Monitor (QE) view

1.3.4 Improve to save RA2A2's waveform setting

In previous version, after clicking the "Start AFE monitoring" button, the RA2A2-SDADC24 monitor settings would be reset to default. From V2.4.0, this has been eliminated, and monitor settings are retained.

1.3.5 Specify Renesas Flash Programmer installation path in [Preferences] menu

The Renesas Flash Programmer installation path can be specified in "[Windows] > [Preferences]" menu.

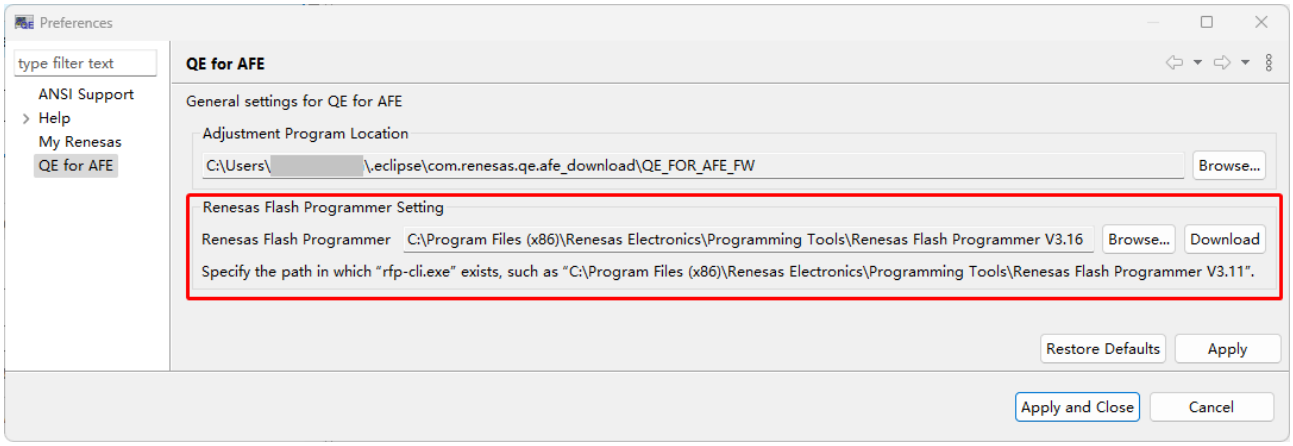

Figure 1-4. To specify Renesas Flash Programmer installation path

1.4 Supported Environment

- RA2A1
  - Windows 10 (64-bit version), Windows 11 (64-bit version)
  - Renesas e^2 studio 2025-07 and later
  - Renesas Flash Programmer V3.11 or later
  - Evaluation board: EK-RA2A1
  - RA2A1 Group Board Control Program for “QE for AFE” in application note R01AN5795EJ0230
    Note: The board control program should be built with FSP5.6.0.
- RX23E-B
  - Windows 10 (64-bit version), Windows 11 (64-bit version)
  - Renesas e^2 studio 2025-07 and later
  - Renesas Flash Programmer V3.11 or later
  - Evaluation board: RSSK RX23E-B
  - RX23E-B Group Board Control Program for “QE for AFE” in application note R01AN6364EJ0100
- RA2A2
  - Windows 10 (64-bit version), Windows 11 (64-bit version)
  - Evaluation board: EK-RA2A2
  - Renesas e^2 studio 2025-07 and later
  - Renesas Flash Programmer V3.11 or later
  - RA2A2 Group Board Control Program for “QE for AFE” in application note R01AN7280EJ0230
    Note: The board control program should be built with FSP5.6.0.

1.5 Supported Microcontrollers

- RA Family (only MCUs that incorporate the AFE)
  - RA2A Series: RA2A1, RA2A2
- RX Family (only MCUs that incorporate the AFE)
  - RX200 Series: RX23E-B

2. Installation and Uninstallation

2.1 Installing This Product

Use either of the following procedure to install this product.

