Integrated Development Environment e² studio

Creating and executing build CMake project

Introduction

e² studio supports project development using CMake.

This document describes how to create a CMake project in e² studio and build the project.

Contents

1. Overview 2
1.1 Purpose 2
1.2 Environment 2
2. CMake support status 3
2.1 FSP projects 3
2.1.1 Creating the project 3
2.1.2 Building the project 3
2.2 Non-FSP projects 4
3. Creating a CMake project 5
4. Registering CMake commands with the build menus 6
4.1 Disabling CDT Core Builder 6
4.2 Registering the CMake Configure command 6
4.3 Registering the CMake Build Command 8
4.4 Registering the CMake Clean Command 9
5. Building the project 11
6. Cleaning the Project 11
7. Using Smart Configurator 12
8. Debugging 14
9. Reference Information 15
9.1 Websites 15
Revision History 16

1. Overview

1.1 Purpose

CMake is an open-source build system that generates build files for Ninja, Make, and other build tools from CMake configuration files that describe software build settings. Because CMake configuration files can be written independently of a specific compiler or development environment, they enable the construction of a portable build environment.

e2 studio is an integrated development environment for Renesas microcontrollers based on the open-source Eclipse platform. e2 studio has supported the creation of CMake-based projects since e2 studio 2020-04. To create and build a project that uses CMake, additional project settings are required.

This document describes how to create a project that uses CMake and how to build the project using CMake and Ninja.

Intended Audience

This document is intended for users who develop embedded software using CMake. The following topics are not covered:

- Basic usage of CMake
- How to create CMake configuration files
- How to configure compiler, assembler, and linker options

Prepare these items in advance according to the project and toolchain you use.

1.2 Environment

Renesas have confirmed the operating procedure explained in this document in the following environment.

[OS]

- Windows 11

[IDE]

- e2 studio 2026-07

[Tools]

- CMake
- Ninja

When you install e2 studio, CMake and Ninja are installed in the following folder:

- CMake
  <e2 studio install folder>\eclipse\plugins\com.renesas.ide.exttools.cmake.win32.x86_64_X.X.X.vXXXXXXXX-XXXX\cmake\bin
- Ninja
  <e2 studio install folder>\eclipse\plugins\com.renesas.ide.exttools.ninja.win32.x86_64_X.XX.X.vXXXXXXXX-XXXX\n

2. CMake support status

CMake support in e² studio differs depending on the project type. The procedures for creating and building a project must therefore match the selected project type.

First, determine whether the project to be created is an FSP project.

2.1 FSP projects

The following are FSP project types:

- Renesas RA C/C++ Project / Renesas RA FSP Solution
- Renesas RA for Wireless C/C++ FSP Project
- Renesas RA for Wireless FSP Solution
- Renesas RH850 C/C++ FSP Project
- Renesas RISC-V MCU C/C++ FSP Project
- Renesas RRQ C/C++ FSP Project
- Renesas RX C/C++ FSP Project
- Renesas RX FSP Solution
- Renesas RZ C/C++ FSP Project

For an FSP project, you can select a CMake project when creating the project.

2.1.1 Creating the project

To create a CMake project, select "e² studio CMake" from the [IDE Project Type] drop-down list on the wizard page.