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

1. Start e² studio.
2. Select the “Renesas Views” - “Renesas Software Installer” menu of e² studio to open the “Renesas Software Installer” dialog box.
3. Select the “Renesas QE” and click the “Next >” button
4. Select the “QE for AFE (v2.4.0)” check box and click the “Finish” button.
5. Check that the “Renesas QE for AFE” check box is selected in the “Install” dialog box and click the “Next >” button.
6. Check that the “Renesas QE for AFE” check box is selected as the target of installation and click the “Next>” button.
7. After confirming the license agreements, if you agree to the license, select the “I accept the terms of the license agreements” radio button, and click the “Finish” button.
8. When the dialog box for selecting a trusted certificate appears, check the displayed certificate, and then click on the “Trust Selected” button to continue installation.
9. Restart the e² studio by following the instructions on the screen.
10. Start this product from the “Renesas Views” - “Renesas QE” menu of e² studio. For details about how to use this product, see the “Help” menu of e² studio.

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

A downloaded zip file has both a plugin version and a standalone version.

2.1.2.1 Install Plugin Version

1. Extract the downloaded zip file.
2. Start the e² studio.
3. Click on “Help”, and then click on the “Install New Software...” menu item to open the “Install” dialog box.
4. Click on the “Add...” button to open the “Add Repository” dialog box.
5. Click on the “Archive...” button, select the installation file (zip file under the QE-AFE folder) in the opened file selection dialog box, and then click on the “Open” button.
6. Click on the “Add” button in the “Add Repository” dialog box.
7. Expand the “Renesas QE” item shown in the “Install” dialog box, select the “Renesas QE for AFE” check box, and then click on the “Next>” button.
   *If you check off the “Contact all update sites during install to find required software” checkbox, you can shorten the installation time.
8. Confirm that the installation target is “Renesas QE for AFE”, and then click on the “Next>” button.
9. After checking the license, select the “I accept the terms of the license agreements” radio button if you agree it, and then click on the “Finish” button.
10. When the dialog box for selecting a trusted certificate appears, check the displayed certificate, and then click on the “Trust Selected” button to continue the installation.
11. Restart the e² studio by following the instructions on the screen.
12. Start this product from the “Renesas Views” - “Renesas QE” menu of the e² studio. For details about how to use this product, see the “Help” menu of e² studio.

2.1.2.2 Install Standalone Version

QE for AFE is provided in zip format. To use this product, please follow the steps below.

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

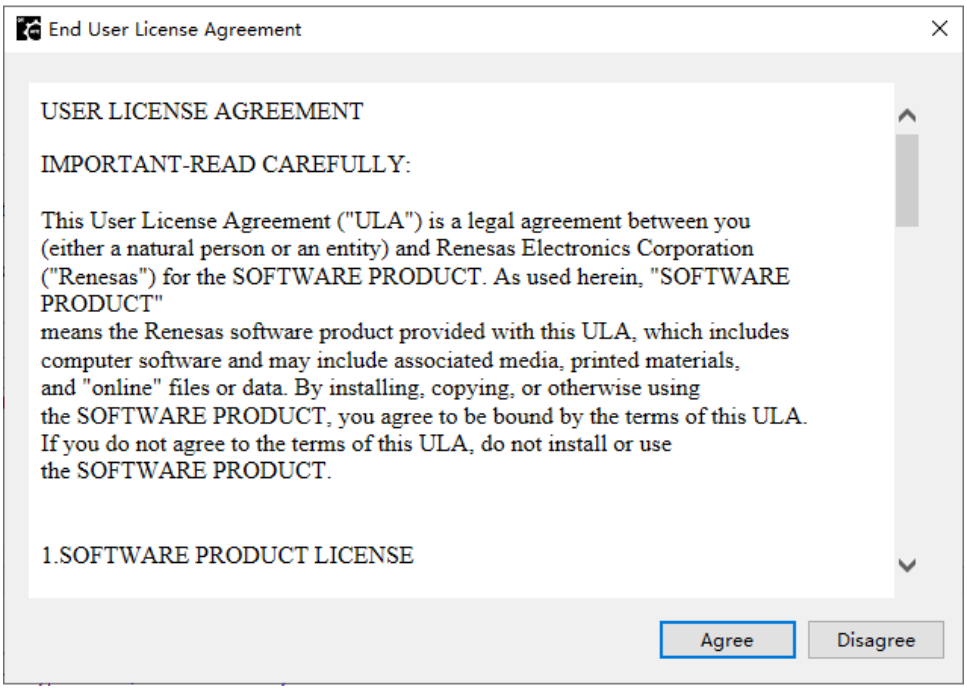

Figure 2-1. License agreement dialog

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

2.2 Updating This Product

If you have already used this product, you can update it in the same way as the procedure for installation.

2.3 Uninstalling This Product

Follow the procedure below to uninstall this product.

2.3.1 Uninstall Plugin Version

1. Start the e^2 studio.
2. Select "Help -> About e^2 studio" to open the "About e2 studio" dialog box.
3. Click the "Installation Details" button to open the "e2 studio Installation Details" dialog box.
4. Select "Renesas QE for AFE" displayed on the "Installed Software" tabbed page and click on the "Uninstall..." button to open the "Uninstall" dialog box.
5. Check the displayed information and click on the "Finish" button.
6. Restart the e2 studio by following the instructions on the screen.

2.3.2 Uninstall Standalone Version

Delete the entire folder which .zip package is extracted.

3. Notes / Restrictions

3.1 Usage Considerations

Please pay attention to the following items.

Table 3-1 List of Limitation ✓: Applicable, -: Not Applicable

No	Description	RA2A1	RX23E-B	RA2A2
1	Notes on reading Board Control Program application note	✓	✓	✓
2	Notes on pressing [Write Value to The Target Board] button after configuring an AFE component setting	✓	–	✓
3	Notes on ADC One-shot and Auto mode selection on [Monitor] View	✓	–	✓
4	Notes on closing [AFE Monitor (QE)] view of e^2 studio plugin version	✓	✓	✓
5	Notes on OPAMP trimming function failed using Emulator connection	✓	–	-
6	Notes on downloading AFE adjustment project	✓	✓	✓
7	Notes on AFE Workflow (QE) view	✓	✓	✓
8	Notes on vertical axis value on [Monitor] view	✓	✓	✓
9	Notes on pressing [Read Value from the Target Board] button	–	–	✓

3.1.1 Notes on reading Board Control Program application note

QE for AFE works with the control program operating on the evaluation board. So when using this product, please read the related Board Control Program application note first and use the recommended parameters in the application note. The parameters to be concerned include:

- System clock setting
- Sampling time of communication I/F
- Default bitrate setting of UART connection

3.1.2 Notes on pressing [Write Value to the Target Board] button after configuring an AFE component setting

It is recommended to press [Write Value to the Target Board] button each time completing one AFE component configuration and move to next AFE component configuration. The reason is that the board control program checks the validity of the new register value according to the existing register value on the evaluation board. Keeping the register values on the evaluation board always consistent with the GUI configuration can avoid unexpected errors when writing new registers values to the evaluation board.

3.1.3 Notes on ADC One-shot and Auto mode selection on [Monitor] View

ADC has 2 monitoring modes: One-shot and Auto. The waveform of these 2 modes is depending on ADC sampling time setting:

- When ADC sampling time is short (performing high-speed conversion)

  One-shot mode: QE for AFE reads data from evaluation board and draws the waveform only once

  Auto mode: QE for AFE reads data from evaluation board and draws the waveform continuously until the "Stop AFE Monitoring" button is pressed

- When ADC sampling time is long (performing low-speed conversion)

  Either One-shot mode or Auto mode, the waveform are same: QE for AFE reads data from evaluation board and draws the waveform continuously until the "Stop AFE Monitoring" button is pressed.

Note: for detailed procedure of One-shot measurement and Auto measurement, please refer to RA2A1 board control program application note.

3.1.4 Notes on closing [AFE Monitor (QE)] view of e2 studio plugin version

In e^2 studio plugin version, if multiple [AFE Monitor (QE)] views are open under different perspectives, closing one [AFE Monitor (QE)] view while the monitor is running, the monitor won't be stopped (the tuning result still can be observed after switching to another perspective). Closing the [AFE Monitor (QE)] view of all perspectives can end the tuning process.

3.1.5 Notes on OPAMP trimming function failed using Emulator connection

When using Emulator connection mode, OPAMP trimming function occasionally fails. The failed phenomenon is that even click "Next" and wait a while on Step1 or Step2, the wizard can't move to next step. So to execute OPAMP trimming function successfully, please take priority to use USB or UART connection mode.