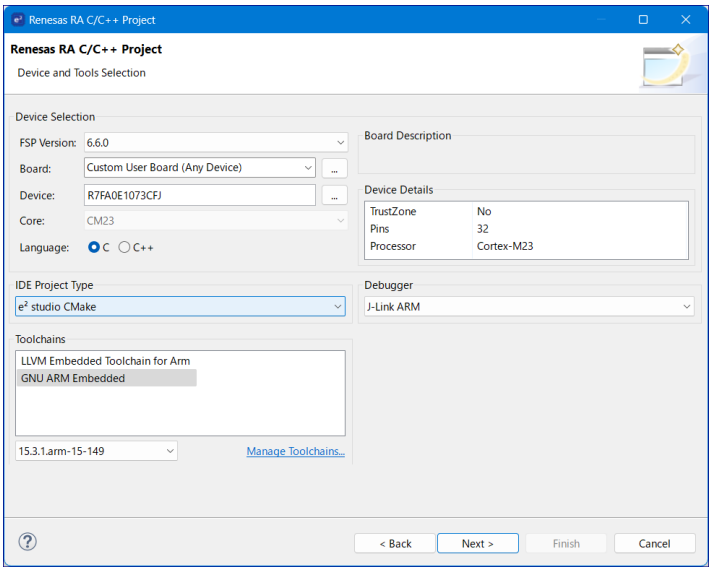


Figure: 1

CMake configuration files are generated together with the source files.

Notes

- Only one build configuration is supported.
- Managing Release and Debug configurations simultaneously is not supported.
- The build-option GUI is not supported.

2.1.2 Building the project

Use the following menus after selecting a project in the [Project Explorer] view:

- Clean: Right-click the project and select [Clean Project].
- Build: Right-click the project and select [Build Project], or select [Project] > [Build Project].

The procedures and settings in the remaining sections are not required for FSP projects.

2.2 Non-FSP projects

For project types such as the following, you must manually associate CMake with the standard e2 studio build functions:

- GCC for Renesas RX C/C++ Executable Project
- GNU for RZ C/C++ Executable Project
- LLVM for Renesas RL78 C/C++ Executable Project
- Renesas CC-RH C Executable Project
- Renesas CC-RL C/C++ Executable Project
- Renesas CC-RX C/C++ Executable Project

For these projects, create the project and configure the build settings by following the procedures in the subsequent sections.

3. Creating a CMake project

This section describes how to create an empty CMake project using the CMake Project template. After creating the project, add the source files and CMake configuration files to it.

1) Start e² studio and select [File] > [New] > [C/C++ Project].

2) In the [New C/C++ Project] wizard, select "CMake" in the left pane and "Empty or Existing CMake Project" in the right pane. Click [Next].

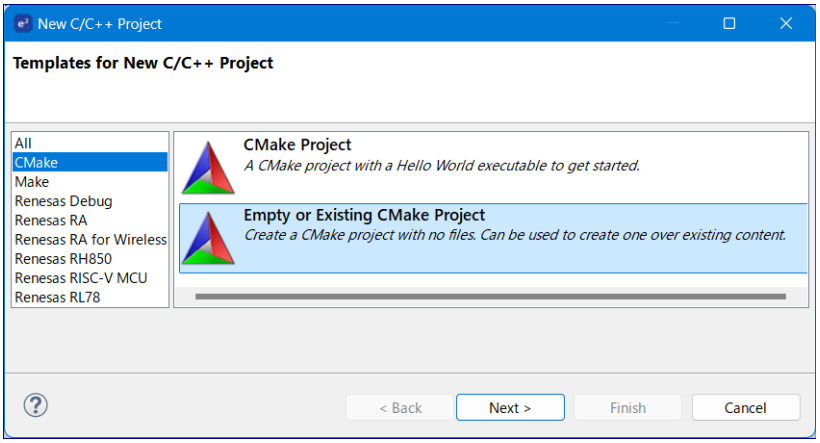


Figure: 2

3) In [New CMake Project - Specify properties of new CMake project], enter a project name and click [Finish].

4) Confirm that the empty project appears in [Project Explorer].

5) Place the source files and CMake configuration files, such as the toolchain file and project configuration files, in the project folder.

4. Registering CMake commands with the build menus

Immediately after a CMake project is created, no build commands are associated with the build-related menus. Configure the following settings to associate CMake build commands with these menus:

- Disable CDT Core Builder.
- Register the CMake Configure command.
- Register the CMake Build command.
- Register the CMake Clean command.

After completing these settings, you can build and clean the project by using the standard Build Project and Clean Project commands.