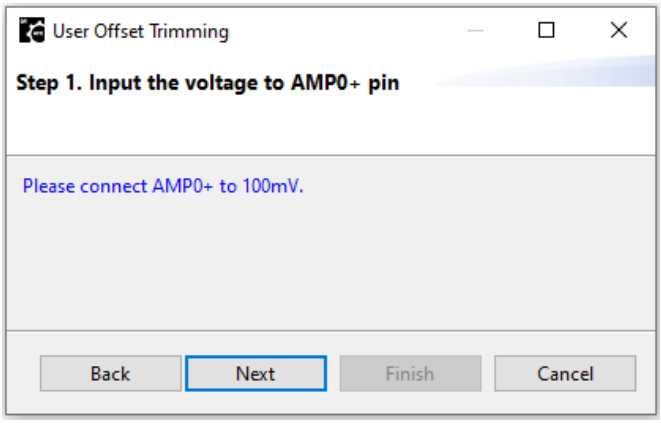

Figure 3-1 OPAMP trimming function dialog

3.1.6 Notes on downloading AFE adjustment project

If there is no adjustment program displayed in the download list after you selected the [Download the Adjustment Project] in the AFE Workflow (QE), you can follow the steps below to download the AFE adjustment program from Renesas website and place it in the specified folder manually.

1) Download the AFE adjustment program for the target board you want to use from the Renesas website.
   - RA2A1: RA2A1 Group Board Control Program for 'QE for AFE' (R01AN5795EJ0230)
   - RX23E-B: RX23E-B Group RSSKRX23E-B Board Control Program Application Note (R01AN6364EJ0100)
   - RA2A2: RA2A2 Group Board Control Program for 'QE for AFE' (R01AN7280EJ0230)
2) Place the downloaded zip file in the folder specified in QE for AFE preferences.

   Folder structure:
   - For RA2A1: {*Path specified in [QE for AFE]*}/RA2A1/xxxx.zip
   - For RX23E-B: {Path specified in [QE for AFE]}/RX23EB/xxxx.zip
   - For RA2A2: {Path specified in [QE for AFE]}/RA2A2/xxxx.zip

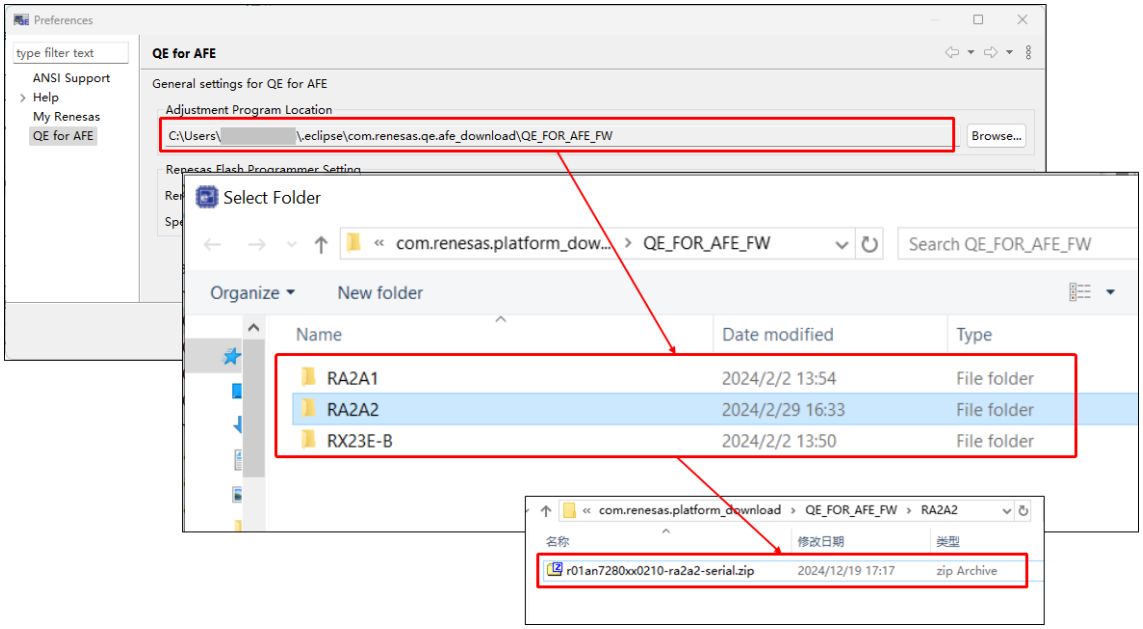

Figure 3-2 Operation when the AFE adjustment program is obtained from the Web manually

3.1.7 Notes on AFE Workflow (QE) view

1) The workflow may not be displayed properly when clicking on the workflow view again during the AFE views refresh process.

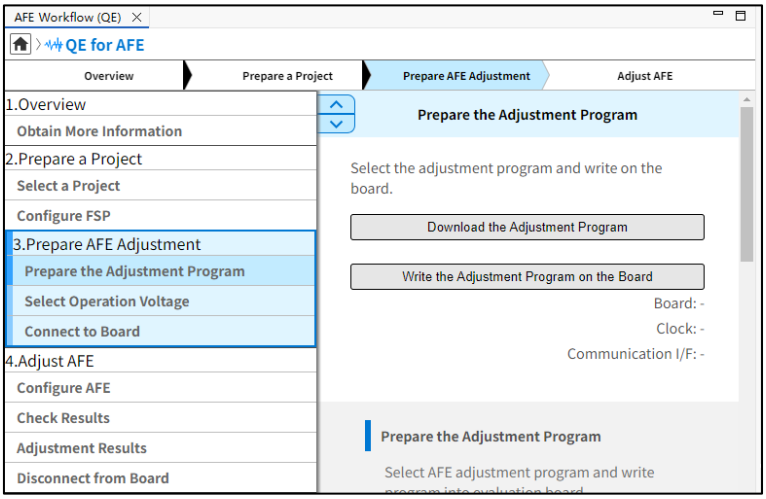

Figure 3-3 Theme color is missing in Workflow

[Workaround]

Close and reopen the AFE Workflow (QE) view.

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

[Workaround]

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

3.1.8 Notes on vertical axis value on [Monitor] view

When the Y-axis is displayed in [Displaying voltage] mode and the [Origin] or [Range] is less than 1 μV the vertical axis value is not used as a reference. Please confirm the voltage value through the marker.

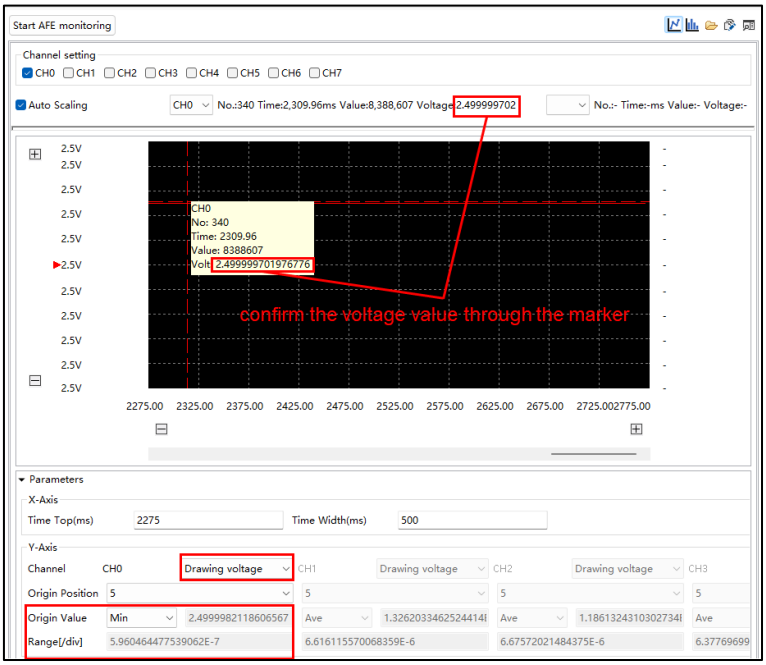

Figure 3-4 Vertical axis reference limit in voltage display mode

3.1.9 Notes on pressing [Read Value from the Target Board] button

When using the [Read Value from the Target Board] button to check the values in the board, please note that the values of the following three registers are unreliable and should not be referenced.