4.1 Disabling CDT Core Builder

Disable CDT Core Builder to prevent the standard e² studio builder and the CMake-based build from running at the same time.

1) Select the project in [Project Explorer], and then select [File] > [Properties] or [Properties] from the context menu.
2) In the [Properties] dialog box, select "Builders" in the left pane.
3) In the [Builders] pane, clear the [CDT Core Builder] check box under [Configure the builders for the project].
4) When the confirmation message appears, click [OK].

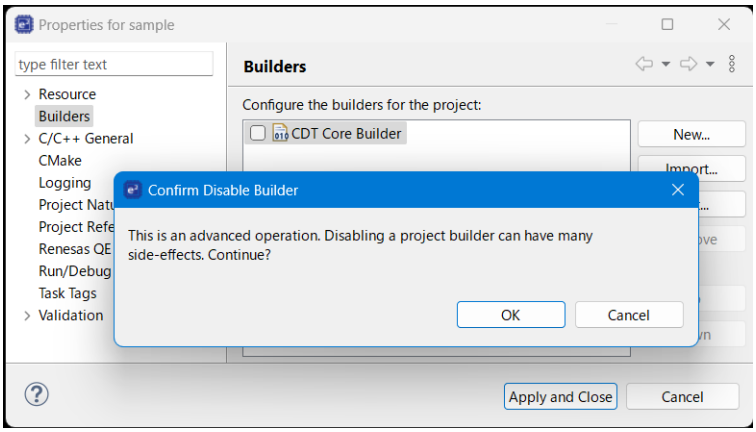


Figure: 3

Continue working in the Builders panel.

4.2 Registering the CMake Configure command

Create a command that runs CMake to generate Ninja build files from the CMake configuration files, and associate the command with the build menu.

1) If the [Builders] panel is not open, open it by following Section 4.1.
2) Click [New...]. In [Choose configuration type], select "Program" and click [OK].
3) In [Edit Configuration], enter a name. This example uses "CMake Configure".
4) On the [Main] tab, specify the settings below.
   - [Location]: Full path to cmake.exe
   - [Working Directory]: ${workspace_loc:/${project_name}}
   - [Arguments]: -S . -B build -G Ninja -DCMAKE_BUILD_TYPE:STRING=Debug -DCMAKE_TOOLCHAIN_FILE:STRING=cmake/cross.cmake -DCMAKE_EXPORT_COMPILE_COMMANDS:BOOL=TRUE

Please refer to the following website for details on parameters and variables.
ccmake(1) — CMake 4.5.0-rc1 Documentation
cmake-variables(7) — CMake 4.5.0-rc1 Documentation

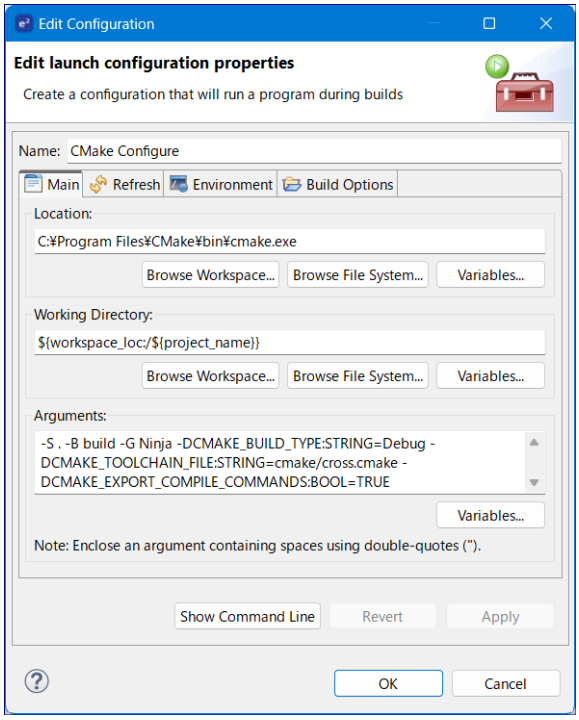


Figure: 4

5) On the [Refresh] tab, select [Refresh resources upon completion] and [The project containing the selected resource].