1) ADANSA0
2) ADADS0
3) ADEXICR

3.2 Functional Restrictions

The following restrictions apply to QE for AFE V2.4.0. These restrictions will be solved in the next or future version.

Table 3-2 List of Restrictions ✓: Applicable, -: Not Applicable

No	Description	RA2A1	RX23E-B	RA2A2
1	Restrictions on ACMPLP configuration	✓	–	–
2	Restrictions on migration pin allocation to Smart Configurator	–	✓	–
3	Restrictions on ADC16 when Emulator connection is used in RA2A1	✓	–	–

3.2.1 Restrictions on ACMPLP configuration

- "DAC8 channel 0 output" is selected as ACMPLP0 input (refer to figure3-5 (1))
  - When switcher (A) selects Vref (refer to figure3-5 (A))
  - When ACMPLP0 is disabled (refer to figure3-5 (D))
  - When switcher (B) selects IVREF0, switcher (C) selects Vref (refer to figure3-5 (B) and (C)) and ACMPLP1 is enabled (figure3-5 (E) selects "Enable")

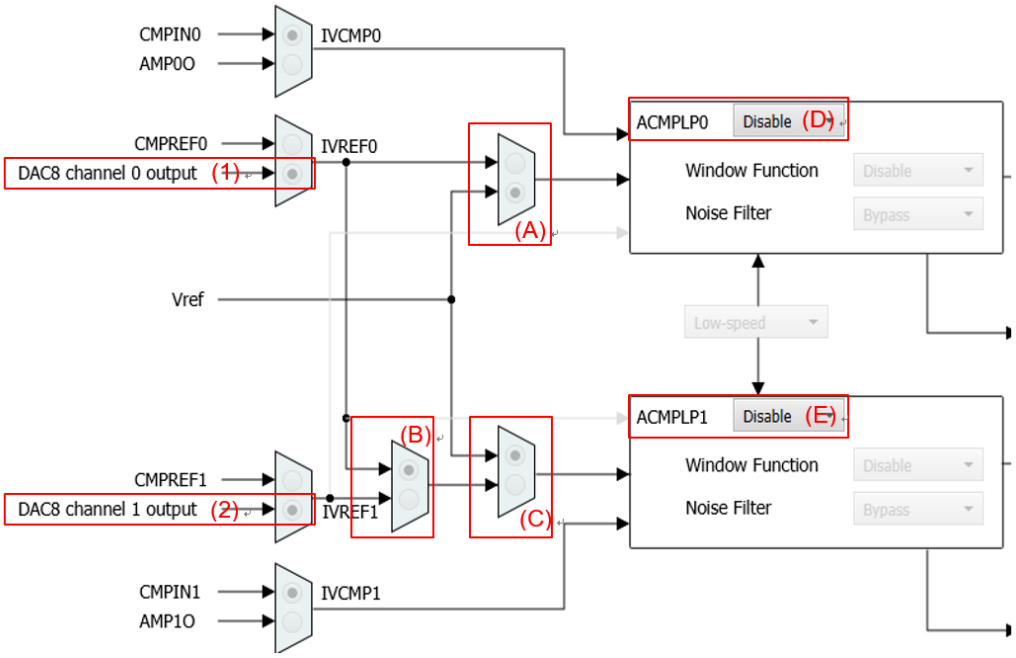

Figure 3-5 ACMPLP1 example setting

Either of above ACMPLP0 settings will cause the register value cannot be successfully written to the EK-RA2A1 board with the following 1) – 3) settings.

1) Set P013 as DA8_0 function in DAC8 page (P013PFS = 0A018000)

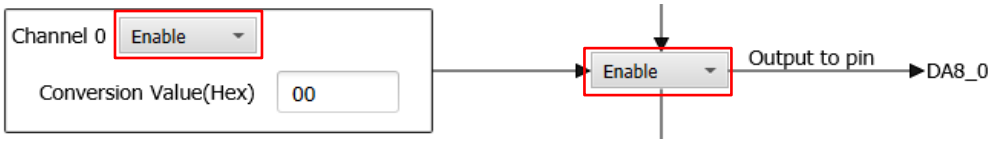

Figure 3-6 DA8_0 example setting

2) Select DA8_0 as OPAMP1 input in OPAMP page (AMP1PS = 80)

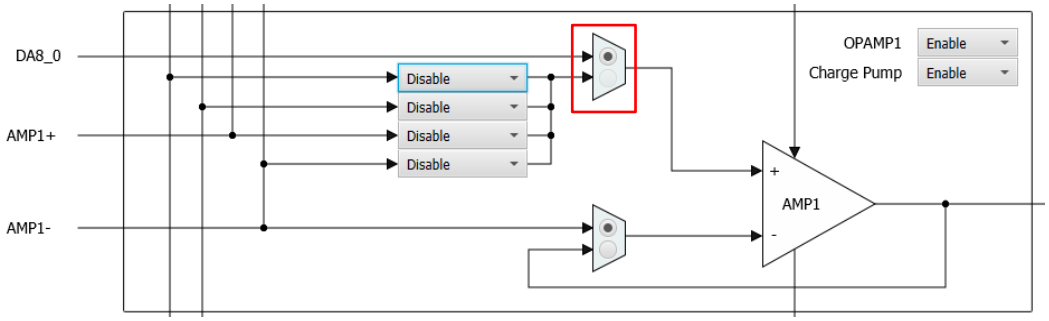

Figure 3-7 OPAMP example setting

3) Select ”DAC8 channel 0 output” as input in ACMPHS page (CMPSEL1 = 08)

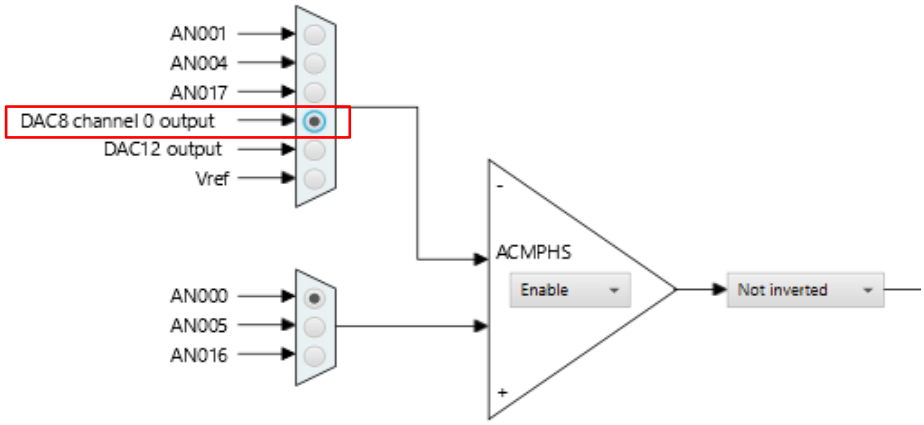

Figure 3-8 ACMPHS example setting

[Workaround]

In above ACMPLP0 setting, figure 3-5 (1) setting is invalid. So please change figure 3-5 (1) from “DAC8 channel 0 output” to “CMPREF0”.

- “DAC8 channel 1 output” is selected as ACMPLP1 input (refer to figure3-5 (2))
  - When switcher (B) selects IVREF0 (refer to figure3-5 (B))
  - When switcher (C) selects Vref (refer to figure3-5 (C))
  - When ACMPLP1 is disabled (refer to figure3-5 (E))

Either of above ACMPLP1 settings will cause the same limitations 1) and 2) as selecting” DAC8 channel 0 output “above.

[Workaround]

In above ACMPLP1 setting, figure 3-5 (2) setting is invalid. So please change figure 3-5 (2) from “DAC8 channel 1 output” to “CMPREF1”.

3.2.2 Restrictions on migration pin allocation to Smart Configurator

When reflecting AFE setting to Smart Configurator, in certain case, the pin allocation in QE for AFE might be lost in Smart Configurator [Pin] > [Pin Funcions] setting.