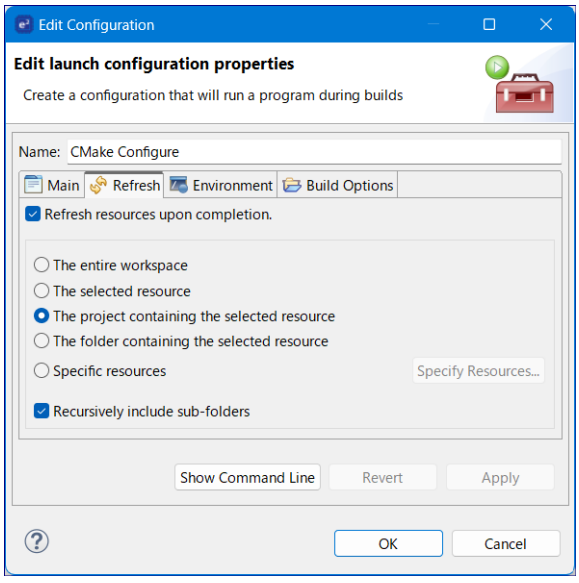


Figure: 5

6) On the [Environment] tab, add PATH=<Ninja installation folder>;%PATH% and any other environment variables required to run CMake and the toolchain.

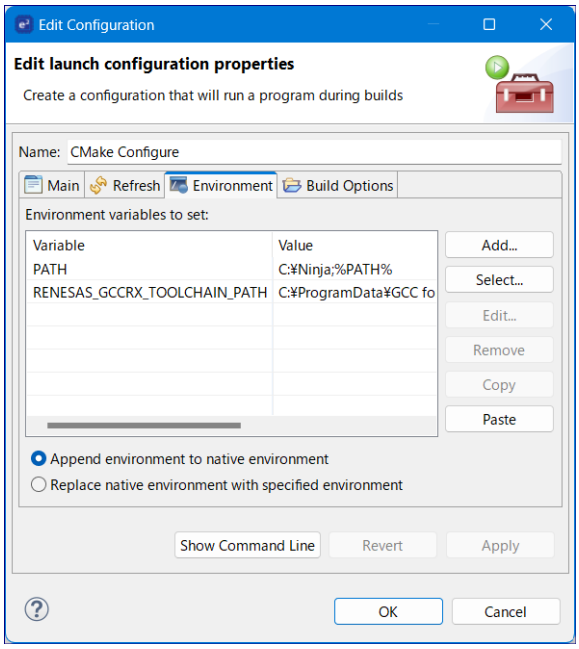


Figure: 6

7) On the [Build Options] tab, under [Standard Input and Output], select [Allocate Console (necessary for input)] and clear the other check boxes. Select [Launch in background]. Under [Run the builder], select [During manual builds] and clear the other check boxes.

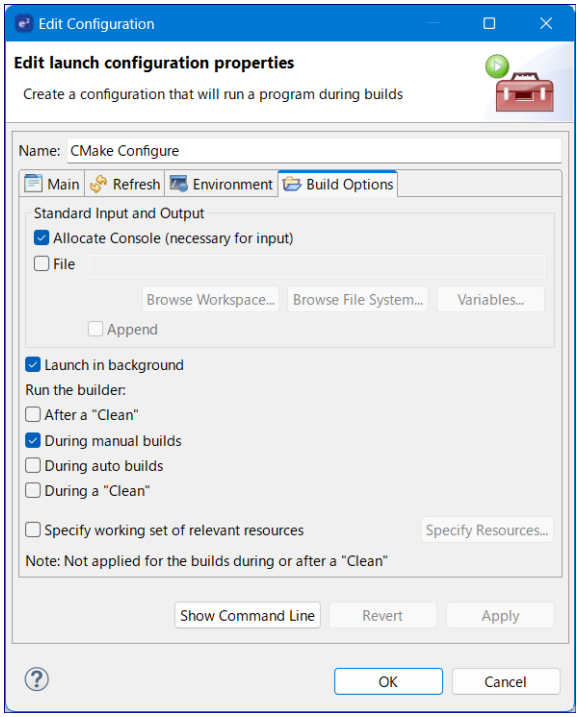


Figure: 7

8) Click [OK], then continue in the [Builders] panel

4.3 Registering the CMake Build Command

Create a command that builds the project using the generated Ninja build files and associate it with the build menu.

1) If the [Builders] panel is not open, open it by following Section 4.1.

2) Click [New...]. Select "Program" and click [OK].

3) Enter a name. This example uses "CMake Build".

4) On the [Main] tab, specify the following settings:
   - [Location]: Full path to cmake.exe
   - [Working Directory]: ${workspace_loc:/${project_name}}
   - [Arguments]: --build build --config Debug --target all
5) On the [Refresh] tab, select [Refresh resources upon completion] and [The project contains the selected resources].
6) On the [Environment] tab, add PATH=<Ninja installation folder>;%PATH% and any other environment variables required to run CMake and the toolchain.
7) On the [Build Options] tab, select [Allocate Console (necessary for input)], clear the other check boxes in that area, select [Launch in background], and select [During manual builds] under [Run the builder]. Clear the other check boxes.
8) Click [OK] and continue in the [Builders] panel.

4.4 Registering the CMake Clean Command

Create a command that deletes generated object and executable files, and associate it with the clean menu.

1) If the [Builders] panel is not open, open it by following Section 4.1.
2) Click [New...]. Select "Program" and click [OK].
3) Enter a name. This example uses "CMake Clean”.
4) On the [Main] tab, specify the following settings:
   - [Location]: Full path to cmake.exe
   - [Working Directory]: ${workspace_loc:/${project_name}}
   - [Arguments]: --build build --config Debug --target clean
5) On the [Refresh] tab, select [Refresh resources upon completion] and [The project contains the selected resources].
6) On the [Environment] tab, add PATH=<Ninja installation folder>;%PATH% and any other environment variables required to run CMake and the compiler.
7) On the [Build Options] tab, select [Allocate Console (necessary for input)], clear the other check boxes in that area, select [Launch in background], and select [During a "Clean"] under [Run the builder]. Clear the other check boxes.

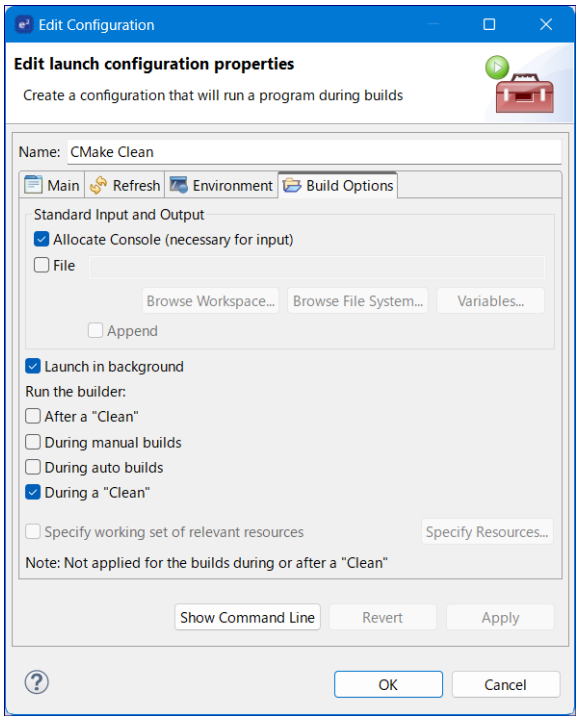


Figure: 8

8) Click [OK]. In the [Builders] panel, click [Apply and Close].