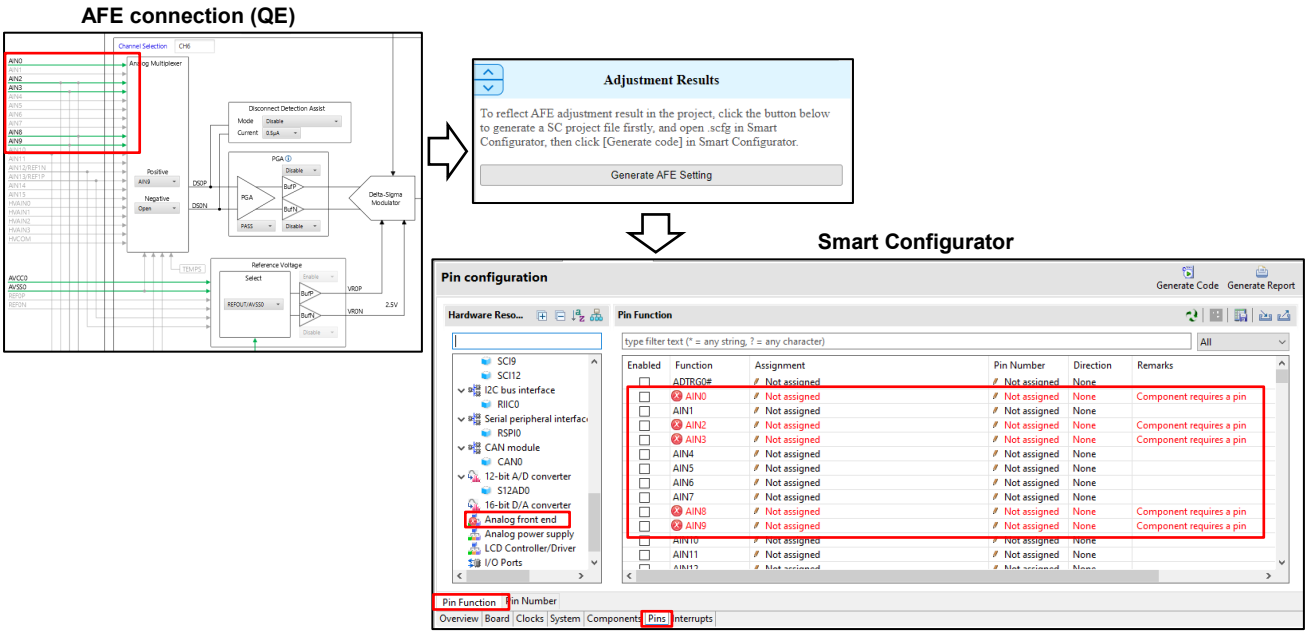

Figure 3-9 Mising pin allocation

[Workaround]

After “Generate AFE Setting” operation, please open Smart Configurator [Pin] > [Pin Funcions] and check. If the AFE module on the left tree display an error, then manually select the pins on the right table according to QE for AFE setting.

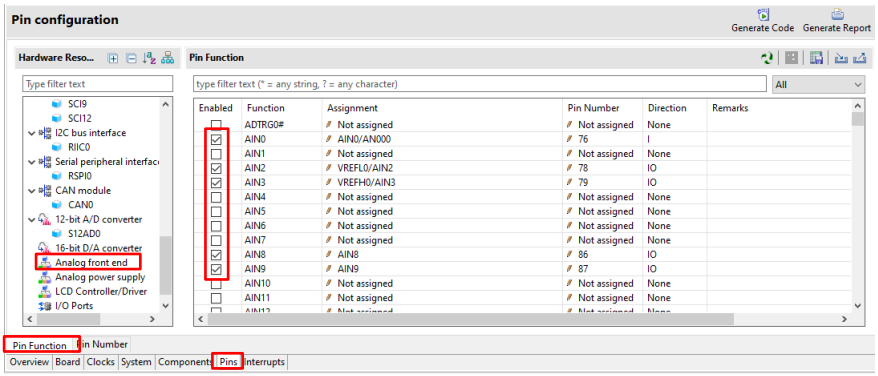

Figure 3-10 Select the pins manually

3.2.3 Restrictions on ADC16 when Emulator connection is used in RA2A1

When the Emulator connection is selected in the plug-in version of RA2A1, ADC16 cannot be monitored.

[Workaround]

There is no workaround.

When monitoring ADC16 with the plug-in version of RA2A1, please select USB connection or UART connection.

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Sep.1.2025	-	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.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
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