5. Building the project

1) Select the project in [Project Explorer].
2) Right-click the project and select [Build Project], or select [Project] > [Build Project].

The commands run in the following order:

- CMake Configure: Generates the Ninja build files.
- CMake Build: Runs the compiler, assembler, and linker.

6. Cleaning the Project

1) Select the project in [Project Explorer].
2) Right-click the project and select [Clean Project].

7. Using Smart Configurator

For a project that uses Smart Configurator, register Smart Configurator as an external tool to start it from the menu and generate code.

1) Select [Run] > [External Tools] > [External Tools Configurations...].
2) In [External Tools Configurations], select "Program" in the left pane and click [New launch configuration]. A new configuration is added to the tree.
3) In the right pane, enter a name.
4) On the [Main] tab, set [Location] to the full path to SmartConfigurator.exe and [Working Directory] to ${workspace_loc:/${project_name}}.
5) In [Arguments], enter the command for the Smart Configurator in use, as shown below.
   - RX Smart Configurator:
     "<file name>.scfg" -enable=cmake,rxcbankmode -disable=iar
   - RL78 Smart Configurator:
     "<file name>.scfg" -enable=cmake -disable=iar
   - RH850 Smart Configurator:
     "<file name>.scfg" -enable=cmake -disable=iar

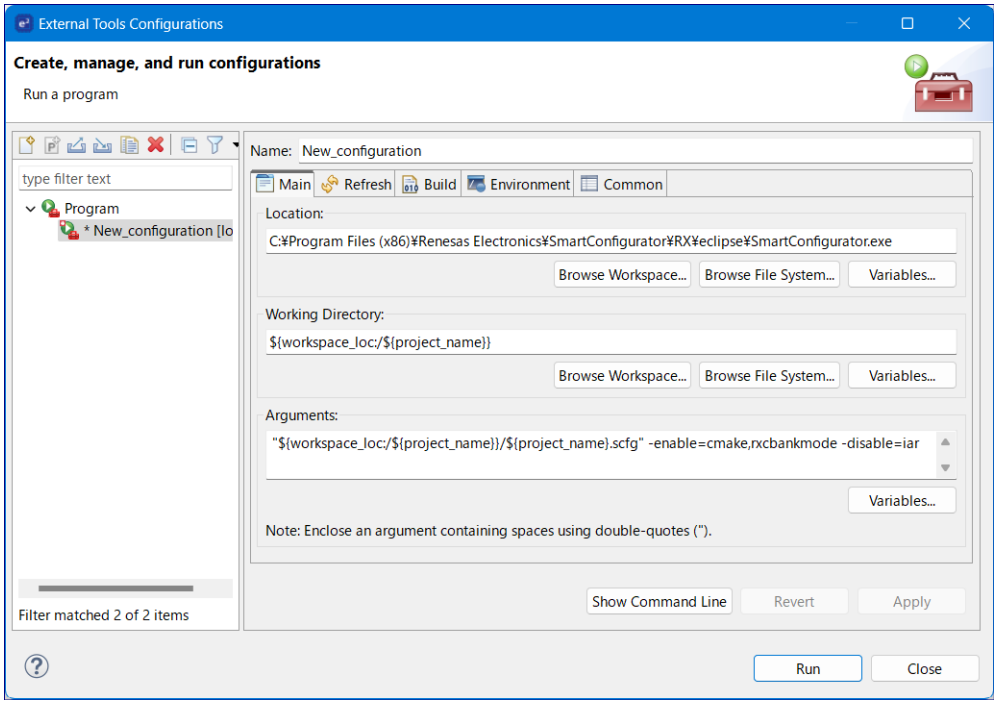


Figure: 9

6) On the [Refresh] tab, select [Refresh resources upon completion], [The project containing the selected resource], and [Recursively include sub-folders].

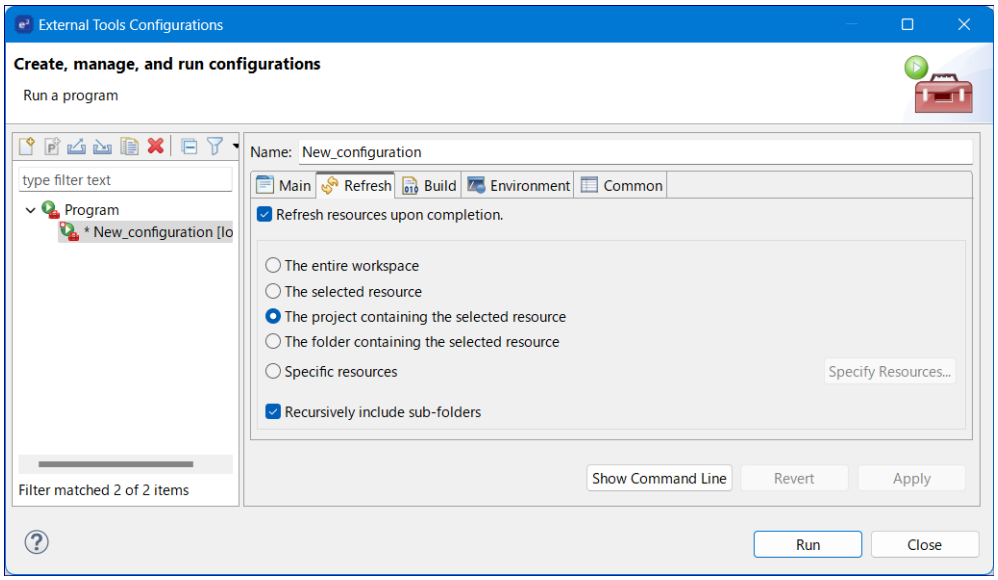


Figure: 10

7) On the [Build] tab, clear [Build before launch].

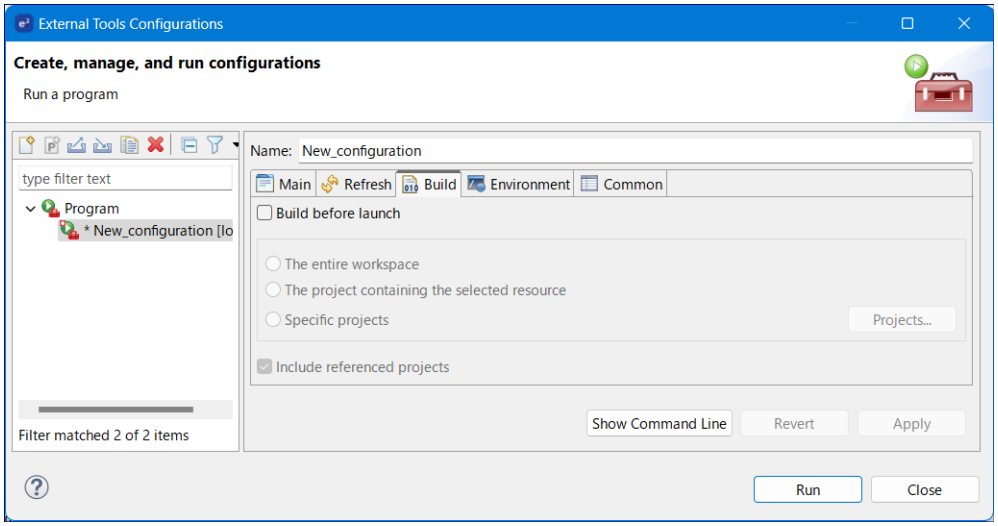


Figure: 11

8) On the [Common] tab, select [External Tools] under [Display in favorites menu], select [Use system encoding (windows-31j)], and select [Merge standard output and standard error (disables color coding of error output)]. Leave the other settings at their defaults.

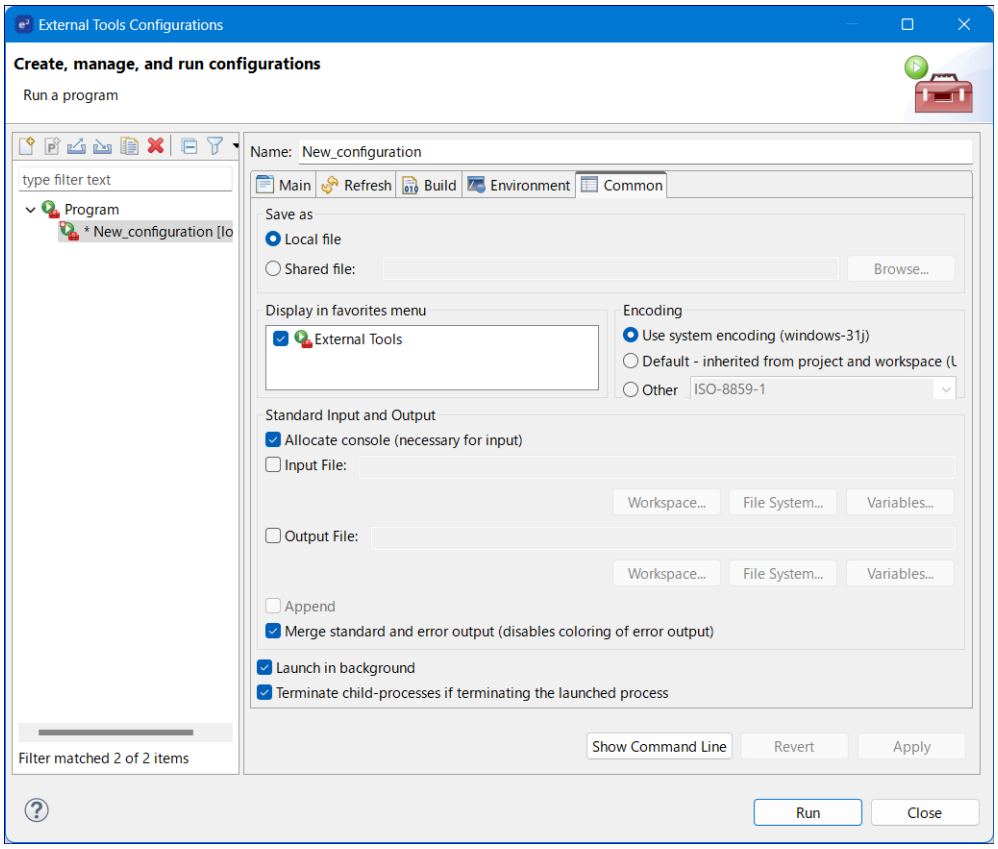


Figure: 12

9) Click [Apply] and then [Close].

To run Smart Configurator, select the project in Project Explorer and then select [Run] > [External Tools] > [<configuration name>].

8. Debugging

A debug configuration is not created automatically for a CMake project. To run the debugger, create a debug configuration by referring to the configuration of an existing non-CMake project. Select [Run] > [Debug Configurations...] and create the configuration in the [Debug Configurations] dialog box.

9. Reference Information

9.1 Websites

- e2 studio:
  https://www.renesas.com/e2studio
- CMake:
  https://cmake.org/
- Ninja:
  https://ninja-build.org/

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Dec.25.20	-	New creation
2.00	Jun.30.21	All	Update whole. - Remove unnecessary information. - Separate toolchain-specific settings.
2.01	Jun.28.22	P.6	Replace “The part “XXXX” differs from each user.” to “The part “XXXX” differs from each version of e2 studio.”
3.00	Oct.13.26	All	Changed the build method from Make to Ninja and revised the section structure accordingly.

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

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins
   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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(Rev.5.0-1 October 2020)

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